# AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been broken down into sections.

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SECTION: 11 OF 11

DOCUMENT #: DOE/EIS-0113

TITLE: Final EIS Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes

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Comments on the Draft Environmental Impact Statement for the Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes

1. To begin with, I commend the Department for investing their time and energy over the past six months to inform and educate the people of the Northwest on the complex situation of Hanford defense wastes. Unfortunately, the Department has
2.3.1.14 failed to include all of the Hanford wastes and has only presented part of the problem. I recommend that the Department of Energy consider all of the defense wastes at Hanford in one complete Environmental Impact Statement. This should include the wastes in the 100 and 300 areas such as the eight old production reactors. To not do this is asking people to solve a jigsaw puzzle with many of the pieces missing.

2. Whereas much concern has been raised about the radioactive nuclear wastes, there is insufficient attention to the problem of toxic chemical wastes. The Department of Energy has yet to complete a comprehensive inventory of the
3.1.6.1 chemical wastes. The Department has not adequately addressed the disposal of those wastes, nor has it presented anything on how the chemicals interact with the nuclear wastes. In fact, this draft Environmental Impact Statement neglects to consider a June 1985 Battelle study of the interactions between Hanford's chemical and nuclear wastes. This report explored the possibilities of explosions in existing waste tanks (PNL-5453, Complexant Stability Investigation, Task 2 - Organic Complexants, E.C. Martin).

3. After reading the draft EIS it becomes clear that most of the proposed disposal methods have yet to be proven. Although the Department has received support for glassifying the liquid wastes in the double-shell tanks, I am not yet convinced that this technology is suitable for deep geologic disposal. Another uncertainty is the grouting of some of the wastes. According to Donald Provost of Washington State
3.3.5.4 grouting contains hazardous chemicals and therefore falls under provisions of the Resource Conservation and Recovery Act (RCRA). The draft EIS does not explain how or when it will meet the RCRA requirements. Other methods are still in the conceptual design stage or merely ideas on paper. The Department of Energy does not know how to safely dispose of the current wastes. Therefore the Department should halt the production of plutonium until the current stockpile of wastes
2.5.6 is disposed of in an acceptable manner. Arguments that such a plutonium production halt would harm national security are

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erroneous. The United States possesses more than is necessary to meet any reasonable need for national security. Moreover, even though this draft Environmental Impact Statement speaks of future defense wastes, it offers no 2.5.6
justification for future plutonium production. The citizens of the Northwest must be told why they should continue to live with the risks of Hanford operations.

4. With regards to the three disposal options presented in the draft EIS, I would favor the Department directing its research to the geologic disposal option. I am aware that this could mean increased radiation exposure to Hanford workers and that it is the most expensive alternative. 3.3.1.1
However I believe that this current generation is morally obligated to accept all the risks and costs associated with these wastes. The majority of the American people have supported the government's nuclear weapons buildup by their votes and taxes. It has been this nuclear weapons buildup that has produced these wastes. Many in the United States, though I am not one, agree that the risks of these wastes are acceptable because of the so-called benefit of national security, supposedly won by America's nuclear arsenal. The present obligation is to cleanup the wastes that have been produced. With any wastes left in Hanford soils, future generations will only reap the risks without enjoying any of the benefits.

5. Given the lack of information concerning many aspects of Hanford's wastes, some of which the Department readily acknowledges, the DOE must commit itself, at minimum, to a 2.3.2.3
supplemental EIS. I would suggest that a period of five years would be enough for the Department to provide the public with sufficient information. Citizens need this information to responsibly participate in the decision-making process.

6. There is considerable uncertainty about the DOE having sufficient financial resources to insure the adequate disposal of all defense wastes. The people of the Northwest will have to generate the necessary political support for the cleanup of the existing wastes. However, the cleanup of 2.2.9
future wastes (assuming continued plutonium production) should be funded on a pay-as-you-go basis. Similar to provisions contained in the Nuclear Waste Policy Act of 1982 (for the disposal of commercial nuclear wastes), the price of special nuclear materials should include a surcharge sufficient to guarantee the safe disposal of subsequent wastes.

7. There continues to be confusion as to what wastes are 3.1.1.9
high-level and which are not. Within the present management system of defense wastes, it is too easy to bypass certain disposal requirements by simply reclassifying the wastes. What was once high-level waste is now considered low-level

and can be disposed of in a less stringent fashion. This is of special concern with the DOE because this agency is still too far removed from public scrutiny. To correct this situation, I propose the following two recommendations. First, the Department should provide specific definitions for the various waste classifications and include them in the final EIS. Second, there needs to be independent oversight
2.2.13 and licensing of the Department's disposal practices. The Nuclear Regulatory Commission, the Environmental Protection Agency and the affected states of Oregon, Idaho and Washington could serve this function.

8. The EIS states that 190 kg. of plutonium in the soil will be cleaned up (page A.17). However, according to Hanford documents, this will mean that over 100 kg. will
3.1.3.4 remain on the Hanford site (BNWL-1779 UC-70, 1972 Waste Disposal Summary, page 4 and BNWL-1701, 1971 Waste Disposal Summary, page 12). Leaving more than 100 kg. in Hanford soils is unacceptable; 10 kg. might be acceptable.

9. I have numerous questions regarding the
3.4.2.7 transportation of TRU wastes to Hanford from offsite. In the October 1983 Defense Waste and Byproducts Management Monthly Report (RHO-PB-SR-10 BWM), it states on page 30 that "offsite waste was received from Canoga Park, Lawrence Berkeley, Kerr-McGee and Westinghouse....A total of 233 drums of TRU waste has been received from Kerr-McGee since 9/01/83." Now if Hanford received 233 drums in just two months from one company, what is the total scope of the situation? How and where are these wastes addressed in the DEIS? What are the contract arrangements and with which companies? Who pays for the disposal? How much has been transported to Hanford already and how much will be transported to the Waste Isolation Pilot Project in New Mexico?



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**Jolene Unsoeld**

State Representative — Washington — 22nd District

August 5, 1986

**Personal Supplemental Comments by Jolene Unsoeld**

**to the Northwest Citizens Forum Report on the U.S. Department of Energy**

**Draft Environmental Impact Statement on Defense Waste**

It has been a privilege and a pleasure to participate with my fellow members of the Northwest Citizens Forum in the task of responding to the U. S. Department of Energy Draft Environmental Impact Statement on Disposal of Hanford Defense High-Level Transuranic and Tank Wastes at the Hanford Site. It is my opinion that the Report prepared and adopted by the Forum is an excellent piece of work and as fine a document as could be prepared under the circumstances. Because of the size of our Forum, however, and the time schedule under which, of necessity, we were forced to operate; it seemed inappropriate yesterday to try to raise some of these issues. I have chosen, instead, to add these additional comments to the Appendix in the Forum Report.

I am in agreement with the Forum Report and the emphasis placed in the Report in the EXECUTIVE SUMMARY which states:

> "First and foremost, the Forum believes we must begin a program for permanent disposal of Hanford defense wastes now. Current temporary near-surface burial of wastes should not be continued. Where disposal technology has been demonstrated, it should be implemented. In areas where uncertainty remains, a focused research and development program should be continued." 3.3.5.3

This objective of ensuring, to the greatest extent possible, the timely cleanup of the 43 years of accumulated nuclear waste at Hanford and additionally the prevention of any additional accumulation of non-recoverable hazardous chemical or radioactive wastes should also be the clearly identified goal of the USDOE and so identified in their final EIS. 2.2.1

I am in agreement with the Forum findings that USDOE has generally provided sufficient documentation to move ahead with the disposal of double-wall tank wastes, post-1970 transuranic wastes (TRU) and cesium and strontium capsules and that USDOE needs further study before proceeding with disposal of the single-wall tank wastes, pre-1970 TRU wastes and TRU contaminated soil sites. Further research and testing certainly is urgently needed before actual disposal can be implemented. 3.3.5.3



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The top priority for the State and for USDOE should be the research, development of technology and clean up of those wastes which pose the greatest risk to health and safety. This includes the single-shell tank wastes, the pre-1970 3.3.5.3 buried suspect TRU-chemical-contaminated solid wastes, and the transuranic and chemically contaminated soil sites. Characterization of the wastes and sites must be a very high priority with a time schedule for both the completion of major portions of this characterization process and availability of results.

I am concerned that a subtle emphasis exists in the Draft EIS in Appendix M and Appendix B which may have the effect of discouraging adequate research and 3.5.1.57 analysis of alternative recovery procedures for single-shell tank wastes for geologic disposal and of an overly optimistic evaluation of the use of engineered barriers for in-place stabilization of these high-level radioactive wastes. I support the view expressed by the Nuclear Waste Board:

> <u>In-Place Stabilization of Single-Shell Tank Wastes Overemphasizes the Role of the Tanks.</u> It is apparent that more emphasis is placed on protection of the single-shell tanks than on their contents. This is in sharp contrast with the premise in the multiple barrier concept of the NWPA that while containers should be as good as possible, the geologic 3.1.4.37 surroundings provide the basic isolation, and that container integrity must be assumed compromised or lost after some conservative period. It is not explained in the DEIS why HLW requiring deep burial in a favorable host rock is somehow different from HLW in some 30 or 40 single-shell tanks within 100 feet or less of the surface. Nor is there adequate documentation of the ability of the "grout" to immobilize radionuclides, or to provide structural stability to protect against cover subsidence into near geologic time. These issues should be addressed in the Final EIS.
>
> <u>The DEIS (Appendix "M") Is Inadequately Documented by References Cited: It is Unduly Optimistic Regarding Performance of Engineered Barriers.</u> The Board's contractor performed a thorough check of the technical references in Appendix "M" and found more than 20 cases where the reference either did not support the conclusion drawn or was misapplied. In all examples the effect 3.5.1.3 was to make the engineered barrier appear more effective or more highly developed than the reference says, or to drop qualifiers in the text. Also we are very concerned that Appendix "M" does not consider the extensive, multi-year design and field testing program of USDOE's Los Alamos National Laboratory, which we feel presents a more accurate and conservative picture of state-of-the-art in engineered barrier development. Data developed in Appendix "M" have been applied to calculations of barrier performance in other appendices, with the result that apparent errors are compounded and the estimates of ability to meet EPA release standards are seriously in question. Engineered barriers are central to the stabilization in-place concept, so that a thorough revision, review and evaluation is required before a Final EIS is issued.
>
> 3.1.4.5 <u>Inappropriate Engineering Design Is Proposed (Appendix "B") To Recover Waste in the Single-Shell Tanks, Creating a Probable Bias Against Recovery and Treatment for Geologic Disposal.</u> Beginning with a statement that no additional water can be introduced in the tanks to assist recovery, a 3.3.2.5 complex, expensive, hazardous and inefficient mechanical design is presented. We believe that on a systems basis it is immaterial if small amounts of water are employed, as long as no significant leak potential is

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> created. We will provide information regarding a recovery option based on commercially available equipment for USDOE consideration. The Final EIS should include a thorough analysis of other recovery options. Realizing 3.1.4.5 that surface treatment, not recovery, is the major cost in implementing geologic disposal, we propose to work with USDOE to develop an alternative flowsheet based on proven technology. The costs and risks of this can be compared to the stabilization in place alternative and a new assessment made of the preferred course of action. As written, the DEIS leads readers to the conclusion that the recovery of single-shell tank wastes for geologic disposal of their HLW fractions is not a reasonable option.
>
> <u>The DEIS Does Not Address the Important Issue of Postclosure Monitoring of a Deep Geologic Repository Within a Near-Surface Contaminated Environment.</u> While some residual contamination after abandonment of the 2.1.7 Hanford site is inevitable, the overall waste management scheme must consider the monitoring problem as long as Hanford remains a repository candidate. Alternatives for disposal should be evaluated for impacts on the monitoring capability after closure. To accomplish this there should be an overall description of the monitoring capabilities in an appendix of the Final EIS. The description should locate all contaminated areas, including LLW sites and areas accidentally contaminated.

In my view insufficient research to date has been completed to determine any preferred choice for permanent disposal of the wastes from the single-shell tanks. 3.1.4.30 At this stage I am unwilling to slight research of any alternatives. It is my position that we do not have enough data to make any reasonable choice — period. Although cost must of course be a consideration, protection of the environment, health and safety of future generations clearly is paramount.

Three pre-1970 transuranic-contaminated waste burial sites are located very near to the Columbia River and to Richland, in an area subject to flooding (the 300 Area). In the reference alternative and the geologic alternative, these wastes are 3.1.3.13 to be removed. The Final EIS should describe the criteria used to determine that these wastes are to be removed and should clearly identify other sites which may fit the criteria for removal of wastes similar to the criteria used to remove these.

USDOE is to be commended for its attempt to involve the public in the comment process on this Draft EIS. Because the issue is so complex, few people have the ability or time adequately to comment on the technical issues. In addition to the standard comment process, additional public involvement should be 2.3.2.8 undertaken before a Final EIS is issued and any record of decision is completed. The most important technical issues should be identified and made the subject of public forums in which technical professionals with different viewpoints or holding different assumptions could engage in dialogue and debate. Such a forum would allow members of the public to better understand and comment on these issues.

I concur with the Forum Report in Finding Number Five under General Comments 2.4.1.1 and Recommendations that "Informal self regulation by DOE is not adequate." However, I depart from the Forum's statement that USDOE "should be committed to substantial compliance with EPA or state hazardous waste disposal standards and other pollution control laws." To me it is not sufficient for USDOE to claim exemption from these and other regulations and it is not sufficient for them to commit to "substantial" compliance as interpreted and monitored by USDOE.

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Jolene Unsoeld Page 4

2.4.1.1 USDOE should comply with all federal and state environmental protection regulations. For example, the DEIS states that "Since no liquid point source discharge will be made to navigable waters, no permits will be required." USDOE should revise this section to note that any discharge of contaminants to waters of the state is subject to state regulation and state wastewater discharge permit requirements. For another example, the USDOE emphasis on stabilization of tanks leads to an acknowledged contamination of Hanford ground water. Contamination of ground water is contrary to state law. In the Final EIS, USDOE should agree to comply with all appropriate state laws to protect public health and the environment. Specifically, the laws with which USDOE should comply include, but are not limited to: The Federal Water Pollution Control Act, The Clean Air Act, The Safe Drinking Water Act, The Atomic Energy Act, The Comprehensive Environmental Response, Compensation and Liability Act, federal and state Water Rights Laws, The Hazardous Wastes Resource Conservation and Recovery Act, Sec. 8 of the Nuclear Waste Policy Act, and the State's dangerous waste management requirements.

Compliance with Washington laws and regulations is a minimal requirement for USDOE to keep faith with the people of this State.

Jolene Unsoeld

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ADDITIONAL VIEWS CONCERNING
GENERAL RECOMMENDATION #2

The following is an additional comment to general recommendation #2:

Because of the possibility of permanent nuclear waste contamination of the soil, air and water by material stored in some contamination of the soil, air and water by material stored in some existing single walled tanks, we believe the department must proceeds, in a timely manner, to provide a permanent disposal method for all high level military wastes at Hanford. 3.3.1.1

DOE as a priority should research and develop technologies for extraction and clean up of all high level waste including those from single walled tanks with efforts to minimize risk to workers.

In place stabilization should be a secondary consideration, after examining other known alternative options for removal or containment of the low level nuclear wastes.

Leonard Palmer

Joyce Cohen

Jane Hardy Cease

Cliff Bailey

James P. Thomas

J. Richard Nokes

Stafford Hansell

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ADDITIONAL COMMENTS CONCERNING
GENERAL RECOMMENDATION NUMBER 2

3.3.1.1 We have no objection to the 5 to 7 year period of research into methods of safe disposal of the waste that remains in the 149 single-well tanks, but we believe the focus should be on a safe system of retrieval, rectification, encapsulation in stainless steel containers and buried in a deep repository instead of into on-site shallow burial at Hanford.

/s/
J. Richard Nokes

/s/
Leonard Palmer

/s/
Senator Cliff Bailey

06/06/x

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GLOSSARY

| | |
|---|---|
| DEIS | Draft Environmental Impact Statement |
| DOE | U.S. Department of Energy |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| HLW | High-Level Radioactive (or Nuclear) Waste |
| HWVP | Hanford Waste Vitrification Plant (See Appendix C in Volume 2 of the DEIS for a description of the Plant.) |
| LLW | Low-Level Radioactive (or Nuclear) Waste |
| MRS | Monitored Retrievable Storage (A radioactive waste storage facility which allows the waste to be closely monitored and easily retrieved at a future date.) |
| MTHM | Metric Ton of Heavy Metal (e.g., uranium) |
| NEPA | National Environmental Policy Act |
| NRC | U.S. Nuclear Regulatory Commission |
| PUREX | Plutonium and Uranium Recovery through Extraction (A process used to recover plutonium and uranium for the national defense program.) |
| RCRA | Resource Conservation and Recovery Act |
| TRU | Transuranic Waste (Waste which contains radioactive elements heavier than uranium and which generally are long-lived.) |
| WIPP | Waste Isolation Pilot Plant (A disposal facility designed to accommodate defense transuranic wastes, located in New Mexico.) |
| WRAP | Waste Receiving and Processing (Facility) (See Appendix E in Volume 2 of the DEIS for a description of the Facility.) |

06/06/x

Exhibit T

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August 8, 1986

Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Dear Mr. Holten:

These comments are in regards to the draft EIS for disposal of Hanford Defense High-Level Transuranic and Tank Wastes, March 1986.

2.3.2.7 The first comment is more of a request. This department did not receive a copy of the EIS until late June, after we requested one. Wasco County is located downstream from Hanford and yet no county department received a copy, nor did the public library. For such important decisions as this it is difficult to comment with such short time available. Even the full comment period would be too short a time to study all three volumes in sufficient detail. We would request an extended comment period of at least an additional 90 days.

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The alternative of in-place stabilization is an obvious choice when considering two major factors:

1) Transportation of nuclear waste to other parts of the county.

2) The continued use of Hanford and therefore continued waste production.

However the contamination possibilites with tanks that may have over 1,000,000 curies of radioactivity left in them appear to be too great to just fill with gravel and bury with markers.

3.5.1.98 We would take exception to the calculations of only 32 health effects over 10,000 years if all control is lost on site and farming took place over the buried tanks. All it would take would be one exception to the theory that people would not dig through the riprap and accidently break open a tank.

It would appear that the geologic alternative would be best suited if the site was located other than in the Columbia Plateau. Groundwater conditions and fractured basalt will allow the groundwater to eventually flood out any deep repository and then only the containers themselves will be protecting
2.1.1 the waste from the environment. It has been apparently shown through studies at Hanford that the groundwater cannot be kept out of the repository for more than 300-500 years. Therefore, trusting containers to withstand





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underground pressures, heat and flooded conditions for thousands of more years. Although much waste would presumably be glassified the groundwater could still be contaminated rather easily.

This alternative would also present risks during transportation if the site was located in some other part of the country. However, transportation accidents would generally be a short-term acute situation that could have adequate clean-up, whereas the disposal site itself, if not placed in a well protected area, could very well cause chronic long-term contamination and be difficult to contain.

Since Hanford is for only one purpose, to produce plutonium and since the countries supply is more than sufficient, as stated by employees at Hanford it would then seem reasonable to come to the following conclusion:

1) Begin studies to find a satisfactory long-term geologic repository. 3.3.1.1

2) Train necessary emergency teams at the federal, state and local levels along the transportation routes. 3.4.2.24

3) Seriously consider a shut down of production facilities at Hanford and therefore eliminating transportation concerns of the waste for extended periods. This would allow concentration of efforts to find a suitable repository with only short term transportation problems. 2.5.6

Sincerely,

Dennis C. Illingworth

Dennis C. Illingworth R.S.
Supervising Sanitarian

DCI/cat

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August 8, 1986

Comments on the DEIS for Defense Waste at the Hanford Reservation

submitted by:

Betty McArdle
Nuclear Disarmament Coordinator
Oregon Chapter Sierra Club
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I would like to speak to you in the first person as well as for the 6,500 Sierra Club members around the state of Oregon. I do this because I, as an individual, am very concerned about what happens at Hanford. I was born in Portland in July of 1946. That means that I was in the womb and a child during the time when clouds of radioactive iodine were released from the Hanford Nuclear Reservation without any notice to the public or follow up health studies. That was just the beginning of a series of releases and leaks, intentional or accidental from Hanford. I think that we the public have to keep a sharp eye on activities at Hanford and make sure that the safest possible means are used in all operations. That might be expensive, even $11 billion or more, but it is a very small price compared to the cost of producing nuclear weapons.

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2.5.6 The number 1 priority and method for "getting rid of" defense waste at Hanford is to quit making it -- right now! It is the first thing to do to protect the environment and public health now and in the future. It is ludicrous to be talking about how to clean up the wastes when they are still being produced.

2.5.6 The best practice is to quit producing defense wastes at Hanford. But, if the Department of Energy (DOE) insists upon producing more waste the DEIS needs to address methods of disposing of future defense waste, as well as that already existing.

2.3.1.3
2.3.1.14 The issue of disposing of defense wastes at Hanford cannot be addressed in isolation from other Hanford issues, i.e., operation or not of the N-Reactor and PUREX plant, low level radioactive waste, non-radioactive waste, and a possible deep geologic nuclear waste repository at the Hanford site. You cannot talk about defense waste without talking about continued production (or non-production) of nuclear waste, without talking about the deep geologic depository, etc.

2.2.11 It is of paramount importance that the short and long term risks to the environment from defense wastes temporarily stored at Hanford be eliminated. Extraordinary efforts must be made to clean up all the wastes so that they cannot and will not escape into the environment. This clean up must happen as soon as possible with an upper limit of five years to complete the clean up.

The options for clean up of defense wastes presented by the DOE in its DEIS are dubious at best. Leaving the waste in the ground is just not acceptable. 3.3.1.1 The DEIS recommendation to continue using soil as a medium for dumping contaminated wastes is totally unacceptable. This practice is being halted at Savannah River. Why would Hanford need to or want to continue dumping waste in the soil? Check with the people at Savannah River for an alternative method. 2.2.10

The DEIS says that "wastes that are difficult and/or hazardous to retrieve will be left in place." Difficult retrieval does not justify leaving it in place. Extra effort (and expense) must be made to find a way to retrieve it. 3.3.2.5 It is much easier to control the safety risks to worker health and the environment at this time in removing all the waste from the ground for processing than it is to control what happens to that waste if it is left in the ground.

The Oregon Chapter of the Sierra Club finds the no-disposal option not acceptable. This option would have the most danger to the environment. 3.3.4.1 We realize that law requires this option be included, and hope that the DOE would never consider this option under any circumstances.

No actions should be taken (aside from permanent geologic disposal) that cannot be undone when better disposal technology is discovered. In place stabilization should not be considered. 3.3.4.1

Of upmost importance is finding a safe repository or safe solution. A key problem is DOE's dropping the search for a second deep geologic depository site, and it has repercussions for Hanford's defense waste. 2.1.3 With only one civilian repository there will be very little space for defense waste. This might influence the DOE to choose a less desirable disposal option that would not include deep geologic disposal of defense wastes. 3.3.5.7 The Oregon Chapter of the Sierra Club calls on the DOE to resume the process for siting a second repository.

DOE uses language that would cause readers to not be in favor of the geologic disposal alternative. Leading language would make readers believe that Congress would not be forthcoming with enough money for the geologic option. 3.3.1.2 Congress may in fact be willing to allocate the funds if the public shows their favor for that option. The Oregon Chapter of the Sierra Club is in favor of deep geologic disposal.

DOE's credibility is in question. The DOE does not have a good track record in telling the public the truth and for looking out for the welfare of the general public. 2.5.5 We the public must take a very active role in looking out for the public good. We insist that this very toxic waste be cleaned up and cleaned up the best possible way.

In several places, the DEIS states that more environmental protection will be considered if needed. 4.1.19 What more environmental protection? Yes, we are sure it will be needed. Use the most protection from the beginning. It is cheaper to prevent problems than it is to clean them up afterwards.

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## DEFENSE vs. COMMERCIAL WASTE

2.2.7 DOE defense facilities have safety standards different from others in the nuclear industry. The DOE claims to comply with Nuclear Regulatory Commission (NRC) regulations even though they are not required to do so. If this is true, the NRC should be invited to participate in this project to attest to DOE's compliance. The standards for disposing of military wastes should be at least as stringent as the standards for disposing of civilian wastes. The waste is highly toxic whether it is generated by a defense reactor or by a commercial reactor.

2.4.1.6 2.2.7 The option that would allow the waste in the single wall tanks to be left in the tanks and "stabilized" is unacceptable. This conflicts with requirements in the commercial industry (Nuclear Waste Policy Act) which say they must dispose of high level wastes in a deep geologic repository.

2.4.1.1 Commercial waste is defined in terms of "concentrations," defense waste is defined in the DEIS in terms of constituents of the waste. The DEIS claims that defense waste is less radioactive than commercial spent fuel. There is a more important consideration - the defense waste is more solubile and dispersable (particularly those in the single shell tanks). The waste will not be safely disposed of
2.4.1.9 unless DOE uses rules and methods at least as strong as those that apply to the commercial industry.

3.3.27 Another federal law that DOE should be required to comply with at Hanford is the U.S. Resource Conservation and Recovery Act (RCRA). One rule under RCRA is the requirement for the use of a liner. Liners are not included in the description of any of the options.

## WHAT TO DO WITH THE WASTES

3.3.1.1 The wastes in tanks should be retrieved, glassified, and deposited in a deep geologic repository. If liquid wastes are left in tanks they will eventually leak. This includes retrieving and processing the pre-1970 wastes. These wastes cannot be left where they are. It may be somewhat more "dangerous" for the workers today who work on the retrieval, but what might happen to those wastes in the future is too uncertain to take a chance on leaving them leaking in the ground.

3.1.3.25 The post-1970 plutonium contaminated wastes (contaminated equipment and laboratory wastes), which have been held with retrieval in mind, should be retrieved and disposed of in the New Mexico repository. Their current storage containers were not meant for long-term storage.

3.1.7.6 If process changes or additions are needed to handle single shell wastes, such must be in the analysis. To not do so says to the public that there is no real option to remove and process these wastes. In place stabilization would encourage the disposal of all defense waste in the Northwest. "The Hanford Reservation already has defense waste permanently stored there, why not send it all?" might be the reasoning. This is obviously unacceptable.

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## ENGINEERED BARRIERS AND MARKERS

The proposed "engineered barriers" have never been tested to see if they would in fact isolate the waste from wind erosion, water infiltration, and plant, animal, and human intrusion. There are some serious questions about whether the protective barrier would in fact
work. Among them is - the upper surface of the barrier is above 3.5.1.7
ground level. Wind erosion is an obvious factor that must be evaluated. To think that the surface would not change in 10,000 years is not realistic. There is likely to be more than one event
happening within 10,000 years affecting the barrier. The combined 3.5.1.32
effects might cause a break in the barrier allowing surface water to get to the wastes.

The engineered barrier is designed to keep roots and burrowing animals away from the waste. But, the soil may be ideal habitat for such animals. Burrows could make vertical movement of water through 3.5.1.84
the barrier soils more likely. Stabilizing the surface with plants might help. But, this raises other questions over long time spans. Some plants will die during drought. As the roots decay, they leave open vertical passageways for water to percolate through when precipitation increases.

Proven technologies are not available for barriers, which are a part of each option. An option which does not include barriers 3.5.1.8
should have been offered. Stabilizing waste in tanks must not be done until the "engineered barrier" has been tested and found foolproof.

If stabilization in place should be chosen (although the Sierra Club opposed that method) the "engineered barriers" (after the testing mentioned in the above paragraph) should not be the only means of protecting the environment. There shosld be other barrier systems that will assure that waste does not leak into the ground
water system (including the aforementioned RCRA required liner). 3.5.1.8
Water can intrude into the tanks from below the surface via the groundwater system, not just from the surface. The already leaking tanks pose a serious hazard.

The proposed markers might in fact attract digging and drilling 3.5.1.31
10,000 years in the future rather than discourage it. "Fatal doses to intruders might event result from the unlikely even of drilling into encapsulated waste in a geologic repository." (from the DEIS) Imagine yourself an archeologist a few thousand years in the future. Very few people in 1986 could read languages from 3,000 years ago. We have a great difficulty with Beowulf written in the Old English of
only about six hundred years ago. A sign showing digging (even with 2.5.1
a slash through it) might say to that future archeologist (or treasure hunter) "DIG HERE."

## GEOLOGIC QUESTIONS

Numerous geologic problems with the Hanford Reservation have been pointed out to DOE by a variety of qualified groups and individuals. Of particular interest is the location of the site near
the middle of the Pasco Basin, within 10 miles of the Columbia River 2.3.2.1
(into which numerous springs flow from the basalts) and in one of the

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2.3.2.1 structurally most complex parts of the Columbia Plateau. To most geoscientists, these factors would imply very complex geohydrology and likely groudwater resurgence. Indeed, after drilling and hydrologic testing in about 35 holes, DOE still cannot define the geohydrology of the site to anyone's satisfaction.

What is the general nature of fracture systems below the Hanford Reservation; the character of the interbeds of sandstone between the various flows? In regard to the last point, the Ellensburg Formation, which occurs as layers of very permeable sandstone between
3.2.1.9 many of the flows, is not given any discussion in this regard and is described, in general, in very benign and misleading terms (according to a geologist consultant). The descriptions of the stratigraphy are just too general. The collection of technical and inadequate information must appear impressive to the non-geological reader. In reality, the section is not at all impressive (again, according to a geologist consultant).

If the Hanford site should be chosen as the national repository (which the Sierra Club opposes), the drilling and driving of miles of tunnels and holes present the risk of altering the groundwater paths in ways that would seem most serious. The problem of reversing the
2.1.9 effects of these constructions is not merely one of backfilling and grouting the tunnel sections. Each hole driven will permit some expansion of existing fractures in the basalt that will be difficult to correct.

There is evidence of current earthquake activity in the immediate area of the Hanford reservation. The whole question of
3.2.2.2 structure and seismicity on the Hanford Reservation is vital to the integrity of shallow waste disposal sites. This question is not fully addressed in the draft EIS. Seismic activity might open up new cracks or other means of conducting groundwater (particularly new vertical conduits) which would allow waste to contaminate groundwater and move into the Columbia River.

Throughout the discussion of the hydrology, little mention is made of the potential for change in the hydrologic system in the projected 10,000 year period. The sole reference to this
4.1.25 (discussions of floods on the Columbia River and flash-floods on Cold Creek) are apparently related to climatic circumstances of today. In addition, there has never been a comprehensive study of the hydrology in this area just four miles from the Columbia River.

COLUMBIA RIVER, DAMS, FLOODS

The DEIS seems to presume that wastes that reach the Columbia River no longer are of concern because of dilution. There is no discussion of concentrations of radioactive material reaching the river or of dilution factors when it enters the river. The "assumption" seems to be that the dilution is so great that there is no problem. If this is the case it should be clearly stated. The radioactivity might not be diluted. We need to know if layers of mud in various parts of the river could become highly radioactive. This
3.2.4.2 could affect the birds, wildlife and fish which populate these river banks. More study is needed in this area.

Dams on the Columbia River upstream of Hanford are credited with 3.5.6.6
reducing the likelihood of floods like those in the past. Those dams will not last forever - they will in fact, last a very short time span compared to the toxic life of the waste. Without the dams natural river forces could alter the river bed. The altered river could eventually encroach upon the disposal area anywhere on the Hanford Reservation.

"The sediments and landscape features of the Pasco Basin ... demonstrate at least four episodes of flooding only a few tens of thousands of years ago in which almost the entire area of the Reservation was inundated. These floods resulted from damming by glacial ice of huge lakes in western Montana, followed by sudden release of the lake water when the ice dams failed. It is not impossible, and according to some climatologists it is probable, that the next few thousand years will see a return of glacial conditions to the northern hemisphere, and that ice dammed lakes may again form in the valley above Hanford.... The highest water level attained at Hanford was about 250 meters above the present rivers.... A flood of the extreme magnitude described might have drastic consequences for very long lived radioactive wastes stored near the present land surface. Soils and sediments containing low level wastes would certainly be eroded, and the present storage tanks for high level wastes might be breached and their contents scattered widely in the flood debris...." (source: Radioactive Wastes at Hanford: A Technical Review, National Academy of Sciences, 1978)

It might not be highly likely that there would be a flood, but when we are dealing with radioactive waste that will be active for at least 10,000 years, we must look at the possibility of unlikely
events. There are ways and places (or will be) to dispose of this 3.5.6.8
waste without inviting the possibility of waste being scattered in a flood.

CLIMATE AND ENVIRONMENTAL CHANGES

The discussion of future climate is based on sketchy data. In reality patterns of climate change for the last 20,000 years for the Pasco Basin are not at all clear and predictions of the next 10,000
years based on good evidence of the past would not necessarily be 3.2.1.3
reliable. The final EIS should evaluate the effects of possible global climatic changes, and the EIS should consider the effects of long-term unforeseen environmental changes such as those similar to the rising of the Great Salt Lake.

GROUNDWATER

The most vulnerable aspect of the environment is water - the groundwater under the Hanford site (and adjoining ground water which intermingles with the Hanford ground water) and the Columbia River. The studies on groundwater systems under Hanford have just begun. There is not enough information to take a chance on leaving any
radioactive waste in the ground. Independent studies have found that 3.5.3.6
radioactive leakage has traveled via underground channel from the ...

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3.5.3.11 Hanford site to the Columbia River at a much faster rate than previously thought by the DOE. The radioactive contamination of an on-site well used for workers' drinking water should by examined further.

3.3.2.9 Potential environmental contamination from strontium and cesium capsules in dry wells is not mentioned. What are the risks of this method? What is the mobility of these ions under various environmental conditions? What is the chance of groundwater invasion of the dry wells?

**EFFECTS OF PAST RELEASES**

In regard to the background radiation levels mentioned in the DEIS, past releases have affected the background radiation levels in the area. The true (pre-1940's) background levels must be ascertained, and compared to background levels elsewhere in the world with similar geology but with no nuclear facilities. The total increase must not exceed EPA standards for Iodine-129 in groundwater. Groundwater contamination risks should be specifically outlined. 3.5.3.11

3.1.3.28 The DEIS states that radionuclides observed in foodstuff samples collected in 1984 from farms around Hanford are attributable to worldwide fallout. No comparison studies are cited which show similar levels of radionuclides in other areas. DOE's conclusion that past releases at Hanford (TRU wastes) have been absorbed near the discharge point is not supported by any evidence/data presented in the DEIS. Where is the evidence to support this contention? What have been the consequences of the deliberate releases in the past?

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**BIRDS, WILDLIFE, FISH**

3.2.4.2 The DEIS states that "samples of deer, rabbits, game birds, waterfowl and fish were also collected near operating facilities and at locations where the potential for radionuclide uptake was most likely .... (Some radionuclides) were detected in some of these samples, (but) concentrations were low...." If concentrations were detectable after only 40 years what would be the level of concentration after 10,000 years? Birds and animals are able to go on site at Hanford and get contaminated at the open trenches and ponds containing radioactive waste. They might also be able to breach near surface permanent storage.

**"OTHER" WASTE**

3.1.3.19 There is also great concern about chemical waste and low level radioactive wastes. The Z plant waste did contain "low
3.1.6.1 concentrations" of plutonium and other TRU waste and was high in metallic nitrates. This waste was discharged via cribs to "soil columns" (section 3.3) The Sierra Club is very concerned about
2.3.1.13 nitrates as well as radioactive waste. There is great concern about the significant heavy metals in the sludge in the single shell tanks. The effects of chemical wastes on the disposal options should be described.

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3.1.3.4 The statement in section 3.2.5, "Waste in these sites (a TRU-contaminated soil site) is considered to have been disposed of." This is not acceptable. These contaminated soils must be cleaned up as well. Support data needs to be provided to back up the statement that TRU concentrations decrease rapidly at increasing depth.

2.1.6 Will there be airborne emissions during the various disposal methods, or in the long run after disposal? If it isn't known then study needs to be done.

2.3.1.14 Decontamination and decommissioning wastes were excluded from the proposed options. These should have been included. They should be described as part of all the waste to be disposed. We want to clean up the entire Hanford Reservation.

3.1.3.17 What will be done with the double shell and single shell tanks when they are emptied? What is to be done with contaminated support equipment including pipes? These things are also radioactive waste and must be safely disposed of.

2.2.2 DOE's DEIS does not deal effectively with the above mentioned wastes. They are potentially a very serious risk to the environment. The DOE must comply with federal and state requirements regarding waste handling and disposal. There needs to be a schedule of compliance which is rigorously followed. Congress will need to provide funding to clean up these wastes as well. A very important aspect of national defense is a clean and healthy environment.

**TRANSPORT**

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2.1.1 Putting all the Hanford waste into a deep geologic repository would require transport of such waste to the final site (and it should not be Hanford). Transporting is preferable to stabilization in the ground at Hanford. In the transport phase the waste would have been processed into a safer form than it is now in the ground. Transporting the existing waste away from Hanford would pose far less risk than transporting the country's waste IN to Hanford. 3.4.2.2

3.4.2.24 There are actions that can be taken to improve transport safety: avoid foul weather, stringent truck inspection, plans and preparation for emergencies, safe parking areas, transporting during slow traffic times, choosing routes with the least history of truck wrecks, working with the state and local agencies along the route.

**TOURISM AND RECREATION**

3.2.6.3 In regards to affects on tourism - the concern is not with tourism on-site at Hanford but with tourism all along the Columbia River downstream - all the way to the Pacific Ocean. Whether or not there is leakage into the Columbia River, if potential visitors think there is radioactive leakage they are going to take their vacation elsewhere. How would the various disposal options affect the Columbia River Gorge? It is being proposed as a National Recreation Area (NRA). Would it be useful as an NRA if (and when) waste leaked into the River (which it already has - source: Columbia River Reach

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3.2.4.1 Project, DOE studies)? The Columbia Gorge is a unique area - a national treasure. All effort must be taken to protect it.



CHANGED STANDARDS

The DEIS states that 45% of TRU waste was reclassified based on "engineering judgment and historical records." It also reflects a change from 10nCi/g to 100/g to qualify as high level waste. What
2.4.1.8 happened when the standard was changed from 10/g to 100/g? What is the justification for this change? The DEIS does not justify this change. How much of the transuranic waste will fit the low-level waste category because of this change? What will be the disposal method for low-level waste?

The EIS should state that no waste form will be diluted so that
2.4.1.15 it may fall under less stringent disposal requirement, or that the rules will be changed again (as in the 10/g to 100/g).

RESEARCH AND DEVELOPMENT

The DEIS does not include a complete inventory of all wastes at Hanford including those not being considered by this DEIS. All waste
2.2.13 should be considered by the EIS. Such an inventory is needed to fully evaluate this DEIS. Also, an ongoing independent audit of DOE waste management work should be done.

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Worst case accident analyses were not included in the risk
2.3.1.7 assessments. We need to look at worst case scenarios for each option and for the possibility that all the waste would be exposed to the environment before the radioactivity had expired. In the case of non-radioactive toxic waste its toxicity does not go away.

2.3.2.1 This DEIS is premature. There need to be more studies, more research and development. All disposal technologies suggested need
2.2.9 refinement. The level of funding necessary to develop a sound disposal technology should be included in the final EIS. There needs to be independent study on the effects of defense waste on the environment. There is word that the U.S.G.S. has agreed to undertake an independent study of the Columbia River below the Hanford Reservation during the summer low-flow periods. More studies such as
2.3.2.9 this need to be undertaken. Additional references on ecological impacts should have been included if they are available - and if they are not available research needs to be done in this area.

2.3.2.3 Research and development will be needed before some of the disposal work can be done. The final EIS should provide performance criteria for the work on which the R&D must be done. Any changes in criteria to complete the work that come out of the research and development must be made open to the public for comment.

The easily retrieved wastes should be permanently disposed of immediately. The pre-1970 wastes and plutonium contaminated waste pose the same hazard as the post-1970 wastes. If the pre-1970 wastes are very difficult to remove, then the DOE must go to extra effort to

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find a method of removing and processing these wastes. All the waste must be processed and safely disposed. 2.2.10

The excelerated research and development on better retrieval and disposal methods would find a better and safer way to retrieve and 3.1.4.30
dispose of the currently difficult to retrieve wastes. There needs to be a time limit on when to begin the retrieval and disposal of the difficult to retrieve wastes (say 2 - 5 years). Stabilization in place is unacceptable.

At Savannah River, DOE used methods other than vitrification to stabilize tank wastes. The DEIS should have described other means of stabilizing waste.

There is a need for studies done by independent, impartial 2.2.13
organizations such as the U.S.G.S., National Academy of Sciences, E.P.A., National Institute of Health, Project Search.

While further research and development is in process some temporary storage methods are not acceptable, such as: cribs, french 2.2.10
drains, reverse wells, ditches and trenches, cardboard boxes, single wall tanks. Of course, the most desireable situation would be to stop further production of waste while research and development is 2.5.6
being completed (and afterward).

If after doing more testing and research and development on 2.3.2.3
better technology there are changes in the DEIS then the DOE must comply with the National Environmental Policy Act (NEPA) to review these revisions. Irreversible actions must not be taken until more testing has been completed successfully.

FUNDING

Weapons program funding should include research and development 2.2.9
for treatment and disposal methods for wastes, and funds for actual disposal. Significant funds should be diverted immediately from new weapons to a concerted effort to research and develop how to make wastes safer. More significant funds should be diverted for construction and expansion of safe disposal areas for defense wastes.

Funding is a serious problem. There has been an enormous amount 2.2.9
of funding for the production of nuclear weapons - but not for the **SAFE** production of nuclear weapons. The problem is the lack of funding for the safe long-term disposal of wastes generated from the production of nuclear weapons. (There are other problems including a lack of safe working conditions) Congress requires the commercial nuclear industry to concurrently set aside funds for the disposal of radioactive wastes as they are generated. DOE should be subject to this requirement. Nuclear weapons production should not be allowed without concurrently providing funding to dispose of generated wastes.

Betty McArdle

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8 August 86

Rich Holten / EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99352

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WM DIVISION

2.1.1 I oppose further disposal of high-level nuclear waste at Hanford, Washington.
2.1.10 I feel the DOE was totally wrong in eliminating a second repository and that the EIS is inadequate in its treatment
2.2.14 of the site selection process and of the potential hazards associated with further
2.5.6 stockpiling of nuclear waste at Hanford.

Please register my strong opposition to continued use of Hanford for storing high-level nuclear waste.

Terri F. Barfield
E17 - 14th Way
Edmonds, WA 98020

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RECEIVED DOE-RL
AUG 12 1986 6
WM DIVISION

August 5, 1986

Dept. of Energy
Federal Building
825 Jadwin
Richland, Wash. 99352

Re: Nuclear Waste Repository

Dear Sir:

There has been a lot of controversy lately about Hanford's selection as a possible waste repository site, and I would like to add my comments to the public record.

The Tri-Cities' has lived and died by the whims of Congress and the NRC since the early 1940's and obviously that is not going to change. As the Hanford Reservation is still federal property I see no reason to consult with any state or local government as to what the Federal Government does on their own property.

I have never heard of nor seen the state or any local government offical consult the Federal Government when they decide to build something that some of us would consider dangerous.

I would not let anyone tell me what I could do with my personal property, don't let anyone tell you what you can do with your land. 2.3.2.12

Sincerely

GERALD H. BOSCH
648 S Booker Rd.
Othello, Wash. 99344

bab:GHB

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RECEIVED DOE-RL
AUG 12 1986 0222
WM DIVISION

USDOE
Att: R.A. Holten
Richland Operations
PO Bx. 557
Richland, Washington
99352

Abundant Future
Kifar Yosemite Spokesperson
1204 Eighth Apt. 4
LaGrande, OR 97850

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Dear Friends,

Without a bullet having been fired, without a missile having been launched, without a bomb having been dropped it can be said that the nuclear dilemma, the nuclear arms race is already KILLING us.

The government wants to bury high-level wastes at some site in the country. It's not a question of whether the radioactive wastes will escape and endanger human beings and all the systems that human beings depend on including the water of the Columbia River, agricultural production in the Northwest and an important fish and wildlife resource. There is no question that radioactive contamination from the repository would occur. The only questions are "How soon?" and "How much?"

2.1.1 Groundwater intrusion, questionable soil and ground water hydrology, transportation hazards and a possible $100 billion price tag by the year 2000 makes the site of Hanford, or any site, a possible potential to be a "Trojan" horse waiting on the doorsteps of our future generations.

We already have enough nuclear waste stored in inadequate surface
2.5.6 facilities to fill one average-size respository. We have not found even one proven geologic repository to store today's wastes, let alone tomorrow's. Are we so confident of our abilities in this department that we can continue to produce these wastes without demonstrating our ability to ship them, store them, and seal them up in perpetuity?

The Nuclear Regulatory Commission is having a hard time trying to decide what to do with the 20 aging power reactors which will be ripe for decommissioning in the next 15 years, a number that will grow to 70 by the year 2[illegible]. So, we have a huge stockpile of spent fuel rods, radioactive wastes, brittle unsafe reactors buildings and a growing foreign array of radio-active waste. But it goes on. The dragon still breathes it's deadly fire.

We call for the IMMEDIATE closing of all the Nation's nuclear power
2.5.6 plants. We call for the ending of the manufacturing of nuclear weapons. We ask for all of the Nation's wastes to stay right where they are until a proven means of making them harmless is found. We want a future for ourselves and our children. The world is abundant once we start living responsibly and in harmony with the good earth.

Sincerely in a Abundant Future,

Kifar Yosemite

Kifar Yosemite

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STATE OF WASHINGTON
NUCLEAR WASTE BOARD
Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6670

August 8, 1986

Michael J. Lawrence, Manager
Richland Operations Office
U.S. Department of Energy
P.O. Box 550
Richland, WA 98352

Dear Mr. Lawrence:

Enclosed are the Washington State Nuclear Waste Board and Council comments on the draft environmental impact statement "Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes" The Board and Council coordinated an extensive review of the document which included a series of public meetings.

In-depth reviews were conducted by the Board, Council, state agencies, staff and contractors to the Board. During and following our public meetings we received comments from local governments and citizens. We expect the final EIS to address each of the comments in this response. Comments were not actively solicited from local governments and our understanding is that they will direct their comments to you.

During our review process we coordinated with each of the affected Indian tribes. The Yakima Indian Nation is represented on the Nuclear Waste Advisory Council and participated in every aspect of this review. They will share the results of their review with us. The Yakima Indian Nation representative indicated concurrence with the issues raised in this comment package.

This comment package includes the following:

- Statement Overview
- State Agency Comments
- Local Government Comments
- Public Hearing Statements
- Citizen Comments Compiled by Hall & Associates
- Technical Review Prepared by URS Corporation

(no comment identified)

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(no comment identified)

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Michael J. Lawrence
August 8, 1986
Page 2

We appreciate the opportunity to comment on this most important document. It was very difficult to complete the evaluation during the limited review period. I am sure you will agree that this is the first critical step in a long, complex, expensive cleanup process which affects all Pacific Northwest citizens. I see an immediate need for an issue resolution process to ensure decisions on priority issues are made in a timely, cost effective manner. The Nuclear Waste Board, with adequate assistance from USDOE, is willing to begin development of a procedure whereby Pacific Northwest groups have an opportunity to participate in an issue resolution process. The goal would be to develop, to the degree possible, a consensus on cleanup priorities and funding.

Please contact me or Terry Husseman if you have questions.

Sincerely,

Warren A. Bishop, Chair

WAB/DF:hlt

Enclosure

cc: R.A. Holten
Nuclear Waste Board
Nuclear Waste Advisory Council

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# STATEMENT OVERVIEW

## INTRODUCTION

The Washington State Nuclear Waste Board has coordinated an extensive review of the Draft Environmental Impact Statement (DEIS) for Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. Reviews were conducted by Board committees, the Nuclear Waste Advisory Council, state agencies and citizens. The Board and Council sponsored a series of public meetings to receive comments on the Defense Waste DEIS. Over 800 citizens attended and more than 200 offered comments.

This Statement Overview is based, in part, on detailed comments which follow. Appendix A contains the individual comments of state agencies. Appendix B contains local government comments. Appendix C contains statements made during USDOE hearings by Governor Gardner, Warren A. Bishop, Chair of the Nuclear Waste Board, Andrea Beatty Riniker, Director, Department of Ecology, and Representative Dick Nelson. Appendix D contains the compiled results of the five public meetings conducted by the Board and Council in Yakima, Kennewick, Spokane, Vancouver and Seattle. Appendix E contains the technical review comments prepared by URS Corporation, a consultant to the Board. This overview and the appendices comprise the Board's response to the adequacy of the Defense Waste DEIS.

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The Board recognizes the inherent complexity associated with cleanup of a 40-year accumulation of defense wastes. This document presents our current findings. We expect to continue working with USDOE to clarify and resolve issues.

This overview highlights the major policy, technical, legal, regulatory and transportation issues raised during the review period. In addition, it contains a proposal for issue resolution while the Final EIS is being prepared.

The major areas of concern identified include the following issues which must be addressed in the Final EIS:

2.3.1.14 - The scope of the DEIS is too narrow because it does not address the full range of radioactive and chemical components of wastes.



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- The document contains overly optimistic performance assessments for engineered soil barriers. 3.5.1.57
- The USDOE vitrification plant alternative does not commit to a facility designed and sized to handle all tank wastes in a timely, efficient manner.
- USDOE plans for disposal of non-high level wastes (grout) do not include provisions for obtaining federal/state hazardous waste permits.
- The document uses bounding assumptions to cover a range of impacts or assumptions rather then specifically identifying impacts of "the" proposal as required by the National Environmental Policy Act. 2.4.1.17
- Delayed Records of Decision are a concern because USDOE has not committed to preparing supplemental EIS's which include opportunities for citizen comment. 2.3.2.3
- If Hanford remains a repository candidate, USDOE must have a monitoring program in place which can determine if the source of environmental contamination is from a repository or from defense wastes. 2.1.10
- The document does not acknowledge USDOE's responsibility to comply with appropriate federal and state laws. 2.4.1.1
- The USDOE decision to delay work on a second repository increases pressure within USDOE to stabilize the single-shell tank wastes in place, and raises the concern that deep geologic disposal is not considered as a serious alternative for all tank wastes. 3.3.5.7
- The document fails to address the possessory and usage rights and cultural heritage of native people. 2.4.2.2

The overall goal of the state of Washington is to ensure the timely cleanup, to the degree possible, of the 40- year accumulation of Hanford wastes while ensuring future waste is treated and disposed as generated. In the Final EIS, USDOE goals should be clearly identified. If the USDOE goal differs from the state of Washington goal, the rationale for such differences should be clearly explained.

2.2.1 The state of Washington and USDOE share a common desire for timely cleanup, to the degree possible, of the Hanford defense wastes. The DEIS is a first, critical step in a process which will span decades and cost billions of dollars. Issues raised in the DEIS and in the comments to the DEIS affect all segments of the Pacific Northwest community.

2.3.1.8 Washington State legislation gives the Nuclear Waste Board the responsibility for developing state policies relating to the management of radioactive wastes, carrying out review of activities which enable the state to effectively evaluate federal actions, monitoring activities related to disposal of high-level waste, and serving as a spokesman on behalf of Washington State citizens. The powers assigned to the Board make it the logical body to take a leadership role in developing a regional consensus on funding priorities and cleanup. The Advisory Council provides advice, counsel and recommendations to the Board and continues to work closely with Board members in the development of state policy.

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The Nuclear Waste Board, with adequate technical and financial support from USDOE, is willing to begin immediately to develop a procedure for resolving issues. Pacific Northwest governmental, technical, and interest groups would be invited to periodic public meetings to air issues and discuss proposed solutions. The goal would be to develop, to the degree possible, a consensus on cleanup priorities and funding.

2.2.9 Whenever USDOE commits to a defense program or project which would generate wastes, there should be an dedicated setaside of monies for treatment and disposal of such wastes. The Nuclear Waste Board and Council will work with the Governor and Congressional delegation to implement this approach.

**POLICY ISSUES**

Scope of the DEIS. The scope of the DEIS is too narrow. Low-level radioactive waste, contaminated soils, hazardous chemicals, organic complexing agents and solvents are

2.3.1.13 all part of the wastes produced and must be addressed within the scope of the Final EIS. The final document must include a complete listing by individual site of types and amounts of radioactive isotopes and hazardous chemicals, along with a description of the impacts associated with their presence.







NEPA Compliance. USDOE must identify impacts of "the" proposal as required by the National Environmental Policy Act. The use of "bounding assumptions" to cover a range of impacts or alternatives is not acceptable. We are also concerned about the use of delayed Records of Decision. We recognize that some alternatives will require additional research. When research is complete, and USDOE is ready to recommend action, USDOE must, as a minimum, prepare a supplemental EIS and give the public an opportunity to comment. 2.4.1.17

The DEIS does not satisfy the requirement that an EIS discuss reasonable alternatives. A discussion in general terms of a range of options, as contained in the DEIS, is insufficient. 2.3.2.2 Further, the alternatives that have been discussed have not been sufficiently described in terms of their application to specific sites. In addition, the DEIS does not set forth even a preferred alternative. This conflicts with the intent of CEQ guidelines that, if a preferred alternative existed when the Draft EIS was issued, the CEQ guidelines require that it be identified.

Timing and Priorities for Cleanup. USDOE should expedite relevant research and procedure development which leads to the timely clean up of those wastes posing the greatest risk to human health and safety. The single shell tank wastes, the pre-1970 buried "suspect" TRU-chemical-contaminated solid wastes, and the transuranic and chemically contaminated 3.3.5.3 soil sites fall into this category. Characterization of the wastes and sites should be a very high priority. USDOE should provide a time schedule for the completion of major portions of this characterization process and indicate when results will become available.

Certain facilities are common to several categories of waste and therefore early design work is appropriate. The vitrification plant would meet this criterion if the facility is designed with sufficient capacity to handle processed single-shell tank wastes. Studies should continue on the grout concept with special emphasis on demonstration of the structural integrity and resistance to leaching of the waste forms. USDOE should keep the Board fully apprised of progress and problems associated with Savannah River activities as they relate to waste form technology development. Assuming that the geologic disposal alternative is chosen as the preferred option for disposal, what type of vitrification facility would be built, and 3.3.5.3 what are the estimates for facility completion? The Board will not support proceeding with waste form technologies involving vitrification or grout until USDOE research clearly demonstrates the ability of the waste forms to meet existing criteria.

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2.2.15 Criteria for Cleanup. On April 18, 1986, the Nuclear Waste Board passed Resolution 86-2, which established criteria for review of the Defense Waste DEIS. Each alternative and recommended action should:

- 2.2.1 minimize environmental and health effects;
- 2.4.1.1 be consistent with appropriate federal and state laws and regulations, including among others the National Environmental Policy Act, the Atomic Energy Act, the Nuclear Waste Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response Compensation and Liability Act, the Clean Water Act, the Clean Air Act, 10 CFR 960 and 40 CFR 191;
- 3.3.5.4 use state-of-the-art technologies which have been proven safe;
- minimize future releases to the environment from ongoing and future nuclear defense activities; and
- 2.2.1 USDOE should consider economics, but economics must not drive decisions.

A copy of the resolution is attached to the Statement Overview.

Relationship to Nuclear Waste Policy Act (NWPA). The state of Washington position is that the defense wastes on the Hanford Nuclear Reservation affect pre-closure activities
2.1.6 and performance if a repository is proposed for the Hanford site, and will affect post-closure activities and performance wherever a repository is located. Site characterization activities will be affected by the location and concentrations of defense wastes, and site characterization activities at Hanford may disperse wastes now in Hanford soils and groundwater.

2.1.8 Implications of Second Round Postponement. On May 28, Secretary of Energy Herrington recommended, and President Reagan approved, three western sites for characterization for the first high-level nuclear waste repository and announced that all site specific work on the second repository would be indefinitely postponed. From all indications the decision to postpone work indefinitely was based, in part, on USDOE data which assumed single-shell wastes would not go to a repository. If the decision was influenced by such an assumption, there will surely be added pressure on USDOE to stabilize the single-shell tanks in-place. This assumption also raises questions as to whether USDOE considers geologic disposal as a serious alternative for single-shell wastes.



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Future Land Use. The DEIS describes a system to mark the boundary of what USDOE describes as "actual disposal sites", which encloses 32 square miles. The Board questions if all the 32 square miles area must be off limits forever. To be consistent with the state of Washington cleanup goal, only that land now irretrievably contaminated by dangerous materials should be written off. USDOE must conduct a separate public process to allow full citizen participation in the process of making any decision concerning the selection of any land for condemnation. 2.5.7

Indian Treaty Rights. A major issue not addressed in the EIS concerns rights of the Indians, and in particular, the Yakima Indian Nation. The Hanford site is included in the ceded lands agreed to in an 1855 treaty. Permanent disposal directly impacts Yakima Nation rights. It is imperative that the possessory and usage rights and the cultural heritage of native peoples be addressed and include all affected tribes. 2.4.2.2

Future Plutonium Production and Military Waste Generation. The DEIS assumes that the N Reactor and PUREX will be operated until 1995, producing tank wastes from this and other USDOE sources corresponding to the processing of 12,000 tons of N Reactor fuel. 3.1.7.3 The DEIS takes into account the processing of an additional 20,000 tons of irradiated uranium beyond 1995 "in response to national defense or research and development needs". The DEIS should consider the impacts of the possible range of defense waste generation, including consideration of the potential for use of either the current plutonium stockpile or recycled plutonium from obsolete warheads. This must be addressed because the total volume of defense and commercial waste will determine the need for a second geologic repository. 2.1.3

Cleanup Funding. The Hanford cleanup will require large financial expenditures over several decades. A mechanism must be established to provide full funding for management of defense radioactive, chemical, and mixed wastes on the Hanford Reservation. The future basis for cleanup should be a setaside of monies in the Department of Energy budget for defense related activities. Whenever USDOE commits to a defense program or project which would result in the generation of such wastes, a percentage of the cost would be placed into a fund dedicated to treatment and disposal activities. The Nuclear Waste Board and Council will work with the Governor and Congressional delegation to develop this approach to funding. 2.2.9

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## TECHNICAL ISSUES

3.1.4.37 In-Place Stabilization of Single-Shell Tank Wastes. It is apparent that more emphasis is placed on protection of the single-shell tanks than on their contents. This is in sharp con-

2.2.7 trast with the premise of the multiple barrier concept of the NWPA that while containers should be as good as possible, the geologic surroundings provide the basic isolation and container integrity must be assumed compromised or lost after some conservative period. It is not explained in the DEIS why low-solubility HLW requiring deep burial in a favorable host

3.1.8.1 rock is somehow different from highly-soluble HLW in single-shell tanks within 100 ft or less of the surface. Nor is there adequate documentation of the ability of the "grout" to immobilize radionuclides, or to provide structural stability to protect against cover subsidence into near geologic time. These issues should be addressed in the Final EIS.

Engineered Barrier Performance. The Board's contractor performed a thorough check of the technical references in Appendix "M" and found more than 20 cases where the reference either did not support the conclusion drawn or was misapplied. In all examples the effect was to make the engineered barrier appear more effective or more highly developed than the reference says, or to drop qualifiers in the text. Also we are very concerned that Appendix "M" does not consider the extensive, multi-year design and field testing program of USDOE's Los Alamos National Laboratory, which we feel presents a more accurate and conservative picture of state-of-the-art in engineered barrier development. Data developed in

3.5.1.3 Appendix "M" have been applied to calculations of barrier performance in other appendices, with the result that apparent errors are compounded and the estimates of ability to meet EPA release standards are seriously in question. Engineered barriers are central to the stabilization in place concept, so that a thorough revision, review and evaluation is required before a Final EIS is issued.

Recovery of Single-Shell Tank Wastes. Beginning with a statement that no additional water can be introduced in the tanks to assist recovery, a complex, expensive, hazardous and

3.1.4.5 inefficient mechanical design is presented. We believe that on a systems basis it is immaterial if small amounts of water are employed, as long as no significant leak potential is created. We will provide information regarding a recovery option based on commercially available equipment for USDOE consideration. The Final EIS should include a thorough analysis of other recovery options. Realizing that surface treatment, not recovery, is the major cost in implementing geologic disposal, we propose to work with USDOE to develop an



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alternative flowsheet based on proven technology or new technology as developed. The costs and risks of this can be compared to the stabilization in place alternative and a new assessment made of the preferred course of action. As written, the DEIS leads readers to the conclusion that the recovery of single-shell tank wastes for geologic disposal of their HLW fractions is not a reasonable option.

Future Climates and Precipitation. The assumed maximum annual precipitation (Appendix "M") is 30.1 cm, with two cases covering maxima in the spring and fall. This fig- 3.5.1.71
ure has been approached within recent years, and much wider swings are observed in tree-ring data going back several hundred years. Established scientific methods backcast for a million years, and they forecast times within the 10,000 year period when climates will be warmer and wetter, then cooler and highly variable due to the onset of a glacial period. The effect of prolonged heavy storms, documented in the Los Alamos reports, is not modeled, yet it will probably dominate barrier performance. The Final EIS should reexamine this issue, using a more informed estimate of precipitation events.

Post-closure Monitoring of a Deep Geologic Repository. While some residual contamination after abandonment of the Hanford site is inevitable, the overall waste management scheme must consider the monitoring problem as long as Hanford remains a repository can- 2.3.1.10
didate. Alternatives for disposal should be evaluated for impacts on the monitoring capability after closure. To accomplish this there should be an overall description of the monitoring capabilities in an appendix of the Final EIS. The description should locate all contaminated areas, including LLW sites and areas accidentally contaminated.

Waste Acceptance Criteria. Under the NWPA, USDOE is responsible for accepting defense high-level waste, but acceptance criteria are not as yet specified. Waste form pro- 3.3.5.3
duction will probably be initiated prior to selection of the first repository site and submission of the license application to the U.S. Nuclear Regulatory Commission (NRC). A significant portion of the defense high-level waste will be committed to permanent waste forms before the first repository is licensed. Although it is USDOE's intent to design defense waste forms that perform satisfactorily at any of the sites under consideration, the following activities should be completed before the waste form production process is finalized:

1. Establish a Quality Assurance Program
2. Allocate performance (specify the design objectives of the waste package and its component parts).
3. Select a design reliability target for the waste package and its component parts.
4. Specify a method for assessing the performance of the waste package and its component parts.
5. Identify the data base required to support the performance assessment.
6. Identify a plan and schedule for acquiring additional data that may be needed.

The completion of the above activities and early interaction with the state and NRC will reduce the risk that the proposed waste forms will be found unacceptable.

<u>COMPLIANCE WITH FEDERAL AND STATE LAW</u>



Requirements for compliance with federal and state laws are often imprecisely stated and sometimes misstated in the DEIS. In relation to the general disposal program discussed in the DEIS and the various radioactive and non-radioactive wastes involved, USDOE must
2.4.1.1 commit to compliance with the following federal and state laws:

<u>Air Pollution Control Laws</u>. The Clean Air Act requires federal departments and agencies to comply with *"...all federal, state, interstate and local requirements...respecting the control and abatement of air pollution in the same manner, and to the same extent as any non-governmental entity."*

2.4.1.11 USDOE falls within the scope of this "federal facilities" mandate. Further, it is clear from legislative history of the 1977 amendments to the federal Act that radioactive pollutants, including source materials, special nuclear materials and byproduct materials subject to regulation by USDOE under the Atomic Energy Act, are also covered. In this light, USDOE's proposed activities must comply with all pertinent substantive and procedural requirements of federal and state law.

<u>Water Pollution Control Laws</u>. The Federal Water Pollution Control Act contains a
2.4.1.13 1977 amended "federal facilities" provision that is almost identical to the one contained in







the Clean Air Act. Thus it would appear that this Federal Water Pollution Control Act provision would have the same broad range of coverage as the Clean Air Act provision even though the legislative history is not explicit on the point.

A better view, which should apply at the very minimum to chemical wastes, is that USDOE should comply with all water pollution control requirements, procedural and substantive, of federal and state law. For example, while the Federal Water Pollution Control Act's (FWPCA) regulatory features do not apply to groundwater, the state's water pollution control laws do. Therefore, USDOE is subject to the state's groundwater protection program of pol- 2.4.1.13
lution prevention requirements and waste discharge permits. As to surface water, both federal and state requirements apply. Of particular note is the FWPCA's provision which states: *"Notwithstanding any other provision of this chapter it shall be unlawful to discharge any radiological...or high-level radioactive waste into navigable waters."*

<u>Hazardous Waste Control Laws</u>. The Resource Conservation and Recovery Act (RCRA) establishes a national program of federal-state administered hazardous waste management. This program incorporates a policy to minimize the generation of hazardous wastes and establishes requirements for the "cradle to grave" treatment, storage and disposal 2.4.1.9
of such wastes. RCRA, like the FWPCA and the Clean Air Act, requires all federal agencies and facilities to comply with the provisions of federal and state law regarding hazardous wastes. The Act does, however, exempt certain radioactive materials (i.e. "source, special nuclear, and byproduct materials") which are under the exclusive authority of the Atomic Energy Act.

This does not mean that all wastes proposed for disposal in the DEIS are immune from federal and state hazardous waste laws. USEPA very recently published notice that at a mini- 2.4.1.9
mum, "mixed wastes" containing both radioactive components (those which of themselves are immune from the standards of RCRA) and hazardous components, are subject to RCRA as regards their hazardous components. While the impact of the EPA action on activities at Hanford is not completely resolved, it is clear that RCRA applies to significant portions of the defense waste materials covered by the DEIS.

<u>Safe Drinking Water Act</u>. The federal Safe Drinking Water Act (SDWA) grants the Administrator of the EPA the authority to establish primary and secondary drinking water 2.4.1.14
standards. The Administrator is required to set maximum contaminant levels for substances

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which may have an adverse effect on human health. Standards have been established for inorganic and organic chemicals, gross alpha particle activity, beta and gamma radioactivity, radium-226 and radium-228, among other contaminants. The states may be delegated primary enforcement authority for the SDWA regulations and further may implement standards which are stricter than those promulgated by EPA. As with the federal water, air pollution and hazardous waste laws, federal agencies must comply with all federal and state requirements to ensure that their activities do not impact on the quality of "any federally owned or maintained public water system", or any other public water supply. USDOE must ensure that disposal activities at Hanford do not result in the violation of SDWA standards for water supply on the Hanford Reservation, or for those public supplies which draw water from the Columbia River. 2.4.1.14

Atomic Energy Act. Activities of USDOE undertaken in the disposal of various wastes at Hanford are subject either directly or indirectly to the requirements established pursuant to the AEA as amended. Among these requirements are those contained in: 2.4.1.1

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(a) 10 CFR Part 20, "Standards for Protection Against Radiation", which includes sections dealing with permissible radiation doses for occupational exposure, and general guidelines for disposal of wastes.

(b) 10 CFR Part 60 sets forth the specific guidelines for disposal of high-level radioactive wastes in geologic repositories.

(c) 10 CFR Part 71 establishes transportation package requirements for highway route controlled quantities.

(d) 10 CFR Part 960 contains the guidelines for the recommendation of sites for nuclear waste repositories.

(e) 40 CFR Part 190 sets environmental radiation protection standards for nuclear fuel cycle operations, including reprocessing of spent uranium fuel.

(f) 40 CFR Part 191 establishes "EPA Radiation Protection Standards for Managing and Disposing of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes". This regulation sets criteria for emissions from repositories and other storage or disposal operations.



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Water Right Laws. In order to carry out a long-term defense waste disposal program, substantial amounts of water will be needed. USDOE has no rights to withdraw surface or groundwaters established under federal or state law for creation and operation of a waste disposal program at this time because (1) no water rights were established with the creation of the Hanford Reservation under the federal "reserved rights" doctrine for a geologic waste disposal purpose and (2) no rights for such a purpose have been established under the permit system of state law. Assuming USDOE follows the longstanding federal "deference" policy of looking to state water rights laws to obtain needed new water rights, USDOE will be required to comply with the state of Washington "permit system" in order to establish needed water rights. 2.4.1.12

Nuclear Waste Policy Act. The NWPA definition of high-level waste clearly includes all tank wastes. By Section 8 of the NWPA, the Secretary of Energy is directed to proceed promptly with arrangements for the disposal of high-level defense wastes in a geologic repository to be developed under Subtitle A of Title I of NWPA, if the President determines that defense wastes should be "commingled" in such a repository. The President has made a decision to commingle. The DEIS should address the approach USDOE will follow in complying with Section 8. 2.4.1.4

Hazardous Waste Cleanup. The federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) imposes liabilities on persons and entities, including agencies of the government, that are responsible for releases of various dangerous substances to the environment. While no state or federal permits are required by CERCLA, the Act does provide substantial powers to both state and federal government to protect natural resources of a state. In this light, USDOE should address the environmental protection and pollution control impacts of CERCLA on the proposed activities of USDOE. The Final EIS should identify specific disposal sites that would come under the purview of this Act. 2.4.1.10

The Final EIS should acknowledge USDOE's responsibility for complying with all the identified laws. If USDOE feels that any of these laws do not apply there should be an explanation on its justification for that position. For the detailed legal citations, see the Attorney General's comments in Appendix A-3. 2.4.1.1

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TRANSPORTATION

3.4.2.2 Transportation risks and impacts probably should not preclude disposal of Hanford defense wastes at an off-site geological repository. However, several points identified below must be addressed in the Final EIS.

Modeling Deficiencies. The estimates of transportation risk are derived from generalized risk assessment models that use highly aggregated data and that do not account for specific conditions along routes. The DEIS should discuss the limitation of the models, the range of uncertainty associated with key parameters, and the sensitivity of risk estimates to
3.4.2.9 change in parameter values. In addition, it appears that the models include only limited quantities of the total defense waste volume currently at Hanford. This implies a preference by USDOE toward in-place stabilization of a significant portion of these wastes. The DEIS should provide additional justification for this approach and include risk assessments based on the potential for transporting the waste volumes described in each alternative.

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NRC Certification of Packaging Used for Defense Waste Shipments. The analysis appears to assume that the overall transportation system is fully developed and functioning well. USDOE needs to take positive action to ensure that this will indeed be the case before any significant number of defense waste shipments begin.

3.4.2.13 Currently the NRC sets design standards for casks and other Type B packaging, and USDOE is allowed (but not required) to self-certify that its packaging meets those standards. (This situation differs from the commercial nuclear industry where the NRC both sets the performance standards and certifies that specific packaging designs do, in fact, comply with those standards.)

Because transportation safety relies so heavily on packaging integrity, NRC certification would be an important step toward assuring the safe transport of defense waste from Hanford. NRC certification would be more likely to result in a thorough design review process and would help to overcome some of the public concern about USDOE's tendency to be
3.4.2.13 self-regulated. This is especially true since the Office of Civilian Radioactive Waste Management has indicated that it will voluntarily obtain NRC certification of Type B packaging used for shipping civilian spent fuel and high-level waste under the Nuclear Waste Policy Act. The Final EIS should reaffirm USDOE's commitment to this policy.



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Improvement of Operational Procedures, Emergency Response Capability, and Highways or Railbeds. Identification of high hazard or highly vulnerable areas along likely routes would allow preventive actions. Risks associated with transportation can be minimized through routing around the area, making localized improvements to the highway or rail system, developing evacuation plans for vulnerable areas--to take place before shipments begin. Similarly, development of procedures for coordinated notification, operating in inclement weather, designating safe parking areas, ensuring adequate inspections and improving local/state emergency response capabilities would improve the safety of transporting these materials. 3.4.2.24

Similar planning activities will also be necessary before initiation of civilian spent fuel shipments to an MRS or to a geological repository. Close coordination between programs could avoid unnecessary duplication and confusion and would more likely result in a consistent set of USDOE policies and procedures for transportation.

NUCLEAR WASTE ADVISORY COUNCIL ISSUES

In addition to concurring with the Nuclear Waste Board's general comments, on July 17 the Nuclear Waste Advisory Council recommended the following policy positions, and on July 18 they were accepted by the Board.

1. The Council strongly supports a thorough and prompt cleanup of Hanford defense wastes, based on recovery and treatment, regardless of where their ultimate disposal is to take place. Continuation of present waste management practices is unacceptable. 2.2.1

2. The Council reemphasizes its concern that the full National Environmental Policy Act process be followed in all significant actions and Records of Decisions. 2.2.11 2.4.1.1

3. We call attention again to an issue not addressed in the DEIS. The Final EIS must describe the impact of each alternative on the ability to monitor post-closure performance of a deep geologic repository. 2.1.7

4. The state's comments on the DEIS should reflect the objective of maximum protection of the environment, health and safety, irrespective of costs. 2.2.3

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3.3.1.1 5. In the future, with respect to defense waste, USDOE should consider geologic media other than the shallow sedimentary deposits of the Hanford Reservation for disposal.

3.1.1.10 6. The Council notes with concern the serious problems created by USDOE in its shifting and expedient definitions of high-level, low-level and transuranic defense wastes. In order to obtain an accurate picture of the quantities and hazards of Hanford defense wastes, a consistent and rational set of definitions must be part of the Final EIS, and there must be consistency with definitions of high-level, low-level and transuranic wastes employed by other federal agencies.



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**WASHINGTON STATE NUCLEAR WASTE BOARD**

**RESOLUTION 86-2**

**April 18, 1986**

(no comment identified)

**WHEREAS, large amounts of high-level, transuranic, and low-level radioactive wastes and chemical wastes associated therewith, have been temporarily stored on or discharged to soils of the Hanford Reservation in Washington State;**

**WHEREAS, this accumulation of radioactive and associated chemical wastes resulted from U.S. Department of Energy atomic energy defense operations;**

**WHEREAS, Washington State Nuclear Waste Board is seriously concerned about the effect of such wastes on the health, safety, and environment of the citizens of the region;**

**WHEREAS, the federal government has the responsibility to provide for permanent disposal of such wastes in accordance with the Nuclear Waste Policy Act;**

**WHEREAS, the President has determined that high-level commercial and defense wastes shall be commingled in repositories developed under the Nuclear Waste Policy Act;**

**WHEREAS, potentially hazardous defense installations or operations may adversely affect or conflict irreconcilably with the siting, design, monitoring, closure, or decommissioning of the geologic repository proposed for construction on the Hanford site;**

**WHEREAS, the U.S. Department of Energy has issued the Hanford Defense Waste Draft Environmental Impact Statement (DEIS); and**

**WHEREAS, resolution of issues raised in the DEIS are of the highest priority to the Nuclear Waste Board.**

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2.2.15 NOW, THEREFORE, BE IT RESOLVED that the Nuclear Waste Board establishes that the criteria for review of the Hanford Defense Waste Draft Environmental Impact Statement shall include:

1. A description and evaluation of the following for each alternative:

2.2.3

2.3.1.4
- the impacts of such radioactive and chemical wastes on the health, safety and environment of the citizens of the region;

2.1.7
- the effects of these wastes on the siting, closure, operation, monitoring, and decommissioning of a geologic repository;

3.5.5.32
- equity of impacts on successive human generations;

3.3.5.4
- the susceptibility to future additional or better cleanup actions; and

2.4.2.2
- the impact of alternatives on Indian treaty rights.

3.3.5.2 2. An evaluation of whether one or more promising alternatives were omitted.

3. An evaluation of each alternative and recommended action to ensure they:

2.2.1
- minimize environmental and health effects;

2.4.1.1
- are consistent with applicable federal and state laws and regulations, including among others, the National Environmental Policy Act, the Atomic Energy Act, the Nuclear Waste Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response Compensation and Liability Act, the Clean Water Act, the Clean Air Act, 10 CFR 960 and 40 CFR 191;

3.3.5.4
- use state-of-the-art technologies which have been proven safe; and



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- minimize future releases to the environment from ongoing and future atomic energy defense activities.

4. Reviewers should ensure the DEIS considers economics, but economics must not drive decisions. 2.2.1

5. The Nuclear Waste Board Radioactive Defense Waste Committee is directed to review the Hanford Defense Waste Draft Environmental Impact Statement against the criteria listed above among others, and to report the results of such review to the Board.

6. The Board directs the Nuclear Waste Board Chair to transmit this Resolution to appropriate persons in the U.S. Department of Energy, and to ask for their assistance and cooperation in the review of the Hanford Defense Waste Environmental Impact Statement.

Approved at Olympia, this 18th day of April, 1986.

Warren A. Bishop

WARREN A. BISHOP, CHAIR

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# APPENDIX A

## STATE AGENCY COMMENTS

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C. ALAN PETTIBONE
Director

STATE OF WASHINGTON
DEPARTMENT OF AGRICULTURE

July 23, 1986

Mr. Don Provost
Performance Assessment Manager
Washington State Department of Ecology
Mail Stop: PV-11
Olympia, Washington 98504

Dear Mr. Provost:

The following comments reflect this agency's position on the general issue of radioactive waste storage at Hanford but relate more specifically to the draft EIS "Disposal of Hanford Defense High Level Transuranic and Tank Waste." I'll refrain from commenting on any technical considerations but rather focus on the aspect we see as critical to Washington agriculture.

Washington State relies extensively on national and foreign markets as an outlet for our products. Additionally, agricultural economic activity provides approximately 20 percent of our employment base. Our ability to compete in an extremely competitive market is a function of our deserved reputation for quality, extensive market promotion, and favorable consumer preference.

Our concern relates to perception. Nuclear waste is not one of the more favored by-products of the 20th Century. Irrespective of the actual risks, the "put it in someone else's backyard" mentality prevails and thus allows a correlation between perceived hazards of high level nuclear waste and begs the question of safety of agricultural products produced in the same geographical area. To what extent this may adversely impact the reputation and subsequent markets for Washington agricultural products may be difficult to quantify. We may, however, safely assume the effect will not be favorable. We're dealing in a global market and global surplus conditions the result of which makes quality an essential element of market potential. The perception of food safety is a critical consideration of the consumer, and we can ill afford to allow any erosion of confidence in the food products we produce. 3.2.6.3

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Mr. Don Provost
July 23, 1986
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3.2.6.3 I would suggest questions pertaining to the above be addressed in potential socio-economic impacts and attempt to ascertain how a consumer in California, New York, or Japan would relate to apples grown in close proximity to a site with an increasing accumulation of high level nuclear waste.

I thank you for the opportunity to comment.

Sincerely,

John P. Daly
Assistant to the Director

JPD/v



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JACOB THOMAS
Director

STATE OF WASHINGTON
OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
111 West Twenty-First Avenue KL-11 • Olympia Washington 98504 • (206) 753-4011

May 21, 1986

Ms. Barbara Ritchie
NEPA Coordinator
Department of Ecology
MS PV-11
Olympia, WA 98504

Log Reference: 762-F-DOE-09
Re: DEIS-Disposal of Hanford Defense Wastes

Dear Ms. Ritchie:

A staff review has been completed of your draft environmental impact statement on the disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes.

For any proposed new construction and excavations, we would recommend consideration be given to archaeological resources, and professional surveys be conducted. 3.2.5.1

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(206) 753-4405

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# OFFICE OF THE ATTORNEY GENERAL

**Inter-office Correspondence** Date: July 29, 1986

To: Warren A. Bishop, Chairman, Nuclear Waste Board

From: Charles B. Roe, Senior Assistant Attorney General
Laurence E. Oates, Legal Intern

Subject: Draft EIS for Hanford Defense Wastes

This memorandum is provided for the purpose of assisting your Board in the preparation of a response to the Draft Environmental Impact Statement for the Disposal of Hanford High-Level, Transuranic and Tank Wastes (DEIS) of the U.S. Department of Energy (USDOE), dated March 1986. The following comments set forth concerns of a legal or a legal-technical nature that we commend to your attention. You will note that most of these comments are relatively short and will sometimes need further amplification. We will work closely with your staff over the next several weeks on the task of integrating our suggestions for inclusion in the Board's formal response to USDOE.

We first note that the National Environmental Policy Act (NEPA) requires a detailed statement (EIS) to be prepared by a federal agency for proposed major actions significantly affecting the quality of the environment. 42 U.S.C.A. § 4332. The Council on Environmental Quality (CEQ) regulations, 40 CFR Part 1500, et seq., provide implementing guidelines that federal agencies are required to follow in the preparation and review of an EIS.

At the outset we address five areas of concern relating to the subject DEIS. They are:

2.3.2.2

1. Preferred Alternative. The DEIS does not set forth a proposal or a preferred alternative. CEQ guidelines at 40 CFR Part 1502.14(e), as we understand them, require an agency to identify its preferred alternative, if one exists at the time of the issuance of the DEIS. Because of its favorable treatment of the "reference alternative" in the DEIS, the document implies that USDOE had such a preferred alternative at that time. Since the guidelines require this to be identified, the USDOE erred in not setting forth its preference in the DEIS.





2. Reasonable Alternatives. The DEIS lacks the description of all reasonable alternatives required by 40 CFR Part 1502.14. See also 42 U.S.C.A. § 4331. The draft does not even attempt, for the most part, to discuss alternatives except in a very general and unacceptable "range" of options scenario. (Our conversations with your technical staff show an accord of view on this point.) See also, the Nuclear Waste Policy Act (NWPA) relating to continued research into disposal alternatives. 42 U.S.C.A. § 10202. 3.3.5.2

   The alternatives which are addressed have not been sufficiently assessed. A full assessment should include reasonable variations on the proposed alternatives, as well as address extremes of impacts which may differ from those posited by the USDOE. Such possibilities include changes in processing technology, modifications to climate, catastrophic events, differing interpretations of technical data, etc. See, e.g., Items G, L, M, infra.

3. Compliance with Federal and State Laws. The DEIS is required to set forth all laws applicable to the proposed project. 40 CFR Part 1502.25(b). The DEIS fails to adequately address the statutory requirements. We believe the document mistates or omits certain laws that are applicable. In addition, the analysis of laws provided in the document does not describe the relevant laws in an understandable fashion. In our view, USDOE should be stating that it is required to comply with the following laws: 2.4.1.1

   a. The Federal Water Pollution Control Act (33 U.S.C. 1251, et seq.). 33 U.S.C.A. § 1323 requires federal agencies to comply with both federal and state laws and regulations regarding water pollution to the same extent as any "non-governmental" agency is required. Chapter 90.48 RCW prohibits the discharge of pollutants, including radioactive materials, into all the waters of the state, including ground waters. In addition, permits must be obtained from the Washington State Department of Ecology prior to making any such discharges in order to comply with this law. See also, E.O. 12088, 43 F.R. 47707, reprinted at 42 U.S.C.A. § 4321 nt. (West Supp. 1986). 2.4.1.13

   b. The Clean Air Act (42 U.S.C.A. § 7401, et seq.). Under the requirements of this Act (CAA), USDOE must comply with emissions limitations established by the United States Environmental Protection Agency (USEPA) and the Washington State Department of 2.4.1.11

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2.4.1.11 Ecology. See e.g., discussion of 1977 amendments to section 118 of the CAA in H.R. Rep. 294, and H.R. Con F. Rep. 564 95th Cong. 2d. Sess. 2, reprinted in 1977 U.S. Code Cong. & Ad. News 1276-1280 and 1523-1524. Such limitations include those set forth in 40 CFR 61 regarding radionuclides, and emissions limitations established pursuant to chapter 70.94 RCW.

c. Safe Drinking Water Act (42 U.S.C.A. § 300f, et seq.). National Primary Drinking Water Regulations, established under the authority of the Act, set maximum contaminant levels for public drinking water supplies. Standards have been established for inorganic and organic chemicals, beta and photon radioactivity, radium-226, radium-228, and gross alpha particle activity, among others. 40 CFR 141.11-141.16. USDOE has not identified the full range of standards which must be complied with. 2.4.1.14

d. Atomic Energy Act (42 U.S.C.A. § 2011, et seq.). Regulations promulgated under the authority of this Act include those found at 40 CFR 191, dealing with standards for radioactive releases to the accessible environment from disposal sites; 10 CFR Part 60, regarding disposal of high level wastes in geologic repositories. 2.4.1.1

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e. Comprehensive Environmental Response, Compensation and Liability Act (42 U.S.C.A. § 9601 et seq.). CERCLA imposes liabilities on persons and entities that are responsible for releases of dangerous substances to the environment. The impact of this legislation on the proposed activities should be addressed by USDOE in the DEIS. 2.4.1.10

f. Water Rights Laws. No water rights now exist under federal or state law to provide water to carry out the several alternatives discussed in the DEIS. Longstanding federal Congressional policy establishes a deference to state water laws, including reliance on said laws, by federal agencies to obtain needed water rights to carry out federal activities. If a new water right is to be established under state law, in order to obtain water for any of the various alternatives, a water right permit must be obtained under chapter 90.03 RCW (for surface waters) or chapter 90.44 RCW (for ground waters). 2.4.1.12





July 29, 1986
Page 4

4. Hazardous Wastes - Resource Conservation and Recovery Act (42 U.S.C. § 6901, et seq.). The discussion of the applicability of the Resource Conservation and Recovery Act (RCRA) to proposed activities is inadequate. 42 U.S.C.A. § 6961 of the Act requires all federal facilities to comply with the provisions of federal and state law regarding hazardous wastes. The Act does, however, exempt certain radioactive materials (i.e. "source, special nuclear, and byproduct materials) which are under the exclusive authority of the Atomic Energy Act. 42 U.S.C.A. § 6903(27). Note, however, the USEPA has recently published notice that "mixed wastes" containing radioactive components, which may by themselves be immune from the standards of the Act, and hazardous components are subject to RCRA as regards their hazardous components. See, 51 FR 24504. 2.4.1.9

The DEIS does not adequately define the nature of the materials contained in the various storage tanks on-site. Without this analysis, it is impossible to determine which materials subjected to the DEIS are purely "source, special nuclear, and byproduct material" and thereby exempt from RCRA; and which are mixed wastes, thereby subject to its requirements. Absent this analysis, the DEIS should present at a minimum a conservative analysis that assumes RCRA would apply to all such wastes, and assess how the application of RCRA could impact proposed activities. Since USDOE has stated an intent to conform all of its activities to the standards set by RCRA, this approach would not go beyond its agreed obligations. See, Memorandum of Understanding between USEPA and USDOE, February 22, 1984. The Washington Department of Ecology authority to implement the provisions of RCRA is contained in chapter 70.105.145 RCW. 2.4.1.9

5. Section 8, Nuclear Waste Policy Act (42 U.S.C.A. § 10107). The DEIS does not make mention of the mandate of section 8 of the NWPA, relating to required disposal arrangements for defense wastes, if an affirmative determination is made by the President "to commingle" the disposal of defense and commercial waste in a single repository. The failure to address the mandate of section 8 is a critical omission. 2.1.3

In addition to the above, we note the following concerns which are also primarily of a legal nature:

7. Technical terminology is not set out in a framework to meet the "plain language" requirement of Part 1502.8. Tables and graphs are sometimes unclear in their meanings and terminology is changed with no apparent basis for differing terms. See, e.g., Items A, B, C, infra. 4.1.1

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Page 5

4.1.10 8. The Department of Energy does not provide adequate support for many of the conclusions put forth in the DEIS. The guidelines at Part 1502.1 require a showing that the agency "has made the necessary environmental analyses." Appendices are improperly used in some instances to provide analysis, where their proper function is to clarify and substantiate an analysis provided in the statement. The text must provide meaningful analyses of the conclusions reached by USDOE. <u>See</u>, <u>e.g.</u>, Items D through K, infra.

2.3.1.7 9. Given the general uncertainties in the technologies proposed, the long-term duration of the wastes involved, and inability to accurately predict the potential impacts, the DEIS should include a "worst case" analysis as required under 40 CFR 1502.22.

2.3.1.14 10. 40 CFR 1508.7 requires analysis of cumulative impacts. While the DEIS makes cursory referral to concurrent projects, no analysis is provided for cumulative regional impacts.

2.4.1.18 11. 40 CFR 1502.16 requires discussion of all unavoidable adverse impacts. The dedication of this site to disposal activities for 10,000 years does not appear to be addressed. Likewise, the adoption of a geologic alternative may result in an "unavoidable adverse impact" as this would preclude any further processing of wastes.

2.3.2.7 12. The document does not provide adequate notice for receipt of comment. 40 CFR Part 1502.11(f) requires the closing date to be stated on the cover sheet. This date is not provided.

The following observations are of a mixed technical-legal nature. They relate in many cases to the observations put forth in the body of this memorandum.

3.5.5.13 Item A. It is critical that technical language in an EIS be decipherable by the reader in those areas where it is utilized. Comprehending the significance of radiation levels and doses is central to an understanding of their potential impacts. While the document's glossary defines several of the important terms, it would improve the document to set the terms in context and to relate the radiological terms to one another so as to establish orders of magnitude and importance. It is not clear why one term is utilized in lieu of another when describing the potential effects of a given scenario. (<u>See</u>, <u>e.g.</u>, man rem (Table 3.2) vs. total body radiation dose (Table 3.15) vs. lifetime whole body dose (Table 3.18) vs. maximum annual organ dose (Table 3.17).)



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Item B. Graphics used to support various premises often cloud the issues. Table 3.8, for example, indicates concentrations of the nitrate ion in the Columbia River. Contamination levels are forecast at ranges from $6 \times 10^{-7}$ to $9 \times 1^{-4}$ mg/l. Ambient levels are stated as currently in the range of 0.36 to 0.37 mg/l. It is not clear whether the chart represents additional loading, or a decrease in the ambient. If it is the former, this seems to refute the postulated effectiveness of the barriers, which theoretically prevent migration. If the latter, on what basis is the prediction of a decrease based? Likewise, Table 2 provides no indication as to the interrelationship or significance of the numbers provided in the "Health Hazard Index." 4.2.5 3.5.5.9

Item C. Table 3.2., comparing potential radiological impacts, considers only fatal cancers and genetic effects. (<u>See also</u>, text at 3.4.2.3.) This seems to artificially reduce actual impacts which should include nonfatal cancers and cumulative health effects which could result in death or illness. 3.5.5.9

Item D. Volumes of the various forms of waste are instrumental in determining the potential impacts associated with the disposal options. However, material in the various tanks has been reprocessed and redistributed to such an extent that it is unclear how the wastes in the various tanks can be characterized. (<u>See</u>, <u>e.g.</u>, p. 1.4 and § 3.2.) The nature and the volume of site wastes must be clarified in order to validate the various impacts postulated. 3.1.4.1

Item E. A variety of treatment and decontamination processes are referred to throughout the document. No mention is made of water requirements, wastewater streams, or air emissions from these processes. (<u>See</u>, <u>e.g.</u>, §§ 3.3.2.1, 3.3.3.1, 3.3.3.4.) The technical aspects of the systems as well as the necessary infrastructure requirements and byproducts should be addressed. 3.4.1.9

Item F. Section 3.4.1.1 of the DEIS states that the geologic disposal option has the highest potential for population exposure due to the work force involved. Does this projected exposure account for any protective methods which would reduce impacts to the workers? Since such measures would not be available to the general public in the event of an accidental release, or to future settlers in the event of intrusion, actual impacts to the work force may be reduced and should be considered when weighing the alternatives. A complete analysis must define mitigation measures assumed for the various posed scenarios. 3.4.1.1

Item G. The success of the barrier system hinges on precipitation and ground water recharge falling below a projected maximum of 30 cm/yr and 5.0 cm/yr respectively. (<u>See</u>, <u>e.g.</u>, § 3.4.2.1 and § 5.2.0.) The maximum recorded rainfall 3.5.1.71

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3.5.1.71 at Hanford for the period of 1945-1970 is 28 cm/yr. Section 4.19 states that recharge rates are uncertain, with some authors estimating up to 5 cm/yr. in unvegetated areas. Given those discrepancies in the assessment of current conditions, the document does not appear to adequately address possible climates over the lifespan of the project.

3.5.1.21 Item H. The functional ability of the barrier system will depend upon the suitability of the site soils. The document does not discuss the nature, depth, or availability of site soils. There is no mention of impacts to the site due to excavation of soils, the ability of the soils to maintain a vegetative cover over 10,000 years, or likelihood of erosion under a drier (or wetter) climate. All of these factors will affect the efficiency of the barrier.

3.5.1.57 Item I. The protective barrier is assumed to be capable of providing the requisite protection without substantial technical evidence of its suitability. Criteria for this assumption and analysis of demonstration projects should be provided.

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3.5.6.17 Item J. Resettlement of the region resulting in fatal doses to the population "would not be realistic" under the no disposal action alternative discussed on page 3.64. No basis for this assumption or analysis of potential for impacts is provided.

3.3.5.4 Item K. No discussion is provided of potential future developments in disposal technology, especially in the areas of treatment and reprocessing. This could significantly affect impacts, particularly under the "no action" alternative and the in place stabilization alternative.

4.1.15 Item L. The 1990 population for the "Hanford environs" is projected at 420,000. Section 3.4.1.1. This figure reflects a population within 80 km of the 200 areas. Section 4.8.2. No rationale is provided for the determination of this affected area. It would seem to be more realistic to provide data for the likely affected population, which would conceivably result in a proportionately larger degree of impact.

3.5.1.86 Item M. The failure scenario postulated in section 5.20-5.21 suggests that a 10 percent loss of soil cover would result in exposure of 10 percent of the underlying waste. In reality, a larger volume of waste could be affected due to leaching of wastes and moisture.







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Item N. The 50 percent functional barrier failure posed in section 4.21 is projected to result in 0.1 cm/yr. infiltration, while also stating the barrier will preclude infiltration of the burial grounds. The two statements seem contradictory. 0.1 cm infiltration based on the projected 5 cm/yr recharge potential under wetter conditions does not seem proportionate for a 50 percent failure scenario. 3.5.1.91

Item O. Section 3.3.4.1 mentions the potential for release of radioactive particulate matter as a result of the collapse of tank domes. What effect might such an occurrence have with respect to settlement and failure of the protective barrier? 3.1.4.36

Item P. Section 3.4.1.2 does not include transportation-associated accidents as a potential source of radiological incidents. 3.4.2.2

Item Q. Estimates of cancer deaths provided on page 5.5 do not state the population for which this number is estimated. 4.1.15

CBR:sc

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TTY RINKER

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

M E M O R A N D U M

July 25, 1986

RECEIVED AUG 8 1986

To: Don Provost

From: Roger Stanley

Subject: USDOE's DEIS covering Hanford Defense High Level, Transuranic, and Tank Wastes

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Please note the following comments which should be incorporated into the state's overall package covering the subject draft Environmental Impact Statement. My current workload has not allowed a detailed review of this document. Consequently, the following comments are based on our overall stance that all USDOE hazardous chemical wastes are subject to the state's dangerous waste management requirements (Ch. 173-303 WAC) regardless of associated radioactive contaminants.

3.1.6.1

1. The requirements of the state's dangerous waste management program (as detailed within Ch. 173-303 WAC) should be factored into USDOE's planning for disposal of Hanford Defense High Level, Transuranic and Tank Wastes. USDOE's brief reference to this issue (D.E.I.S, Vol. 1, Section 6.6) is entirely inappropriate. All Mixed Wastes* generated and/or treated, stored and disposed on the Hanford site should be recognized as subject to the referenced dangerous waste management requirements. These requirements should then be incorporated as a major revision throughout USDOE's Environmental Impact Statement.

3.1.1.11

2. Substantial clarification of the key terms, High level waste, Tank waste, and Defense waste, is needed. Are all High Level Wastes highly radioactive (in concentrations requiring permanent isolation)? Are all tank waste streams high level streams?

The relationships between High Level Waste, Tank Waste and Defense Waste should be clearly identified and references to each throughout the EIS reviewed and revised as necessary.

* including those currently defined by the USDOE as by-product wastes



RECEIVED AUG 8 1986

02-Don Provost
July 25, 1986
Page 2

3.1.1.11

3. The Department of Energy's definition of high level waste notes it as containing transuranic (TRU) waste. USDOE should clarify which high level, tank, and defense wastes (see comment 2 above) are also classed as transuranic waste.

4. The Environmental Impact Statement should clearly note whether or not all waste streams presently routed to the subject Hanford tanks are radioactive and which are by-product (per USDOE's interpretation).

The EIS should be further revised to indicate whether or not nonradioactive and/or non by-product waste streams have been disposed within Hanford tanks prior to or since November 19, 1980.

5. USDOE should clarify whether or not any Hanford site decontamination and decommissioning (D&D) wastes have been disposed within USDOE's Hanford underground storage/disposal tanks.

6. USDOE should provide a concise listing of the designation (identification number and/or name) and description of all individual liquid defense, high level and/or transuranic waste streams routed to tanks. This listing should include items such as volume, frequency of discharge, origin, chemical constituents (along with a notation as to the type of sampling and analysis and resulting statistical validity).

7. USDOE should describe any tank wastes generated outside of the Hanford 200 areas and the overall percentage of this category.

8. The EIS should be revised so as to describe past, present and future analytical efforts to assess the contents of existing tanks and individual tank waste streams.

9. The presence and potential impact of chaelating agents within Hanford's Tanks and Tank wastes should be assessed. The potential for these agents to effect the mobility and migration of contaminants should be described and documented in detail. Any current or planned studies on this issue should be noted. 3.1.6.1

10. The presence of all known and suspected chemical contaminants within Hanford's storage tanks should be detailed. Of special interest are organic compounds, corrosive liquids, and metals. Potential interactions between constituents should be described in detail. 3.1.6.1

11. USDOE should provide a discussion of whether or not the dissemination of knowledge regarding the volume, discharge rate or characteristics of any individual tank waste stream posses a threat to national security. 2.3.1.15

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2.3.1.15 12. USDOE should provide a discussion of whether or not the regulation (as hazardous waste under the Resource Conservation and Recovery Act or Washington's Dangerous Waste Regulations) of Hanford tank wastes poses a threat to national security. If not, then what rationale exists for USDOE's proposed by-product rule?

3.1.4.28 13. USDOE should note if any double walled tank leaks have been discovered.

3.1.4.1 14. USDOE should describe what additional studies are planned or being performed to determine the expected and potential rate of migration of tank waste contaminants to the unconfined aquifer. Include consideration of contaminants such as chaelating agents, acids, and organic solvents.

15. USDOE should provide a listing in tabular form of all nonradioactive and radioactive mixed waste streams expected to be generated under each disposal alternative.

3.3.2.4 16. USDOE should clearly detail stabilization materials and techniques which would be utilized under the in-place stabilization alternative.

2.4.1.12 17. USDOE states under the Applicable regulations section (Vol. 1, Sec. 6.2) that "Since no liquid point source discharge will be made to navigable waters, no permits will be required." USDOE should revise this section to note that any discharge of contaminants to waters of the state is subject to state regulation and state wastewater discharge permit requirements.

RS:aa

cc: Greg Sorlie
Dick Burkhalter
Terry Husseman



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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

M E M O R A N D U M

August 4, 1986

TO: Don Provost/Dick Burkhalter

FROM: Roger Stanley

SUBJ: Defense Waste, DEIS Comments

The following comment should be added to the EIS package as an addendum to my July 25, 1986, memo to Don Provost.

Comment:

Recent discussions with USDOE staff have raised the issue of ALARA (As low as reasonably achievable) concerns should Hanford tank wastes and associated waste management facilities be incorporated under the state's Dangerous Waste Management Program; USDOE's specific concerns should be identified and discussed in relationship to their consistency with the requirements of the Atomic Energy Act.

RS:aa

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BEATTY BINKER
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia Washington 98504-8711 • (206) 459-6000

June 30, 1986

To: Dick Burkhalter

From: Bert Bowen BB 7/1/86

Subject: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes

In review of draft environmental impact statement on the above subject, I offer the following comments. In part 6.0 Applicable Regulations of Volume 1 of the draft EIS, the regulations and requirements of the federal and state Underground Injection Control (UIC) programs are not referenced and appear to apply to several methods used fluid disposal.

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2.4.1.14 In 1984, the department, in response to changes in the federal Safe Drinking Water Act, implemented a state UIC program. This program put into effect a long-standing policy of Ecology prohibiting the injection of waste water into, above or below underground sources of drinking water. This program reflects our commitment to preserve and protect ground water for current and future beneficial uses and not to use ground water as a waste repository. Our UIC program prohibits the injection of hazardous and/or radioactive fluids into, above, or below the lowermost formation containing an underground source of drinking water. All ground water in the state is considered to be either an existing or potential source of drinking water.

Wells are defined as holes whose depth is deeper than wide, except when the well is used for the disposal of hazardous fluids. In this case, a well includes the concept of a drainfield or a buried, horizontal, perforated pipe (40 CFR Part 144(g)(1)(iii).

2.4.1.24 Three fluid disposal methods which appear to fit this definition of a well are reverse wells, cribs, and trenches. In a review of the draft EIS and other documents, 113 temporarily abandoned and active wells were located on site. These wells are listed by type and location in Attachment A.

All three methods of disposal are prohibited by UIC program. In accordance with the provisions of the state and federal UIC programs, these wells must be plugged and abandoned. The owner/operator must notify the department of the location of each well and submit a Closure Plan and Certificateof Closure to the department that the wells have been closed in accordance with the specifications of 40 CFR Part 144.52(a)(6).



ATTACHMENT A

| Type | Location | Number | | |
|---|---|---|---|---|
| CRIB | B PLANT | 216-B-10-A | 216-Z-12 | 216-B-14 |
| | | 216-B-15 | 216-B-16 | 216-B-9 |
| | | 216-B-17 | 216-B-18 | 216-B-19 |
| | | 216-B-43 | 216-B-44 | 216-B-45 |
| | | 216-B-46 | 216-B-47 | 216-B-48 |
| | | 216-B-49 | 216-B-50 | 216-B-55 |
| | | 216-B-60 | 216-B-61 | 216-B-62 |
| | | 216-B-7A | 216-B-7B | 216-B-8 |
| | PUREX PLANT | 216-A-10 | 216-A-2 | |
| | | 216-A-30 | 216-A-36 | |
| | REDOX PLANT | 216-S-1 | 216-B-13 | 216-S-2 |
| | | 216-S-20 | 216-S-21 | 216-S-22 |
| | | 216-S-23 | 216-S-25 | 216-S-3 |
| | | 216-S-5 | 216-S-6 | 216-S-7 |
| | | 216-S-9 | | |
| | C.MASS LAB. | 216-C-1 | 216-C-10 | 216-C-3 |
| | | 216-C-5 | 216-C-6 | 216-C-7 |
| | | 216-C-4 | 216-T-1 | |
| | T-PLANT | 216-T-32 | 216-T-33 | 216-T-34 |
| | | 216-T-35 | 216-T-36 | 216-T-6 |
| | | 216-T-7 | 216-T-8 | |
| | U-PLANT | 216-U-12 | 216-U-2 | 216-U-8 |
| | Z-PLANT | 216-Z-1, 1A | 216-Z-16 | 216-Z-18 |
| | | 216-Z-2 | 216-Z-3 | 216-Z-5 |
| | | 216-Z-6, 6A | 216-Z-7 | 216-Z-9 |
| | | 216-Z-12 | | |
| FRENCH DRAIN | 100 AREA | 116-H-3 | | |
| | 200 EAST AREA | 216-A-11 | 216-A-12 | 216-A-2 |
| | | 216-A-3 | 216-A-33 | 216-A-35 |
| | | 216-A-3A | 216-A-3B | 216-A-4 |
| | | 216-A-5 | 216-A-6 | 216-A-6A |
| | | 216-A-6B | 216-A-7 | 216-A-8 |
| | | 216-B-13 | 216-B-51 | 216-C-8 |
| | 200 WEST AREA | 216-S-4 | | |
| | B PLANT | 216-B-13 | 216-B-51 | |
| | REDOX PLANT | 216-S-4 | | |
| | S.C.MASS LAB. | 216-C-8 | | |
| | T-PLANT | 216-T-29 | 216-T-31 | |
| | U-PLANT | 216-U-3 | 216-U-7 | |
| | Z-PLANT | 216-Z-13 | 216-Z-14 | 216-Z-15 |
| | | 216-Z-8 | | |
| REVERSE WELL | B PLANT | 216-B-11-A&B | 216-B-4 | 216-B-5 |
| | | 216-B-6 | | |
| | PUREX PLANT | SAMPLE PIT | SUMP | |
| | S.C.MASS LAB | 216-C-[illegible] | | |
| | T-PLANT | 216-T-[illegible] | 216-T-3 | |
| | U-PLANT | 216-U-4, 4A, 4B | | |
| | Z-PLANT | 216-Z-1 | | |

9 3 1 1 7 4 2 0 8 8 6

(no comment identified)

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RICHARD H. WATSON
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

AUG 8 1986 02

June 12, 1986

TO: Greg Sorlie

FROM: Nancy Ellison

SUBJECT: Review of Hanford Draft EIS

Air Program staff members have reviewed the subject EIS as you requested in your memorandum of May 23, 1986.

The information dealing with air program concerns and the associated meteorological analyses are accurate and appear to be based on the best available data.

We are reviewing other sections of the EIS as time permits and will communicate any other concerns that arise.

Thank you for this opportunity to review this document which is of interest to all of us.

NE:i



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STATE OF WASHINGTON
WASHINGTON STATE ENERGY OFFICE
400 E. Union, 1st Floor, ER-11 • Olympia, Washington 98504 • (206) 754-0700

AUG 8 1986 02

June 20, 1986

Mr. Bill Brewer
Office of High-level Nuclear
Waste Management
Mail Stop PV-11
Olympia, WA 98504

Re: Comments on the Draft DEIS — Transportation

Dear Bill:

My comments on the transportation sections of the draft Defense Environmental Impact Statement (DEIS) are attached. Please call me (586-5021) if you have any questions or need any further assistance.

Sincerely,

Pat Tangora
Energy Policy Specialist

PT/ks
E-L25-24

Attachment

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## SPECIFIC COMMENTS RELATING TO TRANSPORTATION

| Page | Comment | |
|---|---|---|
| xliii-xlvii | This discussion, which explains why USDOE believes that many of the assumptions in its analysis are conservation, should be referenced and summarized in Appendix I. Specific references would be useful at pages I.12 (Section I.3) and I.20 (Section I.5) as well as at Table I.9. | 3.4.2.9 |
| xliv | The discussion of crew exposure references "a discussion...of the reasons why total dose to the population in vehicles and to persons residing along routes is not needed." The discussion appears to be missing. Did the RADTRAN II analysis, in fact, omit these exposure mechanisms? | 3.4.2.16 |
| xlv | The discussion of "groundshine, resuspension, and ingestion" highlights the need to ensure that plans, procedures, and funding for emergency response and clean-up are in place before substantial numbers of defense waste shipments begin. Some description of the assumptions about emergency response and clean-up effectiveness used in the RADTRAN II analysis should be included. | 3.4.2.27 |
| I.2, I.5 | While USDOE is allowed to certify its own Type B packaging, there is no prohibition on NRC certification of USDOE packaging. The DEIS should clearly describe the options available to USDOE. | 3.4.2.13 |
| I.4 | The DEIS states that truck carriers transporting defense wastes will be required to use interstate highways and bypasses that avoid urban areas, where available. The DEIS should also discuss whether or not USDOE will identify or work with states to identify preferred routes from among those available within the interstate system. Prior identification of preferred route(s) would facilitate advance planning for improving emergency response capability: developing coordinated notification, inspection and enforcement procedures; upgrading or repairing highways in specific areas; and other activities to improve transportation safety and efficiency. | 3.4.2.3 |
| I.4 | Since urban areas cannot be readily bypassed by rail, the DEIS should discuss the historical safety of hazardous materials (including nuclear materials) transport by rail. Specific hazards posed by transporting defense wastes on trains carrying general freight--including other hazardous materials such as explosives--should be discussed. The DEIS should also identify any specific operational controls that might be implemented for rail shipments in order to enhance their safety. | 3.4.2.3 |
| I.14, I.17 | The probability (expressed as a rate) associated with accidents severe enough to exceed test standards is likely to be very low. But increasing the total number of shipments (as will be the case while civilian and possibly defense waste shipments are underway to a repository) will increase the probability that at least one shipment will encounter those sort of accident | 3.4.2.22 |







conditions. The value of having an emergency management system in place to handle a severe accident (as well as more routine incidents) will correspondingly increase. This is especially true considering the level of public concern that may result from these sort of shipments.

| Page | Comment | |
|---|---|---|
| I.17 | A summary explanation of how USDOE arrived at the 99.5% figure for accidents that do not exceed NRC test conditions should be included. | 3.4.2.20 |
| I.17 | Does the last sentence refer only to spent fuel shipments or to all shipments requiring Type B packaging? | 4.2.32 |
| I.18, I.20 | Aggregated accident rates may not be indicative of accident rates along specific routes. The discussion would be improved by citing any available evidence demonstrating that accident rates are sufficiently uniform to allow their aggregation into general rates for urban, suburban, and rural areas. In addition, treating accident rates and population categories as independent variables may underestimate accident risk since the highest accident risk will occur where high accident probabilities and large or highly vulnerable populations coincide. | 3.4.2.21 |
| I.20, I.23 | The discussions of strontium floride state that parameter values for release fractions, dispersibility, and respiribility, are uncertain and require further research. The DIES also states that the assumed values are thought to be conservative. It should also include some indication of the probable range of parameter values and the sensitivity of risk estimates to those parameters. This is especially important since Cesium/Strontium shipments dominate calculated risks from accidents. | 3.4.2.17 |
| I.29 | A summary table of total transportation impacts would be helpful. | 3.4.2.15 |
| I.32 | The DEIS notes that local jurisdictions usually assume primary responsibility for emergency response since they are usually the first on the accident scene. Local jurisdictions and state agencies often do not have the resources necessary to adequately plan for emergency situations and may be unfamiliar with transportation accidents/incidents involving radioactive materials. This type situation needs to be factored into the risk assessment and discussed more openly in the DEIS. | 3.4.2.26 |

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WILLIAM R. WILKERSON
Director

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
115 General Administration Building • Olympia, Washington 98504 • (206) 753-6600 • (SCAN) 234-6600

RECEIVED ... AUG 8 1986 ... DIVISION

July 28, 1986

Mr. Don Provost
Washington Department of Ecology
St. Martins Campus
Olympia, Washington 98504

Dear Mr. Provost:

Draft Environmental Impact Statement for
Disposal of Hanford Defense High-Level,
Transuranic and Tank Wastes

We have reviewed the referenced document and have the following comments. We hope they will be of value in preparation of the State response to the Department of Energy.

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The issue of siting a nuclear waste repository in Washington State is a
particularly sensitive issue and we are concerned that careful attention be
given to all alternative sites before any site is chosen. The referenced
2.3.1.12 Draft Environmental Impact Statement (DEIS) involves only defense wastes,
but if this repository is developed, there will be considerable pressure to
site commercial nuclear waste repositories at Hanford as well.

Recently, Search Technical Services published a report entitled Spring
1986, Data Report that deals with migration of radioactive materials in
water. The information contained in that report may change some of the
assumptions presented in the DEIS. While we have not reviewed this
3.5.36 document in detail, we believe it should be referenced in the DEIS as it
pertains to the waters and fishery resources of the State.

GENERAL COMMENTS

The Washington Department of Fisheries (WDF) is the state agency with a
mandate to preserve, protect, perpetuate and manage food fish and shellfish
resource, including their habitats, of the State of Washington
3.2.6.3 (RCW 75.08.012). In that capacity, we must ensure that projects such as
the disposal of hazardous wastes do not jeopardize the fishery resource in
any manner.

The United States-Canada Salmon Interception Treaty requires protection of
the Columbia River Basin salmon and steelhead runs. Moreover, the
Northwest Power Planning Council and others are making substantial
3.2.4.2 investments to protect and enhance these runs. An environmental threat
such as radionuclides in the Columbia River is contrary to the intent of
the Treaty and the recent investments.





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The DEIS describes impacts to human populations and the probability of
accidents, leaks, and other radionuclide uptake in terms of human health
hazards. We recognize this is the major concern of most agencies and
citizen groups, but in our review of the DEIS, we noted a serious lack of 3.2.4.2
concern regarding impacts to the aquatic environment. There must be a
complete discussion of probable impacts to the adjacent aquatic ecosystem
associated with each disposal scenario when radionuclides reach the
Columbia River. In addition, impacts to downstream aquatic environments,
including the river downstream of Hanford Reach, the various pools behind
hydroelectric dams and the estuary and coastal areas must be discussed to
make the DEIS complete.

There is a considerable amount of information regarding the uptake by
organisms and distribution of radionuclides along the Washington coast, the
Columbia River estuary and the Columbia River itself as a result of studies 2.3.2.10
done at the University of Washington, Laboratory for Radiation Ecology.
These studies should be reviewed and discussed in the DEIS to estimate the
probable impacts of the proposed disposal alternatives.

SPECIFIC COMMENTS

Volume 1, Section 4.6.2. Aquatic Ecology

This section correctly states that more than one-third of the
naturally-spawning fall chinook population of the Columbia River spawn near
the Hanford site. Adult sockeye, summer and spring chinook salmon and
steelhead trout also migrate upstream past the Hanford facility to reach
their natal streams. In addition to naturally-produced fish, millions of
hatchery-reared trout and salmon smolts travel past the site on their 3.2.4.2
migration to the sea. Consequently, the reach of the Columbia that passes
through the Hanford site is vital to the salmon stocks of the river. We
are concerned that water-borne contaminants could affect these stocks plus
other fishery resources in the waters downstream of the proposed- and even
the existing- waste disposal sites.

Ibid, Section 5.2.4. Assessment of Long-term Impacts

The disposal methods and the supporting documentation in the DEIS are
described as having little chance that any radionuclides or other chemicals
will enter the groundwater table and, eventually, the Columbia River. Even 3.5.4.6
if the chances are small, we believe the document should discuss the
expected impacts to the aquatic biota from all sources associated with the
proposed disposal alternatives.

Appendix R, R.1.4.3

These impacts should be described for aquatic species that are relatively
short-lived (salmon) and which would receive relatively small radionuclide
doses over a short period of time as well as those longer-lived species 3.5.4.6
such as sturgeon that might accumulate significant doses over a long period
of time. Shellfish, which have been shown to concentrate radionuclides,

AUG 8 1986

Mr. Don Provost
July 28, 1986
Page 3

3.5.4.6 and other estuarine and coastal fishes should also be discussed. There should be a discussion of the expected impacts to the animal populations themselves as well as probable pathways of radionuclides to the consumers of fish products.

The barrier system described in the DEIS indicates that the chances for water percolating into the buried waste tanks and leaching radionuclides into the groundwater is very small. We appreciate the difficulty in estimating many of the parameters used in the analysis and the relative uncertainty of the conclusions.

3.5.1.8 In light of the uncertainty, it seems prudent that additional measures be taken to prevent any contaminants from entering the ground water table. Therefore, we suggest that the tanks that will contain TRU wastes and the low level waste areas be underlain with an impermeable barrier in addition to the surface barrier described in the DEIS. We believe such a measure could be used to remove any water that may percolate through the barrier by pumping back to the surface for redisposal.

3.4.2.5 The appraisal of the chances of an accident from trucking wastes to another site was interesting and valuable. However, from the standpoint of aquatic ecology protection, there should be an analysis of which waterways will be crossed, and the risks associated with these crossings. We recognize other states may be involved in the transportation also, and those states probably wish this analysis for impacts to their waterways also.

Appendix U, Tables U.3-U.6

3.5.4.7 There should be an analysis of the fate of heavy metals such as chromium, cadmium and mercury that might reach the Columbia River through migration in the water table. We note also that peak arrival time to the river is the only measure of quantity described in the DEIS. Another means of showing the rate at which the materials would enter the river should be presented. Also the fate of the nitrates, nitrites and fluorides should be described, especially as they relate to impacts to the aquatic system.

Thank you for the opportunity to comment, and we hope these remarks are of value.

Sincerely,

for / William R. Wilkerson
Director

cc: WDG
Yakima Tribe
EPA
USFWS
NMFS



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STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES

AUG 8 1986 022

**MEMORANDUM**

TO Terry Husseman, Program Director — Office of Nuclear Waste Management, Depart. of Ecology PV-11

FROM Ray Lasmanis, Nuclear Waste Board Designee — Geology & Earth Resources

SUBJECT Draft EIS - Defense Waste — DATE 6-25-86

I have reviewed the committee documents and the draft EIS. Nowhere do I see any reference to disposal of obsolete defense plant components that are so contaminated with nuclear materials that they can be considered as high level nuclear waste. What is DOE going to do with the N-Reactor parts since the plant has or is approaching its useful life? 2.3.1.14

In a similar situation, under EPA statues and rules the private sector has had a very difficult to impossible task of disposing of plant components (ie Bunker Hill smelter).

I believe the defense waste EIS should address this issue.

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STATE OF WASHINGTON

DEPARTMENT OF SOCIAL AND HEALTH SERVICES

Olympia, Washington 98504-0095

AUG 8 1986

July 23, 1986

Terry Husseman, Assistant Director
Office of Nuclear Waste Management
Mail Stop PV-11
Olympia, Washington 98504

Dear Terry:

Enclosed are the Office of Radiation Protection's review comments on the Hanford Defense Waste Draft Environmental Impact Statement. If there are any questions, please direct them to Al Conklin at 586-0254.

Sincerely,

Terry

T. R. Strong, Chief
Office of Radiation Protection

TRS/AC/db

Enclosure

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THE STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES
Office of Radiation Protection

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REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL, TRANSURANIC AND TANK WASTES

An environmental impact statement (EIS) is recognized as a very complex document providing sufficient information to comprehensively address the impacts of a given project. The Hanford defense waste EIS discusses major issues which, for all intents and purposes, impacts the Hanford environment permanently. The issues and disposal alternatives discussed should provide the public with a clear understanding of all known and potential impacts.

This EIS does not provide the clear understanding required, in that too many issues are raised with too little information provided. Statements are made concerning decisions with inadequate discussion of the decision-making process (e.g., twenty-seven disposal alternatives were considered and all but four dismissed. A complete list of all alternatives is not provided nor is there an adequate discussion as to why twenty-three were dismissed). In other cases, decisions or conclusions are cited with references given, but no discussion of the process leading to that decision or conclusion. The references are not readily accessible to the general public to get background information. This could be rectified with a brief discussion of the conclusion preceding the reference. Some specifics are included in the attached list of comments. 3.3.5.2 4.1.10

include in overview stmt.

A major issue not addressed throughout the EIS concerns the Indians, and in particular, the Yakima Indian Nation. The Hanford site is included in the ceded lands agreed to in an 1855 treaty. Permanent disposal directly impacts Yakima Nation rights. It is imperative that ~~this issue~~ the sovereign rights & the cultural heritage of native peoples be addressed and include all affected tribes. 2.4.2.2

Another general topic which the EIS must better address is monitoring. The potential for releases of radioactivity associated with the various disposal alternatives is discussed and compared to current applicable standards; however, a discussion of monitoring (effluent and environmental) that would ensure that the releases fall within standards and are as low as reasonably achievable is not included. In addition, throughout the document, the only standards used for comparison purposes in many cases are the Department of Energy standards currently in effect. It would be appropriate to compare all potential releases to the most restrictive standards that now apply and/or that are expected to apply in the near future. For example, the EPA drinking water standards do not currently apply to the Hanford site; however, at some point in the future, they may be directly applicable, particularly if the site becomes accessible to farmers. It would also be appropriate to compare any potential releases to the environment to any standard that is applicable to any portion of the nuclear industry today, not just DOE sites. 4.1.14 2.4.1.22

Radionuclide inventories used throughout the EIS are questionable. Early disposal records are inadequate, and more current records often are 3.1.3.9

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3.1.3.9 contradictory or contain numerous discrepancies (as was noted in a recent review of Rockwell's Waste Information Data System) resulting in the need to "best guess" inventories. This may have resulted in TRU sites being left out of this EIS. A more detailed discussion of inventory estimates and the criteria for establishing TRU sites (i.e., how was the concentration in each site derived) is needed.

2.3.1.14 The scope of the EIS needs to be expanded to include intertank farm pipelines, diversion boxes, and other tank farm related facilities, which retain significant residue contamination, and have, on several occasions leaked into the surrounding soil.

2.1.2 Though not the purpose of this EIS, the subject of deep geologic disposal is raised as an alternative throughout the document. The fact that it is not the purpose of the EIS to discuss this alternative (as mentioned throughout) coupled with the fact that it is a viable disposal alternative, illustrates that the two projects are interrelated, resulting in an incomplete EIS.

2.3.1.3 Points not specifically covered in this document at least need to be referred to the repository EIS so it will be clear that all concerns will eventually be addressed.

Other questions and comments are as follows:

2.3.1.14
3.1.6.1

- There is little acknowledgement of the presence of hazardous wastes in the tanks or the TRU waste streams. The chemical contents of the single-shell and double-shell tanks may contain significant elemental chemical as well as organic wastes. There is a brief reference in the text as to the potential applicability of RCRA but not acknowledgement of WAC 173-303. USDOE appears to be giving this subject only cursory attention.

3.1.8.1

- Will the grout proposed for use in the various disposal alternatives be tested for long-term performance characteristics such as:
  - a) Compressive strength after
    - (1) exposure to greater than $10^8$ rads
    - (2) biodegradation
    - (3) immersion testing
    - (4) thermal cycling
  - b) Waste stream testing prior to use
  - c) Maintenance of gross physical properties for the next 300 years.

3.5.1.6

- Will the proposed protection barrier include all the components required under EPA regulations for hazardous waste disposal sites?



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- How has DOE determined that adding gravel to single-shell tanks with the remaining tanks solids will be a suitable method to limit future subsidences? NRC requirements for structural stability of Class B and C low-level wastes call for the formation of a waste form that is a free-standing monolith. Since some of these tank solids contain activities greater than those allowed for low-level wastes, how will DOE ensure the tanks filled with gravel will not be a source of future cover subsidence? Consideration should be given to in-situ stabilization techniques that meet, if not exceed, the requirements for Class C wastes. 3.1.4.25

- How will ground water and air monitoring systems allow for a determination of the impact to the commercial low-level facility of any potential environmental radioactive or chemical releases from this project? It will be necessary for the commercial site operator to determine the impacts of their operation on the environment separately from those impacts produced by USDOE. 2.1.7

- Show how the occurrence and potential adverse impacts of any potentially corrosive soils on integrity of the single-shelled tanks have been taken into consideration. 3.1.4.18

- Regardless of which disposal alternative is finally chosen, remedial action plans should be developed. These plans should identify specific events, both pre and post closure that would trigger specific actions along with the reaction times involved. Alternatives should allow for remediation. 2.3.1.11

- How will internal drains or pipe openings be sealed in a way that will ensure tank integrity? 3.1.4.15

Comments relative to specific pages in the EIS follow.

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| | Page | Comment |
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| 4.2.55 | 1.6 | Some . . . wastes will remain radioactive for . . . <u>tens of thousands</u> of years. Should be <u>hundreds of thousands</u> of years, given the half-life of Pu-239 at 24,000 years. |
| 3.1.4.22 | 1.9, No.2 | Future Tank Wastes. Fourteen tanks are cited. Future tank wastes should include the eight new tanks in AP tank farm, four tanks in the planned AQ tank farm, and the four or eight in the planned AT tank farm. |
| 3.5.5.39 | 1.11 | The Health Hazard Index for Selected Radionuclides cited in Table 2 is, in the context used, meaningless. A detailed explanation of the methodology for determining that Index is needed. |
| 3.3.5.2 | 1.11 | Numerous alternatives were considered, three were selected. There should be a discussion (brief) of those alternatives discarded. |
| 3.1.8.19 | 1.13 | "There would be very little. . .treatment of wastes. . ." In-situ vitrification is treatment and has been proposed for TRU sites. Clarification or definition of "treatment" is needed. |
| 2.3.1.14 | 2.2 | Classification of wastes should include underground transfer lines not covered in facility closure plans, i.e., tank farm to tank farm encased pipelines. Significant residual activity remains in these lines, and has, in many cases, leaked to the soil or encasement. |
| 2.3.1.14 | 3.2 | Though not covered in this environmental impact statement, low-level waste originating from the processes described on Page 3.2 and 3.3 should at least be mentioned, since they make up most of the volume of waste originating from those processes. Also not discussed is the TRU waste that has been disposed of in low-level liquid sites but is not covered by this EIS. Soil sites chosen for inclusion in this EIS were done so based on TRU concentration. Many other sites contain significantly higher inventories of TRU, but are not discussed. How is the long term impact from those sites to be addressed? Additional discussion is needed under each of these processes. |
| | 3.4 | See previous comment. |
| 3.1.4.22 | 3.5 | Existing tank waste. The last sentence of the first paragraph in that section says that residual liquids and slurries are contained in 14 newer tanks of double shell construction, and that 14 double shelled tanks are assigned to future Purex Plant waste storage. Are the 14 |





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| Page | Comment | |
|---|---|---|
| | double shelled tanks assigned to future storage the same 14 tanks cited in the previous sentence or are they tanks that are now under construction and/or in the planning stages? | 3.1.4.22 |
| 3.6 | See comment on Page 2.2. On Table 3.1, the number of TRU contaminated soil sites is given at 24. Given the unknowns in waste disposal and past Hanford practices, how are the inventories known well enough to estimate how many TRU sites there are? An Explanation is needed. | 3.1.3.3 |
| 3.7 | Under Section 3.2.2, Future Tank Waste, in the second full paragraph of that section, it says that cladding waste, beginning in 1985, will be processed for additional TRU removal before being neutralized. Since it is now 1986, has this process already begun, or is it still planned for the future? An update of this paragraph is needed. | 3.1.7.4 |
| 3.8 | Under Section 3.3.3, Strontium and Cesium Capsules, it says that Cesium would be separated out in the in-place stabilization and disposal alternative for single shelled tank wastes. How is this to be accomplished? If it is described elsewhere in the EIS, that area should be referenced. If not, then a discussion is needed. | 3.1.2.4 |
| 3.8 | In Section 3.2.4, it is cited that recently, classification for TRU waste has been changed from ten nanocuries of TRU per gram to 100 nanocuries TRU per gram and the citation given is a DOE document. Is this change in classification accepted industry wide (including Environmental Protection Agency and Nuclear Regulatory Commission) or is this purely an internal DOE classification. A little more description of that change is needed. | 3.1.3.1 |
| 3.9 | Section 3.2.5, discusses the disposal of plutonium in low-level liquid waste sites, and says that plutonium concentration decreases with depth, and gives a volume of contaminated soil of 32,000 cubic meters. Has consideration been given to those sites that receive fairly high concentrations of acid waste which may have driven plutonium deeper in the soil, and thus resulted in a higher volume of contaminated TRU soil. The question of diversion boxes and underground waste transfer lines should also be addressed. | 3.1.3.20 |
| 3.9 | In Section 3.2.6, Pre-1979 TRU Buried Soild Waste, the types of containers are mentioned in the shallow land burial trenches. One of the most important types of container originally used for disposal, and here only covered under the category of "Other Containers", was the wooden box, which has created a hazard as far as cave-ins are concerned. Wooden boxes, in particular, should have | 2.3.1.13<br>3.1.3.11 |

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3.1.3.11 been called out separately, and in addition to the other types of containers mentioned. In addition, the cave-in potential from these wooden boxes needs to be addressed in this EIS.

3.9 In the last paragraph, the last line, it mentions the definition of a TRU waste site for the pre-1970 TRU buried disposal sites. However, the inventory of many of the pre-1970 waste disposal sites is either not known or remains classified. If the concentration is not known or remains classified, then is the site assumed to be a TRU site? That question is not clearly answered in this section. 2.3.1.13 3.1.3.3

3.10 In Section 3.3, Disposal or Management Alternatives, a great deal of reliability is based on the protective barriers, yet many questions concerning those protective barriers are not adequately answered in this environmental impact statement. For example, is the barrier in fact wide enough (large enough in area) to adequately extend beyond any possible waste underneath (taking into consideration lateral migration) so that no possibility of animal or plant intrusion exists? In the past, interim stabilization methods in the 200 Areas have included the addition of soil barriers only to the boundary of the waste disposal site. This has resulted in numerous biological intrusion problems along the boundary. This issue needs to be addressed in more detail and adequate assurance given that the barrier extends far enough beyond the waste to preclude the possibility of biological intrusion. 3.5.1.11

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3.11 The third paragraph discusses a multi-layer protective barrier marker system to discourage farming, root and animal intrusion. The next paragraph, however, states that a 1.5 meter thick layer of fine textured soil would be the top layer. Would the marker system in fact discourage farmers from attempting to farm over that five foot layer of soil, which could result in irrigation and additional water that would or could provide a driving force for the activity below the barrier? In addition, is the barrier designed such that burrowing insects would be prohibited from entering the waste and resurfacing? Would a better type of barrier perhaps be to eliminate the fine textured soil and revegetation on the top and instead provide a sterilized rock barrier that would again absolutely discourage any farmer from attempting to use that land for crop production? 3.5.1.13 3.5.1.36

3.12 Though this EIS is not designed to discuss low-level waste, throughout the document there are many references to low-level waste disposal, such as the case in Section 3.3.1, The Geological Disposal Alternative. In the second 2.3.1.14



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paragraph, last sentence, it says that low-level waste would be converted to a grout and diposed of on-site. If low-level waste is to be discussed or mentioned throughout this document, shouldn't it be in fact covered by this environmental impact statement to provide a comprehensive statement of intent by the Department of Energy on what its plans are for all of the waste and surface contamination in the 200 areas instead of just selected high-level and TRU waste sites? Is the intent and ultimate goal to cleanup the 200 areas or is the intent merely to isolate and/or dispose of highlevel and TRU waste? Many of the disposal alternatives discussed in this EIS are also in other documentation discussed for disposal or isolation of low-level waste. Shouldn't all waste then be covered in this EIS? 2.3.1.14

3.19 In Section 3.3.1.6, second paragraph, it says that residual waste containing less than 100 nanocuries of TRU per gram would be retained in the original excavated burial site. The site would then be backfilled and stabilized in the same manner as any other low-level site. What method of stabilization would be useful? Stabilization of low-level waste sites in the 200 areas has in the past, at best, been temporary. Constant surveillance has been required to maintain the stabilized status on many of these sites, because of animal and plant root intrusion. Constant maintenance has been required. Is it then wise to interim stabilize these low-level sites when so much effort is being put into cleaning up and removing and disposing of the high-level and TRU waste? A more permanent solution for low-level waste needs to be discussed as well. Either ultimate disposal or a more permanent stabilization method. 3.1.5.3

3.21 On the second paragraph, last sentence. The land area associated with tank farm disposal would be about 34 hectors. Does this include only those tank farms currently in place or does it also include tank farms under construction or in the planning stages as well. 3.1.1.12

3.23 In the last paragraph on this page, it says that TRU burial grounds with significant potential for subsidence would be compacted using a vibratory hammer. This method has been suggested in the past as part of the load testing of waste sites with high cave-in potential in the 200 areas. However, each time it has been suggested, it has been denied as an unsafe and unreliable alternative. Safety issues need to be discussed. 3.3.5.4

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3.5.1.12

3.26 The fate of empty and partially filled tanks is discussed. They will be covered by the protective barrier that has been described previously. The question: Is this barrier going to include not only the tanks themselves but tank farm related facilities as well, such as diversion boxes, catch tanks, low-level liquid sites that are associated with the tanks, underground encased and unencased pipelines, etc., or is the barrier just for the tanks themselves? If the latter is the case, then how are these other tank farm related facilities to be addressed?

3.1.4.22

3.30 In the first full paragraph of this section, it cites the need to continue to transfer waste from old to new tanks every 50 years. This situation requires more detailed coverage in this environmental impact statement, i.e., what would be the disposition of the old tanks, how many new tanks would be required, personnel exposure, etc. More discussion is needed.

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3.3.5.2

3.31 Twenty-seven plans are mentioned to dispose of high-level and TRU waste but not all are even mentioned. More discussion is needed concerning the 27 plans that were originally discussed. At a very minimum, each of the 27 alternatives needs to be listed.

3.4.1.3

3.34 Section 3.4.1.1, Radiological Impacts from Routine Operations. More discussion is needed as to how radiation doses to the public and workers were evaluated. The information provided is very sketchy, as is the reason for the man-rems assigned to each operation.

2.4.2.2

3.1.8.1

3.38 Section on Socioeconomics. Much discussion is given for potential impact on tourism but no mention is given to the fact that the Hanford Reservation is included in the ceded lands of the Yakima Indian Nation. That particular subject needs to be addressed in significant detail, since the reservation is an important part of the Yakima Indian Nation's heritage. Future impact on them through the prohibition of their use as promised in the 1855 treaty would have significant socioeconomic impact on the Tribe. Included should also be the other affected Tribes including the Umatilla Indian Tribe and the Nez Perce Indian Tribe.

3.5.6.28

3.44 Potentially wetter conditions are discussed as a possibility to recharge the ground water in Section 3.4.2.1. A concern must also exist that if institutional control were lost after a certain period of time, and the area farmed, then significant recharge to the ground water may result from irrigation practices adjacent to the some of the waste disposal sites. Some discussion should be addressed in this direction.





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3.44 Third paragraph, Radiological Impacts in Terms of Health Effects are cited. Are health effects from nonradiological impacts (i.e., toxic wastes) also addressed? Discussion is needed. 3.5.5.16

3.45 Section 3.4.2.1, last paragraph. Projected environmental impacts are cited as being small; however, in light of previous comments, the potential environmental impacts are not adequately addressed, such as preventing animal and plant root intrusion into the waste or the impact of irrigation in case of farming adjacent to, or even on top of the barriers and questions remain concerning the adequacy of barrier widths, particularly over soil sites, and concerning the barrier designs. Are they engineered properly? Have tests been completed, or are they planned prior to commitment to this method? In addition, are the environmental impacts small enough that the Yakima Indians could have their rights returned to them as far as the 1855 treaty is concerned? Would they again have full right to gather berries and fish and hunt on the reservation if environmental impacts are so small? More detail needs to be given to these sections. 3.5.1.33

3.47 Last paragraph. The total inventory of waste included in this EIS will have decayed to a hazard index about one-fifth of the hazard index of uranium ore etc. Hazard indexes are not adequately described. What do they mean in terms of real health effects? 3.5.5.39

3.48 Second full paragraph. A number of low probability events which could disrupt the barrier are cited including a range fire (which is not a low probability event) that could remove vegetation, strong winds (also not a low probability event) could denude part of the exposed soil and animal excavations (also not a low probability event) burrowing into the barrier. All of these added together are not even low probability events. Such disruptive mechanisms have been working on the Hanford site ever since it started, singly and in combination, that has resulted in some significant disruption of other barriers and soil covers over the Hanford site. A reevaluation of this subject is needed. 3.5.6.15

3.60 The first full sentence says that the dose associated with the no disposal alternative, though larger, would not be expected to be fatal. Does that also mean that the Health Index would also be zero? How does fatality inter-relate to health indices previously discussed? 3.5.5.40

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| 4.4 | 3.5.5.41 First paragraph. The whole body dose to the maximally exposed individual for 1984 was two millirem. It probably should also be added that this two millirem was not measured in the environment but rather was derived through the use of models. |
| 4.5 | 3.5.6.10 Bottom of the page. This sentence which begins on Page 4.4 says that the 200 area's plateau basically was formed by flood waters that occurred 13,000 years ago. This statement implies that within a 13,000 year period sufficient flood would occur that would alter the 200 area plateau in some manner. This would indicate a major upheaval which appears to contradict the implication given on pages 3.47 and 3.48 where impact on man is described as minimal. If a major reformation of the 200 area plateau were to take place, even in the 40,000 to 50,000 year time frame, the plutonium left behind in waste sites would only have gone through at most two half-lives. The minimum impact cited previously on 3.48 does not appear valid if such a major upheaval would take place that sufficient to have formed the plateau 13,000 years ago. Perhaps a little bit better agreement between the two sections needs to be made so that one section supports the other. |
| 4.14, Figure 4.7 | 4.2.8 The figure illustrating surface water bodies on the Hanford site is out of date. Z-19 ditch no longer exists, the 216 S-10 ditch no longer exists, the upper half of the U-14 ditch has been replaced by a power house pond. In addition to that, the B pond (B-3A, B-3B, and B-3C) implies that there are only three sections to that pond where the 3-A, B, and C are expansion lobes to the main pond, so that there are in effect four pond sections at this time. A possible addition would be the contingency pond which is planned in the future. There should also be an explanation as to the numbering methodology of those sites, e.g., that the 216, stands for 200 area low-level liquid waste site etc. The numbering of the sites are not consistent. Most are listed as 216 then the letter and the number. The U-14 and Z-19 are not listed that way. Consistency is needed. |
| 4.14 | 3.5.6.12 Last sentence. U.S. Army Corps of Engineers earlier considered possible construction of a Ben Franklin Dam however, there is no indication in this section that the plans for that dam have been eliminated. Clarification is needed. |
| 4.18 | 4.2.10 The Basalt outcroppings on Figure 4.8 and 4.9 don't match around Gable Mountain, Gable Butte and to the west of Gable Butte. |



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| 4.21 | Second paragraph. Studies indicate that there is migration to the south and east of Gable Mountain pond in the confined aquifer, but then later says that any contaminates in that confined aquifer would discharge back to the unconfined aquifer in the vicinity of West Lake. West Lake is to the northwest of Gable Mountain Pond and yet the flow is cited as migrating south and east. Those two statements don't seem to agree with each other. |
| 4.28 | In Section 4.6.3, Threatened and Endangered Species, the second sentence says that there are no endangered or threatened plant species on the site. Then Table 4.12 lists five plant species as endangered and threatened. There is a contradiction here. 3.2.4.3 |
| 4.30 | In Section 4.7, first paragraph, it says that the entire 1500 square kilometers of the Hanford site is a controlled area. A definition of "controlled area" needs to be included, whether it is for security reasons, radiological reasons, or for both. 4.1.7 |
| 4.30 | Last bullet, the 600 area description. An additional land use in the 600 area is retired dry waste disposal sites, and several low-level liquid waste disposal sites, such as the Gable Mountain Pond and the BC controlled area, both of which are technically in the 600 areas. 4.2.9 |
| 5.4 | Section 5.1.4, third paragraph, Applicable Concentration Guides, needs to be referenced and perhaps have a little bit of additional explanation as to what guides are in fact applicable to the Hanford site. 2.4.1.11 |
| 5.4 | Fifth paragraph. It says that low-levels of radionuclides observed in most food stuff samples are attributable to world-wide fallout. Then a later sentence says Cobalt, Strontium, and Cesium were detected in some of these samples but with concentrations low enough that any radiation dose resulting from them would be negligable, and is well below applicable radiation protection standards. That seems to imply that the activity detected in those samples is not from fallout, so it appears that it is in contradiction to the first sentence of the paragraph. 4.2.11 |
| General Comment: | The subject of deep geologic disposal alternative is raised throughout this document. However, in addition to raising the issue, the fact that the deep geological repository impact is not the purpose of this document is also spread throughout the EIS. This results in an incomplete and confusing EIS. It illustrates that the two projects are intertwined and cannot be separated. Perhaps this incompleteness could be overcome if more of the matters associated with the deep geological repository 2.3.1.3 |

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| | | were covered at least in outline form with the added statement that the EIS for that repository will be forth coming. |
| 3.1.6.1 | 5.28 | In Section 5.3.2.3, nonradiological consequences are discussed but there is no evidence of any discussion concerning any toxic constituents to the waste. That needs to be included. |
| 3.2.5.1 | 5.30 | For the sentence beginning on Page 5.28, Gable Butte is the preferred location for the basalt quarry. There is an archaeological site on Gable Butte that should be addressed if Gable Butte were to be used for a quarry. |
| 3.5.6.19 | 5.59 | First paragraph, last sentence. It says that by 1,000 years, the radiation dose to drillers would be less than .01 rem per year for all classes of waste considered in this EIS. Does this include the possibility of inhaling particulates from excavating into TRU waste? |
| 3.5.6.18 | 6.4 | Concerning the national interim primary drinking water regulations in 40 CFR 141. Even though no public water system currently exists on the Hanford site, many of the alternatives discussed resettlement of the Hanford site, which would eventually result in public water systems located on the site. Due to that potential, the statement in this section needs to be revised to imply that future water systems could be located on the Hanford site for the public. There are some contradictions between Table 2, water concentrations out of DOE 5480.1A and in the Interim Drinking Water Standards. The most conservative should apply. |
| 4.2.14 | 6.11 | The comment under references. It appears that many of the references cited in this list of regulations were left out of this section. They need to be added. |
| 3.5.5.4 | Volume 2, XLI | On Figure 3, Potential Exposure Pathways, there is no pathway illustrated from the buried waste to burrowing animals to man. Burrowing animals may transport the buried waste to the surface, which then may either directly or indirectly impact man, either through inhalation pathway or via uptake by crops which may be grown on the contaminated soil. This has been an important pathway in the 200 areas in the past. Given the uncertainties of the barriers, if your going to include shallow root vegetation in the pathway then animal intrusion must be added as well. |





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| XLII | Last paragraph. Today, radiation doses are usually determined for max man. It seems that in this case, that would be the best approach to use as well, in addition to standard man. The person that is maximally exposed is the one who should be addressed in this area. Later tables in the document do address both. The discussion needs to be expanded. | 3.5.5.18 |
| A-3 | In Section 8.1.1.2, Double Shell Tanks, it says that eight tanks are being constructed in AP tank farm. Since additional tank farms are in the planning stages, (i.e., AQ and AT farm) shouldn't they be included in this discussion as well, or at least a statement mentioning that additional tank farms are planned. | 3.1.4.22 |
| General Comment | One area not covered concerns on-site environmental monitoring to ensure the integrity of whatever disposal alternative is ultimately decided upon. That should play an important role in this environmental impact statement. | 2.3.1.9 |
| A.17 | First complete paragraph, last sentence. The use of each TRU disposal site was discontinued before any radionuclide penetrated to the water table at a concentration exceeding the then applicable concentration limits. This implies that the concentration limits as applied now are, or may be exceeded. Comparisons with the old and new concentration limits are needed to explain this sentence in more detail. | 3.1.1.6 3.1.3.27 |
| A.17 | An additional bullet needs to be added describing or defining unplanned release sites since one unplanned release site (216-E-15) is also included in TRU contaminated soil sites. | 4.1.26 |
| A.18 | Table A-9. When originally excavating the 216-Z-19 ditch to replace the old 216-Z-11 ditch, it was discovered that they were inadvertently digging into the old Z-1 ditch. That contamination which was, and is listed as a TRU site was buried adjacent to the Z-19 ditch at the head-end. Shouldn't that site which is now listed as the 216 W-20 unplanned release site also be included in the TRU sites? | 3.1.3.15 |
| A.19 | First full paragraph, second to the last sentence. Says the two sites (618-1 and 618-2) are within the 300 area. The 618-2 burial ground is in fact co-located with the 618-3 burial ground, and both are within a common fence outside and to the north of the 300 area, and not inside the 300 area. Only 618-1 is inside the 300 area. | 4.1.16 |
| A.20 | Table A-11. In this table (in the overburden volume column) is the additional soil added by interim stabilization also added? Also, some of the trenches located within burial grounds are still listed as classified or | |

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contents unknown. How is it then possible that the actual number of grams of plutonium and total TRU curies are included on this table? An explanation as to how these inventories were estimated needs to be included in this appendix.

A.22 Table A-12. Same comment as above.

3.1.3.3 A.24 Table A-14. Subscript a. It should be mentioned that the area included on 218-E-12B burial ground includes only the inactive portion and does not include the portion that remains active at this time.

3.1.3.23 B.7 Section B.1.1.3, mechanical retrieval of TRU contaminated soil and solid waste sites. On Page B.7 in the third paragraph, it discusses reducing waste items in size if they are too big. More detail is required to discuss how large items are going to be handled or picked up, (i.e., concrete boxes, or equipment such as some vehicles that may be buried. How would they be transported, or would they be left behind?) The explanation given does not appear to be adequate for all types of waste that may be encountered in a solid waste disposal site. In addition, the next paragraph discusses that ventilation air would be discharged through two HEPA filters to maintain effluent radionuclide concentrations of less than maximum permissible concentrations for uncontrolled areas. How are these effluents, or potential effluents, to be monitored to ensure that that will be the case?

3.1.8.22 B.12 Second paragraph. Section B.1.2.1, Radionuclide Concentration for Geologic Disposal, which discusses the building of a radionuclide concentration facility. Concentrations of liquids released to surface ponds would be less than the MPC for releases to uncontrolled areas, except tritium, which would be within the limit for release to controlled areas. This is in conflict with current written goals by Rockwell to reduce all liquid effluent releases to the drinking water standards.

3.5.1.29 B.28 Figure B-23, Protective Barrier System in Place on the 200 Area Plateau. This drawing is not to scale and does not include all sites to be included in the barrier system. The drawing should be replaced by one illustrating all sites to be included underneath this barrier system (for example, the U-10 pond, to scale drawing locations of Z-19 ditch and future tank farms that will ultimately have to be disposed of as well like AP farm AQ, etc.). It would also be beneficial to show the locations of these sites in relation to some of the major facilities so that some idea of the scale and location is more evident.



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B.29 Last paragraph. Airborne emissions of radioactive materials would occur with all classes of waste. How are these airborne emissions to be monitored? 3.2.3.4

B.33 First paragraph. See previous comment.

B.35 Second paragraph. See previous comment.

General Comment References of course are an absolute necessity to support a document of this nature. However, too often throughout this document many conclusions are drawn without any detail given except just to refer to another document. This results in information being inadequate for the reader to fully understand the consequences or lack of consequences of a conclusion that is drawn. Although the references are necessary, a little bit more detail is needed when discussing certain conclusions. For example, on Page C-9, under the HWVP alternative, an evaluation showed that environmental effects resulting from disposal in crystal and ceramic versus borosilicate glass were not significantly different. A reference is given but no detail as to why that conclusion was drawn is included in this EIS. 4.1.10

C.14 Section C.7, Radiological Impacts and Emissions of the Vitrification Alternative. Dose commitments are cited as being all within DOE limits, which is a true statement; however, I wonder if it might be more advantageous to include all other dose limitations that the commitment will fall into, such as EPA and NRC, even though those dose limits do not necessarily apply to the DOE site at this time. 4.2.17

D.3 In Section D.2, Relationship to Other Facilities. Throughout most of the EIS, Purex is simply referred to as Purex, but in this section is referred to as A Plant. In addition, Z Plant is listed, which is the Plutonium Finishing Plant, and S Plant implies that Redox is still active, which is not the case. Additional clarification could possibly be that along with the nomenclature, the type product that each plant produces may be beneficial in understanding the kind of waste which would be generated. 4.1.4

F.3 Figure F.1, Potential Environmental Exposure Pathways. There is no pathway identified on the figure originating from waste disposal activities. There should be. 4.2.19

F.7 Section F.1.5.1, Critical Groups for Dose Assessment. The first sentence states that doses are calculated based on the metabolism of standard man. It is recommend that the maximum individual be considered as well to give a worst case situation. As is stated in this section, metabolism

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3.5.5.18 is not the same for every age group, every sex, etc. By incorporating maximum individual doses as well, that would be compensated for. If not to be taken into consideration, then why do the following tables list not only parameters for average individuals but maximum individuals as well. That indicates that the maximum individual should or would be considered in this document.

I.14 Section I.1.1.3, Routing. This section discusses the transportation requirements as delineated by the Department of Transportation, and says that in the event of any conflict between state and local transportation requirements and the DOT requirements, then the DOT requirements pre-empt state and local requirements. Does this also include those state and local transportation requirements which may be more conservative? This section needs more clarification to ensure that state and local concerns for transportation are addressed. 3.4.2.4

M.1 In the preliminary analysis of the performance of the protective barrier and marker system, it says that, based on an evaluation of the projected ability of these candidate designs, the multilayer earthen cover was chosen for analysis in this EIS. More discussion is needed on why this design barrier was chosen over soil mounding, revegetated covers, synthetic and natural impermeable layers, etc. There are no references given that would discuss why the other designs were discarded. 3.5.1.14

M.9 Section M.3.2, Biointrusion Control. Biological factors including plant and animal activity could lead to radiation doses to man in the long term. However, in the previous section discussing dose pathways to man, animal intrusion into the waste is not discussed, nor is it included on any of the diagrams. 3.5.1.83

M.13 In the first and second paragraphs, it discusses the number of people expected to heed the warning marker system. For example it concludes that 85 to 95 out of 100 individuals would heed warnings and not drill into the barrier or waste site. How were these numbers derived? The risks are meaningless without an explanation. The same comment is appropriate for the entire section. 3.5.1.31

M.19 In Section M.5.1.2, in the first paragraph on page M.19, Plant Cover, it says that the plant cover selected was cheatgrass. The use of cheatgrass is currently prohibited for any stabilization project on the Hanford site due to complaints by area farmers. It would appear that the use of cheatgrass seed would impact those farmers. In addi- 3.5.1.25





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tion, cheatgrass is an annual plant. During drought conditions, it may not come back to adequately prevent significant erosion. These impacts need to be addressed. 3.5.1.25

M.21 In Section M.5.2.1, under test cases, it discusses simulated cover systems, with the combination of factors most and least likely to contribute to drainage (with reference to Table M.7 which provides a summary of multi-layer barrier simulations). Apparently, the different barriers were simulated rather than actually built. The question arises then, how the data was derived as far as drainage is concerned? Will actual barriers be constructed for testing prior to commitment to this alternative? 3.5.1.65

M.24 Cover disturbance considerations. Wind erosion is discussed, however, range fires are not. A range fire may denude the top of the stabilized waste sites and leave the soil open to wind erosion, as was evidenced in the 1984 Hanford range fire. A great deal of soil was moved. The scenario probably should be addressed where a significant amount of the soil cover might be lost following a range fire, and then see what impact that might have on water infiltration, transporation, etc. 3.5.1.100

Section 0 Potential contamination of the aquifer. There is no discussion of potential inter-communication between the unconfined and confined aquifer around the Hanford site. Assuming that there is no possibility of inter-communication, shouldn't there at least be some discussion of that fact? 3.5.3.16

P.21 Section P.2.5, in the first paragraph it states that 618-2 site is located inside the 300 area. Correct that to say that it is located adjacent to outside the 300 area fence, and is, in fact, colocated with the 618-3 burial ground. 4.1.16

P.25 Table P-10. Does the radionuclide inventory included in this table also include tank wastes in tank farms that have yet to be built, or only those that are currently built, but not yet fully used? Same comments for Table P-14, P-15, P-16 and P-17 through P-22. 3.1.4.22

V.1 Second paragraph, the last sentence says ditches are unlined excavations used for conveying the low-level liquid waste to the pond. Some sites officially designated as ditches are also used for specific retention. For example, the 216-S-10 ditch and the 216-B-63 ditch. Neither of these sites are used to convey low-level liquid to pond, but rather fulfills the purpose of a trench. 4.1.17

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3.5.3.21 **V.1** — Last paragraph. It says that for 25 years a comprehensive program has been in effect for monitoring the ground water. I believe its been more of a developmental program, and has not, in fact, been a comprehensive program that has been in effect for that entire period. I think some historical background of the development of the ground water monitoring program would be appropriate.

3.5.3.21 **V.1 and V.2** — A general description is given of low-level liquid waste sites and then a description of the ground water monitoring program. However, Figure V.1 shows the general ground water monitoring network for the Hanford site, but there is no figure that shows the detailed ground water monitoring program in effect to actively monitor those low-level liquid waste sites discussed on the previous page. A figure would be appropriate that shows the extent of the ground water monitoring program inside the 200 areas around the low-level liquid waste disposal sites.

4.2.53 **V.4** — Concerning the characterization of the 216-A-24 crib, in the last sentence, it says that behavior of contaminants migrating from this facility cannot be completly characterized. That is true; however, there is some data available concerning the lateral migration of contamination from this crib, as was documented in an unusual occurrence report written during the excavation of land adjacent to A-24 for backfill in the 241-AN tank farm. At that time, significant lateral migration of contamination away from the crib was noted. That data is valuable and would be beneficial in showing that there can be significant lateral migration of contamination away from the actual disposal site, and can not necessarily be identified just by looking at the surface boundaries of the site.

4.2.50 **V.5** — Figure V.2. It would be well to include a subnote on this figure stating that these drawings are definitely not to scale.

4.2.52 **V.29** — Section V.6, Disposal Ponds. The 216-U-10 pond and associated ditches are discussed, but no where is it discussed that the pond and major ditches flowing into that pond have been retired and stabilized. I think that would be a valuable addition to this section. In addition, the title should be changed from disposal ponds to the 216-U-10 pond systems, since that is the only pond that is discussed.



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**General Comment** — Rockwell Hanford operations has an extensive environmental monitoring program that, if discussed in this EIS, would eliminate many shortcomings in the document. Site specific monitoring (for disposal alternatives) is extremely important. The program is in place. It should be discussed. 4.1.24

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# APPENDIX B

## LOCAL GOVERNMENT COMMENTS



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BENTON COUNTY
**DEPARTMENT OF EMERGENCY MANAGEMENT**
Kennewick City Hall
P. O. Box 6144
Kennewick, Washington 99336-0144

Telephones:
Office: (509) 586-1451
Emergency: 911

June 13, 1986

MEMORANDUM

TO: Washington Nuclear Waste Board

FROM: Donna J. Somers, Director

SUBJ: COMMENT ON DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR DISPOSAL OF HANFORD DEFENSE WASTES

As the department responsible for emergency planning for Benton County, we would like to offer the following comments on the impact on local emergency response.

There are three areas of importance that are not sufficiently addressed in the DEIS, pertaining to the alternatives involving off-site transportation: training, equipment and planning.

1. Training - Currently training is made available to Benton County by the Department of Energy. The training covers radiological monitoring and response procedures for fire fighters, paramedics and law enforcement. This training program should be evaluated in light of the proposed transportation alternatives.

2. Equipment - Local first responders will need equipment, which is not currently available. 3.4.2.24

3. Planning - Additions to current emergency plans or development of special plans will be required. 3.4.2.26

As is stated in the DEIS, local fire and law enforcement are likely to be first responders to a transportation accident. That being the case, it is important to recognize the costs incurred by these agencies, as well as emergency management, for preparing to respond to the increased probability of a transportation accident. This impact should be addressed in the final Environmental Impact Statement. 3.4.2.25

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# Inland Empire Regional Conference

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RESOLUTION

WHEREAS: the Department of Energy has issued its Draft Environmental Impact Statement on disposal of defense waste currently stored at Hanford: and

WHEREAS: the two basic options are to continue to store the present and future nuclear waste at Hanford or to ship it elsewhere: and

WHEREAS: continued storage at Hanford means the transporting of future defense nuclear waste to Hanford and storage elsewhere means the transporting of existing defense nuclear waste from Hanford; and

WHEREAS: any transportation of radioactive material poses some danger: and

WHEREAS: transportation through urban areas creates more risk than through less densely populated areas; and

WHEREAS: the Draft Environmental Impact Statement indicates that the Department of Energy will make available money to ensure adequate emergency response and that federal support is also available from Federal Emergency Management Administration, Environmental Protection Agency, Food and Drug Administration, and the Nuclear Regulatory Commission; and

WHEREAS: local governments bear the ultimate responsibility for emergency response planning; NOW THEREFORE, IT IS HEREBY RESOLVED BY THE INLAND EMPIRE REGIONAL CONFERENCE:

3.3.2.1 1. The Department of Energy is urged to employ the most favorable technological means to solidify and store hazardous wastes at their point of origin, and

3.4.2.2 2. The Department of Energy is urged to choose that option which creates the least risk and requires the least amount of nationwide transportation of defense waste, and

3.4.2.24 3. The Department of Energy and other federal agencies are urged to make available to local emergency response providers the support promised in the Draft Environmental Impact Statement.

Adopted by the Inland Empire Regional Conference May 21, 1986.

John R. (Jack) Hebner, Chairman



Fifth Floor • City Hall • Spokane, Washington 99201 • Phone (509) 456-2665 / (208) 667-1556

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CITY OF SPOKANE, WASH. FOUNDED IN 1881

VICKI S. McNEILL, MAYOR

May 8, 1986

Warren Bishop, Chairman
Nuclear Waste Board
Department of Ecology
Mail Stop PV-11
Olympia, Washington 98504-8711

Dear Mr. Bishop:

The Spokane City Council is concerned about the defense waste currently stored at Hanford and has instructed our staff to make a careful review of the environmental impact statement recently issued. Following that review we unanimously adopted the attached resolutiion No. 86-38.

Please enter this formal resolution in your records and call upon us at anytime for further comment.

We appreciate the difficult task you must face in dealing with such complex technical issues, but hope you realize that Spokane, by virtue of history and geography, is a population concentration equal to that of the State of Wyoming in which the major transportation corridors lie atop a sole source aquifer, in front of three hospitals and a high school, and passes through the center of the largest urban concentration between Minneapolis and Seattle. We are deeply concerned about transportation of all hazardous materials, including especially nuclear waste, because of that unique geographic situation. 3.4.2.2

Sincerely,

Vicki McNeill
Mayor

p9s.hm.58



OFFICE OF THE MAYOR / FIFTH FLOOR CITY HALL / SPOKANE, WASHINGTON 99201-3335 / (509) 456-2665

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<u>RESOLUTION NO. 86-38</u>

WHEREAS, the Department of Energy has issued its Draft Environmental Impact Statement on disposal of defense waste currently stored at Hanford; and

WHEREAS, the two basic options are to continue to store the present and future nuclear waste at Hanford or to ship it elsewhere; and

WHEREAS, continued storage at Hanford means the transporting of future defense nuclear waste to Hanford and storage elsewhere means the transporting of existing defense nuclear waste from Hanford; and

WHEREAS, any transportation of radioactive material poses some danger; and

WHEREAS, transportation through urban areas creates more risk than through less densely populated areas; and

WHEREAS, the Draft Environmental Impact Statement indicates that the Department of Energy will make available money to ensure adequate emergency response and that federal support is also available from Federal Emergency Management Administration, Environmental Protection Agency, Food and Drug Administration, and the Nuclear Regulatory Commission; and

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WHEREAS, local governments bear the ultimate responsibility for emergency response planning: -- NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE CITY OF SPOKANE:

3.3.2.1 1. The Department of Energy is urged to employ the most favorable technological means to solidify and store hazardous wastes at their point of origin, and

3.4.2.2 2. The Department of Energy is urged to choose that option which creates the least risk and requires the least amount of nationwide transportation of defense waste, and

3.4.2.24 3. The Department of Energy and other federal agencies are urged to make available to local emergency response providers the support promised in the Draft Environmental Impact Statement.

Adopted by the City Council May 5, 1986.

Marilyn J. Montgomery
City Clerk

Approved as to form:

B-Assistant City Attorney

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RESOLUTION NO. <u>1986-08-22</u>

A RESOLUTION RELATING TO WASTE MANAGEMENT AT HANFORD

WHEREAS, the United States Department of Energy has issued a Draft Environmental Impact Statement on Defense Wastes; and

WHEREAS, such Draft Environmental Impact Statement raises many issues of substantial interest to the citizens of Clark County, including the potential siting of a nuclear waste repository at Hanford, and the disposition of radioactive wastes already stored at Hanford; and

WHEREAS, the safe and effective disposition of nuclear wastes is a matter which should be cooperatively and publicly pursued; now, therefore,

BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF CLARK COUNTY, STATE OF WASHINGTON, that the Board supports the cooperative stance of the State of Washington towards the United States Department of Energy's commitment to improved waste management at Hanford, and further the Board questions the selection of Hanford as the best site for a long term nuclear waste depository and voices their concern for the potential contamination of the Columbia River and the potential for accidential spills of contaminants being transported to Hanford. 2.1.1

ADOPTED this 5th day of August, 1986.

ATTEST:

Clerk to the Board

Approved as to form Only
ARTHUR D. CURTIS,
Prosecuting Attorney
Clark County, Washington

By:
Deputy Prosecuting Attorney

BOARD OF COUNTY COMMISSIONERS
FOR CLARK COUNTY, WASHINGTON

Vernon V. Veysey, Chairman

John S. McKibbin, Commissioner

David W. Sturdevant, Commissioner

# APPENDIX C

# PUBLIC HEARING STATEMENTS

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TESTIMONY OF

GOVERNOR BOOTH GARDNER

STATE OF WASHINGTON

for

USDOE PUBLIC HEARINGS

on

DEFENSE WASTE ENVIRONMENTAL IMPACT STATEMENT

by

CURTIS ESCHELS

SPECIAL ASSISTANT ON ENERGY ISSUES

July 8, 1986

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Governor Gardner requested that I express his regrets that he could not be here personally to comment on the Draft Environmental Impact Statement on the Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. He asked me to present his testimony. My name is Curtis Eschels. I am Governor Gardner's special assistant on energy issues. I Chair the state of Washington Energy Facility Site Evaluation Council, and I am a member of the state of Washington Nuclear Waste Board.

2.2.3 Before I make specific comments, I will take a few moments to list general criteria the U.S. Department of Energy (USDOE) should use to reach decisions. The number one criterion must be the protection of public health and the environment. To meet this all important criterion, USDOE must:

3.3.5.4 - use state-of-the-art technologies;

2.4.1.1 - comply with appropriate laws by leaving the shadow of the 1954 Atomic Energy Act exclusions and moving into the sunshine of current federal legislation;

2.2.3 - consider economics, but not allow economics to drive decisions;

2.5.6 - minimize future releases; and

2.2.1 - make sure science, not politics, prevail in the decision making process.

The cleanup of this 40 years accumulation of wastes is a major, long-term challenge for USDOE and the state of Washington. This Draft EIS is the beginning of a long, difficult, and expensive task.

2.3.2.8 I am pleased that the citizens of this region have become so knowledgeable about this issue. I credit the USDOE and state of Washington information programs for providing information to the citizens. I hope these information programs will continue even though the Draft EIS comment period will soon end.

The following specific comments are made in the spirit of improving this draft impact statement. This three volume, 1,000 page document is, for the most part, clearly written and technically sound. However, to make the final document complete and adequate, USDOE must incorporate the following issues.

### Chemical Hazards

3.1.6.1 The scope of the DEIS is too narrow. The document does not adequately deal with the hundreds of thousands of tons of chemical wastes included in tank wastes and dispersed in Hanford soils. The hazards of chemical contamination are no less real and urgent than



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the hazards of radioactive materials. USDOE must inventory the chemicals contamination and each disposal alternative must specifically address chemical contamination.

### Soil Barriers

The Draft EIS appears to make overly optimistic performance assessments for soil barriers. The validity of the EIS is in jeopardy if the available literature has been misrepresented. Barrier performance must be substantiated by previous studies and actual experience. Pathway and travel time calculations are meaningless until barrier performance is substantiated. 3.5.1.57

### Compliance With Safety Laws

We are concerned that the USDOE emphasis on stabilization of tanks is contrary to the Nuclear Waste Policy Act "multiple barrier" approach which requires stabilization of both the container and the wastes. The USDOE approach leads to an acknowledged contamination of Hanford groundwater. Contamination of groundwater is contrary to state law. In the final EIS, USDOE should agree to comply with all appropriate state laws to protect public health and the environment. 2.4.1.1

### Compliance With the National Environmental Policy Act

In the final impact statement, USDOE must specifically identify the impacts of "the" proposal as required by the National Environmental Policy Act. The use of "bounding assumptions" to cover a range of impacts or alternatives is not acceptable. Delayed records of decision will require, as a minimum, a supplemental EIS with an opportunity for citizen comment. 2.4.1.17

The draft document calls for a system to mark the boundary of the actual disposal sites. USDOE describes what it calls "actual disposal sites" which would cover 32 square miles. In our opinion, not all the 32 square miles must be off limits forever. Only that land that is irretrievably contaminated by dangerous wastes should be written off. USDOE must establish a separate, public process to condemn land prior to writing it off. 2.5.7

### Ability to Monitor

USDOE must, in the final EIS, evaluate the impact of defense wastes on the ability to monitor a proposed repository. This monitoring is especially important in the earlier postclosure years. It is obvious that even consideration of a repository requires the best possible cleanup of defense wastes. 2.1.7

<u>Effect on Other Decisions</u>

2.2.3 Health and safety issues must be the major factor in the cleanup of
defense wastes and in decisions leading to the selection of a site
for geologic disposal of high-level wastes. From all indications,
the decision to indefinitely postpone work on a second repository
was based, in part, on USDOE data which assumed single-shell wastes
would not go to a repository. If the decision was influenced by
such an assumption, there will surely be added pressure by USDOE to
stabilize the single-shell tank wastes in place. In addition, the
use of such data to make a decision on the second round repository
3.3.2.1 raises serious questions about the validity of the geologic reposi-
tory alternative for single-shell wastes. The spirit and intent of
the National Environmental Policy Act requires consideration of
valid alternatives. The final EIS must clear up this confusion and
must clearly address the impact of single-shell wastes on the
2.1.7 design and construction of a repository--wherever it is built. The
final document must include specific information on the number of
canisters of glassified waste USDOE expects to extract from single-
shell tanks.

<u>Conclusion</u>

In conclusion, I support strongly USDOE's efforts to move ahead on
key elements of the Hanford cleanup. This includes continuing
3.3.5.3 research and preliminary design work on the glassification and
grout facilities. The state of Washington will work to forge a
coalition to support cleanup funding.

The Washington State Nuclear Waste Board will testify at the Seattle meeting and the Board will submit detailed comments on or before the August 9 deadline.

Governor Gardner and I thank you for this opportunity to comment.

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**TESTIMONY OF**
**WARREN A. BISHOP, CHAIR**
**WASHINGTON STATE NUCLEAR WASTE BOARD**
**FOR**
**USDOE PUBLIC HEARINGS**
**ON**
**DEFENSE WASTE ENVIRONMENTAL IMPACT STATEMENT**
**July 15, 1986**

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Thank you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS) on the Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. My name is Warren Bishop. I am Chair of the state of Washington Nuclear Waste Advisory Council and the state of Washington Nuclear Waste Board. My business address is Mail Stop PV-11, Olympia, WA 98504.

The Board and Council have placed a very high priority on the review of this most important document. Early in the review period, we hired a contractor to assist us review the more technical aspects of this three volume, 1,000 page document. Board and Council members, together with staff from the Office of Nuclear Waste Management, compiled a list of significant policy and legal issues. At about the mid-point of the review process we took our preliminary technical, policy, and legal issues to the citizens. We wanted to inform the public about some of the issues associated with the DEIS and to obtain citizen comment on the DEIS.

In mid-June, we held public meetings in Yakima, Kennewick, Spokane, Vancouver, and Seattle. Approximately 800 people attended the meetings and 115 people presented verbal comments. We received excellent testimony which was often very intense and emotional.

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Washington State citizens find it difficult to separate repository issues from defense waste issues. Most speakers expressed deep concern about the Basalt Waste Isolation Project and the siting of a permanent national repository at Hanford. However, there was significant support by the citizens of the Tri-Cities area for the USDOE disposal options.

2.5.5 There is tremendous public distrust of USDOE and deep concern about the decision-making process. Many people feel the decisions have already been made, the
3.3.5.4 decisions may not have a scientific basis, and that the state and its citizens have little voice in the decisions. Most citizen comments on public health, safety and environmental issues related to concerns about possible contamination of the Columbia River and the
3.5.4.3 potential for serious impacts to groundwater and agriculture.

On or before the August 9 deadline, the Nuclear Waste Board will submit detailed comments on the Defense Waste DEIS. Our comments will include a summary of citizen comments made at the state information meetings. In addition, we will include detailed comments on technical, legal and policy issues. In the brief time remaining, I will summarize some of the Board's major public policy concerns.

2.3.2.8 As I mentioned earlier, there is deep citizen concern about the decision making process. In the final EIS, USDOE must clarify the role of the state and citizens in the decision making process. Specifically, USDOE must identify the impacts of "the" proposal as required by the National Environmental Policy Act. The use of "bounding assumptions" to cover a range of impacts or alternatives is not acceptable.

The Nuclear Waste Board is concerned about USDOE's planned use of delayed records of decision. We recognize that some alternatives will require additional research.
2.3.2.3 When the research is complete and USDOE is ready to recommend an action, USDOE must, as a minimum, prepare a supplemental EIS and give the states and citizens an opportunity to comment.



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We are concerned about the USDOE marker proposal which would make 32 square miles of Washington State land off limits forever. USDOE must prove that all the 32 square miles must be off limits forever.

On May 28, Secretary of Energy Herrington recommended, and President Reagan approved, three Western sites for characterization for the first high-level nuclear waste repository and announced that all site specific work on the second repository would be indefinitely postponed. From all indications, the decision to postpone work indefinitely 2.1.8
was based, in part, on USDOE data which assumed single-shell wastes would not go to a repository. If the decision was influenced by such an assumption, there will surely be added pressure by USDOE to stabilize the single-shell tanks in place. This assumption also raises serious questions about the validity of the geologic repository alternative for single-shell wastes.

The Draft EIS appears to make optimistic performance assessments for soil barriers. The validity of the EIS is in jeopardy if the available literature has been 3.5.1.57
misrepresented. Barrier performance must be substantiated by studies and actual experience. Pathway and travel time calculations are meaningless until barrier performance is substantiated.

In summary, the cleanup of this 40-year accumulation of hazardous wastes is a long-term challenge for all of us. Resolution of our policy, technical, and legal issues is the necessary first step in this long, difficult and expensive challenge.

The Nuclear Waste Board supports USDOE's continuing research and design work on the glassification and grout facilities. The Hanford cleanup will require large financial expenditures over the next few decades. The Nuclear Waste Board will work with Governor Gardner and the Congressional delegation from Washington and other states of the Pacific Northwest to forge a coalition to develop financial support for cleanup.

The Nuclear Waste Board and I thank you for this opportunity to comment.

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TESTIMONY BEFORE THE DEPARTMENT OF ENERGY ON THE DEFENSE WASTE EIS

TUESDAY, JULY 15

AUG 8 1986 0223

GOOD AFTERNOON. I AM ANDREA BEATTY RINIKER, DIRECTOR OF THE WASHINGTON STATE DEPARTMENT OF ECOLOGY.

WARREN BISHOP DID A GOOD JOB OUTLINING A NUMBER OF OUR CONCERNS WITH THE DRAFT DEFENSE WASTE ENVIRONMENTAL IMPACT STATEMENT.

3.1.6.1 I WOULD LIKE TO TAKE THE SHORT TIME WE HAVE ALLOTED TO US ON THIS CRITICAL ISSUE TO ZERO IN ON THE CHEMICAL WASTES WHICH ARE MIXED IN WITH THE NUCLEAR WASTES. THESE SO-CALLED MIXED WASTES ARE OF CRITICAL CONCERN TO THE STATE DEPARTMENT OF ECOLOGY.

SPECIFICALLY, I BELIEVE IT IS A MAJOR POLICY ERROR AND A MONUMENTAL ENVIRONMENTAL RISK TO FAIL IN THIS EIS TO ADEQUATELY PRESENT A SOLUTION FOR MANAGING HANFORD'S HAZARDOUS CHEMICAL WASTES.

THE DRAFT EIS FAILS TO GUARANTEE TO THE PEOPLE OF WASHINGTON SAFE MANAGEMENT OF THE APPROXIMATELY 220,000 TONS OF CHEMICAL WASTES WHICH ARE MIXED IN WITH THE RADIOACTIVE STEW AT HANFORD. THAT IS MORE THAN 100 POUNDS OF HAZARDOUS WASTE FOR EVERY MAN, WOMAN AND CHILD IN WASHINGTON.



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DESPITE THIS MASSIVE VOLUME AND THE GREAT POTENTIAL FOR ENVIRONMENTAL DAMAGE, THE EIS FAILS TO RECOGNIZE THE STATE'S AUTHORITY UNDER FEDERAL AND STATE LAW TO MANAGE HAZARDOUS MIXED WASTES AND IT FAILS TO IMPOSE THE STRICTER STANDARDS THE STATE USES IN MANAGING NON-RADIOACTIVE BUT DANGEROUS WASTES. 3.1.6.1

UNFORTUNATELY, THIS IS NOT THE FIRST TIME I HAVE ASKED THE DEPARTMENT OF ENERGY TO ACKNOWLEDGE THE STATE'S AUTHORITY TO REGULATE HANFORD'S HAZARDOUS MIXED WASTES.

MORE THAN A YEAR AGO, IN APRIL 1985, I INFORMED DOE THAT ECOLOGY HAS THE AUTHORITY TO REGULATE HANFORD'S DANGEROUS CHEMICAL WASTES -- JUST AS WE ARE DOING FOR MORE THAN 800 HAZARDOUS WASTE GENERATORS AROUND WASHINGTON.

BUT THE DEPARTMENT OF ENERGY CONTINUES TO REMAIN IN THE SHADOWS OF THE 1954 ATOMIC ENERGY ACT AND DENIES THE STATE AUTHORITY OVER MANAGING THE DANGEROUS CHEMICAL WASTES IN THE HANFORD STORAGE TANKS.

IT IS TIME ENERGY COMES OUT OF THE SHADOWS OF THE 1954 ACT AND INTO THE SUNSHINE OF THE STATE'S DANGEROUS WASTE MANAGEMENT PROGRAM.

THE DRAFT EIS MUST DEMONSTRATE THE STATE'S PERMIT REQUIREMENTS CAN BE SATISFIED AND ESPECIALLY THAT STATE REQUIREMENTS FOR PROTECTION OF GROUNDWATER QUALITY CAN BE MET.

IT IS IMPORTANT TO REMEMBER THE HAZARDS OF CHEMICAL CONTAMINATION ARE NO LESS REAL AND URGENT THAN THOSE DEALING WITH RADIOACTIVITY.

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3.1.6.1 THE PRESENT PRACTICES AT HANFORD CONTINUE TO CONTAMINATE GROUNDWATER IN WASHINGTON. I AM WORRIED THAT IF THESE PRACTICES ARE ALLOWED TO CONTINUE, IT COULD FRUSTRATE THE INTENT OF STRICTER STANDARDS WHICH THE STATE HAS APPLIED ON ALL OTHER INDUSTRIES.

THE HAZARDOUS CHEMICAL WASTES OF HANFORD ARE JUST AS REAL, AND JUST AS DANGEROUS, AS THE HAZARDOUS MATERIALS GENERATED IN OTHER PARTS OF WASHINGTON. AND YET, DOE CONTINUES TO REFUSE TO ACCEPT THE STATE'S ROLE IN CONTROLLING ALL THESE WASTES.

THE DEPARTMENT OF ENERGY, THROUGH THIS EIS, SHOULD MEET THE SAME HIGH STANDARDS REQUIRED OF CIVILIAN OPERATORS AND ALL OTHER FEDERAL FACILITIES.

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I AM NOT ALONE IN URGING THE DEPARTMENT OF ENERGY TO AGREE TO HAVE ITS MIXED WASTES MANAGED UNDER STATE HAZARDOUS WASTE MANAGEMENT SYSTEMS. SOUTH CAROLINA, COLORADO, OHIO AND TENNESSEE ALSO ARE PRESSING TO REGULATE MIXED WASTE.

I MUST ADMIT ENERGY HAS SLOWLY AGREED TO PLACE SOME OF ITS CHEMICAL WASTES UNDER THE STATE'S MANAGEMENT SYSTEM. BUT THE PROCESS HAS BEEN MUCH LIKE PEELING AN ONION AND A HUGE VOLUME OF THE MOST DANGEROUS TANK WASTES ARE STILL UNDER ENERGY'S CONTROL AND NOT PROPERLY MANAGED AS DANGEROUS WASTES IN THE EIS.

THE STATE OF WASHINGTON IS READY TO FIGHT TO PROTECT ITS' GROUNDWATER AND ENVIRONMENT FROM THE MIXED HAZARDOUS WASTES GENERATED AT HANFORD.

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AS I MENTIONED, THE BATTLE LINES ARE FORMING BETWEEN THE STATES AND DOE OVER THIS CRITICAL ISSUE OF MIXED WASTES. WE ALREADY FEEL WE HAVE THAT AUTHORITY UNDER STATE LAW. 3.1.6.1

THE CORRECT STEP NOW WOULD BE TO AVOID A PROTRACTED LEGAL BATTLE AND DO WHAT IS RIGHT -- REWRITE THE MIXED WASTES PORTION, ACCEPT STATE REGULATION AND SHOW US HOW YOU WILL TREAT THESE WASTES TO GUARANTEE FARMERS, FISHERMEN AND OTHERS IN WASHINGTON THAT WE WILL HAVE A SAFE SOURCE OF WATER FOR CENTURIES.

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**TESTIMONY ON HANFORD DEFENSE WASTE DEIS**
**July 15, 1986**
**Dick Nelson**

My name is Dick Nelson. I represent the 32nd Legislative District of Seattle in the Washington State Legislature, and I serve as a member of the State's Nuclear Waste Board. I wish to comment on several issues either not addressed in or not adequately covered by the DEIS. I also would like to indicate that I subscribe to the comments previously made by a representative of the Nuclear Waste Board.

2.5.6 Future Plutonium Production and Military Waste Generation

The DEIS assumes that the N Reactor and PUREX will be operated until 1995, producing tank wastes from this and other DOE sources corresponding to the processing of 12,000 t of N Reactor fuel. The DEIS takes into account the processing of an additional 20,000 t of irradiated uranium beyond 1995 "in response to national defense or research and development needs" (section 3.2.2). The DEIS does not discuss the military necessity for the future production of plutonium, or alternatives in meeting the need which would not result in more waste being generated. The final EIS must address the need for more plutonium by taking into account weapons systems that are under development or are candidates for development, and which cannot be armed by either our current plutonium stockpile or by recycling plutonium in obsolete warheads. This must be addressed for two reasons important to
3.3.5.7 the citizens of Washington: (1) The total volume of waste will determine the need for a second geologic repository for commingled military and commercial waste. (2) We have a right to know what military purposes require that we assume the risk and the responsibility for the generation and storage of a significantly increased quantity of high-level waste.





Quantity of TRU in Various Storage Sites 3.1.3.9

The DEIS provides only approximate values for the quantity of TRU radionuclides in the several sites. Given the great diversity of waste forms and materials contaminated with TRU, and their sources, it is understandable that precise measurements of TRU activity and weight have been difficult over the years in which TRU has accumulated. Estimating techniques were presumably employed to arrive at the values in Table 3.1 and Appendix A. One is led to the inescapable conclusion that there must be considerable uncertainty in the values listed. What is the probable range of activity and weight of TRU for each site? The final EIS should indicate the probable error in the quantities of TRU estimated, and exactly how these quantities were measured or estimated.

Long-Term Impacts Following Postulated Disruptive Events 3.5.6.1

The DEIS does not adequately address possible climatic changes resulting from increased carbon dioxide and trace gases in the earth's atmosphere (the "greenhouse effect"). Current and predicted increases in these gases (produced by deforestation and combustion of fossil fuels) could lead to the melting of the polar ice caps, a significant increase in sea level and groundwater levels, and major climatic changes. Increase in precipitation would increase the expected groundwater recharge, which would speed the migration of radioactivity into

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the groundwater, as would a higher water table. The final EIS must consider the possibility that future precipitation at Hanford may be greater than 30 cm (11 inches) per year, and that the water table may rise.

Increased volcanic activity, possibly caused by cyclic perturbations in the earth's orbit, could also cause climate change. Higher volcanic activity is proposed as a trigger for increased glaciation over relatively short periods of time (decades or centuries). If a new glacial period is initiated, glacial flooding can be predicted at the Hanford site. The DEIS states that such floods could be of a scale that would scour out the waste sites to a depth of several meters. Smaller floods could erode the waste site progressively and transport long-lived plutonium radionuclides in more concentrated alluvial deposits, rather than entraining them uniformly in a great volume of sediment. The final EIS should address the possibility that glacial action is possible much sooner than the 40,000 years estimated in the DEIS. It should also take into account the possibility that glacial flooding could disperse plutonium from stabilized in-place waste sites in a way that increases environmental risks.

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Effects of Nuclear Explosions

3.4.3.7 The DEIS contains no analysis of the disruptive effects of a nuclear explosion at the repository location. Hanford, because it is a production center for nuclear weapons materials, is considered to be a target for nuclear missiles in the event of an enemy attack. It is also potentially a target for a terrorist attack. A ground burst





nuclear explosion at the site of wastes stabilized in place could result in the dispersal of major quantities of radionuclides, far in excess of the amount released by fission of the nuclear warhead. Theodore Taylor, former deputy director of the Defense Atomic Support Agency, stated to a House subcommittee on June 16, "The total inventories of two especially troublesome radioactive isotopes, cesium 137 and strontium 90, in the reprocessing wastes buried [at Hanford] are the same as would be released by the explosions of several thousand one-megaton nuclear weapons." He went on to say that, "Release of these wastes by large chemical or small nuclear explosions could produce long-term fallout contamination on the same scale as a nuclear war." A repository in which high level wastes are stabilized in place could be more vulnerable to terrorist attack than would an operating nuclear reactor. The final EIS should thoroughly analyze the vulnerability of a surface repository to nuclear attack and the health consequences compared to geologic storage.

Funding Clean-Up and Waste Reduction

The DEIS estimates costs for the various alternatives, but suggests no funding source. Spokespersons for the DOE have on several occasions alluded to the probable difficulty of persuading a budget-cutting Congress to appropriate monies to implement the final disposal alternative. They have emphasized the need for strong efforts on the part of Washington citizens and their Congressional representatives to work to secure the necessary funds. The State of Washington should not be placed in the impossible position of lobbying a Congress that is 2.2.9

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preoccupied with balancing a federal budget by eliminating programs. There will be as little support for funds for cleanup outside the few states that produce and store military wastes as there is for a commercial waste repository outside the same states. The final EIS should recommend a guaranteed funding mechanism. A portion of the DOD or DOE budget should be earmarked for the cleanup of existing waste and the reduction and handling of future wastes. The fund should be sufficient to cover the most expensive alternative -- geologic disposal -- should it be chosen.

2.3.1.8 The DEIS does not speak to the State's role in monitoring the research and analysis that will be required. Independent research will be needed to prove the design of the engineered barrier, to analyze features of hydrology, safety of the waste forms, characterization of wastes (especially the tank wastes), retrieval of the wastes, and to research means of waste reduction, among other projects. This role is comparable to the state's efforts in monitoring the site characterization of the BWIP program for the commercial and military repository. Those efforts are, of course, supported by federal grants under the Nuclear Waste Policy Act. The final EIS should indicate how funding of the State's monitoring responsibility will be guaranteed.

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DEIS Process Improvement

2.3.2.8 The DEIS public comment process does not serve the concerned public well when issues are as technical and complex as the siting of a nuclear waste repository. Most citizens do not have either the expertise or the time to plow through thousands of pages of the DEIS and



references. A new approach to public involvement should be taken before the final EIS is issued and any record of decision is issued. The most important technical issues should be identified and made the subject of public forums in which technical professionals with different viewpoints or holding different assumptions engage in dialogue and debate. Written documents should be issued giving the pros and cons of the issues or the differing assumptions. This process would not replace, but would supplement, the standard comment process and public hearings. This dialogue would shed more light on the technical questions that must be answered before decisions are made that could leave large amounts of high level and TRU wastes in the soil of our State for future generations to contend with. 2.3.2.8

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APPENDIX D

CITIZENS COMMENTS

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APPENDIX E

TECHNICAL REVIEW

PREPARED BY

URS CORPORATION

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*Technical Review*

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

# Disposal of Hanford Defense High Level, Transuranic and Tank Wastes

**Washington State**
**Department of Ecology**
Office of Nuclear Waste Management

URS Corporation
Converse GES
Energy Incorporated

July 1986

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(no comment identified)

**URS**

URS CORPORATION
2615 FOURTH AVENUE, SUITE 200
SEATTLE, WASHINGTON 98121
TEL: (206) 623-6000

August 1, 1986

Bill Brewer
Office of Nuclear Waste Management
Washington State Department of Ecology
Mail Stop PV-11
Olympia, WA 98504

AUG 8 1986 0223

Dear Bill:

Submitted herewith is our review of the Draft Environmental Impact Statement (DEIS) for Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. This review was prepared by URS Corporation with significant technical assistance from Converse GES and Energy Incorporated. The review focused upon those elements of the Defense Waste Project which might affect nuclear waste repository siting (Basalt Waste Isolation Project-BWIP) on the Hanford Reservation. In particular, elements of radiochemistry, geohydrology, risk, health effects and disposal alternatives were considered.

The report is organized into four chapters and an appendix. Chapter 1 provides introductory material. Chapters 2 and 3 review the DEIS and ask (numbered) questions of the U.S. Department of Energy (DOE) for their response in their final EIS (FEIS). Chapter 4 and Appendix A provide a critique of many of the references cited by DOE. An Executive Summary is provided. More detail on the approach and organization of this review is discussed in Chapter 1. A Preface is also provided which places this review in context of the waste disposal project and this DEIS.

NEPA allows a lead agency to summarize comments to a DEIS instead of printing a specific response to each one. Because of the specificity and complexity of the questions herein, we suggest that the State should encourage DOE to be as specific as possible in responding to these questions and avoid combining them with other comments.

All questions are numbered consecutively, starting with I001, except for Appendices questions which are numbered by Appendix.

We appreciate the opportunity to assist the Office and the Nuclear Waste Board in their review of this important project and look forward to continuing our association with WDOE in their analysis of activities related to Hanford.

Sincerely,

Grant Bailey

Grant Bailey
Director of Environmental
Studies and Planning

GB/rb

Enclosure

*Technical Review*

# DRAFT ENVIRONMENTAL IMPACT STATEMENT

## Disposal of Hanford Defense High Level, Transuranic and Tank Wastes

**Washington State**
**Department of Ecology**
Office of Nuclear Waste Management

**URS Corporation**
**Converse GES**
**Energy Incorporated**
**July 1986**

## DISCLAIMER

The product of this work effort is to be used by the State of Washington solely in the preparation of a comment letter to the U.S. Department of Energy (DOE) regarding the DEIS on Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. The product of this work effort is not intended to be used in any other way. URS Corporation assumes no liability for use by others.

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## PREFACE

This report provides review comments and questions related to the DEIS entitled Disposal of Hanford Defense High-Level Transuranic and Tank Wastes. As in any report which is focused on uncertainties or on conclusions which are subject to dispute, the report may appear to emphasize the negative aspects of the DEIS. Questions are not asked, nor comments made, about areas with which we are in complete agreement.

The DEIS is an extensive document providing great detail about some very complex topics. It is obvious that it is the product of a great deal of work. It is not surprising that questions would arise over methodology or results in such a technical area. It is hoped that clarification by DOE of the questions raised here will enhance the value of a very important document.

While most environmental impact statements discuss the potential environmental harm which could occur from a proposed project and discuss methods to minimize impacts, the defense waste project is different. A project sponsor usually seeks to receive authorization for a project from permitting authorities who generally choose between denying the project, thereby avoiding impacts, or authorizing it with acceptable impacts. The authorities generally have the choice of denying a project and avoiding most impacts.

Most defense-waste disposal at Hanford, however, has already occurred, and this EIS is intended to discuss the best methods of cleanup and environmental protection for an action that has already happened. Thus, the choice given here to decisionmakers is actually easier. All alternatives proposed by USDOE improve the environment at Hanford over "no action" and any uncertainty discussed herein reflects mainly on the degree of environmental improvement, not degradation. The uncertainties raised in this review affect the amount of environmental improvement possible, not whether environmental improvement will occur.

(no comment idenfified)

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(no comment identified)

EXECUTIVE SUMMARY

Technical Review

Disposal of Hanford Defense, High Level, Transuranic and Tank Wastes Environmental Impact Statement

## INTRODUCTION

This review provides a comment to the USDOE draft Environmental Impact Statement (DEIS) entitled Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. It provides information relevant to the potential impacts of defense wastes disposal on the Geologic Repository at Hanford and considers numerous elements to the defense waste disposal process of interest to the Office of Nuclear Waste Management. It examines Appendices to the DEIS in detail and checks numerous references which were provided in the DEIS.

This review is organized into four chapters. It includes a discussion of Volume 1 of the DEIS (Chapter 2), a discussion of the Appendices to the document (Chapter 3), and a separate section discussing the references checked (Appendix A). The overall review resulted in approximately ninety (90) comments (questions) on the DEIS.

This review examined numerous critical elements within the DEIS either in isolation or, occasionally, within the context of other elements. As a result, no one conclusion or conclusions can be drawn about the project or the document as a whole. The review team did not reanalyze the project or reconstruct the major analyses. Our findings relate to the individual elements examined and the references checked. In many areas, it is difficult to characterize the ultimate importance of our concerns for two reasons: first, the document we reviewed is a draft and subject to considerable revision as a Final EIS, and; second, USDOE themselves recognize the uncertainty of many of their primary conclusions and intend to study many of the issues further before making final decisions.

## SUMMARY OF FINDINGS

This Executive Summary attempts to summarize the important elements of the DEIS. It is difficult to develop a representative summary of the DEIS because of the nature of the document under review, and because this review did not include all elements of the entire document. The reasons for this difficulty are as follows:

- The DEIS document is in three volumes, with more than 1,000 pages, including 22 separate appendices--each a separate report within itself. The length of the DEIS makes it difficult to keep a summary brief. The Appendices represent different topics and do not lend themselves to a single integrated summary.

- Some problems were found in some of the assumptions made and in data utilization. Much of the work done with these data involved very complex analyses. These analyses themselves were not generally checked within this scope. Thus, it was not always clear what the significance of some disagreements would be regarding the potential for changing the final result.

Although we have raised questions regarding errors and uncertainties which, if corrected or clarified, may modify the results of this analysis, we have not conducted our own analysis to develop our own findings about the conclusions. It is hoped that the comments made within this report will be seriously considered in a re-analysis of the topics within the document, and will contribute to a thorough and accurate FEIS.

General Comments

- The USDOE cited more than 300 references in their preparation of the DEIS. A number of references checked did not appear to support the conclusions stated in the DEIS. 4.1.10

- In some important areas, the USDOE appears to be overly optimistic about the uncertainties noted in their discussion. 3.5.6.53

- Some assumptions and findings made by USDOE regarding the effectiveness of the protective barrier are questioned in this review. 3.5.1.57

Specific Comments

Precipitation Assumptions. The DEIS concludes (Appendix R), and we would agree, that if climate changes in the future, the most likely change would be toward a wetter climate. The risk analysis in the DEIS (Appendix S) then assumes a 90 percent probability of a drier climate as a basis for impact analysis. 3.5.6.47

Precipitation Assumptions. In cited references and on DEIS page 4.20, it is assumed that average annual recharge during dry climate conditions would range from 0.5 cm to 5 cm/year. The "worst case" of these two numbers would be 5 cm/year. USDOE assumes 0.5 cm/year. In addition, we feel that the DEIS estimate of 5 cm/year recharge as representative of a wet climate is also nonconservative. 3.5.3.2

Barrier Performance. The DEIS states on numerous occasions that various aspects of barrier performance are uncertain and that testing is planned or is underway on many of these aspects. This is a proper conclusion. The DEIS also makes numerous conclusions, however, about the effectiveness of certain elements of the barrier, which are often not qualified by the appropriate level of uncertainty. Although preliminary, these conclusions remain a part of the final conclusions about environmental impacts from the project. The result, in our opinion, is a 3.5.1.57

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level of confidence about the reliability and effectiveness of the protective barrier that is not supported.

Radionuclide Release and Transport. Although the DEIS suggests (page 0.1) that it is intended to present conservative (worst case)
3.5.2.6 assumptions in its modeling, numerous nonconservative assumptions are made, especially among the distribution coefficients. For example, this review found Kd (distribution coefficient) values in the cited references which were more conservative than those used in the EIS.

3.5.6.28 Groundwater Movement. As described in the DEIS (Appendix Q), various influences, particularly offsite irrigation, are likely to raise the water table to a higher level than assumed in contaminant transport calculations. The resulting shortened travel times for radionuclide movement to the accessible environment do not appear to have been incorporated in the long-term performance assessment or consequence analysis of the various disposal alternatives.

Compliance with EPA Standards. It appears unlikely that EPA standards under 40 CFR 191 could be met by either the in-place stabilization or
2.4.1.16 reference alternatives if more conservative assumptions, as discussed in this review, were used in the analysis of radionuclide release to the accessible environment.

Worst Case (Conservative) Analyses. Our opinion on the type and content of many of the assumptions made in the DEIS is that they are
3.5.1.35 nonconservative. The compounding of these nonconservative assumptions yields a nonconservatively low radiation dose from all alternatives. Compounding these assumptions also results in more similar radiation release results for geologic, in-place stabilization and the reference
3.5.6.53 alternatives than may be justified. We believe that more conservative assumptions will lead to results that might not support the DEIS's conclusions about the effectiveness of the reference alternative and in-place stabilization. We feel that these conservative, yet very realistic assumptions would show much greater differences between these two alternatives and the geologic disposal alternative, than shown in the DEIS. In particular, a conservative approach favors minimum reliance on protective barriers and greater reliance on geologic disposal.

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(no comment identified)

# CHAPTER 1

# INTRODUCTION

## INTRODUCTION

The U.S. Department of Energy (DOE) is underway in the selection and implementation of disposal actions for radioactive wastes on the Hanford Reservation. These wastes were generated from defense-related activities occurring at Hanford over the last 40 years or more. This selection process involves the evaluation of various disposal options and combinations of options. The main components of these alternatives include in-place stabilization and use of a geologic repository.

As part of this analysis, DOE issued a draft Environmental Impact Statement (DEIS) entitled Disposal of Hanford Defense High Level, Transuranic and Tank Wastes. The DEIS was formally issued with its filing in the Federal Register on April 11, 1986 and the 120 day comment period closes on Saturday, August 9, 1986. This report is a review of the EIS which is to be used as part of the State of Washington's comment to DOE on the DEIS.

## PURPOSE

The purpose of this report is to provide the State of Washington with a technical review of the DOE DEIS so that the State might use it as part of their comment letter to the DOE DEIS. This review is intended to point out errors or uncertainties in the DEIS and to ask questions regarding these uncertainties so that DOE may correct or respond, as necessary, as they prepare the final EIS (FEIS).

## SCOPE

The scope of this review includes those elements of the environment shown in the enclosed table of contents and is focused on the references cited in the appendices to the document and the Appendices themselves. It is intended to pay particular attention to the potential effects of defense wastes disposal on the repository at Hanford, although other elements of the document have been reviewed.

The review includes sections of the EIS related to radioactive waste processing and disposal, and excludes analyses of biological affects, socioeconomics, and transportation.

## HOW TO USE THIS REVIEW

This review document of the USDOE Defense Waste EIS has been prepared especially for two user groups: the USDOE and the Nuclear Waste Board and staff.

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(no comment identified)

For USDOE, we have explained the rationale for various concerns and translated the more important concerns into direct questions which are clear and easy to respond to in the FEIS.

For the Nuclear Waste Board, Nuclear Waste Advisory Council, and staff, we have explained the approach to this review, the general contents of each EIS section reviewed, and a narrative characterization of each section with important and unimportant elements highlighted.

To receive a general synopsis of the DEIS: Review the General Comments sections in Chapter 2.

To get a general idea of the accuracy of references: Review Appendix A and associated comments from Chapter 4.



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CHAPTER 2

VOLUME 1 REVIEW

INTRODUCTION

This chapter discusses selected sections from Volume 1 (main text) of the DOE DEIS. For each section or subsection discussed, the following format is followed:

General Comments - This part of the discussion summarizes briefly what is presented in the DEIS so that the reader might receive the comments in proper context. The discussion also includes a qualitative characterization, where appropriate - based upon the opinion of the author, as to the overall content of the section in question. General tone, thoroughness and appropriateness of the section are mentioned.

Errors or Uncertainties - Based upon the review of references cited in the document, and on conclusions in the text, any concerns dealing with the substantive content of the section are discussed here. Concerns may range from typographical errors to major disagreement in concept. In many cases no errors or uncertainties are noted.

Questions - Based upon the discussion above, a list of questions is offered to focus any concerns which have arisen and to clarify to DOE the exact type of response requested. Questions are only asked to substantive issues. Typos and non-critical disagreements are left in the errors or uncertainties discussion. All questions are numbered and formed in a way to encourage clarity of purpose and of response. This should facilitate future discussion or reference to these questions, especially in the FEIS.

1.0 GENERAL SUMMARY

General Comments

This chapter of the EIS presents an overview of the entire project, including alternatives considered. The 24 page summary has been bound separately and is used in place of the EIS for general circulation to the public. As a result, many more people have received the summary (3,000-5,000) than have received the main EIS (1,000-2,000).

Discussion of potential impacts to a repository are limited to a reference to cost sharing on a "pro rata" basis, although it is not mentioned whether this is based on weight, volume or radioactivity. Shipping analyses assumed a repository 3,000 miles away as a worst case.

Four disposal alternatives, including no-action are summarized. The barrier is described and compared to the Silla Dynasty tombs in Korea, although no reference is cited for this important conclusion. Table 3 lists major health and safety impacts, although these impacts are not defined.

(no comment identified)

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The lack of suitable technology available to implement the entire disposal strategy is discussed on page 1.3. This problem is supported by ERDA 77-44 which states that the technology to implement any of the alternatives has not been developed completely, and that significant research and development must be conducted before the plans can be implemented. The result is that DOE, and the public, are in a very difficult position in making decision and disposal strategies when major components of these strategies are still subject to considerable further study. There is no way out of this position, but it underscores the importance of making final decisions only on project elements for which there is proven technical support - and avoiding other decisions until support can be developed. Short of this, only very conservative (near-worst case) assumptions should be made.

Also, because some decisions may have to be made without guarantees afforded by proven experience, these decisions must consider all uncertainties and be made with clear understanding of the risks involved. Such risks must always be balanced against the risk of doing nothing.

Although no alternative has supposedly been chosen for this project, the language of the EIS and events appear to contradict this. For example, it appears that DOE is proposing in-place stabilization combined with some repository disposal. The following observations support this:

3.3.3.1
- Instead of alternative A, B, C, or mixed versus geologic disposal, etc., the term "reference alternative" is used. This term comes from the Defense Waste Management Plan (DE83-013816) which concludes that in-place stabilization, if safe and cost effective, is proposed as part of the reference alternative. A reference is a standard against which others are compared. If DOE had picked a preferred alternative early in the analytical process, it would likely have been called a reference alternative.

3.3.3.1
- The reference alternative is referred to as "a balanced, cost-effective disposal approach", leading the reader to perceive that other alternatives are neither balanced nor cost effective.
- In comparison discussions, the reference alternative is described in positive terms and other alternatives often described in more negative terms.

3.3.3.1
- A recent decision by DOE to suspend siting of the second repository apparently assumes the reference alternative will be chosen.

Because DOE apparently supports the reference alternative, it would appear to have been more straightforward to have proposed it as the preferred plan, instead of omitting a preferred or proposed plan in the DEIS.

Errors or Uncertainties

No errors were found in the report, however, certain elements of the



summary could be clarified or supported to enhance the understanding and credibility of the document. For example:

- Major health and safety impacts should be defined from Table 3.
- A very important substantiation provided in the broadly circulated summary is the analogy between the protective barrier and a 1,500 year old tomb in Korea which remained dry. This tomb is not mentioned again in the EIS, nor are any references or substantiation for its relevance to the project. Thus, the only cited long-term support for a critical element to the success of disposal remains unsubstantiated. 3.5.1.30
- No index was provided. The size and complexity of this document requires that a thorough index, as prescribed by National Environmental Policy Act (NEPA) Guidelines, be included. 4.1.1

Questions

1001. What are the soils, geological and hydrological characteristics of the Silla Dynasty tombs and how well do they compare with conditions at Hanford? 3.5.1.30

1002. Will the Final EIS include a detailed index as prescribed by NEPA? 4.1.1

2.0 PURPOSE AND NEED

General Comments

This three page section discusses events and previous studies leading up to the present action. It describes the waste types considered in the DEIS. It explains that this EIS is both programmatic and implementational (project oriented), and that final decisions in some areas must be made pending further research and development. Such research could include tank characterization, barrier performance, model calibration and waste retrieval methods. DOE has assumed, however, that "no technological breakthroughs are required to implement the reference plan" (DE83-013816).

Errors or Uncertainties

DOE has excluded from the scope of this EIS waste associated with decontamination and decommissioning activities and low-level wastes. The significance of this exclusion is unknown because the volume, location and fate of these wastes is not mentioned. It may be valid to exclude them, but nothing is provided in the DEIS to substantiate that exclusion. 2.3.1.14

Questions

1003. What is the volume, location and fate of wastes associated with surplus or retired facilities at Hanford and other low-level waste?

519 (no comment identified)

## 3.0 DESCRIPTION AND COMPARISON OF ALTERNATIVES

### 3.1 BACKGROUND OF WASTE GENERATION

General Comments

Section 3.1 of the DEIS provides a brief description of the background of waste generation at Hanford, starting in 1944. It includes an overview of the various chemical processes by which plutonium and uranium have been recovered from irradiated reactor fuel and of the disposition of the resulting wastes. Processes covered, and the plants in which they have been carried out, are summarized below.

| Process | Plants |
|---|---|
| Bismuth Phosphate Separations | B and T |
| Uranium Recovery | U |
| REDOX (i.e., REDuction and OXidation) | S |
| PUREX (i.e., Plutonium and Uranium Recovery through EXtraction) | A |
| Thoria or Thorex (i.e., Thorium extraction) | A |
| Plutonium Recovery and Finishing Operations | Z |
| Waste Fractionation (i.e., removal of Sr-90 and Cs-137 from HLW) | B |
| Waste Encapsulation and Storage | B |

Section 3.1 ends with a very brief discussion of past waste management experience at Hanford.

Errors or Uncertainties

None noted.



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Questions

None.

### 3.2 WASTE CLASSES, SITES AND INVENTORIES

General Comments

Each known waste site at Hanford has been assigned to one of six waste classes:

- o existing tank waste,
- o future tank waste,
- o strontium and cesium capsules,
- o retrievably stored and newly generated TRU solid waste,
- o TRU-contaminated soil sites, and
- o pre-1970 TRU buried solid waste.

Section 3.2 of the DEIS provides a brief summary of the six waste classes and gives the following data for each waste class:

- o number of sites,
- o total area, volume, and mass, and
- o total inventories of major radioactive contaminants.

Errors or Uncertainties

The six defined waste classes do not include buried low-level waste sites. The scope of this DEIS includes only high-level, transuranic, and tank wastes. However, a brief acknowledgment of the existence of the many low-level waste sites at Hanford in addition to the sites covered by this DEIS, would help to put the planned disposition of those Hanford defense wastes which are included in the scope of this DEIS in the proper broader perspective. 2.3.1.13

It is stated on page 3.5 of the DEIS that Table 3.1 summarizes the six waste classes, showing the inventories of chemicals of interest among other data. However, no chemicals are listed in Table 3.1, except the elements strontium and cesium, which only happen to be listed as part of the name of one of the six waste classes.

Questions

1004. What are the total number of sites, area, volume, mass, and quantities of radioactive materials and chemicals of interest for low-level waste at the Hanford Site? 3.1.6.3

1005. What are the chemicals of interest and their quantities for the six waste classes described in this DEIS?

1006. What are the health concerns associated with each chemical of interest?

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### 3.3 DISPOSAL OR MANAGEMENT ALTERNATIVES

General Comments

This section of the DEIS provides a brief description of the three "disposal or enhanced protection" alternatives that were selected by the USDOE for detailed analysis: (1) geologic disposal, (2) in-place stabilization and disposal, and (3) the reference alternative (i.e., a combination of geologic disposal and in-place stabilization and disposal). A "no disposal action" alternative is also briefly described. This last alternative was analyzed in order to conform to Council on Environmental Quality (CEQ) regulations, although it is not considered by the USDOE to be a viable long-term option. The last alternative may nonetheless be considered as a "delayed major action" alternative for the short term (i.e., for a period less than 100 yr), during which time other disposal alternatives may be considered.

Each of the alternatives is discussed in terms of its application to the six waste classes described previously in Section 3.2.

A brief discussion is also provided on disposal alternatives that were considered but dismissed from detailed consideration. This discussion covers: (1) geologic repository disposal of entire tank contents, (2) geologic disposal of entire tank contents, tanks, ancillary equipment, and contaminated soil from tank leaks, and (3) geologic repository disposal of selected single-shell tanks. The first two of these additional alternatives were dismissed because the added short-term effort, risk, and cost were believed to outweigh any potential long-term risk reduction that might result from their implementation. The third additional alternative was dismissed from detailed consideration in this DEIS because its impacts were believed to be bounded by the present analytical approach.

Errors or Uncertainties

In the description of the protective barrier on page 3.11, there is little discussion of the rock/gravel layer and no discussion of the geotextile. While the description here is only a summary of a more elaborate description in Appendix M, it needs to be complete enough that the reader who has neither the time nor the training to wade through the appendices can understand how the barrier will function. More discussion of the disruption of the soil layer by plants and animals is needed here. It does not sound unreasonable, for example, for a ground squirrel to dig a hole that has at least one tunnel that reaches down 1.5 meters to the bottom of the soil layer. If this coincided with a low point due to minor subsidence, then a
3.5.1.28 heavy thunderstorm could create a catchment which could drain into the hole to the riprap.

In the discussion of the removal of single-shell tank waste on page
3.1.4.5 3.13, only the mechanical removal technique is presented. Considering all the moving parts, this appears to be a concept likely to cause continuing problems. Due to the possibility of leaks, it is obvious why the sluicing method proposed for double-shell tanks may be inappropriate for single-shell



tanks; however, it does not seem impossible to devise a method that is better than either of the above methods. For example, one might consider a state-of-the-art sluicing method utilizing a low-flow, high-pressure water jet combined with a high- suction vacuum tube so that the water impingement 3.1.4.5
would break up the sludge and salt cake and the loosened material and the water from the jet would be immediately removed by the suction action. With this method there would be little excess water to escape through a tank leak, and the bulk of the moving parts of the mechanism could be located outside the tank where they would be more accessible for maintenance and repair.

The subsidence control methodology described on page 3.21 is suspect. If empty tanks are filled with grout there probably will be no problem with them. If filled with soil, gravel, or sand, however, there is the possibility of compaction due to shaking by small earthquakes over the
centuries, leaving a void at the top of the tank. Subsidence of the barrier 3.5.1.82
above may then occur when the top of the tank eventually collapses.

The problem for buried TRU waste appears worse. Whereas the tanks could be filled with grout, buried TRU waste sites probably could not. It is stated on page 3.23 that the waste will be compacted by vibratory hammer and piles where there is "significant potential for subsidence". There is a brief description of the envisaged compaction process in Appendix B (see pages B.22 to B.24). There are two readily apparent problems with this approach:

- o how to ensure that all the areas with a "significant potential for subsidence" are located, and
- o how to ensure complete compaction.

The waste is comprised of various, dissimilar materials and it is not likely that the proposed pile-driving densification will collapse all containers and infill all voids. The proposed densification is conducted from a remote position which does not permit direct observation and verification of results.

Questions 3.5.1.84

1007. How does the design of the protective barrier prevent the creation of release pathways due to animal intrusion? 3.5.1.26

1008. What part does the geotextile play in this scenario?

1009. What consideration has been given to alternate methods of removal of single-shell tank wastes? 3.1.4.5

1010. Have experience-based reliability, availability, and maintainability of equipment associated with alternate technologies been taken into account? (Also see related Question B-1.) 3.3.5.4

3.1.3.12

1011. What alternatives to the pile-driving method of subsidence control for TRU burial grounds have been considered?

1012. How do the assurances of complete compaction compare to that of the pile-driving method?

1013. How do their estimated costs compare to the costs associated with the pile-driving method? (Also see related Question B-6.)

1014. How will the effectiveness of the proposed densification procedure be evaluated.

### 3.4 COMPARISON OF IMPACTS FROM ALTERNATIVES

General Comments

In Section 3.4 of the DEIS, the three selected disposal alternatives and the no disposal action (i.e., continued storage) alternative are compared with respect to operational and postdisposal impacts. The discussion of environmental impacts includes:

- radiological impacts from routine operations,
- potential radiological accidents,
- nonradiological impacts -- injuries, illnesses and fatalities,
- resource commitments,
- ecological impacts,
- socioeconomics,
- costs, and
- decontamination and decommissioning of retired waste processing facilities.

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In addition, the long-term impacts of the selected alternatives and of the no disposal action (i.e., continued storage) alternative are compared given the following circumstances:

- where conditions remain unchanged,
- where disposal systems are disrupted by postulated natural events, and
- postulating human intrusion into waste sites.

Finally, the alternatives are compared in terms of key impacts from future tank waste and newly generated TRU waste, and a summary comparison of impacts among alternatives is presented.

Errors or Uncertainties

3.5.3.2 On page 3.44 it is stated that the average annual recharge rate for the "wetter climate" is 5.0 cm/yr, but the basis for this number is not provided. (See discussion in our review of Appendix O, Chapter 3.)



In regard to the assumed loss of institutional control in the year 2150, the following statement is made on page 3.51:

> In reality, however, if DOE chose the no disposal action alternative, it would maintain control, and the described intrusions would not be realistic.

The above statement appears overly optimistic. The same point is made again on page 3.64; again, it appears overly optimistic.

Questions

1015. What is the basis for the conclusion that the USDOE "would maintain control" for some hundreds of years into the future, making the described intrusion scenarios unrealistic? 2.3.1.9

### 4.0 AFFECTED ENVIRONMENT

Chapter 4 of DEIS, Volume 1 provides a general description of the Hanford site and surrounding areas, emphasizing environmental attributes that potentially could be affected by defense waste disposal practices. Contents of DEIS Chapter 4 are discussed in this report under the four following major headings.

### 4.1 BACKGROUND RADIATION

General Comments

This section of the DEIS reports on the radionuclide concentrations in the air, soil, and water in the Hanford vicinity. The data are taken from reports giving the results of continuing measurements made at Hanford.

Errors or Uncertainties

None noted.

Questions

None.

### 4.2 GEOLOGY AND PHYSIOGRAPHY

General Comments

The geologic and physiographic characteristics of the Hanford site region are summarized in general terms in DEIS Section 4.2.

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Errors and Uncertainties

None.

Questions

None.

4.3 SEISMICITY

General Comments

DEIS Section 4.3 summarizes existing knowledge of earthquake activity in the Hanford site region.

Errors and Uncertainties

3.2.2.1 The DEIS states (page 4.10) that seismic activity and related phenomena are not believed to be plausible events that might directly release waste. While we agree with this statement, we believe seismic factors must be taken into account in conceptual design and performance evaluation of the protective barrier proposed for wastes intended to be stabilized in-place (see discussion in our review of Appendix M, Chapter 3 of this report).

Questions

None.

4.4 HYDROLOGY

General Comments

DEIS Section 4.2 summarizes the general surface water hydrology and groundwater hydrology of the Hanford site region.

Errors and Uncertainties

3.5.3.1 The DEIS states (pages 4.18-19) that some investigators have concluded that no downward percolation of precipitation occurred on the 200-acres plateau. We do not necessarily concur with these conclusions (see discussions of references 3.7, 11.15, and 13.10 in Chapter 4 of this report). More detailed discussion of errors and uncertainties in regard to groundwater are presented in Chapter 3 of this report.

Questions

None.



5.0 POSTULATED IMPACTS AND POTENTIAL ENVIRONMENTAL CONSEQUENCES

5.1 INTRODUCTION

General Comments

This first part of Section 5.0 provides an introduction to the alternative disposal options considered and their general impacts, both radiological and non-radiological. Cumulative impacts are summarized. The role of various appendices in support of the document and impact analysis is explained. Because the details of individual impact analyses are discussed in future sections, no analysis is made of 5.0. See Sections 5.2, etc., of the review, for an analysis of environmental consequences.

(no comment identified)

5.2 GEOLOGIC DISPOSAL ALTERNATIVE

General Comments

In this section it is stated that in the geologic disposal alternative greater than 95 percent of the Hanford tank waste and approximately 99 percent of the Hanford TRU waste would be removed and placed in a geologic repository, which may be situated either on-site or off-site. Some low-level radioactive waste resulting from processing the tank waste would be disposed of in an on-site near-surface burial ground.

A summary of operational impacts associated with the geologic disposal alternative is presented including:

- radiological consequences from routine operations,
- radiological consequences from postulated accidents,
- nonradiological consequences,
- ecological impacts,
- resource commitments, and
- costs.

Summaries are also provided in the following areas:

- socioeconomic impacts,
- assessment of long-term impacts,
- irreversible and irretrievable commitment of resources,
- unavoidable adverse impacts,
- relationship to land-use plans, policies and controls, and relationship between near-term use of the environment and enhancement of long-term productivity.

Errors or Uncertainties

None noted.

Questions

None.

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(no comment identified) 523

5.3 IN-PLACE STABILIZATION AND DISPOSAL

General Comments

This section discusses the disposal alternative that involves stabilizing the wastes in place and covering all the disposal sites with protective barriers. The reader is referred to a more detailed discussion in Appendices B and M.

Summaries are provided in the same areas as noted in Section 5.2 above.

Errors or Uncertainties

None noted.

Questions

None.

5.4 REFERENCE ALTERNATIVE

General Comments

This section discusses the reference alternative, which combines disposal elements from the geologic disposal and the in-place stabilization and disposal alternatives. Reference to more detailed discussions in other parts of the DEIS is provided.

Summaries are provided in the same areas as noted in Section 5.2 above.

Errors or Uncertainties

None noted.

Questions

None.

5.5 NO DISPOSAL ACTION

General Comments

This section discusses the "no disposal action (continued storage)" alternative, in which wastes would continue to be stored essentially as they are now for the indefinite future, and active institutional control is assumed to be lost at some future date. Again, reference is made to more detailed discussions in other parts of the DEIS.



Summaries are provided in the same areas as noted in Section 5.2 above, with the exception of the following areas:

- o relationship to land-use plans, policies and controls, and
- o relationship between near-term use of the environment and enhancement of long-term productivity.

The two areas listed above are not applicable for this alternative, since it does not represent a deviation from present practices. Instead, an additional area is discussed, called "resettlement" (DEIS Section 5.5.5). Resettlement is discussed as part of the long-term impacts area for other alternatives in DEIS Sections 5.2, 5.3, and 5.4.

Errors or Uncertainties

None noted.

Questions

None.

6.0 APPLICABLE REGULATIONS

General Comments

Chapter 6.0 very briefly lists permits, licenses and other requirements that would be required before implementing Hanford waste disposal action. Additionally, applicable regulations are briefly described. Much of Chapter 6.0 is a duplication of the text and tables from various cited regulations and laws.

In general, there is no discussion and/or analysis of the potential effects of these regulations or laws on the various defense waste alternatives. Neither does the chapter contain an analysis of the actions which would be required in order to comply with the cited regulations and laws. Without some discussion and analysis of applicable regulations as they may effect the defense waste program, it is difficult for a reviewer of the DEIS to draw conclusions as to the impact that applicable regulations may have on the selection of alternatives which are discussed elsewhere in the DEIS. Nor is it possible for a reviewer to estimate the relative ease or difficulty USDOE may have in satisfying the provision of applicable regulations.

The Chapter as a whole appears to have been assembled from several sources. General overview of regulatory requirements would provide significant assistance to DEIS reviewers.

Errors and Uncertainties

DOE Order 5480.1A, Chapter XI. The text does not clearly indicate the effect of the regulation or the defense wastes discussed in the DEIS. The 2.4.1.19

references in Table 6.3 to discharge wastes to sanitary sewer systems may give the impression to the reviewer that USDOE might discharge defense wastes to such systems, not withstanding the comments to the contrary at the bottom of the page. The unusual method of presenting two tables within a third table on page 6.3 is very confusing. Clarification of the reference is required for a clear understanding of the department's interest.

4.2.13 Federal Water Pollution Control Act (33USC 1251 et seq.). Reference at page 6.3 to the issuance of NPDES permits by the Washington State Department of Ecology should also include reference to the issuance of NPDES permits for thermal power plants (including three on the Hanford site) by the Washington State Energy Facility Site Evaluation Council.

Possible regulatory effects of defense wastes reaching navigable waters through groundwater movement have not been discussed. Since defense water from the PUREX facility have been documented as having reached the Columbia River, source discussion of FWPCA requirements would be helpful.

Air Quality. Air emissions on the Hanford site are also regulated by the Washington State Energy Facility Site Evaluation Council for thermal power plants.

Resource Conservation and Recovery Act. Discussion in this section is inconclusive and does not provide the reviewer with an understanding of the consequences of RCRA application to the defense waste alternatives discussed
2.4.1.9 in the DEIS. A "worst-case" analysis on this point would be useful given USDOE uncertainty as to the applicability of the RCRA provisions. Assertions that RCRA provisions (if applicable) will be met without discussion and analysis of implementation issues and consequences are inclusive.

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Licensing by the USNRC. Regulatory requirements of the Nuclear Waste Policy Act of 1982, given the Presidential decision for comingling of defense and commercial waste in a common repository requires substantially
2.1.3 more description and discussion than that contained in the single paragraph at page 6.11

In general, Chapter 6.0 lacks sufficient information to allow an adequate understanding of the effect and consequences of applicable regulations.

Questions

None.



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CHAPTER 3

APPENDICES REVIEW

APPENDIX A WASTE SITE DESCRIPTIONS AND INVENTORIES

General Comments

Appendix A describes in more detail the waste sites addressed in Section 3.2 of the DEIS. The appendix includes estimates of expected radionuclide inventories at the waste sites. It also includes estimates of selected nonradioactive material inventories for wastes stored in tanks.

Most of the information in this appendix was extracted from Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS (RHO-RE-ST-30, Rockwell Hanford Operations, 1985).

The waste site descriptions are presented in six sections corresponding to the six waste classes defined in Section 3.2 of the DEIS:

1. Existing Tank Waste
2. Future Tank Wastes
3. Strontium and Cesium Capsules
4. TRU-Contaminated Soil Sites
5. Pre-1970 TRU Solid Waste Burial Grounds
6. Retrievably Stored and Newly Generated TRU Solid Waste

Existing tank waste types include sludge and salt cake (stored mostly in single-shell tanks), slurry and complexed concentrate (stored mostly in double-shell tanks). Inventories are given as of October 1983 with radioactive decay calculated to December 31, 1995.

(no comment identified)

Future tank wastes include wastes generated by current PUREX Plant operations, which started in November 1983, and liquid wastes expected to be generated by other sources through 1995. The sources and some of the characteristics of the following categories of future tank wastes are described:

- Future High-Level Tank Waste - in-process HLW and neutralized current acid waste (NCAW).
- Future Non-High-Level Tanked Waste - cladding removal waste (CRW), organic wash waste, and miscellaneous wastes (including Plutonium Finishing Plant waste).

Radionuclide and chemical inventories are tabulated for HLW, CRW, Plutonium Finishing Plant waste, and other waste.

Double-wall metal capsules contain most of the high-heat-generating fission products (i.e., Cs-137 and Sr-90) in the form of cesium chloride and

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strontium fluoride. The capsules are currently stored under four meters of demineralized water in stainless steel-lined concrete basins.

TRU-contaminated soil sites include the following formerly used systems for discharging TRU-bearing solutions to Hanford soils:

- o Cribs
- o Ponds
- o Trenches
- o Ditches
- o French Drains
- o Reverse Wells
- o Settling Tanks

Appendix A to the DEIS provides brief descriptions of the above listed systems and briefly discusses movement of TRU elements and compounds into and through the soil, relevant site characteristics, and estimated inventories and concentrations.

Pre-1970 TRU solid waste burial grounds contain dry waste trenches used to bury TRU-contaminated waste between 1944 and 1970, in which the TRU concentration of some containers is estimated to exceed 100 nCi/g. Based on this definition, eleven TRU burial sites have been identified. Most of these sites are located within the 200 Areas, although two are in the 300 Area and one is near the WYE barricade (300-Y).

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Retrievably stored and newly generated TRU solid waste includes TRU waste generated since 1970. Most of this waste is stored in 55-gal drums on asphalt pads, covered with a layer of uncontaminated soil to reduce surface radiation exposure rates. If the surface dose rate of a container exceeds 200 mrem/hr, the waste is classified as remote-handled (RH) and is either stored in caissons similar to those used for pre-1970 TRU solid waste or packaged with sufficient shielding to meet requirements for contact-handling. TRU waste unsuitable for asphalt pad or caisson storage because of size or other considerations has been packaged in reinforced wood, concrete, or metal boxes, and stored in dry waste trenches.

Errors or Uncertainties

3.1.4.19 On page A.3 it is stated that concrete in the single-shell tanks has maintained its integrity, preventing tank collapse, during many years of service. ERDA 77-44 (Reference 7.2) is cited in support of this statement. Nothing was found in the reference document to support the statement. The reference document does, however, state that problems were experienced with liquid leaking from some of the tanks beginning in 1958.

Questions

A-1. Given the documented leakage of liquid HLW through the steel liners of some single-shell tanks within a period of 14 years or less, what is the potential adverse impact on the structural integrity of the concrete in the tanks during the remaining period of service?



APPENDIX B DESCRIPTION OF FACILITIES AND PROCESSES

General Comments

Appendix B to the DEIS describes some of the new facilities and construction actions that would be required for the various alternatives. New facilities would be required for retrieval of wastes and for chemical or mechanical processing of wastes, for every alternative considered. Construction would be required for site stabilization and isolation.

Proposed waste retrieval methods are described for:

- o mechanical retrieval from single-shell tanks,
- o hydraulic sluicing from double-shell tanks,
- o mechanical retrieval of TRU-contaminated soil and solid waste sites,
- o mechanical retrieval from caissons, and
- o mechanical retrieval from reverse wells.

Some chemical separations would be necessary to reduce the volume of high-level or TRU waste requiring permanent isolation from the environment. In addition, chemical processing would be required to convert retrieved wastes to a form suitable for disposal. Chemical processing methodologies described in Appendix B to the DEIS include:

- o radionuclide concentration for geologic disposal,
- o glass immobilization for geologic disposal, and
- o solid waste processing (i.e., combination and treatment of retrieved solid TRU waste and contaminated soil, possibly using slagging pyrolysis incineration).

Mechanical processing would be required to prepare strontium and cesium capsules for disposal and, in the reference alternative, to prepare RH TRU solid waste for shipment to a geologic repository. Mechanical processing methodologies considered include:

- o packaging of strontium and cesium capsules,
- o storage of encapsulated waste in near-surface drywells, and
- o packaging of remote-handled TRU solid waste.

Construction actions required for site stabilization and isolation include:

- o subsidence control for waste tanks,
- o subsidence control for solid waste sites, and
- o emplacement of the protective barrier and marker system.

(no comment indentified)

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Candidate processes and anticipated operational releases are discussed separately for each of the four alternatives analyzed in the DEIS.

Errors or Uncertainties

3.1.4.5 On page B.1 it is stated that addition of liquids for removal of solid waste (i.e., sluicing) from single-shell tanks would increase the risk that some of the tank contents could leak to the surrounding soil. It is concluded that sluicing should be discarded in favor of mechanical retrieval. From the brief discussion presented in the DEIS, it is not clear that state-of-the-art sluicing techniques were considered, i.e., low volume liquid sluicing and retrieval systems which expose only the immediate area with liquid. Such techniques might enable retrieval of virtually all of the sludge and salt cake from the single-shell tanks with very little risk of liquid escaping from the confines of the tanks. Such techniques might represent lower cost and smaller risk overall than the complex mechanical retrieval method described in the DEIS, which has not been tested at full scale.

4.2.55 In Figure B.6, the "Equipment Contamination Building" should be labeled the "Equipment Decontamination Building".

3.3.5.10 There is no apparent basis for the assumption that decommissioning would require 20% of the effort used for assembly of the TRU-contaminated soil and solid waste site recovery facility and equipment.

3.1.3.29 On page B.8 it is stated that special access shaft refrigeration equipment, used for freezing the surrounding water table during excavation, would be required at site 216-B-5 (a reverse well) where contaminated soils extend to the groundwater. From this brief statement it is not clear that adequate consideration has been given to the possibility that contamination might have spread horizontally over a large area after contacting the water table. In addition, it is not clear who would decide to stop retrieval actions at a given site when unforeseen difficulties arise (e.g., when the contaminated area is discovered to be much larger than anticipated, as may be the case in the example above), or what criteria would be used to make such a decision.

The pile-driving method of subsidence control for solid waste sites, described on pages B.22 and B.23, could open new paths for transport of transuranic radionuclides to the surface. The idea of withdrawing piles, and simply redriving them for in-place disposal if contamination can be detected during withdrawal could create problems not mentioned in the DEIS.

3.1.3.12 The waste is comprised of various, dissimilar materials and it is not likely that the proposed pile-driving densification will collapse all containers and infill all voids. The proposed densification is conducted from a remote position which does not permit direct observation and verification of results.



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Some values apparently were inaccurately converted from Table 2-14a of RHO-RE-ST-30 (Reference 21.18) to Table B.2 of the DEIS, especially in the existing tank waste glass column. Consequently, the average composition (Ci/m3) of the final waste forms for the geologic disposal alternative appear to be underestimated by as much as a factor of 2 (e.g., Cs-137 and Tc-99). In addition, although it is stated in connection with Table B.2 and other tables of the DEIS that the values reported for Ru-106 do not include the activity of short-lived daughters in equilibrium with the parent radionuclide, it is not clearly explained why it is thought the short-lived activity can be safely deleted from the values given in RHO-RE-ST-30 or how this was done. 4.2.16

On page B.32 it is stated that immediate installation of barriers is a problem for approximately 12 tanks in A, C, and SX farms since these tanks may reach unacceptably high temperatures. This raises the question of how temperature affects solubility, sorption, or diffusion in the event of leakage from these single-shell tanks while the construction of barriers over them is deferred until the year 2030. Ions will diffuse more rapidly at higher temperatures. Solubilities generally will increase (except for some carbonates) and sorption can either increase or decrease with temperature depending on the species. It is not apparent that these temperature-related dependencies have been addressed in the modeling of radionuclide transport from leaky tanks. 3.5.2.10

Questions

B-1 Were state-of-the-art sluicing techniques considered for removal of solid waste from single-shell tanks? 3.1.4.5

B-2 How do such techniques compare to the mechanical retrieval method discussed in the DEIS in terms of cost, risk, and uncertainties associated with the level of development of the technology?

B-3 What is the basis for the assumption that decommissioning would require 20 percent of the effort used for assembly of the TRU-contaminated soil and solid waste site recovery facility and equipment? 3.3.5.10

B-4 Who would make the decision to terminate the retrieval attempt at any given waste site when unforeseen difficulties arise, and what criteria would be used to make such a decision?

B-5 What procedures are in place to ensure that such a decision would receive sufficient public input and review?

B-6 How will residual void spaces be detected after pile-driving densification, and how will incomplete compaction affect long-term subsidence? 3.1.3.12

B-7 How would the spread of contamination from transport paths created by pile-driving operations be prevented? 3.1.3.12

B-8 In view of the potential problems noted in Section B.2 above, what assurance is there that all data transferred or converted from RHO-RE-ST-30 to the DEIS was done so accurately?

4.2.16 B-9 Why is it thought that the activity of short-lived daughters in equilibrium with Ru-106 can be safely deleted from values tabulated in RHO-RE-ST-30? How was this done?

B-10 How have temperature-related dependencies been addressed in the modeling of radionuclide transport from leaky tanks?

APPENDIX D TRANSPORTABLE GROUT FACILITY

General Comments

The Transportable Grout Facility (TGF) would be used to make a cementitious waste form for disposal in near-surface disposal sites in the 200 East Area. The TGF would blend Hanford defense liquid wastes with grout-forming solids and pump the resulting mixture in the form of a slurry into trenches, culvert vaults, and (possibly) into retired underground waste tanks, where it would solidify into large monoliths.

Appendix D describes the TGF, its relationship to other Hanford facilities, the grouting process, waste feedstreams, resource needs, nonradiological emissions, radiological impacts, and costs.

Errors or Uncertainties

3.1.8.4 Reference 26.7 (Wald et al, 1980) does not delineate the contents of the "typical" grout mixture as stated in the DEIS.

3.1.8.23 The DEIS lists physical and mechanical properties upon which the grout's durability depends and cites Reference 28.3 (Young et al, 1982). The cited reference, in contrast, addresses environmental factors affecting long-term stabilization of soil layers used as radon suppression covers for uranium mill tailings. The stabilization method described in the cited reference is the use of rock aggregate riprap applied to the suppression cover. Nothing was found in the cited reference about grout, its physical and mechanical properties, or its durability.

3.1.8.1 On page D.5 it is stated that tests will be conducted to provide data required to improve assessments of the operational and long-term performance characteristics of each type of grout. It is concluded that it may not be possible to develop a grout formula adequate for near-surface disposal of a particular waste, and it is implied that in such cases other treatment and disposal options will have to be considered. It is not clear whether any grout testing has been completed or whether a grout formula has yet been demonstrated to be adequate for any of the specific Hanford waste forms.



Questions

D-1. What published documentation forms the basis for the "typical" grout mixture described in the DEIS? 3.1.8.4

D-2. What published documentation describes the physical and mechanical properties upon which the grout's durability depends?

D-3. Are there available any results of tests in which grout formulas have been tailored to the chemical properties of specific Hanford waste forms? In the absence of such test results, what is the basis for recommending the development and implementation of the TGF? 3.1.8.1

APPENDIX E WASTE RECEIVING AND PROCESSING FACILITY

General Comments

The Waste Receiving and Processing (WRAP) Facility is intended to support examination and certification of contact-handled (CH)-TRU waste for repository disposal. The WRAP Facility will also provide the capability to process and package CH-TRU waste currently in 20-year retrievable storage.

Appendix E describes the WRAP Facility, the waste treatment and packaging processes, the flow of materials through the facility, and the associated waste feedstreams. It also summarizes resource requirements, emissions, radiological impacts, and costs associated with construction, operation, and decontamination and decommissioning of the facility.

Errors or Uncertainties

On page E.13 it is stated that projected annual releases from the WRAP Facility are well below the limits established by DOE for release in uncontrolled areas, and DOE Order 5480.1A, Chapter XI (Reference 5.16) is cited in support of this statement. Projected annual releases from the WRAP facility are given in Ci/yr, but the limits for release in uncontrolled areas are given in Reference 5.16 in microcuries per mililiter. Assumptions on rates of dilution or dispersion of released radionuclides were not found in the DEIS. Therefore, it was not possible to verify the statement using the cited reference. 3.1.8.17

Questions

E-1. How was it concluded that projected annual releases from the WRAP Facility are well below the limits established by DOE for release in uncontrolled areas?

(no comment identified)

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APPENDIX F METHOD FOR CALCULATING RADIATION DOSE

General Comments

This appendix describes the methods used in computing the radiological dose to on-site workers during waste handling and emplacement and to the off-site public during and after waste emplacement. The different types of doses and the pathways by which the radionuclides reach man are explained. The bulk of the appendix consists of a description of the computer programs and data bases used in calculating doses in the Hanford vicinity. This is followed by a discussion of how the Hanford codes compare to others. Some of the dose factors and other data do not reflect the latest national and international tabulations. These differences are discussed. Compared to the uncertainties arising from the source term assumptions, these differences are not significant.

Errors or Uncertainties

No significant errors or uncertainties were noted. However, several minor discrepancies were noted in reference citations (see Chapter 4 of this report).

Questions

None.

APPENDIX G METHOD FOR CALCULATING NONRADIOLOGICAL INJURIES AND ILLNESSES AND NONRADIOLOGICAL FATALITIES

General Comments

Appendix G describes the method used to estimate postulated nonradiological injuries and illnesses and nonradiological fatalities associated with each alternative analyzed in the DEIS. Postulated occurrences are based on an estimate of manpower requirements and occupational accident rates of major industry groups and of DOE and its contractors.

The methodology appears to be consistent with that used in past EISs.

Errors or Uncertainties

None noted.

Questions

None.



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APPENDIX H RADIATION DOSES TO THE PUBLIC FROM OPERATIONAL ACCIDENTS

General Comments

This appendix discusses only doses to the public from operational accidents. Because the facilities have not been designed and built, realistic occupational doses from accidents cannot be obtained. This appendix is largely a summary of PNL-5356 (Reference 15.10).

For each waste handling operation in each disposal option, the accident which would release the most airborne radioactive material is summarized and discussed. The methods and assumptions used to compute the off-site doses are discussed.

Due to the location and form of the waste, the off-site doses from accidents are generally small. The assumptions made on the whole appear to be sufficiently conservative, i.e., approaching worst case.

Errors or Uncertainties

The population figures in Table H.9 are not taken from Reference 14.11 (PNL-3777), but from an older document (Reference 24.10, PNL-4010). While the values used are the larger of the two sets, an explanation of why the older values were used would be helpful. 4.1.15

The reference cited (Reference 20.1) in the discussion on the postulated presence of ferro- or ferricyanide precipitates in single-shell tank wastes did not appear to contain a description or discussion of ferrocyanide precipitates. While the airborne respirable release is conservatively large for the existing tank waste, a specific reference to a description of these precipitates should be provided. 3.1.4.32

Questions

H-1 Please explain the rationale for selection of older population figures than one currently available. 4.1.15

APPENDIX J METHOD FOR CALCULATING REPOSITORY COSTS USED IN THE HANFORD DEFENSE WASTE ENVIRONMENTAL IMPACT STATEMENT

General Comments

Appendix J describes the method of estimating costs for repository emplacement, which is only one of three activities associated with the total costs for repository disposal of Hanford defense wastes. The other two activities are: (1) retrieval and processing, and (2) transportation. Costs of these other two activities are discussed and summarized elsewhere in the DEIS.

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(no comment identified)

Appendix J includes a discussion of the use of the RECON computer model, a program for calculating life-cycle construction and operating costs for a geologic repository based on user-selected design characteristics and related cost inputs. Separate estimates are reported for emplacement of non-TRU Hanford defense waste in commercial waste repositories assuming two different media: basalt and granite. Design and economic data from draft studies of a commercial repository in salt were used in estimating the costs associated with emplacement of contact-handled transuranic waste at the Waste Isolation Pilot Plant (WIPP).

Errors or Uncertainties

None noted.

Questions

None.

APPENDIX M PRELIMINARY ANALYSIS OF THE PERFORMANCE OF THE PROTECTIVE BARRIER AND MARKER SYSTEM

General Comments

The DEIS proposes that a protective barrier be constructed over wastes that are stabilized in-place. There are two main purposes of the barrier: 1) to reduce or prevent precipitation and runoff from infiltrating the soils above the wastes and subsequently contacting, dissolving, and transporting wastes downward to the water table, and 2) to reduce or prevent intrusion of the wastes by humans, plants, or animals.

The protective barrier is intended to remain functional for at least 10,000 years.

Appendix M describes the conceptual design of the barrier and the theoretical and practical bases for the design. It also estimates input parameters required for preliminary numerical analysis of performance, and it reports results of that analysis. Two barrier failure scenarios are outlined, the consequences of which are evaluated elsewhere in the DEIS.

Errors and Uncertainties

Errors and uncertainties in the DEIS analysis of the protective barrier system are described below, in general terms, under five subheadings. More specific technical issues contributing to some of these general categories are summarized in subparagraphs (indicated by o). Specific errors and uncertainties are also addressed in more detail in a set of questions regarding specific DEIS assertions and omissions. The questions are listed in order of their appearance in the DEIS, and are referenced by number in the general discussion that follows.



Technological Feasibility. The DEIS discusses significant uncertainties in conceptual barrier design and in input parameters required for final design and performance evaluation. The DEIS points out the need for detailed engineering evaluations and field testing but is unspecific as to the authorization and schedule of such investigations. The DEIS implies that tests of the feasibility of barriers of similar design and intended function have been conducted or is in progress elsewhere, but we find documentation of such tests to be lacking. Questions M.1 through M.3 address this issue.

- o Previous Studies -- On page M.6, first paragraph, the DEIS implies that a multilayer system with a capillary barrier can eliminate deep drainage and that field testing of such a barrier is underway; however, none of the references cited present data indicating such a system can completely prevent moisture migration, and none report field tests in progress (Questions M.1 and M.2). 3.5.1.18

- o Future Research -- On page M.2, second paragraph, a "multi-year research and demonstration project focused on barrier performance" is outlined that would include actual laboratory and field data under both as-designed and perturbed conditions. We understand from non-DEIS sources that this project may take up to 7 years. It is not clear how the results of this project can contribute to the selection of one of the alternative methodologies for disposing defense wastes. Information in the DEIS on the schedule, scope, and planned utilization of this project in decision-making would reduce this uncertainty (Question M.3). 3.5.1.1

Theoretical Basis. The DEIS attempts to provide a theoretical justification for its assertion (page M.9, second paragraph) that "a multilayer cover ... can be designed to prevent water transmission below the root zone, even for present or future wet-year conditions..."

- o The major omission we find in the USDOE theoretical rationale is failure to consider barometric pressure and/or vapor transport mechanisms. Thermal gradients can be expected to give rise to vapor flux that will transfer water across the capillary barrier, between the soil moisture zone concentrated at the base of the upper fine-layer and the soil underlying the capillary barrier (Question M.4). 3.5.1.68

- o USDOE's application of capillary theory to barrier design appears inconsistent for alternative barrier configurations (Questions M.5 and M.17). 3.5.1.17

Conservatism of Conceptual Barrier Design. The DEIS claims (page M.2, top paragraph) that "a conservative evaluation of the efficiency of the barrier is presented in this EIS." Contrary to this assertion, the barrier design presented in the DEIS is non-conservative in three major respects:

- o Uncertain Internal Stability -- the barrier as conceptually designed in the DEIS appears vulnerable to failure in the

interface zone between the upper fine-textured soil and the coarse
(riprap) moisture barrier. Conceptual design of the protective
barrier, described in section M.2 and figure M.3 (pages M.6-M.8),
indicates a 0.3-meter-thick graded gravel layer will separate the
upper fine soil from the lower 12- to 25-cm size riprap. The
thickness of this intermediate gravel layer is thus roughly
comparable to the size of voids in the upper surface of the riprap
layer. A silica glass geotextile is proposed between the upper
3.5.1.27 soil layer and the intermediate gravel, to prevent migration of
fines that would decrease the effectiveness of the capillary
break. Our concerns in this area include the stability of the
fine soil/riprap interface and, the strength and durability of the
geotextile (Questions M.6, M.19, and M.23).

Because slice glass geotextiles may have limited puncture and
tearing resistance, the surface upon which the geotextile is laid
must be extremely smooth and stable. The larger the gravel, the
more tendency there will be for tearing the geotextile where it
attempts to bridge between points of grain contact in the gravel.
However, the finer the gravel, the greater its tendency to flow
3.5.1.92 downward irregularly and unpredictably into the large interstices
of the riprap, especially under dynamic stresses such as could be
expected during construction of the upper soil zone or from
earthquake shaking. Our concerns in this area include the
stability of the fine soil/riprap interface and durability of the
geotextile (Questions M.6 and M.19).

The slice glass geotextile must also have sufficient tensile
strength and elongation properties to span across potential
depressions in the coarse granular layers that may result from
settlement of wastes or densification of the riprap and/or gravel.
The riprap is described as "loosely consolidated" on page M.13;
densification of the gravel will be less than maximum due to
limitations of construction equipment. Non-uniform subsidence may
be expected over time in these materials, due to rearrangement of
particles caused by dynamic forces such as earthquake shaking and
traffic vibrations.

- Unrecognized Disruption Factors -- the DEIS fails to address
aspects of biointrusion that would likely contribute to degraded
moisture barrier performance. Section M.3.2 discusses
biointrusion control and focuses on methods to prevent plant roots
and burrowing animals from contacting and transporting toxic
3.5.1.84 wastes directly. The riprap layer is indicated to be the key
barrier to biological intrusion. As noted in the first paragraph
on page M.10, however, "channels created by plants and animals may
also promote the infiltration of surface water into the waste."
The capillary barrier will be ineffective to the extent that water
infiltrates the riprap layer after passing through such channels.
References cited in the DEIS indicate a number of plant and animal
species can be expected to readily penetrate the upper 1.5-meter
capillary barrier with roots or burrows, including Russian
thistle, rabbitbrush, sage brush, prairie dogs, and ground
squirrels. Plant species in particular may be attracted by the
relatively high moisture content of the upper zone. Die-off of 3.5.1.84
plants as by fire, disease, or extended drought and subsequent
decay could result in extensive formation of macropores in the
barrier. These holes could provide conduits for rapid
infiltration through the fine-textured layer during intense storms
or snow-melt periods (Questions M.9 and M.22).

Macropores will provide a particularly rapid avenue for water
infiltration through the barrier in low spots (catchment basins)
that collect runoff and snowmelt. The upper fine-soil layer is
proposed to be very loosely densified (minimum porosity of about 3.5.1.84
43 percent, as indicated by moisture content on Figure M.2,
page M.5). Catchment basins are likely to form in the upper
surface of this loose material by a) differential settlement of
the waste and barrier materials over time, and b) wind and water
erosion. Armoring to prevent such erosion is limited by moisture
performance considerations (Question M.21). Development of
catchment basins will lead to concentration of recharge in certain
areas of the barrier, causing in turn soil saturation and drainage
through the barrier. Soil dessiation structures may develop to
further increase drainage.

- Lack of Overall System Evaluation -- proposed barrier features and
protection measures would likely degrade barrier performance in
ways that are ignored in the DEIS. Adverse consequences of this 3.5.1.36
piecemeal approach to conceptual design include development of
settlement-induced basins because of low densification of barrier
materials (Question M.23), concentration of moisture by subsurface
markers (Question M.7), and reduction of evapotranspiration by
surface armoring ("stone mulches") to prevent erosion by wind and
water (Questions M.20 and M.21).

Simulation of Barrier Performance. The DEIS states (page M.19, first
paragraph), "The intent of the modeling effort was to use the best
simulation techniques available to gauge the effectiveness of the multilayer
cover in stopping infiltration of water in the waste." We found the
simulation to be unclear, or non-conservative with respect to various input
parameters, including soil moisture (question M.8), precipitation (question
M.10), soil moisture characteristic curves (questions M.11 and M.12), plant 3.5.1.37
growth cycle (question M.13), and potential evapotranspiration (question
M.15). The DEIS concludes (page M.23, key result #2) that the simulation
indicated "fine-textured soil overlying coarse layers will store and
transmit water so that evapotranspiration processes can effectively recycle
the precipitation, thus preventing drainage even under high rainfall
conditions (30 cm/yr)." Apart from conceptual or theoretical
considerations, we find this conclusion questionable for the specific

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conditions proposed and simulated at Hanford because of the inadequacies in the input parameters mentioned above (see also question M.16). Moreover, three of the four test cases of primary interest are reported in insufficient detail to fully evaluate their results (question M.14).

<u>Barrier Failure Scenarios</u>. Based on considerations discussed above, it is our opinion that a substantial likelihood of barrier failure exists over
3.5.1.32 even a fraction of the 10,000-year period considered. Contrary to the DEIS assertion of a likely human cause (page M.25 and Volume 2, page xxxi), we judge the disruptive failure scenario outlined on page M.25 to be a plausible event under purely natural biological, erosive, and physical forces. Moreover, we do not feel that it presents a conservative upper
3.5.1.38 bound for barrier failure consequences. In our opinion, catchment basins could realistically form by erosion and/or settlement over as much as 50 percent of the barrier surface, rather than 10 percent as postulated in the disruptive failure scenario (see also subheading "Wind Erosion," in our discussion of Appendix R, Errors and Uncertainties, this chapter). We judge the functional barrier failure scenario outlined on pages M.25-M.26 to be unlikely primarily in its mildness, and we would place more credence in use of this scenario elsewhere in the DEIS if the infiltration rate was increased to between 1 and 2 cm/yr over the entire barrier.

<u>Questions</u>

M-1 On page M.1, second paragraph, reference is made to multilayer cover systems "for restricting gas exhalation (e.g., 222Ra) from waste materials." Two of the three references cited for "recent studies by PNL" discuss barriers designed for this purpose. However, there is no discussion in the DEIS that indicates gas exhalation (e.g., radon) is a problem or should be addressed.

531 3.5.1.18 a) Is exhalation of radioactive gas believed to be a problem or an engineering consideration relative to Hanford defense wastes? If so, what specific measures are being considered to mitigate gas exhalation?

b) Would the radon barrier designs discussed by Gee et al. (1981) and Hartley and Gee (1981) be effective in preventing water infiltration? If not, what is the relevance of radon gas barriers to performance of the protective barrier system proposed in the DEIS?

M-2 On page M.1, second paragraph, the following statement is made, "Multilayer barriers can be designed to prevent or minimize water infiltration into the waste and at the same time limit biotic and human intrusion" (see also Chapter 4). However, the references noted do not show that water infiltration can be prevented, nor do they discuss barriers to biotic and human intrusion in significant detail.

a) Have any data been reported from field testing of barriers that would demonstrate the concept that infiltration can be prevented?



b) What if any data exist that specifically support the concept that barriers to biotic and human intrusion can be effective?

M-3 On page M.2, second paragraph, a "multi-year research and demonstration project focused on barrier performance" is outlined that would include actual laboratory and field data under both as-designed and perturbed conditions.

a) Has this research program actually been authorized?

b) What is the specific schedule and scope of the research program and how will its results be incorporated into selection from among the various disposal alternatives? 3.5.1.1

M-4 Figure M.2 on page M.5 illustrates the concentration of soil moisture expected to occur near the base of the fine-soil layer for as-designed functioning of the protective barrier.

a) Is the "capillary barrier" zone intended to be open to the atmosphere such that there is never a pressure gradient developed across the fine layer due to barometric changes? If not, does USDOE assume development of barometric pressure gradients is unimportant?

b) With or without maintenance of atmospheric pressure in the capillary barrier, thermal gradients can be expected to give rise to vapor flux that will transfer water across the capillary barrier, between the soil moisture zone concentrated at the base of the upper fine-layer and the soil underlying the capillary barrier. Have these effects been analyzed? If so, what is the seasonal and net vapor flux across the barrier? If vapor phase water flux has not been analyzed, it is it considered unimportant? If so, what is the specific rationale for this conclusion?

M-5 Table M.1 (page M.5) depicts laboratory results from the literature suggesting changes in potential water storage made possible by varying the texture of the upper soil zone overlying a capillary barrier. In contrast, Table M.2 depicting alternative barrier configurations keeps the texture of the upper layer constant and varies the texture of the coarse capillary barrier. 3.5.1.17

a) Is USDOE implying that the texture of the coarse capillary barrier zone is the more critical element in barrier performance?

b) What specific data, if any, were used in formulating Table M.2?

M-6 Conceptual design of the protective barrier, described in section M.2 and figure M.3 (pages M.6-M.8), indicates a 0.3-meter-thick graded gravel layer will separate the upper fine soil from the

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3.5.1.27 lower 12- to 25-cm size riprap. The thickness of this intermediate gravel layer is thus roughly comparable to the size of voids in the upper surface of the riprap layer. A silica glass geotextile is proposed between the upper soil layer and the intermediate gravel, to prevent migration of fines that would decrease the effectiveness of the capillary barrier.

a) Has an analysis been performed of the long-term and dynamic stability of this fine soil-riprap interface zone?

b) Are specific field tests programmed for future engineering evaluation of these factors? If so, what tests?

c) What, if any, specific silica glass geotextiles (trade-names) have been considered and what data exist on their strength and durability?

3.5.1.16 M-7 Gravel admixture in the surface soil is proposed on page M.8 as necessary to prevent uncovering of subsurface markers by erosion. A surficial "stone mulch" would undoubtedly inhibit evapotranspiration from the upper fine soil zone (see question M.22, this section). Also, significant gravel content within the soil layer reduces porosity available for moisture storage. What are the quantitative effects of the subsurface markers and of gravel armoring or admixture on hydraulic performance of the protective barrier?

3.5.1.45 M-8 On page M.9, the moisture content of vadose-zone sediments at Hanford is stated to be 2 to 5 weight percent for sands and 5 to 15 weight percent for silts.

3.5.1.46 3.5.1.47 a) The references cited in support of these figures, except for Isaacson et al. (1974) and Gee and Heller (1985), are for artificially homogenized and reconstituted lysimeter soils. Data from Isaacson et al. (1974) and Gee and Heller (1985) partially contradict the figures used in the DEIS. Are the actual moisture contents of undisturbed Hanford soils likely to be more variable than the DEIS indicates?

3.5.1.48 b) Is weight percent (rather than volume percent) the intended mode for reporting soil moistures in this DEIS section?

3.5.1.84 M-9 Section M.3.2 discusses biointrusion control and focuses on methods to prevent plant roots and burrowing animals from contacting and transporting toxic wastes directly. As noted in the first paragraph on page M.10, "channels created by plants and animals may also promote the infiltration of surface water into the waste." The capillary barrier will be ineffective to the extent that water infiltrates the riprap layer after passing through such channels in the fine soil layer. References cited in



the DEIS indicate a number of plant and animal species can be expected to readily penetrate the upper 1.5-meter soil. 3.5.1.84

a) What measures, if any, have been formulated to prevent the biological formation of conduits (macropores) through the upper 1.5-meter fine soil zone?

b) What is the likely effect of macropores on performance of the moisture barrier, particularly in combination with local catchment basins formed by erosion or subsidence due to barrier settlement or tank collapse?

c) Can the hydraulic consequences of biointrusion in the upper 1.5-meter soil zone be credibly modeled?

M-10 The first paragraph on page M.18 describes precipitation inputs for the numerical simulation of moisture flux in the protective barrier.

a) The DEIS states, "The 100-year maximum precipitation is considered a reasonable estimate for the mean value of precipitation in a future climate scenario at Hanford (Kukla, 1979)." We found no reference to this method for estimating precipitation in the cited reference. What is the specific rationale supporting the quoted assumption? 3.5.1.81

b) The DEIS indicates that 30.1 cm/yr was the value selected from historic site climate data compiled by Stone et al. (1983) that "... represents the maximum amount of annual precipitation that on the average will occur once every 100 years." Contrary to the citation, figure 37 of Stone et al. (1983) indicates over 32 cm/yr for the average 100-year maximum precipitation. What is the reason for this discrepancy, and would use of 32 cm/yr in the simulations result in significant drainage for test cases 2, 3 or 6 (Table M.7)? 3.5.1.67

c) Based on the first paragraph of DEIS page M.18, it appears that the simulation of barrier performance used actual rainfall records for the years 1947 and 1948. How do extreme and/or closely spaced precipitation events affect barrier performance? Was the frequency distribution of such events analyzed and incorporated in the simulation?

M-11 The reference source for the gravel moisture-characteristic curve shown on figure M.4 is incorrectly cited on page M.18. What is the correct source of this curve? 4.2.34

M-12 The fine-soil characteristic curve shown on figure M.4 displays an unusually sharp change in slope at a capillary pressure head of about 1,000 cm. 3.5.1.72

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a) Can the data used in formulating this curve be documented?

3.5.1.72 b) Hysteresis appears not to be represented in this formulation of the characteristic curve. What is the magnitude of hysteresis in this soil, and what would be the probable effect of incorporating hysteresis in the analysis of barrier performance?

c) Was selection of 1.5-meters as the design thickness of the upper fine soil layer of the protective barrier based solely on the computer simulation using this soil? What other considerations, if any, contributed to selection of the 1.5-meter thickness?

3.5.1.70 M-13 Under the discussion of plant cover on page M.19, a cheat-grass growing (transpiration) cycle of 152 days is reported to have been used; however, the cited reference used 70 days. Why was the transpiration cycle lengthened and what effect does this have on simulation results for test cases 2 and 3 (Table M.7)?

3.5.1.64 M-14 Results of various simulations of moisture barrier performance are given in Table M.7 and section M.5.2.1 (pages M.20-M.21). In only one (case 4) of the four test cases involving 1.5 meters of fine soil were results reported for enough years to establish equilibrium between yearly precipitation and drainage plus evapotranspiration. Were simulations of test cases 2, 3, and 6 carried to equilibrium; if so, what were the specific numerical results?

3.5.1.76 M-15 On page M.21 (last paragraph) it is stated that although the higher rainfall rates (30.1 cm/yr) assumed for the wetter climate scenario were normalized for the test years used in the simulation, potential evapotranspiration was not. Does USDOE assume in the simulations that potential evapotranspiration would remain the same as at present, even though the climate became wetter? If so, what is the specific rationale for this assumption? If not, how would an appropriate reduction in potential evapotranspiration affect results of test cases 2, 3, and 6 (Table M.7)?

3.5.1.77 M-16 Would the combined effects of increasing precipitation to 32 cm/yr (question M.10), decreasing cheat-grass transpiration to 70 days (question M.13), and reducing potential evapotranspiration appropriately for a wetter climate (question M.15) result in significant drainage through the moisture barrier in test cases 2, 3, or 6?

3.5.1.24 M-17 In the last paragraph on page M.22, a clay layer system is proposed in addition to the rock sublayer as a redundant protective layer to minimize drainage under even extremely wet conditions. The clay can be expected to absorb water readily from the fine-soil layer if they are in contact, and it will release water to evapotranspiration much more slowly. If the clay layer is below the riprap zone, it will eventually become saturated and transmit water under any sustained drainage from the overlying layer. 3.5.1.24

a) Is the clay layer contemplated above or below the riprap zone?

b) What documentation exists to show the clay layer could be effective in reducing drainage over the long term?

M-18 At the top of page M.24, the DEIS states, "A proper cover design is possible using on-site materials..." Assuming a cover design as outlined in section M.2, have the specific on-site sources of fine soil, gravel, and riprap been identified, quantified, and tested for uniformity and quality? What specific information is available to support the assertion of on-site availability? 3.5.1.21

M-19 Section M.5.4 discusses Cover Disturbance Considerations. As addressed in question M.6 of this section, construction-induced vibrations and earthquake shaking would appear to be serious engineering considerations for stability of the soil-riprap filter zone.

a) What is the basis of USDOE's statement in paragraph two regarding vibrations and earthquakes shaking that "mechanisms like this ... seem highly unlikely"? 3.5.1.92

b) Has USDOE conducted detailed characterization of occurrences of natural layers of clean rock and gravel persisting below fine soil layers without disruption (page M.24)? If so, can this be documented in relation to thicknesses, textures, and densities of the proposed barrier layers?

M-20 Bander (1982), cited on page M.24 of the DEIS, indicates wind erosion from tailings piles in Colorado removed on the order of one inch per year. Does specific evidence exist to support a lesser rate of erosion for elevated, loose, unvegetated and unarmored fine-soils of the type proposed for the protective barrier? 3.5.1.96

M-21 Surface armoring of gravel or rock is proposed on DEIS pages M.24-M.25 to prevent soil erosion on the protective barrier surface. Abundant evidence (e.g., Unger, 1971, cited in Appendix M bibliography) indicates that a surface gravel layer (also known as a "stone mulch") substantially retards soil evaporation. Assuming continuous plant cover cannot be assured, how can effective erosion protection be achieved without degrading the barrier's moisture retardation function? 3.5.1.15

M-22 Nowhere in DEIS section 5.4 on cover disturbance considerations is biointrusion mentioned. As addressed in question 9 of this 3.5.1.83

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3.5.1.83 section, penetration of the 1.5-meter fine-soil zone by roots and burrows, especially in combination with erosion or subsidence-induced runoff catchment basins, threatens serious degradation of the moisture barrier performance. Why was this potential problem not addressed in section 5.4?

3.5.1.39 M-23 The rip-rap layer is proposed to be "loosely consolidated" (page M.13), and the minimum porosity of the fine soil layer is apparently about 43 percent (Figure M.2, page M.5). What data exist to ensure that settlement of the barrier surface will not occur, given these relatively low constructed densities?

APPENDIX N RADIOLOGICALLY RELATED HEALTH EFFECTS

General Comments

The human health effects that result from different radiological doses to the various organs of the body are discussed in this appendix. While the immediate (acute) effects of large doses are fairly well understood, the problem is much more difficult for very small doses which are the same order of magnitude as the background, since only a small portion of the population exposed shows any effects and those effects may be be delayed for decades or appear in the next generation.

4.2.3.5 Errors or Uncertainties

A specific page reference is required for the quote on pages N.2 and N.3.

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The summary of the types of genetic disorders on page N.8 is misleading and has very different implications (especially for the general reader) than the descriptions in the source references.

Table N.4 deserves more discussion, especially the fact that the total line does not appear to reflect the values above it in the table.

Questions

None.

APPENDIX O STATUS OF HYDROLOGIC AND GEOCHEMICAL MODELS USED TO SIMULATE CONTAMINANT MIGRATION FROM HANFORD DEFENSE WASTES

General Comments

This Appendix summarizes and discusses the conceptual and numerical models used to estimate potential movement of toxic contaminants away from waste facilities that are proposed to be disposed or stabilized in place. The path of potential transport of contaminants is envisioned to occur partly above the water table in unsaturated (vadose zone) soils and partly in the underlying water-table (unconfined) aquifer. The physical and



chemical framework for transport in these systems is described, to the extent it can be characterized within present knowledge.

Conceptual models are presented for a) hydraulic flow within the saturated and unsaturated zone, b) release of contaminants to the saturated groundwater system, and c) retardation of contaminants within the groundwater systems. Computer simulation is not attempted for the unsaturated system, but formulation and calibration of a numerical hydraulic model of the saturated flow system is described.

Most important with respect to the results of transport modeling reported elsewhere in the DEIS, two recharge scenarios, for "drier" and wetter" climates are proposed, along with a limited rationale for their development.

Errors or Uncertainties

As is pointed out repeatedly in the DEIS, characterization of unsaturated soil hydraulic properties and of chemical retardation factors is inadequate at present to permit credible numerical simulation. Although this position is taken consistently throughout most of Appendix O, it appears to be contradicted with respect to chemical retardation by a statement in the introductory section that there is relatively good understanding of contaminant behavior in the saturated zone from previous site monitoring. 3.5.2.25

Significance of Previous Monitoring Experience. The last paragraph of the introduction to Appendix O (page O.2) includes the statement, "Over forty years' experience in monitoring this unconfined aquifer with hundreds of wells has resulted in a relatively good understanding of the behavior of various contaminants in this zone. Such data have been used to calibrate numerical codes used to simulate groundwater movement in the unconfined aquifer". This statement is directly contradicted on page O.28 (first paragraph). where the DEIS states "... calibration and hence validation of the transport model is limited to our confidence in the travel time distributions supplied by the unconfined aquifer model. Longitudinal dispersion models applied to the ... unconfined aquifer ... have not been calibrated." 3.5.2.20

Groundwater Recharge Rates. Probably the most significant aspect of the conceptual model in terms of its conservatism or non-conservatism with respect to contaminant travel times is the groundwater recharge scenario. This aspect of the model is given relatively little attention in Appendix O or elsewhere in the DEIS. The lysimeter studies conducted to date at Hanford used artificially reconstituted soils. It is not clear whether any experiments have been conducted at Hanford that would indicate lack of long-term deep drainage and associated recharge under natural conditions.

As discussed in Section O.3.2. (page O.12), the DEIS assumes 0.5 and 5.0 cm/yr average recharge rates under drier and wetter conditions, respectively. These figures are the basis of many calculations in this and other parts of the DEIS. We feel that the DEIS estimates of recharge are 3.5.3.2

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non-conservative in both the drier and wetter climate scenarios, as discussed below.

Because of soil variability and the difficulty of measuring moisture flux in undisturbed conditions, great uncertainty exists in projecting recharge rates from the areally restricted and generally artificial (lysimeters with reconstituted soils) studies conducted to date. The DEIS (Vol. 2, page xxviii) indicates that existing quantitative predictions of water recharge rates are good only to within 2 or 3 cm/year. As noted in volume I of the DEIS (top of page 4,20), the value of recharge under existing, relatively dry climatic conditions is expected to be resolved through more sophisticated investigation between 0.5 and 5 cm/yr. The same range is tentatively proposed by Gee and Heller (1985, page 11 - reference cited in DEIS appendix M) based on methodology being developed in current research. Kukla (1979), cited in Appendix M, indicates that present conditions represent the dry extreme of potential climatic variation. Therefore, it is non-conservative for USDOE to select the low end of this 0.5 to 5.0 cm/yr range in the DEIS as representative of dry climate conditions.

No actual data exist on recharge under a wetter climate; however, simulation of wet-climate recharge through a coarse soil was described in appendix M. Test cases 2 and 7 (Table M.7, page M.20) indicated about 15 to 20 cm infiltration, depending on plant cover, after two years with 30 cm annual precipitation. The DEIS also states (page M.9, first paragraph), "The majority of soils and sediments in the vadose zone at Hanford consist of coarse-textured materials which tend to drain readily." In view of this simulation, and the fact that recharge under present dry conditions could be as much as 5 cm/yr, the assumption of 5 cm/yr average recharge appears non-conservative for the wetter-climate scenario.

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<u>Groundwater Transport of Contaminants</u>. The DEIS (page 0.1) expresses an intent to incorporate conservatism throughout its modeling analysis. Allowing for the general uncertainty in soil and transport characteristics, assumptions appear to be non-conservative in two main areas of the conceptual model of the basic transport framework. First, the assumption
3.5.2.15 that hydraulic conductivities can be vertically averaged is non-conservative with respect to contaminant travel times in the unconfined aquifer. Second, and potentially more significant, assumptions regarding contaminant retardation, which the authors of the DEIS state (page 0.15) "...cannot be stated as necessarily conservative," are in fact made non-conservatively (see review of Appendix P).

Section 0.4.2 discusses assumptions made for numerical analysis of flow in the unconfined aquifer. While the assumptions listed on page 0.26 represent great simplification of actual physical conditions, one in particular appears significantly non-conservative. Vertical averaging of hydraulic conductivities could result in horizontal travel times that are too long by an order of magnitude or more, if large variations in hydraulic conductivity are present. This averaging in effect ignores aquifer-scale longitudinal dispersion, as is indicated at the bottom of page 0.26. A



conservative approach for travel time calculation would use the largest values of hydraulic conductivity observed. The effect of this assumption is not large in the final analysis, however.

<u>Numerical Model-Unconfined Aquifer</u>. There is uncertainty as to what type of TRANSS model was used in the transport modeling. Section 0.4.3.2 states that a stochastic formulation was used which according to
Section 0.4.3.3 and its references (Simmons, 1981, 1982) eliminates the 3.5.2.9
dispersion term by setting the dispersion coefficient to zero and in its place, uses a random function for velocity to simulate dispersion. However, Section 0.4.3.5 states that the transport was determined using the convective-dispersive equation with a local-scale dispersion coefficient. These statements are contradictory.

Because hydraulic flow velocities in the saturated zone are so high, they are relatively unimportant in the overall analysis of contaminant travel time. We are therefore not overly concerned with the process used in calibrating the numerical model of the unconfined aquifer.

<u>Unsaturated Flow Model</u>. Transport in the vadose zone can be very slow so that assumptions made for calculations of unsaturated travel time
(presented elsewhere in the DEIS) are important. Section 0.4.11 describes 3.5.2.16
the unit hydraulic gradient model used for hand calculating vertical groundwater travel times in the vadose zone. Use of this model requires estimating or determining three soil parameters: the saturated moisture content, saturated hydraulic conductivity, and "b" value, the latter depending in turn on the precise relationship between soil moisture content and capillary water potential. These soil parameters would appear from references cited in the DEIS not to have been characterized with much precision, especially considering hysteresis and spatial variation among natural soils at Hanford.

Under the assumptions used in this model, travel velocity could have been obtained by simply dividing the assumed infiltration rate by the
estimate average moisture content. It is not clear whether this is, in 3.5.2.16
effect, what has been done later in the DEIS to obtain travel times in the vadose zone, as is suggested by the moisture content assumption at the bottom of page P.6.

The diffusion controlled transport in the unsaturated zone beneath the
protective barrier is discussed in Section 0.4.1.3. An assumption is made 3.5.2.17
that there will be a linear concentration profile throughout the diffusion zone. Diffusion controlled profiles will be concave and not linear in this region. It is uncertain whether this assumption is ultimately conservative. The approach to modeling diffusion in this section is questioned since there are analytical solutions to the one-dimensional diffusion equation which include source decay and contaminant decay which would be more appropriate. Finally, the diffusion coefficients used (Appendix P) are in some cases not conservative (see Appendix P review).

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Questions

O-1 Has any waste site monitoring experience (Appendix V) been used a) to calibrate contaminant movement in the saturated zone, or b) to quantify contaminant transport parameters in the vadose zone?

O-2 Given the preliminary judgements that recharge rates at Hanford under existing dry conditions are between 0.5 and 5 cm/yr, how can the DEIS selection of 0.5 cm/yr--the low of this range--be construed as conservative for the drier climate scenario?

O-3 In view of results of simulations presented in Appendix M, how can 5 cm/yr be construed as a conservative estimate of annual recharge at Hanford under a wetter climate?

3.5.2.16 O-4 Section O.4.11 describes the unit hydraulic gradient model used for hand calculating vertical groundwater travel times, in the vadose zone. Use of this model requires estimating or determining three soil parameters: the saturated moisture content, saturated hydraulic conductivity, and "b" value, the latter depending in turn on the precise relationship between soil moisture content and capillary water potential.

a) How were each of the required soil parameters characterized under spatially and temporally varying conditions?

b) Has an adequate range of soil conditions been investigated to be able to confidently ascertain what a "conservative" soil moisture characterization is?

c) Were travel times in the vadose zone computed by assuming a range of soil moisture contents? If not, which specific soil moisture characteristic data were used to obtain Ks and b values?

O-5 What specific range of hydraulic conductivities was considered in the vertical averaging of hydraulic conductivity?

3.5.2.9 O-6 How were depth zones weighted, and what range of average values was used in the analysis?

O-7 How will using more conservative retardation factors and diffusion coefficients affect travel times, first arrival, and peak concentrations for the various release scenarios?

O-8 What was the actual TRANSS model used in the transport modeling?

3.5.2.17 O-9 How would a more realistic model of transport in the diffusion controlled zone affect travel times and concentrations?



APPENDIX P RELEASE MODELS AND RADIONUCLIDE INVENTORIES FOR SUBSURFACE SOURCES

General Comments

This appendix concerns the rate at which radionuclides are released from the waste and become available for transport to the aquifer. The rate of release predicted depends upon the form of the waste as well as the manner in which it is stored. The rate of release predicted also is affected by physical and chemical constants and assumptions made as to the appropriate mechanisms. Once released from their original location, the radionuclides are transported to the aquifer by recharge water moving downward. The three models utilized in Appendix O are:

1. adsorption-controlled release,
2. solubility-controlled release, and
3. dissolution-controlled release.

In addition, diffusion-controlled release is modeled to account for the horizontal movement of radionuclides under a protective barrier. This is followed by a discussion of the release model(s) that are applied to each waste form. Numerous tables summarize the results of the release calculations and the data upon which they are based.

Our analysis of this Appendix suggests that radionuclides may travel faster than shown in this Appendix.

Errors or Uncertainties

The discussion in Section P.1.4 of Appendix P, on diffusion-controlled release beneath a protective barrier, depends upon the assumption that the barrier will be 100 percent successful in eliminating infiltration. In the first paragraph of Section P.1.4 it is stated that the analysis is 3.5.1.57
predicated on "our professional judgment" that the barrier will eliminate advection as a viable or dominant mechanism for the transport of radionuclides and chemicals in the soils beneath the barrier. Such a conclusion appears unsubstantiated given the doubts about the efficacy of the protective barrier that were raised in the comments provided previously on Appendix M.

One of the principal assumptions made on page P.6 is that the vertical distance from the bottom of the waste form to the water table is a uniform 64 meters. However, the reported vertical distance for 36 tanks (i.e., 15 percent of the waste) is less than 50 meters, and it is substantially less under other plausible scenarios (see more detailed discussion in our review of Appendix Q, this chapter). We understand that the transport path from any given waste site to the water table is not necessarily vertical or even linear, but the assumption of a uniform distance of 64 meters is non-conservative.

The assumptions of 0.5 and 5.0 cm/yr infiltration rates is (pages P.1 and P.6) non-conservative, as discussed in our review of Appendix O (this chapter). These assumptions imply non-conservatively low soil moisture contents, slow radionuclide release rates, and slow radionuclide transport.

3.1.4.17 The general corrosion rate (6 mil/yr) used to estimate the time of failure of a steel tank liner is not the most severe rate as stated on page P.12 of Appendix P. Corrosion rates may be three times this rate (reference NBS Circular 579, 1957).

3.5.2.39 The diffusion controlled release scenario using uncorrected molecular diffusion coefficients of 1.0 $cm^2$/day as shown in Table P.3 on page P.16 is not conservative. For example, $Cs^+$ and $NO_3^-$ both have molecular diffusion coefficients 50 percent greater or 1.5 $cm^2$/day at 65°F.

3.5.2.41 On page P.18, it is stated that while leach testing of Hanford grout is in progress, a uniform leach rate for nitrate ion has been assumed to apply to all grouted wastes at Hanford. The leach rate may not be the same for different wastes. The assumed leach rate for nitrate ion should be replaced by measured leach rates upon completion of Hanford grout testing, and this should be reflected in the final analysis and FEIS.

3.5.2.42 On page P.19 it is stated that the diffusion-controlled pathway commonly exhibits release periods in excess of the value dictated by the grout release mechanism for 14,000 years. It is not clear where the 14,000 year figure came from.

3.5.2.38 On page P.19 it is stated that the release of radionuclides from contaminated soils is assumed to be controlled by adsorption in the cases of carbon, strontium, cesium and neptunium. However, according to Table P.27, adsorption will not control carbon. In addition, we believe neptunium is probably controlled by solubility, not by adsorption.

3.5.2.37 On page P.24 it is stated that chosen values of the distribution coefficient (Kd), shown in Table P.27, are a conservative representation of values germane to the Hanford Site given in the literature. Delegard and Barney 1983 (Reference 5.7) is cited as the reference. No data was found in Reference 5.7 regarding Cs-137 for Kd's under different Hanford solution types. The Kd of 26 chosen for Cs-137 is not the lowest value in Reference 5.7. The lowest value in Reference 5.7 is 23. The value used for Hanford soils in Murthy et al. 1983 (Reference 16.4) is even lower (i.e., 20).
3.5.2.35 Also, samarium is expected to act chemically like plutonium under oxidizing conditions, and therefore its Kd should be conservatively assumed to be equal to the Kd for plutonium in cases where the tabulated value of Kd for plutonium is lower.

3.5.2.37 The conservative approach used by DOE in choosing Kd values is outlined in pages P.24 and P.26 of Volume 3. The following categories of assumptions have been made to achieve this approach:

1. The lower end of measured values of these Kds are assumed to be taken as a conservative (worst-case) value, that is, of a range of





potential Kd values which could be used, the worst-case (lowest) values were to be used by DOE. We support this correct approach, but not the assumptions.

2. Kd values used are from laboratory studies using organic complexing agents which are part of the High Level Waste (HLW). These complexing agents bind the multivalent radionuclides quite strongly (all but $^{137}Cs^+$) and thereby make them more mobile by keeping them in solution. The conservative assumption here is that these organics will break down under prolonged exposure to radiation and release the radionuclides. 3.5.2.37

3. The final assumption used by DOE is that TRU wastes are assumed to contain no complexing agents. We question this assumption. 3.5.2.37

Based on the above, a number of comments arise regarding these assumptions:

1. The accuracy of the Kds measured in Delegard and Barney (1983) are in question. For example, they did not account for container wall adsorption in their experiments. Their method of determining Kds is by taking the differences in the activity in solution before and after contact with sediment (and container) without determining the amount adsorbed on the container surfaces. This may lead to erroneously high Kd values. This would be especially true in their experiments which used small solution volumes (5 mL). For example, Schell et al. (1979) found that, in a total mass balance calculation for radionuclides in their adsorption experiments (including solution, sediments, filters, and containers), only 68 percent of $^{241}Am$ and 21 percent of $^{238}Pu$ was recovered. This was after three washings with hot nitric acid of all glass containers. They concluded that these nuclides were strongly adsorbed to the containers and were not removed by the hot acid rinses. 3.5.2.36

The Kds in Delegard and Barney were predicted values from quadratic expressions generated by a factor analysis of different solutions. Most of the predicted values upon which DOE makes their analysis are actually quite variable due to the large errors within the predictions. An example from page 25 of Delegard and Barney is given below for a 95 percent confidence interval ($\pm 2\sigma$) error estimate. 3.5.2.37

| Radionuclide | Relative Error (+95% CI) |
|---|---|
| Sr | 860% |
| Am | 320% |
| Np | 30% |
| Pu | 50% |

The DOE analysis does not consider those errors in determining the lower end of the predicted values. The significance of this is that they may be underestimating the peak arrival times,
3.5.2.37 concentrations and flux rates in their transport assessment. Another comment regarding the Delegard and Barney data is in regard to Table 2. The values for the Kds and the CEC do not correspond to what is given in their reference to this Table (Routson et al, 1981). For example, Routson et al. has values of Kd for the referenced solution matrix of 0.09 for Sr and 27 for Cs for sediment type S and P, respectively. Delegard and Barney list values of 0.32 (Sr) and 35 (Cs). The result of these differences is that the accuracy of the data used in the study is suspect.

Based on the above discussion, it is questionable whether the authors <u>have</u> taken a conservative approach in selecting the Kd values used in the analysis. A good argument could be made that they have not done so. A more conservative Kd would yield higher concentrations sooner and result in higher dose rates and consequently a more serious impact on public health and safety.

2. The second conservative assumption is that the organic complexing agents will break down under prolonged radiation and not maintain their complexing ability. A recent Battelle report (Martin,
3.5.2.37 1985), which was not cited in the EIS, shows that by 1980 (Delegard, 1980) it was known that one of the main complexing agents HEDTA (N-hydroxy ethyl ethylenediaminetriacetic acid) does undergo oxidative decomposition in simulated double shell tanks (DST) mixtures to a chemically similar complexant, ethylene-diaminetriacetic acid. This compound was also found to be the principle complexant degradation product in a LLW burial site at Maxey Flats, Kentucky.

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Therefore, there is no evidence at this time which would indicate a loss of complexing ability of waste solutions over time. The EIS conservative assumption regarding breakdown of organic complexing agents is unfounded and should not be considered as a conservative assumption at this time.

3. The final assumption concerns TRU wastes which, according to the EIS, are assumed to contain no complexing agents. From the description of the past waste handling practices in Volume 1, it
3.5.2.37 would appear contrary to the DEIS, that all wastes are complexed. Page 3.4 of the DEIS describes LLW solutions being generated by removing $^{90}$Sr and $^{137}$Cs from tank supernatant and disposing of the supernatant as LLW. Page 3.9 classifies "a TRU contaminated soil site as a site to which liquids (usually aqueous solutions classified as LLW) had been released." Since these solutions came from the tanks, they will be a complexed solution according to Schultz (1980). This is also confirmed in the preceding discussion section in which complexant-degradation products were present at the Maxey Flats LLW burial site.



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To assume that TRU wastes are uncomplexed is not accurate, and would not be a conservative assumption in any case. If this assumption is disregarded, the result to the analysis would be that many of the scenario results in Appendix Q which show <u>small or no impacts for TRU contaminated soils, would have larger impacts</u>.

References Used:

Martin, E.C. 1985. Complexant stability investigation. Task 2 - Organic complexants. Pacific Northwest Laboratory, Battelle Memorial Institute.

Schell,W.E., T.H. Sibley, A.L. Sanchez, J.R. Clayton, Jr., A.E. Nevissi, and E.A. Wurtz. 1982. Distribution coefficients for radionuclides in aquatic environments, final summary report. NUREG/CR-1869, U.S. Nuclear Regulatory Commission, Washington, D.C., 21 pp.

On pages P.24 and P.26 it is stated that TRU wastes in double-shell tanks are assumed to be equivalent to dilute, noncomplexed HLW contained in double-shell tanks at Hanford. However, Shulz 1980 (Reference 22.14) indicated that Tank 101-SY (a double-shell tank) has an organic carbon concentration of 1.19M which is equivalent to 0.12M EDTA+HEDTA. This is a complexed solution according to Delegard and Barney 1983 (Reference 5.7), which uses a value of 0.15M HEDTA+EDTA to indicate a complexed solution. In addition, the reported concentrations of Na+ and NaAlO2 and NaOH would indicate a concentrated solution. Therefore, the Kd's should be much lower.

<u>Questions</u>

P-1 Given the non-conservative approach in choosing molecular diffusion coefficients and Kds, how will choosing more conservative values affect the release and transport scenarios?

P-2 What effect would the use of the relative errors of the Kd values (statistical uncertainty) shown in your reference (Delegard and Barney) have on the results of your release and transport modeling? 3.5.2.37

P-3 Please correct the Kd values taken from the Routson et al. reference which were incorrectly quoted.

P-4 What effect would variations in reliability of the analytical techniques used in determining the Kd values have on your conclusions?

P-5 What was the basis for your assumption that complexing solutions would lose complexing ability and would break down and release bound radionuclides?

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P-6 Why was it assumed that TRU wastes are uncomplexed solutions? The references suggest that they are complexed solutions.

P-7 Why is Sm assumed to behave chemically similar to Am?

APPENDIX Q APPLICATION OF GEOHYDROLOGIC MODELS TO POSTULATED RELEASE SCENARIOS FOR THE HANFORD SITE

General Comments

Appendix Q presents a series of groundwater contaminant pathway analyses for the four alternative disposal methods. Analytical results are presented for two climatic scenarios, a drier climate represented by 0.5 cm/yr average annual recharge, and a wetter climate represented by 5.0 cm/yr recharge. For the wetter climate case, consequences of two barrier-failure scenarios are also analyzed.

Groundwater travel times in the vadose zone were computed manually, using a fixed vadose-zone thickness of 64 meters. Travel times for the saturated zone were analyzed using a numerical simulation. The boundary conditions, solute transport assumptions, and output of this numerical model are described generally.

Quantitative overall radionuclide travel times, from disposal in the 200-Areas to peak arrival in the accessible environment, and peak nuclide concentrations/fluxes are tabulated for each disposal alternative. Two points of contaminant release to the accessible environment were considered, the Columbia River, and a hypothetical domestic well 5 km downgradient of the 200 disposal areas.

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Separate subsections summarize radionuclide transport from the 300 disposal areas and describe water table changes resulting from potential irrigation scenarios.

Errors and Uncertainties

Because the radionuclide travel time analyses incorporate assumptions described earlier in the DEIS, most of the errors and uncertainties discussed for appendices M, O, and P are compounded in the quantitative transport assessments tabulated in Appendix Q. The net effect is that these results are non-conservative. In addition to this compounding of earlier problems, several new errors or uncertainties are manifest in Appendix Q.

The most significant of these errors or uncertainties includes the development of the off-site irrigation scenarios, and the apparent omission of these scenarios in any of the quantitative analyses of radionuclide transport, long-term performance assessment, or probability and consequence analysis. DEIS section Q.8 (page Q.31) states "After site closure or loss of institutional control, the possibility of irrigation on Hanford land becomes real." Areas likely to be farmed are discussed on page Q.31 and



shown on a map of the Hanford area (Figure Q.5, page Q.32). Two irrigation scenarios are developed in Section Q.8. The two irrigation scenarios assume, first, a very low (10 percent) deep percolation rate with one irrigated acreage and, second, a higher percolation rate (20 percent) with what appears to be a lesser irrigated area. The degree of conservatism of these scenarios cannot be assessed from information presented in the DEIS; however, Table Q.17 (page Q.36) indicates either scenario can substantially reduce the thickness of the vadose zone in the 200-areas, which would lead to proportionate or greater reduction in times required for contaminants to reach the accessible environment.

DEIS section Q.3 summarizes some of the input data assumptions and results of vadose zone modeling. The table at the bottom of page Q.3 indicates a vadose zone thickness of 64 meters was used to calculate unsaturated travel times for all recharge scenarios. This assumption contradicts information presented elsewhere in Appendix Q. Specifically:

a) Data from figure Q.3 (page Q.8) and table Q.17 (page Q.36) indicate the depth to groundwater beneath the 200-area tank bottoms would range between about 37 and 57 meters for 5 cm/yr average recharge.

b) Scenarios regarding off-site irrigation after site closure or loss of institutional control, presented in section Q.8 (Table Q.17, page Q.36), indicate vadose zone thicknesses beneath the 200-area tank bottoms as small as 15 meters.

c) For situations not involving site closure, artificial recharge of cooling and waste waters at Hanford cannot conservatively be assumed to cease. In this case, vadose zone thicknesses beneath the 200-area tanks should be less than the present 59-meter average, to account for continued artificial recharge.

Each item (a through c) above implies significantly shorter vadose zone travel times than are indicated on pages Q.3 and Q.9. This is true for the 0.1, 5.0, and 15.0 cm/yr recharge and in cases (b) and (c) probably the 0.5 cm/yr recharge rates as well.

Questions

Q-1 In view of a number of factors indicating much smaller possible vadose-zone thicknesses, why is 64 meters used in all calculations of unsaturated zone travel times for the 200 disposal areas? 3.5.2.30

Q-2 DEIS section Q.4 on aquifer modeling discusses the simulated steady-state configuration of the water table corresponding to the 0.5 and 5 cm/yr infiltration (recharge) scenarios. The modeling implies that with 0.5 cm/yr recharge, the water table drops to

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3.5.2.30 near its natural (pre-1945) condition, while 5 cm/yr recharge causes the water table to rise above its present level.

a) To what extent did these simulations use actual measured aquifer properties?

b) The simulation of 1983 water table (figure Q.3, page Q.7) differs from the water table observed in fall, 1982, as depicted on figure 4.8 (page 4.18). To what extent were attempts made to calibrate simulations of the 0.5 and 5 cm/yr recharge scenarios against pre-1945 and later water level data?

Q-3 DEIS section Q.7 (page Q.30) computes vadose zone travel times in the 300-area TRU burial grounds at 14 and 114 years, respectively, for 5.0 and 0.5 cm/yr recharge. According to the unit hydraulic gradient model (Appendix O), these values imply average soil moisture contents of 8.75 percent and 7.125 percent, respectively, for 5.0 and 0.5 cm/yr recharge, versus 6.4 percent and 7.8 percent assumed on page P.6 for the 200-areas. A finer-textured soil is implied in the 300-areas. Is this supported by actual soil moisture characterization?

Q-4 What is USDOE's estimate of the probability of occurrence of the off-site irrigation scenario discussed in Section Q.8?

Q-5 The two off-site irrigation scenarios developed in Section Q.8 describe off-site land areas that are or may be irrigated in the future. Do historic soil surveys indicate significant agricultural potential of any other areas tributary to or overlying the unconfined aquifer modeled in the DEIS?

Q-6 Irrigation losses to the groundwater table of 10 percent and 20 percent are used in DEIS section Q.8, analyzing water-table effects of future irrigation. These figures appear non-conservative in relation to average deep percolation rates. Probably only trickle systems or intensively managed sprinkler systems could attain these rates in the relatively sandy soils of the Hanford region. Would the capital and operational costs for such systems, compared to the incremental costs of pumping additional water from the basalt aquifer and/or Columbia River, justify such low deep percolation rates?

Q-7 What specifically is the quantitative effect of the irrigation scenarios presented in Section Q.8 on contaminant travel times from the 200-areas?

Q-8 Deep percolation losses of 20 percent (or greater) in combination with irrigation of all potentially irrigable land would appear to represent a reasonable but more conservative irrigation scenario than those presented in Section Q.8. What is the maximum water



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table rise and minimum and average vadose zone thicknesses beneath the 200-area tank bottoms that would result from this more conservative scenario?

Q-9 Have the reduced contaminant travel times due to water-table rises associated with off-site irrigation been incorporated in the overall analyses of, a) long-term performance of waste disposal systems, or b) probability and consequence of radionuclide release and transport after disposal? If not, why? 3.5.2.30

APPENDIX R ASSESSMENT OF LONG-TERM PERFORMANCE OF WASTE DISPOSAL SYSTEMS

<u>General Comments</u>

Appendix R presents an extensive series of tables assessing long-term performance of each of the four disposal alternatives, in terms of maximum radiation doses. Three main sources of radiation exposure are considered: a drinking-water well 5 km downgradient of the disposal area; a well used for irrigation and stock watering in addition to drinking water; and the Columbia River. Concentrations of radionuclides are tabulated for the well sources using the wet climate scenario (0.5 and 5 cm/yr average recharge), and for the Columbia River using both wetter and drier (0.5 cm/yr average recharge) climate scenarios. Barrier failure scenarios are considered for the wet-climate cases.

In addition to the above combinations of scenarios, the potential impacts of a number of other disruptive events are considered in varying detail.

<u>Errors or Uncertainties</u>

Appendix R combines results from nearly all the preceding appendices. Non-conservatism pointed out in this review in those appendices is, therefore, compounded in Appendix R. An example of this is the migration analysis presented in DEIS Section R.1.3 (page R.4) in which groundwater travel times are reported based on assumptions which we judged in our review of Appendix O (this chapter) to be non-conservative. 4.1.21

<u>Effects of Compounded Non-Conservatism.</u> For Appendix R as a whole, the compounding of non-conservative assumptions and results from elsewhere in the DEIS has the end result of making the computed maximum radiation doses (tabulated in Tables R.2 through R.61 and others) unconservatively low for all disposal alternatives. It also makes the results of the evaluation of maximum radiation doses appear more similar for the geologic, in-place stabilization, and reference alternatives than is reasonable, given the current state of knowledge. We believe the consequences of the in-place stabilization and reference alternatives differ from consequences of the geologic disposal alternative by a greater degree than is indicated in the DEIS. 4.1.21

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Table R.47 (page R.62), comparing effects of the various disposal alternatives on the Columbia River, does not specify whether barrier failure
3.5.6.25 scenarios have been incorporated. If those scenarios were not incorporated, then the apparent similarity between consequences of geologic disposal and consequences of the in-place stabilization and reference alternatives is further exaggerated.

Offsite Irrigation. A potentially major impact on contaminant migration into the accessible environment could result from off-site irrigation. This impact would stem from reductions in vadose zone thickness, with associated substantial reductions in contaminant travel times. While DEIS Section R.1.2 (page R.4) indicates that off-site irrigation was addressed in Appendix Q, the significant results of the off-site irrigation scenarios have apparently not been quantitatively incorporated in any of the analyses of long-term performance of waste disposal systems (Appendix R) or of probability and consequence analysis of radionuclide release and transport (Appendix S).

Wind Erosion. Effects of wind erosion are discussed in DEIS Section R.8 (pages R.92-93). The DEIS postulates wind erosion rate of 0.025 mm/year for the Hanford site. In contrast, Bander (1982), cited in Appendix M, indicates up to 1 inch (25.4 mm) per year wind erosion from tailings piles. Presumably those materials were similar in texture to the upper fine-soil zone proposed in Appendix M for the protective barrier. The DEIS assumption of 0.025 mm/yr is non-conservative with respect to wind
3.5.6.38 erosion of the proposed protective barrier, given the much greater rates observed elsewhere and considering the barrier's fine surficial soil texture, elevated position in the landscape, and limitations on any type of armoring system to limit erosion (see our discussion of Appendix M, this chapter). Contrary to the DEIS statement (page R.93) "Wind erosion is not seen as a discriminator for choice among the waste disposal alternatives," existing information indicates that wind erosion considerations favor minimum reliance on protective barriers.

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Questions

R-1 Were any barrier failure scenarios considered in the computations leading to the comparative assessment of health efforts presented in Table R.47 (page R.62)?

R-2 If worst-case assumptions are made regarding barrier failure (see our discussion of Appendix M), groundwater recharge (Appendix O), chemical retardation (Appendix P), and the thickness of the vadose zone (Appendix Q), what will be the effect on computed maximum radiation doses for the disposal and continued storage alternatives?



APPENDIX S PROBABILITY AND CONSEQUENCE ANALYSIS OF RADIONUCLIDE RELEASE AND TRANSPORT AFTER DISPOSAL

General Comments

This appendix summarizes the results of the preliminary analysis required by 40 CFR 191. The calculations of probabilities and consequences of release and transport after disposal were done for the three disposal alternatives and the no disposal action alternative. In the absence of applicable data, values were assumed for several key parameters.

The methods used to make the calculations are summarized and the assumptions made are stated. The results indicate that, with the assumptions made, the EPA standards could be met.

Errors or Uncertainties

Appendix S utilizes results of several preceding appendices, 3.5.6.42
particularly M, O, P, and Q. Non-conservative assumptions and results of those appendices, discussed in other sections of this chapter, are compounded in the conclusions of Appendix S. The most significant non-conservative assumptions in this regard are:

1. Consequences of protective barrier failure (see our discussion of Appendix M).

2. Recharge rates of 0.5 and 5.0 cm/yr for drier and wetter climates, respectively, affecting contaminant release rates and travel times (see our discussion in Appendix O).

3. Distribution coefficients (Kd) and related contaminant release rates and retardation factors (see our discussion of Appendix P).

4. Fixed 64 m thicknesses of vadose zone, and associated contaminant travel times (see our discussion in Appendix Q).

In calculating the release ratio consequence $C_A$, 11 radionuclides were used in Appendix S. There is no indication that these 11 radionuclides make 3.5.6.43
a total contribution to $C_A$ that is large enough so that $C_A$ is a good approximation to what it would be if more radionuclides were considered. That is, do these 11 radionuclides comprise all the significant contributions to $C_A$, what is the contribution of the largest excluded radionuclide?

The text on page S.24 claims that "partitioned" release limits are defined and calculated in section S.1 and shown in Table S.2. While section S.1 does discuss the calculation of the values listed in Table S.2, 3.5.6.44
there is no mention of the word "partitioned", so the reader has little idea of what is being partitioned and how this applies to Figure S.10.

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3.5.6.45 Regarding the Kd values assumed for the mathematical model of natural release consequences and uncertainty in Section S.3, it is stated on page S.17 that the value used for plutonium is very important. This is supported in the description of the sensitivity analysis in Section S.6. Based on our comments on Appendix P, the probability distribution function of Kd values for plutonium should include much lower values.

3.5.6.30 Appendix S appears to disregard the off-site irrigation scenarios, which could significantly accelerate contaminant releases to the accessible environment under several disposal alternatives.

These non-conservative assumptions and omissions have the most significant impact on estimates of contaminant release under the in-place disposal, reference, and continued storage alternatives. The net effect is to make the adverse consequences of those alternatives appear closer than they should to consequences of the geologic disposal alternative.

We also regard the probabilities assigned to climate and barrier failure scenarios in Section S.2 (see Figure S.3, page S.8) as distinctly non-conservative. This further underestimates the consequences of alternatives other than geologic disposal and further minimizes the difference in impacts between geologic disposal and the other alternatives.

In the probability analysis, the drier climate scenario is given a 90 percent probability, while the wetter climate is assigned a 10 percent probability. This is in direct contradiction of the conclusion in Appendix R (page R.3) that "it seems most likely that the most probable
3.5.6.47 change will be toward a cooler climate," and "climate is considered under three different states, with the largest expected change being toward a cooler and wetter state." This conclusion is supported by Kukla (1979), cited in Appendix M, who indicates, 1) that the present interglacial climate is representative of the warmest and driest of four climatic variations, and 2) that the present interglacial climate, which has persisted over the past 11,000 to 13,000 years, has only about a 10 percent probability of continued occurrence.

The probability analysis assigns a 50 percent probability to failure of the protective barrier. Within this overall 50 percent probability, the much less significant "functional" barrier failure is assumed to be approximately 19 times more probable than the much more significant (but still non-conservative in our opinion) "disruptive" failure. The DEIS thus assumes the probability of "disruptive" barrier failure is only about
2.4.1.16 2-1/2 percent. In our opinion, conservative estimation of the probability of disruptive failure could plausibly be 50 percent or more. Moreover, as discussed in our review of Appendix M (this chapter), we believe conservative assessment of the consequences of "disruptive" failure could be several times as great as estimated in the DEIS.

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Within the present state of knowledge, it appears unlikely that EPA standards under 40 CFR 191 could be met by either the in-place stabilization or reference alternatives, given reasonably conservative assumptions and analyses of contaminant release to the accessible environment.

Questions

S-1 How will lower Kd values affect the results of the release consequence models? 3.5.6.52

S-2 What would be the effect on the results of the release consequence model of 90 percent probability of a wetter climate and 10 percent probability of a drier climate? 3.5.6.46

S-3 What would be the effect on the release consequence model of a 50 percent probability of disruptive failure?

S-4 If worst-case assumptions are made regarding the severity of barrier failure (see our discussion Appendix M), groundwater recharge rates (Appendix O), chemical retardation (Appendix P), and vadose-zone thicknesses (Appendix Q), in combination with probabilities postulated in questions S.2 and S.3 above, what will be the effect on the results of the release consequence model?

S-5 What are the contributions to the consequence measure, $C_A$, of the radionuclides excluded from consideration?

APPENDIX U PRELIMINARY ANALYSIS OF THE FUTURE GROUNDWATER TRANSPORT OF CHEMICALS RELEASED

General Comments

Appendix U describes the release and transport models for nonradioactive chemicals disposal of at the Hanford site. This excludes organic chemicals, most of which are chelating agents. However, there is a lack of information on chemicals discharged into cribs and trenches at Hanford which may contain more hazardous compounds. These are supposedly being looked at in the current CERCLA program at Hanford.

Errors or Uncertainties

The cadmium and fluoride equilibrium concentrations could not be evaluated or verified with the references cited. Consequently, the source terms for these elements could not be verified. 3.1.6.2

The same problems with the diffusion controlled transport and release as described in Appendix O and P reviews apply here. The molecular diffusion coefficients used are probably not conservative.

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Questions

None.

APPENDIX V SITE-MONITORING EXPERIENCE

General Comments

Appendix V provides a brief description of the program that has been in effect for monitoring the movement, distribution, and concentration of radiocontaminants from waste disposal activities in the unconfined aquifer on the Hanford Site for over 35 years. It describes a network of wells used for monitoring waste disposal sites. It also discusses characterizations (i.e., field measurements of radionuclide distributions in the sediments surrounding the facilities) that have been conducted on selected retired facilities including certain cribs, a trench, a French drain, a reverse well, and a disposal pond and ditch system.

No discussion of future monitoring activities associated with the nuclear waste program is provided.

Errors or Uncertainties

This EIS provides no discussion or design about a monitoring program specific to defense wastes or related to these wastes which may go to the repository.

Questions

2.1.7 V-1 What changes or development for the monitoring program are proposed for long-term monitoring at the defense waste site?

V-2 How will a monitoring program for a nuclear waste repository at Hanford be affected by the defense waste program?

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CHAPTER 4

REFERENCE CHECK DISCUSSION

(no comment identified)

This chapter provides discussions of certain conclusions regarding references checked which required more room than available on Appendix A. Providing this collection of comments in paragraph form in a separate chapter provides the reader with a summarized assemblage of key reference findings and helps to minimize the length of Appendix A.

Conclusions here can be reviewed on their own or as a backup to Appendix A. Questions arising from some of the comments made here are found in Chapters 2 and 3. Chapter 2 asks questions of Volume 1 of the DEIS. Chapter 3 asks questions of the Appendices to the DEIS.

The reference numbers cited here are from a catalog system prepared by USDOE which assigns numbers to each reference cited in the DEIS. The author of each such reference may be found in Appendix A. The complete citation for each reference may be found in the DEIS or by contacting the Office of Nuclear Waste Management or USDOE.

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Page 3.13 Reference 5.18

3.1.8.12 Although the text states glass leachability is low and thermal stability high, the reference refers to them as "acceptable"

Page 3.15 Reference 6.20

3.1.4.26 The EIS states that leak residues are a small fraction of the 5 percent residual waste in single-shell tanks. However, the reference cites a leak of 40,000 Ci of $^{137}$Cs, 14,000 Ci of $^{90}$Sr, and 4 Ci of plutonium to underground soils. The reference is not supported. Although the spill volume was 115,000 gallons (perhaps a small fraction of the residual waste left in tanks), the volume of contaminated sediments as a result of the spill was 850,000 $ft^2$ (6-20, Vol. I, III.2.2.2.).

Page A.3 Reference 7.2

3.1.4.19 Nothing was found in the reference document to support the statement in the EIS that "concrete in the single-shell tanks has maintained its integrity preventing tank collapse, during many years of service." The reference document does, however, state that problems were experienced with liquid leaking from some of the tanks beginning in 1958.

Page B.3 Reference 6.4

Conclusions of analysis regarding consequences of single-shell tank leaks checked.

Page B.16 Reference 6.10

4.2.15 This reference does not directly address requirements for concentration of radionuclides in discharged air. A more appropriate reference would be DOE Order 5480.1A Chapter XI (Reference No. 5.16).

Page B.30 Reference 21.18

Selected nuclide gaseous emission values checked against tables in reference.

Page B.31 Reference 21.18

4.2.16 Some values apparently were inaccurately converted from Table 2-14a of the reference document to Table B.2 of the DEIS, especially in the existing tank waste glass column. Consequently, the average composition ($Ci/m^3$) of the final waste forms for the geologic disposal alternative appear to be underestimated by as much as a factor of 2 (e.g., Cs-137 and Tc-99). In addition, although it is stated that the values reported in the DEIS for Ru-106 do not include activity of short-lived daughters in equilibrium with the parent radionuclide, it is not clearly explained why it is thought the short-lived activity can be safely deleted from the values given in the reference document or how this was done.



Page B.33 Reference 21.18

Selected nuclide liquid discharge values checked against Reference 21.18, Table 4-129.

Page D.4 Reference 26.7

The reference document does not delineate the contents of the "typical" grout mixture as stated in the DEIS. 3.1.8.4

Page D.4 Reference 28.3

The DEIS lists physical and mechanical properties upon which the grout's durability depends. The cited reference, in contrast, addresses environmental factors affecting long-term stabilization of soil layers used as radon suppression covers for uranium mill tailings. The stabilization method described is the use of rock aggregate riprap applied to the suppression cover. Nothing was found in the cited reference about grout, its physical and mechanical properties, or its durability. 3.1.8.23

Page D.5 Reference 6.9

Timing of grout technology development/implementation appears inconsistent. The DEIS implies grout formula testing is still in the planning stage. The schedule in Figure III-8 of the reference document shows grout technology development ending and grout disposal beginning in Fiscal Year 86.

Page E.13 Reference 5.16

It is not clear that the projected annual releases from the WRAP facility (given in the DEIS in Ci/yr) are below the limits established by DOE for release in controlled areas (given in u Ci/ml). Assumptions on dilution/dispersion of released radionuclides were not found in the DEIS. 3.1.8.17

Page F.12 Reference 1.9

The connection between particle velocities used in the DEIS and the reference document is not clear. 4.2.20

Page F.16 Reference 25.1

The wrong reference is cited for documentation of SUBDOSA. Reference No. 25.2 should be cited. 4.2.21

Page F.17 Reference 14.15

BIOPORT/MAXI1 was not mentioned among the numerous codes reviewed in the reference document. The citation in the DEIS associates BIOPORT/MAXI1 with the reference document. 4.2.22

Page F.19 Reference 28.1

4.2.23 The DEIS states that estimated down-river populations are taken from the projections of the reference document. But the reference document only provides population estimates out to a 50-mile radius from Hanford, not down-river.

Page F.30 Reference 11.7

4.2.24 Reference to measurements of radioactive fallout was not found in the reference document.

Page F.30 Reference 17.15

4.2.25 The DEIS states that the mathematical models used in the reference document to simulate the behavior and fate of radionuclides in environmental media are based on formulas originally used in the HERMES computer code. This was not confirmed, as no mention of HERMES was found in the reference document.

Page F.31 Reference 17.17

4.2.26 The reference was not confirmed because only Volume 2 of the 4-volume reference document was provided for review and the citation was apparently not from Volume 2.

Page F.34 Reference 18.8

4.2.27 Use of the PABLM code was not confirmed. The copy of the reference document provided for review was incomplete, and it appears this may not be the right reference.

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Page F.35 Reference 17.1

4.2.28 The DEIS implies the PABLM code was used to calculate projected radiation doses reported in the reference document. No mention of PABLM was found in the reference document.

Page F.36, 38 Reference 24.3

4.2.29 Reference document for review provided was EPA-520/5-80-002 (draft), not EPA-520/5-80-026 as cited.

Page H.10 Reference 5.16

4.2.30 A USDOE guideline of 0.5 rem/yr to a member of the population from occasional releases at federal facilities was not found in the reference document. The same statement in the DEIS refers to a 1985 USDOE memorandum by W.A. Vaughan, which is not listed separately as a reference and is not included in the set of references provided by USDOE.



Page H.10 Reference 20.1

No mention of ferrocyanide precipitates was found in the reference cited. Ferrocyanide precipitates were briefly mentioned on page 5.5 of Reference 15-10 (PNL-5356), but no reference was cited there. 4.2.31

Page H.11 Reference 15.10

The citation states that additional information on the conversion factors used could be found in this reference. Some conversions were done in Sections 9.1 and 9.2 of the reference, but there was no explanation or discussion of the factors utilized and the only additional information appeared to be some assumed densities. 3.4.3.9

Page H.19 Reference 25.6

The DEIS estimates 1 percent of the contents of a contact-handled TRU waste package, as particles with 10 um AED, would become airborne in an explosion or pressurized release. This is not supported by the cited reference document, which concludes that the average weight percent of powder airborne in experimental releases ranged from about 2 percent to 24 percent. The basis for the extrapolation to 1 percent in the DEIS might be a larger assumed average source particle size than that used in the reference experiments, but this is not evident. 3.4.3.10

Page H.21 Reference 21.9

The dispersion value used for a dropped shipping container (i.e., $1X10^{-5}$) was not found in the reference document. 3.4.3.10

Page J.3 Reference 6.6

The reference was not confirmed because the copy of the reference document provided was incomplete.

Page M.1 Reference 8.16, 10-3

These references discuss barriers to limit exhalation of radon gas, which are fundamentally different in design and purpose to the moisture-infiltration barriers discussed at length in the DEIS. Because gas control is not mentioned in the DEIS as a significant consideration for performance of the proposed protective barrier, this citation appears somewhat inappropriate and not directly applicable to the DEIS discussion. A barrier of the design cited in the reference may be ineffective in preventing moisture migration. 3.5.1.40

Page M.1.6 Reference 2.11

This reference discusses a radon and erosion barrier of fundamentally different design and purpose than the moisture-infiltration barrier proposed in the DEIS. The reference mentions the need for measures to prevent human 3.5.1.41

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intrusion rather than addressing considerations for barrier design in the substantive way implied in the citation. The reference concludes that human
3.5.1.41 intrusion "...over a long period of time cannot be absolutely prevented but can be inhibited to a great degree." The barrier referred to in the reference is not designed to prevent water infiltration. This reference does not appear to support the DEIS statement.

Page M.1.6 Reference 10.6

The DEIS citation states "Multilayer covers can be designed to prevent or minimize water infiltration into the waste and at the same time limit biotic and human intrusion." Contrary to the citation, there is no claim in this reference that water infiltration into the waste can be prevented. The reference does not discuss biotic or human factors. Contrary to the
3.5.1.99 citation on page M.6, the reference does not report any results or design of field tests. The reference "Discussion and Conclusions" states "This literature search located very little information dealing specifically with the design of cover for low-level radioactive waste sites...no criteria have been established to determine cover effectiveness...no designs that have been proposed appear to be able to withstand subsidence caused by differential settlement of waste." The DEIS indicates elsewhere (page M.25), and we concur, that subsidence is an important consideration for barrier integrity. This reference does not appear to support the DEIS statement.

Page M.1.6 Reference 12.6

The DEIS citation states "Multilayer covers can be designed to prevent or minimize water infiltration into the waste and at the same time limit biotic and human intrusion." Contrary to the citation, there is no claim in this reference that water infiltration into the waste can be prevented. The reference does not discuss human or biotic factors. The reference is a laboratory and modeling study whch is primarily concerned with low level radioactive wastes. The reference states (p.86), "It has been suggested previously that saturation of the overlying layer is required before
3.5.1.99 moisture breakthrough will occur in such layered systems...the simulations in this study indicate that moisture movement through layered systems of highly contrasting texture can occur when the moisture content of the overlying layer is less than saturation and the pressure head at the interface is less than zero. The significance of these results must be evaluated in reference to observed behavior in laboratory column and field experiments, and to limitations of instrument measurement of the parameters of interest."

Page M.1.6 Reference 27.11

3.5.1.99 The DEIS indicates that this reference suggests that "Multilayer barriers may be effective for disposal of high-level waste at arid sites." Winograd qualifies this suggestion as follows (p.1462). "Such a barrier...would undoubtedly require extensive engineering pilot studies to determine the degree to which various fine-coarse geometries can retard or divert deep



percolation." We agree with this statement, and we are not aware that any 3.5.1.99
such pilot studies have been reported to date. Thus, the validity of the concept remains unproven. The underlying problem with this and other citations here is that important qualifiers are included in the DEIS, e.g., "has suggested", "may be effective", "can be designed" without a similar possibility that they "may not" be effective. Yet, the DEIS concludes that "a multilayer system has been selected"..."it would provide long-term protection". Where are the qualifiers?

Page M.1.10 Reference 4.4

The barrier construction discussed in the reference is different than
proposed in the DEIS. Roots penetrated into rock through 1 meter of soil in 3.5.1.5
a number of test cases. Total root length was 2.4 meters. Also, in contrast to the citation on page M.10 of the DEIS, the reference states that the zone beneath the barrier should be kept dry (not "as dry as possible"). The reference also includes prevention of burrowing by animals to prevent water channelization, as a fourth measure, in addition to the three cited in the DEIS.

Page M.3 Reference 10.7, 10.8, 10.9

The DEIS states "Layered soil effects on water storage are described in detail in (Hillel and Van Bavel, 1976; Hillel, 1977; Hillel and Talpaz, 1977)." In actuality, the cited references discuss only simulations of these effects, and each reference makes a similar disclaimer as to the applicability of these simulations to actual field situations. For example,
the following statement is from Hillel and Van Bavel (p.814): "This model 3.5.1.42
study of profile moisture dynamics in relation to soil texture and hydraulic properties was based on a rather arbitrary and hypothetical selection of soils and weather patterns. Hence we make no claim that our reported results are realistic in the sense that they can serve directly to describe any particular field situation. Our present model, furthermore, omits potentially important phenomena such as spacial heterogeneity, surface crusting or mulching, soil moisture hysteresis, energy relations (van Bavel and Hillel, 1975), as well as the often dominant uptake of water by plant roots (Hillel et al., 1976)." These qualifications are for the most part ignored entirely in the DEIS, but are critically important to the actual functioning of the protective barrier.

Page M.6 Reference 15.4

The reference cited was published in 1971. Contrary to the citation, this 3.4.1.43
reference does not discuss gravel layers.

Page M.6 Reference 15.5

The DEIS reports results of laboratory-type experiments for the most part, 3.5.1.44
including lysimeters with reconstituted soils. This reference reports some differences between lab and field observations. It considers 0.01 to 0.1 cm of drainage "negligible", which is not the case for purposes of the DEIS.

Page M.9 Reference 3.6

3.5.1.45 Contrary to the citation, this reference does not contain explicit soil moisture. Only one example chart of soil moisture is presented, with no reference to soil type or location.

Page M.9 Reference 3.7

3.5.1.46 The citation mentions specific soil moisture ranges for vadose zone sediments, based on "past work at Hanford." However, this reference does not report measurements in undisturbed soils. Some psychrometers were reportedly installed outside lysimeters, but those results were not reported. (Soils placed and monitored inside lysimeters were thoroughly mixed, obliterating natural stratification and structure. No soil descriptions are included. Authors reported percolation in lysimeter to 6 meter depth, with a "residual envelope of 'perched' water at a depth of 4 to 6 meters below the surface." This result suggests a potential for greater buildup of moisture than reported in the DEIS.)

Page M.9 Reference 7.4

3.5.1.47 Contrary to the citation, no soil moistures were reported in this reference: The abstract states "A more refined analysis...is required to give a definite answer as to the direction of flow...if flow existed at this location, it was less than 1 cm/yr." This illustrates the difficulty and lack of precision that has characterized investigations of soil moisture movement at Hanford.

Page M.9 Reference 8.18

3.5.1.48 There appears to be confusion in this reference between weight percent and volume percent moisture (contrasting statements on page 9 of the reference with pages v and 35 of the reference). The moisture figures reported in the reference differ from those stated in the DEIS. On page v of the reference, it is stated "...the soils are extremely heterogeneous; hence soil water content is not a predictable parameter." Wide ranges in deep drainage are suggested at various sites. For example, page 11 suggests ranges of 0.5 to 5 cm/yr; page 14 suggests ranges of 0.3 to 1 cm/yr; page 17 suggests ranges of 0.03 to 4 cm/yr. These indicate both the lack of precision obtained to date in soil moisture movement characterizations at Hanford and the potential for perching and soil moisture buildup in excess of the ranges reported in the DEIS.

Page M.9 Reference 11.1

3.5.1.49 Contrary to the citation, no moisture measurements were reported in natural (undisturbed) soils. No textural descriptions of reconstituted soils are given. (A record rain is reported to have produced a wetting front in a lysimeter that was moving downward past 5'7" at time the of the report. This suggests a potential for perching and local soil moisture buildups in excess of the ranges cited in the DEIS.)



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Page M.9 Reference 11.15

The reference reports soil moisture of 5 percent to 9 percent by volume in sand/loamy sand, versus DEIS statement of 2 to 5 percent by weight for sands. 3.5.1.50

Page M.9 Reference 12.8

Contrary to the citation, no soil moistures were reported for natural (undisturbed) soils. (Net downward flux of liquid phase moisture was reported in lysimeters, suggesting a potential for perching and soil moisture buildup in excess of the ranges reported in the DEIS.) 3.5.1.49

Page M.9 Reference 12.9

Contrary to the citation, no soil moistures were reported outside caissons. (Deep drainage was reported in caissons, suggesting a potential for perching and soil moisture buildup in excess of the ranges reported in the DEIS.) 3.5.1.49

Page M.9 Reference 12.10

Contrary to the citation, no soil moistures were reported outside caissons. (Deep drainage was reported in caissons. This suggests a potential for perching and soil moisture buildup in excess of the ranges specified in the DEIS.) 3.5.1.49 The unsaturated flow model "UNSAT1D" was criticized in the reference (p.44)). This is the same model used in the DEIS (section M.5)). 3.5.1.51

Page M.9 Reference 20.15

Contrary to the citation, this reference does not explicitly present soil moisture contents. Figure 10 indicates 9 percent moisture for gravelly sand, versus 2-5 weight percent mentioned in the DEIS.

Page M.18 Reference 12.19

This reference describes general academic theory. There is no explicit treatment of Hanford data, as could be inferred from the citation. 3.5.1.52

Page M.18 Reference 13.8

This reference does not address the methodology described in the citation (using the 100-year maximum) for assessing precipitation under a wetter climate. 3.5.1.53

Page M.18 Reference 15.4

The paper cited was actually published in 1971. Contrary to the citation, no characteristic curve is presented. 3.5.1.43

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Page M.18 Reference 24.16

3.5.1.52 Figure 37 of this reference indicates the maximum amount of annual precipitation that on the average will occur once every 100 years is over 32 cm, versus 30.1 cm cited in the DEIS.

Page M.19 Reference 23.12

3.5.1.54 This reference uses a cheatgrass growing season of 70 days. The DEIS uses 120 days. This could result in a significant difference in the calculated moisture flux through the protective barrier.

Page M.24 Reference 22.16, 23.1, 23.2

3.5.1.55 None of these references deals explicitly with waste or construction sites at Hanford, nor with wind erosion at Hanford as were implied in the citation. Rather, they discuss, in general, airborne dust concentrations, deposition, and resuspension.

3.5.1.55 Page M.24 Reference 23.1

This article is general in nature, with the only reference to Hanford being example data sets. Contrary to the citation, we found no specific reference to the proposed barrier nor to any data deficiencies at Hanford.

Page N.2, N.3 Reference 1.12

4.2.35 No page number is given for the quote from BEIR III and the quoted sentences could not be located in the reference.

Page N.6 Reference 18.5

4.2.36 Apparently no table in the reference document gives the numbers in Table N.2 directly. The central and lower bound values have to be calculated from the upper bound values in Table 2-2 using formulas given on pages following page II-97.

Page N.8 Reference 1.12

4.2.37 The text on page N.8 is somewhat misleading. To get the 1 percent figure for the autosomal dominant and X-linked disorders, color blindness must be included. While the other disorders listed are certainly an "appreciable handicap", many would disagree with this characterization of color blindness. This description of this type of disorder implies that 1 baby in 100 has a handicap-like six fingers, anemia, or muscular dystrophy. The discussion of the irregularly inherited disorders is also misleading. It implies that 9 babies out of 100 are seriously handicapped by these disorders. The phrase "at some time during their lifetime" in BEIR III has been omitted. Thus, the inherited disorder may be the tendency to develop heart disease or a certain type of cancer late in life.



Page O.2 Reference 6.7

The DEIS (p.O.2 through O.5) contains several pages of quotations from the cited reference. The symbol "..." is used at several points in the quoted material to indicate where parts of the cited document are omitted. However, numerous other omissions are unmarked. The significance of these omissions to the DEIS conclusions has not been determined. 4.2.38

Page O.2 Reference 15.3

These authors (p.260) considered the Ringold Formation to be Pleistocene. The DEIS citation indicates a Pliocene age. 4.2.39

Page O.12 Reference 11.17

This report appears to contain a factual error that contradicts the DEIS citation: "A previously conducted study, using lysimeters near the 200 East area, concluded that unsaturated sediments <u>retain little or no additional water</u> under existing arid climate conditions (Issacson and Brown, 1978...)" (emphasis added). The reference gives an undocumented summary of lysimeter experiments conducted in 1973-74 south of the 200-East area. Figure 14 (p.26) from the reference purports to show soil/moisture content in the Hanford open-bottom lysimeter, and is interpreted to indicate that no additional moisture was retained in the soil at the end of the study period. In fact, the final moisture curve (Oct. 18, 1974) does <u>not</u> show moisture in the open-bottom lysimeter, which, as described in reference 13.10 (Last et al, 1976, p.9-10 in Appendices) <u>did</u> retain additional moisture, not only at the 1974 measure, but also through water-year 1975-76. This moisture resulted from heavy rains in 1973-74. 4.2.42

Page O.12 Reference 13.10

The DEIS accurately cites the conditions of this reference. However, one of the two lysimeter monitoring results (the open-bottom lysimeter) reported in this reference <u>did</u> in fact still retain significant additional moisture in the soil profile, approximately two years after the causative rainfall. Thus, the validity of the conclusion is questionable and the results of the cited studies do not necessarily differ as asserted in the DEIS. (See Gee and Heller, 1985, Ref. No. 8-18, p.11: deep drainage at the lysimeter site is likely occurring.) 4.2.42

Page O.27 No Reference Number (Dept. of Energy, 1984b)

This reference was cited but not listed or supplied with the supporting documents. Mention of the modeling elements cited in the DEIS cannot be found in this reference. 4.2.44

Page O.2 Reference 7.16

This reference gives no information on the drilling and sampling methods used in obtaining samples of subsurface sediments, nor does it describe how 4.2.45

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4.2.45 the textured analyses were performed. Because these factors can have a very substantial influence on the interpreted grain-size distributions, the validity of the data matches described in the DEIS cannot be assessed.

<u>Page Q.33</u> <u>Reference 3.1</u>

4.2.46 This reference indicates that the tank bottom elevation in the BY and B tank farms are not the same as was indicated in DEIS Table Q.17. Also, the minimum tank bottom elevation in the A Farm is 193m, not 194m.

<u>Page R.3</u> <u>Reference 17.10</u>

3.2.1.2 This reference contradicts the citation in the DEIS, which states: "The Pasco Basin is believed to have been cooler and wetter 13,000 to 10,000 years ago than it is today, and to have changed to a warmer, drier climate about 8,000 years ago (Nickmann and Leopold, 1985)". The reference actually indicates, a) colder climate between about 13,000 and 11,500 years ago; b) change to a warmer, drier climate about <u>10,000</u> years ago; and c) change to a <u>wetter</u> climate about 8,000 years ago.

<u>Page R.89</u> <u>Reference 4.14</u>

4.2.54 This reference analyzes <u>hydraulic</u> aspects of glacial flooding, <u>not</u> the probability of occurrence. Probability of occurrence estimates given in paragraph 3 of DEIS section R.6 cannot be found in the reference.

<u>Page S.17</u> <u>Reference 13.16</u>

4.2.48 The connection between annual borehole frequency/$km^2$ in the DEIS and the reference document is unclear.

<u>Page V.3</u> <u>Reference 13.1</u>

4.2.51 Contrary to the citation, no calibration involving radiocontaminant behavior is included in this reference.

<u>Page V.3</u> <u>Reference 20.17, 20.18, 20.19</u>

Contrary to the citation, calibration and verification of the model are not discussed in these volumes.

<u>Reference 6.6</u>

4.2.55 Reference not cited in text; actual date is June 1985; only part (16 pages) of the reference provided (see 6.7).



LIST OF REVIEWERS

| Name | Title/Experience | Years Experience | Expertise Applied To Review |
|---|---|---|---|
| Grant Bailey | Environmental Director/ Nuclear Power Projects, Energy Studies | 16 years environmental studies on energy and facility siting projects. | Project Director, Quality Assurance, NEPA Review |
| Chuck Boatman | Geochemist/ Geochemical Processes in Sediments | 15 years geochemical studies focused on sediments, and pollutant transports. | Geochemistry |
| John Held, Ph.D. | Nuclear Engineer/ Nuclear Plant Operations | 14 years experience in nuclear plant operations, engineering, licensing, and analysis. | Radiochemistry, Risk Analysis |
| Roger Breeding, Ph.D. | Geophysicist/Nuclear Containment and Radioactive Waste Management | 19 years experience in nuclear and non-nuclear safety, hazards analysis, environmental and risk assessments. | Radiation Physics |
| Mark Shaffer, P.E. | Geological Engineering/ Geohydrology and Engineering Geophysics | 16 years experience in water resources and waste management projects. | Geology/ Geological Engineering |
| Daniel Sunada, Ph.D. | Civil Engineer/ Groundwater Engineering | 20 years experience groundwater hydraulics and hydrology, modeling and soil mechanics. | Chemical Hydrology |

APPENDIX A



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APPENDIX A

REFERENCE CHECK TABLE

INTRODUCTION

Appendix A lists references we were able to check in the EIS. The table which comprises Appendix A lists, in order:

- the reference code number assigned by USDOE to each of the references provided by USDOE.
- the publication year and principal author(s) of each reference.
- the page number of the EIS where the particular reference was cited.
- a statement as to whether the reference was checked - and whether it was confirmed or not.
- initials of the reviewer.
- comments.

In some cases, the comments to a particular reference check were longer than one or two short lines. In such cases, these comments appear in Chapter 4. A second advantage to compiling these comments in Chapter 4 is that comments in Chapter 4 are now organized by location in the EIS, rather than by an arbitrary reference number as they are in this table. Persons using this table should refer to Chapter 4 of this report.

(no comment identified)

REFERENCE CHECKS (1)

DRAFT ENVIRONMENTAL IMPACT STATEMENT
DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL, TRANSURANIC AND TANK WASTES

| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 1.1 | 1985 | Aaberg, R.L.&B.A. Napier | | | | | |
| 1.2 | 1981 | Adams, N. | | | | | |
| 1.3 | 1984 | Aldrich, B.C. | | | | | |
| 1.4 | 1977 | Ahlstrom, S.W. et al. | V.3 | Y | Y | MS | |
| 1.5 | 1974 | Ames, L.L. | | | | | |
| 1.6 | 1978 | Ames, L.L. and D. Rai | 0.39 | Y | Y | CB | - |
| 1.8 | 1973 | Atl.Rich.Hanf.Co.Res.Dept.Stf. | | | | | |
| 1.9 | 1968 | Atomic Energy Comm. (AEC) | | | | | |
| 1.11 | 1972 | BEIR Report | | | | | |
| 1.12 | 1980 | BEIR Report | N.75-89 | Y | Y | JH | See Chapter 4. |
| | | | N.2,N.3 | Y | N | RB | Could not find quote. |
| | | | N.8 | Y | N | RB | Statement in Appendix N is misleading. |
| 1.13 | 1976 | Baker, D.A. et al. | | | | | |
| 1.14 | 1973 | Baker, V.R. | 0.5 | Y | Y | MS | Cited pages are not included |
| | | | R.89 | Y | Y | MS | in this reference. |
| 1.15 | 1982 | Bander, T.J. | | | | | |
| 1.16 | 1976 | Barney, G.S. | | | | | |
| 1.17 | 1984 | Barney, G.S. | | | | | |
| 2.1 | 1983 | Basalt Waste Isol. Proj. | F.34 | | | JTH | Ref doc wasn't available for review. |
| 2.2 | 1984 | Beasley,T.M.&C.D.Jennings | | | | | |
| 2.3 | 1970 | Bechtel Corp. | | | | | |
| 2.5 | 1960 | Benson, D.W. | 0.39 | Y | Y | CB | |
| 2.6 | 1963 | Berg, J.W. and C.D. Baker | 4.8 | Y | Y | GB | |
| 2.7 | 1984 | Bjornstad, B.N. | 0.4 | N | | MS | Reference illegible. |
| 2.9 | 1981 | Bond, F.W. et al. | 0.24 | Y | Y | MS | |
| 2.10 | 1982 | Bond, F.W. et al. | M.16,17 | Y | Y | MS | |
| 2.11 | 1984 | Bone, M.J. and T.J. Schruben | M.1,6 | Y | N | MS | Little relation to Hanford. |
| 2.13 | 1971 | Braden, D.E. et al. | | | | | |
| 2.14 | 1982 | Bresler, E. et al. | 0.22 | Y | Y | CB | Most data in a secondary reference: Olsen & Kemper, 1968. |
| 2.15 | 1923 | Bretz, J.H. | 0.5 | Y | Y | MS | Cited pages are not included in this reference. |
| 2.16 | 1983 | Brodzinski, R.L. et al. | | | | | |

(1) Comments requiring more than two comment lines on this table are found in Chapter 4.

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| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 2.17 | 1959 | Brown, D.J. | 0.2 | Y | Y | MS | |
| 2.18 | 1960 | Brown, D.J. | 4.7 | N | - | GB | Not significant. |
| 3.1 | 1960 | Brown, D.J. | Q.33 | Y | Y | MS | See Chapter 4. |
| 3.2 | 1977 | Brown, D.J. and R.E. Isaacson | | | | | |
| 3.3 | 1979 | Brown, D.J. et al. | | | | | |
| 3.4 | 1948 | Brown, R.E. and H.G. Ruppert | | | | | |
| 3.5 | 1950 | Browne, R.E. and H.G. Ruppert | | | | | |
| 3.6 | 1971 | Brownell, L.E. et al. | M.9 | Y | N | MS | |
| 3.7 | 1975 | Brownell, L.E. et al. | M.9 | Y | N | MS | |
| 3.8 | 1985 | Bryan, G.H. and J.R. Divine | | | | | |
| 3.9 | 1979 | Bull, C. | R.3 | Y | N | MS | Cited statement cannot be found in ref. |
| 3.10 | 1983 | Caggiano,J.A.&D.W.Duncan,eds. | 4.8 | N | | GB | Not significant. |
| 3.12 | 1971 | Cearlock, D.B. et al. | 0.25 | Y | Y | MS | |
| 3.13 | 1975 | Cearlock, D.B. et al. | 0.25 | Y | Y | MS | |
| 3.14 | 1963 | Chepil, W.S. and N.P. Woodruff | | | | | |
| 3.15 | 1983 | Chick, L.A. and R.P. Turcotte | | | | | |
| 3.16 | 1984 | Chick, L.A. et al. | | | | | |
| 3.17 | 1978 | Christian, J.D. et al. | | | | | |
| 4.1 | 1983 | Clark, L.L. et al. | | | | | |
| 4.2 | 1984 | Clements, T.L. et al. | | | | | |
| 4.3 | 1977 | Cline, J.F. et al. | 4.19 | Y | Y | MS | |
| 4.4 | 1980 | Cline, J.F. et al. | M.1 | Y | Y | MS | See Chapter 4. |
| | | | M.10 | Y | Y | | See Chapter 4. |
| 4.5 | 1985 | Cline, C.S. et al. | V.3 | Y | Y | MS | |
| 4.6 | 1980 | Cloninger, M.O. et al. | | | | | |
| 4.7 | 1984 | Cluett, C. et al. | | | | | |
| 4.9 | 1982 | Coles, D.G. and L.D. Ramspott | 0.38 | Y | Y | CB | - |
| 4.10 | 1969 | Corps of Engineers | | | | | |
| 4.11 | 1969 | Corps of Engineers | | | | | |
| 4.13 | 1981 | Council on Env. Qual. | P | Y | N | GS | No citation of document found in text. |
| 4.14 | 1985 | Craig, R.E. and J.P. Hanson | R.89 | Y | N | MS | |
| | | | R.90 | Y | N | | |
| 4.15 | 1972 | Cryer, M.A. and K.F. Baverstock | | | | | |

| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 4.16 | 1983 | Dahlke, H.J.C.&C. DeFigh-Price | | | | | |
| 4.17 | 1984 | Darby, S.C. | | | | | |
| 4.18 | 1970 | Daubenmire, R. | | | | | |
| 5.2 | 1978 | Davis, J.A. et al. | | | | | |
| 5.5 | 1982 | DeFigh-Price, C. | P.13 | Y | Y | CB | Data questioned not confirmed. |
| 5.6 | 1983 | Delegard,C.H.&S.A.Gallagher | 0.39 | Y | Y | CB | - |
| 5.7 | 1983 | Delegard,C.H.&G.S.Barney | 0.39 | Y | Y | CB | - |
| 5.9 | 1978 | Dennis, A.W. et al. | | | | | |
| 5.10 | 1979 | Dept. of Energy (DOE) | 3.42 | N | | GB | Missing |
| 5.11 | 1979 | Dept. of Energy (DOE) | G.2 | N | - | JTH | Ref doc not available for review. |
| 5.12 | 1980 | Dept. of Energy (DOE) | - | N | - | GB | 1500 pg document (DOE/EIS-0026 VC-70) |
| | | | 4.4 | N | - | GB | Not feasible to check. |
| | | | G.2 | | | JTH | WIPP manpower est. were not confirmed. |
| 5.13 | 1980 | Dept. of Energy (DOE) | 4.1 | N | - | GB | Not significant. |
| | | | A.1 | Y | Y | JTH | - |
| | | | A.3 | Y | Y | JTH | - |
| | | | A.11 | Y | Y | JTH | - |
| 5.14 | 1980 | Dept. of Energy (DOE) | 3.42 | N | | GB | Not significant. |
| | | | G.2 | | | JTH | Ref doc not available for review. |
| 5.15 | 1980 | Dept. of Energy (DOE) | | | | | |
| 5.16 | 1981 | Dept. of Energy (DOE) | 4.1 | Y | Y | GB | Document shows page standards. |
| | | | E.13 | Y | N | JTH | See Chapter 4. |
| | | | H.10 | Y | N | JTH | See Chapter 4. |
| 5.17 | 1982 | Dept. of Energy (DOE) | 4.1 | N | - | GB | Not significant. |
| | | | 4.0 | N | - | GB | Not significant. |
| 5.18 | 1982 | Dept. of Energy (DOE) | 3.13 | Y | | GB | See Chapter 4. |
| 5.19 | 1982 | Dept. of Energy (DOE) | B.15,H.21 | | | JTH | Ref doc not available for review. |
| 6.1 | 1982 | Dept. of Energy (DOE) | | | | | |
| 6.2 | 1983 | Dept. of Energy (DOE) | | | | | |
| 6.3 | 1983 | Dept. of Energy (DOE) | 2.1 | Y | Y | GB | Citation on page 3. |
| 6.4 | 1983 | Dept. of Energy (DOE) | 3.42 | N | - | GB | Not significant. |
| 6.5 | 1983 | Dept. of Energy (DOE) | | | | | |
| 6.6 | 1985 | Dept. of Energy (DOE) | Missing | Y | N | GB | See Chapter 4. |



| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| | | | from Ch.2 | | | | |
| 6.7 | 1984 | Dept. of Energy (DOE) | 0.2 | Y | Y | MS | See Chapter 4. |
| | 1984 | Dept. of Energy (DOE) | 0.27 | Y | N | MS | |
| | | | 4.8 | Y | Y | GB | |
| 6.8 | 1982 | Dept. of Energy (DOE) | | | | | |
| 6.9 | 1984 | Dept. of Energy (DOE) | D.5 | Y | N | JTH | See Chapter 4. |
| | | | P.7 | N | N | JTH | See Chapter 4. |
| 6.10 | 1984 | Dept. of Energy (DOE) | B.3 | Y | Y | JTH | Requirement for double containment confirmed. |
| | | | B.7 | Y | Y | JTH | Requirement for double containment confirmed. |
| | | | B.16 | Y | N | JTH | See Chapter 4. |
| | | | E.2 | Y | Y | JTH | |
| 6.11 | 1982 | Department of Labor | | | | | |
| 6.13 | 1982 | Dove, F.H. et al. | 0.6 | Y | Y | MES | |
| 6.14 | 1983 | Dove, F.H. | | | | | |
| 6.16 | 1981 | Dunning, D.E. and G. Schwarz | | | | | |
| 6.18 | 1983 | Eddy, P.A. et al. | | | | | |
| 6.19 | 1980 | Emery, R.M. and M.C. McShane | | | | | |
| 6.20 | 1975 | Energy Res. & Dev. Adm. (ERDA) | V.6 | Y | Y | MS | |
| | | | U.1 | Y | Y* | CB | *Difficult to determine if these are the only carbon sources. |
| | | | 3.2 | | | GB | |
| | | | 3.4 | | | GB | |
| | | | 4.1 | N | N | GB | Not significant. |
| | | | A.1 | Y | Y | JH | - |
| | | | A.7 | Y | Y | JH | - |
| | | | A.19 | Y | Y | JH | - |
| | | | A.23 | Y | Y | JH | - |
| | | | F.39 | Y | Y | JH | - |
| 7.1 | 1976 | Energy Res. & Dev. Adm. (ERDA) | | | | | |
| 7.2 | 1977 | Energy Res. & Dev. Adm. (ERDA) | 3.1 | | | GB | Not included in Ch.3 ref. list. |
| 7.3 | 1980 | Energy Systems Group (ESG) | 3.32 | N | | GB | None. |

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| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| | | | H.16 | | | JH | Est. slurry pumping rate not found in the reference document. |
| 7.4 | 1973 | Enfield, C.G. et al. | M.9 | Y | N | MS | See Chapter 4. |
| 7.5 | 1966 | Engel, R.L. et al. | | | | | |
| 7.7 | 1977 | Env. Prot. Agency (EPA) | | | | | |
| 7.8 | 1978 | Env. Prot. Agency (EPA) | | | | | |
| 7.9 | 1979 | Env. Prot. Agency (EPA) | | | | | |
| 7.10 | 1979 | Env. Prot. Agency (EPA) | | | | | |
| 7.11 | 1984 | Env. Prot. Agency (EPA) | | | | | |
| 7.13 | 1985 | Env. Prot. Agency (EPA) | F.36 | Y | Y | JH | EPA 1982 should read "EPA 1985a". |
| | | | F.39 | Y | Y | JH | - |
| | | | S.1 | Y | Y | JH | - |
| 7.14 | 1985 | Env. Prot. Agency (EPA) | | | | | |
| 7.15 | 1979 | Erdal, B.R. et al. | | | | | |
| 7.16 | 1979 | Fecht, K.R. et al. | Q.2 | Y | N | MS | |
| 7.17 | 1983 | Fed. Emerg. Mgmt. Agency (FEMA) | | | | | |
| 8.1 | 1973 | Fed. Register | | | | | |
| 8.3 | 1984 | Felmy, A.R. et al. | 0.38 | Y | Y | CB | - |
| | | | 0.39 | Y | Y | CB | - |
| 8.4 | 1984 | Fields, D.E. et al. | | | | | |
| 8.5 | 1973 | Fitzner, R.E. and K.R. Price | | | | | |
| 8.6 | 1975 | Fitzner, R.E. and W.H. Rickard | | | | | |
| 8.7 | 1979 | Fitzner, R.E. and R.G. Schreckhise | | | | | |
| 8.8 | 1979 | Fitzner, R.E. et al. | M.10 | Y | Y | MS | |
| 8.9 | 1981 | Fitzner, R.E. et al. | | | | | |
| 8.10 | 1980 | Fitzner, R.E. et al. | | | | | |
| 8.11 | 1971 | Fletcher, J.F.&W.L.Dotson, comps. | | | | | |
| 8.12 | 1966 | Galley, J.E. | M.8 | Y | Y | MS | |
| 8.13 | 1965 | Gardner, W.R. | | | | | |
| 8.14 | 1979 | Gee, G.W. and C.S. Simmons | M.17 | Y | Y | MS | |
| 8.15 | 1981 | Gee, G.W. et al. | 0.39 | Y | Y | CB | - |
| 8.16 | 1981 | Gee, G.W. et al. | M.1 | Y | N | MS | Not relevant to DEIS. |

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| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| 8.17 | 1984 | Gee, G.W. and R.R. Kirkham | M.9 | Y | Y | MS | |
| 8.18 | 1985 | Gee, G.W. and P.R. Heller | M.9 | Y | N | MS | |
| 9.1 | 1983 | Gelhar, L.W. and C.L. Axness | | | | | |
| 9.2 | 1976 | Gephart, R.E. et al. | | | | | |
| 9.3 | 1979 | Gephart, R.E. et al. | | | | | |
| 9.5 | 1980 | Godbee, H.W. et al. | P.18 | Y | Y | CB | - |
| 9.6 | 1981 | Graham, M.J. | | | | | |
| 9.7 | 1981 | Graham, M.J. et al. | V.1 | Y | Y | MS | |
| 9.8 | 1983 | Graham, M.J. | | | | | |
| 9.9 | 1984 | Graham, M.J. et al. | Q.2 | Y | Y | MS | |
| 9.10 | 1977 | Gray, R.H. and D.D. Dauble | | | | | |
| 9.11 | 1984 | Grazulis, T.P. | | | | | |
| 9.12 | 1979 | Grieve, R.A.F.& P.B.Robertson | | | | | |
| 9.13 | 1978 | Gupta, S.K. et al. | M.16 | Y | Y | MS | |
| 9.15 | 1966 | Hajek, B.F. | 0.39 | Y | Y | CB | - |
| 9.16 | 1982 | Hakonson, T.E. et al. | M.10 | Y | Y | MS | |
| 9.17 | 1959 | Haney, W.A. and C.E. Linderoth | V.3 | Y | Y | MS | |
| 9.18 | 1967 | Eff.of Ben Franklin Dam on Hanf | | | | | |
| 9.19 | 1980 | Hanks, R.J. and G.L. Ashcroft | 0.17 | Y | Y | MS | Statement not made explicitly, but is mathematically implied. |
| 10.1 | 1973 | Hanson, G.L. et al. | | | | | |
| 10.2 | 1971 | Hanson, W.C. and L.L. Eberhardt | | | | | |
| 10.3 | 1981 | Hartley, J.N. and G.W. Gee | M.1 | Y | N | MS | Not relevant to DEIS. |
| | 1982 | Harwell et al. | 0.29 | N | N | CB | No reference available. |
| 10.4 | 1980 | Hayward, W.M. and R.J. Jensen | | | | | |
| 10.6 | 1982 | Herzog, D.L. et al. | M.1,6 | Y | Y | MS | See Chapter 4. |
| 10.7 | 1976 | Hillel, D. and C.H.M. Van Bavel | M.3 | Y | Y | MS | See Chapter 4. |
| 10.8 | 1977 | Hillel, D. | M.3 | Y | Y | MS | See Chapter 4. |
| 10.9 | 1977 | Hillel, D. and H. Talpaz | M.3 | Y | Y | MS | See Chapter 4. |
| 10.10 | 1975 | Hinds, W.T. | 4.19 | Y | Y | MS | |
| 10.11 | 1977 | Hoenes, G.R. and J.K. Soldat | | | | | |
| 10.12 | 1984 | Hoffman, F.O. et al. | | | | | |
| 10.14 | 1974 | Houston, J.R. et al. | F.15 | Y | Y | JH | - |

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| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| | | | F.18 | Y | Y | JH | - |
| 10.15 | 1978 | Houston, J.R. and P.J. Blumer | 4.4 | N | - | GB | Not significant. |
| 10.16 | 1979 | Houston, J.R. and P.J. Blumer | 4.4 | N | - | GB | Not significant. |
| 10.17 | 1979 | Houston, J.R. and P.J. Blumer | 4.4 | N | - | GB | Not significant. |
| 10.18 | 1980 | Houston, J.R. and P.J. Blumer | 4.4 | N | - | GB | Not significant. |
| 10.19 | 1980 | Houston, J.R. and P.J. Blumer | 4.4 | N | - | GB | Not significant. |
| 11.1 | 1973 | Hsieh, J.J.C. et al. | M.9 | Y | N | MS | |
| 11.2 | 1973 | Hsieh, J.J.C. et al. | | | | | |
| 11.3 | 1983 | Hubbard, L.L. et al. | | | | | |
| 11.5 | 1981 | Intl. Atomic Energy Agency | F.30 | | | JH | Ref doc not available for review. |
| 11.6 | 1982 | Intl. Atomic Energy Agency | | | | | |
| 11.7 | 1984 | Intl. Atomic Energy Agency | | | | | |
| 11.8 | 1959 | Intl.Comm.,Radiological Prot. | F.6 | Y | Y | JH | - |
| | | | F.11 | Y | Y | JH | Individual ventilation rate confirmed. |
| | | | F.15 | Y | Y | JH | - |
| 11.9 | 1966 | Intl.Comm.,Radiological Prot. | F.6 | Y | Y | JH | - |
| | | | F.11 | Y | Y | JH | - |
| | | | F.15 | Y | Y | JH | - |
| 11.10 | 1975 | Intl.Comm.,Radiological Prot. | F.6 | | | JH | Ref doc not available for review. |
| 11.12 | 1977 | Intl.Comm.,Radiological Prot. | F.8 | Y | Y | JH | - |
| | | | N.7 | Y | Y | JH | - |
| 11.13 | 1979 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1970 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1979 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1980 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1981 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1981 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1982 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.14 | 1982 | Intl.Comm.,Radiological Prot. | | | | | |
| 11.15 | 1974 | Isaacson, R.E. et al. | M.9 | Y | Y | MS | Soil moistures reported 5% to 9% by volume in sand/loamy sand as opposed to 2-5% by weight reported in the DEIS. |

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| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 11.16 | 1974 | Isaacson, R.E. et al. | | Y | | MS | |
| 11.17 | 1978 | Isaacson, R.E. and D.J. Brown | M.9 | Y | N | MS | |
| | | | 0.12 | Y | N | MS | |
| 12.1 | 1984 | Jablon, S. | N.5,Abs.151 | Y | Y | JH | - |
| 12.2 | 1982 | Jamison, J.D. | 4.1 | N | - | GB | Not significant. |
| | | | 4.3 | N | - | GB | Not significant. |
| 12.3 | 1985 | Javitz, H.S. et al. | | | | | |
| 12.4 | 1978 | Jefferson,R.M.& H.R.Yoshimura | | | | | |
| 12.5 | 1979 | John, B.S., ed. | | | | | |
| 12.6 | 1983 | Johnson, T.M. et al. | M.1,6 | Y | Y | MS | See Chapter 4. |
| 12.7 | 1985 | Joint Integration Office (JIO) | | | | | |
| 12.8 | 1978 | Jones, T.L. | M.9 | Y | N | MS | |
| 12.9 | 1984 | Jones, T.L. and G.W. Gee | M.9 | Y | N | MS | |
| 12.10 | 1984 | Jones, T.L. et al. | M.9 | Y | N | MS | |
| 12.11 | 1971 | Joseph, A.B. et al. | | | | | |
| 12.12 | 1982 | Jury, W.A. | | | | | |
| 12.13 | 1979 | Kasper, R.B. et al. | V.3,9,11,12 | Y | Y | MS | |
| 12.14 | 1981 | Kasper, R.B. | V.3,6,8 | Y | Y | MS | |
| | | | V.6 | | | | |
| 12.15 | 1981 | Kasper, R.B. | V.3,6 | Y | Y | MS | |
| 12.16 | 1982 | Kato, H. and W.J. Schull | | | | | |
| 12.17 | 1984 | Kennedy, W.E. and B.A. Napier | | | | | |
| 12.18 | 1981 | Kerr, G.D. | | | | | |
| 12.19 | 1983 | Kinnison, R.R. | M.18 | Y | Y | MS | See Chapter 4. |
| 13.1 | 1972 | Kipp, K.L. et al. | 0.24,25 | Y | Y | MS | |
| | | | V.3 | Y | Y | MS | |
| 13.2 | 1984 | Kirkham, R.R. and G.W. Gee | M.9 | Y | Y | MS | |
| | | | 0.12 | Y | Y | MS | |
| 13.3 | 1979 | Kirstein, B.E. et al. | | | | | |
| 13.4 | 1979 | Klepper, E.L. et al. | V.3,4 | Y | Y | MS | |
| 13.5 | 1966 | Knoll, K.C. | 0.39 | Y | Y | CB | - |
| 13.6 | 1969 | Knoll, K.C. | 0.39 | Y | Y | CB | - |
| 13.7 | 1980 | Kocher, D.C. | | | | | |

| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 13.8 | 1979 | Kukla, G.K. | M.18 | Y | N | MS | Contrary to the citations, reference did not report specific precipitation amounts. |
| | | | P.15 | | | JH | Wetter annual precip. rate was not confirmed. |
| 13.9 | 1981 | Landeen, D.S. and R.M. Mitchell | | | | | |
| 13.10 | 1976 | Last, G.V. et al. | O.10 | Y | N | MS | |
| 13.12 | 1982 | Leggett, R.W. et al. | | | | | |
| 13.13 | 1980 | Leonhart, L.S. | | | | | |
| 13.14 | 1979 | Lindberg, J.W. and F.W. Bond | Q.31 | Y | N | MS | |
| 13.15 | 1979 | Lindsay, W.L. | U.3 | Y | N | CB | No fluoride info in ref. Incomplete. |
| 13.16 | 1980 | Little, A.D. | | | | | |
| 14.1 | 1981 | Loewe, W.E. and E. Mendelsohn | | | | | |
| 14.2 | 1978 | Ludowise, J.D. | | | | | |
| 14.3 | 1983 | Madsen, M.M. et al. | | | | | |
| 14.4 | 1983 | Madsen, M.M. and E.L. Wilmot | | | | | |
| 14.6 | 1980 | Malhotra, S. and D. Manninen | | | | | |
| 14.7 | 1974 | Markee, E.H. et al. | | | | | |
| 14.8 | 1985 | Marratt, M.C. et al. | | | | | |
| 14.9 | 1980 | McClure, J.D. and E.L. Emerson | | | | | |
| 14.11 | 1984 | McCormack, W.D. et al. | F.4 | Y | Y | JH | - |
| | | | F.14 | Y | Y | JH | - |
| | | | H.12 | Y | N | RB | Most current population data not used. |
| | | | H.13 | Y | Y | JH | - |
| 14.12 | 1982 | McDaniel, E.W. et al. | | | | | |
| 14.13 | 1977 | McKee, E.H. et al. | 4.7 | N | - | GB | Not significant. |
| 14.14 | 1981 | McKee, E.H. et al. | 4.7 | N | - | GB | Not significant. |
| 14.15 | 1982 | McKenzie, D.H. et al. | M.10 | Y | Y | MS | |
| 14.17 | 1980 | McVay, G.L. and C.Q. Buckwalter | | | | | |
| 14.18 | 1975 | Medical Research Council | | | | | |
| 15.1 | 1979 | Meinhardt, C.C. and J.C. Frosteson | | | | | |
| 15.2 | 1978 | Mendel, J.E. | | | | | |
| 15.3 | 1917 | Merriam, J.C. and J.P. Buwalda | O.2 | Y | N | MS | |

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| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 15.4 | 1963 | Miller, D.E. and J.S. Aarstad | M.6 | Y | N | MS | Not applicable. |
| | | | M.18 | Y | N | MS | |
| 15.5 | 1969 | Miller, D.E. | M.6 | Y | Y | MS | See Chapter 4. |
| 15.6 | 1973 | Miller, D.E. | M.5 | Y | Y | MS | Does not report field observations. |
| 15.7 | 1983 | Mills, M. and D. Vogt | | | | | |
| 15.8 | 1973 | Mishima, J. and L.C. Schwendima | | | | | |
| 15.9 | 1975 | Mishima, J. | | | | | |
| 15.10 | 1986 | Mishima, J. et al. | H.11 | Y | N | RB | No discussion of conversion factors. |
| 15.11 | 1983 | Mitchell, T.H. and K.A. Bergstr | 4.7 | N | - | GB | Not significant. |
| 15.12 | 1981 | Moody, J.B. | O.38 | Y | Y | CB | - |
| 15.13 | 1977 | Moore, J.G. et al. | P.18 | Y | Y | CB | - |
| 15.14 | 1979 | Moore, R.E. et al. | | | | | |
| 16.1 | 1982 | Muller, A.B. et al. | O.7 | Y | Y | CB | Listed as 1983 in EIS, should be 1982. |
| 16.2 | 1977 | Mullineaux, D.R. et al. | O.5 | Y | Y | MS | |
| 16.3 | 1980 | Murphy, E.S. and G.M. Holter | | | | | |
| 16.4 | 1983 | Murthy, K.S. et al. | R.47 | Y | Y | MS | Only reports and endorses results of others with respect to groundwater. |
| | | | A.6 | Y | Y | JH | - |
| | | | A.17 | Y | Y | CB | - |
| | | | B.1 | Y | Y | JH | No. confirmed leakers checked. |
| | | | B.3 | Y | Y | JH | See Chapter 4. |
| 16.5 | 1979 | Myers, C.W. et al. | O.4 | Y | Y | MS | |
| - | 1979 | Myers and Price | 4.8,4.10 | N | N | GB | Ref not provided-not significant though |
| 16.6 | 1981 | Myers, C.W. and S.M. Price, eds | 4.7 | Y | Y | GB | |
| 16.7 | 1980 | Napier, B.A. et al. | | | | | |
| 16.8 | 1980 | Napier, B.A. et al. | | | | | |
| 16.9 | 1981 | Napier, B.A. | | | | | |
| 16.10 | 1982 | Napier, B.A. | | | | | |
| 16.12 | 1984 | Napier, B.A. et al. | | | | | |
| 16.13 | 1986 | Napier, B.A. et al. | | | | | |
| 16.17 | 1978 | Natl.Acad.Sci.-Natl.Res.Council | M.8 | Y | Y | MS | Only one page-doesn't discuss groundwater, but not important. |
| | | | 4.4 | N | - | GB | Not significant. |

| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| 17.1 | 1983 | Natl.Acad.Sci.-Natl.Res.Council | | | | | |
| 17.2 | 1984 | Natl.Aeronautics&Space Admin. | | | | | |
| 17.3 | 1975 | Natl.Council,Radiation Prot. | 4.4 | N | - | GB | Not significant. |
| 17.4 | 1980 | Natl.Council,Radiation Prot. | | | | | |
| 17.5 | 1969 | National Env. Pol. Act of 1969 | | | | | |
| 17.6 | 1985 | National Institutes of Health | | | | | |
| 17.7 | 1985 | National Safety Council | | | | | |
| 17.8 | 1984 | Neuhauser, K.S. et al. | | | | | |
| 17.9 | 1972 | Newcomb, R.C. et al. | 0.2 | Y | Y | MS | |
| 17.10 | 1985 | Nickmann, R.J. and E. Leopold | R.3 | Y | N | MS | |
| 17.11 | 1974 | Nuclear Reg. Comm. | | | | | |
| 17.12 | 1975 | Nuclear Reg. Comm. | 4.1 | N | - | GB | Not significant. |
| 17.13 | 1975 | Nuclear Reg. Comm. | N.2 | Y | Y | JH | - |
| 17.14 | 1977 | Nuclear Reg. Comm. | | | | | |
| 17.15 | 1977 | Nuclear Reg. Comm. | F.20 | Y | Y | JH | - |
| | | | F.30 | Y | N | JH | Ref to HERMES code not found. |
| 17.16 | 1977 | Nuclear Reg. Comm. | | | | | |
| 17.17 | 1981 | Nuclear Reg. Comm. | F.31 | Y | N | JH | Only Vol.2 of 4 vols. provided. |
| 18.1 | 1982 | Nuclear Reg. Comm. | 4.1 | N | - | GB | Not significant. |
| | | | F.4 | Y | N | JH | See Chapter 4. |
| | | | F.32 | Y | Y | JH | - |
| 18.2 | 1982 | Nuclear Reg. Comm. | | | | | |
| 18.3 | 1982 | Nuclear Reg. Comm. | F.31 | Y | Y | JH | - |
| 18.5 | 1985 | Nuclear Reg. Comm. | N.6 | Y | Y | JH | See Chapter 4. |
| | | | N.2 | Y | Y | JH | - |
| | | | N.4 | Y | Y | JH | - |
| | | | N.5 | Y | Y | JH | - |
| | | | N.7 | Y | Y | JH | - |
| | | | N.9 | Y | Y | JH | - |
| 18.6 | 1977 | Nuclear Sci. Corp. | | | | | |
| 18.7 | 1982 | Nuclear Waste Policy Act | 2.1 | Y | Y | GB | |
| 18.8 | 1983 | Ofc. of Nuclear Waste Isolation | F.34 | Y | N | JH | See Chapter 4. |
| 18.10 | 1984 | Ofc. of Nuclear Waste Isolation | | | | | |



| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| 18.11 | 1968 | Orem, H.M. | | | | | |
| 18.12 | 1966 | Orr, C., Jr. | H.17 | Y | Y | JH | - |
| 18.13 | 1973 | Papworth, D.G. and J. Vennart | F.8 | Y | Y | JH | - |
| 18.15 | 1980 | Parkhust, D.L. et al. | 0.38 | Y | Y | CB | - |
| 18.16 | 1978 | PEDCo. | | | | | |
| 18.17 | 1985 | Perf.Assess.Natl.Rev.Grp. | F.36 | Y | Y | JH | (Typo:"1984" should read "1985".) |
| | | | F.41 | Y | Y | JH | (Typo:"1984" should read "1985".) |
| 19.1 | 1984 | Perry, J.H., ed. | H.16 | Y | Y | JH | - |
| 19.2 | 1983 | Piott, J. and D. Schau | | | | | |
| 19.3 | 1984 | Piott, J. and D. Schau | | | | | |
| 19.5 | 1984 | Prater, L.S. et al. | 4.3 | N | - | GB | Not significant. |
| | | | V.3,9 | Y | Y | MS | |
| 19.6 | 1975 | Price, S.M. and L.L. Ames | | | | | |
| 19.14 | 1979 | Price, S.M. et al. | 0.4 | Y | N | MS | Citation is improper. |
| | | | V.3 | Y | Y | MS | |
| 19.15 | 1982 | Price, E.H. | | | | | |
| 19.16 | 1984 | Price, K.R. et al. | 4.14 | N | - | GB | Not significant. |
| | | | H.10 | Y | Y | JH | - |
| | | | F.30 | Y | Y | JH | - |
| | | | F.39 | Y | Y | JH | - |
| 19.17 | 1985 | Price, K.R. et al. | 4.1 | Y | Y | GB | Typo-85Kr was shown in EIS as 85K. |
| | | | 4.3 | N | - | GB | Not significant. |
| 19.18 | 1982 | Public Law 97-90 | 4.3 | N | N | GB | Couldn't find no./Not major concern. |
| 20.1 | 1980 | Quinn, D.J. et al. | H.10 | Y | N | RB | No mention of ferrocyanide precipitates |
| 20.2 | 1977 | Rai, D. and R.J. Serne | 0.39 | Y | Y | CB | - |
| 20.3 | 1978 | Rai, D. and R.J. Serne | 0.39 | Y | Y | CB | - |
| 20.4 | 1980 | Rai, D. et al. | P.19 | Y | Y | JH | - |
| | | | P.19,0.39 | Y | Y | CB | - |
| 20.5 | 1981 | Rai, D. et al. | P.19 | Y | Y | JTH | - |
| | | | P.19,0.39 | Y | Y | CB | - |
| 20.6 | 1982 | Rai, D. et al. | 0.39 | Y | Y | CB | - |
| 20.7 | 1983 | Rai, D. and J.L. Ryan | 0.39 | Y | Y | CB | - |
| 20.8 | 1984 | Rai, D. et al. | U.3 | Y | N | CB | Couldn't derive cadmium concentrations |

| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | | from reference. |
| 20.9 | 1981 | Ramsdell, J.V. | | | | | |
| 20.10 | 1985 | Rand McNally | | | | | |
| 20.11 | 1982 | Rao, R.K. et al. | | | | | |
| 20.12 | 1967 | Rasmussen, N.H. | 4.8 | Y | Y | GB | - |
| 20.13 | 1967 | Raymond, J.R. and V.L. McGhan | V.3 | Y | Y | MS | - |
| 20.14 | 1981 | Reardon,E.J. | 0.38 | Y | Y | CB | - |
| 20.15 | 1963 | Reisenauer, A.E. | M.9 | Y | N | MS | |
| 20.17 | 1979 | Reisenauer, A.E. | U.4 | Y | Y | CB | |
| | | | V.3 | Y | Y* | MS | |
| 20.18 | 1979 | Reisenauer, A.E. | U.4 | Y | Y | CB | |
| | | | V.3 | Y | Y* | MS | |
| 20.19 | 1979 | Reisenauer, A.E. | U.4 | Y | Y | CB | |
| | | | V.3 | Y | Y* | MS | |
| 21.1 | 1982 | Reisenauer, A.E. et al. | 0.23 | Y | Y | MS | |
| 21.3 | 1956 | Rhodes, D.W. | | | | | |
| 21.4 | 1957 | Rhodes, D.W. | 0.39 | Y | Y | CB | - |
| 21.5 | 1968 | Rice, D.G. | | | | | |
| 21.6 | 1968 | Rice, D.G. | | | | | |
| 21.7 | 1931 | Richards, L.A. | 0.16 | Y | Y | MS | |
| 21.8 | 1950 | Richards, L.A. | M.3 | Y | Y | MS | |
| 21.9 | 1980 | Richardson, G.L. | H.21 | Y | N | JH | See Chapter 4. |
| 21.10 | 1973 | Robertson, D.E. et al. | | | | | |
| 21.11 | 1979 | Rock.Hanf.Ops.&Kaiser Engrs. | P.12 | Y | Y | JH | - |
| 21.14 | 1985 | Rockwell Hanf. Opers. | 3.5 | Y | Y | GB | |
| | | | 3.18 | Y | Y | GB | |
| | | | E.6 | Y | Y | JH | - |
| | | | E.7 | Y | Y | JH | - |
| 21.16 | 1983 | Rockwell Hanf. Opers. | J.2 | Y | Y | JH | - |
| 21.17 | 1983 | Rockwell Hanf. Opers. | | | | | |
| 21.18 | 1985 | Rockwell Hanf. Opers. | A.1 | Y | Y | JH | - |
| | | | B.1 | Y | Y | JH | - |
| | | | B.30 | Y | Y | JH | See Chapter 4. |

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| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| | | | B.31 | Y | N | JH | See Chapter 4. |
| | | | B.33 | Y | Y | JH | See Chapter 4. |
| | | | E.2 | Y | Y | JH | - |
| | | | E.3 | Y | Y | JH | - |
| | | | G.2 | Y | Y | JH | - |
| | | | H.22 | Y | Y | JH | - |
| | | | P.12 | Y | Y | JH | - |
| | | | P.20 | Y | Y | JH | - |
| | | | P.22 | Y | Y | JH | - |
| | | | P.24 | Y | Y | JH | - |
| | | | P.25 | Y | Y | JH | - |
| | | | P.27 | Y | Y | JH | - |
| 21.19 | 1985 | Rockwell Hanf. Opers. | | | | | |
| 22.1 | 1977 | Rogers, L.E. and W.H. Rickard | 4.1 | N | - | GB | Not signficant. |
| 3.10 | 1983 | Rohay, A.C. and J.D. Davis | 4.8 | Y | Y | GB | |
| 22.3 | 1975 | Ross, W.A. and T.H. Smith | | | | | |
| 22.4 | 1972 | Routson, R.C. and R.J. Serne | 0.39 | Y | Y | CB | - |
| 22.5 | 1976 | Routson, R.C. et al. | 0.39 | Y | Y | CB | - |
| 22.6 | 1978 | Routson, R.C. et al. | 0.39 | Y | Y | CB | - |
| 22.7 | 1979 | Routson, R.C. et al. | 0.19 | Y | Y | MS | |
| 22.8 | 1980 | Routson, R.C. et al. | 0.39 | Y | Y | CB | - |
| 22.9 | 1981 | Routson, R.C. et al. | 0.39 | Y | Y | CB | - |
| 22.11 | 1980 | Roy, D.M. et al. | 0.4 | Y | Y | JH | - |
| 22.12 | 1983 | Roy, D.M. and C.A. Langton | 0.7 | Y | Y | JH | - |
| 22.13 | 1982 | Runkle, G.E. and J.K. Soldat | F.37 | Y | Y | JH | CRCP Index ICRP30/ICRP2 correction factors confirmed. |
| 22.14 | 1980 | Schulz, W.W. | | | | | |
| 22.15 | 1979 | Scott,B.L.et al.,eds. Tubbs in | R.92 | Y | Y* | MS | *Evidence is indirect. |
| 22.16 | 1976 | Sehmel, G.A. | M.24 | Y | Y | MS | |
| 23.1 | 1979 | Sehmel, G.A. | M.24 | Y | N | MS | |
| 23.2 | 1981 | Sehmel, G.A. | M.24 | Y | N | MS | |
| 23.3 | 1973 | Serne, R.J. et al. | | | | | |
| 23.4 | 1976 | Serne, R.J. and D. Rai | 0.39 | Y | Y | CB | - |

| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| 23.5 | 1983 | Serne, R.J. and J.F. Relyea | 0.14 | Y | Y | CB | Very good methods reference. Authors should have used this in evaluating which Kd data was reliable. |
| 23.6 | 1964 | Seymour, A.H. and G.B. Lewis | 4.12 | N | - | GB | Not significant. |
| 23.7 | 1983 | Shah, K.R. | | | | | |
| 23.8 | 1976 | Sheppard, J.C. et al. | 0.39 | Y | Y | CB | - |
| 23.9 | 1983 | Shirley, C.G. | | | | | |
| 23.10 | 1983 | Sillings, S.A. | 0.24 | Y | Y | MS | |
| 23.11 | 1981 | Simmons, C.S. | | | | | |
| 23.12 | 1981 | Simmons, C.S. and G.W. Gee | M.17 | Y | Y | MS | |
| | | | M.19 | Y | N | MS | |
| 23.13 | 1982 | Simmons, C.S. | | | | | |
| 23.14 | 1985 | Simmons, C.S. and C.R. Cole | M.16 | Y | Y | MS | |
| 23.15 | 1981 | Skaggs, R.L. and W.H. Walters | 4.12 | Y | ? | GB | See Chapter 4. |
| 23.16 | 1974 | Skidmore, E.L. | | | | | |
| 24.2 | 1981 | Slate, S.C. et al. | | | | | |
| 24.3 | 1985 | Smith, J.M. et al. | F.36,38 | Y | Y | JH | See Chapter 4. |
| 24.4 | 1979 | Smith, R.B. et al. | | | | | |
| 24.5 | 1980 | Smith, R.M. | | | | | |
| 24.5a | 1981 | Smith, R.M. | | | | | |
| 24.7 | 1971 | Soldat, J.K. | F.12 | Y | Y | JH | - |
| 24.8 | 1974 | Soldat, J.K. et al. | F.10,F.35 | Y | Y | JH | - |
| 24.9 | 1976 | Soldat, J.K. | F.6 | Y | Y | JH | - |
| 24.10 | 1981 | Sommer, D.J. et al. | F.19, H.12 | Y | Y | JH | - |
| 24.11 | 1976 | Speer, D.R. et al. | 4.4 | N | - | GB | Not significant. |
| 24.13 | 1983 | Stather, J.W. et al. | F.8 | Y | Y | JH | - |
| 24.14 | 1980 | Steindler, M.J. & W.B. Seefeldt | H.15 | Y | Y | JH | - |
| 24.15 | 1972 | Stone, W.A. et al. | H.23 | Y | Y | JH | - |
| 24.16 | 1983 | Stone, W.A. et al. | M.18 | Y | N | MS | |
| | | | 4.1 | N | - | GB | Not significant. |
| 24.17 | 1982 | Strait, S.R. and B.A. Moore | | | | | |
| 24.18 | 1973 | Strenge, D.L. and E.C. Watson | F.30 | Y | Y | JH | - |
| 25.1 | 1975 | Strenge, D.L. | F.15 | Y | Y | JH | - |

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| Ref. No. | Year | Reference | EIS_Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Ini-tial | Comments |
|---|---|---|---|---|---|---|---|
| | | | F.16 | Y | Y | JH | Wrong reference cited. |
| 25.2 | 1975 | Strenge, D.L. et al. | F.15,16,18 | Y | Y | JH | - |
| 25.3 | 1980 | Strenge, D.L. et al. | F.15,18 | Y | Y | JH | - |
| | | | H.? | N | N | JH | No specific citation found in App.H. |
| 25.4 | 1983 | Sula, M.J. et al. | | | | | |
| 25.5 | 1980 | Sutter, S.L. | H.16,22,23 | Y | Y | JH | |
| 25.6 | 1983 | Sutter, S.L. | H.19 | Y | N | JH | Statement not supported by ref doc. |
| 25.7 | 1979 | Swanson, D.A. et al. | 0.2 | Y | Y | MS | See Chapter 4. |
| 25.8 | 1979 | Tallman, A.M. et al. | Q.4 | Y | Y | MS | |
| 25.9 | 1981 | Tallman, A.M. et al. | 0.4 | Y | Y | MS | |
| 25.11 | 1982 | Taylor, J.M. and S.L. Daniel | | | | | |
| 25.12 | 1984 | Thompson, F.L. et al. | F.35 | Y | Y | JH | |
| 25.16 | 1983 | Tri-Cities Real Est. Rsrch. Com | . | | | | |
| 25.17 | 1981 | U.S. Army Corps of Engrs. | | | | | |
| 25.19 | 1976 | U.S. Geological Survey (USGS) | | | | | |
| 25.20 | 1985 | U.S. Geological Survey (USGS) | | | | | |
| 25.21 | 1971 | Unger, P.W. | M.6 | Y | Y | MS | |
| 26.1 | 1977 | UN Sci.Comm.on Atomic Radiation | F.8 | Y | N | JH | Confirmation of statement not found. |
| | | | N.2 | Y | Y | JH | - |
| | | | N.7 | Y | Y | JH | - |
| | | | N.9 | Y | N | JH | Confirmation of tabulated data not found. |
| | | | N.10 | Y | Y | JH | - |
| 26.2 | 1982 | UN Sci.Comm.on Atomic Radiation | | | | | |
| 26.4 | 1968 | Unruh, C.M. | | | | | |
| 26.5 | 1982 | Van Luik, A.E. and R.M. Smith | V.3 | Y | Y | MS | |
| 26.6 | 1980 | Vine, E.N. et al. | | | | | |
| 26.7 | 1980 | Wald, J.W. et al. | D.4 | Y | N | JH | See Chapter 4. |
| 26.8 | 1983 | Walker, F.W. et al. | P.41 | Y | Y | JH | Radionuclides half-lives confirmed. |
| 26.9 | 1980 | Wallace, R.W. et al. | | | | | |
| 26.12 | 1981 | WPPSS | | | | | |
| 26.13 | 1982 | Washington State | | | | | |
| 26.14 | 1984 | Washington State | | | | | |

| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 26.14 | 1984 | WAC | U.1 | N | N | CB | Not on reference list. |
| 26.15 | 1984 | WA State Emply.Sec.Dept.,Rsrch | | | | | |
| 26.16 | 1974 | Watkins, N.D. and A.K. Baksi | 4.7 | N | - | GB | Not significant. |
| 26.17 | 1961 | Watson, D.G. et al. | 4.12 | N | - | GB | Not significant. |
| 26.18 | 1970 | Watson, D.G. | | | | | |
| 26.19 | 1984 | Watson, E.C. et al. | | | | | |
| 27.2 | 1982 | West, J.M. et al. | | | | | |
| 27.3 | 1985 | West, J.M. et al. | | | | | |
| 27.4 | 1984 | West, J.M. and I.G. McKinley | 0.7 | Y | Y | CB | - |
| 27.5 | 1985 | Westinghouse Electric Corp. | E.1 | Y | Y | JH | - |
| 27.6 | 1977 | Weston Geophysical Research | 4.8 | N | - | GB | Not significant. |
| 27.7 | 1983 | Wilbur, J.S. et al. | | | | | |
| 27.8 | 1981 | Wilmot, E.L. | | | | | |
| 27.9 | 1981 | Wilmot, E.L. et al. | | | | | |
| 27.10 | 1983 | Wilmot, E.L. et al. | | | | | |
| 27.11 | 1981 | Winograd, I.J. | M.1,6 | Y | Y | MS | See Chapter 4. |
| 27.12 | 1980 | Winsor, T.E. and F.W. Whicker | | | | | |
| 27.13 | 1979 | Wolery, T.J. | 0.38 | Y | Y | CB | - |
| 27.14 | 1979 | Wolfsberg, K. et al. | | | | | |
| 27.15 | 1981 | Wolfsberg, K. et al. | | | | | |
| 27.16 | 1975 | Woodward-Clyde Consultants | | | | | |
| 27.18 | 1981 | Wuschke, D.M. et al. | F.36 | Y | Y | JH | - |
| 28.1 | 1980 | Yandon, K.E. and D.K. Landstrom | F.19 | Y | N | JH | Ref doc doesn't estimate down-river population. |
| 28.3 | 1982 | Young, J.K. et al. | D.4 | Y | N | JH | See Chapter 4. |
| 28.4 | 1980 | Zach, R. | F.16 | Y | Y | JH | - |
| 29.1 | 1975 | Anderson, J.D. | V.4 | Y | Y | MS | |
| 29.2 | 1982 | Kasper, R.B. | | | | | |
| 29.3 | 1983 | Last, G.V. | | | | | |
| 29.4 | 1973 | Smith, A.E. | | | | | |
| 29.5 | 1982 | Harwell, M.A. et al. | | | | | |
| 29.6 | 1985 | McGhan, V.L. et al. | V.1 | Y | Y | MS | |
| 29.7 | 1984 | Wash. Adm. Code (WAC) | | | | | |

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| Ref. No. | Year | Reference | EIS Page | Reference Checked Yes or No | Reference Confirmed Yes or No | Initial | Comments |
|---|---|---|---|---|---|---|---|
| 30.1 | 1981 | Blume, J.A. and Assoc. | | | | | |
| 30.2 | 1978 | Blume, J.A. and Assoc. | | | | | |
| 30.3 | 1982 | McKenzie, D.H. et al. | | | | | |
| 30.4 | 1981 | Westinghouse Electric Corp. | | | | | |
| 30.5 | 1985 | Heller, P.R. et al. | | | | | |
| 30.7 | 1985 | U.S.Code,Title40,Prts 1500-1508 | | | | | |
| 30.8 | 1985 | U.S. Code,Title10,Prt 60 | | | | | |
| 30.9 | 1975 | Natl.Council,Radiation Prot. | | | | | |
| 30.10 | 1981 | McClure, J.D. | | | | | |

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Southwest Washington Health District

A MULTI JURISDICTIONAL HEALTH DISTRICT ENCOMPASSING CLARK, KLICKITAT AND SKAMANIA COUNTIES

August 7, 1986

Richard L. Holten
Department of Defense Waste
Draft EIS
U. S. Department of Energy
P. O. Box 550
Richland, WA. 99352

0224

Dear Mr. Holten:

The purpose of this letter is to provide a response to the Draft Environemntal Impact Statement on behalf of the Southwest Washington Health District. The Board of Health passed resolution no. 85-20 in 1985. A copy of that resolution is enclosed for your information.

2.1.1 As you will note, the Board of Health opposes the placement of the proposed repository at Hanford until such time as the risks to the health and safety of the public can be assured. A review of the Environmental Impact Statement, together with information provided at a recent meeting of the Joint Nuclear Waste Management Boards for Oregon and Washington, demonstrates that health-related concerns are still associated with the Hanford site. Moreover, the process used by U.S. DOE to determine the 2.2.14 finalist three sites rated Hanford lower than four other potential sites on variables associated with health and safety. Finally, the decision by U.S. DOE to defer the legislatively mandated process to select a second repository site in the East is also of relevance to the concerns of the Board of Health. It is feasible that the results of this decision will (1) 2.1.8 increase the probability of Hanford's selection without the health risks being adequately addressed, and/or (2) increase the amount of high-level nuclear waste transported on Washington State highways and deposited at the Hanford facility.

These concerns are of significance to the Board of Health. In their behalf, I am relaying to you the continued opposition of the Board of Health for the Southwest Washington Health District in the consideration of Hanford as a respository for high-level nuclear waste disposal.

Sincerely,

Thomas L. Milne,
Executive Director

np/EW38)LTS)

cc: John McKibbin, Chairman, Board of Health

ADDRESS REPLY TO APPROPRIATE OFFICE.

560

SOUTHWEST WASHINGTON HEALTH DISTRICT
2000 Fort Vancouver Way
Vancouver, Washington

0224

RESOLUTION NO. 85-20

WHEREAS, the Hanford Nuclear Reservation has been tentatively nominated by the Secretary of Energy as one of three sites for final consideration as the first of two Federal repositories for high-level nuclear waste; and

WHEREAS, the proposed site of the repository is only six miles from the Columbia River in basalt rock, a highly fractured substance which is permeable to the flow of ground water; and

WHEREAS, the U.S. Geological Survey, the U.S. Environmental Protection Agency and the Nuclear Regulatory Commission have all indicated that the Hanford Site is potentially unsuitable for a nuclear waste repository because of the complex geology of basalt and the associated unpredictability of ground water flows through the site; and

WHEREAS, the flow of ground water through the burial site could transport radionuclides from leaking burial containers to the Columbia River; and

WHEREAS, radioactive contamination of the Columbia River would adversely affect drinking water supplies, fishing and agricultural industries, recreational activities on the river, and would pose a serious health hazard to the public; and

WHEREAS, the buried wastes will retain their radioactivity for approximately 200,000 years, and will retain sufficient radioactivity to constitute a significant health hazard for several thousands of years; and

WHEREAS, the Board of Health has a great concern over the impacts on public health and safety associated with potential seepage of radioactive wastes into the Columbia River and potential spillages resulting from transportation accidents in the three county area; and

WHEREAS, the Board of Health also recognizes that these dangers will continue to place the population of the three counties at risk for more than 100 generations;

(no comment identified)

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Resolution No. 85-20
Page Two

NOW, THEREFORE, BE IT RESOLVED that until the risks to the citizens of Clark, Skamania and Klickitat Counties have been satisfactorily determined and
2.1.1 alleviated so as to protect their environment, health and welfare in perpetuity, the Board of Health opposes consideration and nomination of
3.3.1.1 Hanford as a Federal nuclear waste repository; and

FURTHER, BE IT RESOLVED that the notice of this Resolution shall be made known to the Secretary of the U.S. Department of Energy, the House Interior Committee of the U.S. Congress, Congressional delegation for the State of Washington, and other groups and jurisdictions potentially affected by the proposed repository; and

FURTHER, BE IT RESOLVED, that the officials from the cities, towns and counties of the three county region will be advised of this action taken by the Board of Health.

Dated this 19th day of March, 1985.

SOUTHWEST WASHINGTON BOARD OF HEALTH

William Benson

William Benson, Chairman

561

225

Aug 8, 1986

0224

0225

Rick Holten / EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99352

I oppose further disposal of high level nuclear waste at Hanford, Washington. 2.1.1
I feel the DOE was totally wrong in eliminating a second repository, and 2.1.8
the the EIS is inadequate in its treatment of the site selection process 2.2.14
and of the potential hazards associated with further stockpiling 2.5.6
of nuclear waste at Hanford.

Please register my strong opposition to continued use of Hanford for storing high-level nuclear wase.

Marilyn Christofferson
817 - 14th Way
Edmonds, WA. 98020

226

8 August 1989

[illegible], EIS
Department of Energy
[illegible] Operations Office
Box 550
[illegible], WA 99352

1016 1989 0226

2.1.1 [illegible]ppose further disposal of high level
[illegible] waste at Hanford, Washington
[illegible] the DOE was totally wrong in
2.1.8 [illegible]minating a second repository, and
[illegible] the EIS is inadequate in its treatment
2.2.14 the site selection process and of the
[illegible]ential hazards associated with
2.5.6 further storing of nuclear waste
at Hanford

Please register my strong opposition to continued use of Hanford for storing high-level nuclear waste

John R Christ[illegible]
817 14th way [illegible]
Edmonds, WA 98020

227

TO: Rich Holten/EIS
U. S.Dept. of Energy
P. O. Box 550
Richland, WA.

[illegible] 0227

As a citizen of Coeur d'Alene, Idaho, Pacific Northwest of the U. S. A., Planet Earth, I am opposed to the production of nuclear waste and weaponry altogether. 2.5.6
I am especially opposed to the unnecessary transportation of Hanford's nuclear waste which will further endanger 3.4.2.2
our fertile home and perpetuate the myth that there is anyplace safe for such waste. Bury it as "safely" as possible and HALT further production as soon as possible! 3.3.5.1

Thank you for this chance to be heard,

[illegible signature]

228

TO: Rich Holten/EIS
U. S.Dept. of Energy
P. O. Box 550
Richland, WA.

As a citizen of Coeur d'Alene, Idaho, Pacific
2.5.6 Northwest of the U. S. A., Planet Earth, I am opposed
to the production of nuclear waste and weaponry altogether.
3.4.2.2 I am especially opposed to the unnecessary transportation
of Hanford's nuclear waste which will further endanger
our fertile home and perpetuate the myth that there is
3.3.5.1 anyplace safe for such waste. Bury it as "safely" as
possible and HALT further production as soon as possible!

Thank you for this chance to be heard,

229

TO: Rich Holten/EIS
U. S.Dept. of Energy
P. O. Box 550
Richland, WA.

As a citizen of Coeur d'Alene, Idaho, Pacific 2.5.6
Northwest of the U. S. A., Planet Earth, I am opposed
to the production of nuclear waste and weaponry altogether.
I am especially opposed to the unnecessary transportation 3.4.2.2
of Hanford's nuclear waste which will further endanger
our fertile home and perpetuate the myth that there is
anyplace safe for such waste. Bury it as "safely" as 3.3.5.1
possible and HALT further production as soon as possible!

Thank you for this chance to be heard,

[illegible signature and address]
83814

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GREENPEACE

Greenpeace Northwest
4649 Sunnyside Ave. North
Seattle, Washington 98103
(206) 632-4326

RECEIVED ... AUG 12 1986 0236 ... DIVISION

8 August 1986

Michael Lawrence, Manager
Richland Operations Office
U.S. Department of Energy
P.O. Box 550
Richland, Washington 98352

Re: "Disposal of Hanford Defense High-Level, Transuranic and Tank Waste"

Dear Mr. Lawrence:

Enclosed please find Greenpeace's comments to the Department of Energy's draft document entitled "Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes". We are submitting these comments for your consideration pursuant to the procedures established by the Department for this process.

Sincerely,

Robert Rose
Greenpeace Intern

James E. Beard
Greenpeace Intern

11322 WMD MGR ANLS COM

RL COMM ... CONTROL

RICH... ...ATIONS OFFICE



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GREENPEACE COMMENTS ON HIGH LEVEL WASTE "DEIS"

August 8, 1986

In what it calls the Draft High Level Waste Environmental Impact Statement ("DEIS"), the Department of Energy has attempted to address the environmental hazards posed by high level waste accumulated at Hanford from the military production of plutonium over the past 40 years. However, several crucial issues regarding the high level waste problem have been omitted from the "DEIS", or are not adequately addressed. Also, it appears that the DOE is already proceeding with some of the plans that are supposedly under evaluation in the "DEIS". Finally, the DOE has not considered the alternative of stopping plutonium production as a first step towards the solution of the High Level Waste problem.

I. The scope of the "DEIS" is too narrow. 2.3.1.14

In order to protect the environment around the Hanford Reservation, the clean-up of all contaminated sites must be considered. The scope of the "DEIS" is too narrowly defined, excluding many contaminated sites. Some categories of defense waste which are excluded from the "DEIS" are:

- Fission products such as cesium, strontium, and cobalt. These remain hazardous for several hundred years and have been dumped in large quantities (see addendum for examples).

- High level waste accidentally spilled or leaked to the soil, in several areas around the reservation, including leaks from the single-shell tanks, diversion boxes, etc.(see addendum for examples)

- Basins near the old production reactor sites. (see addendum for examples)

- Other trenches, ponds, cribs, etc., containing chemical waste, mixed chemical and radioactive waste, fission products, and even some transuranic waste. Only 24 out of an estimated 200 soil sites are considered in the "DEIS".

- Transuranic (TRU) waste sites at concentrations lower than 100 nCi/gram.

- 300-Area soil sites near laboratories and plutonium fabrication plants.

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2.3.1.14 - Contaminated facilities including the old production reactors, plants no longer in use, and underground vaults, piping, etc.

The DOE should make public a comprehensive inventory of all contaminated sites and facilities at the Hanford Reservation.

Not only are many contaminated sites left out of the "DEIS", but there is no consideration of how the high level waste cleanup will affect, or be affected by, other DOE projects at Hanford, such as the repository siting and future modifications of PUREX.

II. The "DEIS" provides an inadequate discussion of the topics it does consider.

3.1.1.1 The "DEIS" provides incomplete inventories of the categories of waste that it does consider. WASH 1538, Draft Environmental Statement--Hanford Waste Management Operations, which inventoried the waste at Hanford in 1974, reports 190,000 grams of plutonium and 110 million grams of uranium dumped into the soil prior to 1972. The "DEIS" accounts for 190,000 grams dumped up to the present, leaving 14 years of plutonium dumping

3.1.3.6 unaccounted for. The "DEIS" only accounts for a few million grams of uranium dumped into the soil. Is this waste unaccounted for? Why isn't it mentioned in the "DEIS"?

3.1.3.4 The DOE does not consider cleanup of the TRU soil sites they identify in the "DEIS". According to the "DEIS", pre-1972 TRU solid waste burial sites are "...considered to have been disposed of..." ("DEIS", pg 3.9) even though the sites exceed currently allowed levels for TRU solid waste. The same is true for the 24 identified soil sites contaminated with radioactive waste.

The alternatives for disposal of high level waste presented in the "DEIS" are not adequately refined. The DOE admits that a great deal remains to be learned about both vitrification and in-place stabilization, and admits that

2.3.2.3 these techniques need to be further researched. Yet the "DEIS" presents conclusions of environmental impact and health effects from these processes. Because so much is currently unknown and because this "DEIS" discusses many different procedures and each one only briefly, provisions should be made now for future "DEIS"'s, both before the choice of disposal method is made and before disposal operations begin. This would also allow for necessary public input.

The disposal of future waste is inadequately discussed. There is not enough space in the double shell tanks to contain projected waste. The plan is to 3.1.7.5
concentrate the waste to reduce the volume, but there is no description of how this will be done, or what the impacts will be. Dangers to the storage tanks (higher chemical concentration, more thermal stress) are not discussed.

The range of possible disposal methods is too narrow. Calcination of the waste should be considered. Also, the possibility of stopping plutonium production as a means to controlling the high level waste problem should be considered. A true environmental impact statement would include discussion of all possible options. 3.3.5.2 3.3.2.2 2.5.6

III. Stopping plutonium production should be considered. 2.5.6

A halt to plutonium production does not threaten our existing arsenal, as the half-life of plutonium-239 is 24,400 years. In fact, the arsenal could be expanded long after plutonium production ended, since the current primary source of fissionable material for the production of new weapons is retired weapons, not DOE plutonium production facilities. Defense Secretary Weinberger stated during a 1983 Armed Services Committee meeting that the number of warheads in our arsenal has declined 40% since the peak in the 1960's, freeing large amounts of plutonium for use in new weapons. The continued production of plutonium has no strategic value, and puts the environment at great risk. Money diverted from the production of plutonium could be used to begin cleaning up the Hanford Reservation.

IV. The DOE should be held accountable for its decisions. 2.5.5

The DOE is making internal decisions on high level waste, and appears to be circumventing true EIS process. Eight double-shell high level waste tanks are under construction, and funds for 4 more are allocated in the 1987 budget. Also, money is being spent to further expand the use of soil for waste disposal. One must question how serious the DOE is about finding an environmentally sound waste disposal technique.

Most of the 1986 and 1987 DOE money for development of high level waste disposal technology at Hanford is going to 'in-place disposal' of single shell tanks. Also, money was allocated for construction of a transportable grout facility. These decisions are supposed to result from the "DEIS" process.

These decisions are particularly disturbing because the DOE is self-regulating. They are not held accountable for their decisions.

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V. Conclusions.

2.5.5 The incompleteness and technical inadequacy of the "DEIS" leads us to question the DOE's motives behind its preparation. The "DEIS" process appears to be mainly a public relations scheme. We question whether a serious effort is being made to solve the High Level Waste problem. The DOE appears to be using the "DEIS" to mollify the public, so as to continue the production of weapons-grade plutonium and the inadequate and dangerous waste disposal practices.

ADDENDUM

0236

(no comment identified)

Other sites that should be considered:

TRU soil sites:

- 216-S1+2 cribs also contain 750,000 Ci fission products. By 1966, Sr and Cs had reached the water table. (WASH 1538)

- 233-S Filter House drain line backed up. 0.1 gram plutonium spilled. (WASH 1538)

- Behind the 224T Building, leaks were found from process waste tank pipes. 139 drums with 72 g. plutonium were removed leaving an unknown amount of plutonium in the soil. Similar leaks are believed to exist behind the 224B Building. (WASH 1538)

- 216-S-7 cribs replaced the S-1+2 cribs. They received 282,000 curie gross beta that reached a level of 150 feet by 1966. Were any TRU elements released to these cribs as to the S-1+2 cribs? (WASH 1538)

- 216-S-207 retention pond was contaminated with 10 curies of fission products after a coil leak in the REDOX plant. The basin's use was discontinued. Why? Any TRU's there? (WASH 1538)

- 221-U Metal Recovery Building had 13.6 kg uranium (UNH) overflow and drain to the ground. (WASH 1538)

- A 1946 report listed 7.5 kg plutonium in the 361 sump tanks. Where did it go and is there any residual left in the tanks? About 500 grams of this plutonium went to dry wells and cribs (there are no dry wells in this DEIS). Also 750 gm uranium was reported in one 300-Area retention pond. (HW 7-5463)

- Paint removal from cask cars increased the activity in the 'N' area ditch. (HW 3-5511)

- 300-Area pond received .8 tons uranium per year from the 303 operating area and 4 1/2 pounds uranium per day from the 3706 Laboratory Building through waste lines (are these lines still contaminated?) The pond had an earthen bottom. 61 pounds of uranium flowed into the river during a dike break. During that time, waste was sent (2/3 pound uranium per day) to a "crib" about 5 miles north of the 300-Area. (HW 12677)

- Laundry ditch received about 0.02 Ci alphas in one week. 200-area area T-swamp registered several hundred nCi per kg soil. (HW 17003)

- Plutonium was found in the T-swamp mud. Uranium was found in the old and new 300-area ponds. (HW 17434)

0238

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(no comment identified)

- Traces of plutonium found at the 234-35 pipe outlet. A maximum of 20 nCi/ gm. soil was found. (HW 26493)

- B-swamp received some plutonium waste during an "unusual incident" in 1956. (HW43012)

- 321 crib received uranium until about 1950. The crib is 5 miles north of the 300 area. In 1957 the uranium at the 321 crib was considered 'fixed at the site' and it was deleted from the future reports. (HW51009)

- 216-A-8 crib was detected as leaking. No long-lived isotopes were found but 10 microCi/liter gross beta detected. (HW51091)

- Co-60 was found in the BY-area at concentrations in the groundwater 30 times the drinkable limit. The cobalt was complexed so it was not sorbed to the soil. (HW53225)

- Waste from 216-S1+2 reached the groundwater by 1957, including some Sr-90.

- Transuranics are still being dumped into the soil. In 1980, 24 grams of plutonium was dumped into the 200-area soil. In 1982 342 kg U-238 was dumped into the 200-area soil.

- The Z-9 trench had to be dug up because it was heating up and might have gone critical.

Basins near old production reactors:

- In 1969, plutonium and polonium was detected in isolated samples from reactor effluent to the river.

- In 1954, a "double rupture" in the 100 DR reactor sent radiation to the river. (HW 31818)

- In 1954 a break in the 107-B reactor effluent basin sent water to percolate into the ground.

- In 1956 a uranium slug burned sending radiation to the cooling water effluent. (HW 46726)

- The 1957 "hot purges" sent 25 times the normal P-32 concentration levels to the effluent waste.

- In 1955 a ruptured fuel element burned sending 1000 to 2000 Ci fission products to the 105-H reactor basin. (WASH 1538)

- In 1963 about one pound of uranium was lost to the river when a fuel element failed in the KE reactor in one of the process tubes. This was the largest single release of fission products to the river yet.

- In 1980, 1.4 Ci plutonium-239/240 was dumped into the soil in the 100-area.



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(no comment identified)

- In 1968 2000 Ci of mixed fission products were sent to the river from the 105 KE reactor. (WASH 1538)

Fission products:

- 2 tons of cesium, 7 tons of strontium, 1900 tons of uranium, and 120,000 tons of chemical sodium nitrate have been dumped into the ground at Hanford, according journalist Keith Ervin.

- In a 1971 estimate, 42 cribs have cesium and strontium in the lowest 50 feet of the vadose zone above the water table, with a total of 400 Ci of cesium plus strontium. (WASH 1538)

- To the eight 216-BY cribs, 410,000 curies gross beta were dumped from U-Plant high salt scavenged waste. This included 3300 curies cesiumium and 12,900 curies strontium by 1966. (WASH 1538)

- During the 1950's, the 216 B/C cribs and trenches (78 in all) received the greatest amount of activity at any one Hanford site: 920,000 curies gross beta in 120 million liters of tank farm and U-Plant high salt scavenged waste. By 1966 the waste was found up to 328 feet deep. (WASH 1538)

- In 1953 five leaks were found in the B-Plant waste lines. An estimated 10 Ci of fission products were released, though the activity below the surface was never determined. The soill was covered with 2 feet of clean soil. (WASH 1538)

- In 1956 it was reported that the Redox cribs in 200-West area received more high activity waste than any other ground disposal unit. High-energy beta emitters reached the groundwater too. (HW 46726)

- In 1957 radioactive material from 216-A-8 crib first reached the groundwater. No long-lived isotopes were seen. (HW 50186)

Chemical waste:

- In 1956 hexone and other organic solvents were found to remove cesium and plutonium from $NaNO_3$ solutions and from the soil. The "DEIS" does not discuss this problem. (HW 43149)

Area around HLW tanks:

- 105-C tank line to B-Plant leak 2600 gallons of waste in 1969. 11,300 Ci Cs-137 was lost. The ground was covered by gravel. (WASH 1538)

- 102-C tank line from PUREX leaked 36,000 gallons to the ground in 1969. 360 Ci of strontium and 720 Ci of cesium was lost. The ground was covered by gravel. (WASH 1538)

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(no comment identified)

- In 1946 a total of about 10 kilograms of plutonium was reported in the B. C. T, U tank farms. Where is the plutonium now? (HW 7-5463)
- 110-B tank line from B-Plant leaked 5,400 gallons with 4,780 Ci Ce-144. The site was covered by gravel. (WASH 1538)
- In 1973 a blockage in the 102-S tank riser leaked 8,660 gallons of waste over a 50x200 foot area. 1,020 Ci of Cesium was lost. Soil was removed from the site and replaced with clean soil. (WASH 1538)
- 241-C tank from the AR vault process transfer lines leaked 8 feet underground. About 25,000 Ci of Cs-137 contaminated 1,300 cubic feet of soil. (WASH 1538)
- In 1953 a 200-W area tank farm pipe broke. Some uranium and plutonium was found in the ground. (HW27510)
- In 1953 there was a "blowout of radioactive liquid waste on April 30" in the 241-U tank farm. (HW29514)
- In 1955 there was a leak in the B-Y tank farms and diversion boxes. (HW40871)
- A total of 500,000 gallons of waste has spilled in the 26 tank spills. This waste sits in the soil around the tanks.

Solid waste:

- 234-35 ditch solids averaged 1200 microCi/g alphas in 1953 (HW275-1).
- In 1956 it was reported the "highly contaminated material" from Redox was buried in the 200-W area, mostly Ru-106. Where was it buried and what else was buried there? (HW43012)
- In 1972 1,125 kg of uranium, 3,894 kg plutonium and 12 kg U-233 was buried. (BNWL 1701)
- In 1981 5.6 million grams of uranium, 29,000 grams of plutonium and 22,000 grams TRU waste was buried. Where will future solid waste be stored?
- Stored in the PUREX equipment storage tunnels in 1973 was 39,000 cubic feet of waste, including 15,000 Ci Co-60 and less than 500 grams of plutonium. (WASH 1538)







CONFEDERATED TRIBES

of the

*Umatilla Indian Reservation*

# REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL, TRANSURANIC, AND TANK WASTES

AUGUST 1986

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NUCLEAR WASTE PROGRAM

CONFEDERATED TRIBES
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August 8, 1986

Department of Energy
Richland Operations Office
Waste Management Division
P.O. Box 550
Richland, WA 99352

Attention: R.A. Holten/EIS

Dear Sir:

Enclosed, please find three copies of the written comments on the DOE Draft Environmental Impact Statement (DOE/EIS 0113) "Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes."

The primary concerns and key issues identified by the Umatilla Nuclear Waste Study Program are discussed in the initial "General Comments" section of the review document. Specific comments on each section of Volume I and each of the key appendices follow these "General Comments."

We are looking forward to your response to these comments.

Sincerely,

Stephen S. Hart for

William H. Burke, Director
Umatilla Nuclear Waste Study Program

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TREATY JUNE 9, 1855 ✦ CAYUSE, UMATILLA AND WALLAWALLA TRIBES

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# REVIEW OF DRAFT ENVIRONMENTAL IMPACT STATEMENT
# DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL
# TRANSURANIC AND TANK WASTES

Submitted by:

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
NUCLEAR WASTE PROGRAM

August 1986

Prepared by:

Council of Energy Resource Tribes
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(303) 832-6600

REVIEW OF DRAFT ENVIRONMENTAL IMPACT STATEMENT

DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL TRANSURANIC, AND TANK WASTES

GENERAL COMMENTS

The following general comments and concerns relate to the Draft EIS as a whole and not to specific chapters or appendices:

1. There is no discussion in the Defense Waste DEIS on the responsiblity of the U.S. Department of Energy (USDOE) to meet its obligations under the trust relationship
2.4.2.2 between the U.S. government and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The potential disposal of high-level defense wastes either in situ or in a deep geologic repository at the Hanford site along the Columbia River requires consideration of this important federal responsibility.

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On January 23, 1983, President Reagan reaffirmed his administration's commitment to the protection of Indian rights and resources held in trust by the federal government. The President's Indian Policy Statement declared in part:

> "This Administration honors the commitment this nation made in 1970 and 1975 to strengthen tribal government and lessen federal control over tribal government affairs. The Administration is determined to turn these goals into reality. Our policy is to reaffirm dealing with Indian tribes on a government to government basis and to pursue the policy of self-determination for Indian tribes without threatening termination.
>
> In support of our policy, we shall continue to fulfill the Federal trust responsibility for the physical and financial resources we hold in trust for the tribes and their members. Fulfillment of this unique responsibility will be accomplished in accordance with the highest standards."

The CTUIR has off-reservation treaty rights in the vicinity of the Hanford reservation and which could be significantly and adversely impacted by the disposal
2.4.2.2 of defense wastes at the Hanford site whether in-situ or in a deep geologic repository. The treaty rights were guaranteed to the CTUIR in their 1855 Treaty (12 Stat. 945). These off-reservation rights, which include the right to fish, hunt, graze cattle, and gather roots and berries, may be exercised by tribal members in the immediate vicinity and downriver of the Hanford site.





The DEIS contains no discussion about how DOE intends to satisfy its trust responsibilities in disposing of the Hanford defense wastes. It should be pointed out 2.4.2.2
that DOE owes this trust responsibility to many Northwest Indian tribes that could be impacted by DOE's defense waste disposal decisions. Certainly the failure to provide a cumulative impacts analysis of all Hanford nuclear waste activities does not bode well for tribal confidence in DOE's commitment to its trust responsibilities.

Based on Determination 3 above, the following actions and facilities should, as a minimum, be considered in the DEIS:

- BWIP high-level nuclear waste repository;
- N-reactor;
- Purex and other 200 area plants;

2. The Defense Waste DEIS is deficient in its analysis of the cumulative impacts of the disposal of defense wastes at the Hanford site combined with the variety of federal and non-federal activities at Hanford involving plutonium processing, 2.3.1.14
radioactive materials research, nuclear power plant construction, operation and decommissioning, and high and low-level waste disposal activities. The inadequate consideration of the cumulative impacts violates the Council on Environmental Quality Regulations and the caselaw interpreting NEPA and its regulations.

The Council on Environmental Quality regulations require that the scope of an environmental impact statement include cumulative impacts. (40 C.F.R. Section 1508.25). Cumulative impact is defined as "the impact on the environmental which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal and non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor collectively significant actions taking place over a period of time." (40 C.F.R. Section 1508.7.)

The Fifth Circuit Court of Appeals has determined that a meaningful cumulative-effects study must identify:

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1. The area in which effects of the proposed project will be felt;

2. The impacts that are expected in that area from the proposed project;

3. Other actions – past, proposed, and reasonably foreseeable – that have had or are expected to have impacts in the same area;

4. The impacts or expected impacts from these other actions; and

5. The overall impact that can be expected if the individual impacts are allowed to accumulate.

Fritiofson v. Alexander, 772 F.2d 1225 (5th Cir. 1985).

2.3.1.14 Based on Determination 3 above, the following actions and facilities should, as a minimum, should be considered in the DEIS:

1. BWIP high-level nuclear waste repository;

2. N-reactor;

3. Purex and othe 200 area plants;

4. Decommissioning, decontamination, and disposal of the B, C, D, DR, F, H, KE, and KW reactors;

5. Fast Flux Test Facility;

6. 300 area laboratories;

7. WPPSS WNP-2 power plant;

8. U.S. Ecology low-level radioactive waste disposal facility.

In Natural Resources Defense Council, Inc. v. Callaway, 524 F.2d 79 (2nd Cir. 1975), the court held that an environmental impact statement for a Navy dumping proposal was inadequate under NEPA when it failed to discuss other dumping and dredging projects in the same area. The court rejected the Navy's argument that many of the other projects had not been finally approved or that those projects were unrelated to the Navy's proposal the court found that the other projects were more than mere speculation, that they were planned or existed in the same geographical area, involved dredging and disposal of spoil, and presented similar pollution problems. The court therefore required the environmental impact statement to consider all of the projects in the area. Id. at 87; see also, National Wildlife Federation v. U.S. Forest Service, 592 F.Supp. 931 (D. Or. 1984).



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3. The Defense Waste DEIS fails to discuss the application of relevant hazardous waste laws.

While it is stated that all applicable laws will be followed the statements are vague and conflictive. The DEIS does not address the requirements and the intent of federal environmental law embodied, particularly, in RCRA and CERCLA ("Superfund"). Defense waste disposal activities must carry out the intent of NWPA and the standards established to support NWPA by NRC (10 C.F.R. 60) and EPA (40 C.F.R. 191); otherwise an inconsistent dual system is established in which the lower standards of the defense-only disposal scheme will defeat the purpose of NWPA and other federal laws. 2.4.1.1 2.4.1.9

In particular, provisions of the Atomic Energy Act (AEA) exempting some defense waste streams from federal standards must not be used to bypass what is in effect a form repository under NWPA. AEA creates the exemption for the sole purpose of preventing undue interference with defense and national security programs, and to carry the exemption over into matters of environmental safety, measured, in geologic time, cannot be justified either in terms of national environmental policy or statutory intent. The DEIS must demonstrate that permitting requirements of federal and state law can be satisfied at all disposal sites, and especially that state requirements for protection of groundwater quality can be met. As federal and state definitions of "mixed" chemical and radioactive waste are developed and appropriate standards and jurisdictions are established, defense waste actions must be shown to be capable of compliance by the time any Record of Decision is issued. 2.4.1.1

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2.3.1.14 4. The Defense Waste DEIS does not discuss the disposal of some of DOD's most radioactive waste--spent reactor cores from nuclear naval vessels. Such cores would constitute a significant inventory to be processes if Hanford were used for co-disposal of commercial and defense wastes in a high-level nuclear waste repository. An impact assessment for this potential DOE/DOD activity should be included in the Final EIS.

3.3.1.3 5. The Defense Waste DEIS uses a "granite repository" for cost calculations used to compare the "geologic disposal alternative" to the "reference alternative." The "granite" or second, repository program was "postponed indefinitely" by the Secretary of Energy on May 28, 1986. This postponement may prevent completion of a granite repository and may invalidate the cost comparisons.

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EXECUTIVE SUMMARY

The Executive Summary indicates that non-high level and non-defense nuclear waste is not considered in the draft EIS. This means that past, present, and future low-level commercial-generated waste, decommissioned submarine reactors, and retired DOE and foreign production reactors are not discussed in this EIS. Recently released documents on past radionuclide releases at Hanford indicate that any future development at Hanford, including the proposed BWIP nuclear waste repository, should be considered in terms of cumulative environmental and socioeconomic impacts, not separately as is the current practice. 2.3.1.14

On page x, second paragraph, the statement is made that "the environmental impacts (both short- and long-term) calculated for the four alternatives generally are low and show no marked difference among the three disposal alternatives." This statement is misleading, since many readers will not critically review the appendices, where Appendix R indicates that in the in-situ and no-action disposal alternatives, fatalities can be expected from drilling or excavating into buried strontium and cesium capsules. A more judicious, accurate statement of differential environmental impacts is warranted.

CHAPTER 1 - GENERAL SUMMARY

Better written and more useful than the Executive Summary, Chapter 1 does convey the significant differences in environmental and health consequences of the four alternatives being considered in this EIS in Tables 3 and 4. The discussion of these tables on page 1.19 does not, however, emphasize these differences and includes little to draw the readers' attention to the radiological reasons for proposing the reference alternative.

CHAPTER 2 - PURPOSE AND NEED

Descriptions of the statutory requirements appear to be adequate, although discussion of the "need" for permanent defense waste isolation from the biosphere is largely absent. To some extent, comparative disposal methods and related hazards are described elsewhere in the document. However, more information in Chapter 1 and 2 concerning permanent isolation and its role in protecting the general public from exposure to ionizing radiation would be helpful to lay readers. This information could include brief

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descriptions of the radiation hazards associated with defense waste disposal, the biological effects of ionizing radiation, and the relative effectiveness of engineered and natural barriers in isolating wastes from the biosphere.

CHAPTER 3 - DESCRIPTION AND COMPARISON OF ALTERNATIVES

The alternatives selected for disposal of the Hanford defense waste are logical and make
a particularly strong case against the "no disposal action" alternative (Table 3.28). The
3.3.3.1 cost comparisons for the four alternatives make a strong case for the "reference"
alternative over the only slightly less expensive "in-situ" and "no disposal action"
3.3.4.1 alternatives. The "reference" alternative fails, however, to provide unrestricted use of
the Hanford Reservation to future generations of Umatilla tribal members, to whom the
right to hunt, fish, and gather roots and berries on the lands comprising Hanford was
restricted in 1942 in violation of their respective treaties of 1855. The majority of the
comments on the technical content of this chapter are made in comments on the
appendices, particularly Appendices C, D, E, M, R, S, and U.

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CHAPTER 4 - AFFECTED ENVIRONMENT

Chapter 4 discusses environmental monitoring results for Hanford as of 1984, the last
complete data set available. However, this chapter discusses very little data on
historical releases at Hanford (1943 to 1984) or the long-term degradation of the
enviroment due to these releases. This is in contrast to Section 4.3, Seismicity, which
3.5.4.6 discusses historical seismicity since 1850 (see Figure 4.4). The cumulative, long-term
impacts of all of Hanford's operations are of particular concern to the Umatilla, who
have treaty rights and "usual and accustomed" fishing grounds on the entire Columbia
River above Bonneville Dam. The comment on page 4.12 that 270 Ci of Cobalt-60 are
found in Columbia River sediments between the Hanford site and the mouth of the river
can be combined with the comment on page 4.28 that "the Hanford site serves as the
spawning area for more than one-third of the fall chinook salmon in the mid-Columbia"
to see that the tribe has legitimate cause for concern over Hanford's past, present, and
future operations.

The fact that "the prevailing wind directions are from the northwest in all months" (page
2.4.2.3 4.21 and Figure 4.10) is a major concern of the tribe because the reservation is located
southeast of the Hanford reservation. The viability of future hunting and gathering on
contaminated lands within the Hanford reservation is also of concern to the tribes.



Although most of the comments on the technical content of Chapter 4 are contained on
the comments on individual appendices, some will be included here. The reference to
Myers and Price, 1979, extensively paraphrased on pages 4.8 and 4.9, is confusing because
the reference is not listed in this format in the reference list on page 4.39. The vertical 3.5.2.4
exaggeration of 52 on Figure 4.3 is too great, leading the lay reader to a distorted view
of the surficial geology of the Hanford area. Although the magnitude of the probable
maximum flood on Cold Creek is discussed on page 4.12, the locations of any high-level
waste disposal sites within the 200 Areas that may be included in this floodplain now or
10,000 years in the future are not discussed in chapters 4 or 5.

CHAPTER 5 - POSTULATED IMPACTS AND POTENTIAL ENVIRONMENTAL CONSEQUENCES

Because Chapter 5 deals with impacts of the four alternatives discussed in Chapter 3, it is based on data from all of the appendices. For this reason, detailed comments on the models and conclusions discussed in the chapter are found in the evaluations of the individual appendices. Some general comments are, however, included in the following paragraphs.

On page 5.4, data concerning monitored releases from Hanford in 1984 is discussed. The
cumulative whole-body dose incurred by an individual due to 40 years of Hanford releases 2.3.1.14
is not discussed. The impact of the proposed action is not an isolated event, but only a
part of the total history of plutonium processing, radioactive materials research, nuclear
power plant construction and operation, and high- and low-level waste disposal activities
at Hanford. Unless these activities are considered together, the actual impacts to the
environment cannot be determined. For this reason, the Umatilla, who are very
concerned about long-term impacts to their possessory and usage rights area, which
includes all of the Hanford reservation, does not accept the impact scenarios discussed in
Chapter 5 and Appendices H, I, N, and R.

Sections 5.2.2.4, 5.3.2.4, 5.4.2.4, and 5.5.2.4 discuss ecological impacts of the four
alternatives being considered for defense waste disposal. These sections, however,
discuss only the on-site impacts and not the impacts off the Hanford reservation. Even 3.2.4.2
on Hanford, Chapter 5 presents no quantitative data for impacts to wildlife and plants.
DOE seems to confuse "ecological impacts" with the amount of sand gravel resources to

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be used in construction of each alternative. Therefore, the "operational" ecological impacts of the no disposal action alternative (Section 5.5.2.4) should be defined as all impacts from blowing dust, seepage, etc., over the period from the present to the year 2150, since no conventional "operations" will be performed to clean up the waste. These
3.2.4.2 impacts are stated to be ". . . essentially unchanged from present conditions," although
the potential for the long-term contamination of plants and wildlife through this alternative is undoubtedly greater than the potential for all the other alternatives combined.

Summary tables are needed for Sections 5.3.4.3 and 5.5.4.3, Impacts from Disruption of
3.5.1.9 Wastes by Intruders, and 5.3.5 and 5.5.5, Resettlement, similar to those in Appendix R.
These tables should summarize the very large maximum doses that an intruder may incur during the first 500 to 1000 years from drilling, excavating, drinking water, or farming on the waste sites for the in-situ and no disposal action alternatives.

CHAPTER 6 - APPLICABLE REGULATIONS

Regulations concerning the applicable EPA standards for radionuclides are covered in Chapter 6. The regulations applicable to hazardous chemical wastes, their control, and
3.1.6.1 their approved disposal methods are not included in this chapter. Because the hazard to
the environment may be as great or greater from the chemical processing wastes, including heavy metals and organic compounds, as from the radioactive wastes, these regulations must be included in this chapter and a discussion of the short- and long-term impacts of these chemical wastes must be included in Chapter 5.

2.4.1.9 While it is stated that all applicable laws will be followed the statements are vague and
conflictive. The DEIS does not address the requirements and the intent of federal environmental law embodied, particularly, in RCRA and CERCLA. Defense waste disposal activities must carry out the intent of NWPA and the standards established to
2.4.1.10 support NWPA by NRC (10 C.F.R. 60) and EPA (40 C.F.R. 191); otherwise an inconsistent
dual system is established in which the lower standards of the defense-only disposal scheme will defeat the purpose of NWPA and other federal laws.

In particular, provisions of the Atomic Energy Act (AEA) exempting some defense waste streams from federal standards must not be used to bypass what is in effect a form repository under NWPA. AEA creates the exemption for the sole purpose of preventing





undue interference with defense and national security programs, and to carry the exemption over into matters of environmental safety, measured, in geologic time, cannot be justified either in terms of national environmental policy or statutory intent. The DEIS must demonstrate that permitting requirements of federal and state law can be satisfied at all disposal sites, and especially that state requirements for protection of groundwater quality can be met. As federal and state definitions of "mixed" chemical and radioactive waste are developed and appropriate standards and jurisdictions are established, defense waste actions must be shown to be capable of compliance by the time any Record of Decision is issued.

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COMMENTS ON APPENDIX B
DESCRIPTION OF FACILITIES AND PROCESSES

The following comments refer to Appendix B:

3.1.3.12 1. On page B.22, why are piles to be hammered into the waste? The potential for contamination spread with this technique is enormous.

3.1.3.12 2. Instead of piles, the use of the state-of-the-art "dynamic compaction" technique is recommended. This technique has been used successfully in consolidating organic soils, sanitary landfills, and hazardous waste disposal areas. The technique was even previously recommended to DOE for the TRU waste disposal area of INEL in a 1980 report by Dames & Moore for EG&G Idaho, Inc.

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COMMENTS ON APPENDIX D
TRANSPORTABLE GROUT FACILITY

Several general comments on this appendix follow:

1. The use of acronyms in this appendix is excessive. Although the use of such acronyms is symptomatic of many government documents, this EIS is supposed to be written for the general public. 4.1.1

2. Metric units are used first, with English equivalents in parentheses, throughout most of this EIS. In this appendix, however, English units are sometimes used first. This adds to the confusion of the non-technical audience for which this document is supposed to be oriented. 4.1.1

3. No basis is given, and no references are cited, for the Radiological Impacts cited in Section D.7.

4. Similarly, no basis for calculation or references are given for the costs in Section D.8.

5. The reference to Roy, et al., 1983, notwithstanding, no mixtures of man-made cement grout and radioactive, heavy metal, and toxic chemical wastes have been shown to have survived for 10,000 years. No solubility studies for this grout, especially assuming a climatic change to wetter conditions or a rise, however unlikely, in the water table, are utilized in this disposal scenario. Based on a reference not used in this study: 3.1.8.1

> Dames & Moore, 1980, Final report, research and development on in-situ encapsulation for low-level Transuranic buried waste at the Idaho National Engineering Laboratory: Unpublished rept. for EG&G Idaho, Inc., Idaho Falls, Idaho,

the addition of zeolite or diatomaceous earth and clay to the grout might prove more effective in containment and absorption of the waste than a straight cement grout.

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COMMENTS ON APPENDIX G
METHOD FOR CALCULATING NONRADIOLOGICAL INJURIES
AND ILLNESSES AND AND NONRADIOLOGICAL FATALITIES

3.4.2.1 Appendix G states on page G.1 that its purpose is to describe methods used "to estimate postulated nonradiological injuries and illnesses and nonradiological fatalities associated with each alternative analyzed in this EIS." This appendix sets forth five (5) categories of nonradiological injuries, illnesses, and fatalities as follows:

- Occupational injury associated with actual work environment;
- Occupational illness related to workplace conditions in which workers contract acute or chronic disease which may be caused by inhalation, absorption, ingestion, or other direct contact;
- Lost workdays due to occupational injury or illness;
- Recordable cases involving occupational injury or illness, including death; and
- Nonfatal cases without lost workdays.

The following comments refer to Appendix G:

3.4.2.1 1. A major deficiency of Appendix G (and the entire Draft EIS) is the limited scope of nonradiological effects. As noted above, this appendix covers nonradiological occupational impacts only. No attempt is made to identify nor evaluate other significant nonradiological impacts which are likely or possible as a result of the postulated defense waste disposal alternatives. These include, but are not limited to, the following:

   - Injuries and deaths attributable to:
     - Automobile and other vehicular traffic accidents involving project employees commuting between work locations and residences;
     - Vehicular accidents, in which project-related nonradiological materials shipments and related transport workers are involved in collisions with members of the general public (drivers or pedestrians) in nearby communities.
     - Other accidents stemming from generally increased economic activity.
   - Property damage resulting from local or regional vehicular accidents involving commuting employees, nonradiological materials shipments, and members of the general public within the vicinity of the project sites.
   - Increased airborne nonradiological emissions from increased vehicular traffic in the study area.

   Data on local/regional traffic volumes, accident frequency, and transportation injuries and fatalities should be provided in Appendix G or Appendix K to support further analysis of such impacts.



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2. Table G.3 provides data on incidence rates used for repository construction and operation activities. Data for "underground mining" is 8.37 injuries and illnesses per 100 worker-years and 0.09 fatalities per 100 worker-years, based on averages from the Mine Safety and Health Administration for all noncoal underground mines, including metal, nonmetal, and stone. It is unclear whether such data include underground uranium or phosphate mines which may experience higher rates of nonradiological (as well as radiation-related) injuries or occupational illnesses. (Note: it is also unclear whether radiological effects of uranium mining or other "pre-disposal" uranium or plutonium processing steps have been factored into analyses of radiological impacts as described in Appendix F. Such radiological effects of the "nuclear fuel cycle" are routinely included in EIS's for individual commercial nuclear power plants, based on "generic" factors for the various processing steps. Similar provisions should be made in the Hanford Defense Waste EIS). 3.4.1.4

3. Note: see additional comments on Appendix L: Non-Radiological Impacts—Construction and Operational Period.

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COMMENTS ON APPENDIX H

RADIATION DOSES TO THE PUBLIC FROM OPERATION ACCIDENTS

The following comments refer to Appendix H:

1. The intentional omission of occupational doses (see first paragraph, Page H.1) for accidents is a major weakness of this appendix. Although the facilities have not yet
3.4.1.2 been built, predictions based on models of occupational exposure should have been included. Nuclear reactors are not licensed for construction until the NRC is satisfied that they meet all safety regulations. A high-level nuclear waste disposal program should be subject to similar constraints, i.e., that all potential accident scenarios have been modelled and prove that the risks are acceptable.

2. Unlike most EIS's, this appendix is little more than a summary. There is little or no development within the appendix of how a given conclusion or assumption was
4.1.1 reached. Almost all major points are referred back to one or more other documents on how the point was reached. Source terms for accidental releases of radioactive materials are of particular concern.

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As an example, in Section H.3.1 there seems to be no published documentation of how the EIS authors go from a referernce (Steindler and Seefeldt, 1980) on a detonation in an air cleaning system to an in-tank explosion which creates an aerosol release of almost 500 metric tons. No estimate of explosive yield is given, yet almost 10% of the tank mass is estimated to be converted to an aerosol form (about 500 metric tons). At the same time, the respirable fraction of the 500 metric tons released is estimated to be only 13 kilograms. For a tank which is buried only a few meters below the surface, and probably not designed to contain an explosion, it seems most unusual that an explosion large enough to generate 500 tons of aerosol would only breach the filters and not blow the tope of the tank out of the ground. Further, for a 500-metric ton aerosol release, a release of only 13 kg of respirable material (or a fractional release of 0.0026%) seems low.

3.4.1.2 3. While doses are calculated for this release, no discussion of chemical toxicity (i.e., from cloud passage and inhallation) is presented.



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COMMENTS ON APPENDIX I

ANALYSIS OF IMPACTS FOR TRANSPORTATION OF HANFORD DEFENSE WASTE

The following comments refer to Appendix I:

1. Appendix I is confined to a discussion of radiological and nonradiological impacts of Hanford defense waste. While reference is made in the Hanford Defense Waste DEIS to WIPP and Savannah River Plant (SRP) defense waste environmental effects, no mention is made of environmental effects of transporting defense HLW 3.4.2.11
from the Idaho National Engineering Laboratory (INEL) to a Hanford geologic repository nor shipments of TRU-wastes from INEL to WIPP.

2. If defense HLW is shipped to a Hanford disposal facilitiy from SRP or INEL, it is possible that routes through the Umatilla Reservation could be utilized and therefore entail potential adverse environmental impacts.

3. The RADTRAN II computer model described in Appendix I can be utilized to evaluate radiological risk from transportation accident release scenarios. RADTRAN II does not accommodate atmospheric disperson to the natural environment from the point of contaminant release from a transportation accident scenario. Airborne material disperses from the accident site as a function of the prevailing meteorological conditions. Generally, these conditions can be described in terms of time-integrated atmospheric dilution factors (Curies-sec/$m^3$) as a function of area within an isopleth contour on which it applies. In RADTRAN II the user must specify a set of integrated concentration values and corresponding areas which have been computed assuming a totally reflective lower boundary. The code then calculates a set of airborne concentration and deposition contours out to a 3.4.2.11
maximum area of $10^9 m^2$. Thus, in most practical situations the analyst must utilize an atmospheric disperson model to develop the contaminant disperson characteristics of the contaminant release in any event. However, the RADTRAN II model provides a very effective method for quantifying the release of specific radionuclides to the environment (source term) once the mechanisms for contaminant release in an accident scenarios have been established by means of fault tree analysis as previously described. RADTRAN II also has the capability to provide an estimate of human health effect from a transportation accident release

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to the atmosphere, which will be discussed in greater detail in a subsequent section of the report. RADTRAN II will not, however, accommodate the analysis of a water immersion accident scenario. Since many of the proposed transportation routes for high-level nuclear waste shipments pass along major waterways and barge shipments still remain a possibility, this omission in the code must be considered a major deficiency in terms of the CTUIR program to develop risk assessment methodologies for evaluation of transportation accident scenarios involving high-level nuclear waste shipments through tribal lands. 3.4.2.11



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**COMMENTS ON APPENDIX J**
**METHOD FOR CALCULATING REPOSITORY COSTS**
**USED IN THE HANFORD DEFENSE WASTE EIS**

This appendix outlines the method for calculating costs for repository emplacement of Hanford defense wastes. Total costs are derived from the sum of costs for:

- Retrieval and processing;
- Transportation; and
- Repository emplacement.

In computing repository emplacement costs, use is made on the so-called RECON computer model which calculates life-cycle construction and operating costs for a geologic repository. As stated on page J.2, paragraph 3, the RECON model parameters describe "facilities, construction times, shafts, mine design, emplacement limitations, waste quantities available for disposal, waste processing parameters (labor, materials, utility, and equipment requirements), facility construction cost and unit labor, materials, utility and equipment costs." The following comments refer to Appendix J: 3.3.5.9

1. No mention is made of important parameters involved in computing life-cycle costs such as capitalization and amortization charge rates, costs of ultimate decommissioning of geologic repositories (assuming comingling of defense HLW and spent fuel from commercial nuclear power plants), and perpetual monitoring following repository closure. 3.3.5.9

2. "Total" costs are ostensibly summarized in Appendix L (Tables L.6, L.10, L.14, and L.18); however, only the "No Disposal Action" (Table L.18) describes specific costs for monitoring, surveillance, vegetation control, and subsidence maintenance. Similar costs for other disposal alternatives should be provided. 3.3.5.9

3. Costs of land allocated to repository or other defense waste disposal options are not mentioned. It is unclear whether land values or costs are included in the calculations. Since such land has definite value for alternative uses (at least prior to use for waste disposal purposes and perhaps following decommissioning and decontamination), "marginal" and "real" costs of land should be included with such data disaggregated for purposes of identification and analysis. 3.3.5.9

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3.3.5.9
4. On page J.2, last paragraph, first sentence, the statement is made that "the design basis modeled was for a 47,000 MTU repository containing equal amounts of spent fuel and high-level waste." What is the basis for choosing this capacity? It would appear that 23,500 MTU was selected as the capacity for spent fuel and an equal capacity for defense HLW in this "model" repository. Since the Nuclear Waste Policy Act specifies a geologic repository capacity of up to 70,000 MTU for spent fuel (plus unspecified capacity for defense waste if comingled with spent fuel), repository costs with these specified capacities should be described in the EIS, at least as one of several scenarios for defense waste repository emplacement.

3.3.5.9
5. Additionally, a sensitivity analysis indicating computed costs at several defense HLW and spent fuel capacity levels should be described in the EIS.



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## COMMENTS ON APPENDIX K
## SOCIOECONOMIC IMPACTS

This appendix describes methods used by DOE to evaluate socioeconomic impacts of the alternative defense waste disposal methods as summarized in Sections 4.8 and 5.7 of Volume 1 of the draft EIS. As stated in Appendix K, socioeconomic impacts are confined, geographically, to a study area encompassing Benton and Franklin counties in the State of Washington. Socioeconomic parameters identified and assessed within this two-county area are limited primarily to:

- Project workforce estimates for each alternative; and
- Population effects related to increased project employment.

The following comments refer to Appendix K:

1. Very cursory information is provided on social, fiscal, infrastructure, and community impacts. DOE's analysis concludes that only minimal socioeconomic impact will be experienced in the study area due to: (1) adequate labor supply for the relatively small workforce associated with disposal operations; (2) ample housing stock for incoming workers and increased population; and (3) community services which are projected to be sufficient to support the project, its employees, and related population. 3.2.6.4

2. The analysis of socioeconomic impacts is deficient in several respects. First, the scope of the socioeconomic parameters covered in the analysis is unjustifiably restricted. Second, the geographic scope of the socioeconomic evaluation appears arbitrarily limited and therefore insufficient. Third, the historical perspective (empirical socioeconomic evidence) is too limited to permit adequate analysis. Finally, the cumulative socioeconomic impacts of other nuclear energy activities at the Hanford federal reservation (federal, State, and private sectors) are inadequately considered. 3.2.6.4

3. As indicated in 1 above, the draft EIS considers project workforce and related demographic impacts, but provides only superficial analysis of social, fiscal, 3.2.6.4

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3.2.6.4 infrastructure, and community services impacts. No baseline information nor projections of economic parameters are offered (i.e., personal and per capita income, employment by Standard Industrial Classification, unemployment, labor force participation rates, etc.). These should be described in the EIS.

3.2.6.6 4. A distinction should be made between <u>construction</u> employees and permanent <u>operations</u> workers in each alternative.

3.5.5.42 5. Demographic data should also include composition of the regional workforce and population in terms of age profiles, ethnic composition, wage and salary rates by major employer category (SIC code or similar), and educational levels.

3.2.5.1 6. Cultural, aesthetic, recreational, and other attributes should be described as part of a comprehensive socioeconomic assessment.

3.2.6.4 7. Additional parameters should include summaries of county and community fiscal data, traffic volumes along critical street and highway segments, traffic accident frequency, and related infrastructure descriptions.

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8. The geographic scope of the socioeconomic analysis in the draft EIS is confined to Benton and Franklin counties in the State of Washington. No evidence is presented
3.2.6.4 in the DEIS to support the exclusion of areas beyond the two-county study area. For example, profiles of the residential locations and commuting patterns of current Hanford employees may or may not support the present geographic extent of the present study area. With improved regional highway facilities becoming available recently and expected to be further refined over the next few years, commuting times and traffic congestion in the Tri-cities area may be reduced. Consequently, project employees may be attracted to residences well beyond the two-county area. This issue should be addressed in the EIS.

3.2.6.6 9. In estimating population changes and secondary employment, differential effects of construction versus operations should be considered. The DEIS states that a multiplier of 1.2 is used to calculate secondary employment, but it is unclear whether this factor is used for both construction and operations workforces.



10. If distinctions are shown in the final EIS between construction and operations workforces, as recommended above, appropriate "secondary (or total) employment multipliers" should be identified for each type of workforce data. 3.2.6.6

11. Likewise, calculations used for total induced population changes should reflect possibly different ratios for construction-related activities and operational activities, if applicable. Historically, in many other major industrial and energy- 3.2.6.5
related projects developed near non-metropolitan areas, population changes related to construction activities have generally been different than those induced by permanent operational workforces. It may be quite helpful to examine longer-term historical employment, population, and other demographic data for the Hanford complex and surrounding communities in order to discern important relationships between changes in workforces and population changes that have occurred over the 43 year history of the Hanford Works.

12. Another important body of historical data that is absent in the DEIS concerns epidemiological baselines. No information is provided on the status of population health in the study area. It is recommended that available data on mortality and 3.5.5.42
morbidity rates, age profiles of residents, incidence of cancer, and other health-related indicators be described in the EIS, along with appropriate comparisons with regional, State, and national health statistics.

13. The final EIS should incorporate relevant historical data (prior to 1984) concerning radiological releases and emissions and any correlations between such releases and calculated public exposures to ionizing radiation in the study area. The body of historical data recently released by DOE/Richland Operations Office (approximately 19,000 pages covering the years 1943-1984), together with other available 3.5.5.42
information, should be utilized to establish an appropriate epidemiological baseline.

14. Another significant deficiency in the draft EIS is the very limited treatment of <u>cumulative</u> socioeconomic effects resulting from several major DOE and non-federal activities which may be developed simultaneously with the proposed defense 3.2.6.5
waste disposal projects.* Although several other major projects (such as the

* Note: The lack of "cumulative impacts" information applies to all environmental parameters, not just socioeconomic factors.

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3.2.6.5 possible resumption of construction of the WPPSS nuclear power units and the potential development of the Basalt Waste Isolation Project) are mentioned in the draft EIS, very little statistical data is provided.

15. No mention is made of ongoing DOE defense materials production activities nor any related socioeconomic impact information. Other DOE projects such as the recent and proposed future land burial of irradiated reactor components at Hanford from decommissioned nuclear-powered submarines, are omitted in the draft EIS.
3.2.6.5 Furthermore, DOE plans for decommissioning of several "moth-balled" production reactors at Hanford and subsequent disposal of activation products (radioactive wastes) from these reactor components are not addressed. The cumulative socioeconomic and other environmental effects of such activities are not considered in the discussion of "cumulative impacts" in Section 5.1.4 nor in the Appendices to the draft EIS.

3.2.6.5 16. Moreover, other non-DOE nuclear energy activities such as the Exxon Nuclear Company's nuclear fuel fabrication facilities at Richland nor the commercial low-level radioactive waste burial facility at Hanford are mentioned in the draft EIS.

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17. In discussion of long-term contingency events that could have environmental and socioeconomic consequences (Sections 5.3.4.4, 5.4.4.4, 5.5.5) no consideration is given to the possible loss of resources and Indian treaty rights by radioactive contamination or cataclysmic meteorological or geological events or through other
2.4.2.2 mechanisms whereby institutional control is lost. The draft EIS does not mention off-reservation "possessory and usage rights" specified by the 1855 treaty between the United States and Umatilla. This treaty provides for perpetual rights to hunting, fishing, gathering of natural foods and medicinal herbs, access to traditional ceremonial and religious sites, and grazing of livestock on unclaimed lands within a large region including the present Hanford federal reservation.

While the tribe has been denied free access to these treaty rights on the Hanford
2.4.2.2 reservation since 1943 when the War Powers Act authorized federal control of the site, they continue to be interested in the utilization of this aboriginal tribal site and its possible eventual return to Indian access and/or control. Additionally, the



Nuclear Waste Policy Act (P.L. 97-425) grants federal recognition and status as "affected Indian tribes" to the Umatilla. Similarly, the DOE Defense Programs office, through discussion in the draft EIS and other documentation, should 2.4.2.2
recognize these treaty provisions and describe the utilization and cultural significance of the Hanford reservation in terms of aboriginal and historic possession by the "affected Indian tribes" as well as contemporary and future impacts.

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## COMMENTS ON APPENDIX L
## NONRADIOLOGICAL IMPACTS-
## CONSTRUCTION AND OPERATIONAL PERIOD

This appendix addresses nonradiological impacts for the three disposal alternatives and the "no disposal" action. For each disposal option, nonradiological impacts include only the following:

- emissions of nonradiological pollutants
- estimated injuries and fatalities
- requirements for depletable resources
- costs

Nonradiological impacts related to transportation of defense wastes are not included in this appendix and are addressed in Appendix I. The following comments refer to Appendix L:

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1. Estimates for nonradiological emissions (including particulates, oxides of sulfur, carbon monoxide, nitrogen oxides, and hydrocarbons) appear to be reasonable, based on methods for calculating these emissions as described in Appendix G.

3.4.2.1 2. As indicated in comments on Appendix G, a significant deficiency in Appendix L is the omission of other nonradiological, non-occupational impacts such as:

   - Injuries and deaths attributable to increased automotive accidents involving commuting workers, nonradiological materials shipments to and from the disposal sites, and secondary business (induced economic growth) activities.

   - Property damage resulting from both increased traffic accidents and normal transportation (i.e., increased deterioration of highways as well as loss or damage to property, etc.).

   - Airborne nonradiological emissions resulting from increased vehicular traffic in the study area.



3. On page L.4, the costs for the geologic disposal alternative are based on the use of an off-site "granite" repository at higher costs than an on-site basalt repository. The "granite," or "second," repository program was dropped by DOE on May 28, 1986, and this cost comparison is no longer valid. The use of this distant repository causes the cost comparison between the geologic and reference alternatives to be unrealistically favorable for the reference option. 3.3.1.3

4. See comments on Appendix G for additional remarks and recommendations.

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COMMENTS ON APPENDIX M
PRELIMINARY ANALYSIS OF THE PERFORMANCE OF THE PROTECTIVE BARRIER AND MARKER SYSTEM

The following numbered comments and questions refer to Appendix M of the Draft Hanford Defense Waste EIS:

1. On page M.6, a figure is needed to show the cover to be constructed over the grouted trench.

3.5.1.27 2. In section M.2 and Figure M.3, what is the tested life of geotextile, especially if uncovered and exposed to sunlight for long durations of time? How long after deterioration of the geotextile will fine-grained soils pipe into the filter and the filter pipe into the riprap? A graded filter, the standard in the construction industry, would prevent such piping, but would severely reduce the capillary effect.

3.5.1.7 3. In Figure M.3, side slopes of 1:1 are too steep to avoid gravitational slumping and erosion for 10,000 years, especially if the climate becomes significantly wetter.

4. On page M.10, what happens to the "dry cobble" plant and animal barrier if the "barrier failure scenarios" are considered? A possible solution is the pyrite and broken glass barrier described in:

> Dames & Moore, 1980, Final report, research and development on in-situ encapsulation for low-level Transuranic buried waste at the Idaho National Engineering Laboratories: Unpublished rept. for EG&G Idaho, Inc., Idaho Falls, Idaho.

3.5.1.25 5. In Section M.5.1.2, is cheatgrass all that will grow on the waste cover for 10,000 years? What about deep-rooted arid vegetation, like sagebrush, alfalfa, Russian olive, and others?

6. The models described on pages M.21 and M.22 are for one to 16 years. What happens after 100, 500, or 1000 years?



7. The barrier failure scenarios are not discussed in any detail in Section M.6. The limits of these scenarios and their radiological effects are not discussed at all in this appendix.

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## COMMENTS ON APPENDIX O
## STATUS OF HYDROLOGIC AND GEOCHEMICAL MODELS USE TO SIMULATE CONTAMINANT MIGRATION FROM HANFORD DEFENSE WASTES

The following comments on Appendix O summarize the hydrogeologic models used to estimate travel times and peak concentrations from a release of contamination to the ground water.

1. In the vadose zone, a simple, unit hydraulic gradient, one-dimensional, analytical model was used to simulate advective transport. Under the protective barrier, where there would theoretically be no infiltration, molecular diffusion was assumed to the predominant transport mechanism and a diffusion model used. A version of the TRUST model was used to attempt a simulation of two-dimensional ground water flow in the vadose zone, but evidently the writers were unable to operate the model. 3.5.2.8

2. A finite difference model (VTT) was used to simulate saturated groundwater flow. This model has been calibrated to the unconfined aquifer at the Hanford site.

3. An analytical, one-dimensional transport model was used to simulate contaminant transport through both the unsaturated and saturated zones. The model is referred to as a stochastic-convective model because it uses the dispersion term of the equation to simulate the random nature of travel time estimates along streamlines of flow. This section of Appendix O is confusing; an example calculation would aid the reader in interpreting exactly how the model was used. 3.5.2.11

4. On page O.33, section O.4.3.6, it is stated that a constant dispersion coefficient based on dispersion through the unsaturated zone is used in both the unsaturated and saturated zones, but nowhere in Appendices O or Q is the method of calculating the dispersion coefficient described. 3.5.2.12

5. Appendix O contains a good discussion of geochemical interactions and the limitations of the models applied, but reached no conclusions on the effectiveness of the models or on other potentially usable models.



## COMMENTS ON APPENDIX Q
## APPLICATION OF GEOHYDROLOGIC MODELS TO POSTULATED RELEASE SCENARIOS FOR THE HANFORD SITE

The following comments on Appendix Q discuss the application of geohydrologic models to the Hanford site:

1. Generally conservative assumptions were made throughout the appendix. Based on the models described in Appendix O, travel times through the unsaturated zone are much larger than travel times through the saturated zone. Unfortunately, very little information is given on exactly how these computations were performed and the assumptions that were made. 3.5.2.6 3.5.2.27

2. The text correctly states that hydraulic conductivity in the unsaturated zone is a very sensitive parameter. The Campbell equation was used to estimate hydraulic conductivity as a function are not given in the text. Since the vadose zone model was uncalibrated, the parameters used in the calculations are very important and should be discussed in the text. 4.2.55

3. Equation Q.1 on page Q.3 is incorrect also; it is not known exactly what the equation is supposed to be. 4.2.55

4. Assumptions used in the saturated zone modeling are adequate, although, as mentioned above, travel times through the unsaturated zone are much longer than travel times through the saturated zone.

5. Some additional saturated zone modeling was performed to look at the consequences of increased irrigation in the area. It was assumed that a maximum of 20 percent of the irrigation water applied would become groundwater recharge. This is not a bad assumption, but it is certainly not a worst case assumption. It is almost always necessary to over-apply irrigation water to flush the salts through the root zone to avoid increasing soil salinity. With saline water, and saline soils, it is not uncommon to have 50 percent of applied irrigation water become ground water recharge. 3.5.3.1

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**COMMENTS ON APPENDIX R**
**ASSESSMENT OF LONG-TERM PERFORMANCE OF WASTE DISPOSAL SYSTEMS**

3.5.5.8 In general, this is the most hypothetical appendix. Conclusions are based on analytical techniques which may or may not be valid. As stated in this appendix, groundwater transport of the contaminants is the most probable scenario for the release of the contaminants from a disposal site. Yet, there are more unknowns concerning the mechanisms involved in the groundwater transport scenario than in any other scenario. As pointed out in Appendix V, the construction of a valid groundwater model of the Hanford site is very difficult. Even using "conservative ions," variations in the hydrogeology make long-term prediction with any certainty very difficult. Without a high degree of certainty in the analysis, the long-term predictions on the effects on man are merely pulling numbers out of the air. The following comments refer to Appendix R:

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3.5.5.8 1. In the tables presenting the performance of each alternative, definition of terms (i.e., Transport Assessment Table) should be added to the text.

3.5.5.8 2. A table presenting various health standards should be added.

3. What is a Transport Assessment Table?

3.5.5.8 4. Why did this appendix not address the performance of the various alternatives in terms of the chemical species which may be released from the storage sites?

5. At this time, groundwater models cannot be fully developed for the site because of the high degree of uncertainty in the geology; therefore, groundwater travel times cannot be accurately predicted.

3.4.3.1 3.5.6.35 6. On pages R.63, R.90, and R.93, DOE has a tendency to dismiss some "catastrophic" accident scenarios with a statement that ". . . waste would be a small factor in the devastation from a giant meteorite," flood, volcano, etc. Although obvious that such a destructive event would destroy numerous man-made structures and, probably, kill a number of people, such destruction is temporary and such natural events have occurred numerous times throughout history. For example, 200,000





people may have died in a single earthquake in China and 100,000 may have died in a single cyclone in Bangladesh. Within the short period of a few years after these natural disasters, farmers are again plowing the fields and towns are being rebuilt. However, if such a natural disaster also spread high-level radioactive isotopes and created an environment too contaminated to support life for thousands of years, the impacts on life in the region would be far greater. These statements that radiation would be a "small factor" should, therefore, be carefully reevaluated. 3.4.3.1

7. On page R.64, no probabilities are given for the airplane crash scenario. 3.4.3.6

8. On pages R.68 and R.82, the "in-place stabilization" alternative must include an impenetrable cover to prevent individual maximum annual doses for the well drilling and excavation scenarios of 1,000 to 100,000 rem/yr. Such a cover is technically feasible, although at considerably higher cost than the proposed cover. This cost increase might make the geologic disposal alternative more competitive in price with the in-place stabilization alternative. 3.5.1.9

9. On page R.74 and in Table R.57, the use of any impermeable membrane on the surface of the ground in arid areas has been proven to create increased moisture below the membrane due to capillary rise and condensation from air moving through the soil. This is the experience of highway departments with impermeable paving, mining companies with pond liners, and landscapers with plastic sheeting in areas of expansive soil. When such soil moisture is produced, plant roots grow into the area of higher moisture even if they have to grow through the membrane or horizontally beneath it. If the proposed impermeable cover over the radwaste is planted with shallow-rooted grasses, other deeper-rooted vegetation will eventually establish on the cover through natural migration methods. As this new vegetation grows, roots will move into the moisture collecting below the membrane and eventually move into the waste. For example, the USGS has documented cases of alfalfa roots penetrating into underground mine workings at depths of several hundred feet in Nevada, because the mines formed the nearest water table to the surface in this arid region. 3.5.1.27

10. On page R.86, "5 acre-ft/yr per acre" should be "12.2 acre-ft/yr per acre" and the use of the word "erode" in line 13 is questionable. 4.2.55

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4.2.55 11. On page R.90, "12,320 m$^3$" should be 12,320 m$^3$/sec.

12. On pages R.90 - R.92, flooding is analyzed only for the Columbia River and changes in sea level. No mention is made of flooding on the Yakima River or on Cold
3.5.6.7 Creek. The potential for flash flooding on Cold Creek has been identified as a potential area for additional study in the repository siting program by the NRC. This is due to the potential for flooding of the southwestern corner of the 200 West area by the Cold Creek PMF.

4.2.55 13. On page R.91, a table or figure is needed to show the peak flows for all of the floods discussed in the report.

14. On page R.93, the cumulative impacts of lava flow or mudflow (lahar) damming of the Columbia River Gorge and subsequent flooding of the Hanford area are not
3.5.6.5 evaluated. These types of dams have occurred during the late Pleistocene according to work by Crandall and Vallance of the USGS.

15. On page R.94 - R.96, the seismicity models consider only "historical observations and instrument recordings" and "over a 100-year period from the year 2000." There
3.5.6.32 is no citation of any work on the largest earthquake in the region in the last 35,000 years (maximum credible event) or, even the last 10,000 years. There is also no estimate of the largest earthquake to be expected 10,00 years into the future.

16. On page R.96, "criticality" is mentioned, but it is not discussed in any detail. If it is of sufficient concern to be mentioned in the DEIS, it is of sufficient concern to
3.4.3.8 the reader to be thoroughly discussed and not summarily dismissed. This is particulary true since the AEC was concerned enough about criticality to take emergency measures to prevent a plutonium waste trench at Hanford from becoming critical. The credibility of DOE is the only thing that suffers from such statements as criticality having "no credible basis."

4.2.55 17. On page R.97, the reference for Stone, Thorp, Gifford, and Holtink has no date.





**COMMENTS ON APPENDIX U**
**PRELIMINARY ANALYSIS OF THE FUTURE GROUNDWATER TRANSPORT OF CHEMICAL RELEASED**

The make-up of the chemical wastes which were disposed in the cribs, trenches, ponds, French drains and tanks is not well understood. As pointed out in this appendix, 3.1.6.1
substantial quantities of nitrate compounds and various salts are within the waste. In addition, metals such as chromium and mercury and organic compounds are available for solute transport from the waste. In the EIS, these compounds are considered secondary to the radiological wastes disposed at the site. For the long-term, these pollutants may be just as important because these do not decay with time. It is important that the nature of these chemical waste be fully understood and that the sources are characterized in detail.

The following comments refer to Appendix U:

1. Maps would be helpful illustrating the sources of the chemical contaminants.

2. Maps should be drawn showing the predicted distribution of the various chemical contaminants with time after final burial.

3. Illustrations would be useful in defining terms such as what happens when Kd (distribution coef.) = 0 as opposed to Kd = 10E3.

4. In this appendix, all analytical projections were based on conservative estimations which were considered "worst case" transport times for various chemical parameters. A "conservative ion" is an ion that moves essentially at the same velocity of the groundwater. Because of the unknowns (esp. the waste make-up and volume available for transport) at the site, the statement that the chemical solutes will travel in the groundwater with little or no retardation may or may not be true, but to state this is the most conservative approach is wrong. Time is a relative parameter, the longer a chemical species remains in the groundwater system, the more potential for harm. It is important to know if any retardation of any chemical species occurs in the groundwater system and how long it will take to flush the system. Prior to assessing the impact of various disposal systems, it is important to understand the self-cleaning capacity of the aquifer.

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COMMENTS ON APPENDIX V
SELF MONITORING EXPERIENCE

In general, this appendix raises some interesting questions about past waste disposal activities at the Hanford Reservation. In the text, it is stated that there are approximately 200 waste disposal facilities constructed in the 200 Areas and very little is known about the majority of them. The following comments refer to Appendix V:

1. The groundwater monitoring network is comprehensive with over 2900 wells drilled and approximately 1100 wells being completed below the water table. It is understood (not clearly stated) from reading the text that the wells which are monitored on a regular basis act as a early detection system for possible excursions of radionuclides from cribs, trenches, ponds, French drains, storage tanks and reverse wells. If it is detected in one of the observation wells that groundwater contamination is occurring, a detailed characterization of the waste site takes place.

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3.5.6.41 2. At the Hanford site, four cribs, one trench, one French drain, one tank leak, one reverse well, and one disposal pond have been characterized. The reasons for the selection of these particular disposal sites for characterization is not clearly understood. However, in each case contamination of the subsoil had occurred to some extent. Groundwater contamination was detected only in a few instances. In one case (Trench 216-Z-9), over 100 kg of Pu was deposited and critically was of concern. This trench was mined for plutonium from 1976-1977.

3.5.6.41 3. If only nine sites out of 200 have been characterized, there are several questions still remaining as to the nature of the wastes and whether or not an effective EIS can be written evaluating the potential impact of waste disposal at the Hanford site.

3.5.6.41 4. It would be helpful if a map of the 200 Areas were presented showing the locations of all the disposal sites.

3.5.6.41 5. A table should be prepared showing the chemical make-up of the waste in each disposal site.



6. In the characterization of the various cribs, trenches and pond sites, dry wells were used to study the vadose zone. Since wells are generally not valid for monitoring water in the unsaturated zones, suction lysimeters or other methods are recommended. 3.5.6.41

7. Several of the wells were drilled on the site in the 1940s, 1950s and 1960s. Were these wells drilled and completed to strict QA/QC standards? If not, how valid is the data? 3.5.6.41

8. This appendix points out the complexity of each disposal site. The potential for groundwater contamination and solute transport is highly dependent on the site specific geology and hydrogeology of each site. This appendix also points to the difficulty of modeling the groundwater system for solute transport due to these complexities. Of the 200 sites, only four percent have been characterized. Until each site is fully understood, it will be very difficult with any certainty to predict the impact of the various disposal scenarios. 3.5.6.41

9. No information from field testing was utilized in the analysis of cumulative impacts from the 200 disposal sites. Such an analysis should be required. 3.5.6.41

Representative Dean Sutherland

LEGISLATIVE BUILDING OLYMPIA WASH.

AUG 1 4 1986

July 29, 1986

Mr. Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

Dear Mr. Holten:

Comments follow on the DEIS, "Disposal of Hanford Defense High-level, Transuranic, and Tank Wastes" DOE/DEIS-0113.

The DEIS includes (in addition to the required "no action" alternative) three alternatives: almost complete geologic disposal, complete in-place stabilization, and a reference alternative that is a combination.

The DEIS asserts that there is no preferred alternative at this time, but one can reasonably infer the reference alternative is preferred. Accordingly, I shall direct my comments to this alternative.

3.3.4.2 I have basic concerns about national radioactive waste disposal plans which include deep geologic disposal. Out of sight-out of mind-out of control. On the other hand, when material is in monitored retrievable storage, it is under surveillance and amenable to future uses which may arise or neutralization methods which may be developed.

3.3.4.2 Applying these basic concerns to the Hanford DEIS, I include transuranics in interim, retrievable storage, double-wall tank contents, single-wall tank contents, strontium and cesium in capsules, and newly generated high-level and transuranic wastes. These wastes should be placed in safe and secure monitored retrievable storage. There are some additional transuranic sites, pre-1970 ones, which should be evaluated for monitored retrievable storage. These sites are indicated in the DEIS.

2.3.1.13 All radioactive waste should be rendered safe and inaccessible. In this connection it is appropriate to stabilize in place low activity low-level waste and provide sites with barriers and markings. Monitored, retrievable storage sites should be marked and include features to preclude unauthorized access.

COMMITTEES CHAIR, NATURAL RESOURCES • TRANSPORTATION • ENERGY & UTILITIES

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Assured protection of the public should be the underlying basis for all operations and I ask that all plans and operatives reflect this. 2.2.1

Thank you for the opportunity to comment.

Sincerely,

Representative Dean Sutherland
17th District

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Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99352

Dear Mr. Holten: August 8, 1986

In accordance with the guidelines on presenting comments on the Hanford Defense Waste EIS and with the instructions from the DOE Hanford staff, my review comments are enclosed. If you or the DOE Hanford staff have any questions on these comments, please call to discuss them at your convenience. If you call and leave a message at work (404-722-4471 E205) or at home (404-860-2567), your call will be returned at the earliest opportunity.

Sincerely,

W.F.Lawless

W.F. Lawless,
Assistant Professor of Mathematics
Paine College
1235 15th Street
Augusta GA 30910

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Department of Energy Draft Environmental Impact Statement
Disposal of Hanford Defense High-Level,
Transuranic and Tank Wastes,
Hanford Site
Richland, Washington

W.F.Lawless
Assistant Professor of Mathematics
Paine College

August 8, 1986

Abstract

By 1980, significant differences existed between Department of Energy (DOE) practices and DOE technical requirements in the DOE radioactive waste management guidelines (AEC 0511). At DOE Hanford, these differences resulted in 149 tanks of high-level radioactive waste that could not be removed from failed Hanford high-level waste tanks nor sent to a federal repository. In addition, at Hanford, 12 million cubic meters of plutonium-contaminated soil exceeded the volume of the proposed DOE New Mexico plutonium repository by 65 times. The DOE began to revise their guidelines during 1980-84. But difficult obstacles remained that prevented the DOE from easily affecting changes, including the 1982 Nuclear Waste Policy Act. However, the new DOE radioactive waste management guidelines, DOE Order 5820.2, allow the contents of the failed Hanford high-level waste tanks to be left in place (in situ) and may prevent the high-level waste in the failed Hanford tanks from being regulated by the Nuclear Regulatory Commission as required by the 1982 Nuclear Waste Policy Act.

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Department of Energy Draft Environmental Impact Statement

Disposal of Hanford Defense High-Level,

Transuranic and Tank Wastes

## Summary

The Department of Energy (DOE) knew by 1980 that DOE was unable to comply with its 1973 AEC radioactive waste guidelines at any of its military nuclear waste disposal sites. The problems at DOE Hanford were larger in magnitude than those at other DOE sites (1). The Hanford problems centered around a large volume of plutonium-contaminated soil, and high-level wastes in 149 failed or isolated high-level waste tanks. Both of these problems were the subject of DOE meetings in 1982 and both were resolved by replacing the AEC radioactive waste guidelines with a new DOE Order. The new DOE Order for radioactive waste management did not receive public notice nor a public review as required by CEO regulations, although the Order represented a major federal action (2).

Of many changes, the new DOE Order redefined high-level and transuranic wastes. Paradoxically, DOE is responsible for the
2.4.1.8 high-level waste repository program for commercial and military nuclear waste. but the 1984 repository guidelines have a different definition of high-level waste than does the 1984 DOE Order for defense radioactive wastes, although both were published 2.2.7
in 1984 (cf. 3 and 4). This means that DOE can treat its defense high-level waste differently from the high-level waste identified for the high-level waste repository. Specifically, under the new DOE criteria, military high-level waste that cannot be moved to a federal repository need not be moved as required by law. Also, if the Hanford high-level waste is buried at the surface in Hanford soil, the new DOE Order may prevent the failed Hanford high-level waste tanks from being licensed by the NRC.

The new DOE Order treats high-level waste as a combination of transuranic and low-level waste. In normal high-level waste tank operations, this may not lead to different procedures. However, classifying the high-level waste as a combination of transuranic and fission product waste (low-level waste) allows the DOE to redesignate the high-level waste in the failed tanks as less restrictive radioactive waste categories. The new DOE Order assists this recategorization with a new higher level of concentration for the definition of transuranic waste (i.e., 100
nCi/g instead of 10 nCi/g). This new definition for transuranic 2.4.1.8
waste allows the high-level waste in the 149 failed tanks to be reclassified as low-level waste, the least restrictive category, skipping the transuranic waste category altogether. Because tran-

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2.4.1.8 suranic waste may be required to be sent to the WIPP repository for transuranic waste in New Mexico, the 1984 DOE Order provides an incentive and a means to reclassify the high-level waste in the failed Hanford high-level waste tanks not as transuranic waste but as low-level waste.

Plutonium waste in the failed Hanford tanks could be reclassified as low-level waste instead of transuranic waste by adding rocks, cement, or other material to the tanks. Radioactive waste is categorized as transuranic only if the concentration of alpha emitters (e.g., plutonium) exceeds 100 nCi/g. This concentration is calculated by dividing the number of curies of alpha emitting waste by the total weight of the waste matrix including containment and shielding; homogeneity of the waste matrix is not a factor (3,5). Although the amount of plutonium in an isolated tank would stay the same, the calculation is based on total weight. This means that rocks, concrete, or other materials added to the failed high-level waste tanks would reduce the calculated concentration or ratio of plutonium. Since the amount of transuranics depends on the ratio of plutonium to total weight, the result would decrease the amount of transuranic waste while increasing the amount of low-level waste. Alternatively, if the contents of a tank cannot be recategorized low-level but can be classified transuranic, the new DOE Order no longer requires

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transuranic waste to be sent to WIPP for repository disposal if DOE can prove to itself that the transuranic waste is safer buried where it is.

The new DOE Order for radioactive waste management is not in accord with public law, the 1982 Nuclear Waste Policy Act. For example, the 1982 law defines high-level waste as the liquid or solidified liquid waste resulting from fuel reprocessing, but not as a combination of transuranic and low-level waste as defined in the new DOE Order. The 1982 law includes all military high-level nuclear waste without exception. Third, the law specifies that the Nuclear Regulatory Commission license all high-level waste disposal. This requires that the high-level waste in the failed Hanford high-level waste tanks be retrieved, solidified, and buried in deep geological disposal. If the Hanford high-level waste in the failed tanks is left in the tanks in near surface-disposal, the law requires that the Nuclear Regulatory Commission license the disposal site of the failed tanks as a repository. If the site of the failed Hanford high-level waste tanks becomes a high-level waste repository, the releases of contamination from the disposal site must meet Environmental Protection Agency regulated release limits. However, Hanford data indicates that current releases into the Columbia River from the Hanford site already exceed EPA regulations (e.g., 6). 2.4.1.6

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General Comments

1. In 1983, the Department of Energy (DOE) Inspector General investigated whether or not the self-regulated DOE changed the criteria and guidelines in its policy for military radioactive waste management to cover up or to mitigate the effects of significant environmental contamination at DOE waste management disposal facilities located throughout the United States (7,8). Although the DOE Inspector General found instances of mismanagement and improprieties, the Inspector General found that the DOE had not acted improperly by issuing new guidelines for the management of military nuclear waste (9). The DOE Inspector General's investigation did not include site visits to any of the DOE nuclear waste disposal sites, and did not verify any of the DOE technical studies supporting the revision of the DOE guidelines. The DOE Inspector General's conclusion was made "...subject to onsite investigation..." (9).

The first radioactive waste management guidelines for military nuclear waste were published in 1973 by the Atomic Energy Commission (AEC) (5). But before these guidelines were written, the AEC had established by 1968-6[5] two of the key provisions of the 1973 guidelines: that all high-level radioactive waste should be solidified, and that plutonium contaminated waste

(no comment identified)

(no comment identified)

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was to be retrievable for later disposal (10). The formal 1973 guidelines grew out of these provisions and the overall AEC policy to minimize releases to the public to the extent possible (10).

The 1973 AEC guidelines defined high-level waste as the aqueous waste, or the products of its solidification, resulting from processing irradiated reactor fuels (spent reactor fuel was included in the definition but is not germane to this issue). High-level waste was initially to be placed in retrievable storage; then, eventually, it was to be isolated from the human environment. Transuranic (usually plutonium) solid waste was defined as being different from high-level waste. However, transuranic waste was also to be stored for later retrieval, but the 1973 criteria did not require the repository disposal that has since been chosen for transuranic waste (at WIPP in New Mexico). The guidelines did state that transuranic waste was to begin at and include alpha-contaminated waste above concentrations of 10 nCi/g (5).

The AEC guidelines became policy. This nuclear waste policy was reflected in reports from 1974-1982. For example, a 1974 Hanford (Richland, WA) report stated:

> Present Atomic Energy Commission (AEC) regulations require that the liquid high-level waste from fuel reprocessing 1) be converted to a solid material within 5 years after separation in the fuel reprocessing step, and 2) be encapsulated and shipped to a federal repository within 10 years of its production for long-term management by the AEC (11).



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(no comment identified)

In another example, a 1982 Savannah River Plant (Aiken, SC) report stated:

> The current reference plan for managing high-level wastes from the processing of nuclear reactor fuels is to solidify the wastes in a high-integrity form with very low release potential and place the immobilized waste in federal repositories (12).

More important than the AEC guidelines, but just as specific, were the federal regulations established by AEC in 10 CFR 50:

> High-level liquid radioactive wastes shall be converted to a dry solid...and placed in a sealed container prior to transfer to a Federal repository ...(13).

The plans for the disposal of military high-level waste were solidification and disposal in federal repositories. But problems, somewhat unforeseen in 1973, became apparent soon after.

(no comment identified)

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Part of the guesswork in the 1973 AEC guidelines was on the use of seepage basins, cribs, and other natural soil columns to dispose of voluminous but lightly contaminated liquid wastes. With the many hydrogeologic uncertainties that existed then, the 1973 AEC guidelines stated that these natural soil columns should be replaced as soon as technically and economically feasible (5). Yet, with approval by the Atomic Energy Commission (and subsequently ERDA and DOE), AEC contractors described this requirement as too restrictive and unnecessary (8).

Environmental problems first became evident with the use of these natural soil columns. For example, plutonium released to the Z-9 crib at DOE Hanford resulted in an increase of reactivity and a near criticality accident (14; 15, p. V.17). Mercury released at DOE Oak Ridge (Oak Ridge, TN) through leaks and from seepages resulted in one of the largest industrial spills of mercury in the U.S. (16) and led to a successful lawsuit that removed from DOE the right to self-regulate hazardous wastes (8). (The DOE Byproduct Rule recently promulgated by DOE has been challenged by a Congressional Subcommittee as an attempt by DOE to circumvent the 1984 federal court ruling regarding DOE hazardous wastes.(17) A lawsuit settlement prevented disclosures of radioactive contamination problems at DOE Los Alamos (Los Alamos, NM) (18). The Snake aquifer and plant drinking water at the DOE







Idaho National Engineering Laboratory (Idaho Falls, ID) were contaminated (8). Drinking water and the Tuscaloosa aquifer at the Savannah River Plant have become contaminated (8). But to DOE management, the more serious DOE radioactive waste problems involved the Hanford plutonium soil contamination and the Hanford high-level waste in the failed high-level waste tanks (1,7).

The Hanford problems were well-known by 1980 within the DOE community (19), but these problems did not surface outside of DOE until DOE began to change the old AEC standard in 1982 (1). The Hanford problems were two-fold. First, the plutonium contaminated soil in concentrations above 10 nCi/g, released to the environment through seepages or cribs, was estimated at up to 12 million cubic meters of soil (1). This volume of soil, if transported to the plutonium repository under construction in New Mexico, the Waste Isolation Pilot Project (WIPP), would exceed the WIPP volume by almost 65 times. The second major problem was the 149 failed or isolated Hanford high-level waste tanks. The single shell high-level waste tanks at Hanford were deactivated and isolated from the rest of the Hanford tank farm system in 1980 by disconnecting and sealing all pipelines and tank connections. In 1985, stabilization and isolation was planned by DOE headquarters to be completed for the Hanford tanks by 1989 (19).

Whereas both of these Hanford problems represented a failure



(no comment identified)

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by DOE to meet the criteria set in the AEC guidelines and regulations, a further concern was the 1982 Nuclear Waste Policy Act (20). This law required commercial and military high-level waste to be isolated from the biosphere in a permanent, deep geological repository, and that such repositories be licensed by the Nuclear Regulatory Commission, not DOE. The 1982 law defined high-level waste in the historical tradition,

> the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations... (20)

This law meant that if the high-level waste in the failed Hanford high-level waste tanks could not be removed, then the failed tanks may become a repository licensed by the NRC. In addition, releases from this repository would be regulated by the Environmental Protection Agency (20). If the NRC and the EPA began regulating high-level waste in the failed Hanford high-level waste tanks, it would represent a diminution of DOE authority on DOE property, and it would establish a precedent.

During 1982, the first modification of the AEC guidelines began with the issuance of part of the new DOE Order solely for



transuranic waste management (21). This portion of the new DOE Order changed the definition of transuranic or plutonium waste from 10 to 100 nCi/g. Plutonium waste less than 100 nCi/g became low-level waste. Of further importance, transuranic waste no longer had to be sent to a federal repository if DOE could demonstrate to itself that the waste was safely buried where it was. Although the amount of transuranic waste at Hanford above 10 nCi/g was estimated by DOE at up to 11 million cubic meters, the amount above 100 nCi/g was estimated in 1983 by DOE at 4 million cubic meters (22). In 1984, without explanation, the transuranic contaminated soil at Hanford decreased from 4 million to 32,000 cubic meters (23).

The final version of the new DOE Order for radioactive waste management was published in 1984 (3). With the new order, the definition of high-level waste and the policy for the disposal of high-level waste changed. The new definition for high-level waste became:

> The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from that liquid, that contains a combination of TRU waste and fission products in concentrations as to



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require permanent isolation (3).

The key difference in the new DOE Order from the 1973 AEC criteria was to define high-level waste (HLW) as a combination of transuranic (TRU) waste and fission products (low-level waste). But the definitive change in the new DOE Order was on the treatment of its military high-level waste:

> New and readily retrievable existing HLW shall be processed for disposal in a geologic repository according to the requirements of the Nuclear Waste Policy Act of 1982 (Public Law 97-425). Other waste will be stabilized in place if after the requisite environmental documentation, the stabilization in place meets applicable EPA standards...Any radioactive waste disposed prior to implementation of this Order shall be periodically monitored insitu (3).

Although the last two sentences quoted from the DOE Order do not specify high-level waste, these sentences are located in the requirements for high-level waste.

The new DOE Order on radioactive waste management represented a major change in the management of military radioactive waste. Federal regulations require an environmental impact statement for any major federal action (24). The DOE did not prepare an environmental impact statement for the new DOE Order, and DOE



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issued the new order without public notice or public review (7,8).

2. DOE admitted before a State of Washington legislative hearing in June 1986 that Hanford is disposing of low-level radioactive waste in cardboard boxes, including plutonium waste below 100 nanocuries per gram (25). Although DOE Order 5820.2 allows the use of cardboard boxes, the NRC has banned their use in commercial burial grounds. DOE Savannah River Plant has also terminated the use of cardboard boxes (9). Hanford should terminate the use of cardboard boxes for radioactive waste, or the EIS should justify their continued use. 3.1.5.8

3. The DOE self-regulates its own management of radioactive wastes. Many of the problems at the Hanford facility and at other DOE facilities can be traced to self-management practices. e.g., changing DOE standards without public review, using cardboard boxes, coverups of reports (7,9), recalling letters and reports and converting them to drafts to avoid Freedom of Information requests (7,9), etc. DOE radioactive waste management should be brought under NRC, EPA and state regulation, ending the DOE self-regulation of nuclear wastes. 2.2.13

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4. DOE self-regulation is compounded by writing DOE environmental impact statements, such as the Hanford Defense Waste Draft EIS, to support DOE decisions. EIS documents are written by well-informed, well-paid experts, but EIS documents are reviewed by an ill-prepared public within a restricted time period (the DEIS was itself 2 years overdue). DOE environmental impact statements
2.3.2.9 should be reviewed by independent peer review groups, for the benefit of the public and DOE, before the EIS documents are reviewed by the public.



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Specific Comments

1. Foreword, p. v. The Hanford Defense Waste Draft EIS (DEIS) excluded low-level radioactive wastes in liquid and solid disposal sites at Hanford after DOE changed its regulations for radioactive wastes. This change reduced the amount of transuranic and 2.3.1.13
high-level wastes considered by the Hanford DEIS, e.g., 99.7% of the amount of transuranic contaminated soil was changed to low-level waste. The Foreword should justify the exclusion of low-level wastes from the DEIS.

2. Foreword, p. vi. The Defense Waste Management Plan (DOE/DP 0015) publication date of June 1983 should be included in reference to the Plan. The 1983 date of this Plan indicates that 2.2.8
DOE had already determined by 1983 that the high-level waste in the failed Hanford high-level waste tanks were not to be moved. Although in conflict with the 1982 NWPA public law, DOE changed the definition and management proceedures for Hanford high-level waste in its DOE Order 5820.2 to support the 1983 decision by DOE in its Plan. Because the EIS is the decision document for major federal actions, the final EIS should justify the early decision by the Plan and DOE Order 5820.2; and the EIS should state whether the Plan and the DOE Order have made the DEIS for Hanford

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Defense Wastes a superfluous document.

3. Foreword, p. vii. The Draft EIS states that it has been written in compliance with CEQ guidelines. The CEQ guidelines require that an EIS be written for all major federal actions, including the replacement of guidelines and operational criteria (2), e.g., 2.4.1.8 DOE Order 5820.2 for radioactive waste management. An EIS for DOE Order 5820.2 was not written. The final Hanford Defense Waste EIS should justify not publishing an EIS for DOE Order 5820.2. The DEIS did not describe the environmental impact that changing the DOE Order has had on the Hanford environment, e.g., the DOE Order allows Hanford high-level waste to be left in Hanford high-level waste tanks, at a savings of approximately $8,700 million (geologic disposal minus reference disposal: cf. 15, p. xi). But this is not an accurate assessment of the impact the DOE Order means to DOE Hanford because the definition of transuranic waste was also changed. The 12,000,000 cubic meters of Hanford plutonium contaminated soil should be included in determining the impact of DOE Order 5820.2 on the Hanford defense wastes. A conservative estimate of the impact of DOE Order 5820.2 on the Hanford facility could exceed $ 10 billion in savings (possibly exceeding $25 billion: cf. 15, p. 3.33). These estimates of multibillion dollar costs would agree with the prediction made by DOE

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contractors during 1982 (1).

4. Executive Summary, p. ix. The DRAFT EIS states that decontamination and decommissioning wastes are to be excluded from consideration. 2.3.1.14 The EIS should justify the exclusion of D&D waste from the Hanford DEIS. The EIS should list all projects in the Hanford D&D program. The EIS should review whether transuranic contaminated soil is or has been in the Hanford D&D program. The EIS should quantify the radioactive constituents in the Hanford D&D program.

5. General Summary, p. 1.3. Since the dual purpose N-Reactor is used to generate commercial electricity, the N-Reactor should be regulated by NRC regulations for commercial power generators.

6. P. 1.5. The phrase 'a high level of public protection' should be quantified. The relevance of the phrase should be extended to Hanford plant workers under all working conditions at Hanford, e.g., the contamination of plant drinking water at Hanford with tritium that exceeded the EPA drinking water standard (26).

7. P. 1.5. The comment that Hanford wastes pose no danger to the 3.5.3.12 general public should be changed to include a comment that cur-

rent releases to the Columbia River exceed allowable release levels established by EPA standards (e.g., 6; cf. 15, Table 4.2). The current concentrations of all radionuclides and RCRA nuclides by source, volumes, type (e.g., groundwater spring, etc.), entering the Columbia River should be included as data in this EIS.

3.2.3.5 Because reprocessing re-started at the end of 1983, the latest Hanford annual monitoring report, a 1983 report, indicates that the current level of airborne contamination affecting the public is unknown. The current actual, not calculated, plume concentrations per cubic meter (total, minimum, maximum, mean, standard deviation, etc.) of airborne radioactive and/or hazardous wastes reaching the public should be published in this EIS (cf. 15, Table 4.1, p. 4.3).

3.1.4.29 8. P. 1.7. Figure 5 should include and differentiate the Hanford tank waste that is the subject of this EIS. This figure should also note the amount of commercial high-level waste that is spent fuel and not reprocessed versus the amount of commercial high-level that has been reprocessed.

2.4.1.2 9. P. 1.8. The Draft EIS states that it may not be justified to solidify Hanford wastes and send those wastes to a repository. The EIS should include at this point a comparison with the







requirements of the 1982 NWPA for high-level wastes, and an analogous comparison with the former requirements of AEC 0511. The EIS should also state at this point why the management of high-level waste in DOE Order 5820.2 is different from the requirements in both the 1982 NWPA and DOE repository guidelines 10 CFR Part 960 (4). The EIS should discuss whether it is advisable that the public law be changed to accomodate the possibility that DOE may leave high-level waste in the soil. 2.4.1.2

10. P. 1.8. The EIS states that about 44,000 cubic yards of high-level, transuranic and tank wastes have accumulated through 1983. The EIS should reference the 12,000,000 cubic meters of transuranic contaminated soil inventoried at Hanford by DOE in 1983 (23), and explain how the 12,000,000 cubic meters of plutonium contaminated soil has been recategorized, where it is now located, what dangers it poses to the public, and what has been done to protect the environment from this recategorized plutonium waste.

11. P. 1.8. The use of the term "football field" does not connote danger from radioactive wastes and could be misleading. 4.2.1
Since the amount of strontium-90 at Hanford exceeds 100 million curies (15, p. 5.48), and 1 curie of strontium-90 proportionately

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4.2.1 spread into the drinking water would exceed the EPA drinking water standard for almost 1 year for the population of the United States, the comparison should help the public not only comprehend the volumes involved, but as well the dangers of radioactive wastes.

3.1.1.11 12. P. 1.9, item 1. The EIS should explain the use of 'Existing Tank Wastes' as a term instead of high-level wastes. The tanks should be referred to as the failed Hanford high-level waste tanks. The 1975 Hanford EIS listed all of the Hanford tanks receiving high-level waste (14; e.g., pp. II.1-32 and 33). In the Hanford Defense Waste DEIS, those same tanks are not described as high-level waste tanks (15; e.g., p. A.4). The EIS should justify these changes.

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3.1.3.2 13. P. 1.9, item 4. The EIS should describe and list the differences between the NRC regulation for low-level waste which describes transuranic waste, and DOE Order 5820.2. The EIS should provide the technical rationale why plutonium waste exceeding 10 nCi/g but less than 100 nCi/g is being treated as low-level waste. The EIS should provide its technical justification for the use of cardboard boxes to dispose of plutonium waste less than 100 nCi/g, and compare the practice to the NRC ban of cardboard



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boxes at commercial low-level burial grounds.

14. P. 1.13. The suggestions that the Hanford high-level waste in the failed tanks could be separated into two fractions, or to permanently fix high-levle waste in place, should not be considered as alternatives until the 1982 NWPA law is changed to allow this course of action for high-level wastes. 2.4.1.3

15. P. 1.14. The third bullet states that the aridity of the Hanford site makes it attractive to consider leaving the defense waste in situ. The third bullet should incorporate DOE data that groundwater springs into the Columbia River already exceed EPA drinking water standards. Although water is the primary pathway considered for the migration of contamination, Hanford data and reports indicate that the controlling pathway for migration will not be water after the facility has been closed but will probably be through biotic vectors, e.g., animals, plants such as tumbleweeds, insects, etc. (Appendix M). While the Hanford facility is operating, the primary surface pathway will probably be through seepage springs into the Columbia River. 3.5.3.11

16. P. 1.14. The effectiveness of the barrier should be compared to a geologic high-level waste repository.

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3.1.4.4 17. P. 1.15. The nuclear waste in the single-walled tanks should be described as high-level waste (see Specific Comment number 12 above).

4.2.55 18. P. 1.17. The comment that "Single-wall tank waste is not readily retrievable ..." should be changed to read " Although single-wall high-level tank waste is readily retrievable at the Savannah River Plant, Hanford single-wall high-level tank waste is not readily retrievable..."

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3.1.6.1 19. P. 1.21. Table 4 should include the health effects from hazardous/ RCRA wastes associated with the defense wastes.

3.5.3.11 20. P. 1.22. The drinking water standard in the Columbia River has already been exceeded at entry/discharge points into the Columbia through groundwater springs (e.g., 6).

2.4.1.8 21. P. 2.1. Earlier comments on the Plan apply in this section (see Specific Comment number 2 above).

3.1.6.1 22. P. 3.2. The effects of RCRA/ hazardous wastes, including solvents, on the confined and unconfined Hanford aquifers should be reported in the EIS.



23. P. 3.21 The predicted RCRA/ hazardous consequences of the 173,000 cubic meters of grout should be reported in the EIS. 2.4.1.9

24. P.4.2. The 200 Area's groundwater recharge indicates an effluent release of 5 E9 gallons of effluent per year into the soil. This figure should be expanded and updated to include all Hanford releases broken down like ERDA-1538, II.1-32 and 33.

25. P. V.2. All groundwater well-log data and monitoring data for unconfined and confined aquifers for CY 1985 should be reported in this EIS for radionuclides and RCRA chemicals.

26. The geologic disposal option at Hanford for tank wastes at $11 billion is approximately 3 to 5 times more expensive for the same option at the Savannah River Plant where all of the high-level waste is going to a repository. The EIS should justify this higher Hanford cost differential. 3.3.1.2

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13. 10 CFR 50 Appendix F. Policy relating to the siting of fuel reprocessing plants and related waste management facilities.

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16. Marshall, E., The Lost Mercury at Oak Ridge. Science, 221, 130-132 (1983).

17. Congressional testimony before the Subcommittee on Energy Conservation & Power, U.S. House of Representatives, April 10, 1986.

18. Rogers, M.A., vs. Los Alamos National Laboratory, Case No. LA 82-176(C). See also Rogers, M.A. History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T). LA-6848-MS, Vol.I (1977).



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19. FY 1985 Program Summary Document, DOE Office of Defense Waste and Byproducts Management, DOE/DP-0016/1 (ca. 1984).

20. The Nuclear Waste Policy Act of 1982, 10 CFR Part 960.

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22. Kennedy, W.E., Napier, B.A., & Soldat, J.K. Advanced Disposal Systems For Transuranic Waste: Preliminary Disposal Criteria For Plutonium at Hanford. Nuclear and Chemical Waste Management, 4, 103-112, (1983).

23. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, p. 103. DOE/NE-0017/2 1983); and p. 121, DOE/RW-0006 (1984).

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25. Legislative Hearing, State of Washington House of Representatives, House Energy and Utilities Committee, June 6, 1986.

26. Eddy et al., Radiological Status of the Groundwater Beneath the Hanford Project, 1979 to 1982, PNL 3346, 3768, 4237, 4659.

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REVIEW

# DRAFT ENVIRONMENTAL IMPACT STATEMENT

## DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL, TRANSURANIC, AND TANK WASTES

AUGUST 1986

Nez Perce

NUCLEAR WASTE POLICY ACT PROGRAM

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**REVIEW OF DRAFT ENVIRONMENTAL IMPACT STATEMENT**

**DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL**

**TRANSURANIC AND TANK WASTES**

Submitted by:

**NEZ PERCE TRIBE**
**NUCLEAR WASTE POLICY ACT PROGRAM**

909

August 1986

Prepared by:

Council of Energy Resource Tribes
1580 Logan Street, Suite 400
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Nez Perce
NUCLEAR WASTE POLICY ACT PROGRAM

AUG 14 1986 0234

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August 5, 1986

Department of Energy
Richland Operations Office
Waste Management Division
P.O. Box 550
Richland, Wa 99352

Attention: R.A. Holten/E.I.S.

Dear Sir:

Enclosed herewith are written comments on the draft Environmental Impact Statement (EIS) "Disposal of Hanford Defense High-level, Transuranic, and Tank Wastes" DOE/EIS 0113.

The prepared comments do not directly state a recommended alternative, but discuss details relative to issues of tribal concern. The Nez Perce Tribe prefers the geologic disposal alternative where most of the waste is exhumed, treated... and disposed of in a deep geologic repository; where high level waste is disposed of in a commercial repository developed pursuant to the NWPA; and TRU would be disposed of in the WIPP site near Carlsbad, New Mexico.

Thank you for your attention to this important matter.

Sincerely,

Del T. White, Chairman
Special Nuclear Waste Sub-committee

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**REVIEW OF DRAFT ENVIRONMENTAL IMPACT STATEMENT**

**DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL, TRANSURANIC, AND TANK WASTES**

**GENERAL COMMENTS**

The following general comments and concerns relate to the Draft EIS as a whole and not to specific chapters or appendices:

1. There is no discussion in the Defense Waste DEIS on the responsibility of the U.S. Department of Energy (USDOE) to meet its obligations under the trust relationship between the U.S. government and the Nez Perce Tribe. The potential disposal of high-level defense waste either In situ or in a deep geologic repository at the Hanford site along the Columbia River requires consideration of this important responsibility. 2.4.2.2

2. The Defense Waste DEIS is deficient in its analysis of the cumulative impacts of the disposal of defense wastes at the Hanford site combined with the variety of federal and non-federal activities at Hanford involving plutonium processing, radioactive materials research, nuclear power plant construction, operation and decommissioning, and high and low-level waste disposal activities. The inadequate consideration of the cumulative impacts violates the Council and Environmental Quality Regulations and the caselaw interpreting NEPA and its regulations. 2.3.1.14

3. The Defense Waste DEIS fails to discuss the application of relevant hazardous waste laws.

While it is stated that all applicable laws will be followed the statements are vague and conflictive. The DEIS does not address the requirements and the intent of federal envrionmental law embodied, particularly, in RCA and CERCLA (Superfund). Defense waste disposal activities must carry out the intent of NWPA and the standards established to support NWPA and NRC (10 CFR 60) and EPA (40 CFR 191); otherwise an inconsistent dual system is established in which the lower standards of the defense-only disposal scheme will defeat the purpose of NWPA and other federal laws. 2.4.1.1 2.4.1.9



4. The Defense Waste DEIS does not discuss the disposal of some of DOD's most radioactive waste--spent reactor cores from nuclear naval vessels. Such cores would constitute a significant inventory to be processes if Hanford were used for co-disposal of commercial and defense wastes in a high-level nuclear waste repository. An impact assessment for this potential DOE/DOD activity should be included in the Final EIS. 2.3.1.14

5. The Defense Waste DEIS uses a "granite repository" for cost calculations used to compare the "geologic disposal alternative" to the "reference alternative". The "granite" or second, repository program was "postponed indefinitely" by the Secretary of Energy on May 28, 1986. This postponement may prevent completion of a granite repository and may invalidate the cost comparisons. 3.3.1.3



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## EXECUTIVE SUMMARY

The Executive Summary indicates that non-high level and non-defense nuclear waste is not considered in the draft EIS. This means that past, present, and future low-level
2.3.1.14 commercial-generated waste, decommissioned submarine reactors, and retired DOE and foreign production reactors are not discussed in this EIS. Recently released documents on past radionuclide releases at Hanford indicate that any future development at Hanford, including the proposed BWIP nuclear waste repository, should be considered in terms of cumulative environmental and socioeconomic impacts, not separately as is the current practice.

On page x, second paragraph, the statement is made that "the environmental impacts (both short- and long-term) calculated for the four alternatives generally are low and show no marked difference among the three disposal alternatives." This statement is misleading, since many readers will not critically review the appendices, where Appendix R indicates that in the in-situ and no-action disposal alternatives, fatalities can be expected from drilling or excavating into buried strontium and cesium capsules. A more judicious, accurate statement of differential environmental impacts is warranted.

## CHAPTER 1 - GENERAL SUMMARY

Better written and more useful than the Executive Summary, Chapter 1 does convey the significant differences in environmental and health consequences of the four alternatives being considered in this EIS in Tables 3 and 4. The discussion of these tables on page 1.19 does not, however, emphasize these differences and includes little to draw the readers' attention to the radiological reasons for proposing the reference alternative.

## CHAPTER 2 - PURPOSE AND NEED

Descriptions of the statutory requirements appear to be adequate, although discussion of the "need" for permanent defense waste isolation from the biosphere is largely absent. To some extent, comparative disposal methods and related hazards are described elsewhere in the document. However, more information in Chapter 1 and 2 concerning permanent isolation and its role in protecting the general public from exposure to ionizing radiation would be helpful to lay readers. This information could include brief



descriptions of the radiation hazards associated with defense waste disposal, the biological effects of ionizing radiation, and the relative effectiveness of engineered and natural barriers in isolating wastes from the biosphere.

## CHAPTER 3 - DESCRIPTION AND COMPARISON OF ALTERNATIVES

The alternatives selected for disposal of the Hanford defense waste are logical and make
a particularly strong case against the "no disposal action" alternative (Table 3.28). The 3.3.3.1
cost comparisons for the four alternatives make a strong case for the "reference" alternative over the only slightly less expensive "in-situ" and "no disposal action"
alternatives. The "reference" alternative fails, however, to provide unrestricted use of 3.3.4.1
the Hanford Reservation to future generations of Nez Perce tribal members, to whom the right to hunt, fish, and gather roots and berries on the lands comprising Hanford was restricted in 1942 in violation of their respective treaties of 1855. The majority of the comments on the technical content of this chapter are made in comments on the appendices, particularly Appendices C, D, E, M, R, S, and U.

## CHAPTER 4 - AFFECTED ENVIRONMENT

Chapter 4 discusses environmental monitoring results for Hanford as of 1984, the last
complete data set available. However, this chapter discusses very little data on 3.5.4.6
historical releases at Hanford (1943 to 1984) or the long-term degradation of the enviroment due to these releases. This is in contrast to Section 4.3, Seismicity, which discusses historical seismicity since 1850 (see Figure 4.4). The cumulative, long-term impacts of all of Hanford's operations are of particular concern to the Nez Perce, who have treaty rights and "usual and accustomed" fishing grounds on the entire Columbia River above Bonneville Dam. The comment on page 4.12 that 270 Ci of Cobalt-60 are found in Columbia River sediments between the Hanford site and the mouth of the river can be combined with the comment on page 4.28 that "the Hanford site serves as the spawning area for more than one-third of the fall chinook salmon in the mid-Columbia" to see that the tribe has legitimate cause for concern over Hanford's past, present, and future operations.

The fact that "the prevailing wind directions are from the northwest in all months" (page
4.21 and Figure 4.10) is a major concern of the tribe because the reservation is located 2.4.2.3
east of the Hanford reservation. The viability of future hunting and gathering on contaminated lands within the Hanford reservation is also of concern to the tribes.

Although most of the comments on the technical content of Chapter 4 are contained on the comments on individual appendices, some will be included here. The reference to
3.5.2.4 Myers and Price, 1979, extensively paraphrased on pages 4.8 and 4.9, is confusing because the reference is not listed in this format in the reference list on page 4.39. The vertical exaggeration of 52 on Figure 4.3 is too great, leading the lay reader to a distorted view of the surficial geology of the Hanford area. Although the magnitude of the probable maximum flood on Cold Creek is discussed on page 4.12, the locations of any high-level waste disposal sites within the 200 Areas that may be included in this floodplain now or 10,000 years in the future are not discussed in chapters 4 or 5.

CHAPTER 5 - POSTULATED IMPACTS AND POTENTIAL ENVIRONMENTAL CONSEQUENCES

Because Chapter 5 deals with impacts of the four alternatives discussed in Chapter 3, it is based on data from all of the appendices. For this reason, detailed comments on the models and conclusions discussed in the chapter are found in the evaluations of the individual appendices. Some general comments are, however, included in the following paragraphs.

On page 5.4, data concerning monitored releases from Hanford in 1984 is discussed. The cumulative whole-body dose incurred by an individual due to 40 years of Hanford releases is not discussed. The impact of the proposed action is not an isolated event, but only a
2.3.1.14 part of the total history of plutonium processing, radioactive materials research, nuclear power plant construction and operation, and high- and low-level waste disposal activities at Hanford. Unless these activities are considered together, the actual impacts to the environment cannot be determined. For this reason, the Nez Perce, who are very concerned about long-term impacts to their possessory and usage rights area, which includes all of the Hanford reservation, does not accept the impact scenarios discussed in Chapter 5 and Appendices H, I, N, and R.

Sections 5.2.2.4, 5.3.2.4, 5.4.2.4, and 5.5.2.4 discuss ecological impacts of the four alternatives being considered for defense waste disposal. These sections, however,
3.2.4.2 discuss only the on-site impacts and not the impacts off the Hanford reservation. Even on Hanford, Chapter 5 presents no quantitative data for impacts to wildlife and plants. DOE seems to confuse "ecological impacts" with the amount of sand gravel resources to





be used in construction of each alternative. Therefore, the "operational" ecological impacts of the no disposal action alternative (Section 5.5.2.4) should be defined as all 3.2.4.2
impacts from blowing dust, seepage, etc., over the period from the present to the year 2150, since no conventional "operations" will be performed to clean up the waste. These impacts are stated to be ". . . essentially unchanged from present conditions," although the potential for the long-term contamination of plants and wildlife through this alternative is undoubtedly greater than the potential for all the other alternatives combined.

Summary tables are needed for Sections 5.3.4.3 and 5.5.4.3, Impacts from Disruption of Wastes by Intruders, and 5.3.5 and 5.5.5, Resettlement, similar to those in Appendix R. These tables should summarize the very large maximum doses that an intruder may incur 3.5.1.9
during the first 500 to 1000 years from drilling, excavating, drinking water, or farming on the waste sites for the in-situ and no disposal action alternatives.

CHAPTER 6 - APPLICABLE REGULATIONS

Regulations concerning the applicable EPA standards for radionuclides are covered in Chapter 6. The regulations applicable to hazardous chemical wastes, their control, and 3.1.6.1
their approved disposal methods are not included in this chapter. Because the hazard to the environment may be as great or greater from the chemical processing wastes, including heavy metals and organic compounds, as from the radioactive wastes, these regulations must be included in this chapter and a discussion of the short- and long-term impacts of these chemical wastes must be included in Chapter 5.

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COMMENTS ON APPENDIX B
DESCRIPTION OF FACILITIES AND PROCESSES

The following comments refer to Appendix B:

3.1.3.12 1. On page B.22, why are piles to be hammered into the waste? The potential for contamination spread with this technique is enormous.

2. Instead of piles, the use of the state-of-the-art "dynamic compaction" technique is recommended. This technique has been used successfully in consolidating organic soils, sanitary landfills, and hazardous waste disposal areas. The technique was even previously recommended to DOE for the TRU waste disposal area of INEL in a 1980 report by Dames & Moore for EG&G Idaho, Inc. 3.1.3.12



COMMENTS ON APPENDIX D
TRANSPORTABLE GROUT FACILITY

Several general comments on this appendix follow:

1. The use of acronyms in this appendix is excessive. Although the use of such acronyms is symptomatic of many government documents, this EIS is supposed to be written for the general public. 4.1.1

2. Metric units are used first, with English equivalents in parentheses, throughout most of this EIS. In this appendix, however, English units are sometimes used first. This adds to the confusion of the non-technical audience for which this document is supposed to be oriented. 4.1.1

3. No basis is given, and no references are cited, for the Radiological Impacts cited in Section D.7.

4. Similarly, no basis for calculation or references are given for the costs in Section D.8.

5. The reference to Roy, et al., 1983, notwithstanding, no mixtures of man-made cement grout and radioactive, heavy metal, and toxic chemical wastes have been shown to have survived for 10,000 years. No solubility studies for this grout, especially assuming a climatic change to wetter conditions or a rise, however unlikely, in the water table, are utilized in this disposal scenario. Based on a reference not used in this study: 3.1.8.1

> Dames & Moore, 1980, Final report, research and development on in-situ encapsulation for low-level Transuranic buried waste at the Idaho National Engineering Laboratory: Unpublished rept. for EG&G Idaho, Inc., Idaho Falls, Idaho,

the addition of zeolite or diatomaceous earth and clay to the grout might prove more effective in containment and absorption of the waste than a straight cement grout.

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COMMENTS ON APPENDIX G
METHOD FOR CALCULATING NONRADIOLOGICAL INJURIES AND ILLNESSES AND AND NONRADIOLOGICAL FATALITIES

3.4.2.1 Appendix G states on page G.1 that its purpose is to describe methods used "to estimate postulated nonradiological injuries and illnesses and nonradiological fatalities associated with each alternative analyzed in this EIS." This appendix sets forth five (5) categories of nonradiological injuries, illnesses, and fatalities as follows:

- Occupational injury associated with actual work environment;
- Occupational illness related to workplace conditions in which workers contract acute or chronic disease which may be caused by inhalation, absorption, ingestion, or other direct contact;
- Lost workdays due to occupational injury or illness;
- Recordable cases involving occupational injury or illness, including death; and
- Nonfatal cases without lost workdays.

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The following comments refer to Appendix G:

1. A major deficiency of Appendix G (and the entire Draft EIS) is the limited scope of nonradiological effects. As noted above, this appendix covers nonradiological occupational impacts only. No attempt is made to identify nor evaluate other significant nonradiological impacts which are likely or possible as a result of the postulated defense waste disposal alternatives. These include, but are not limited to, the following: 3.4.2.1

   - Injuries and deaths attributable to:

     — Automobile and other vehicular traffic accidents involving project employees commuting between work locations and residences;





     — Vehicular accidents, in which project-related nonradiological materials shipments and related transport workers are involved in collisions with members of the general public (drivers or pedestrians) in nearby communities.

     — Other accidents stemming from generally increased economic activity.

   - Property damage resulting from local or regional vehicular accidents involving commuting employees, nonradiological materials shipments, and members of the general public within the vicinity of the project sites.

   - Increased airborne nonradiological emissions from increased vehicular traffic in the study area.

   Data on local/regional traffic volumes, accident frequency, and transportation injuries and fatalities should be provided in Appendix G or Appendix K to support further analysis of such impacts.

2. Table G.3 provides data on incidence rates used for repository construction and operation activities. Data for "underground mining" is 8.37 injuries and illnesses per 100 worker-years and 0.09 fatalities per 100 worker-years, based on averages from the Mine Safety and Health Administration for all noncoal underground mines, including metal, nonmetal, and stone. It is unclear whether such data include underground uranium or phosphate mines which may experience higher rates of nonradiological (as well as radiation-related) injuries or occupational illnesses. (Note: It is also unclear whether radiological effects of uranium mining or other "pre-disposal" uranium or plutonium processing steps have been factored into analyses of radiological impacts as described in Appendix F. Such radiological effects of the "nuclear fuel cycle" are routinely included in EIS's for individual commercial nuclear power plants, based on "generic" factors for the various processing steps. Similar provisions should be made in the Hanford Defense Waste EIS). 3.4.1.4

3. Note: See additional comments on Appendix L: Non-Radiological Impacts—Construction and Operational Period.

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COMMENTS ON APPENDIX H

RADIATION DOSES TO THE PUBLIC FROM OPERATION ACCIDENTS

The following comments refer to Appendix H:

1. The intentional omission of occupational doses (see first paragraph, Page H.1) for accidents is a major weakness of this appendix. Although the facilities have not yet been built, predictions based on models of occupational exposure should have been included. Nuclear reactors are not licensed for construction until the NRC is satisfied that they meet all safety regulations. A high-level nuclear waste disposal program should be subject to similar constraints, i.e., that all potential accident scenarios have been modelled and prove that the risks are acceptable. 3.4.1.2

2. Unlike most EIS's, this appendix is little more than a summary. There is little or no development within the appendix of how a given conclusion or assumption was reached. Almost all major points are referred back to one or more other documents on how the point was reached. Source terms for accidental releases of radioactive materials are of particular concern. 4.1.1

As an example, in Section H.3.1 there seems to be no published documentation of how the EIS authors go from a referernce (Steindler and Seefeldt, 1980) on a detonation in an air cleaning system to an in-tank explosion which creates an aerosol release of almost 500 metric tons. No estimate of explosive yield is given, yet almost 10% of the tank mass is estimated to be converted to an aerosol form (about 500 metric tons). At the same time, the respirable fraction of the 500 metric tons released is estimated to be only 13 kilograms. For a tank which is buried only a few meters below the surface, and probably not designed to contain an explosion, it seems most unusual that an explosion large enough to generate 500 tons of aerosol would only breach the filters and not blow the tope of the tank out of the ground. Further, for a 500-metric ton aerosol release, a release of only 13 kg of respirable material (or a fractional release of 0.0026%) seems low.

3. While doses are calculated for this release, no discussion of chemical toxicity (i.e., from cloud passage and inhalation) is presented. 3.4.1.2



COMMENTS ON APPENDIX I

ANALYSIS OF IMPACTS FOR TRANSPORTATION OF HANFORD DEFENSE WASTE

The following comments refer to Appendix I:

1. Appendix I is confined to a discussion of radiological and nonradiological impacts of Hanford defense waste. While reference is made in the Hanford Defense Waste DEIS to WIPP and Savannah River Plant (SRP) defense waste environmental effects, no mention is made of environmental effects of transporting defense HLW from the Idaho National Engineering Laboratory (INEL) to a Hanford geologic repository nor shipments of TRU-wastes from INEL to WIPP. 3.4.2.11

2. If defense HLW is shipped to a Hanford disposal facilitiy from SRP or INEL, it is possible that routes through the Nez Perce Reservation could be utilized and therefore entail potential adverse environmental impacts.

3. The RADTRAN II computer model described in Appendix I can be utilized to evaluate radiological risk from transportation accident release scenarios. RADTRAN II does not accommodate atmospheric disperson to the natural environment from the point of contaminant release from a transportation accident scenario. Airborne material disperses from the accident site as a function of the prevailing meteorological conditions. Generally, these conditions can be described in terms of time-integrated atmospheric dilution factors (Curies-sec/m$^3$) as a function of area within an isopleth contour on which it applies. In RADTRAN II the user must specify a set of integrated concentration values and corresponding areas which have been computed assuming a totally reflective lower boundary. The code then calculates a set of airborne concentration and deposition contours out to a maximum area of $10^9 m^2$. Thus, in most practical situations the analyst must utilize an atmospheric disperson model to develop the contaminant disperson characteristics of the contaminant release in any event. However, the RADTRAN II model provides a very effective method for quantifying the release of specific radionuclides to the environment (source term) once the mechanisms for contaminant release in an accident scenarios have been established by means of fault tree analysis as previously described. RADTRAN II also has the capability to provide an estimate of human health effect from a transportation accident release 3.4.2.11

3.4.2.11 to the atmosphere, which will be discussed in greater detail in a subsequent section of the report. RADTRAN II will not, however, accommodate the analysis of a water immersion accident scenario. Since many of the proposed transportation routes for high-level nuclear waste shipments pass along major waterways and barge shipments still remain a possibility, this omission in the code must be considered a major deficiency in terms of the Nez Perce program to develop risk assessment methodologies for evaluation of transportation accident scenarios involving high-level nuclear waste shipments through tribal lands.







COMMENTS ON APPENDIX J
METHOD FOR CALCULATING REPOSITORY COSTS
USED IN THE HANFORD DEFENSE WASTE EIS

This appendix outlines the method for calculating costs for repository emplacement of Hanford defense wastes. Total costs are derived from the sum of costs for:

- Retrieval and processing;
- Transportation; and
- Repository emplacement.

In computing repository emplacement costs, use is made on the so-called RECON computer model which calculates life-cycle construction and operating costs for a geologic repository. As stated on page J.2, paragraph 3, the RECON model parameters describe "facilities, construction times, shafts, mine design, emplacement limitations, waste quantities available for disposal, waste processing parameters (labor, materials, utility, and equipment requirements), facility construction cost and unit labor, materials, utility and equipment costs." The following comments refer to Appendix J: 3.3.5.9

1. No mention is made of important parameters involved in computing life-cycle costs such as capitalization and amortization charge rates, costs of ultimate decommissioning of geologic repositories (assuming comingling of defense HLW and spent fuel from commercial nuclear power plants), and perpetual monitoring following repository closure. 3.3.5.9

2. "Total" costs are ostensibly summarized in Appendix L (Tables L.6, L.10, L.14, and L.18); however, only the "No Disposal Action" (Table L.18) describes specific costs for monitoring, surveillance, vegetation control, and subsidence maintenance. Similar costs for other disposal alternatives should be provided. 3.3.5.9

3. Costs of land allocated to repository or other defense waste disposal options are not mentioned. It is unclear whether land values or costs are included in the calculations. Since such land has definite value for alternative uses (at least prior to use for waste disposal purposes and perhaps following decommissioning and decontamination), "marginal" and "real" costs of land should be included with such data disaggregated for purposes of identification and analysis. 3.3.5.9

3.3.5.9 4. On page J.2, last paragraph, first sentence, the statement is made that "the design basis modeled was for a 47,000 MTU repository containing equal amounts of spent fuel and high-level waste." What is the basis for choosing this capacity? It would appear that 23,500 MTU was selected as the capacity for spent fuel and an equal capacity for defense HLW in this "model" repository. Since the Nuclear Waste Policy Act specifies a geologic repository capacity of up to 70,000 MTU for spent fuel (plus unspecified capacity for defense waste if comingled with spent fuel), repository costs with these specified capacities should be described in the EIS, at least as one of several scenarios for defense waste repository emplacement.

3.3.5.9 5. Additionally, a sensitivity analysis indicating computed costs at several defense HLW and spent fuel capacity levels should be described in the EIS.





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## COMMENTS ON APPENDIX K - SOCIOECONOMIC IMPACTS

This appendix describes methods used by DOE to evaluate socioeconomic impacts of the alternative defense waste disposal methods as summarized in Sections 4.8 and 5.7 of Volume 1 of the draft EIS. As stated in Appendix K, socioeconomic impacts are confined, geographically, to a study area encompassing Benton and Franklin counties in the State of Washington. Socioeconomic parameters identified and assessed within this two-county area are limited primarily to:

- Project workforce estimates for each alternative; and
- Population effects related to increased project employment.

The following comments refer to Appendix K:

1. Very cursory information is provided on social, fiscal, infrastructure, and community impacts. DOE's analysis concludes that only minimal socioeconomic impact will be experienced in the study area due to: (1) adequate labor supply for the relatively small workforce associated with disposal operations; (2) ample housing stock for incoming workers and increased population; and (3) community services which are projected to be sufficient to support the project, its employees, and related population. 3.2.6.4

2. The analysis of socioeconomic impacts is deficient in several respects. First, the scope of the socioeconomic parameters covered in the analysis is unjustifiably restricted. Second, the geographic scope of the socioeconomic evaluation appears arbitrarily limited and therefore insufficient. Third, the historical perspective (empirical socioeconomic evidence) is too limited to permit adequate analysis. Finally, the cumulative socioeconomic impacts of other nuclear energy activities at the Hanford federal reservation (federal, State, and private sectors) are inadequately considered. 3.2.6.4

3. As indicated in 1 above, the draft EIS considers project workforce and related demographic impacts, but provides only superficial analysis of social, fiscal, infrastructure, and community services impacts. No baseline information nor 3.2.6.4

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3.2.6.4 projections of economic parameters are offered (i.e., personal and per capita income, employment by Standard Industrial Classification, unemployment, labor force participation rates, etc.). These should be described in the EIS.

3.2.6.6 4. A distinction should be made between construction employees and permanent operations workers in each alternative.

3.5.5.42 5. Demographic data should also include composition of the regional workforce and population in terms of age profiles, ethnic composition, wage and salary rates by major employer category (SIC code or similar), and educational levels.

3.2.5.1 6. Cultural, aesthetic, recreational, and other attributes should be described as part of a comprehensive socioeconomic assessment.

3.2.6.4 7. Additional parameters should include summaries of county and community fiscal data, traffic volumes along critical street and highway segments, traffic accident frequency, and related infrastructure descriptions.

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8. The geographic scope of the socioeconomic analysis in the draft EIS is confined to Benton and Franklin counties in the State of Washington. No evidence is presented in the DEIS to support the exclusion of areas beyond the two-county study area.
3.2.6.4 For example, profiles of the residential locations and commuting patterns of current Hanford employees may or may not support the present geographic extent of the present study area. With improved regional highway facilities becoming available recently and expected to be further refined over the next few years, commuting times and traffic congestion in the Tri-cities area may be reduced. Consequently, project employees may be attracted to residences well beyond the two-county area. This issue should be addressed in the EIS.

9. In estimating population changes and secondary employment, differential effects of construction versus operations should be considered. The DEIS states that a
3.2.6.6 multiplier of 1.2 is used to calculate secondary employment, but it is unclear whether this factor is used for both construction and operations workforces.

10. If distinctions are shown in the final EIS between construction and operations
3.2.6.6 workforces, as recommended above, appropriate "secondary (or total) employment multipliers" should be identified for each type of workforce data.



11. Likewise, calculations used for total induced population changes should reflect possibly different ratios for construction-related activities and operational activities, if applicable. Historically, in many other major industrial and energy-related projects developed near non-metropolitan areas, population changes related 3.2.6.5
to construction activities have generally been different than those induced by permanent operational workforces. It may be quite helpful to examine longer-term historical employment, population, and other demographic data for the Hanford complex and surrounding communities in order to discern important relationships between changes in workforces and population changes that have occurred over the 43 year history of the Hanford Works.

12. Another important body of historical data that is absent in the DEIS concerns epidemiological baselines. No information is provided on the status of population 3.5.5.42
health in the study area. It is recommended that available data on mortality and morbidity rates, age profiles of residents, incidence of cancer, and other health-related indicators be described in the EIS, along with appropriate comparisons with regional, State, and national health statistics.

13. The final EIS should incorporate relevant historical data (prior to 1984) concerning radiological releases and emissions and any correlations between such releases and calculated public exposures to ionizing radiation in the study area. The body of 3.5.5.42
historical data recently released by DOE/Richland Operations Office (approximately 19,000 pages covering the years 1943-1984), together with other available information, should be utilized to establish an appropriate epidemiological baseline.

14. Another significant deficiency in the draft EIS is the very limited treatment of cumulative socioeconomic effects resulting from several major DOE and non-federal activities which may be developed simultaneously with the proposed defense 3.2.6.5
waste disposal projects.* Although several other major projects (such as the possible resumption of construction of the WPPSS nuclear power units and the potential development of the Basalt Waste Isolation Project) are mentioned in the draft EIS, very little statistical data is provided.

* Note: The lack of "cumulative impacts" information applies to all environmental parameters, not just socioeconomic factors.

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3.2.6.5 15. No mention is made of ongoing DOE defense materials production activities nor any related socioeconomic impact information. Other DOE projects such as the recent and proposed future land burial of irradiated reactor components at Hanford from decommissioned nuclear-powered submarines, are omitted in the draft EIS. Furthermore, DOE plans for decommissioning of several "moth-balled" production reactors at Hanford and subsequent disposal of activation products (radioactive wastes) from these reactor components are not addressed. The cumulative socioeconomic and other environmental effects of such activities are not considered in the discussion of "cumulative impacts" in Section 5.1.4 nor in the Appendices to the draft EIS.

3.2.6.5 16. Moreover, other non-DOE nuclear energy activities such as the Exxon Nuclear Company's nuclear fuel fabrication facilities at Richland nor the commercial low-level radioactive waste burial facility at Hanford are mentioned in the draft EIS.

2.4.2.2 17. In discussion of long-term contingency events that could have environmental and socioeconomic consequences (Sections 5.3.4.4, 5.4.4.4, 5.5.5) no consideration is given to the possible loss of resources and Indian treaty rights by radioactive contamination or cataclysmic meteorological or geological events or through other mechanisms whereby institutional control is lost. The draft EIS does not mention off-reservation "possessory and usage rights" specified by the 1855 treaty between the United States and the Nez Perce. This treaty provides for perpetual rights to hunting, fishing, gathering of natural foods and medicinal herbs, access to traditional ceremonial and religious sites, and grazing of livestock on unclaimed lands within a large region including the present Hanford federal reservation.

2.4.2.2 While the tribe has been denied free access to these treaty rights on the Hanford reservation since 1943 when the War Powers Act authorized federal control of the site, they continue to be interested in the utilization of this aboriginal Tribal site and its possible eventual return to Indian access and/or control. Additionally, the Nuclear Waste Policy Act (P.L. 97-425) grants federal recognition and status as "affected Indian tribes" to the Nez Perce. Similarly, the DOE Defense Programs office, through discussion in the draft EIS and other documentation, should recognize these treaty provisions and describe the utilization and cultural significance of the Hanford reservation in terms of aboriginal and historic



possession by the "affected Indian tribes" as well as contemporary and future impacts. 2.4.2.2

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COMMENTS ON APPENDIX L
NONRADIOLOGICAL IMPACTS-
CONSTRUCTION AND OPERATIONAL PERIOD

This appendix addresses nonradiological impacts for the three disposal alternatives and the "no disposal" action. For each disposal option, nonradiological impacts include only the following:

- emissions of nonradiological pollutants
- estimated injuries and fatalities
- requirements for depletable resources
- costs

Nonradiological impacts related to transportation of defense wastes are not included in this appendix and are addressed in Appendix I. The following comments refer to Appendix L:

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1. Estimates for nonradiological emissions (including particulates, oxides of sulfur, carbon monoxide, nitrogen oxides, and hydrocarbons) appear to be reasonable, based on methods for calculating these emissions as described in Appendix G.

3.4.2.1 2. As indicated in comments on Appendix G, a significant deficiency in Appendix L is the omission of other nonradiological, non-occupational impacts such as:

   - Injuries and deaths attributable to increased automotive accidents involving commuting workers, nonradiological materials shipments to and from the disposal sites, and secondary business (induced economic growth) activities.
   - Property damage resulting from both increased traffic accidents and normal transportation (i.e., increased deterioration of highways as well as loss or damage to property, etc.).
   - Airborne nonradiological emissions resulting from increased vehicular traffic in the study area.



3. On page L.4, the costs for the geologic disposal alternative are based on the use of an off-site "granite" repository at higher costs than an on-site basalt repository. The "granite," or "second," repository program was dropped by DOE on May 28, 1986, and this cost comparison is no longer valid. The use of this distant repository causes the cost comparison between the geologic and reference alternatives to be unrealistically favorable for the reference option. 3.3.1.3

4. See comments on Appendix G for additional remarks and recommendations.

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**COMMENTS ON APPENDIX M**
**PRELIMINARY ANALYSIS OF THE PERFORMANCE OF THE PROTECTIVE BARRIER AND MARKER SYSTEM**

The following numbered comments and questions refer to Appendix M of the Draft Hanford Defense Waste EIS:

1. On page M.6, a figure is needed to show the cover to be constructed over the grouted trench.

3.5.1.27 2. In section M.2 and Figure M.3, what is the tested life of geotextile, especially if uncovered and exposed to sunlight for long durations of time? How long after deterioration of the geotextile will fine-grained soils pipe into the filter and the filter pipe into the riprap? A graded filter, the standard in the construction industry, would prevent such piping, but would severely reduce the capillary effect.

3.5.1.7 3. In Figure M.3, side slopes of 1:1 are too steep to avoid gravitational slumping and erosion for 10,000 years, especially if the climate becomes significantly wetter.

4. On page M.10, what happens to the "dry cobble" plant and animal barrier if the "barrier failure scenarios" are considered? A possible solution is the pyrite and broken glass barrier described in:

   Dames & Moore, 1980, Final report, research and development on in-situ encapsulation for low-level Transuranic buried waste at the Idaho National Engineering Laboratories: Unpublished rept. for EG&G Idaho, Inc., Idaho Falls, Idaho.

3.5.1.25 5. In Section M.5.1.2, is cheatgrass all that will grow on the waste cover for 10,000 years? What about deep-rooted arid vegetation, like sagebrush, alfalfa, Russian olive, and others?

6. The models described on pages M.21 and M.22 are for one to 16 years. What happens after 100, 500, or 1000 years?



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7. The barrier failure scenarios are not discussed in any detail in Section M.6. The limits of these scenarios and their radiological effects are not discussed at all in this appendix.

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COMMENTS ON APPENDIX O
STATUS OF HYDROLOGIC AND GEOCHEMICAL MODELS USE TO
SIMULATE CONTAMINANT MIGRATION FROM HANFORD DEFENSE WASTES

The following comments on Appendix O summarize the hydrogeologic models used to estimate travel times and peak concentrations from a release of contamination to the groundwater.

1. In the vadose zone, a simple, unit hydraulic gradient, one-dimensional, analytical model was used to simulate advective transport. Under the protective barrier, where there would theoretically be no infiltration, molecular diffusion was assumed to the predominant transport mechanism and a diffusion model used. A version of the TRUST model was used to attempt a simulation of two-dimensional ground water flow in the vadose zone, but evidently the writers were unable to operate the model. 3.5.2.8

2. A finite difference model (VTT) was used to simulate saturated groundwater flow. This model has been calibrated to the unconfined aquifer at the Hanford site.

3. An analytical, one-dimensional transport model was used to simulate contaminant transport through both the unsaturated and saturated zones. The model is referred to as a stochastic-convective model because it uses the dispersion term of the equation to simulate the random nature of travel time estimates along streamlines of flow. This section of Appendix O is confusing; an example calculation would aid the reader in interpreting exactly how the model was used. 3.5.2.11

4. On page O.33, section O.4.3.6, it is stated that a constant dispersion coefficient based on dispersion through the unsaturated zone is used in both the unsaturated and saturated zones, but nowhere in Appendices O or Q is the method of calculating the dispersion coefficient described. 3.5.2.12

5. Appendix O contains a good discussion of geochemical interactions and the limitations of the models applied, but reached no conclusions on the effectiveness of the models or on other potentially usable models.



02

COMMENTS ON APPENDIX Q
APPLICATION OF GEOHYDROLOGIC MODELS TO POSTULATED
RELEASE SCENARIOS FOR THE HANFORD SITE

The following comments on Appendix Q discuss the application of geohydrologic models to the Hanford site:

1. Generally conservative assumptions were made throughout the appendix. Based on the models described in Appendix O, travel times through the unsaturated zone are much larger than travel times through the saturated zone. Unfortunately, very little information is given on exactly how these computations were performed and the assumptions that were made. 3.5.2.6 3.5.2.27

2. The text correctly states that hydraulic conductivity in the unsaturated zone is a very sensitive parameter. The Campbell equation was used to estimate hydraulic conductivity as a function are not given in the text. Since the vadose zone model was uncalibrated, the parameters used in the calculations are very important and should be discussed in the text. 4.2.55

3. Equation Q.1 on page Q.3 is incorrect also; it is not known exactly what the equation is supposed to be. 4.2.55

4. Assumptions used in the saturated zone modeling are adequate, although, as mentioned above, travel times through the unsaturated zone are much longer than travel times through the saturated zone.

5. Some additional saturated zone modeling was performed to look at the consequences of increased irrigation in the area. It was assumed that a maximum of 20 percent of the irrigation water applied would become groundwater recharge. This is not a bad assumption, but it is certainly not a worst case assumption. It is almost always necessary to over-apply irrigation water to flush the salts through the root zone to avoid increasing soil salinity. With saline water, and saline soils, it is not uncommon to have 50 percent of applied irrigation water become ground water recharge. 3.5.3.1

COMMENTS ON APPENDIX R
ASSESSMENT OF LONG-TERM PERFORMANCE OF WASTE
DISPOSAL SYSTEMS

3.5.5.8 In general, this is the most hypothetical appendix. Conclusions are based on analytical techniques which may or may not be valid. As stated in this appendix, groundwater transport of the contaminants is the most probable scenario for the release of the contaminants from a disposal site. Yet, there are more unknowns concerning the mechanisms involved in the groundwater transport scenario than in any other scenario. As pointed out in Appendix V, the construction of a valid groundwater model of the Hanford site is very difficult. Even using "conservative ions," variations in the hydrogeology make long-term prediction with any certainty very difficult. Without a high degree of certainty in the analysis, the long-term predictions on the effects on man are merely pulling numbers out of the air. The following comments refer to Appendix R:

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3.5.5.8 1. In the tables presenting the performance of each alternative, definition of terms (i.e., Transport Assessment Table) should be added to the text.

3.5.5.8 2. A table presenting various health standards should be added.

3.5.5.8 3. Whe [illegible] a Transport Assessment Table?

4. Why did this appendix not address the performance of the various alternatives in terms of the chemical species which may be released from the storage sites?

5. At this time, groundwater models cannot be fully developed for the site because of the high degree of uncertainty in the geology; therefore, groundwater travel times cannot be accurately predicted.

3.4.3.1 6. On pages R.63, R.90, and R.93, DOE has a tendency to dismiss some "catastrophic" accident scenarios with a statement that ". . . waste would be a small factor in the devastation from a giant meteorite," flood, volcano, etc. Although obvious that such a destructive event would destroy numerous man-made structures and, probably, kill a number of people, such destruction is temporary and such natural
3.5.6.35 events have occurred numerous times throughout history. For example, 200,000 people may have died in a single earthquake in China and 100,000 may have died in a single cyclone in Bangladesh. Within the short period of a few years after these 3.4.3.1
natural disasters, farmers are again plowing the fields and towns are being rebuilt. However, if such a natural disaster also spread high-level radioactive isotopes and created an environment too contaminated to support life for thousands of years, the impacts on life in the region would be far greater. These statements that radiation would be a "small factor" should, therefore, be carefully reevaluated.

7. On page R.64, no probabilities are given for the airplane crash scenario. 3.4.3.6

8. On pages R.68 and R.82, the "in-place stabilization" alternative must include an impenetrable cover to prevent individual maximum annual doses for the well drilling and excavation scenarios of 1,000 to 100,000 rem/yr. Such a cover is 3.5.1.9
technically feasible, although at considerably higher cost than the proposed cover. This cost increase might make the geologic disposal alternative more competitive in price with the in-place stabilization alternative.

9. On page R.74 and in Table R.57, the use of any impermeable membrane on the surface of the ground in arid areas has been proven to create increased moisture 3.5.1.27
below the membrane due to capillary rise and condensation from air moving through the soil. This is the experience of highway departments with impermeable paving, mining companies with pond liners, and landscapers with plastic sheeting in areas of expansive soil. When such soil moisture is produced, plant roots grow into the area of higher moisture even if they have to grow through the membrane or horizontally beneath it. If the proposed impermeable cover over the radwaste is planted with shallow-rooted grasses, other deeper-rooted vegetation will eventually establish on the cover through natural migration methods. As this new vegetation grows, roots will move into the moisture collecting below the membrane and eventually move into the waste. For example, the USGS has documented cases of alfalfa roots penetrating into underground mine workings at depths of several hundred feet in Nevada, because the mines formed the nearest water table to the surface in this arid region.

10. On page R.86, "5 acre-ft/yr per acre" should be "12.2 acre-ft/yr per acre" and the 4.2.55
use of the word "erode" in line 13 is questionable.

4.2.55 11. On page R.90, "12,320 $m^3$" should be 12,320 $m^3$/sec.

3.5.6.7 12. On pages R.90 - R.92, flooding is analyzed only for the Columbia River and changes in sea level. No mention is made of flooding on the Yakima River or on Cold Creek. The potential for flash flooding on Cold Creek has been identified as a potential area for additional study in the repository siting program by the NRC. This is due to the potential for flooding of the southwestern corner of the 200 West area by the Cold Creek PMF.

4.2.55 13. On page R.91, a table or figure is needed to show the peak flows for all of the floods discussed in the report.

3.5.6.5 14. On page R.93, the cumulative impacts of lava flow or mudflow (lahar) damming of the Columbia River Gorge and subsequent flooding of the Hanford area are not evaluated. These types of dams have occurred during the late Pleistocene according to work by Crandall and Vallance of the USGS.

3.5.6.32 15. On page R.94 - R.96, the seismicity models consider only "historical observations and instrument recordings" and "over a 100-year period from the year 2000." There is no citation of any work on the largest earthquake in the region in the last 35,000 years (maximum credible event) or, even the last 10,000 years. There is also no estimate of the largest earthquake to be expected 10,00 years into the future.

3.4.3.8 16. On page R.96, "criticality" is mentioned, but it is not discussed in any detail. If it is of sufficient concern to be mentioned in the DEIS, it is of sufficient concern to the reader to be thoroughly discussed and not summarily dismissed. This is particulary true since the AEC was concerned enough about criticality to take emergency measures to prevent a plutonium waste trench at Hanford from becoming critical. The credibility of DOE is the only thing that suffers from such statements as criticality having "no credible basis."

4.2.55 17. On page R.97, the reference for Stone, Thorp, Gifford, and Holtink has no date.



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COMMENTS ON APPENDIX U
PRELIMINARY ANALYSIS OF THE FUTURE GROUNDWATER
TRANSPORT OF CHEMICAL RELEASED

The make-up of the chemical wastes which were disposed in the cribs, trenches, ponds, French drains and tanks is not well understood. As pointed out in this appendix, substantial quantities of nitrate compounds and various salts are within the waste. In addition, metals such as chromium and mercury and organic compounds are available for solute transport from the waste. In the EIS, these compounds are considered secondary to the radiological wastes disposed at the site. For the long-term, these pollutants may be just as important because these do not decay with time. It is important that the nature of these chemical waste be fully understood and that the sources are characterized in detail. 3.1.6.1

The following comments refer to Appendix U:

1. Maps would be helpful illustrating the sources of the chemical contaminants.

2. Maps should be drawn showing the predicted distribution of the various chemical contaminants with time after final burial.

3. Illustrations would be useful in defining terms such as what happens when Kd (distribution coef.) = 0 as opposed to Kd = 10E3.

4. In this appendix, all analytical projections were based on conservative estimations which were considered "worst case" transport times for various chemical parameters. A "conservative ion" is an ion that moves essentially at the same velocity of the groundwater. Because of the unknowns (esp. the waste make-up and volume available for transport) at the site, the statement that the chemical solutes will travel in the groundwater with little or no retardation may or may not be true, but to state this is the most conservative approach is wrong. Time is a relative parameter, the longer a chemical species remains in the groundwater system, the more potential for harm. It is important to know if any retardation of any chemical species occurs in the groundwater system and how long it will take to flush the system. Prior to assessing the impact of various disposal systems, it is important to understand the self-cleaning capacity of the aquifer.



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COMMENTS ON APPENDIX V
SELF MONITORING EXPERIENCE

In general, this appendix raises some interesting questions about past waste disposal activities at the Hanford Reservation. In the text, it is stated that there are approximately 200 waste disposal facilities constructed in the 200 Areas and very little is known about the majority of them. The following comments refer to Appendix V:

1. The groundwater monitoring network is comprehensive with over 2900 wells drilled and approximately 1100 wells being completed below the water table. It is understood (not clearly stated) from reading the text that the wells which are monitored on a regular basis act as a early detection system for possible excursions of radionuclides from cribs, trenches, ponds, French drains, storage tanks and reverse wells. If it is detected in one of the observation wells that groundwater contamination is occurring, a detailed characterization of the waste site takes place.

3.5.6.41 2. At the Hanford site, four cribs, one trench, one French drain, one tank leak, one reverse well, and one disposal pond have been characterized. The reasons for the selection of these particular disposal sites for characterization is not clearly understood. However, in each case contamination of the subsoil had occurred to some extent. Groundwater contamination was detected only in a few instances. In one case (Trench 216-Z-9), over 100 kg of Pu was deposited and critically was of concern. This trench was mined for plutonium from 1976-1977.

3.5.6.41 3. If only nine sites out of 200 have been characterized, there are several questions still remaining as to the nature of the wastes and whether or not an effective EIS can be written evaluating the potential impact of waste disposal at the Hanford site.

3.5.6.41 4. It would be helpful if a map of the 200 Areas were presented showing the locations of all the disposal sites.

3.5.6.41 5. A table should be prepared showing the chemical make-up of the waste in each disposal site.



6. In the characterization of the various cribs, trenches and pond sites, dry wells were used to study the vadose zone. Since wells are generally not valid for monitoring water in the unsaturated zones, suction lysimeters or other methods are recommended. 3.5.6.41

7. Several of the wells were drilled on the site in the 1940s, 1950s and 1960s. Were these wells drilled and completed to strict QA/QC standards? If not, how valid is the data? 3.5.6.41

8. This appendix points out the complexity of each disposal site. The potential for groundwater contamination and solute transport is highly dependent on the site specific geology and hydrogeology of each site. This appendix also points to the difficulty of modeling the groundwater system for solute transport due to these complexities. Of the 200 sites, only four percent have been characterized. Until each site is fully understood, it will be very difficult with any certainty to predict the impact of the various disposal scenarios. 3.5.6.41

9. No information from field testing was utilized in the analysis of cumulative impacts from the 200 disposal sites. Such an analysis should be required. 3.5.6.41

9 3 1 1 7 4 2 1 0 2 6

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8-11-86

Dear Mr. Holten,

2.1.1 I think Hanford is a very poor site for a repository. I believe the military waste that is there now is harming the environment and is a major threat to life in Washington. We certainly do not need more waste to deal with especially that which is created on the East Coast and abroad. The basalt is full of cracks and the Columbia river is too close.

Sincerely,
Mari Hoffman
Kelso, Wa.

AUG 15 1986 0235

**236**

August 6

R.A. Holten/EIS
U.S. Dept. of Energy
Richland Operations
P.O. Box 550
Richland, Wa 99352

RECEIVED DOE-RL
AUG 13 1986 0236
WM DIVISION

Dear Mr. Holten,

My husband and I attended the hearings in Portland concerning nuclear waste disposal at Hanford. We did not testify so I am writing to say that we are incredulous that anyone can talk about any place on earth being SAFE for radioactive waste. There is no such place on the planet! 3.3.5.1 And we are all responsible for the situation because we all consume electricity - You and your dept. are not the only bad guys. Each household must be aware of how it's polluting the earth! Our supposed "needs" have grown too fast. Can't you be leaders in saving the planet and promoting clean, free energy

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from the sun and wind? It
can be done and to every:
one's betterment.

Thank you,

Mr. + Mrs. Goodwin W. Harley
44405 So. Coast Hwy.
Neskowin, Or. 97149

RECEIVED
AUG 13 1986 0236
DIVISION

237

August 12, 1986
815 36th Ave E.
Seattle, WA 98112

Mr Wollen

I am writing this letter to voice my strong opposition to the use of Washington state as a dumping site for radioactive waste. I am sure that you are aware of all the opposition arguments I might make. My concern is for my children and the future of us all. 2.1.1

Colleen Murphy

RECEIVED
AUG 14 1986 0237

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE SUITE 350
PORTLAND OREGON 97232 2279
503 230 5400

F/NWR5

AUG 15 1986

AUG 1 1986

Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99353

Re: Draft Environmental Impact Statement (DEIS) - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes

Dear Mr. Holten:

The National Marine Fisheries Service (NMFS) has reviewed the subject Draft Environmental Impact Statement (DEIS).

In order to provide as timely a response to your request for comments as possible, we are submitting the enclosed draft comments to you directly, in parallel with their transmittal to the Department of Commerce for incorporation in the Departmental response. The formal, consolidated views of the Department should reach you shortly.

If you have questions concerning our draft comments, please contact Dr. Jacqueline Wyland (503) 230-5432 or FTS 429-5432. Your continuing coordination efforts are appreciated.

Sincerely,

Dale R. Evans
Division Chief

Enclosure

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DRAFT F/NWR

AUG 1 1986

Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99353

Re: Draft Environmental Impact Statement (DEIS) - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes

Dear Mr. Holten:

The National Marine Fisheries Service (NMFS) has reviewed the subject Draft Environmental Impact Statement (DEIS) and has the following comments:

General Comments

The National Marine Fisheries Service has a responsibility to protect and conserve marine, estuarine and anadromous fisheries and their habitat. We are concerned with plans to provide long-term disposal for the high-level nuclear defense wastes presently at Hanford. 3.5.4.6

Our concern is based upon the proximity of Hanford to the Columbia River. If significant amounts of long-lived radionuclides stored at Hanford were to reach the Columbia River, they could affect the living aquatic resources of the river, the estuary and the ocean for generations. 3.5.4.6

Specific Comments

The subject document provides no discussion of the genetic and physiological impacts to fish, shellfish and aquatic food webs of either a major pulse or a continuous leak of radioactive materials to the Columbia River. These impacts should be assessed due to the economic, cultural, and recreational benefits of the fisheries of the Columbia River. 3.5.4.6 3.2.4.2

The discussion of trucking wastes to another site should include an analysis of risks and impacts to aquatic organisms from accidental entrance of radionuclides into waterways. 3.4.2.5

If you have any questions on our comments or would like more information on the points discussed, please contact Dr. Jacqueline Wyland of my staff at (503) 230-5432 or FTS 429-5432.

Sincerely,

Dale R. Evans
Division Chief

AUG 1 7 1986

cc: EPA
FWS
CRITFC - Heindl
WDF
WDG
WDOE
DEQ
ODFW

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10/07/86 10:15 NRC-HILLSTE NO.003 001

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

Kitty Rising

SEP 2 4 1986

RECEIVED DOE-RL
OCT 7 1986
WV DIVISION

Mr. R. A. Holten
U. S. Department of Energy
Richland Operations Office
Waste Management Division
Richland, WA 99352

Dear Mr. Holten:

The U. S. Nuclear Regulatory Commission (NRC) staff has reviewed the U. S. Department of Energy's (DOE) draft environmental impact statement (DEIS) entitled Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, DOE/EIS-0113. On the basis of our review, the NRC offers the enclosed general and detailed comments. Although not part of our comments on the draft EIS, the NRC also wishes to express its concerns regarding other legal and institutional issues related to the concept of *in situ* disposal of high-level wastes (HLW) at Hanford.

First, as you are aware, under Section 202(4) of the Energy Reorganization Act of 1974, any facilities expressly authorized for disposal of defense high-level wastes are subject to the licensing and related regulatory authority of the Commission. Whether the express authorization for particular facilities is legislative or administrative in our judgment has no bearing upon the concerns that led Congress to provide for licensing by NRC. Also, it appears that the Hanford "tank wastes," which from the information presented in the draft EIS would have been regarded as HLW when the Energy Reorganization Act was passed, remain HLW for purposes of determining 3.1.1.11
whether or not NRC has such jurisdiction. If DOE believes that subsequent processing of the "tank wastes" may have altered the classification of some of the materials being stored, more detailed waste characterization information 3.1.4.4
would be necessary to support that view.

Second, licensing of Hanford waste tanks for HLW disposal will be procedurally complex because of the need to develop appropriate standards and procedures, the existing *fait accompli* status of the waste tanks, and the difficulty in reasonably evaluating alternatives (e.g., alternative sites) as required by the National Environmental Policy Act. Other statutes would also 2.2.17
need to be considered, including one provision (42 U.S.C. § 7272) which could be read to bar the expenditure of funds for purposes related to the licensing of defense waste management activities such as those that might be undertaken at Hanford.

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SEP 2 4 1986



- 2 -

2.2.18 Although NRC staff does not prejudge the disposal of HLW, _in situ_, in the Hanford tanks, we believe establishing the feasibility of such disposal as technically adequate to protect the public health and the environment will be exceedingly difficult and may not be achievable. Consequently, nothing in our comments should be read as NRC agreement or endorsement of such disposal. In addition, our comments at this stage do not restrict NRC from making additional comments in the future, when or as appropriate.

Thank you for providing the opportunity to comment on the Hanford Defense Waste DEIS. We hope that these comments will be of assistance in preparing the final environmental statement. We would be pleased to discuss the comments with you and members of your staff if you desire.

Sincerely,

R E Browning
Robert E. Browning, Director
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure:
NRC's General and Detailed Comments
on the DEIS

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COMMENTS
OF THE
U. S. NUCLEAR REGULATORY COMMISSION
ON THE
U. S. DEPARTMENT OF ENERGY'S
DRAFT ENVIRONMENTAL IMPACT STATEMENT
RELATED TO
DISPOSAL OF HANFORD
DEFENSE HIGH-LEVEL, TRANSURANIC
AND TANK WASTES
(DOE/EIS-0113)
PUBLISHED MARCH 1986

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## GENERAL COMMENTS

It is stated in the DEIS (p. 1) that the purpose of the EIS is "to provide
environmental input into the selection and implementation of the final disposal
actions for high-level, transuranic and tank wastes located at the Hanford
Site." The document goes on to state that the DEIS is "both a programmatic EIS
intended to support broad decisions with respect to the disposal strategies for
the Hanford waste" and "an implementation EIS intended to provide project
specific environmental input for decisions on moving forward with certain
2.5.2 disposal activities" (p. xiii). The DEIS further indicates that following
publication of the Final EIS, the DOE "will begin selection of a Hanford
Defense Waste final disposal strategy which will be documented in one or more
Records of Decision. The DOE may decide to proceed with implementing certain
parts of the strategy while delaying final decision on other parts pending
further research and development" (p. xiii). This approach makes the review of
the document difficult because it is unclear which areas will receive
additional research and development and how the results of these research and
2.3.2.3 development efforts will be factored into the decision-making process. The
DEIS indicates that further NEPA review is anticipated to support certain other
specific activities prior to their implementation but the document does not
indicate which activities this would apply to, what the additional review would
consist of, or when it would occur. The NRC staff recommends that the Final
EIS clearly identify which decisions will be postponed pending completion of
additional research and development, when these activities are likely to be
completed, and the type of NEPA review that is anticipated.

The NRC agrees with DOE that several areas require additional research and
3.3.5.3 development prior to making decisions concerning the disposal of the Hanford
wastes. These include: (1) characterization of the wastes in the single-shell
tanks; (2) long-term performance of the protective barrier system; (3)
geochemical characteristics of the site; and (4) development of analytical
capabilities for projecting waste transport. Each of these is discussed below.

### Characterization of single-shell tank wastes

The DEIS notes (p. 3.5), and the NRC staff agrees, that additional
characterization of wastes in the single-shell tanks will be necessary to
2.3.2.1 provide more detailed information about waste inventories. The NRC recommends
that the wastes also be characterized, to the extent practicable, by their
sources in fuel reprocessing operations. If, for example, certain tanks
contain wastes from the operation of the first cycle solvent extraction system,
then these wastes would clearly be considered as high-level wastes. However,
if some of the tanks contain predominantly incidental wastes such as cladding
removal wastes or organic wash wastes, and if the radionuclide concentrations
in these wastes are comparable to other low-level wastes, these wastes might
not be properly classified as high-level wastes.









After the completion of the waste characterization program, the NRC recommends
that the selection of a disposal alternative be made on a tank-by-tank basis.
Information presented in Appendix A (Tables A.4 and A.5) of the DEIS suggests 3.1.4.1
that a large fraction of the total curie inventory of single-shell tank wastes
may be contained in only a few tanks. If this is accurate, a substantial
fraction of the total radionuclide inventory could be retrieved at only a small
fraction of the cost presented in the DEIS. Furthermore, if some or all of the 3.1.4.5
tanks with large inventories are in sound condition and do not leak, wastes
could be retrieved by sluicing, further reducing the cost of waste retrieval.

In summary, the NRC agrees that additional waste characterization should be
completed in order to (1) properly classify wastes as high-level or
non-high-level, and (2) permit selection of a disposal alternative which is
most appropriate for each tank of waste.

### Long-term performance of protective barrier system

As noted in the DEIS (p. 1.14), the protective barrier and marker system is the
key to effectively isolating from the environment wastes that are disposed of 3.5.1.1
near-surface. Two of the three disposal alternatives that are considered in
the DEIS (i.e., the in-place stabilization alternative and the reference
alternative) rely heavily on the capability of the proposed protective barrier
system to minimize water infiltration and to reduce the likelihood of plant,
animal, and human intrusion. Indeed, it is the view of the NRC that
near-surface disposal of many of the Hanford wastes would likely pose
unacceptable risks to public health and safety unless substantial protection is
provided by such barriers. The DOE acknowledges (DEIS, p. M.2) that a specific
barrier design has not yet been determined. The DEIS further notes that the
DOE will conduct a NEPA review of the final specific barrier to evaluate its 3.5.1.57
anticipated performance as designed and its performance under perturbed
conditions. This review is to be based on actual laboratory and field data.
The NRC encourages the DOE to conduct these further studies to resolve
uncertainties with respect to the effectiveness of the barriers. Our detailed
comments list some of the aspects of barrier design and performance which
should be addressed in these studies.

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Geochemical characteristics of the site

3.3.5.4 The DEIS is replete with statements that indicate a lack of geochemical data for the site. The DOE acknowledges (DEIS, p. O.7) that the absence of this data precludes a more rigorous analysis of the environmental effects of the proposed alternatives. It is recommended that sufficient data be available to support the analyses of environmental impacts presented in the DEIS before decisions are implemented.

Development of analytical capabilities for projecting waste transport

3.3.5.4 The DEIS recognizes that the linear distribution coefficient (Kd) modeling approach is a potential technical limitation in modeling efforts because it combines several geochemical processes into a single empirical parameter. The DOE indicates that additional development work is being pursued on the models. As indicated above with regard to the geochemical characteristics of the site, it is recommended that sufficient model development be completed to support the estimates of environmental impacts set forth in the DEIS before decisions are implemented.

2.4.1.23 Finally, the NRC agrees with the position stated in the DEIS (p. 6.11) that to the extent that any decision based on the DEIS (and subsequent final environmental statement) requires defense high-level waste to be placed in a facility which is authorized for the express purpose of subsequent long-term storage, such a facility would have to comply with any applicable licensing requirements of the NRC. Notwithstanding any comments presented here, NRC may (1) incorporate into any license that may be issued at a later date conditions that may reflect a more restrictive position than that taken in these comments; or (2) deny a license for activities at a proposed facility.

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DETAILED COMMENTS

DISPOSAL OF TRU WASTES WITH CONCENTRATIONS BELOW 100 NCi/GM

The NRC staff is concerned about disposal of wastes with TRU concentrations below 100 nCi/gm (e.g., Section 3.3.1.4, paragraph 1). Disposal of such wastes may require better protective measures than are evidenced in this DEIS. For example, NRC's analyses in support of 10 CFR Part 61 showed that Class C wastes, including wastes with TRU concentrations between 10 and 100 nCi/gm, must be disposed of using a stable waste form and the disposal facility must either permit emplacement at least 5 meters below the ground surface or must include an engineered intruder barrier. The staff encourages the DOE to consider the results of the Part 61 supporting analyses when developing disposal concepts for such wastes. (The staff notes that, for other projects, the DOE has committed itself to comply with the 10 CFR Part 61 performance objectives for disposal of low-level wastes. See, for example, the Proposed Finding of No Significant Impact, Disposal of Project Low-Level Waste, West Valley Demonstration Project, West Valley, New York, April 1986.) 2.3.1.14 3.1.3.32

PROTECTIVE BARRIER AND MARKER SYSTEM

Appendix M, Preliminary Analysis Of The Performance Of The Protective Barrier And Marker System

The NRC staff recognizes that substantial research and development of barrier concepts remains to be completed before a decision can be made to implement either the in-place stabilization or the reference alternative. The following concerns regarding the design and performance of barriers should be considered during DOE's future barrier research and development efforts. 3.5.1.57

Overall Barrier Design

The barrier design shown in Figure M.3 of Appendix M is based on construction of a multilayer capillary (or "wick") barrier that is intended to reduce deep drainage. The key to this design is a layer of very coarse gravel or rock with an overlying revegetated layer of fine-textured soil. Under ideal conditions this multilayer design can minimize infiltration rates by trapping fluids in the uppermost soil layer and subsequently removing soil moisture through evapotranspiration. Such a cover is only effective to the extent that hydraulic pressure within the wick is insufficient to cause a breakthrough into the pervious layer beneath the wick. If breakthrough occurs the pervious layer must direct water horizontally so that it will not migrate further down toward the waste. In order to do this, the base of the pervious layer must have adequate slope, probably greater than 5 percent. Such a slope is not apparent in the barrier design of Appendix M. 3.5.1.10

It should be noted further that a wick design should be based on extreme precipitation events rather than average annual precipitation. Wetting fronts and subsequent breakthrough are likely to occur during storms with infrequent return periods. Given the time period during which this barrier must be effective, it is prudent to design it for a storm with a very low recurrence interval (e.g., 1000 yr, 24 hr storm). 3.5.1.34

The DEIS also states that the barrier would restrict penetration by plants and animals into the waste, because of the rock and absence of moisture beneath the
3.5.1.83 wick. The staff is concerned, however, that even shallow burrowing within the upper soil layer (down to the rock) could impair the effectiveness of the wick as a moisture barrier. The DOE should investigate means for preventing or minimizing burrowing within the barrier.

Potential for Erosion

It appears that little or no consideration has been given to the potential for erosion of the soil cover of the protective barriers due to the occurrence of local intense precipitation. Several long-term stability investigations performed for the NRC staff indicated that the most disruptive natural
3.5.1.80 phenomena affecting long-term stabilization are likely to be wind and water erosion (Nelson et al., 1983; Young et al., 1982; Lindsey et al., 1982; and Beedlow, 1984). These studies also indicated that wind and water erosion can be mitigated by a rock cover of reasonable thickness and that the size of the rock chosen for the protective cover will normally be controlled by a design precipitation or flood event.

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The NRC staff considers it very important that adequate erosion protection be provided to prevent the occurrence of sheet erosion and the initiation of gully erosion. Gully erosion, once initiated, can cause extensive damage to any soil
3.5.1.34 cover, such that previous assumptions regarding infiltration, biotic intrusion, erosion, and releases of radionuclides may no longer be valid.

On the basis of NRC staff experience with long-term stabilization in arid regions of the western United States, it is very unlikely that the proposed vegetative cover will provide adequate protection to prevent the occurrence of gully erosion (Nelson et al., 1983). In general, a rock cover is usually
3.5.1.34 needed to provide such protection. A mixed rock/soil cover might provide similar protection while also allowing growth of a vegetative cover. The NRC staff recommends that such a protective cover be considered. To address various uncertainties and provide for a conservative design basis, it would be prudent for the DOE to design the rock cover for an occurrence of localized intense precipitation as previously discussed.

Long-Term Stability

The performance of the barrier shown in Figure M.3 of Appendix M is dependent on the overall structural integrity of the barrier system and on the
3.5.1.57 maintenance of interlayer textural differences. It is not known whether these factors can realistically remain stable over a time scale of 10,000 years. Even if structural integrity of the barrier can be maintained over this time
3.5.1.7 scale, downward infiltration of fine-grained soil materials into voids of the gravel layer could compromise the barrier effectiveness by altering textural differences in the capillary barrier. This could occur through gradual settling or minor subsidence of the protective barrier after construction. (The structural stability of waste tanks is of particular concern in this regard.) Other mechanisms for altering textural differences would include biogenic activity (discussed above), and liquefaction of the base of the soil cover if it is near saturation and experiences significant seismic accelerations.

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It is noted that overall deterioration of the capillary barrier would be accelerated by any physical rupture of the barrier, as perhaps induced by vibratory ground motions or by the intrusion of man. Such a physical rupture would allow direct influx of runoff and precipitation through and beneath the barrier. In that event, contaminant transport within the vadose zone beneath the protective cover could be increased significantly.

In summary, the NRC staff considers that many uncertainties remain unresolved
regarding long-term performance of a capillary barrier. Substantial additional 3.5.1.57
research and development of barrier concepts must be completed before a preferred alternative can be selected for actual disposal of wastes.

Volume 2, Foreword, page xxxiv, paragraph 2

The assumption that the single-shell tanks remain integral for 165 years is both arbitrary and unsubstantiated. As stated in the DEIS: "an arbitrary
assumption has been made that none of the tanks provides a barrier after the 3.1.4.9
year 2150. This is equivalent to assuming the tanks provide a barrier to significant levels of vapor-phase transport of moisture for another 165 years."

The DEIS goes on to state that there are "no data to suggest that significant releases from the solid waste form are currently occurring." This may indeed
be correct. However, there are data which show that releases have occurred 3.1.4.35
from these tanks in the past. Based on historical difficulties with the integrity of the single-wall tanks, the highly soluble waste form they contain, and the lack of data supporting the integral tank assumption, it would be prudent to assume that properly backfilled tanks will provide only the structural stability necessary to inhibit slumping, collapse, or other failure of the disposal site. While the proper backfilling of tanks is necessary for structural stability, it will not significantly inhibit water infiltration or radionuclide release.

Appendix M, Section M.4, Reduction in Risk of Inadvertent Intrusion Through Passive Institutional Controls, page M.12, paragraph 1

The Final Environmental Impact Statement on 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste" (NUREG-0945, 1982), indicates intruder pathways dominate the potential health effects from commercial low-level radioactive waste disposal. Appendix R (p. R.1) of the
DEIS recognizes a similar effect, in that "scenarios involving contact with or 3.5.1.97
intrusion into waste...predict significant adverse or fatal consequences to those ignoring warnings and intruding into the wastes." However, the DEIS puts considerable reliance in the passive institutional controls described in Appendix M to avoid the intruder problem. The arguments supporting reduction in the risk of inadvertent intrusion are very weak: "The risk reduction factors presented here are based solely on the author's judgment; at present there are neither empirical nor theoretical models upon which these risk reduction factors can be based."

The Final EIS should provide a stronger basis to support the effectiveness of the proposed barriers as a deterrent to inadvertent intrusions.

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<u>Appendix M, Section M.4, Reduction In Risk of Inadvertent Intrusion Through Passive Institutional Controls, page M.11</u>

This section presents factors by which the risk of human intrusion into wastes is estimated to be reduced by different protective means. When more than one means is present, these factors are then multiplied together to obtain an overall risk reduction factor.

3.5.1.69

The NRC staff considers that failure of some of the protective means (e.g., boundary markers and monuments) might result from the same primary cause (e.g., evolution of the language so that the meaning of the markers and monuments would no longer be understood). The potential for such "common-mode failures" indicates that multiplication of the individual protective factors to obtain an overall risk reduction factor is not appropriate. The method for combining the individual protective factors should accommodate the possibility that a single primary cause might render two or more of the protective mechanisms ineffective.

<u>REGULATORY</u>

<u>Volume 1, Foreword, page v, paragraph 7</u>

The NRC staff is concerned about the long-term cumulative effects of all ongoing and reasonably foreseeable waste disposal activities at the Hanford Reservation. The defense wastes, which include high-level and transuranic wastes, are already present and in need of permanent disposal. As stated on page v of the Foreword, the scope of the DEIS excludes low-level radioactive wastes in liquid and solid disposal sites at Hanford. Also excluded are wastes generated by the decontamination and decommissioning of surplus or retired facilities (post-1983). It is stated that those operations will be the subject of other National Environmental Policy Act (NEPA) reviews.

2.3.1.14

It is not clear why the DOE evaluated the environmental impacts of defense waste disposal alternatives without consideration of the cumulative effects of all existing and reasonably foreseeable activities. On page vii of the Foreword it is stated that, if the BWIP site were to be selected as a candidate site for repository development, a corresponding EIS would be written to support that site and to address cumulative impacts of that and other reasonably foreseeable activities on the Hanford Site. Why does the Defense Waste DEIS differ in that cumulative effects of all <u>current</u> waste disposal activities at Hanford are not addressed?







<u>Section 3.4, Comparison of Impacts From Alternatives, pages 3.33-3.65</u>

The DOE's proposals for permanent disposal of defense wastes at Hanford may pose special problems with respect to the NRC's current and future reviews and licensing decisions involving BWIP as a candidate site for the high-level waste geologic repository. For example, the DOE is required to develop a Performance Confirmation Program for BWIP to provide data that indicate, where practicable, whether subsurface conditions encountered and changes resulting from construction and waste emplacement are within limits assumed in the licensing review and that natural and engineered systems and components are functioning as intended. 2.1.10

Some of the actions proposed in this DEIS could potentially make a BWIP Performance Confirmation Program more difficult to design and carry out. For example, the barriers proposed for in-place stabilization of wastes may reduce infiltration to the unconfined aquifer system, potentially altering groundwater flow conditions. The Final EIS should include, in the discussion of impacts, possible effects of the proposed alternatives on licensability of a high-level waste repository at the BWIP site.

<u>Section 6.6, Resource Conservation and Recovery Act, pages 6.10 and 6.11</u>

In this section the DOE suggests that all of the waste covered in the DEIS is byproduct material and therefore not subject to subtitle C of the Resource Conservation and Recovery Act (RCRA). Throughout the text, however, the DOE acknowledges in numerous instances that the waste contains materials that are considered hazardous, dangerous and/or toxic by the EPA. In section 6.6 the DOE appears to be relying on a legal interpretation of authority rather than a technical analysis of hazard to make the conclusion that RCRA does not apply. Since no final determination has been made concerning the EPA and/or primary state authority regarding the disposal of this material, it would seem prudent that the DOE at least consider the impacts of the prescriptive disposal and monitoring requirements that would be mandated by RCRA. 2.4.1.9

<u>HYDROLOGY</u>

<u>Section 4.4.1, Surface Waters, page 4.12, paragraph 2</u>

The flood analyses and information provided in the DEIS indicate that facilities may be exposed to a potential flood threat from Cold Creek, since portions of the site may be flooded by a 100-year flood. It therefore appears that the requirements of Executive Order (E. O.) 11988, "Floodplain Management", have not been addressed. This E. O. requires, among other considerations, that the hazards and impacts associated with siting in a floodplain be identified and evaluated. Accordingly, an outline of the procedures involved in this decision-making process should be provided, and compliance with E. O. 11988 should be discussed. 3.5.6.7

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Section 4.4.1, Surface Waters, page 4.12, paragraph 2

3.5.6.7 Results of flood studies in the Cold Creek watershed (Skaggs and Walters, 1981) indicate that a potential for flooding of portions of the site exists. As proposed, it appears that several facilities may be placed in an area of the Cold Creek floodplain, which could be inundated by several feet of water.

Based on an examination of the Skaggs and Walters report, it appears that the magnitude of flooding on Cold Creek may be underestimated. The Probable Maximum Flood (PMF) was estimated in the report to have a magnitude of 55,000 cubic feet per second (cfs) at the site where the drainage area is about 86 square miles. Review of historic flood data for arid regions of Washington and Oregon with similar climates and weather patterns indicates that a flood of this magnitude has occurred on a stream with a drainage area of about 13 square miles, located less than 150 miles from the site.

In recognition of the fact that the Cold Creek basin could have different flood-producing characteristics from the stream that produced the historic maximum discharge, it is nevertheless important that the PMF represent an upper bound of flood potential for a particular stream. It appears that this upper
3.5.6.7 bound is not well-defined for Cold Creek.

In addition, maximum water levels will be increased as a result of increased PMF discharge and may also be increased by site location in the flood plain. The amount of increase in water level due to flood plain constriction has not been discussed in the DEIS. On the basis of topographic and cross-sectional examination of the site area, surface facilities may be subject to flooding and may constrict the flow area in the flood plain. This may increase the water levels associated with major floods; this increased level and its potential impacts should be discussed in the Final EIS.

Section 4.4.2, Groundwater, page 4.18, Figure 4.8

3.5.2.46 Isoheads indicate a potential for migration of waste from the 200-W area to the existing commercial low-level waste facility situated near the southwest corner of the 200-E area. This may adversely impact groundwater monitoring activities associated with that facility.

Appendix R, Section R.7, Other Surface Flooding, page R.92, paragraph 1

Disposal alternative #2, and in some respects alternatives #1 and #3 (page ix, Executive Summary), present disposal scenarios similar to the burial of high-level waste in a shallow land disposal site. All or some of the high-level and low-level wastes would remain at shallow depths below the ground surface. Consequently, the waste may be subject to near-surface natural phenomena.

3.5.6.11 The draft EA for the proposed disposal of high-level wastes at Hanford concluded, and the NRC agreed, that proglacial catastrophic flooding associated with the melting phase of glaciation would not likely occur during the 10,000-year isolation period. However, other consequences of either significantly warmer or cooler climatic trends could result in adverse environmental conditions at the Hanford Site. For example, future climatic







variations may cause increased sediment loads in the Columbia River and its tributaries, resulting in possible channel migrations. These possible adverse conditions are discussed in major comment #2 of NRC's comments on the draft EA for Hanford (NRC, 1985a) and should be considered in the defense waste Final EIS.

Appendix S, Section S.2, Radionuclide Releases to Accessible Environment, page S.6, paragraph 2

From discussions in the DEIS, it is unclear whether the drier-climate scenario is considered representative of either the Holocene (recent) climate at Hanford or of conditions drier than at present. Assumed log-normal probability density functions for annual groundwater recharge were described for both drier and wetter climate scenarios over the next 10,000 years. The drier climate scenario was assumed to have a median annual recharge of 1.5 cm, whereas the value for the wetter climate scenario was assumed to be 5.0 cm.

If it is intended that the drier climate scenario is representative of recent
conditions, what is the basis for the assumed median annual recharge of 1.5 cm? 3.5.2.52
On pages 4.19 and 4.20 it is stated that the annual average recharge from
precipitation on the 200 Areas plateau has not been established to date, but
two sets of lysimeter measurements are expected to resolve this question within
4 to 5 years. It was also stated that DOE expects that the value will lie 3.2.1.3
within the range of 0.5 to 5.0 cm/yr based on data to date.

In summary, with regard to future climate scenarios, the Final EIS should contain a discussion that more clearly defines and differentiates between the terms "drier" versus "wetter." Also, more information should be included about uncertainties in assumed values for ranges and median values of future annual recharge for the Hanford Site.

Appendix S, Section S.5 Results, page S.24, paragraph 3

It is stated that the composite release-ratio/probability curves show that the in-place stabilization and disposal alternative and the reference alternative meet the EPA standard at the 99.9 percentile. This conclusion is not adequately supported. 3.5.6.3

Specifically, over the next 10,000 years, it is assumed that a drier climate scenario is nine times more probable than a wetter climate scenario (0.9 vs. 0.1; combined probability = 1.0). No basis for this assumption is given and no relevant references are cited in the appendix. This assumption biases the results of the composite release curves (Figure S.10) in favor of a drier climate with its implications of reduced recharge, infiltration, and contaminant transport. The rationale for assigning such a high probability to dryer climate scenarios should be explained in greater detail.

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GEOCHEMISTRY

Appendices O, P and Q, Transport and Attenuation Modeling

The DOE recognizes that the total $K_d$ (distribution coefficient) modeling approach is a "potential technical limitation" in modeling efforts (DEIS, Vol. 3, p. O.15) which has "come under severe criticism recently" (DEIS, Vol. 2, p. xxxii) because it combines complex geochemical processes into a single empirical parameter. This methodology is used, however, because of the "limited data base" at Hanford (DEIS, Vol. 2, p. xxxii). It is the NRC staff's
3.5.2.6 position that the lack of data for more complex models and codes is not, by itself, a sufficient basis for using simplifying models and assumptions. Rather, the DOE should also demonstrate that the simplified models and assumptions are sufficiently realistic (or conservative) to support the decisions to be made using them. The DEIS states that the DOE is developing more complete and advanced transport and attenuation models (DEIS, Vol. 3, pp. O.15, P.3). The DOE should use these new models to evaluate the accuracy of the simpler Kd modeling approach.

Areas of concern pertaining to the DEIS modeling methodology include the
3.5.2.35 following. The DOE does not show that the Delegard and Barney (1983) $K_d$ values are directly applicable to the transport and attenuation models in the DEIS. The Delegard and Barney (1983) study illustrated the effects of certain waste components on the sorption properties of Hanford soils under specific laboratory conditions, but did not attempt to duplicate the ambient and expected site geochemical conditions at the Hanford Site. Delegard and Barney (1983) state that their $K_d$ values are valid only within the range of their test conditions and that slight changes in waste composition can change migration rates by a factor of 13 to 40. Kelmers (1984) notes that in measuring
3.5.2.7 laboratory $K_d$ values it is "essential that test materials and conditions duplicate those to be encountered in the field situation being evaluated." It appears that this criterion is not met.

The contaminant transport assessment calculations do not account for all factors which can influence contaminant retardation. Changing site geochemical conditions due to spatial variation in groundwater or soil chemistry (DEIS, Vol. 3, pp. O.35, O.9, V.9) or to the introduction of contaminants (DEIS, Vol.
3.5.2.31 3, p. O.37) will change the sorption characteristics of the Hanford Site. Kinetics of sorption-desorption reactions are not accounted for, nor is mass action competition for sorption sites. Additionally, the effect of naturally occurring organic material, which may be important in sorption and transport processes at Hanford (Toste and Myers, 1986), has not been examined. To perform a thorough transport assessment at the Hanford Site, the DOE should examine the impact of changing geochemical conditions on contaminant retardation and assess the effect of those geochemical processes not accounted for by their current methodology.

3.5.2.40 Limitations in the Hanford geochemical data base also limit the DOE to the use of contaminant release models that do not explicitly account for solubility limits as dictated by the current and expected site geochemical conditions

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(DEIS, Vol. 2, pp. xxxi and xxxii; Vol. 3, pp. P.1, P.11). Release concentrations used in the DEIS are described by the DOE as being conservative estimates on the basis of data available in the literature (DEIS, Vol. 2, p. 3.5.2.40
xxxii). Future release models, which the DOE states will take into account waste form release characteristics (DEIS, Vol. 3, p. P.18), should be incorporated into future impact assessment calculations.

Appendices O and U, Hanford Site Geochemical Conditions

The DEIS does not demonstrate that the ambient geochemical conditions and the composition of the tank waste have been adequately characterized to allow realistic transport assessments of contaminants at the Hanford site. To develop valid transport models and use accurate values for parameters in these 3.5.2.23
models, the site geochemistry must be carefully examined and characterized. Since the DOE repeatedly cites the lack of site geochemical data (DEIS, Vol. 3, pp. O.7, O.8, O.15, U.4, and others) and uncertainty as to the composition and speciation of the tank waste (DEIS, Vol. 2, p. xxxv), the DOE should demonstrate that the site geochemical conditions are known well enough to ensure that the models and model parameters used in the impact assessment calculations are reasonable and conservative.

Appendix P, Section P.1.4, Diffusion-Controlled Release Beneath a Protective Barrier, page P.7, bullet 4

The DOE states that prior releases of contaminants (e.g., tank leaks, crib disposals, well injection) are not included in transport simulations because "most are not categorized as high-level or transuranic (TRU) waste," and those 3.5.3.21
that are high-level or TRU are of negligible quantity. The DOE should take into consideration prior releases of contaminants in the transport calculations since these wastes are components of the current site geochemical conditions. Because these wastes will continue to be transported, their effects on the transport and attenuation of other contaminants (i.e., future releases of defense wastes) and their contribution to waste concentrations at site boundaries should be assessed.

Appendix V, Site-Monitoring Experience

The DEIS includes a brief discussion of current and former environmental monitoring activities at Hanford. Examples of localized contamination problems 3.5.2.21
(cribs, trenches, etc.) are discussed in detail, while larger-scale contaminant plumes receive little mention. The large-scale movement of these plumes has been studied at Hanford for decades, and much has been learned about 3.1.1.3
contaminant migration in the unconfined aquifer system. Some of this valuable information should be incorporated in the Final EIS. At a minimum, additions to the Final EIS should include available maps that show, for various times, the shapes and movements of various contaminant plumes known to exist in the unconfined aquifer system. This would include constituents like nitrate, tritium, I-129, Ru-106, Co-60, and Tc-99. These types of mobile contaminants show considerable promise in the continued study of flow paths for contaminant migration in the unconfined aquifer system at Hanford. The Final EIS should include a discussion of the role of large-scale contaminant plume behavior in evaluating the environmental impacts of future defense waste disposal operations.

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Appendix V, Section V.5, Reverse Wells, page V.29, paragraph 2

3.5.3.4 The DEIS states that "the zone of [radiologic] contamination around the 216-B-5 reverse [injection] well appears to be [chemically] stable, with no apparent further migration of radionuclides." Results are shown for Cs-137, Sr-90, and Pu-239,240. However, a previous DOE investigation indicated that there was some evidence of contaminant migration beneath the well site, the source of which was uncertain. The following was reported by Smith (1980):

> Gamma logging showed that sediments distributed over a broad area and located just above the basalt surface were contaminated with low-level gamma contamination. Examination of previously collected gamma logs indicated that a possible source of this contamination could be the BY cribs located [approximately] 900 m north of the reverse well. This work also indicates that the contamination may be moving in a southeasterly direction.

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Smith (1980) also recommended that the broad contamination plume at the basalt surface should be investigated as to its distribution, source or sources, radionuclide identity and concentrations, and that a monitoring plan be developed if required. This study showed that the position of the water table and the type of sediment to which waste solutions are discharged are important factors for controlling radionuclide distributions. The study also recommended the use of stainless steel well screens for monitoring wells. Anomalous beta activity was present on rusted portions of corroded well casings and was believed to have produced some erroneous radionuclide analyses.

3.5.3.4 This is the only reverse well for which contaminant migration has been characterized, and one could not thereby conclude that the results are statistically significant. Because of aquifer heterogeneities and the chemical variability of fluids originally injected into various reverse wells, it may not be reasonable to extrapolate these results to other reverse well locations. It is noted that zones of contamination appear to extend beyond the maximum depth of penetration of the monitoring wells. It would be useful to know to what depth contaminants may have penetrated basalts at the base of the unconfined aquifer. Previous researchers at Hanford have presented some evidence for deeper contamination. Brauer and Rieck (1973) noted the presence of I-129 in groundwater obtained from well 699-10-E12 P. The sampled aquifer was believed to be confined, and it was suggested that there had been some contamination of the groundwater since the early 1940's.

3.5.3.4 The presence of varying concentrations of contaminants that were released to the unconfined aquifer system over the last four decades provides a unique opportunity to better understand in situ solute behavior and geochemical retardation processes. Given this unique opportunity, the DOE should plan additional in situ characterization studies of this type as a means of better supporting modeling studies of contaminant transport in the unconfined aquifer system.









GEOLOGY

Section 3.3.2.5, In-Place Stabilization and Disposal Applied to Previously Disposed-of TRU-Contaminated Soil Sites, page 3.24, paragraph 1

This section states that a geophysical survey of the liquid waste sites with high subsidence potential will be completed to characterize them and to identify grout-injection points. Further discussion of the feasibility and adequacy of subsidence control should be provided in the Final EIS. 3.1.3.12

Section 4.0, Affected Environment, page 4.2, Figure 4.1

Figure 4.1 provides the general locations of the defense high-level and transuranic wastes. Figure 4.1 indicates that waste disposal occurred in the 200-W, 200-E, and 300 Areas and in the Wye Burial Ground. The DEIS should more precisely identify all waste locations at Hanford. It is further recommended that the Final EIS include additional information regarding the geohydrology, 3.1.1.3 geochemistry, and geology (e.g., geomorphology, stratigraphy, and structure) of specific waste disposal areas to better characterize these sites. For example, the potential for contaminant migration in the vadose zone beneath a given disposal site cannot be reliably determined without an evaluation of actual, site-specific soil moisture characteristics and curves of pressure head versus hydraulic conductivity.

Section 4.3, Seismicity, page 4.10, paragraph 4

The existence of faulting and the possibility of fault reactivation in the waste disposal areas has not been adequately addressed. The general guideline in 10 CFR 61.50(a)(9) may be of use in discussing the potential and significance of faulting in these areas. 3.2.2.2

The referenced draft EA for Hanford (DOE, 1984) presented a generally favorable view of the tectonic setting and possible effects of tectonics on waste isolation. In the NRC's major comment #4 on the draft EA (NRC, 1985a), this view was considered to be inadequately supported by the data and analyses presented. The statements made by the NRC staff regarding the reference repository also apply to the waste disposal alternatives of this DEIS.

Section 4.3, Seismicity, page 4.10, paragraph 4

A series of sub-vertical clastic dikes has been observed (NRC, 1985b) in the trench walls at the U.S. Ecology Low-Level Waste Disposal Area, which is located in close proximity to the 200-E Area. The dikes cut across, but do not appear to offset the sand and silt strata in the trenches. They taper upward 3.2.2.7 and extend from below the base of the trench to within 8 to 10 feet of the surface. They are approximately 2 to 3 feet wide at the base and several inches wide where they are truncated or pinch out near the ground surface. The dikes, which occur in other areas of the Hanford Reservation, may be related to fissuring caused by ground motion resulting from seismic activity. The

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fissures were apparently filled by movement of water-saturated sediments under hydrostatic pressure, which are susceptible to liquefaction.

3.2.2.7 The presence of these clastic dikes may have significant implications for shallow land burial of low-level and high-level wastes. In the 500 to 10,000 year periods of isolation required for low-level and high-level wastes, respectively, there is a possibility that fissuring may again occur or that existing fissures may be reopened as a result of seismic activity. Existing fissures may also provide avenues for groundwater migration. The probability of occurrence as well as the significance of these fissures should be addressed. Additionally, the possible existence of these dikes within the waste disposal areas should be determined.

<u>Section 4.7, Land Use, page 4.30</u>

3.2.1.6 The DEIS does not address nor does it provide information on the potential for the existence of natural resources in the defense waste areas. 10 CFR 61.50 (4) requires that, for the near-surface disposal of low-level wastes, areas known to contain natural resources should be avoided. While the disposal of defense wastes is not subject to 10 CFR Part 61, the reasons for avoiding such areas remain valid. The Final EIS should provide an evaluation of natural resources, including hydrocarbon and mineral resource potential at the proposed site. This is particularly relevant in view of a natural gas discovery within sediments underlying the basalts in the Saddle Mountains area of the Hanford Reservation by Shell Oil Company (NRC, 1985a).

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3.5.3.14 <u>Appendix D, Section D.1, Stratigraphy Beneath The Hanford 200 Areas, pages D.2-D.5</u>

The principal units that comprise the unconfined aquifer system at Hanford are discussed in Appendix D. Little information is provided on the topic of paleogeomorphology at Hanford. This topic may be of importance in developing a better understanding of flow and transport in the unconfined aquifer system.

3.5.2.34 Brown et al. (1962) provided geologic interpretations that accounted for the apparently rapid dispersal of tritium in the unconfined aquifer system at Hanford. They noted that the contaminants appear to be following old Columbia River channels incised into the eroded upper surface of the low-permeability Ringold Formation sediments. These channels are filled with more recent deposits (Hanford Formation) that have permeabilities approximately two orders of magnitude greater than in the underlying Ringold strata. It appears that the relative subcrop elevation of the Ringold Formation with respect to the water table thereby exerts considerable influence over groundwater flow paths. This may account for the observed branching (anomalous macrodispersion) of contaminant plumes migrating away from the 200 East Area. This information should be considered when interpreting the results of groundwater surveillance at Hanford and in the continued development of a groundwater monitoring program.







<u>ENVIRONMENTAL</u>

Several of the NRC's detailed environmental comments on the DOE's draft Environmental Assessment are applicable to the DEIS. The comment numbers are E-1, 3-30, 4-3, 4-5, 5-10, 5-11 and 6-38. These comments should be considered in preparing the Final EIS.

ED 7

Section 3, The site, page 10, paragraph 4

3.2.4.4 The first sentence in this paragraph states that there are "no threatened or endangered animals and plants...known to occur at the site." The second sentence states "However, the bald eagle (an endangered species) and the peregrine falcon (a threatened species) have been sighted at the Hanford Site." The fact that both these species have been documented to be winter visitors to the A-H site (Landeen, D. S. and R. M. Mitchell, 1981) indicates that they do occur onsite.

These same two statements are also found in the following sections/pages: 3-iii; 3.4.2.5, page 3-103; 5.2.1.3.1, page 5-43; 6.2.1.6.11, page 6-37. The statement that there are no federally endangered or threatened species onsite is also made in the following sections/pages: 2.3.9.2, page 2-71; pages 5-i, 5-ii; 6.2.1.6.10, page 6-34; 6.2.1.6.11, page 6-35; 7.3.2.1.1, page 7-78.

It is suggested that the final EA clarify the apparent inconsistency perhaps by indicating that as far as is known, neither species nests onsite.

3.2.3.1 3-30 F

Section 3.4.3.5, Air quality, pages 3-114, second paragraph

Insufficient information is presented in the draft EA to define air quality in the region. This information is necessary for the evaluation of the conclusions regarding air quality. The assessment only refers to the Skagit/Hanford DES for current air quality conditions in the Columbia Basin. It is suggested that a summary table of air quality in the Hanford area be presented in this assessment and compared to the standards presented in Table 3-11 (page 3-117).

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4-3

Section 4.1.2.5, Archaeological surveys, page 4-17

3.2.5.1 The discussion in this section omits reference to required consultation activities. It is recommended that DOE include provision for consultation with the State Historic Preservation Officer and when appropriate, contact with the Keeper of the National Register of Historic Places and the Advisory Council on Historic Preservation to assure compliance with the National Historic Preservation Act of 1966 and 36 CFR 800.

4-5

Section 4.2.1.3.1.1, Terrestrial, page 4-25, paragraph 3

3.2.4.2 It is stated that "More than half the plants within this area were destroyed and all the animals were displaced during construction activities." It is not clear why only about half the plants were destroyed. In most cases the species population will eventually be reduced by the number of individuals the lost habitat supported and will result in a permanent reduction in wildlife populations. It is suggested that emphasis be placed on habitat loss and the associated permanent reduction in wildlife population (Kroodsma, 1985).

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5-10

Section 5.2.1.3.3, Noise impacts, page 5-44

Noise related impacts on wildlife during facility operation are acknowledged but not described qualitatively or quantitatively. The need for mitigation is also not discussed. Similarly, noise related wildlife impacts due to the access roads and railroad are not discussed. It is suggested that the final EA consider the noise impacts of transportation and impacts on wildlife. 3.2.4.7

5-11

Section 5.2.2, Expected effects of transportation, page 5-46

The impacts from transportation accidents, including the estimated dose to the maximally exposed individual and the estimated number of latent cancer fatalities, are not discussed. It is suggested that the final EA include either an explanation of the use of existing analyses and studies to substantiate the assertion that transportation accident impacts are small, or an analysis of the consequences, probabilities, risks and cleanup costs for a severe transportation accident enroute to the site. 3.4.2.23

6-38

Section 6.3.1.4, Climatic changes, pages 6-111 to 6-113

The principal assumption for the discussion of the impacts of climatic change is that the climatic changes that took place during the Quarternary Period bound the extreme conditions expected over the next 10,000 years. This assumption does not appear to be adequately supported in this section. According to many authors (e.g., Imbrie and Imbrie, 1979), the atmospheric warming induced by increasing atmospheric concentrations of carbon dioxide will likely result in a "super-interglacial" period with a higher mean global temperature than that estimated during the last interglacial period (about 125,000 years before present) and which would last several thousand years. Eventually, the "super-interglacial" period would be overwhelmed by orbital-climate relationships. It is suggested that the discussion of paleoclimate and climate change might be expanded to include this possible "super-interglacial" period, particularly with respect to identification of comparable paleoclimates with mean global temperatures of about 63°F (compared to about 61°F estimated during the last interglacial period and observed at present). 3.2.1.3

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HOLTEN 3.5.1.2

Natural Resources Defense Council

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August 21, 1986

Mr. Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Dear Mr. Holten:

Attached are the comments of the Natural Resources Defense Council (NRDC) on the draft Environmental Impact Statement (EIS) "Disposal of Hanford Defense High-Level Transuranic, and Tank Wastes," DOE/EIS-0113. In a telephone conversation on Monday, August 11, 1986 Mr. Steve Leroy of DOE stated to me that comments received within two weeks of the August 9 EIS filing deadline would be considered timely.

Sincerely,

Dan W. Reicher

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Natural Resources Defense Council

1350 New York Ave., N.W.
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August 21, 1986

Mr. Rich Holten/EIS
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Dear Mr. Holten:

The Natural Resources Defense Council, Inc. (NRDC) submits the following comments on the Department of Energy's (DOE)'s Draft Environmental Impact Statement for Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes (DEIS) (March 1986).[1/]

These comments focus primarily on the high-level radioactive waste (HLW) currently stored in 149 single and 14 double-shell tanks at Hanford. In the DEIS DOE discusses three alternatives for disposal of this waste. In the "geologic disposal" alternative HLW retrieved from single and double-shell tanks is disposed of in a combined commercial-defense geologic repository. DEIS at 1.13. In the "in-place stabilization and disposal" alternative all wastes--including HLW in single and double-shell tanks--are left in-place. Id. In the "reference (combination disposal)" alternative, HLW in double-shell tanks is retrieved and emplaced in a geologic repository while HLW in single-shell tanks is left in-place.[2/] Id. at 1.17.

(no comment identified)

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1/ The notice of intent to prepare an Environmental Impact Statement was announced in 48 Fed. Reg. 14029 (April 1, 1983).

2/ DOE also proposes a "no disposal action" alternative in which storage of all wastes continues and there is no permanent disposal. However, "this is a contrived case that is included to comply with the Council on Environmental Quality Requirements." DEIS at ix.

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In brief, we find that the DEIS is fundamentally flawed because it fails to acknowledge that the Nuclear Waste Policy Act, 42 U.S.C. §10101 et seq (NWPA), requires disposal of all HLW in a deep geologic repository. Thus DOE has considered disposal alternatives for HLW not allowed under the NWPA. The final EIS must reflect this legal mandate and address the other concerns we raise here.3/

2.4.1.4
2.4.1.6

1. The Proposed Alternatives are Inconsistent with the Nuclear Waste Policy Act.

The in-place stabilization and reference alternatives in the DEIS fail to acknowledge that the Nuclear Waste Policy Act (NWPA) contemplates only geologic disposal for all high-level waste (HLW), including defense HLW.

In the NWPA, Congress specifically found that the "Federal Government has the responsibility to provide for the permanent disposal of high-level radioactive waste." 42 U.S.C. § 10131(a)(3). To ensure that this mandate is carried out fully and fairly, Congress created an intricate scheme for the development of a HLW geologic repository. Nowhere in this elaborate plan did Congress authorize a single alternative to geologic disposal of HLW. Under the NWPA, the only choice to be made about defense HLW is whether such waste would be disposed of along with commercial waste in a single repository or whether separate defense and commercial waste repositories would be developed. Thus NWPA section 8(b)(2) states that:

> Unless the President finds...that the development of a repository for the disposal of high-level radioactive waste resulting from atomic energy defense activities only is required..., the Secretary [of Energy] shall proceed promptly with arrangement for the use of one or more of the repositories to be developed under subtitle A of title I for the disposal of such waste..."

3/ At a minimum DOE must state "how alternatives considered...will or will not achieve the requirements" of the NWPA. 40 C.F.R. §1502.2(d).

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On April 30, 1985, President Reagan chose to dispose of defense and commercial HLW in the same geologic repository. DEIS at 3.32. Once that decision was made, the provisions of the NWPA became applicable to the disposal of all defense HLW. 42 U.S.C. § 10107(c). 2.4.1.4

Implicit in DOE's consideration of alternatives to geologic disposal is the Department's assumption that an engineered barrier and marker system is a safe substitute for a geologic repository. DEIS at 1.14. However, this assumption is contradicted by the Act and its legislative history. The NWPA defines engineered barriers as "manmade components of a disposal system designed to prevent the release of radionuclides into the geologic medium involved." 42 U.S.C. § 10101(11) (emphasis added). The NWPA thus considers engineered barriers to be an additional element of and not a substitute for the geologic isolation provided by a repository.4/

The legislative history of the NWPA makes this point clear. In introducing H.R. 8578, Congressman Morris Udall stated that "[t]he rock formations deep underground in which the waste will be buried will be the most important barrier keeping the waste out of the biosphere after the first 500 years or so." 126 Cong. Rec. H11753 (Dec. 3, 1980). The House Report accompanying the NWPA stated as well that "the geologic media is to be the ultimate barrier which isolates the waste from the biosphere, and that engineered barriers are but intermediate and short-term

4/ A major concern with the use of engineered barriers alone is the possibility of intrusion through drilling or excavation. DOE predicts "significant adverse or fatal consequences" to individuals intruding into wastes where passive institutional controls are not effective. DEIS at R.1. By DOE's own admission the likelihood of such intrusion is greater with near-surface disposal than with deep geologic disposal. Thus DOE states that "the [p]robability of intrusion is highest in the no disposal action," DEIS at R.1, and "near-zero" in the case of geologic disposal. DEIS at 3.51. Engineered barriers alone, then, simply do not offer the protection against intrusion of deep geologic disposal.

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forms of isolation." H.R. Rep. No. 1156, pt. III, 96th Cong., 2d Sess. 29 (1980) (emphasis added). Furthermore, the "need for any man-made containers to endure for a quarter of a million years is mitigated by the fact that the only real barrier to the release of any radioactivity into the biosphere will be the geologic medium itself." H.R. Rep. No. 785, pt. 1, 97th Cong., 2d Sess. 48 (1981).

Thus the NWPA envisions the use of engineered barriers only to enhance the protection provided by the ultimate geologic barrier, not to substitute for it. The NWPA does not in any way equate the effectiveness of the long-term isolation provided by a geologic repository with the short-term isolation provided by a man-made barrier. As Representative Ottinger stated in deliberations over the NWPA, "[t]he decision to go with deep geologic disposal is based on a belief that, no matter now well crafted, no manmade barrier is likely to last the eons during which the radioactive waste must be contained." 128 Cong. Rec. H8195-96 (Dec. 2, 1982).[5/] It is thus inescapable that HLW may
2.4.1.4 not be left in-place using only engineered barriers.

2.4.1.6 2. DOE Has No Authority to Exempt Certain HLW from Geologic Disposal on the Basis of its Retrievability.

As we have shown, the NWPA does not authorize alternatives to geologic disposal of HLW. DOE thus has no basis for its proposal under the "in-place stabilization" and "reference" alternatives to leave HLW in the single-shell tanks because it is "not readily retrievable." DEIS at 1.17 and 3.24. DOE also has

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5/ DOE touts the Silla Dynasty tombs in Korea, which have remained intact for greater than 1500 years, as an example of the longevity of man-made barriers. DEIS at 1.14. However, in comparison with the half-lives of many radioactive elements the longevity of the Silla tombs is but a bat of an eyelash. Furthermore, DOE fails to mention the untold number of ancient tombs which were intruded upon long ago by man or nature. Finally, under EPA standards HLW must be isolated from the environment for almost seven times as long as the Silla tombs have maintained their integrity.

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no basis to leave 5% of the HLW in single-shell tanks and .05% in the double-shell tanks under the geologic disposal alternative because further removal is not "practicable." DEIS at 3.13.

DOE's attempt to exempt the existing HLW in single-shell tanks from geologic disposal because they are not "readily retrievable" is particularly troubling. Over a decade ago, NRDC expressed its concern that by delaying a decision on the single-shell tanks for such a long period, DOE's predecessor (ERDA) was probably choosing to leave the wastes in the underground tanks, because the opportunity to retrieve them by safe, known means was being rapidly lost. "Comments of the Natural Resources Defense Council on the Atomic Energy Commission's Draft Environmental Statement for Waste Management Operations at the Hanford Reservation," January 21, 1975, p. 54.

In response, DOE insisted that the Hanford tanks were being used for "interim (i.e., short term) storage of waste in a retrievable form until a suitable long-term disposal process...[has] been developed..." S. Rep. No. 94-514, 94th Cong., 1st sess., 76 (1975), cited in Natural Resources Defense Council, Inc. v. Administrator, Energy Research Development Administration, 451 F. Supp. 1245, 1251 (D.D.C. 1978), modified on appeal, 606 F.2d 1261 (D.C. Cir. 1979). DOE even successfully argued against NRC licensing of double-wall tanks as long-term storage under Section 202 of the Energy Reorganization Act on precisely this basis in a 1976 lawsuit brought by NRDC. Id. Now, however, DOE proposes in the reference alternative to do exactly what it insisted it would not do, i.e. dispose of the wastes in-place.

DOE's justification for leaving the HLW in-place, i.e. that it is not "readily retrievable" is contradicted by the Department's own statements in the DEIS. While in Volume I DOE 3.1.4.5
claims that the wastes are not readily retrievable because they are not "pumpable," DEIS at 2.2, in Volume II DOE presents a workable alternative namely "mechanical retrieval." Using this technique DOE "would be capable of retrieving all types of salt

cake and sludge [from the single-shell tanks] without the addition of liquids." DEIS at B.2. Mechanical retrieval would thus avoid the necessity for hydraulic retrieval which "is difficult [because] the tanks may leak." DEIS at 3.24.

2.2.7 Retrieval of HLW, then is both legally required and technically feasible. DOE should not be considering the illegal and anomalous step of "disposing" of the least-safely packaged HLW only 30 feet below ground while much more safely packaged HLW is emplaced 3000 deep in a geologic repository. The NWPA does not give DOE any authority to exempt certain wastes from geologic disposal, even if the costs of disposing of those wastes are higher than under other alternatives.

3. DOE's Claim that Retrieval of Certain HLW Would be Hazardous is not Adequately Explained and is in Fact Contradicted in the DEIS.

3.3.2.5 DOE also justifies leaving HLW in-place under the in-place stabilization and reference alternatives on the basis that retrieval of such waste "is considered to be hazardous." DEIS at 3.24. DOE does not explain this claim adequately and, in fact, it is contradicted by DOE's own statements in the DEIS.

First, while removal of these wastes under the geologic alternative may increase total occupational radiation doses somewhere between two and four times that expected under the reference alternative, DEIS at 5.8 - 5.9, 5.39 - 5.41, DOE expects that individual occupational doses can be maintained within the range found at the Hanford site over the last several decades. DEIS at 5.8, note (b). Second, DOE states that radiation doses from postulated accidents during retrieval would not exceed DOE standards. Id. at 5.8. Third, DOE expects off-site radiological effects from operations involving HLW under the geologic as well as the reference alternative to be miniscule in comparison with the effects of natural background radiation. DEIS at 5.8, 5.41. Fourth, while DOE postulates four to eight times the nonradiological injuries, illnesses and fatalities associated with geological disposal than with the other

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alternatives, DEIS at 3.38, Table 3.4, the vast proportion of these effects will occur as a result of repository construction and not waste retrieval. DEIS, Vol. 2, App. G.

Thus DOE has not substantiated its claim that HLW retrieval would be hazardous enough to justify leaving HLW in-place, assuming that were even an option permitted by the NWPA. In fact, DOE states clearly that "[i]n terms of human health and safety, any of the disposal alternatives could be safely implemented." DEIS at 5.2, (emphasis added).

4. DOE Obscures the Significant Long-Term Radiological Impacts of Near-Surface Disposal.

In the DEIS DOE obscures the greater long-term radiological impacts of near-surface as compared with deep geologic disposal. DOE states, for example, that with respect to radiological impacts "there is little to distinguish among disposal alternatives" under various scenarios. DEIS at 3.53. However, DOE's data in Appendix R paint a different picture.6/ Most striking are cases involving the consumption of contaminated drinking water and agricultural products after engineered barrier failure. Thus 200 years after a "disruptive barrier failure," an individual consuming drinking water and agricultural products would receive a 70-year radiation dose to the thyroid of 900 rems from single-shell wastes left in-place under the reference alternative. DEIS at R.42. Under the geologic disposal alternative, in which most of the single-shell wastes would be emplaced in a repository, the 70-year dose to the thyroid would be 20 rems. DEIS at R.36. Similarly, with a "functional barrier failure," the 70-year individual dose to the thyroid from single-tank residuals under the reference alternative would be 100 rems, DEIS at R.43, whereas under the geologic disposal alternative the dose would be 1 rem. DEIS at R.37. Where drinking water is the

6/ Much of the data of greatest concern in Appendix R is missing from DOE's summary of radiological impacts in Chapter 3.

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only contamination pathway and there is a functional barrier failure, DOE predicts a 70-year individual organ dose under the reference alternative that is 20 times the dose under the geologic disposal alternative. DEIS at R.11, 23. It is apparent, then, that radiological impacts may differ substantially between the reference alternative and the geologic alternative.

DOE does not even present data concerning the radiological impacts of a major excavation of near-surface HLW under the three disposal alternatives. DEIS at R.71. DOE says that "such a systematic intrusion is considered to be credible only in the no disposal action alternative. The barrier and marker system is assumed to preclude excavation; the excavator is assumed to be alerted to the danger by the markers internal to the barrier." Id. We disagree strongly with DOE's assumption. While passive institutional controls, such as markers, may be presumed to function past the period of active institutional control, it is simply not credible to expect that they will do so in all

3.5.1.31 cases. Every day excavators proficient in English strike gas pipes clearly marked with warning signs. It is ludicrous to think that excavators in distant generations, who may not share our language or symbology, would not do the same. EPA has clearly stated, with respect to its HLW standards, that "passive institutional controls have not been assumed to prevent all possibilities of inadvertent human intrusion, because there will always be a realistic chance that some individuals will overlook or misunderstand the markers and records." 50 Fed. Reg. 38080 (Sept. 19, 1985, col.1). In fact DOE itself acknowledges in the DEIS that "passive institutional controls can be expected to prevent systematic intrusion, but not to prevent occasional inadvertent intrusion[.]" DEIS at 3.43 (emphasis added). We

3.5.6.26 suspect that if DOE were to calculate doses from excavation of the single-shell tank wastes under the reference alternative they would be nearly as large as the frighteningly high doses presented under the "no-disposal" option. DEIS at R.73.

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5. DOE Has Impermissibly Rejected Consideration of Two Geologic Disposal Alternatives.

In the DEIS DOE impermissibly rejects consideration of two disposal options under which HLW retrieved from single and double-shell tanks would be disposed of in their entirety in a geologic repository without fractionation into HLW and LLW components.[7/] DEIS at 3.32 - 3.33. DOE states that "geologic isolation of all retrieved waste [is]...impractical." DEIS at 3.1.4.5
3.12 DOE finds these alternatives "impractical" on the basis of increased costs and risks. However, DOE fails to substantiate its claims about such costs and risks adequately. For example, DOE does not explain at all how it "scaled up" costs to the present from its 1980 analysis of the costs of disposing of entire tank contents as compared with fractionated wastes (ESG (1980)). DEIS at 3.32. DOE also does not explain the relevance of present tank construction costs to a determination of the costs of tank removal. Id. at 3.33. Finally, DOE does not substantiate in any way its claim of increased radiological and nonradiological risk under these alternatives. Id. at 3.32. It is ironic that DOE considers further analysis of these geologic disposal alternatives as "unwarranted" use of its time and resources. If DOE would simply accept the fact that in-place stabilization is not a permissible alternative, it could redirect its time and resources toward an adequate evaluation of geologic disposal alternatives.

6. DOE Fails to Explain the Basis for Its HLW Classification. 3.1.1.9

DOE fails to explain the definition of HLW it will use to classify wastes for disposal.[8/] Since DOE proposes to

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7/ Under the first option DOE would dispose of the "entire" contents of existing and future HLW tanks. Under the second option DOE would also dispose of the tanks themselves, ancillary equipment, and contaminated soil surrounding the tanks. DEIS at 3.32 - 3.33.

8/ The DEIS contains several "definitions" of HLW. The first footnote cont'd fractionate wastes into high and low-level components, the Department should explain how it or another agency has or will establish threshold levels of radioactivity and/or radioactive constituents which will distinguish HLW requiring geologic disposal from LLW which may be disposed of by other means. We are concerned that radioactive wastes resulting from fractionation of HLW which DOE plans to mix with grout and dispose of via shallow land-burial may actually warrant more protective disposal measures. DOE must provide more complete data in the EIS concerning the residual radioactivity and constituents in this solidified waste in order that informed decisions about shallow-land burial can be made.

3.1.1.9 DOE should also clarify how its definition of HLW applies to its treatment of transuranic (TRU) wastes. DOE makes the cryptic statement that some TRU waste "might be classified as high-level and some might not." DEIS at 1.4. DOE should state explicitly the basis on which it will classify TRU wastes as HLW, requiring geologic disposal.

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chapter of the DEIS describes HLW as wastes that "come from reactor fuel that has been reprocessed. They are highly radioactive, emit penetrating radiation, and create a lot of heat." DEIS at 1.4, 1.5. The DEIS glossary defines HLW as "the highly radioactive waste material that results from the reprocessing [sic] spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of TRU waste and fission products in concentrations as to require permanent isolation (DOE Order 5820.2)." DEIS at 8.10.

The NWPA defines HLW as (A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (B) other highly radioactive materials that the Commission, consistent with existing law, determines by rule requires permanent isolation. 42 U.S.C. § 10101(12).







7. DOE Should State Whether It is Planning to Develop "Other Facilities" for Hanford HLW. 2.1.4

DOE's states that:

> to the extent that any decision based on a final environmental impact statement requires defense high-level waste to be placed in a repository constructed under the Nuclear Waste Policy Act, or placed in other facilities, which are authorized for the express purpose of subsequent long-term storage of such waste (within the meaning of Section 202 of the Energy Reorganization Act), such a repository or other facilities would comply with subsequent applicable licensing requirements of the Commission. DEIS at 6.11.[9/] (emphasis added).

DOE should explain what the cryptic term "other facilities" means in the above statement. If DOE is considering the development of facilities, other than a repository, for the "long-term storage" of HLW the Department should state so and provide details.[10/]

8. DOE Misstates the Way the Resource Conservation and Recovery Act Applies to the Identification of Hanford's HLW. 2.4.1.9

DOE states that the wastes addressed in this EIS constitute "byproduct material" and are not subject to the requirements of subtitle C of the Resource Conservation and Recovery Act (RCRA),

9/ In the sentence preceding the one quoted above, DOE cites Section 8(a)(3) of the NWPA (42 U.S.C. § 10107(a)(3)) for the proposition that any HLW disposal in a defense-only repository requires NRC licensing under Section 202 of the Energy Reorganization Act of 1974. Section 8(a)(3) of the NWPA, however, does not exist. DOE may have intended to refer to Section 8(b)(3) (42 U.S.C. § 10107(b)(3)). However, that section applies solely to a defense-only geologic repository which President Reagan has removed from consideration.

10/ The NWPA holds out the possibility of long-term storage in a monitored retrievable storage facility (MRS). However, the NWPA permits only the study of MRS, 42 U.S.C. § 10161, and Congress must specifically authorize the development of such a facility. 42 U.S.C. § 10161(c)(2). An MRS facility would then be subject to licensing by the NRC. 42 U.S.C. § 10161(d).

2.4.1.9 42 U.S.C. §6901 et seq. DEIS at 6.10-6.11. DOE refuses to comply with RCRA until "it is subsequently determined" that these wastes are subject to RCRA. However, "EPA has now determined that wastes containing both hazardous waste and radioactive waste are subject to RCRA regulation." 51 Fed. Reg. 24504 (July 3, 1986, Cols. 2-3).

Despite EPA's determination, DOE continues to consider a proposed rule which attempts to limit the applicability of RCRA to mixed wastes. 50 Fed. Reg. 45736 (Nov. 1, 1985). However, as NRDC, a number of states, and the Nuclear Regulatory Commission have commented, such a rule is illegal and illogical. See e.g., "Comments of the Natural Resources Defense Council, Energy Research Foundation, and the Environmental Policy Institute on the Department of Energy's Proposed Byproduct Material Rulemaking," January 6, 1986. In view of EPA's recent decision that all mixed wastes are subject to RCRA and the universally negative reaction to the proposed rule, DOE should submit to joint RCRA-AEA jurisdiction over all Hanford defense wastes containing RCRA-listed or characteristic wastes.

RCRA regulations impose a duty upon a waste generator, such as DOE, to determine whether any of its waste sites are subject to the Act. 40 C.F.R. 262.11. It is therefore DOE's responsibility to determine if the Hanford wastes are subject to RCRA. The Department should do so now during this EIS process to integrate RCRA requirements fully into its decision on disposal options for the Hanford wastes.

DOE should also explain the procedures it is following in the "current Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) Coordination Program" to determine the "disposition of hazardous organic compounds in the Hanford waste disposed of in the ground." DEIS at U.1. DOE recognizes that it does not have adequate information on actual concentrations, solubilities, and adsorption reactions for organics. DEIS at
3.1.6.1 U.1. DOE should obtain this information as well as information on the distribution of organic carbons already discharged to

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cribs and trenches at Hanford. Analyses of these organic compounds must be included in this EIS to prevent underestimation of the environmental impacts of permanently disposing of HLW containing such organic compounds.

9. DOE Has Impermissibly Restricted the Scope of the EIS. 2.3.1.5

DOE impermissibly restricts the scope of the EIS by excluding assessments of technologies essential to the implementation of the final disposal strategy. DOE also fails to 2.3.1.14
explain why it does not expect the decontamination and decommissioning of existing waste sites and surplus facilities at Hanford after 1983 to affect the environmental impacts evaluated in the DEIS.

DOE states that engineering decisions about waste retrieval, treatment, and handling have been postponed until the final disposal decision has been made. DEIS at vii. DOE promises to determine whether the environmental effects of these processes are within the limits described in this EIS. If these reviews indicate greater environmental impacts than those presented in the EIS, DOE "will determine in accord with agency guidelines" what additional NEPA documents are required. DEIS at vii. However, reviewing these processes after a disposal decision has been made will occur too late to be meaningful. Waste retrieval, treatment, and handling are crucial to an informed final disposal decision. By excluding them from this EIS, DOE has improperly segmented the EIS process.

With respect to decontamination and decommissioning, DOE should explain whether these actions will affect the volume of HLW at Hanford and implementation of the permanent HLW disposal plan chosen based on the EIS. It is not enough that DOE has committed to perform a separate NEPA review of decontamination and decommissioning at some unspecified point in the future.

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2.3.1.7 10. DOE's Worst-Case Analyses are Inadequate.

DOE postulates the effect of renewed glaciation on waste sites at Hanford. DOE states that "[b]ecause of the low residual hazard index of the wastes and the low concentrations of plutonium, the radiological consequences of a glacial flood would not appear important in contrast to the effects of the flood itself." DEIS at 3.48. DOE concludes, however, with the statement that "current technology is believed capable of controlling the buildup of water behind ice dams, thus precluding the catastrophic floods just described." DEIS at 3.48. DOE should clarify this cryptic statement which seems to imply that present technology or institutional controls would mitigate or prevent the effect of catastrophic ice floods in the future. DOE should also explain how this statement does not constitute reliance on active institutional controls in contravention of EPA's requirement that performance assessments of HLW isolation "not consider any contributions from active institutional controls for more than 100 years after disposal." 40 C.F.R. 191.14(a).

DOE has failed to consider the environmental impacts of a military attack with respect to each of the HLW disposal alternatives discussed in the DEIS. U.S. nuclear weapons
3.4.3.7 production facilities, such as Hanford, are prime military targets. HLW disposed of at the surface of the earth may be a substantial and perhaps lethal source of radiation if disturbed as a result of an attack. In contrast, waste disposed of 3000 feet underground in a repository would be less vulnerable to such a disturbance. In fact, this was one of Congress's reasons for requiring disposal of HLW in a deep geologic repository. A military attack at Hanford is no less likely than the hypothetical plane crash considered in the DEIS. DEIS at 5.20. It is also potentially far more disruptive. DOE must consider the environmental impacts of a military attack on the waste disposal alternatives considered in the DEIS.

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Thank you for the opportunity to comment on the DEIS. We would appreciate a written response to any of the foregoing comments that are not addressed in the final EIS.

Sincerely,

Dan W. Reicher

Dan W. Reicher
Attorney
Natural Resources Defense Council, Inc.
1350 New York Avenue, N.W.
Washington, DC 20005

Ellen S. Kern (DWR)

Ellen S. Kern
Legal Intern

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

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September 2, 1986

[redacted]
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
richland, WA 99353

Dear Mr. Holten:

This is in reference to your draft environmental impact statement for the Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes. Enclosed are comments from the National Oceanic & Atmospheric Administration.

We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

David Cottingham

David Cottingham
Ecology and Conservation Division

Enclosure

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE, SUITE 350
PORTLAND OREGON 97232-2279
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F/NWR5

AUG 15 1986

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[redacted]
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99353

Re: Draft Environmental Impact Statement (DEIS) - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes

Dear Mr. Holten:

The National Marine Fisheries Service (NMFS) has reviewed the subject Draft Environmental Impact Statement (DEIS) and has the following comments:

General Comments

The National Marine Fisheries Service has a responsibility to protect and conserve marine, estuarine and anadromous fisheries and their habitat. We are concerned with plans to provide long-term disposal for the high-level nuclear defense wastes presently at Hanford.

Our concern is based upon the proximity of Hanford to the Columbia River. If significant amounts of long-lived radionuclides stored at Hanford were to reach the Columbia River, they could affect the living aquatic resources of the river, the estuary and the ocean for generations. 3.2.4.1

Specific Comments

The subject document provides no discussion of the genetic and physiological impacts to fish, shellfish and aquatic food webs of either a major pulse or a continuous leak of radioactive materials to the Columbia River. These impacts should be assessed due to the economic, cultural, and recreational benefits of the fisheries of the Columbia River. 3.2.4.2

The discussion of trucking wastes to another site should include an analysis of risks and impacts to aquatic organisms from accidental entrance of radionuclides into waterways. 3.4.2.5

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If you have any questions on our comments or would like more information on the points discussed, please contact Dr. Jacqueline Wyland of my staff at (503) 230-5432 or FTS 429-5432.

Sincerely,

Dale R. Evans
Division Chief



cc: EPA
FWS
CRITFC - Heindl
WDF
WDG
WDOE
DEQ
ODFW

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ENVIRONMENTAL POLICY INSTITUTE

COMMENTS OF THE ENVIRONMENTAL POLICY INSTITUTE

REGARDING

THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON

DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL,

TRANSURANIC AND TANK WASTES
(DOE/EIS -0113)

HANFORD SITE

RICHLAND, WASHINGTON



filed by Robert Alvarez
Director, Nuclear Project
September 1986

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3.1.4.9 I. THE HANFORD DEFENSE WASTE DRAFT ENVIRONMENTAL IMPACT STATEMENT FAILS TO ADDRESS THE SAFETY, ENVIRONMENTAL IMPACTS AND TECHNOLOGICAL VIABILITY OF GENERATING LIQUID HIGH-LEVEL NUCLEAR WASTES STORED IN CARBON STEEL TANKS

To a major extent, DOE/EIS-0013 advocates various long-term nuclear waste management options which allow for the continued generation of liquid high-level wastes stored in carbon steel tanks. The basic premises which therefore serves as a foundation for DOE's proposed long-term waste management plan for Hanford is the claim that "waste management practices at Hanford were shown to safely and effectively isolate waste on an interim basis."[1] A previous Final Environmental Impact Statement (ERDA-1538) issued in 1975 is cited as support for this claim.

This document is not only outdated, but most important, is not based on a comprehensive assessment of Hanford's high-level waste "Tank Farm" operating history. Rather ERDA-1538 was performed after the Energy Research and Development Administration (DOE's predecessor) was forced to do so by a federal court. This reluctance by ERDA to comply with the National Environmental Policy Act (NEPA) is reflected in this document by the fragmentary data upon which extrapolations about Hanford's "Tank Farm" safety are drawn.

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On the other hand, more thorough analyses drawn from extensive historic data assembled in a centralized data bank regarding the DOE's Savannah River Plant's (SRP) high-level radioactive waste "Tank Farm" have been performed.[2/3] The Savannah River Plant is considered to be a "second generation" Hanford-type operation which adopted changes in its wastes operations based on problems experienced at Hanford. Also, current tank designs for Hanford were initially developed at SRP. Both facilities share the same general design basis for their high-level nuclear waste operations. The wastes are generated first as a liquid acid which is then neutralized for sequential storage and volume reduction treatment in carbon steel tanks. Therefore, it is reasonable to compare the two sites -- something that DOE does extensively in DOE/EIS-0013.



Based on the very limited and fragmentary data that is publicly available on Hanford's "Tank Farm" operating history, there are clear indications of serious management and technological problems. Perhaps the most striking fact, underscoring the severity of Hanford's waste problems, is that some 500,000 gallons of mobile liquid high-level radioactive wastes have accidentally leaked into the environment. This far exceeds the amounts leaked at SRP. Moreover, the deliberate removal of radiation warning signs, prior to the visit of the governor of Washington, last year, after a diversion box plugging at Hanford's high-level waste "Tank Farm" contaminated a large area, indicates that there still exists serious management problems stemming from a lack of concern for health and safety. 2.2.12

Recently, the Environmental Policy Institute (EPI) released a five-year study of the operating history of SRP's high-level radioactive waste "Tank Farm."[4] This assessment involved a review of over 14,000 "unusual occurances" recorded by the E.I. DuPont de Nemours & Co. (SRP's contractor and the original Hanford contractor) into a centralized plant data bank. Our report also reviewed several documents that were previously classified regarding impacts of the SRP nuclear waste operations. Given the general similarities of SRP and Hanford's "Tank Farm" operations, there are some general conclusions that can be arrived at about Hanford based on our analysis of SRP's "Tank Farm" operations.

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(no comment identified)

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A. DESIGN PREMISE FOR HANFORD'S "TANK FARM" OPERATIONS

The premise on which Hanford and SRP's radioactive waste tank farms are starkly simple: High-level wastes could be safely stored in tanks "until national policy and criteria can be agreed upon for the long-term storage of these wastes."[5/] No time period after which the tanks might become unsafe seems to have ben specified. Thus, a timetable for the emptying of the tanks and the initiation of a long-term management method seems to not have been part of the original design premise. The implicit conclusion must be that the DOE (then the Atomic Energy Commission) and its contractors assumed that the wastes could be stored in tanks for an indefinite period.

This confidence in tank storage was accompanied by the premise that long-term management could be relatively easily accomplished by in-place disposal at Hanford or pumping of wastes directly into bedrock beneath SRP.[6/]

The original decision to generate and store neutralized high-level liquid wastes was based on the belief that it was the "most economical"[7/] and would not interfere with the rapid accumulation of nuclear weapons. This decision seems to stem initially from wartime shortages of special materials, particularly stainless steel. Acid wastes coming directly from reprocessing plants must be handled with specifically resistant equipment and stored in stainless steel tanks because they would dissolve cheaper carbon steel tanks. Therefore, the waste form was selected to accomodate cheaper carbon steel tanks.

An underlying assumption of Hanford and SRP's nuclear waste operations is that wastes can be routinely or accidentally discharged into soil because soil would tend to trap the most dangerous materials and prevent widespread contamination. This "buffer zone" concept of nuclear waste management required very large land bases where radioactive and toxic discharges are regulated at the plant boundary.

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But this original assumption of a quick, cheap and safe solution to long-term management has proved to be elusive. Similarly, the operating history of SRP's "Tank Farm" does not support the premise that these wastes can be stored safely in tanks for an indefinite period -- even though this continues to be the official view of the DOE and its contractors. Moreover, the data on SRP clearly indicates that continued generation of neutralized liquid high-level radioactive wastes is obsolete and ultrahazardous -- particularly since the DOE has available to it better and proven methods which have been in place at the Idaho National Engineering Laboratory (INEL) for about 20 years.[8/] 3.4.3.4

B. PROCESS AND OPERATING PROBLEMS

In an industry not dealing with highly toxic, explosive and persistently radioactive materials, many problems such as measuring instrument malfunctions, small pipe leaks, or plugging, might be considered minor. However, in the context of managing enormous amounts of intense radioactive and toxic wastes which generate explosive gases, there are few if any problems that can be considered minor. 3.4.3.4

There have been many process and operating problems at SRP's "Tank Farm." The attached tables contained in our recent assessment of SRP's waste operations are taken from SRP's centralized plant data bank and provide several examples of the kinds of problems which may have been encountered at Hanford. (See Appendix A.)

The nature of the materials and the reprocessing techniques at SRP and Hanford meant that a large volume of high-level radioactive wastes would be generated. Unfortunately, the decision to neutralize Hanford's and SRP's high-level wastes has had a number of severe impacts on the question of 3.4.3.4

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long-term waste management. As it turned out, even near or medium-term problems became so severe as to require substantial modifications in the process and equipment design.

3.4.3.4 The problems stemmed from two sources -- first, the lack of a suitable long-term management plan for nuclear wastes and Hanford and SRP for several decades after the wastes were generated; and second, from the characteristics of neutralized wastes. For instance, many single-shell tanks at Hanford were not constructed to take into account waste sludge removal. In addition, the sludge in the tanks became hotter than anticipated, perhaps contributing to problems such as leaks and cracks in primary steel containers and cooling coil leaks and failures.

Waste volumes at Hanford and SRP, as nuclear explosive production was stepped up, exceeded the planned waste tank storage capacities. This, in turn prompted the adoption of evaporation techniques, which then created a new set of problems.

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3.4.3.4 Thus, design for new tanks at SRP "was modified to take into account Hanford experience which indicated that the sludge layer would become hotter than the supernate [tank liquid] and also to allow for probable future waste concentration by evaporation."[9]

3.4.3.4 In the absence of a long-term storage plan during most of SRP's and Hanford's operating histories, which would make room for newly generated wastes, there appeared to be two possibilities: construct a large number of new tanks or reduce the waste volumes by evaporation. Both facilities decided eventually to rely primarily on waste volume reduction and to build new tanks to accomodate added wastes and other problems. Thus, leaks and cracks in many tanks and evaporation of wastes have resulted in a marked increase in handling and movement of the wastes where each tank was sequentially made to handle various kinds of waste.



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These additions to the process have required additional equipment -- pumps, pipes, high pressure jets, etc. Much of this equipment have been a source of considerable operating problems, accidents and breakdowns. Evaporators have also been a source of considerable operating problems. These problems in turn have caused worker exposures and environmental contamination. 3.4.3.4

It is important to note that with several decades of operating experience, it has proven impossible to develop remote maintenance methods for many jobs essential to "Tank Farm" operations, given the level of resources devoted to it. Many of the operating problems -- such as plugging of jets and pipes and pump failures as well as failure to adequately develop remote maintenance and operating procedures -- have a direct bearing on the prospects for long-term waste management in general and nuclear waste vitrification in particular.

For instance, at SRP, radiation exposure rates during replacement of an evaporator feed pump in November of 1968 ranged up to 30,000 millirads/hour.[10] One method of inspecting the inside of the waste tanks is surprisingly primitive where the price for this is often paid by increased risks to workers and environmental contamination. The inspection involves opening a "riser" cover (akin to a manhole cover), dangling a light and looking in. 3.4.3.4 When a tank riser cover is opened, fission products and plutonium rise up from the vapor space and contaminate the air.[11/12]

By virtue of the need to transfer wastes from tank to tank, volume reduction by evaporation, and constant surveillance, Hanford and SRP's "Tank Farm" operations require extensive "hands on" maintenance and repair. A large fraction of the 14,000 entries in the SRP 200-Area data bank either describe people working in radioactive environments and with radioactive system components, or imply such work by describing equipment problems. For example, problems with reel tapes (which measure tank waste levels)

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have been frequent, requiring workers to perform "hands on" work to correct the situation. Reel tapes are quite radioactive since they come in contact
3.4.3.4 directly with the wastes and with radioactive vapors above the liquid. Also, problems with evaporator feed pumps and concentrate transfer system pumps have been fairly frequent, requiring work in dangerously high radiation fields. At SRP in 1976, workers encountered a radiation field of 500 rads/hour while excavating contaminated soil around a tank.[13]

As a final example, there are the explosive gases that are continuously
2.3.1.14 generated in DOE high-level nuclear waste tanks at SRP and Hanford. Hydrogen is formed by the interaction of radioactivity with chemicals and water in
3.1.4.32 the tanks (radiolysis). A substantial accumulation of hydrogen can result in a tank explosion (see Appendix A, Table 5). At SRP there were several occasions where hydrogen build-up in tanks reached levels of concern. In one instance, the data suggests an explosion occured in October of 1966.[14] However, the confused and contradictory data on SRP's "Tank Farm" safety analysis[15] and the SRP 200-Area data bank does not permit us to arrive at any conclusions about this event other than it shows the unreliability of the data and public reports for even the most serious accidents that could happen. It is curious that DOE/EIS-0013 does not even consider a hydrogen explosion in its tanks as being serious enough to warrant discussion, while DOE and DuPont at SRP considers it to be the worse possible accident that can take place at the "Tank Farm" within human and technological control. (See discussion in Section I-D of these comments.)

In addition to hydrogen gas build-up in the tanks, the waste also generate organic vapors that also have explosive potential. The tank wastes are made up of a mixture of various chemicals including a significant quantity of organic complexants, used mainly in the chemical separations processes.



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Of particular concern is the interaction of radiation, heat, water and other chemicals that can give rise to explosive gases. This problem is
addressed in a Battelle report, not referenced in DOE/EIS-0013.[16] Although 3.4.3.4
the report discounts the probability of such explosions occuring, its conclusions are based on very limited reliance on operating data and hypothetical formulations of chemical changes. However, the report does make reference to hydrogen buildup in double-shell tank waste slurry which is believed responsible for growth in slurry volume.[17]

## C. EQUIPMENT PROBLEMS

Many problems at DOE's radioactive waste "Tank Farm" operations have 3.1.4.9
been rendered more severe by equipment problems relating to tank integrity. There have been several problems with the tanks. For instance, one major problem relates to cooling coil leaks. A large number of cooling coils in SRP's batch of 12 Type I tanks and the second batch of 4 Type II tanks leaked. The leaking coils had to be taken out of service, reducing available cooling to the tanks. In some cases a large number of coils had to be blanked off because of leaks. Partly due to such leaks, some tanks are more hazardous than others for storing wastes. Cooling coil leaks have also necessitated an increased number of transfers from one tank to another. Ironically, such transfers have created cooling coil leaks.

Various incidents at SRP, some of frequent occurrence, have cast doubt on the integrity of both the primary and secondary containment of the tanks In DOE/EIS-0013, a sweeping claim is made that "the outer liner would prevent leakage into the soil around the tank.[19] This claim has not been validated at SRP, where Hanford's waste operations has in recent years adopted their tank designs. Evidence of the ineffectivene containment of DOE's double-shell tanks can be seen by the frequency with which groundwater and rainwater flows into the annular space of SRP's tanks. For instance, several hundred gallons of water leaked into one of their newer tanks (Tank 40) in August of 1982 due to inadequate sealing. That same year, 4,800 gallons of rainwater flowed into Tank 11 due to cracked risers.[20]

3.1.4.9 The primary shell containment has been subject to cracking and leaks -- something that has occured most seriously at Hanford. At SRP four of the first sixteen tanks had developed leaks by the late 1950's -- just a few years after operations began.[21] Some tanks have had extensive corrosion cracking. While leaks from these cracks tend to get sealed with salt deposits (as is the case with several Hanford tanks), these deposits may not similarly keep the wastes confined in the event of mechanical stress from efforts to remove the wastes or tank explosions. The presence of many cracks and leaks in some tanks at SRP and Hanford has possibly compromised their structural integrity.

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The substantial redesign of the tanks based on problems experienced at Hanford and SRP was supposed to address these problems. Unfortunately, a large number of new Type III tanks at SRP (similar to Hanford's new tanks) were already compromised during construction by severe corrosion pitting. At least 14 out of 27 tanks at SRP have experienced this problem (Tanks 38 through 52). Such pitting was found on all 14 tanks under construction during 1980 and 1981. The deepest pit found in the tanks was 170 mils or about one-third of the wall thickness. Tank 38, which was eventually considered safe to contain wastes, experienced a leak in the primary containment months after it was put in service, possibly due to a welding problem.[22]

The absence of detailed information about Hanford's equipment problems in light of data on SRP's waste operations further adds to the uncertainty about the viability of Hanford's "Tank Farm" continued operation.







D. CATASTROPHIC EVENTS

In Appendix H of DOE/EIS-0013, a "Summary of Upperbound Operational Accidents" is presented. The accident scenarios cited in Appendix H "were developed by using information on the design of the waste processing facilities 3.4.3.4 and extrapolating from other industrial facilities with similar features. It goes on to state that accident scenarios are also "based on a best estimate of their future design; good engineering practices in their design and construction will make most of these accidents unlikely."[23]

By these statements, one can assume that estimates of severe accidents involving the long-term and interim management of defense high-level and TRU wastes have not systematically taken into account evidence from routine operations of Hanford's existing nuclear waste operations. By ignoring this evidence, Appendix H is fundamentally flawed.

Although this section is careful to state that several facilities in this analysis are not yet built or operational, it incredibly ignores the fact that a major portion of activities regarding the various long-term waste management options will take place in the existing tank farms. Enormous volumes of waste will be moved about involving miles of pipes, and an array of processing equipment such as evaporators, diversion boxes, pumps, valves, etc.

There exists a record of "unusual occurances" probably spanning the 43-year operation of Hanford's nuclear waste operations.[24] Nuclear waste workers at Hanford have been uniformly monitored for exposure to radiation. 3.4.3.4 Yet, no attempt has been made by Hanford's contractors to organize these data for risk assessment purposes. Important criteria to be followed in assembling a data base on Hanford's "Tank Farm" operation include:

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- A clear philosophy of data recording and uniformity of recording data over periods comparable to or longer than the periods for which estimates are to be made;
- Changes in recording procedures should be clearly motivated and related to field conditions;
- When different recording procedures are used, a systematic attempt to bring all periods to a comparable statistical basis must be made.

Unfortunately, none of these criteria have been followed in the recording of the Fault Tree Data Bank for SRP's "Tank Farm." Nonetheless, both analyses
3.4.3.4 by SRP and Appendix H contain serious deficiencies in data that relate to hundreds of pieces of equipment and process details. These deficiencies are of such an enormous magnitude that risk assessments cannot be made up by the technical judgment of a few experienced people. Further, primary reliance on Hanford employees opinions to estimate the risks and consequences of severe accidents contains an inherent conflict of interest.

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A finding of high failure probabilities would reflect unfavorably upon the quality of the technical work and the inadequacy of corrective measures.
3.4.3.4 It might also jeopardize jobs of the very personnel making the estimates if there was a finding that the probabilities of serious damage to the public were large because such a finding might imply a lack of due care or responsibility. All of this would be true even if the management were committed to a scientific and thorough evaluation of the dangers of the plant operation.

Judgment of technical personnel can, in general, only be supplemental to an evaluation based on reasonably comprehensive data. It cannot make up for lack of essential data.

As an "upperbound operational accident" involving future tank wastes,
3.4.3.4 Appendix H fails to seriously consider explosions in Hanford's tanks from hydrogen build-up. However, at the Savannah River Plant, DOE and DuPont,





a waste tank explosion resulting in a collapse of a tank roof is estimated to deliver a population dose that could give rise to as many as 20,000 cancers to offsite residents.[25/] Although population density is greater 3.4.3.4
near SRP and the wetter climate would enhance the spread of radionuclides, a hydrogen explosion rupturing a waste tank at Hanford should not be so casually discounted. In a 1978 safety analysis of the SRP "Tank Farm" operation done by DuPont, a waste tank explosion resulting in a collapse of the tank roof is considered. The scenario would include: (a) failure of the tank ventilation system; (b) failure of pressure alarm to detect ventilation failure or failure of personnel to heed warning; (c) spark initiation in tank after gases exceed their lower explosive limits; and (d) failure in procedural safeguards.[26/]

At SRP, the 200-Area Fault Tree Data Bank contains several entries where ventilations systems were not working properly (see Table 5 of Appendix A). One can assume that this problem has been shared at Hanford.

The risk calculations in Appendix H also appear to omit the effects 3.4.3.4
of non-radioactive toxic materials present in the tanks such as organic complexants which can cause tremendous acceleration of migration of some radionuclides -- plutonium in particular.

### F. ENVIRONMENTAL CONTAMINATION

DOE/EIS-0013 is seriously deficient in detailing the environmental contamination which has resulted from interim high-level radioactive waste storage at Hanford. There are four kinds of contamination to the environment that result from radioactive and non-radioactive substances which occur at the Hanford "Tank Farm" operation:

- o Routine discharges to the environment, notably of large quanitites of contaminated liquids to the retention and seepage basins;
- o Releases due to improperly working equipment, such as air filters;
- o Accidental contamination, such as that from tank and pipe leaks;
- o Disposal or abandonment of contaminated materials and equipment used on the "Tank Farm."

Table 2 of Appendix A of EPI's comments contains some 235 examples of environmental contamination that have occured at SRP's "Tank Farm" operation. Legally, the management at SRP and Hanford are constrained to keep discharges of radioactivity so that the dose to an individual member of the public from its activities will not exceed 500 millirems per year.[27/] The permissible levels of discharges are calculated from the 500 millirem limit using a "dose-to-man" model. These limits are very large at SRP and presumably are comparable to Hanford's. Since DOE/EIS does not contain release limits for Hanford's operations, but rather oblique references to broadly applicable standards, we include the limits for SRP in Table I. Overall, they allow releases of over a million curies per year, including 800,000 curies of tritium. Large releases of alpha emitters, like plutonium and uranium$^{235}$, are permitted. For instance, they allow the release of 600 curies of $U^{235}$ per year, which amounts to over 25 tons. These legally allowed limits are non-conservative, and allow for public radiation exposures which are higher than those for commercial nuclear power plants by a factor of twenty.[28/]

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2.2.16 Underscoring the primitive and non-conservative nature of Hanford's environmental protection standards is the regulation of these radioactive poisons at "the point at which effluents pass the site boundary" and not the more conservative standards that apply to private industry. By using

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the plant boundary as the point at which discharges are regulated, Hanford continues to use the site like a "giant sponge." Moreover, this method of regulation prevents the DOE from precisely assessing the performance standards for an array of facilities discharging pollutants into the environment. Thus, highly speculative modeling is used that cannot possibly be validated when the site is subjected to performance standards for pollutant discharges that have their origins in the World War II period. It is these primitive standards that, in essence, serve to justify the obsolete design basis for the Hanford nuclear waste operations. 2.2.16

The basic features of DOE's regulations which justify these practices is the presence of a large land base with abundant supplies of water. These combined factors provide for a "buffer zone" whereby radioactive and non-radioactive chemicals discharged into the environment would be diluted to "safe" levels at the plant boundary. At the same time, heavy industrial demand for water use could be met.

The "buffer zone" concept assumed, more often than not, the most dangerous products discharged into the environment could be absorbed indefinitely in the soils. This assumption is not supported by the operating histories of SRP and Hanford. First of all, the build-up of waste chemicals in soils has a finite absorption capacity. When the limits are reached, the molecular barriers are overcome and a "breakthrough" occurs. This "breakthrough" effect is enhanced by the presence of organic solvents such as tributyl phosphate in soil. Soil intrusion by "cleavage" from rainfall can enhance the vertical migration of substances like plutonium. Additionally, the transport of contaminants by plants and animals is also a problem.

The Atomic Energy Commission (AEC) itself acknowledged some of these problems as long ago as 1971. Although it prefaced its concerns with the

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2.2.10 claim that waste disposal in soil was a "well established safe procedure," it issued a policy on handling low and intermediate liquid wastes which called for an end of "the use of natural soil columns (by means of cribs, seepage ponds, and other facilities..."[29/]

The AEC further noted that:

> There is an explicit assumption that favorable environmental conditions will exist until the radioactivity in the soil decays to innocuous levels. Because of the long-term burden of control and surveillance inherent in the use of the technique that results in large local accumulation of radioactivity in soil, AEC sites are eliminating the routine use of surfance and near surface techniques that depend on soil to remove radioactivity from liquid wastes...[30/]

2.2.16 The AEC set a deadline of 1976 to discontinue the use of seepage basins, cribs, ponds and other disposal methods. But, the practice continues today and, moreover, appears to be an integral part of Hanford's long-term radioactive waste management options. In 1984, DOE issued an internal waste management standard, which supercedes one established in 1973 (DOE Order 5280). Although it also contains similar statements about the unacceptability of using soil as disposal media, it gives these statements a hollow ring by its continued support for the use of the plant boundary as the point at which pollutants are regulated. Moreover, DOE Order 5820 also raises the control limit for plutonium in soils by a factor of 10. This increase in permissible alpha contamination in soil appears to be designed to accomodate the enormous amount of alpha contamination at Hanford and to pave the way for discharges resulting from DOE's proposed long-term management technologies -- most notably, grouting. (See discussion in Part II of comments.)

3.5.5.11 The raising of the control limit for alpha emitters in soils by a factor of 10 assumes that substances like plutonium can be compared to natural analogs -- an approach not widely accepted in industry.[31/]



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G. ALTERNATIVES TO STORING NEUTRALIZED WASTES IN TANKS

The Hanford Environmental Impact Statement, by not addressing the *a priori* assumption that high-level wastes can be safely stored indefinitely as neutralized liquids in tanks, therefore is deficient in considering alternatives to this obsolete and ultrahazardous method. As discussed previously, storage in tanks has faced a number of problems and cannot be a long-term or interim option because of severe dangers of this kind of storage posed in case of accidents or natural catastrophes. The numerous tank leaks at Hanford which have been persistent throughout Hanford's operating history has also pointed to the necessity of a better interim method of waste management.

A superior method has been adopted at DOE's Idaho National Engineering Laboratory where reprocesing wastes are calcined. This method simply involves drying the waste to a powder form and storing it in stainless steel canisters. Not only does it eliminate the multitude of problems associated with storing neutralized liquid wastes, it creates a much smaller volume of wastes. 3.3.2.2

Since calcination is an integral step in the proposed vitrification plant at Hanford, it may be possible to modify this facility to calcine all existing tank wastes prior to vitrification. Unfortunately, this does not deal with the generation of future wastes from the Hanford PUREX facility. But there it is also possible to calcine future wastes by retrofitting PUREX. 3.3.2.2

Calcination would also eliminate the need to fractionate the waste as is proposed in the EIS where sludge is to be vitrified and tank liquids and other process wastes are to be grouted.

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3.1.8.9 II. THE HANFORD EIS DOES NOT ADEQUATELY ADDRESS THE ENVIRONMENTAL IMPACTS AND POTENTIAL PROBLEMS ASSOCIATED WITH VITRIFICATION AND GROUTING OF MILITARY NUCLEAR WASTES

Successful solidification of high-level military nuclear wastes would be a positive step forward in protecting the public and the human environment from the dangers associated with the current liquid tank wastes. However, we have serious reservations about the way in which this plan is being carried out by the Energy Department, since there are a number of unresolved issues and problems relating to both the routine operation of a vitrification facility as well as to potential accidents. In addition, there are basic questions relating to the glass and grouting and the disposal of radioactive grout in shallow burial pits.

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The first and perhaps most significant fact about routine operation of a vitrification plant, is to note that there is no experience with such a
3.1.8.9 facility even on a pilot plant basis, to say nothing of an actual full-scale industrial basis. At SRP, where a full-scale vitrification plant is under construction, not a single glass cylinder of SRP waste has been glassified. Thus far, SRP has produced simulated glass cylinders but without radioactive wastes in them. The production of single glass cylinders without radioactive wastes is qualitatively different in major respects from a large-scale plant producing 500 canisters each year, each containing up to 200,000 curies of radioactivity. In fact, many of the major features of radioactive waste processing that will be peculiar to SRP's Defense Waste Processing Facility (DWPF) have never been operationally tested with actual radioactive materials for any significant length of time. Further, the entire process has not been tested on an industrial scale, with the actual equipment even with



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3.1.8.9

simulated (non-radioactive) wastes. Nor has a pilot plant been operated. Thus many critical pieces of equipment, such as the slurry-fed glass melter, have not been adequately tested under anticipated operating conditions.

In this regard, the DOE's proposed vitrification schedule for Hanford is relying upon the experience gained mainly at SRP's DWPF. Hanford's pilot plant approach is commendable. The formation of waste-glass mixture, the production of canisters filled with radioactive glass and many of the other processes in the DWPF at SRP will be remotely controlled and operated. Under such conditions, maintenance, repair and replacement of equipment and clean-up after accidents may pose more serious problems than those which have been encountered so far in DOE's "Tank Farm" operations.

Although the pilot plant approach has been chosen for Hanford, DOE/EIS-0013 does not provide adequate discussion about the types of accidents that could release significant amounts of materials into the environment. Such accidents include a spill from a slurry receipt tank and steam explosion in the glass melter. In the EIS for SRP's DWPF only the consequence for immediate releases to the environment are discussed. The analysis is based on a number of assumptions, many of which do not derive from direct operating experience. It comes to the conclusion that the radiation doses to the public would be small.

The Hanford EIS not only mimics the approach taken by the SRP EIS on its Defense Waste Processing Facility, it also omits any substantial discussion of what might become a critical problem for the continued operation of a plant, and hence for the future vitrification of wastes. This is the problem of the effect of accidents ranging from small spills to fires or explosions, on the operability of the plant itself. Failure of the plant to operate substantially as predicted would have substantial environmental and economic impacts, and possibly major health impacts as well.

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3.1.8.9 For instance, a spill of several thousand gallons of highly radioactive sludge slurry onto the cell wall floor of a vitrification plant could have a significant impact on subsequent operation and maintenance of the plant. One impact of this and other spills is to make the processing areas very radioactive. This would make entry into the process area much more dangerous. Consequentially, all maintenance, repair and replacement requiring entry by personnel would involve higher exposures and work under more hazardous conditions. This could seriously impair the maintainability and hence the operability of the plant.

There is another class of events that could seriously affect operation of a vitrification plant that DOE/EIS-0013 has not taken into account. This relates to the ability to produce consistently the kind of feed solutions and slurries that will be required for vitrification, without seriously impairing the integrity of the "Tank Farm" operation.

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For instance, water and hot chemicals will be added to the sludge and the mixture is then agitated to produce a slurry-feed for the glass melter. As noted, such a process has been suspected at SRP to cause failures of several tank cooling coils on at least one occasion. Failure of a large number of cooling coils in the new tanks would seriously impair their ability to hold high-level wastes. The older tanks already have many leaking coils, rendering them unfit for holding hot sludge. Most of the older tanks also have leaks in the primary containemnt vessels which are currently plugged with salt which has crystallized on the cracks. Thus the transfer of wastes from older tanks to newer ones and the preparation of feedstock for the vitrification plant could lead to serious problems, including leaks of radioactivity and impairment of the "Tank Farm" operations.





This may explain why the DOE is so reluctant to remove the "single-shell" tank wastes at Hanford. But this should not be considered an environmentally acceptable rationale for their permanent in-place disposal.

Grouting

In order for DOE to implement its long-term defense waste management plan of permanently disposing of wastes perviously designated as "high-level" in shallow burial pits, it had to adopt a new waste management standard, that was tailored to meet this particular policy decision. Thus, DOE promulgated DOE Order 5820 which supercedes the previous standards (AEC Manual Chapter 0511) set in 1973. Although this standard has been justified as being based on the "best available science," it has not been subject to independent evaluation. Nor has the underlying scientific rationale been subject to an open peer review. Moreover, this new standard is certainly not based on scientific data derived from operating experience of DOE nuclear waste programs. Nor are they established to meet the 25 millirem/year radiation dose standard set for commercial nuclear power plants, but rather on the 500 millirem/year limit. 3.1.8.1

Without question, DOE Order 5820 will allow for significant increases in the radiological and toxic burden of soils at DOE sites. Grouting of nuclear and toxic wastes for soil disposal will be a major contributor. In this regard, Appendix D of the Draft EIS is seriously deficient in presenting data about volumes, concentrations of radioactive and non-radioactive wastes in the grout and leach rates. on page D.5, conflicting figures are given as to the grouted waste volumes.

> On the average there would be about five grout campaigns per year, each lasting about 1 month. About 3,800 $m^3$ of waste feed would be mixed with

> the grout formers to produce a total grouted waste volume of about 5,300 $m^3$ per campaign. At a rate of five campaigns per year, it would take 20 yr of operations to grout the total volume of the candidate feed waste streams. The resulting grouted waste volume would be about $4.9 \times 10^5 m^3$.

If one performs the arithmetic spilled out in this section, the total grouted waste volume is $5.3 \times 10^5 m^3$. There is no explanation for this difference. It may be an inadvertant error. Nor is there adequate data on the non-radioactive hazardous waste constituents.

In Appendix B, (Tables B.2, B.4, B.6) a range of grout volumes are presented relative to the different alternatives for long-term disposal. They are:

| Geologic Disposal | In-place disposal | Reference Alternative |
|---|---|---|
| 829,000 $m^3$ | 272,000 $m^3$ | 272,000$^3$ |

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No efforts are made in the draft EIS to reconcile these different estimates, particular with regard to the reference alternative which is almost twice as less as the volume stated in Appendix D. These widely differing estimates suggests that DOE does not know what the actual volumes will be.

In terms of the amounts of radionuclides to be released to the environment from grouting, the draft EIS is also deficient. However, if the cumulative discharges at the Savannah River Plant's 200-Area seepage basins between 1954-76 32/ are compared with the radionuclide content of grouted wastes estimated in Table B.4, the potential discharges of certain radionuclides in Hanford's grouted wastes could be significantly larger than 22 years of routine discharges at SRP's chemical separations area. This may be the case for very long-lived radionuclides. About 10 times more zirconium$^{93}$, 13 times more tectnicium$^{99}$, and 10 times more iodine$^{129}$ are estimated to be in grouted wastes, than discharged in the F&H seepage basins at SRP between

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1954-76. These radionuclides are of concern because they have extraordinarily long half-lives ($Tc^{99}$ - 210,000 years, $Zr^{93}$ - 950,000 years and $I^{129}$ - 16 million years) and will persist in the environment beyond the life-span of civilizations to manage them.

The draft EIS does mention that efforts will be taken to remove as much $Tc^{99}$ before the wastes are mixed with cement, however, the other radionuclides will, apparently, remain in the grout.

In terms of alpha emitters like plutonium, the draft EIS mentions that levels in the 20 to 80 nCi/g will be disposed in this form.33/ Although the EIS is careful to mention that this level is below its recently adopted internal waste management standards (DOE Order 5820.2), it is 2 to 8 times higher than was permitted for contaminated soils under the previous standard. DOE Order 5820 raises the control limit for alpha emitters in soil from 10 nCi/g to 100 nCi/g by assuming that substances like plutonium can be compared to natural analogs -- an approach that is non-conservative and widely accepted in industry. In essence, the new standard no longer considers the carcinogenic and mutagenic properties of the radiation emitted by alpha emitters in soil and instead treats it as if it were a non-radioactive substance like lead. 2.4.1.8 3.5.5.11

Finally, the draft EIS fails to address the non-radioactive hazardous waste discharges posed by grouting. The various wastes planned to be grouted also contain an array of hazardous chemicals, which may not necessarily be removed prior to being mixed with cement. They include organic complexants, nitrates, and heavy metals. 3.1.8.1

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With the exception of a vague reference to preliminary leaching studies being done at SRP, the draft EIS makes much of the claim that "cement based structures more than 3,000 years old are still standing. These ancient analogs provide additional confidence that grouts can be formulated 3.5.1.30

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3.5.1.30 to last for long time periods." While some structures containing cement have survived for very long periods of time, the vast majority have not. Moreover, none of these ancient structures (such as the pyramids) contained large amounts of radioactive and non-radioacitve hazardous chemicals which could cause the cement to break down before anticipated. Such statements are of the "handwaving" variety and should not be taken seriously. However, the draft EIS is replete with such sweeping and unsupported claims.

Given the complexity of the chemicals and radionuclides involved, and the complete absence of industrial experience with this technology, quality assurance will have to be extremely stringent during the first few years of operation -- something which by its very nature may prove to be impossible. Underscoring the tenuous viability of grouting is the fact that the feed materials will vary widely in their composition. Therefore, given the unproven state of grouting, the draft EIS has no realistic estimates of leach rates, grout breakdown, or reasonably accurate estimates of volumes of grouted wastes and their mixed radioactive and non-radioactive hazardous wastes contents.

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III. THE HANFORD EIS DOES NOT CONTAIN ENOUGH INFORMATION TO MAKE GOOD DECISIONS RELATIVE TO LONG-TERM NUCLEAR WASTE MANAGEMENT 3.1.1.1

The Draft EIS is fundamentally flawed in terms of providing basic and detailed information concerning:

- o the magnitude and character of the radioactive and toxic burden of the site;
- o Decontamination and Decommissioning techniques for the tank farms and;
- o specific data on the individual tank contents.

First, DOE/EIS-0013 provides no usable information concerning site specific concentrations of radionuclides and hazardous chemicals in numerous soil dumping areas. Nor has there been any effort to present data concerning site-specific characterization of Hanford's early and current burial grounds. The Draft EIS also does not provide any information about organic complexants possibly present in soil and groundwater. 3.1.1.1

Second, the document contains sparse discussion about specific techniques for removal of single-shell tank wastes and no discussion about decontamination and decommissioning of the tanks themselves. By all indications, DOE does not have any good information on this alternative because it has no plans for decontamination and decommissioning of the single-shell tanks. The lack of research funds in DOE's long-term nuclear waste management program at Hanford for alternatives other than in-place disposal of the single-shell tanks is a clear sign of this.[34/] According to the FY 1986 and 1987 budget requests for DOE's Atomic Defense program, the only research going on concerning long-term disposition of single-shell tank wastes is to demonstrate their in-place disposal. Without an adequate data base on alternatives other than in-place disposal, this document represents a cynical effort on the part of DOE management to convey the false notion that citizens will actually 3.1.4.5 2.3.2.8

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have meaningful input in the decision for the most troublesome aspect of Hanford's nuclear waste problem.

There exists data on SRP's Tank 16 (a Class I Tank with an annulus; well known as a "leaker") and the successful efforts by DOE to remove most of its contents. Yet, the authors of the Draft EIS chose only to selectively use data from SRP to bolster decisions which already apparently had been made for in-place disposal.

Finally there is no data about the specific contents of the single-
3.1.1.1 shell tanks, other than extrapolations from some data on a handful of tanks. This also indicates that DOE is not interested in knowing this -- something
2.5.5 that underscores the official cynicism of this exercise.

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FOOTNOTES


1. U.S. Department of Energy, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Draft Environmental Impact Statement, DOE/EIS-0013, Vol. 1, p.v., National Technical Information Service, Springfield, VA, 22161, March 1986.

2. E.I. DuPont de Nemours and Company, Safety Analysis Report: Liquid Radioactive Waste Handling and Storage Facilities (200 Area) - Savannah River, DPSTSA-200-3, Aiken, South Carolina, August 1978.

3. Makhijani, A., Alvarez, R., and Blackwelder, B., Deadly Crop in the Tank Farm: An Assessment of the Management of High-Level Radioactive Wastes in the Savannah River Plant Tank Farm, Based on Official Documents, Environmental Policy Institute, Washington D.C., 20003, July 1986.

4. Ibid.

5. Barah, A.A., "The Nature of Handling and Storage of Separations Process Wastes," in Management of Radioactive Wastes at the Savannah River Plant, presentations made to the Committee on Radioactive Waste Management of the National Academy of Sciences at the Savannah River Plant, January 21, 1969, p. 42.

6. Op Cit, Reference 3, page 34.

7. Proctor, J.F., General Introduction and Description of the Site, in Op Cit, Reference 5, p. 3.

8. Statement of Ronald W. Cochran, Deputy Assistant Secretary for Nuclear Materials, in Energy and Water Development Appropriations for 1986, Hearings before a Subcommittee on Appropriations, House of Representatives, March 20, 1985, Vol. 7, U.S. Government Printing Office, p. 778.

9. Cristl, R.J., "Designs and Construction Criteria for Facilities to Handle Highly Active Liquid Waste," in Op Cit, Reference 5, p. 45.

10. Op Cit, Reference 3, p. 36.

11. Energy Research and Development Administration, Waste Management Operation, Savannah River Plant, Aiken, S.C., ERDA-1537, National Technical Information Service, Springfield, VA, September 1977, p. 11-102.

12. Savannah River Plant - 200 Area Fault Tree Data Bank - F&H Area, Waste Tank Farm, Computer Printout of Data Bank provided to the Environmental Policy Institute in July 1983, with entries dating from December 1953 to November 1982.

13. Ibid. (H-Area entry dated 03-12-76)

14. Ibid. (F-Area entry dated 10-03-66)

15. Op Cit, Reference 2.

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16. Martin, E.C., Complexant Stability Investigation Task 2 - Organic Complexants, Pacific Northwest Laboratory, Battelle Memorial Institute, National technical Information Service, Springfield, VA, 22161 (PNL-5453)

17. Ibid, p. 35.

18. Op Cit, Reference 12.

19. Op Cit, Reference 1

20. Op Cit, Reference 12.

21. Op Cit, Reference 3, p. 38.

22. Op Cit, Reference 3, p. 39.

23. Op Cit, Reference 1, p. H.2, Vol. 2.

24. DOE Chapter Manual Appendix 0502, Type "A," Type "B" and Type "C" investigation reports as well as "Works Technical Monthly Reports."

25. Op Cit, Refernece 3, p. 65.

26. Op Cit, Reference 2, p. III-19.

27. DOE Order 5820. Contained in the DOE Chapter Manual.

28. U.S. Code of Federal Regulations, 10 CFR 40.

29. "Plan for the Management of AEC-Generated Radioactive Wastes," USAEC Report WASH-1202, January 1972.

30. Ibid.

31. Lawless, W., Fifth Complaint to the U.S. Department of Energy Inspector General, August 27, 1983, Available through Environmental Policy Institute, 218 D. Street SE, Washington D.C., 20003.

32. Marter, W.L., New Criteria for Seepage Basin Use, DPST-77-444, E.I. DuPont de Nemours and Co., Savannah River Laboratory Report, Aiken, S.C., 1977, p. 11.

33. Op Cit, Reference 1, p. B.36.

34. U.S. Department of Energy, Congressional Budget Request, Atomic Defense Activities, Vol. 1, DOE/MA-0064/4, February 1986.




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APPENDIX A

INTRODUCTION

The tables on worker exposures, environmental contamination, technical problems and accidents have been compiled from the 200-Area Fault Tree Data Bank - F and H Area Waste Tank Farms - a computer listing of such occurances located at the Department of Energy's Savannah River Plant near Aiken, South Carolina. These data were obtained by the Environmental Policy Institute through a Freedom of Information Act request. This listing comprises 700 pages of computer print-outs in which there are about 14,000 entries. Each entry is a summary of some problem which took place at the Savannah River Plant high-level radioactive waste "Tank Farm" - whether this be a "non-routine maintenance" of an instrument or a major radioactive spill or worker exposure.

The record comprising the "Fault Tree Data Bank" is very uneven both in quanityt and quality of entries, as is discussed in a recently released study of SRP's "Tank Farm" operating history* prepared by EPI. The frequency of entries increased from about 4 per year during 1953-59 to about 1800 per year during 1977-82. The variation in frequency of entries bears no apparent relation to the frequency of problems. Rather the range of problems and method of reporting seemed to have changed. While the range of problems reported on has become much wider, the quality of the entries has not improved. In some cases, it has tended to deteriorate.

The Data Bank entries are divided into two chronological sets, one each for the F and H areas. The earliest entry is dated December 20, 1953, and the latest was on November 30, 1982. We have chosen to group the entries into eleven tables based on the following problem areas:

- o Worker Exposures
- o Environmental Contamination
- o Tank Leaks and Overflows
- o Tank System Failures and Problems
- o Explosions: Potential and Actual
- o Equipment plugging
- o Power Supply Failures
- o Pump Failures
- o Instrument Problems
- o Miscellaneous Leaks
- o Miscellaneous



* Makhijani, A., Alvarez, R., and B. Blackwelder, Deadly Crop in the Tank Farm; an assessment of the management of high-level radioactive wastes in the Savannah River Plant Tank Farm, based on official documents, report of the Environmental Policy Institute, July 1986, 170p.

(no comment identified)

(no comment identified)

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Each table is organized chronologically with one set of entries each for the F and H areas. The first two tables, "Worker Exposures" and "Environmental Contamination" contain every explicitly recorded entry on such events in the Data Bank. The entries are not repeated, however, so that there are many entries in the "Worker Exposures" table which also deal with environmental contamination and vice-versa. This non-repitition of entries that apply to more than one category applies to all tables. Our resources did not permit a fully cross-referenced compilation, which might provide further insights.

The remaining tables, ie., Tables 3 through 11, contain, selected entries whose purpose is to illustrate typocal and frequent problems encountered. Frequent problems, such as plugging of certain equipment, or failure of cooling coils are noted in parenthetical comments. All of our comments are given in parenthesis. The text of the description, when in quotation marks is directly from the Data Bank entry; when not in quotation marks it is a summary of the Data Bank entry. Our clarification inside quotation marks is inside square brackets.



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TABLE 1

WORKER EXPOSURES

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 02-00-60F | Skin and clothing contamination - 2 people - safety violation. |
| 06- -64F | "A transfer jet was moved from Tank No. 19 and installed in Tank No. 20 Body exposure rates to 1 R/hr. were experienced. Contamination to 1R/hr. was released inside the windbreak protected job site when liquid leaked from the jet dip tribe during removal." |
| 02-10-66F | Leak in diversion box. Radiation level increased to 25 R/hr. Body exposure rate 5R/hr. Adjacent ground areas contaminated to 320 M/Rad/hr at 2 ubcges, |
| 02- -68F | Failed tank 18 evaporator feed pump. "Body exposures ranging to 30 R/hr. at 18 inches" during replacement. Asphalt also contaminated to 5 rads/hr at 5 inches. "Total estimated personnel exposure was 0.8 R." |
| 09-30-69F | Cooling water contaminated. Faulty valve and leaking tube bundle 1.5 curies of Cs-137 released to seepage basin. "Estimated 2.6 R exposure" to workers during "clean up." |
| 11- -70F | 6 workers - nasal and skin contamination during removal of defective reel tape. (Reel tape problems are frequent.) |
| 06- -71F | Skin contamination to wrist. Gloves not taped to coveralls. |
| 07- -71F | Total of 3.4 R worker exposure "while tightening packing glands." "Exposure resulted from high irradiation levels in feed pump enclosure." |
| 11-20-72F | Exposure during removal of a valve. "Nasal contamination 400 to 70,00 Dis/m. beta gamma," 4 people. "Hands, face and personal items contaminated to 2000 c/m beta-gamma. Bioassay - 13 NCi, Cs-137/1.5 L. Body count = 84 NCi Ru-106, 368 NCi Cs-137." |
| 04-00-73F | "242-F. Personnel received 13 R total exposure." (No explanation given.) |
| 09- -73F | High radiation levels near vent filter up to 30 R/hr # 1 inch. Replacement cased estimated 3.5 R exposure. |
| 05-00-74F | "Exhaust filter; Radiation drain build-up of radioactivity on the original exhaust filter for tanks 18 & 20 resulted in exposure dose rates to 3 m/hr in the control room and lunch room." |
| 05-00-74F | (The entry just above appears to have been repeated by mistake.) |
| 05-08-74F | Reel tape replacement, "Max exposure was 30/30 mrads/mr/hr. at 12 inches." |
| 08-21-74F | Jumper problems on Concentrate Transfer System Tank. Exposed at top of open riser 2000 mrads/2000 mr/hr. |

(no comment identified)

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WORKER EXPOSURES, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 09-26-74F | 1.4 R total estimated exposure to 14 people during feed pump replacement. Total 1-1-74 to 09-26-74 exposure due to "evaporator feed pump job" above is 11.5 R |
| 01- -75F | "14 R received by personnel installing new feed system in 242F." |
| 02-03-75F | 1 worker 4,000 c/m beta-gamma on shorts, 30,000 c/m on coveralls. "His flash suit pants had a hole." |
| 05-07-75F | Steam condensate leak repair. "Exposure rate 500/500 mrads/mr/hr. at 12 inches from spool piece." |
| 06- -75F | 2R exposure during 2 replacements of evaporator feed pump. |
| 06-26-75F | 3.8 R due to concentrate tank lines being uncovered. |
| 07- -75F | 1 R during concentrate transfer system inspection and excavation. 2-5 R/hr at 18 inches. |
| 08-15-75F | 3.7 R during removal and shipment of 18 jumpers. "6.8 R during removal of CTS tank from pit. 10 R/hr. @ 15 ft." |
| 08-21-75F | "Contaminated soil encounted [sic] during excavation around Riser 6 Tank 3. 350 R/hr @ 1 inch from steam supply line to the jet in Tank 3. Probably the result of suckback and leak. Soil contained about 50 Ci 137-Cs." |
| 08-22-75F | "CTS Pit - Waste management began steam cleaning inside the CTS pit. Work was stopped when steam vapor was observed seeping thru cracks in the hut. Sample taken outside the hut read less than 1 x $10^{-9}$ micro ci FP/cc and 5.0 x $10^{-12}$ micro ci PW [sic]/cc on initial count." |
| 10- -75F | Total exposure at CTS pump pit excavation to date 21.6 R |
| 12-15-75F | Low activity waste transfer to 241-F. "Got gassed out several times." |
| 02- -76F | 10 R/hr radiation level @ 2" during removal of piping. (Worker exposure not given.) |
| 03-12-76F | "Radiation rate 10R/hr close to Riser 6, Tank 3 during contaminated soil removal. Soil to 500 rads/200 R/hr at 2 inches. 100 cu. ft. contained 8-1/2 Ci of 137-Cs. Excavation stopped." |
| 08-13-76F | 1.5 R during evaporator feed pump replacement. Pump had leaked. |
| 02-17-77F | Change trailer floor and bench contaminated. Up to 150 c/m beta-gamma. "Successfully deconned." |
| 06-03-77F | Tank 7 feed pump leak repair. Safety violation. 2 workers. One had about 1000 d/m beta/gamma in nostrils. |
| 09-22-77F | 0.7 R during valve repair tank 31. |
| 10- -77F | 3.3 R exposure during repair of pump to tank 7 evaporator. |

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(no comment identified)

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WORKER EXPOSURES, Page 3

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 11-30-77F | 30 c/m on control room floor and 50 c/m on lunch room floor found. Cleared. (No estimates of worker exposures. No data on possible sources of contamination.) |
| 01- -78F | Filter replacement. "ETE [Estimated Total Exposure] = 3.2 R." |
| 06-12-78F | Dip leg of transfer jet replacement "stopped when exposure rates increased to 30 R/hr. at 2 ft. of the dip leg." (Total worker exposure not given.) |
| 06-15-77F | Workers rubber shoe came off. Personal shoe contaminated through cloth cover to 40,000 c/m beta-gamma. Working in hut on Tank 34. |
| 10-07-78F | 2 contaminated hard hats found in regulated locker area of control room. |
| 10-16-78F | "Breathing air compressor shut down by waste management. Puff workers using [it] had to evacuate maintenance area. "No communication between groups. No audible alarm." |
| 02- -79F | 3 workers exposed to CTS loop. No badges. Exposure estimated 65 mr. Cause accidental removal of a fence. |
| 03-08-79F | "Employee scratched the back of his left hand [during]...CTS live work. No beta-gamma or alpha contamination." |
| 03-14-79F | "Construction worker got 8,000 c/m beta gamma on gloves. Worked in a 241-F regulated area without health physics coverage." |
| 04-16-79F | "People that were contaminated B.G. went home at 7 p.m. 4-12 [shift]" (No further explanation.) |
| 10-23-79F | Construction worker hands contaminated: "2,000 c/m beta-gamma on palm and back of his left hand, 200 c/m beta-gamma on back of his right hand." |
| 02-29-80F | "Unauthorized line break on an evaporator process line." 100 ml liquid contaminated 1.5 sq. ft. area in gang valve house to 500 mr/hr. at 3 feet. One mechanic hands contaminated to 35 mr/hr., gloves and coveralls to 6,000 c/m. Two mechanics had nasal smears of 300 d/m and 275 d/m. Suckback in the line had occurred." |
| 03-04-80F | 241-F. Worker had 1000 c/m gamma on right palm and 600 c/m beta on left palm. |
| 03-09-80F | Draining and drying of probes in LDB's which had ½" liquid in them. "No smearable contamination." |
| 04- -80F | "A dip tube had to be mined loose from approximately 12 feet of salt in Tank No. 19. Total estimated exposure for 36 people was 1.2 R." |
| 04-07-80F | "Two construction carpenters entered a barricaded excavation adjacent to F area diversion box No. 2 while waste was being transferred through lines exposed by excavation. The carpenters received 230 and 160 mr respectively." |

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(no comment identified)

WORKER EXPOSURES, Page 4

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04-21-80F | Tank 33: liquid radiationg 500 mrad/hr. at 5 cms spilled onto ground. 3,000 to 80,000 c/m in a 6 sq. ft. area. 3 workers had skin contamination to 60,000 c/m beta-gamma. |
| 04-21-80F | "Hard hats in change and trialer floor smearing 8,000 c/m." |
| 04-23-80F | Tank 33: Repairs to hut. 2 men got 30 mr. "The top of the tank, out approx. 2 m from the hut, was found contaminated to a max of 40,000 c/m beta-gamma at 2.5 cm. transferable." |
| 04-28-80F | "A Juno with 200 mrads/hr. of smearable beta-gamma was left in seat of (pick-up truck). Seat and floor board contaminated to 30,000 c/m. Health physics inspector contaminated the seat of his personal trousers to 2,000 c/m." |
| 07-11-80F | Worker had 1,000 c/m to 2,000 on both shoes and 1,000 c/m on bottom of left sock. Had been working on tank 20. |
| 08- -80F | "Fiberglass filter for Tank No. 1 removed." It contained estimated 0.8 Ci activity. "Total estimated worker exposure for 65 employees was 2155 mr." |
| 12-12-80F | "Employee reported to medical this a.m. with a slight wound on the back of her left hand that she said she received at DB-1 on 12-4-80." |
| 12-20-80F | "Worker removed his plastic suit top at bottom of DB-1 due to the hoses being tangled. Nasal smears taken were less ms." |
| 01-06-81F | Tank 18 transfer jet repair. Dose rate: "250/250 mrads/mr/hr. at 30 cms." |
| 02-24-81F | Tank 25: Repairs. "Exposure dose rate to 350 mrad/350 mr/hr." |
| 03-16-81F | HEPA filters changed. "T&T operator had 2000 c/m beta on his throat area." "North HEPA DOP tested 99.94%.." |
| 04-10-81F | Ph-12 alkaline solution ("inhibited water") sprayed into hut and on workers during probe of Tank 2. |
| 05-19-81F | "As sampler was pulled from tank 1 it brought with it discarded steel tapes from the tank interior. Liquid on the tapes contaminated the wrists and nasal passages of the foreman" because he "grabbed the steel tape, broke it into (sic) and pushed it back in hole before h.p. could stop him. Skin: 5 mrads/hr. beta-gamma at 5 cm. on right wrist; 60,000 c/m beta-gamma on left wrist. Nasal contamination 590 d/m beta-gamma." |
| 05-27-81F | Mechanic changing feed pump. Tank 7, had 2 pairs coveralls on mask. 20,000 c/m beta-gamma on right sleeve of inner coveralls and 2,000 c/m on skin on underside of right forearm. |
| 06-01-81F | Removal and shortening of transfer jet. 06-01-81; 3R to 19 men. Again 6-14-81. 1.7R for 16 men. One worker had 1,000 c/m beta-gamma on left forearm. Causes: repair to jet; pluggage; leak in diversion box; inspection. Dose rate: 50/mr/hr. |
| 07- -81F | Lead Liner was inserted in riser #3. Radiation level over riser reduced from 15 R/hr to 2.5 R/hr. Estimated total exposure to 12 workers: 565 mr. |

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(no comment identified)

WORKER EXPOSURES, Page 5

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 07-20-81F | Worker contaminated his left shoe to 1,000 c/m by stepping out of shoe cover at hut of Tank 26. |
| 07-21-81F | Clean-out port to Diversion Box 5: "Water and salt backed out line and contaminated employee." Rubber gloves 150 mr/hr. at 8 cm., left cover was 10 mr/hr. at 8 cm. Left shoe (personal) 7,000 c/m beta-gamma. Cause: apparently a plugged line. |
| 07-25-81F | Same clean-out. Worker contaminated to 2,000 c/m above port #15 after liquid sprayed from line. |
| 12-21-81F | Tank purge HEPA filters fail. Estimated release to atmosphere: 10 micro-curies of fission products. Total exposure of 2 rads to 20 persons. |
| 01-28-82F | Further repairs tank 28 jet. "Body dose rates ranged to 8 r/hr. at 45 cms of open riser...Employee knelt on damp cardboard." He had right knee: 3,000 c/m beta-gamma; left knee: 1,000 c/m beta-gamma; another had 2,000 c/m beta-gamma on right knee. Backflush valve installed in Tank 25. "Total exposure to 5 men was 100 mr." Leak repair concentrate transfer system pit. "Total exposure to 15 men was 720 mr." |
| 03-18-82F | Work on failed sump jet steam line. "Total exposure to 4 people was 85 mr." |
| 03-21-82F | Extensive work on transfer jets to replace gaskets, flush and align jet. "Body dose rates ranged to 8 R/hr. at 45 cm. above open riser. Total estimated exposure involving 30 people was 3,000 mr." |
| 04-13-82F | Blow back of water from "catheter line": (used to unplug pipes) at Tank 25. "Contamination to 500 mr/hr. at 8 cm....Inside the enclosure on the outer SWP clothing of the operator. |
| 05-03-82F | Interarea pump pit repairs. "Total exposure for 17 people was 580 mr." |
| 05-03-82F | Tank #27 transfer jet leak. Jet raised 3 times to regasket it. "Body dose rate was 2 R/hr at 0.5 meter above open riser...Total exposure was 1,025 mr. for 6 people." |
| 05-11-82F | Power outage to Tank 33 and 44 ventilation system. During survey of vapor space skin contamination to foreman: left ear, 600 c/m (beta-gamma); hair, 2,000 c/m; inside both forearms, 20,000 c/m; and left side of abdomen, 600 c/m. Personal clothing was contaminated up to 10 mrad at contact.... Foreman's car and a personal wash cloth at the foreman's home were also contaminated. The foreman proceeded without monitoring as required. Blame partly laid to "insufficient training." (In spite of extensive body contamination, the report of the incident found "no nasal contamination or body assimilation.") |
| 05-12-82F | Hydrogen survey tanks 33 and 34. Foreman had "skin contamination to 20,000 c/m beta-gamma — deconned to no detectable. Her clothing and personal items — several were contaminated to 25,000 c/m beta-gamma probe." A Health Physics department truck "contaminated to 100 c/m beta-gamma smearable and probed at 8,000 c/m. Hot smear problem was found in the truck." |

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|---|---|
| 06- -82F | New CTS ventilation system construction. "Body dose rates ranged to 20 mr/hr. The total estimated dose was 560 mr for 43 people. |
| 06- -82F | Excavation around tanks 17 and 18 "to install foundations for salt removal equipment. Body dose rates ranged to 100 mr/hr. The total estimated dose was 515 mr for 28 people." |
| 06-09-82F | Installation of pump tank transfer jet. "Total exposure was 80 mr for four people." |
| 06-10-82F | "Construction concrete worker probing from 2,000 c/m to 6,000 c/m all over his person...May have had radioactive injection. Determined he had received an injection of thallium given by doctor." |
| 07- -82F | Installation of new CTS ventilation system. "Body dose rates ranged to 50 mr/hr in the trenches. The total estimated exposure involving 201 personnel was 3565 mr." |
| 07-13-82F | Concentrate Transfer System vent line construction. CTS just entered for work. "Total exposure for seven people was 550 mr." |
| 08- -82F | CTS vent system construction. Body dose rates to 40 mr/hr. Total estimated dose to 158 people: 2030mr. |
| 08- -82F | Tank #26 feed pump change. Dose rates to 2.5 r/hr. at 0.5 meters above open riser. "Total estimated exposure to four people was 165 mr." |
| 08- -82F | Leaking evaporator condenser replaced. Dose rates to 1 r/hr. Total estimated dose to 30 workers was 635 mr. |
| 08-24-82F | Replacement of failed pump in the concentrate transfer system. Total exposure for 9 workers: 340 mr. |
| 08-25-82F | CTS pit reentered to check recirculation pump. 435 mr to 11 workers. |
| 09- -82F | Check out of CTS vent system. 900 mr to 24 workers. |
| 09- -82F | Tank #3 repairs. Dose rates to 1-5 r/hr at 50 cm above open riser. Estimated exposure to 40 people: 895 mr. |
| 09-12-82F | 2F Evaporator work. Exposure to 20 people: 400 mrem. |
| 09-17-82F | Tank #33 transfer jet repairs. Total exposure of 865 mr to 7 people. |
| 09-29-82F | CTS vent system modifications. 50 mr total exposure to 4 people. |
| 10- -82F | Installation of asphalt on tanks 1,2,3,4. Body dose rates ranged to 100 mr/hr at 60 cm above tank tops. Total dose to 135 people estimated 1,390 mr. |
| 10- -82F | "Installed a pump insert plug in the dome riser" at Tank #17. Dose rates to 800 mr/hr at 45 cm of riser top. Total estimated exposure to 8 people: 140 mr. |
| 10- -82F | Diversion box FDB-4 entered twice for inspection and repair of leak. Total estimated exposure to 15 people: 560 mr. Dose rates ranged to 500 mr/hr at 1 meter above open box. |

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 10-15-82F | FDB-4 entered again to verify valve operation. Total exposure to 7 people was 470 mr. |
| 11- -82F | Replacement of leaking nozzle gaskets on Tank 26. Body dose rates to 8 R/hr. at 0.5 meters above open riser. Total estimated exposure to 12 people: 2465 mr. 1 worker knelt on wet lead shielding contaminating his right knee to 4,500 c/m. Decontaminated. |
| 11-19-82F | CTS vent system check out preparation. Total exposure for 5 people: 135 mr. |
| | F AREA LISTING ENDS |
| | H AREA LISTING BEGINS |
| 02-15-61H | Raising of thermocouple were from annulus plug on Tank 16 caused contamination of 2 workers "up to 6,000 c/m" and equipment contaminated up "to 15 r/hr. on a riser plug." "Approved procedures" not followed. |
| 09-21-65H | Suck back, ascribed to leaking valve. Contaminated control room to 5 mr/hr. |
| 08-31-66H | "241-H tank 21. High exposure" to seven workers. Exposure levels to 7 r/hr. "without H.P. [health physics] monitoring the max expose was 565 mr." Exposure was during excavation of a trench over waste tank 24. |
| 09-00-66H | "Radiation exposure. See SHI 243." |
| 11- -68H | "Film badge of sep. dept. supv. indicated skin exposure of 14,590 mrads during Oct. exceeding AEC manual quarterly standard of 10 rem. The exposure prob[ably] occured when the employee removed two acme nuts from a 241-H waste transfer pump in railroad tunnel airlock. See special hazards investigation 266." |
| 11-15-68H | Worker contaminated hands to 150 mr/hr. at 3 inches while attempting repairs [to evaporator] without proper protection equipment. |
| 01-00-69H | "Exposure rates to 20 rads/hr" during removal of transfer jet from tank 14. |
| 03-00-69H | Nasal contamination of worker during work on Tank 15 removal of reel tape to 30,000 c/m beta-gamma and face and hair contamination of 10,000 c/m. "Apparently occured during removal of protective equipment at end of job." |
| 04-00-69H | Removal of slurry pumps and equipment from Tank 14. Exposure rates to 10 rads/hr. "Estimated exposure to personnel was 9 rad." |
| 10-16-69H | "8 construction men and 1 HP inspector received nasal contamiantion during change of four slurry pumps from tank 11. Contamination levels were 530 to 43,500 d/m beta-gamma." |
| 06-12-72H | "Undetected leak resulted in airborne contamination to personnel and equipment. 3 employees nasal contamiantion to 7,200 c/m beta-gamma. A vehicle and pavement around DB-2 contaminated." |

(no comment identified)

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(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 08-23-72H | Worker exposure during grinding of contaminated piping. 4 workers had contamination to 1,500 d/m beta-gamma. "One construction personnel received an assimilation. Bioassay = 0.65 d/m 1.5L, chest - 33 NCI." |
| 02-28-74H | 1 pint of contaminated liquid sprayed from a leak. "Grating of the catwalk around the evaporator cell was contaminated to 8 Rads/hr...2 maintenance mechanics were contaminated by falling droplets. Nasal contamination up to 1,345 d/m beta-gamma. Body contamination 300 mr/hr at 2" from arm, 1st mech. bioassay = 12 NCI; Cs-137/ 1.5L Chest count = 262 NCI; Cs-137, 43 NCI Ru-106. Body burden (1% MPBB). 2nd mech. bioassay = 64 NCI, Cs-137/1.5L Rec'd (2% MPBB)." |
| 06-26-74H | Student contaminated right hand to max. of 1,500 c/m beta-gamma. |
| 07-02-74H | Jumper repairs DB-4. Liquid flooded bottom of box. |
| 07-11-74H | Worker's "dosimeter was off scale at conclusion of job. His film badge was pulled and this revealed he had accumulated 590 mrads/590 mr." |
| 08-00-74H | Radiation rates to 40 R/hr. above open riser, Tank 29. Personnel exposure rates to 3 R/hr. "Transferable contamination to 2.E06 d/m foot square alpha and 40,000 c/m foot square beta-gamma within plastic hut." |
| 01- -75H | "Exposure rates to 400 mr/hr to construction personnel during live connections between Tank 13 and evaporator." |
| 03- -75H | Failed evaporator feed pump. Exposure rates to 10 R/hr. Total exposure to 9 people 0.8R. |
| 09- -75H | CTS leak detection system installation, exposure rates to 100 mr/hr. Total exposure to date 4R. |
| 11-28-75H | CTS leak repair. Radiation exposure rate 3 R/hr. at 3 ft. above all. 4.8 R personnel exposure during inspection and leak repair. |
| 12-15-75H | "Tank 15 - outside coveralls contaminated 6,00 c/m beta-gamma. No alpha on upper right leg." Student given used coveralls. |
| 01-07-76H | Valve replaced. Maintenance mechanic's coveralls contaminated to 20,000 c/m beta-gamma at 1 with 3,000 d/m alpha. Air sample at hut door outside, during the job "revealed 1-75 x $10^{-9}$ microci FP/cc and 153 x $10^{-12}$ microci Pu/cc in air." |
| 03-04-76H | CTS tank dravoff pump replaced. Exposure rate to 500 mr/hr. Pump radiated 25 rad/hr. at 2 inches. |
| 03-24-76H | Technical engineer contaminated personal shoes to "1,500 c/-beta-gamma" by stepping on ledge of tank 31 to remove thermocouple. |
| 04- -76H | Tank 31 HEPA filter replacement. Dose rates to 20 Rads/10R/hr at 2 inches and 1-5 R/hr at 2 feet. |

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04-27-76H | Evaporator cell: Air sample taken during jumper change: 0.44 x $10^{-9}$ micro Ci FP/cc and 40.6 x $10^{-12}$ micro Ci Pu/cc. |
| 05-30-76H | Steam leak into Tank 22 sump. Air sample taken 10 ft. east of hut downwind measured 0.18 x $10^{-9}$ microcuries FP/cc of air. |
| 07-11-76H | Hosed salt deposits in feed pump cell will water. Body exposure rate of 200 mrads/100 rm/hr at 2 ft. from hole. "No spread of contamination" from hosing. |
| 08- -76H | Cesium removal column replaced. Exposure rates 700 mr/hr. 60 cm. over open riser and 100 mr/hr at 0.5 from the column. |
| 08-16-76H | Pump pit No. 3. 3 workers contaminated clothes up to 40,000 c/m. 1 had 1,000 c/m on hair over right ear. Nasal smears for foreman 242 c/m to 300 c/m. Air samples: 10.66 x $10^{-9}$ microCi FP/cc and 47.7 x $10^{-12}$ microCi Pu/cc. Similar levels of air contamination on 08-17-76. |
| 08-24-76H | Hard hats at 241-H contaminated "up to 18 c/m beta-gamma, no alpha." |
| 09-10-76H | Survey on 09-10-76 revealed hard hats contaminated up to 670 c, beta-gamma. |
| 09-07-76H<br>09-17-76H<br>09-22-76H<br>09-23-76H<br>10-14-76H<br>10-15-76H<br>11-10-76H | Tank 31. Air samples during equipment removal: 86 x $10^{-9}$ microCi FP/cc and 400 x $10^{-12}$ microCi Pu/cc. Exposure rates to 150 rads/80 R/hr flush with open tank risers. Somewhat lower levels in air on 09-23-76 and again on 10-14-76. 1.9 x $10^{-9}$ microCi FP/cc and 40.5 x $10^{-12}$ microCi Pu/cc at Tank 13 on 11-10-76. |
| 11-12-76H<br>11-19-76H<br>12-03-76H<br>03-08-77H<br>04-20-77H<br>04-26-77H<br>05-26-77H<br>09-07-77H | Tank 13 drill motor repairs. Air activity 3 meters east of hut at HEPA exhaust .16 x $10^{-9}$ microCi, FP/cc and 56 x $10^{-12}$ microCi Pu/cc. Similar levels on 11-19-76 when all covers removed in CTS. Again at Tank 13 on 12-03-76. Entry into Diversion Box 1 on 03-28-77. 90.1 x $10^{-12}$ microCi Pu/cc. Similar level during survey of Tank 16 for maintenance on 04-26-77. Similar level during removal of Jumper DB-2. DB-1 work. Installation of "U" Jumper. 49 x $10^{-9}$ microCi FP/cc and 18.3 x $10^{-12}$ microCi Pu/cc. |
| 12-10-76H | Tank 13. Workers hoses contaminated to 7,000 c/m beta-gamma. |
| 01-17-77H | "attempted decontamination" of ball value radiating 1,000 rad/hr at 58 cm. |
| 02-01-77H | Tank 29. Liquid spill during repairs. Exposure rates 150 rads/100 R/hr. at 5 cms. "Personal shoes" contaminated. |
| 02-07-77H | Tank 29 repairs. Total exposure 1,800 mr. |
| 02-22-77H | "Contaminated water 15,000 c/m/ml, beta-gamma) bubbled from ground at Tank 13 during hydrostatic testing of a line, faulty weld. Exposure rates to 1 R/hr at 30 cm." Total exposure 2.6R. |
| 05- -77H | "High personnel exposures to T&T workers on hot job." |

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(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 05-03-77H | "New pumphouse - high activity was recorded in control room at 7:00 pm... 1/imrad/mr/hr. gen. area." |
| 05-17-77H | DB-5 repairs. "Exposure rate (hand rate also) was 20 rads/.2R/hr. at 5 cm. nozzle to regasket." |
| 06-01-77H | Tank 16 maintenance. "Jet radiated 50 rads/4 R/hr at 5 cm." |
| 09-15-77H | Removal of valve in Tank 31. "Radiation level flush with open hole 50 rads/hr. 15R/hr." DB-4. Gasket replacement. Body exposures rates to 8 rads/3R/hr. at 45 cm. |
| 02-09-77H | Evaporator cell: Plugged vent and transfer line. Exposure rate 25R/hr. at 3 cm. "Repair personnel got about 2R." |
| 02-15-78H | Liquid leak from evaporator cell. Exposure rates to 50 R/hr at 1 inch. |
| 04-02-78H | "Repairs to valve on evaporator feed pump in Tank 13." Total exposure 0.8 R. |
| 05-01-78H | Replaced gaskets in CTS pit. Total exposure to 8 people: 950 mr. |
| 05-19-78H | Repairs to CTS draw-off pump. 4,000/200 mrad/mr at 18 inches. 3 days to repair. |
| 07- -78H | Removal of CTS agitator. Total exposure 1 R. |
| 07-16-78H | Up to 15,000 c/m on personal shoes of worker, probably while taking a reading at P-Trap riser #8. |
| 08- -78H | Unplugging of vent line from 242-H evaporator. Total exposure to 15 workers: 800 mr. |
| 08-03-78H | "Construction pipe fitter, to 8,000 c/m beta-gamma at 3 cms. on chest (small area)." Clothes also contaminated. "An open bag containing used regulated clothing was found radiating 20,000 c/m beta-gamma at 3 cms." |
| 09-18-78H | Worker had 7,000 c/m "on his neck in one small spot." |
| 02-05-79H | "Employees burned eyes while watching welding operation..." |
| 02-15-79H | Worker contaminatead right index finger and left hand to max of 30,000 c/m while handling bottles of contaminated mercury. |
| 03-02-79H | 2 workers contaminated personal clothing and shoes up to 30,000 c/m while working at Tank 16. |
| 04-17-79H | 281-8H. Miscellaneous basin maintenance. "One employee's results was 620 mrems/620 mrems. The other employee's results was 825 mrems/825 mrems. |
| 05-03-79H | Survey prior to repair of bad valve. Radiation rates over open hole of 1000 mr/hr beta-gamma and 1000 mr/hr gamma. |

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 06-04-79H | Leak in evaporator bottom line. "100 workers accumulated 4750 rems." [This might be an error. The figure intended is probably 4750 mrems.] |
| 12-05-79H | "CTS area - employee contaminated the front of his shirt and pants to 2,000 c/m beta-gamma." |
| 01-02-80H | Soil near 502 line measured 1 rad/hr at 5 cm. Two workers contaminated their shoes to 1,000 c/m beta-gamma due to contaminated soil. |
| 01-25-80H | Tank 16. Tape taping worker's gloves to coveralls came loose. Right forearm contaminated 20,000 c/m, left forearm to 40,000 c/m. |
| 01-27-80H | Regulated hard-hat found contaminated to a max. of 200 c/m beta-gamma during weekly routine check. |
| 02-07-80H | Worker's palm and forefinger contaminated to 10,000 c/m beta-gamma while sampling Tank 31. |
| 03-28-80H | Removal of specific gravity dip tube from Tank 13. One worker's left hand contaminated to 100 mrad/hr. at 5 cm; right hand to 40,000 c/m beta-gamma. Second worker's wrist to 40,000 c/m beta-gamma. |
| 04- -80H | 6 sq. ft. area contaminated while removing dip tubes. 3 construction workers received up to 60,000 c/m contamination on skin during cleanup. |
| 04- -80H | Installation of new line at evaporator. Total exposure of 1,100 mr to 30 people. |
| 04-10-80H | Inside of vehicle cab found contaminated to 20,000 c/m beta-gamma during a survey. |
| 05-10-80H | "Extensive decontamination of salt and gravel on top of Tank No. 13 was performed." Source of contamination apparently a crack in reel jet pill box. Total exposure to 11 people to remove tar and gravel: 140 mr. |
| 05-30-80H | Work on air compressor. Exposure rate 10 mrad/10 mr/hr. |
| 06-19-80H | CTS area - workers' shoes contaminated from 800 c/m up to 8,000 c/m beta-gamma. One worker "stepped in water that came up over his workshoes." |
| 09-08-80H | Dismantled purge blower. Exposure rate "10/10 mrad/mr/hr gen. area." |
| 10-02-80H | Repaired leaking jumper connector at 242-H evaporator. "Body dose rate flush with open cell was 2,000/1500 mrad/mr/hr. 3 shifts. |
| 10-10-80H | Removal of faulty feed pump (Tank 13) and its transport. Exposure rates to 3 R/hr. Reinstallation exposure rate 8,000/mrads/3,000 mr/hr. |
| 12-03-80H | Check on feed probe on Tank 13. Worker's personal jacket contaminated to "15,000 c/m beta-gamma (no alpha)." |
| 01- -81H | "Exposure rates to 30 rads/hr.2R/hr were encountered to remove a wire that had become wrapped around a sludge probe" in Tank 15. Total estimated exposure to remove wire: 435 mrems. |

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(no comment identified)

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WORKER EXPOSURES, Page 11

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-11-81H | Accidental pressurization of riser on Tank 31 during work. 10 sq. ft. area contaminated. Worker's clothing and shoes contaminated from 2,000 c/m to 35,000 c/m beta-gamma. |
| 01-20-81H | Entry into Diversion Box 4 for repairs: worker contaminated shoe covers and clothing to 20,000 c/m beta-gamma. |
| 02-07-81H | Loop line to CTS and Tank 29 pluggage and malfunction. Repair causes exposure of 2,220 mrem. Total to 17 persons. Exposure rates to 8R/hr. |
| 02-09-81H | Worker's clothes, including insulated underwear contaminated to 3,000 c/m beta-gamma while welding. |
| 02-12-81H | By-pass valve cracked due to freezing and contaminated tank top and ground. Worker without protective clothing contaminated shoes and trousers to 1000 c/m and hand to 200 c/m. |
| 02-16-81H | CTS line radiating 80 R/hr uncovered late Friday night. Measurement taken on Monday. |
| 02-21-81H | Safety showers at evaporator replaced. General area dose rate 10 mrads/ 10 mr/hr. |
| 03-20-81H | "T&T rigger's exposure of 1,145 mr exceeded exposure guide of 600 mr for month. He was changing jumpers in Diversion Box 4. Failure to communicate was principal cause." |
| 04- -81H | Excavations for concrete pad at riser 3. Total exposure to 11 persons: 310 mrem. |
| 04-02-81H | Workers from "Puritan Janitorial Service" exposed to ammonia vapor. |
| 04-14-81H | Construction worker at Tank 15: gloves contaminated to 40,000 c/m and tarp over riser and plastic on floor to 60,000 c/m beta-gamma. |
| 04-27-81H | Transfer jet screen plugged. Removal exposure rates to 10 R/hr. at 30 cm. Total exposure 3.2 R to 27 workers. |
| 05- -81H | Removal of obsolete equipment from insider riser 6, tank 9. 40 workers accumulated 3.7 R exposure. |
| 05-22-81H | Failed draw-off valve removed from Tank 36. Total exposure over 2-day job to 7 workers was 190 mr. |
| 05-29-81H 06-01-81H | Installation of Thermocouple on valve riser C-2, Tank 36. |
| 07- -81H | Removal and regasketting and reinstallation of jumpers in DB-6. 37 workers total exposure: 4.6 R. |
| 07- -81H | Riser plug removals. Exposure rates to 1.5 R/hr. Total estimated exposure to 37 workers: 2265 mr. |
| 07-04-81H | Change of bad gasket on trasnfer jet, Tank 36. "WM and T&T changed gasket on transfer jet at C-1 riser using a radiation dose rate of 5 rads/4 R/ hr at 0.5 m from connector. Radiation level at top of riser was 20 rads/ 15 rads/hr." |

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WORKER EXPOSURES, Page 12

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 07-13-81H | "Employee inadvertently contaminated his personal clothing (to 6,000 c/m beta-gamma) after removing a rope (safety belt rope) from an open bag in the 242 supply room." |
| 07-17-81H | Riser jet put on truck for disposal leaked. Both shoes of worker on truck contaminated to 80,000 c/m beta-gamma. |
| 07-22-81H | "Construction boilermaker and laborer incurred skin contamination while handling a portable hand saw which was contaminated. The laborer also sustained nasal contamination." |
| 08- -81H | Continuation of work on transfer piping installation. 43 workers exposed to a total of 1405 mr. |
| 08- -81H | Installation of new nozzles in DB-6. Total exposure to 31 workers: 1885 mr. |
| 08-14-81H | "Employee contaminated himself and clothing when he removed drain plug rod...at the CTS pit. Procedures not followed." |
| 08-24-81H | T&T rigger contaminated arms and clothes up to 20,000 c/m after handling used tag line. |
| 09-02-81H | Construction pipefitter handled contaminated welding lead. Right hand contaminated. Some area at 20 mrads/hr. |
| 09-07-81H | Failed recirculation pump. "1035 mr for 11 men." |
| 09-21-81H | Radiation survey inside transition box showed max. radiation level of 300 R/ hr at 3 inches. |
| 09-24-81H | Installation of new steam line. Dose rate 70 mrads/70 mr/hr. in the "general area." |
| 09-25-81H | 4 ball valves in CTS cell rebuilt. Exposure rates to 1R/hr. Total exposure to 13 people: 750 mr. |
| 09-28-81H | Repaires to valve jumper, CTS pit. Exposure rates 500 mr/hr. at 30 cms. from jumper and 1R/hr over open cell. Total estimated exposure: 315 mr. Reentry into cell on 09-29-81. Total exposure to 6 people: 180 mr. |
| 09-29-81H | "CTS pit - E&I, WMO, and T&T attempted to repair the automatic valve using a dose rate of 500 mr/hr." |
| 09-29-81H | Worker contaminated hands and clothes up to 4,000 c/m. |
| 09-30-81H | New thermocouple installed "using a dose rate of 100 mr/hr." |
| 10- -81H | Jumper placed in burial box. Total exposure to 14 people: 2340 mr. |
| 10- -81H | Installation of jumper in DB-2. Total exposure of 8 people: 775 mr. |
| 10- -81H | Replacement of failed transfer pump and other repairs in CTS pit. Total exposure to 62 people: 2400 mr. |

(no comment identified)

(no comment identified)

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WORKER EXPOSURES, Page 13

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 10- -81H | "Repair a bent nozzle inside the cell. The total exposure to (involving 70 construction, waste management, and T&T personnel) was 3900 mr." |
| 10-04-81H | "Employee contaminated his right shoe to 2500 c/m beta-gamma while working in 281-BF retention basin." |
| 10-09-81H | "Flush water jockey pump down..." Dose rates: up to 2,000 mrads/200 mr/hr at 30 cms. |
| 10-12-81H | Worker knelt in contaminated water on cell covers. Right knee: 10,000 c/m beta-gamma. |
| 10-16-81H | Replacement of contaminated filter on experimental gas sampler. Worker's hand and clothes contamlented to 70,000 c/m beta-gamma. "No nasal contamination or body assimilation." |
| 11- -81H | Tank 13 feed pump work. Total exposure to 38 workers: 1495 mr. CTS work: Exposure to 18 workers: 1990 mr. |
| 11- -81H | Installation of new jumper for DB-4, DB-6 transfer system. Total estimated 11 workers: 640 mr. |
| 11- -81H | Work for start-up of evaporator. Total exposure to about 20 workers: 950 mr. |
| 11-23-81H | Installation to replace failed feed pump. Exposure to 21 workers: 1245 mr. Decontamination and repair of another feed pump. "Total exposure to 40 men...was 33,000 mrad and 2,000 mr." |
| 12- -81H | Installation to replace failed feed pump. Exposure rate to 2000 mrads/100 mr/hr at 0.5 m from pump. Total estimated exposure to 33 people: 1245 mr. |
| 12-03-81H | Tank 31 - Worker contaminated right shoe to 3000 c/m beta-gamma, less than 500 d/m alpha. |
| 12-17-81H | Changes in DB-7. Total exposure to 9 workers, 70 mr. |
| 12-18-81H | Tank 38: lengthening of transfer jet. Total exposure to 5 workers: 370 mr. |
| 12-21-81H | Diversion Box 1. Jumper changes. Total exposure to 8 men was 1,030 mr. |
| 12-22-81H | Work in "HPT-3" mainly on transfer jet. Total exposure to 13 men: 980 mr. |
| 01- -82H | Installation of new Jet C-1 riser. Radiation level at top of open riser up to 20R/hr. Total estimated dose to 5 workers: 605 mrem. |
| 01- -82H | Tank 13. Removal and installation of pump. Total of 4 entries needed to complete the job. Radiation exposure rates to 9R/hr. Total estimated dose to 29 people: 1560 mrem. [Same item appears to have been entered on 01-02-82H with exposure of 1420 mrem to 15 people?] |
| 01-05-81H | Diversion Box 2 jumper changes. "Total exposure to 11 men was 1,160 mr." |
| 01-06-82H | Replaced stator on recirculation pump motor. Total exposure to 15 workers: 1,240 mr. |

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WORKER EXPOSURES, Page 14

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-06-82H | CTS pit - transport of contaminated metal angle riser. 3 workers' coveralls, gloves contaminated from 10,000 c/m beta-gamma to 100 mr/hr at 5 cms. Pick-up truck contaminated to 10,000 c/m beta-gamma. |
| 01-25-82H | "Waste header tie-in. HP [Health Physics] started to set a rate for construction and found liquid dripping from canyon encasement rain line. The radiation rate was 60 rads/20 R at 18 inches from liquid...Approximately 5 gallons had drained into sump." |
| 01-25-82H | Lift jumper vent line repaired "using a dose rate of 1000 mrads/200 mr/hr. at 0.5 meters from jumper." |
| 01-28-82H | High radiation rate in Diversion Box #5 flug box - 200 rad/15 R/hr due to a leak. Total exposure to 3 workers: 350 mr. |
| 01-29-82H | Work on jumpers - total exposure to 12 workers: 895 mr. |
| 02- -82H | "Construction completed tie-in of the new jacketed waste headers. Problems were encountered when liquid radiating up to 150 rads/hr dripped from several of the headers." |
| 02- -82H | Tank 13 failed feed pump. Exposure rates to 3R/hr above open riser. Total estimated exposure to 10 workers: 1035 mr. |
| 02-07-82H | Tank 31 work. Total exposure to 3 workers: 155 mr. |
| 03- -82H | "Construction chipped through four feet of concrete on top of Tank 38" to weld cooling waster line to tank primary. Radiation levels up to 600 mr/hr. at 5 cms. from tank top. Total estimated exposure to 24 workers: 920 mr. |
| 03-31-82H | Diversion box 7 repairs. Total exposure to 27 workers: 4,370 mr. |
| 04- -82H | Preparation for installation of jet for Tank 9. Total estimated exposure to 17 people: 1030 mr. |
| 04-02-82H | Work in DB-5 "Radiation levels were reduced from 40 rads/2H[sic]/hr to 10 rads/1R/hr at 5 cms. Radiation dose rate of 2,000 mrads/200 mr/hr at 0.5 m was established..."Total estimated exposure to 7 workers: 215 mr. |
| 04-02-82H | Diversion box #5 hose installation. "Job was stopped when outer pair of coveralls were contaminated to 15 mrads/hr at 2 inches." |
| 04-05-82H | "DB-5 - WMO installed a flush valve on nozzle no. 9 flush valve using a dose rate of 3000 mrads/300 mr/hr. Estimated total exposure: 110 mr." |
| 04-07-82H | Entry unto DB-2: Jumper change. Total exposure to 7 men was 610 mr. |
| 04-27-82H | CTS - removal of radioactive materials for burial. Broken jumper radiated 4000 mrads/300 mr/hr at 5 cms. |
| 04-29-82H | Entered CTS pit for inspection of pump. [Exposure rate or total exposure not given.] |

(no comment identified)

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WORKER EXPOSURES, Page 15

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 05- -82H | Failed feed pump decontaminated from 20 rads/1R/hr. at 30 cm to 1000 mrad/100 mr/hr at 30 cm. Total exposure to 17 workers: 555 mr. |
| 05- -82H | Miscellaneous maintenance in CTS cell during April and May. Total exposure to 33 workers: 1,605 mr. |
| 05- -82H | "Dry airborne waste contaminated 9 personnel and a 2500 sq. ft. area south of Tank 16 during removal of a recirculation jet." Improper equipment and procedure. Skin contamination up to 40,000 c/m beta-gamma. Nasal up to 700 c/m beta-gamma. |
| 05-17-82H | "Construction began repair of leak...using dose rates to 100 mr/hr at 0.5 m. |
| 05-18-82H | CTS work on drop valve in Tank 36. Total exposure to 3 workers: 220 mr. |
| 05-19-82H | 2 entries work on drop valve tank 37 "using a dose rate of 300 mr/hr at 0.5 from edge of riser (at tank level). Radiation level incrased to 50 R/hr. over open riser when valve was removed." Total exposore to 4 men was 165 mr. |
| 05-21-82H | Severe right forearm laceration during work in repair cell (299-H). Survey revealed, "Metal plate causing injury: 2,000 c/m less than 500 d/m alpha; cut area of plastic suit 45,000 c/m is 50 d/m alpha...employee's arm less than 10 c/m beta-gamma, less than 10 d/m alpha; and a blood smear less than 20 c/m beta-gamma, less than 10 d/m. [The last figure is apparently an alpha count but this is not stated.] |
| 05-28-82H | Puncture wound on finger to maintenance mechanic. Cut area of finger contaminated to 1000 c/m beta-gamma. |
| 06- -82H | Leaking transfer jet, Tank 24 mechanic had puncture wound: 1000 c/m on excised. Estimated total exposure: 240 mr. |
| 06- -82H | Tank 41 gravity line plugged. Catherization required. Total exposure to 4 workers: 30 mr. |
| 06- -82H | Unsuccessful attempt to install sump jet. DB-6. Total estimated exposure for 11 people: 580 mr. "The radiation level increased to 2500 mr/hr over the open cell. A dose rate of 500 mr/hr was established for the job." |
| 07- -82H | Regasketing of Tank 37 CTS spool piece. Total exposure to 14 workers: 2165 mr |
| 07- -82H | Regasketing of Tank 37 CTS spool piece. Max. radiation level 30 R/hr. Used an exposure date rate 500 mr/hr. at 1 m. from outside edge of riser. Estimated total exposure to 6 people: 910 mr. |
| 07-13-82H | Work procedure violation. Maintenance mechanic received facial and hair contamination of 700 c/m beta-gamma. |
| 07-19-82H | Entry to evaporator cell. Total exposure to 6 workers: 60 mr. |
| 07-21-82H | Tank 38 transfer jet adjustment. Leak check. Total exposure to 7 workers: 145 mr. Again on 07-26-82. Exposure: 95 mr to 5 workers. |

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WORKER EXPOSURES, Page 16

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 07-22-82H | Removal of sump jet from DB-6. Total exposure to 5 workers: 75 mr. |
| 08- -82H | Worker contaminated soles of personal shoes to 200 mrads/hr by stepping on a piece of contaminated plastic on Tank 35. Monitor house floor contaminated up to 4,000 c/m; sample truck cab floor to 40,000 c/m and tank top up to 200 mrad/hr. |
| 08- -82H | Tank 35. Worker contaminated personal shoes to 200 mrad/hr by stepping on contaminated plastic. Sample truck cab contaminated up to 40,000 c/m beta-gamma, and top of Tank 35 up to 200 mrad/hr. [This entry appears to have been repeated in somewhat different from on 08-20-82H.] |
| 08-05-82H | DB-6. Sump jet installation. Total exposure to 4 workers: 90 mr. |
| 08-06-82H | Pump replacement. Total exposure to 4 workers: 140 mr. |
| 09- -82H | Removal of clean out port #3. 24 persons received a total of 980 mr. |
| 09- -82H | Decontamination of Tank 13 in prepration for off plant vendor work to repair cracks. Total exposure to 19 people: 1560 mr. Continuation in Octobeer: Total exposure to 28 people: 1435 mr. |
| 11- -82H | Unsuccessful attempts to change jumpers remotely in CTS cell using shielded crane. Exposure rate in cab of shielded crane 1 mr/hr compared to 2R/hr over open cell. Later hands-on change gave 1115 mr over 30 personnel entries, and further work gave estimated 900 mr over 50 personnal entries. |

(no comment identified)

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TABLE 2

ENVIRONMENTAL CONTAMINATION

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 03-00-60F | 1800 square yard area around diversion box contaminated with particulates. |
| 02-29-61F | Plutonium leaked from evaporator to ground 4 times in "recent months." |
| 08-13-62F | Flange leak between tanks 18 and 19. Radiation rates 4 to 10 R/hr at 4 inches., 186 cu-yds of soil and asphalt excavated. [Worker exposure not cited.] |
| 04-00-63F | 10,000 square feet area downwind of diversion box contaminated "due to jumper changes." |
| 11-18-64F | Column feed pump shut off for shows. Radiocesium released to seepage basin. |
| 01-15-65F | "Cesium release - Cs columns inadvertently bypassed for 11 hours." |
| 02-03-66F | Radioactivity by-passed exhaust filter during sludge transfer. "Nearby area: contaminated." |
| 05-13-66F | "Cesium 137. Continuing problems with high Cs" |
| 04-00-67F | "Suckback through steamline." 60 R/hr at gang valve area. "Gang valve replaced and area decontaminated." |
| 02-15-68F | Pump gasket ruptured. Area contaminated. |
| 09- -68F | 4.03 curies Cs released to seepage basin. Monthly guide of 2.5 curies exceeded, during August 30 - Sept. 5 releases. |
| 12-00-70F | "Difficulty in meeting guides" for alpha release to seepage basins due to high alpha activity in Savannah River Laboratory waste. |
| 08-00-71F | Leaking feed pump flush line caused ground contamination. 100 R/hr. on line insulation and 15 R/hr. on adjacent ground. 80,000 c/m released to Four Mile Creek after rain. |
| 05-02-73F | Discharge of near boiling concentrate to Tank 34. Result: flashing of vapor and discharge of airborne activity from cracks in concrete and riser covers - 20 R/hr. |
| 08-00-73F | Increase of Cs to Four Mile Creek - "Surface contamination in waste tank farm—storm sewer—rainfall??" |
| 03-00-74F | Well FTF7, minor contamination has been found in groundwater of this well, new waste tanks 3 & 5 in F area, since last October, shortly after the wells were drilled." Cause of contamination unknown. |

(no comment identified)

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ENVIRONMENTAL CONTAMINATION, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04- -74F | 10 cubic yards contaminated asphalt removed. [Source of contamination not stated.] |
| 04-05-74F<br>04-23-74F | "Contamination. Contaminated water was found between CTS pit liner and concrete encasement at 242-F. 300 mrad/hr at 2 inch." The liquid which was subsequently pumped out was found to have radioactivity levels of $7.07 \times 10^{+7}$ d/m/ml cesium-137 and $7.04 \times 10^{+5}$ d/m/ml Cs-134. |
| 05-00-74F | Ru-106 contamination found in monitoring well FTF-6. Pumping continued throughout June 1974. |
| 06- -74F | Top of Tank 29 contaminated. |
| 06-05-74F | $1.0 \times 10^{-8}$ microcuries/cc of air released during jumper change in diversion box 1. Worker has nasal contamination of 8200 dis/mn beta-gamma was not wearing "respirator protection." 3 others and 1 pickup also contaminated. |
| 07-16-74F | 242F: Exhaust air ("airout") 24 hr. count of plutonium was $4.1 \times 10^{-2}$ microcurie/cc. Fission products: $6 \times 10^{-9}$ microcurie/cc during jumper removal work. |
| 09- -74F | "Steam vapors and minor contamination escaped through HEPA filter on exhaust from Tanks 18 and 20." |
| 09-05-74F | Contamination escapes Tank 18-20 filters. Filters replaced. Tank 20 samples: "62,000 cm beta-gamma $3.1 \times 10^{-8}$ microcuries FP/cc" and "96 cm alpha, $4.8 \times 10^{-12}$ microCi Pu/cc." |
| 04-09-75F | "242-F. The storm sewer monitors alarmed...point 4 which monitors tanks 17-20 went off scale. Special water samples pulled were < than m.s. (less than measurable)." [Cause of alarm appears not to have been found.] |
| 08-25-75F | 500 R/hr in dry wells adjacent to Tank 3. "Contamination within 4 ft. of riser and 208 ft. deep." |
| 09- -75F | Sr-90 to seepage basins above guide. |
| 10- -75F | Asphalt near Tank 8 contaminated. Operator error. |
| 06-16-76F | Concentrate Transfer System. Air Activity-fisson products. $166 \times 10^{-9}$ microCi/cc. |
| 05- -77F | "A HEPA filter installed downstream of Tank 7 fiberglas [sic] filter after release of 137 Cs to environment. |
| 07- -77F | High activity waste evaporator "continued deterioration." Release of Ru-102 to seepage basin "exceeded monthly guide in June." |

(no comment identified)

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ENVIRONMENTAL CONTAMINATIONS, Page 3

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-16-78F | Tank 7 filter leak contaminates road and platform. Operating error - portable filter left running over the weekend. |
| 05-11-78F | "Filter tested 99.50% Tank 8 tea pot. HP [Health Physics] suspected leak." |
| 05-24-78F | Wrong valve opened on evaporator. Alarm ignored. Road contaminated. 250 mr/hr at 5 cms; 20,000 c/m beta-gamma at 3 cm and "less than 500 d/m alpha." |
| 02-26-79F | "The canyon diverted segregated on 281-8F...due to alpha contamination 11 d/m/ml." |
| 03-06-79F | 221-F canyon diverted segregated cooling water to 281-8F basin - alpha contamination 24.8 d/m/ml at water monitor. |
| 03-07-79F | Contamination leaked from plastic construction hut to ground outside. "40 square feet contaminated to 60,000 c/m." |
| 03-13-79F | Leak in a "loop line" during modifications. Construction hut floor contaminated to 3500 c/m beta-gamma. |
| 03-16-79F | "radiation reading(s) in trench from DB-5...are 3R/hr. at 3 cm. south end, 1R (at 1 foot) at east end of the line, and 15-30 mr. at south end of trench." |
| 03-27-79F | Tank #20 west riser radiating at 1 R/hr at 5 cm. |
| 04-02-79F | HEPA filters on DB-5 leaking. Test efficiency 99.25% |
| 04-04-79F | Water diverted "due to 13.4 d/m alpha, 180 d/m beta-gamma." |
| 04-18-79F | "281-5 segregated cooling water diverted at 10:10 p.m. Initial contamination 200,000 d/m." Water diverted again at 3:30 pm. To 8F due to contamination of 20 d/m/ml beta-gamma. |
| 05-13-79F | "Got alarm on DRB-5 high air activity. H.P. checked and O.K. now." [Not clear whether this was an instrument problem or leakage of radio-activity or both.] |
| 06-06-79F | Leak from concrete encased line. Soil samples "showed 100 c/m beta-gamma and less than 10 c/m alpha transferable contamination." |
| 07-13-79F | Segregated cooling water diverted to seepage basin due to beta-gamma and alpha contamination. |
| 08-16-79F | "Caved in [depression] area of berm on east side of 242-F evaporator" had radiation reading of 4 R/hr. in depression and 40 mr/hr at 60 cm above depression. |
| 09-13-79F | "281-6 high activity alarm went off."...Diverted to 281-8. Counts were about 400 d/m/ml. |

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(no comment identified)



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ENVIRONMENTAL CONTAMINATION, Page 4

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-29-80F | Construction breached tank 2 positive pressure and "caused tank air to flow from the tank 2 riser 2 opening. No consequence occured, but the incident resulted because the job was not reviewed by HP and operations as required by procedure." |
| 02-11-80F | "While digging holes for streamline poles" the soil was found to have activity of 2,000 c/m near seepage basin line near road C. |
| 03-03-80F | Diversion box #1 opened for a leak check. Dose rate 20 R/hr at 60 cm. After remote flushing, dose rate 5 R/hr. Job stopped "due to high winds that spread contamination outside the windbreak for a distance of 30 ft.". Cause: leaking jumper. |
| 04-18-80F | "Trebler line - at 15 feet below p-30 manhole. Water seeping out berm was detected that probed 1 to 4,000 c/hr. beta-gamma." |
| 05-16-80F | 30 cc of contaminated liquid released due to operating errors during work on Tank 25 to remove pluggage. Radiation was 500 mr at 5t m." |
| 07-08-80F | Tank 18. Condensate leaked from HEPA filter at temporary exhaust system. 5 square feet area contaminated to 15,000 c/m beta-gamma. |
| 07-25-80F | "Water leaking around segregated water; some at P-3 manhole. Each probed 6,000 c/m beta-gamma. |
| 07-26-80F | "During excavation for new tank" dirt under road found radioactive to 4,000 c/pm. |
| 08-26-80F | "Contaminated zeolite "inadvertently released." |
| 09-17-80F | Contaminated Zeolite again released out to top of Tank 27 in attempt to clear a plugged line. |
| 12-03-80F | Filter change on tanks 18 and 20. "Max rate 30 mr/hr." 20 gallons water drained into plastic pages "with small amounts escaped to asphalt." |
| 12-08-80F | "During startup, about 115 grams of uranium fromk the uranium cycle were lost to DW waste stream when mixer-settler D was operated 20 minutes with failed impellers. (Also see, DPSPU-80 272-238; SI-80-12-153.)" |
| 03- -81F | "A valving error in JB-line resulted in a transfer of 494 grams Pu into canyon tank 9.7. This solution was subsequently fed to the Law [low activity waste] evaporator and discarded." |
| 04-14-81F | 3 gallons of flush water and zeolite contaminated platform and tank top. "Decontamination will require about 10 man-days." |
| 04-29-81F | "Segregated C.W. from 22-F is still diverted to 281-8F." Readings inlet: 209 d/m/ml; outlet: 227 d/m/ml. |
| 05-13-81F | Accidental fire in a "waste box stored in the windbreak." Box radiated 5 mrads/hr and ashes smeared 10,000 beta-gamma." |

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 06- -81F | Release of Sr-90 and Ru-106 "exceeded the prorated monthly guide" in April 200-F. Release of other beta-gamma also exceeded monthly release guide in April. Several causes. |
| 06-08-81F | "Pumping from F-area retention basin to seepage basin was discontinued due to high seepage basin level. Acid has been added to seepage basin to aid in seepage process. |
| 06-09-81F | High activity in circulated cooling water at 281-4F (561 d/m/ml beta-gamma). Evaporator 1 shut down. |
| 06-22-81F | 1.3 million gallons cooling water collected in 8F basin. Samples "analyzed less than 50 d/m/ml. Pumping from 8F to seepage basins in progress. Seepage basins are ninety-two percent filled." |
| 06-23-81F | Segregated cooling water with up to 700 d/m/ml diverted to 281-8F from canyon. |
| 06-23-81F | "DOP Test results – Tanks 18 exhaust greater than 99.97% efficient. Tanks 17 and 19 exhaust 99.90% efficient." Cause of low efficiency at 17 and 19: inleakage of air at blower (06-25-81 entry). Increased efficiency to 99.60% by 06-29-81. Increased to 99.8% by 07-07-81. |
| 07-19-81F | "Building 221-F circulating cooling water was diverted once and the segregated cooling water diverted four times to the 281-8F retention basin due to contamination from canyon equipment during July." Levels of radioactivity in samples from 30 d/m/ml to 150 d/m/ml. |
| 08-03-81F | "281-6F was diverted to 281-8F. ..281-6F samples 182 to 362 d/m/ml." |
| 08-10-81F | "Segregated cooling water was again diverted to 281-F on August 7, 12, 17, 19, 21, and 27. [Contamination to 104 d/m/ml.]" |
| 08-11-81F | Canyon diverted water to 281-8F. Sample reading 2150 d/m/ beta-gamma. |
| 09-01-81F | "241-F-T&T completed removal of contaminated asphalt in front of Tank No. 26 and by west side of Tank No. 27." |
| 10- -81F | Release of several beta-gamma emitters including Sr-90 and Cs-137 and alpha emitters exceeded monthly guide. "Source of release was 211-F building segregated cooling water contaminated by leaks." |
| 10-16-81F | Low level waste trailer leaked liquid "probing 8000 c/m to 10,000 c/m beta-gamma. 30 gallons of low level waste backed...out the roadway and into an adjacent drainage ditch." |
| 11- -81F | "Releases of Ru-103 and Ru-106 to F area seepage during July exceeded monthly guide." Cause: tube leak in building 221-F evaporator re boiler. Releases for other beta-gamma and alpha emitters also exceeded guide. Same cause. |
| 11- -81F | "The combined 200-F and H releases to Four Mile Creek of Sr-89, Sr-90, Cs-134 Cs-137 and other beta-gamma emitters exceeded the monthly and annual guides in September." |

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS. |
|---|---|
| 11-21-81F | Radioactivity release to air saturated HEPA filters. Air filter counter 20,000 c/m. |
| 12- -81F | Monthly release guides again exceeded for several beta-gamma emitters in October. Annual guides again exceeded for several beta-gamma emitters in October. Annual guides for several radionuclides "had already been exceeded." |
| 12-04-81F | "5000 gals chromated water was lost from system and diverted to the retention basin." |
| 12-23-81F | "Cesium removal column hopper overflowed. "Less than 500 d/m alpha smearable and less than 1000 c/m beta-gamma smearable." |
| 12-26-81F | Radiation from riser opening 100 mr/hr. Rainwater leaking into annulus. |
| 01- -82F | "Four transfers totalling 36,000 gallons from catch tank to Tank 7" in January 82. Contamination levels from $6.05 \times 10^{+4}$ d/m/ml (last transfer) $2.48 \times 10^{+6}$ d/m/ml (first transfer). Heavy rain caused water leakage into transfer line encasement. |
| 01- -82F | Monthly release guide for several radionuclides exceeded in November 1981. |
| 02- -82F | "7500 gallons of water contaminated to $1.5 \times 10^{+5}$ d/m/ml beta-gamma was transferred from F-area catch tank to Tank 7." Cause: "unusually heavy rains." |
| 02- -82F | Monthly releases for a number of beta-gamma emitters exceeded release guides to seepage basins and to Four-Mile Creek in December 81. They "had already exceeded the annual guide." |
| 02-01-82F | "Leak in No. 3 valve house. Smears showed 3500 c/m beta-gamma in drain." |
| 02-21-82F | Radioactive liquid "came out of gang valve" accidentally while flushing. "Radiation 5 mrad/5 mr and floor under gang valve where it leaked was 15,000 beta-gamma." |
| 02-24-82F | 87,000 gallons of segregated cooling water diverted in February. [Radio-activity levels not cited.] |
| 03-01-82F | Tank #7 HEPA filter tested 99.5% efficient. |
| 03-25-82F | Failure of cooling coil on neutralization tank 12.1. Tank vessel replaced. 1.63 million gallons diverted. ".08 total beta-gamma Ci." |
| 03-26-82F | "Canyon is draining 281-5F basin to 281-8F basin. Total gallons to be drained – 380,000. Contamination was 164 d/m/ml." |
| 04-15-82F | 281-8F retention basin, 530 gallons of slightly contaminated water. 5 d/m/ml beta-gamma, was pumped to Four Mile Creek." |
| 04-22-82F | "Canyon diverted segregated cooling water to 281-8F...2,000 d/m/ml alpha." |

(no comment identified)

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(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04-28-82F | Tank #17 HEPA filter tested only 99.6% efficient. |
| 05-17-82F | Changed hose from interarea pump pit leaked water radiating 1000 mr/hr. on top of cell cover. |
| 05-17-82F | Regulated tools taken to truck. 9 *square* feet of truck bed contaminated to "15,000 c/m...beta-gamma fixed and 125 c/m beta-gamma transferable." |
| 06- -82F | Zr-95 and Ru-103 releases to seepage basin *exceeded* monthly guide in April "due to decreased recycle of acid recovery unit." Zr-95 also *exceeded* in May for the same reason [entry date 07- -82F]. |
| 06- -82F | 1.36 million gallons of cooling water containing about 24 millicuries transferred from the *retention* basins to *seepage* basin "677,000 gallons of slightly contaminated water transferred to creek releasing approximately 9 millicuries." |
| 07- -82F | 720,000 gallons *rainwater* transferred from retention basin to Four Mile Creek on July 13 and 15. Estimated activity released. 4.21 millicuries beta-gamma and 0.82 millicuries alpha. |
| 07- -82F | Sr-89, 90 and other beta-gamma releases in May *exceeded* monthly guide to the Creek. May release of Sr-89,90 was 35 curies compared to monthly guide of 2.916 curies. |
| 07-26-82F | HEPA filter test results: Tank No. 1 - 99.92%; #2 - 99.35%; #3 - 99.80%; #4 greater than 99.97%; #8 - 99.93%. |
| 08- -82F | June Sr-89.90 release to creek 3.12 mCi [Monthly guide stated as 2.916 curies in previous (July) entry and 2.916 millicuries in this entry.] |
| 09- -82F | 241-F, Tank #33. "Breakthrough of the tank purge exhaust system HEPA filter caused an atmospheric release of an estimated 325 microcuries of Cs-137." Filters replaced. |
| 11- -82F | P-30 A manhole plugged and overflowed while pumping salt and sand from 281-8F retention basin. 2000 sq. ft. contaminated from 4,000 c/m to 15,000 c/m. "Contaminated soil was removed and the area returned to normal on 11/4/82." |
| 11- -82F | 200 sq. ft. asphalt and soil to a depth of 4 to 6 inches removed - contaminated by leak. "Radiation level reduced terom 1.5 R/hr to 200 mr/hr at 5 cm." Body exposure dose rates to 1 R/hr. Total worker exposure to 27 workers estimated at 940 mr. |
| 11-03-82F | 2000 sq. ft. ground area contaminated from 4,000 c/m to 5,000 c/m. Process sewer plugged from silt and mud being removed from 281-8F retention basin. "The potential existed for a larger quantity of radioisotopes to be released to area if the overflow had not been detected." |
| | F AREA LISTING COMPLETE |

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| | H AREA LISTING BEGINS |
| 04-00-58H | "241-H, Tank 9. Concern for severai airborne contamination if dehumidification system is not equipped with filtering device and a more annulus flushing. |
| 01-00-59H | "Ground water leak contaminates diversion box. Groundwater leak into catch tank at 300 gallons a day since 11/57." |
| 05- -60H | "H-canyon jumpers shipped to burial ground. 5 R/hr at 1 ft. from box. Maximum contamination 60,000 c/m beta-gamma." |
| 10-00-60H | "High activity waste was detected in water discharged from a well around Tank 16." |
| 03-00-66H | "About 4 curies of Cs-137 was released to segregated water while unplugging waste evaporator bottoms discharge line." "Sent flow to 281-3 retention basin for 7 hours. There was no release to 4 Mile Creek." |
| 12-00-66H | "Leak - environmental contamination. Liquid backed up the water flush line and leaked out ground and pavement near the backflush riser at Tank 24." |
| 02-01-67H | Leak of high level waste due to rupture of flexible pipe. "50 gallons of slurry contaminated approximately 1000 square feet of the ground surface and equipment." Ground contaminated to 200 mrad/hr. at 6 inches was temporarily covered with earth and sprayed with asphalt to immobolize the activity. 2 workers had "slight nasal contamination" but bioassay was "negative." |
| 04-00-67H | "Released waste. During repairs to an evaporator gang valve a leak caused extensive contamination." No further information. |
| 04-10-67H | "Contamination of ground area" during resin removal from cesium removal column. 1 gallon contaminated water fell on ground. |
| 05-01-67H | "An estimated 100-200 gallons of highly radioactive liquid waste containing 1500-2000 Ci (90% Cs-137), overflowed from riser 6 of waste tank 9 in 241-H. Crystalized salts plugged the 2 foot diameter riser causing waste to overflow the riser. The waste flowed across the ground following the grade to the lip of an open storm sewer." 1200 sq. ft. of earth and asphalt had "radiation intensities to 100 R/hr at 1 ft. The storm sewer effluent was impounded within a few hours by constructing a dam near the sewer outfall. The impounded water was pumped to 281-3H retention basin (Z ci) and the seepage basin (4 Ci). The storm sewer was subsequently flushed with clean water. Flow of water was discontinued through the most highly contaminated portion of natural stream bed at the sewer outfall and downstream of the temporary impoundment dam. Some of the waste escaped into Four Mile Creek and as of May 29, 16.62, 9.32 and 0.47 curies had passed sample points at Road 4, C and A respectively." No release detected in Savannah River. Ground covered with earth to "Immobolize radiation." About 150 cubic yards containing an estimated 1200 curies taken and buried in burial ground. "Rainwater caused overflow of small dam at sewer." NOTE: Uncertainty about quantity of leakage and escaped activity. |
| 07-00-67H | "Cs releases from the 5/67 tank 9 incident in the Four Mile Creek are tabulated as of 7/24/67 - see DPSP 67-1-7, on page 405." |

(no comment identified)

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## ENVIRONMENTAL CONTAMINATIONS, Page 9

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 07-24-67H | "Cesium released to Four Mile Creek as of July 24 was measured as follows. 26.7, 16.1 and 0.9 total curies passing sample point at Roads 4, C and A respectively." |
| 02-05-69H | "About 1 Ci" Cs-137 released to ground near tank 9. Estimated 0.5 Ci flowed into Four Mile Creek. 6 cu. yds. of earth and asphalt containing 0.5 Ci removed to burial ground. Total worker exposure was 5.8 R. |
| 12-22-69H | "Poor performance" of zeolite column is causing Cs-137 to be released to seepage basin. [Quantity and period not cited.] |
| 01-00-71H | Radiation from tank 32 vent continues to increase. Magnitude not cited. |
| 12- -71H | 0.2 m Ci to storm sewer. 200 sq. ft. asphalt "contaminated 1000 c/m beta-gamma at 1 inch. 100 gallons process liquid overflowed from E.P. 4 and 5 overheads." Further overflow recorded 12-09-71. Samples from sewer outfall were 20 d/m/ml. |
| 01- -72H | Tank 29 HEPA filter "efficiency less than the required 99.9%. |
| 08-00-73H | "Contaminated water from water addition system under tank 16 pumped to seepage basin." |
| 09-28-73H | "An estimated 2 gallons of contaminated liquid spilled...during attempts to remove salt blockage...between Tank 29 and the CTS system. A 5 foot by 20 foot area was contaminated to 500 mr/hr. at 3 feet above the asphalt." Rain storm fed activity into sewer "which was diverted to the seepage basins." Estimated release to the plant streams of Cs-137 is 20 microcuries and 200 microcuries to the seepage basin. "Personnel received an estimated 1.8 R exposure during cleanup operations." |
| 11-00-73H | Leak and subsequent rain contaminated 600 sq. ft. to 1 rad/hr at 2 inches of ground deposited from the top of Tank 13. |
| 04-00-74H | Evaporator concrete pad "highly contaminated and an additional 300 feet square ground was contaminated with low level radiation." |
| 05-08-74H | "Trebler sample [routine] off at 10 am, counted 38,348 d/m/ml beta-gamma and 96 d/m/ml alpha [119,000 gallons]. Total release calculated 8 curies gross beta-gamma and 0.019 curies gross alpha." |
| 06-11-74H | "Air sample at piping from catch tank...Sample calculation] 48.5 x $10^{-9}$ microcuries Pu/cc and 11.044 x $10^{-12}$ microcuries Pu/cc. |
| 06-24-74H | Tank 29 water valve contaminated - "3000 mrad/hr at 2 inch beta-gamma. Valve connection radiating 40 rads/10R/hr. at 3 inches...Air sample taken downwind at approximately 10 feet; $2^{-6}$ x $10^{-10}$ microCi FP/cc and 64 x $10^{-12}$ microcuries Pu/cc of air..." |
| 08-16-74H | Tank 23 dip tube left in a trailer overnight before shipment to burial ground. Contaminated shoes and trousers of 6 workers and 35 sq. ft. of asphalt. |

(no comment identified)

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## ENVIRONMENTAL CONTAMINATIONS, Page 10

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 08-28-74H | Liquid spilled on hut floor during reel tape change. Tanks 9 and 12. Radiation to 25 rads/hr at 2 inches. |
| 10- -74H | Monthly release of Cs-134 to streams exceeded guide of 8.33 mci for Sept. due to "runoff water from waste tank farms." [Indicated a high level of contamination of the soil in the waste tank areas.] |
| 11-06-74H | "Transfer between Tank 29 to 21 gassed out today. Steam visible... ground area at filter radiating 120 mrad/hr. C. at 1 inch..." |
| 11- -74H | About 130 gallons of liquid waste "generated in RBOF" containing 1.9 micro curies/gallon Cs-137 sent to seepage basin. Total radioactivity discharged about 0.6 Ci. |
| 11-11-74H | 907-4H and Water monitor alarmed. "Water samples indicated up to 99 d/m/ml beta-gamma." |
| 12- -74F | "Sightglass on cesium removal column froze and burst." Four gallons evaplorator] overheads spilled on top of Tank 9. "Less than 2,500 d/m gamma." No further details are given. |
| 07-25-75H<br>08-06-75H | "Tank 31 and 32 - the following filters were leaking: Tank No. 31 "A" filter on condensate exhaust (99.92%). Tank No. 32 pump filter (inlet) (95.00%)." [95% efficiency have meant large releases of radioactivity into the air. No figures cited.] Efficiency stated at 95% during 08-06-75 report in spite of filter change on 8/1/75. Tank 16 annulus filter efficiency 97.60%. |
| 08-12-75H | "907-3H monitor - water diverted." Calculated 1028 d/m/ml beta-gamma. |
| 08-14-75H | Leaking process line. "Contamination 1000 mrad/600mr hr. 25 R/hr at 2 inches from recycle line jacket." Ground contaminated. |
| 08-19-75H | "904-48G - Sample calculation 1067 d/m/ml beta-gamma F-11 d/m/ml alpha on routine sample...Source of activity appears to be Tank 23 material." |
| 09- -75H | Cs-137 contaminated water 34 gallons to 56 d/m/ml pumped from leak detection sumps of Tanks 21, 22 and 24. |
| 09-11-75H<br>09-11-75H | Tank 11. 2 leaking HEPA filters replaced. |
| 09-12-75H | Tank 16 annulus exhaust filters leaking and found installed backwards. Filters changed. |
| 10- -75H | Exhaust filters for Tanks 29 and 31 changed. Old filters radiating 1-5 RH 10R at 3 inches. |
| 10-09-75H | "Tanks 21 and 22 - purge inlet filters...were 98.50% efficient and... for Tanks 23 and 24, 99.80% efficient." |
| 10-27-75H | "CTS - liquid detector alarmed..." samples was "less 1000 c/m beta-gamma and less 500 d/m alpha." |

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 11- -75H | Ladder contaminated to 20,000 c/m fixed beta-gamma put in clean scrap and sent to salvage yard. [Apparent safety violation.] |
| 11-14-75H | "Overflow of 242-H concentrate pump tank to sump. 50 gallon of very dilute waste. 13 Ci of 137cs. Failure to follow approved procedures and false liquid level readings." |
| 01- -76H | 1975 annual release guide of 4 Ci for Cs-137 exceeded. Total 1975 release 6.22 curies. 2.25 Ci released in December 75. Cause believed to be loosening of sediment in line between H area and seepage basin. |
| 03-03-76H | "907-2H...water diverted." Samples up to 125 d/m/ml. |
| 03-15-76H | 907-5H water diverted to retention basin. 666 d/m beta-gamma and 3 d/m/ml alpha in water sample. |
| 03-04-76H<br>03-06-76H | Low efficiency for HEPA filters on tanks 9, 12 and 16. |
| 06-01-76H<br>06-16-76H<br>06-28-76H | Tank 29. Air sample 15 feet downwind $3.05 \times 10^{-9}$ microCi FP/cc and $75 \times 10^{-12}$ microCi Pu/cc duirng change of demister. Similar levels ($1.6 \times 10^{-9}$ and $12^{-9} \times 10^{-12}$ respectively) downwind of annulus plug on tank 16. $11 \times 10^{-12}$ microcuries Pu/cc near Tank 16 on 06-28-76. |
| 07-06-76H | $14 \times 10^{-12}$ microCi Pu/cc in air during work in diversion box 2. |
| 09-29-76H | "19,500 gallons (0.01 Ci) waste tank cooling water leaked under road... Circumferential break (in the pipe) due to heavy loads on road." |
| 12-17-76H<br>01-04-77H | "Filter tested 90.00%. New construction. Location not specified." 96.00% on 01-04-77H. |
| 01-26-77H | Line or jet pluggage. Ground contaminated up to 1 R/hr. Ten pairs of shoes contaminated 15,000 c/m, 3 vehicles had contamination — "all decontaminated." |
| 03-16-77H | Liquid spill in diversion box 2. Dose rate increased from 1-5 R/hr. to 30 R/hr. Air sample 3 meters downwind showed $8 \times 10^{-9}$ microCi FP/cc. Total worker exposure 0.5R. |
| 04-18-77H | Purge filter on Tank 31 tested only 90.00% efficient. |
| 05-01-77H | "The 221-H circulating water has been increasing in alpha activity. If it continues the C.W. will have to be diverted to seepage. The 5:30 sample had 8 c/m alpha." |
| 05-03-77H | Tank 29 filter tested 90.60%. Tank 24: 99.29%. |
| 06-09-77H | Tank 29 filter tested 99.80%. "Replaced because of high radiation." |

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 06-15-77H | Similar changes on same day on other Tank 29 and Tank 31 filters. But poor efficiencies seen again on 06-15-77. (99.30 to 99.88%) and 06-20-77. |
| 08-01-77H | "Liquid high level waste leaked from transfer line as waste was pumped from Tank 16 annulus to tank 14. Line thought to be acketed was in fact unjacketed 2-inch carbon steel with no waterproofing. Presence of jacket never confirmed. No prints available. Tech. std. violation. About 400 gallons of salt solution and about 500 Ci Cs-137 leaked into earthen berm over line. Pipe failed from corrosion." |
| 08-01-77H<br>08-10-77H | Radiation rates to 15 rads/10R/hr. at 5 cm. during start of clean-up and up to 40 rads/30R/hr. after pipe and some dirt removed. [entry of 08-10-77] Pipe and some soil slipped to 643-6. Air samples: $2.5 \times 10^{-9}$ micro Ci FP/cc and $7.8 \times 10^{-12}$ microCi Pu/cc. |
| 09-07-77H | 221-H cooling water diverted to 281-8H "when alpha contamination was detected (max. of 190 d/m/ml)." After 4 hours alpha was 3 to 11 d/m. |
| 10-04-77H | Tank 35 intake filter 99.60%. Tank 37 intake filter 97.50%. |
| 10-10-77H | Valve stuck open on waste evaporator overheads tank. 0.34 Ci of Cs-137 sent to seepage basin. |
| 11-07-77H | Warners pond area bushes showed contamination to 6000 c/m beta-gamma. |
| 12-02-77H | Water monitor-3H. "Beta-gamma 28 c/m/ml = 235 d/m/ml = $1.0 \times 10^{-4}$ microCi/ml." |
| 03-08-78H | Water leaking out of seepage basin line. Extent of contamination, if any, not given. |
| 07-19-78H | Tank #13 top contaminated up to 1R/hr during HEPA filter installation. "Soil moved to burial ground." |
| 08-16-78H | "Misvalving released 2-3 Ci of Cs-137 to H seepage basin [about one-third of annual guide] in one week." |
| 09-08-78H | "904-8G...trebler sample calculated 65,000 [d/m/ml. 1.42 curie based on 128,400 gallons released." Composition of release given. |
| 09-21-78H | Pluggage of cooling water line to high level waste neutralization tank and cooling coil leak. "134,000 d/m/ml beta-gamma and 443 d/m/ml alpha measured at 281-4H monitor house." Diverted to 281-8H retension basin: "This incident put 1.7 million gallon of water containing 30 curies in retention basin 281-8H, capacity is 5.2 million gallon. Twice water overflowed a manhole in route to the seepage. The overflow and other water discharged per procedure to Four Mile Creek released 11.5 MCi." |
| 09-25-78H | Diversion box overflowed while diverting water to 281-1. Soil leading to ditch at Warner's pond contaminated to 40,000 c/m beta-gamma. [NOTE: repair work given to contractor (date book entry dated 10-10-78).] |
| 05-23-78H | 281-8H: contaminated soil from around this basin being sent to burial ground. 17 truckloads to date. |

(no comment identified)

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(no comment identified)

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 07-29-79H | "Environmental well pump is leaking and flowing between tanks 15 and 16. Analyzed 15 d/m/ml beta-gamma and 0 d/m alpha." |
| 09-07-79H | Waste leaked into pit during repairs. Exposure rate event from 600 mr/hr. to 3 R/hr. Total exposure not given. |
| 09-17-79H | Leak due to corroded pipes - they were improperly fabricated. Earth contaminated to 3000 mrad/hr at 2 inches. |
| 11-05-79H | Cesium removal column. Valve leaked and an "area approx. 10 feet long [contaminated] to 15,000 c/m beta-gamma." |
| 03-07-80H | Spill over top of pan being transported to burial ground contaminated 2 areas, including one near building 643-G receiving area to 2000 c/m. |
| 03-17-80H | Waste truck mishandling resulted in spill on top of tank 21 contaminating ground up to 20,000 c/m beta-gamma. |
| 04-30-80H | Old CTS ventilation system - filter accidentally separated from housing during removal. Plastic under filter contaminated to 400 mr/hr transferable. |
| 09-05-80H | "The new purge ventilation system for tanks 23 and 24 was placed in service without a HEPA filter and operated from September 5 - September 10." |
| 09-10-80H | "Changed air sample for tanker [?] 23 and 24 exhaust. 4.1 x $10^{-12}$ microCi Pu/cc air, 10 ft. south of tanks 23 and 24 exhaust filter." |
| 12- -80H | "Exposure rates to 2 R/hr. were encountered during removal of a concrete pill box from Tank 9. The soil underneath the pill box is contaminated and will be removed at a later time." Soil removed in 01-81. 7.5 cubic yards contained 115 curies. Taken to burial ground. |
| 01-06-81H | "Charging hopper of cesium removal column backed up overflowing onto ground and asphalt which were contaminated to 40,000 c/m beta-gamma at 9 inches." |
| 01-14-81H | "Water coming from tank no. 14 and running across road smeared less than 1000 c/m beta gamma and less than 500 d/m alpha." |
| 01-16-81H | Sand and asphalt around riser 4, Tank 15 contaminated to 5 rads/hr at 8 cm. Removed. |
| 02-05-81H | Leak in line during welding work. [Tanks 14.] "Swipe indicated 30 mrads/hr. Area was covered with plastic." |
| 02-12-81H | Tank 29 drop valve. "100 mrad smearable, 500 mr probe at 3 inches on the ground...600 c/m to 100 mrad. Ground is iced and also the liquid at tank. Employee had 200 c/m on his hand, it cleaned up. He had 1000 c/m on right pants knee...contaminated asphalt removed 2/22." |
| 03-17-81H | Tank 24 HEPA filter 99.92% efficient. |
| 03-30-81H | Segregated cooling water [sample 289 d/m/ml beta-gamma] diverted to 281-8H. [Quantity not stated.] |

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(no comment identified)

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04-20-81H | "Liquid was found coming out of the air vent to the draw-off valve Tank 31, liquid was smearing to 1000 mr. |
| 05-05-81H | Segregated cooling water sent to seepage basin "for 3 days...as a result of high activity." Cause, quantities, sample measurements not given. |
| 06- -81H | 0.294 Ci of Ci-144 released to seepage basin during 4/81, compared to "monthly guide" of 0.125 Ci. |
| 06-25-81H | Liquid, up to 400 mrad smearable, found on top of riser 3, tank 13. |
| 08-06-81H | "Tank 13 - HEPA radiation level remains the same the slight [2 R/hr. at 8 cms. and 10 m/hr. at rope.] |
| 09-01-81H | Liquid leak onto riser and tank area, Tank #13. "Maximum smearable 60,000 c/m beta-gamma, less than 500 d/m alpha detected liquid." |
| 09-26-81H | Ground under leaking CRC column filter "radiates to 10,000 c/m." |
| 10-14-81H | "Overflow from cesium removal column due to wear on valve no. 32, teflon seats worn due to zeolite particles. Potential for serious release. 32 sq. ft. of ground and hopper contaminated to 200 mrad/hr...1/2 gallon." |
| 10-28-81H | DB-4 hut area: 1 sq. ft. soil contaminated to 15 mrads/hr. |
| 11- -81H<br>01- -82H | August releases of Ci-144 and tritium to seepage basin exceeded monthly guide. Tritium exceeded guide in July as well. "The year-to-date release of Ci-144 [1.701 curies] has exceeded the annual guides of 1.5 curies." "Sr-90 release has exceeded...the annual guide of 0.600 curies." Ci-144 increased to 2.005 Ci by November. |
| 12- -81H | 15,100 gallons of contaminated water to seepage basin in 3 transfers. "One transfer of 6,500 gallons measured 3,070 d/m/ml, exceeding the limit." |
| 12-01-81H | Fire burned 3000 square feet bank near 241-H. |
| 01- -82H | 5700 gallons contaminated water, 3250 d/m/ml beta-gamma and 1 d/m/ml alpha sent to seepage basin in the month. Activity exceeded release limit of 1500 d/m/ml; but was "only 2% of the monthly discharge." |
| 01- -82H | 3.5 million gallons of retention basin water released to creek from December 29 to January 5. "A sample measured 100 d/m/ml beta-gamma. 5.6 millicuries is estimated to have been released during the transfer of the last 50,000 gallons." |
| 03-18-82H | Top of Tank 13 and 1000 square feet asphalt contaminated to 10,000 c/m beta-gamma smearable. Leak due to possible crack between pill box and encasement. |
| 05- -82H | Spill during removal of mixing jet from tank #16. 2500 square feet contaminated up to 20 mrads/hr. Workers had skin and personal clothing contamination up to 40,000 c/m beta-gamma. 3 workers nasal contamination - max. was 722 d/m beta-gamma. All persons skin decontaminated using soap and water. |

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 05-12-84H<br>06- -82H | "Decontamination of ground area continues around tanks 15 and 16H. Roadway of tanks decontaminated from 30,000 c/m to 2,400 c/m." Work completed in June. |
| 06- -82H | Total of 10.1 million gallons of mud and water transferred from retention basin to seepage basin over 2 months. "No annual release guides were exceeded as a result of the cleaning." One transfer, 662,000 gallons also made to creek. "Activity...was less than minimum sensitivity of the monitors." |
| 06- -82H | Transfer of about 12,000 gallons from catch tank to seepage basin. Activity average about 1100 c/m beta-gamma and less than 1 d/m/ml alpha. Total activity released 0.02 Ci. |
| 06- -82H | March releases to H area seepage: Sr-90: 0.150 Ci. Pu-247: 0.142 Ci. |
| 06-14-82H | 600-800 gallons evaporator overheads spilled to ground from seepage basin manhole. "The release to ground was 0.5 percent of the annual guide to plant streams from F and H areas. The contamination was actually carried to the retention basin via the storm sewer system." |
| 08- -82H | 11,700 gallons water contaminated to about 450 d/m/ml [0.009 Ci] released to seepage basin. |
| 08-19-82H | 50 squre feet ground area contaminated to 20,000 c/m beta-gamma during transfer to seepage basin. |
| 10- -82H | "Beginning in August, radioactivity up to 27,000 c/m has been detected intermittently in air exhausted from the annuli of Tanks 29 and 31." Normal activity is 100-700 c/m. |
| 10- -82H | Release to seepage basin in Agusut exceeded monthly guide: Sr-90: 0.190 Ci released [guide 0.083 Ci]. |
| 10- -82H | H area outfall-52 - soil contaminated to 12,000 c/m beta-gamma excavated to improve drainage. |

(no comment identified)

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TABLE 3

TANK LEAKS AND OVERFLOWS

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04-00-61F | Tank 8 overflow. Reel tape error. Contamination of 2-2 R/hr at 2" found in well on 10-9-74 possibly from this spill. |
| 02-00-69F | Tank 1 leak. [No details given.] |
| 08-12-73F | Leakage of groundwater to 241-F catch tank. |
| 03-15-74F | Tank 18 overflow. Increased pressure caused overflow from riser. [Environmental contamination not discussed.] |
| 06-19-74F | Catch tank overfill. Instrument problems. |
| 12- -74F | Miscellaneous serious problems with tanks 4, 8, 15, 29, 31 ranging from build up of salt to reel tape malfunction. "Tank 8 drove uncontrollably on 2 occasions." |
| 04-17-74F | 4,000 c/m in Tank 7 dehumidification exhaust dust. Source unknown. Mainly Cs-137. |
| 06-30-75F | Waste solution sprayed as mist onto top pf riser cover of Tank 19. |
| 09-06-75F | Tank 19 - cracks in riser contaminate soil - 500 mrads/hr. |
| 09-06-75F | Rain leaks into annulus of Tanks 1, 4, 5, 33, 34. [Frequent occurrence.] |
| 11- -76F | 2230 gallon groundwater in leakage to catch Tank. |
| 12-11-76F | 67,000 gallon rain to waste tanks. Operating error during construction. Tank 7 above mx. operating level and 4.2 below max. fill limit. |
| 03-08-77F | Crack in tank sealer. "Steam and condensate seeping out." Tank No. 6. 10,000 c/m beta-gamma; 4,000 d/min. alpha. |
| 05-29-77F | Tank 7 feed pump packing leak. 1,500 mrad/200 mr/hr at 5 cm. |
| 02-09-78F | "Solution backup flush water tank overflow and it reads from 7 to 25 rads/hr." |
| 07-25-79F | Lightning struck surge tank level instrument. Tank overflowed to chromate water tank. Chromate water tank full because the pump is inoperable." |
| 12-24-79F | "Underground water leak between Tank 2 and 4." |
| 01-04-80F | Condensate leaking from bottom hole at Tank 27 filter encasement. Condensate drain valve cracked. Liquid reading 20 mrads/hr at 5 cms. |
| 05-22-80F | 5600 lb. of 51% nitric acid overflowed tank 35 and went to seepage basin. Cause: valve leak. |

(no comment identified)

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-07-81F | Tank 14: Small crack found. Sealed itself after "a very small leak occurred." "Tank 14 has a history of inactive leak sites, and this additional crack does not significantly change the tank integrity." |
| 06-20-81F | Nozzle 6 leaking. Stopped transfer from Tank 26 to Tank 47. Extent of contamination, if any, not cited. |
| 07-21-82F | 241-F - Tank #26. Line leaking - "probed 45 mrad/5 mr/hr. at 5 cms and smeared 30,000 c/m beta-gamma and less than 500 d/m alpha." |
| 08- -82F | Rainwater in leakage into annulus of tanks 40H and 47F. "The leaking penetration on tank 40 was found when a cooling water line near the penetration ruptured." |
| 08- -82F | "The catch tank collected...6,044 gallons of ground water that leaked into the encasements. 408 gallons were collected in the previous report period. |
| 10-02-82F | High level waste required more sodium hydroxide for neutralization than tank 12.1 could hold. 300 lbs. of solution overflowed onto cell floor. |
| | F AREA LISTING COMPLETE |
| | H AREA LISTING BEGINS |
| 05-27-59H | "Tank 14 leaking." (No further information.) |
| 07-10-59H | "Tank 10 leaking - this is the third apparent leak in H area waste tank farm. Tank 9 and 14 are also leaking." |
| 11-00-59H | "241-H leak. Waste detected in annular space of tank 16." No measurements of activity in or near annulus given. |
| 03-00-60H | "241-H leak. Tank 14." |
| 07-00-60H | "Leaking tank. Tanks 14 and 16." |
| 09-08-60H | "Tank 16. Waste leaking into annulus at rate of 0.2 inch increase/hour." |
| 10-00-60H | "241-H leak. High activity waste was detected in water discharged from a well around Tank 16." No measurements given. Test north of tank also showed activity. Also activity beneath contructions pad. (Entries 11-07-60 and 12-01-60.) |
| 06-17-61H | "Tank 16. Many leaks observed...in annulus space." |
| 06-22-61H | "Tank 9. About 850 gallons waste leaked into annulus in a week. Total about 5000 gallons." |
| 9-19-61H | "Tank 10. Leak into annulus - solids have been visible for 2 years." |

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-31-67H | Waste tank 10 - high pressure water flange leak. Leak developed "while line was under 2000 lbs. of pressure. Potential danger to personnel." |
| 01- -71H | "Increase of 84 inches noted in tank 21 leak detention sump." Max. activity "200 c/m/ml gross beta-gamma and 29 counts Cs-137. Source of activity unknown." |
| 03-00-71H<br>04-00-71H | Tank 21 sump leak 36 gallons/day. Cause unknown. Activity about 30 c/m/ml.<br>Pump out continues for months. |
| 04-00-73H | Tank 21 contaminated water accumulates in bottom leak detention sump. Many tanks have this problem in the H-area. |
| 07-00-73H | "Unexplained increase in Tank 10 liquid level." In August same for Tank 9. |
| 09-00-73H | "Evidence of leakage of groundwater in...Tank 24." |
| 04-01-80H | Underground water leak into annulus of Tank 11. |
| 01- -82H | New leak found in Tank 14 - "inactive." "About 40 other leak sites have been previously detected in Tank 14." |
| 06- -82H | Several hundred gallons water in leakage tank 40 annulus. Inadequate sealing. Water carried some clay into annulus. |
| 09-18-82H | 4800 gallons rainwater entered tank 11H through inadequate seals to tank risers...A means existed for uncontrolled water addition to tank. Causes: heavy rain plus failure to repair cracks soon enough. |
| 10- -82H | 4600 gallons rainwater into Tank 11 through riser #1. |

(no comment identified)

TABLE 4

TANK SYSTEM FAILURES AND PROBLEMS

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 08-00-56F | Cooling water to tank 3 shut off for 2 days due to "operating error." |
| 12-01-64F | Error shut off cooling water for "several hours." |
| 01-28-69F | Cooling water contaminated to 80,000 cis./m/ml due to operating error. |
| 03-21-69F | Tank 7. "Half of cooling coil orifices plugged." |
| 12- -74F | 64 leaks total in cooling coils of Tanks 1, 2, 3, 8, 9, 10, 11, and 14 – presumably for 1974. |
| 10- -75F | Waste tank cooling water contaminated due to leaks. 4300 d/m/ml of Cs-137. |
| 09-19-79F | Failure of refractory band on new tank (#26) before radioactive service. Corrosion caused by heating caused high carbon steel to crack. |
| 10-16-79F | "Reheat box on Tank 7 drain line increased in radiation to 25 R/hr at drain line." After flushing radiation reading down to 1 R/hr. |
| 01-10-80F<br>01-11-80F | Several unexplained entries called "non-routine maintenance" on various tanks. [Many similar entries thereafter also.] |
| 01-21-80F | Sample taken six months prior to entry date "was outside technical standard limits for the prevention of nitrate-induced stress corrosion cracking." |
| 04-06-80F | Vent line on cesium removal column radiated at 2500 mr/hr at 5 cms. "Vamp on Tank 19 alarmed." |
| 05-17-80F | "Flush tank L.L. [low level] is acting crazy, it has filled to overflow at anything from 20 to 60%." |
| 08- -80F | "Alpha activity in process vessel vent discharge to sand filters increased sporadically up to 20 times normal. Air sparge on Tank 16.1-2 prior to sampling of frame waste recovery product resulted in high alpha activity." |
| 10-14-80F | Radiation filed at monitor on tank 26 was 4 R/hr. Cause: "probably leaking automatic valve." |
| 05-26-81F | Tank 2. Two shaft sections of a probe disengaged. One 10 ft. section left in tank. |
| 05-27-81F | 14' long 160 lb. probe and shaft "uncoupled and fell into waste Safety champ failed. |
| 07-01-81F | 43' long dip tube (600 lbs.) fell 6 feet to bottom of tank 19. |

(no comment identified)

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| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 02- -82F | Fission product decay heat in Tank 32 increased to 20% limit due to receipt of fresh waste – i.e. to $37 \times 10^{-6}$ Btn/hr. |
| 05-13-82F | Tank 38 containing 19,000 gallons of waste "was outside technical standards for inhibitors." ["Inhibitors" inhibit tank corrosion from unneutralized high level waste.] |
| 08- -82F | Tank #27 cesium removal column (CRC) pluggage. Dead algae apparently present at inlet seem to be the cause. [CRC pluggage fairly frequent.] |
| 09-15-82F | "Unplanned transfer of Pu solution to canyon tank 9.7, due to defective valve handle installation. 46 grams of Pu accidentally transferred. Tank 9.7 contents recycled through canyon second Pu cycle." |
| 09-24-82F | 100 grams Pu again accidnetally transferred to canyon tank 9.7 due to improper valving. Tank contents again recycled through second Pu cycle. |
| | F AREA LISTING COMPLETE |
| | H AREA LISTING BEGINS |
| 02-00-58H | "Outside air purged hot jet line and got 200 mpc. Tank 9 annulus flushed and transfer line was 4.5 R/hr with 1/4 inch lead shield. Concluded they should have flushed with water somehow." |
| 05-00-58H | Tanks 10, 11, 12 gamma radiation: max. measurements 306 R/hr at 1 foot, 1.5 R/hr at 2 feet and 1240 l/hr at 1 foot respectively. |
| 05-01-61H | "Corrosion pitting to 5 mils observed" on tanks 21 and 22. |
| 12-22-66H | "Radiation. 5 R/hr. From unshielded feed line from tank 23." |
| 01-22-69H | Tank 10 cooling coil leaking. |
| 01-23-69H | Tank 14 cooling coil leaking. |
| 06-00-69H | 3 cooling coil leaks in one month. Tank 10 on 5-30-69; Tank 14 coil #10 on 6-1-69 and Tank 14, coil #4 on 6-15-69. Coils blanked off. [Cooling coil leaks frequent.] |
| 07-00-69H | "241-H, Tank 9. Exterior wall of the tank 9 reel jet riser was contaminated to 30 rads/hr. at 3 inches. Jet discharge line inside riser had failed. |
| 09-25-69H | "Cracked refractory line of new tank. Affected tanks 29 through 32." |
| 11-00-69H | 16 coil leaks in Tank 11 coils between 10-28-69 and 11-23-69 following sludge removal. "No coil leaks had previously been observed in this tank." |
| 02-00-70H | 11th leak in Tank 10 cooling coils. [Total no. of coils = 35.] Two more failed by 04-00-70. Two more failed during 06-00-70. Total number of failures by 05-00-72 was 19. |

(no comment identified)

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(no comment identified)

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TANK SYSTEM FAILURES AND PROBLEMS, Page 3

| DATE AND AREA | DESCRIPTION AND COMMENTS |
| --- | --- |
| 10- -72H | Tank 32 temperature rise. Unexplained. Increased cooling reduced temperature but "sludge temperature remained at approximately 99° C." |
| 12-27-72H<br>12-27-73H | Almost same entry as for 12-27-73 of 14,000 gallons waste siphoning into annulus of Tank 14. Siphon broke. [Could be a coincidence or duplicate entry with wrong date. Annulus alarm was ignored for several hours.] |
| 07-26-74H | 5000 gallons of high level waste supernate containing up to 5000 Ci, Cs-137 inadvertently transferred to low level waste receiving tank. |
| 04- -75H | "Tank 15 smear samples taken with wet cotton swipes on the pan floor disclosed contaminated much higher than found...in 1973." Actual values not given. |
| 10-12-79H | Tanks 36 annulus: Air sample showed 746 c/m beta-gamma and 1202 c/m alpha. Alarm did not indicate high activity. |
| 04- -80H | Tank 16. 100 gallons of sludge at the bottom of tank. |
| 11- -80H<br>12- -80H | Temperature of cooling water for Tank 16 found higher than standard due to faulty air lock and heat exchanger. |
| 01-31-81H | Valving error. High heat waste sent to wrong tank. |
| 02-04-81H | "Construction has completed over eighty percent of measuring and mapping of pits in Tank 38. To date the deepest pit is 0.061. Inspection of the clearing floor is revealing hundreds of shallow pits between 30 to 60 mils deep." |
| 09-10-81H | Unsealed cooling coil penetration, Tank 38. This "allowed contaminated air to be drawn from the primary tank vapor space into the annulus." |
| 12-02-81H | Tank 32 annulus fan shut down during core drilling. "The WMO self imposed limit of 115 C on bottom temperature was exceeded due to loss of cooling air flow." |
| 02-05-82H | "A back-up system has been provided for annulus air exhaust from Tank 32H ...to prevent possible hardening of sludge onto the tank bottom upon interruption of cooling effect of airflow through the air slots under the primary tank." |
| 02-11-82H | Erroneous transfer of 18,000 gallons of concentrate supernate between tanks. |
| 04-21-82H | Radioactive waste accidentally sucked back into unshielded above ground piping. Radiation rates were 4 R/hr at 5 cm. between tank top and manual sparger valves... |
| 07- -82H | 7½ inch crack observed in Tank 16 primary wall. Longest previous observed crack was 6 inches. |
| 07-20-81 | "Uninhibited seal water" supplied to Tank 41 for 1 month in place of standard due to failure of automatic chemical addition system. |

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TABLE 5

EXPLOSIONS: POTENTIAL AND ACTUAL
(due to build up of hydrogen, ammonia, organic compounds)

| DATE AND AREA | DESCRIPTION AND COMMENTS |
| --- | --- |
| 06-00-60F | Hydrogen in Tank #8 |
| 04-00-61F | Hydrogen build-up to 95% of lower explosive limit – fan failure on tank 5 and 8. [NOTE: All percentages below refer to lower explosive limit.] |
| 05-07-62F | Hydrogen to 20%. Fan not started. |
| 07-31-62F | Hydrogen to 30%. |
| 08-29-62F | Hydrogen to 80% in Tank 4; 45% in Tank 8; and 20% in Tank 3. To 100% in Tank 2 during scheduled power outage. Operating error. |
| 05-08-64F | Tank #1 H2 would read "100% in 2-4 day" without ventilation. [Comment only.] |
| 12-12-65F | Organic solvent "degration" – fumes and smoke. |
| 10-03-66F | "Hydrogen explosion." H2 to 15% in 11½ hours. Vent blower off for 19 hrs. [Possibly an erroneous entry. Intent might have been to write possible explosion. Hydrogen explosions not mentioned in any other report.] |
| 08-30-68F | H2 to 5-15%. "Temporary blowers being used." |
| 06-26-70F | H2 to 12%. Failure to turn on hydrogen purge blower. |
| 01-16-76F | H2 to 10% in riser #7 of Tank 8. |
| 01-18-76F | H2 to 10% in Tank 18 vapor space. |
| 08-05-76F | Ammonia from added ammonia nitrate evolves in Tanks 4 and 17. |
| 08-07-76F | NH3 to 8%. |
| 06- -77F | 140 ppm ammonia in Tank 7 air exhaust. |
| 12-11-77F | Tank 8 explosimeter readings, presumably hydrogen: "4 pm = 7%; 6 pm = 6%; 8 pm = 4%; 10 pm = 3%. No smoke. Still smells same." |
| 02- -78F | Ammonia at Tank 4 purge exhaust 1000 ppm during transfer of flush solution from 221-F. |
| 12-05-78F | Tank 8 purge had 2000 ppm ammonia 12-8 shift. |
| 12-05-78F | Tank 8 purge exhaust had 1000 ppm ammonia 8-4 shift. |
| 12-06-78F | Tank 8 purge exhaust had 3000 ppm ammonia 12-8 shift. |
| 07-06-82F | "241-F PP No. 2 and 3 purge exhaust" ...ammonia 1500 ppm. |

(no comment identified)

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(no comment identified)

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EXPLOSIONS: POTENTIAL AND ACTUAL, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| | F AREA LISTING COMPLETE |
| | H AREA LISTING BEGINS |
| 06-00-56H | Hydrogen in vapor space of Tank 9 to 150%. [No forced ventilation.] |
| 07-00-60H | H2 build-up to 40% in the air space above Tanks 14 and 16." |
| 08-00-60H | Tank 14 H2 to 30%. Blower found off. |
| 12-26-61H | Tank 15. H2 to 10%. |
| 02-07-62H | "Tank 14. Leak of 25 gallon per day essentially self sealed." |
| 02-21-62H | "Tank 16. 26 previously undetected leaks seen through hole 42." |
| 08-25-64H | Tank 21, Hydrogen to 5% |
| 06-18-70H | "On 3-26-70 firecracker-like detonations occured during the removal, regasketing and reinstallation of the 242H evaporator...The potential problem from explosive compounds was emphasized when Tank 21 jet pill box was entered ...several cap-pistol pops with puffs of smoke occured on the skinless steel floor under the operators rubber overshoes." Further information in DPSP 70-1-6, pages 68-69. |
| 08-00-70H<br>09-00-70H | Silver compounds may be responsible for detonations. |
| 07-00-71H | H2 to 5% in Tank 11. |
| 01-00-71H | "Tank 32 hydrogen build-up." In leakage of air also indicated. |
| 07-16-77H | H2 to 37%. Tank 11. |
| 07-28-77H | "Tank 15 - 4% hydrogen detected today on weekly routine." |
| 08-09-77H | Tank 8 - 8% H2. |
| 12-15-77H | "Tank 35 - 350 ppm ammonia." |
| 12-31-77H<br>01-02-78H<br>01-04-78H | "First transfer from canyon to Tank 22 containing ammonia was started at 6:15 a.m." NH3 rose from 25 ppm to 450 ppm. "Next check due at 11 a.m." 650 ppm at 10:30 p.m. On January 2, 1978, HN3 reached more than 1000 ppm. Not this is an intentional transfer. Purpose not stated. 1000 ppm on 01-04-78. |
| 02-14-82H | "...hydrogen was coming out of tank [32] at 10% on explosimeter scale." |

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TABLE 6

EQUIPMENT PLUGGING

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 04-00-61F | Evaporator line plugged: contamination |
| 04-11-61F | Evaporator line plugged - waste accumulated in cell. "Radiation was 5R outside cell wall." |
| 07-06-64F | Leak due to jet pluggage. Beta-gamma contamination to 80,000 C/M |
| 02-16-67F | Evaporator bottoms line plugged. [Frequent occurrence.] |
| 04-25-67F | Concentrate transfer system [CTS] loop pump plugged. [Plugging equipment such as pumps and pipes common in this system.] |
| 10-14-68F | Steam vent lift line plugged. [Frequent problem.] |
| 11-00-69F | "4 major line plugs" in one month. |
| 07-20-78F | Lift dropvalve plugged. Evaporator down 12 hours. [Lite line problems particualrly plugging common.] |
| 08-17-78F | Extensive pluggage in recirculation pump, 301 line to Tank 34 D/O valve and instruments. |
| 03-16-79F | "some" pluggage in high level waste header #1. Removed with heated water. |
| 02-04-80F | Vent line plugged. [Frequent problem.] Evaporator down due to this and other problems. |
| 03-04-80F | Both F-area evaporators down due to line pluggage and valve problems. |
| 08-[illegible]-81F | "Evaporator down 299.5 hours. Primarily caused by plugging of both loop and vent lines..." and some other factors. |
| 11-12-81F | "CRC is plugged." Even extensive efforts to unplug it were not successful as per entry of 11-14-81. |
| | F AREA LISTING ENDS |
| | H AREA LISTING BEGINS |
| 03-15-68H | "242-H evaporator. Persistent plugging." |
| 05-23-68H | "Cs column. Plugging problems." |
| 06-10-68H | "242-H evaporator. Bottoms line plugged due to electrical power failure." |

(no comment identified)

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EQUIPMENT PLUGGING, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 09- -73H | "242-H Evaporator. 67.5 hours downtime due to pluggage of Tank 29 draw-off valve and tank loop line." |
| 01-07-74H | During unplugging of CTS tank level instrument, the tank overflowered 2000 gallons to the sump. "Sump contents returned to the system and the cell floor flushed." |
| 08-00-74H | Unsuccessful attempt to unplug high level waste header by jetting hot 25% sodium hydroxide. |
| 08-23-77H | Transfer jet to Tank 31 plugged. "Could not be removed, stuck in salt. Mining tool made of Al dissolved when lowered into tank, liquid backed up contaminated Al tubing and contaminated hut"...Worker exposure not given. |
| 10-17-80H | "Pluggage of lift line of evaporator. Attempts to catheter were unsuccessful because the lift pumper connector block was not properly designed. Pluggage was removed using caustic and acid." |

(no comment identified)

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TABLE 7

POWER SUPPLY FAILURES

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 12-20-53F, 04-04-54F<br>07-10-56F, 07-13-56F<br>07-07-57F, 07-27-57F<br>07-31-59F, 07-25-60F<br>08-08-60F, 08-14-60F<br>08-06-62F, 08-07-62F<br>06-11-63F, 07-29-64F<br>05-28-65F, 07-08-65F<br>07-17-68F, 08-18-68F<br>05-25-69F, 04-05-71F<br>07-02-71F, 07-27-71F<br>08-04-71F, 08-31-81F<br>02-20-73F, 06- -73F<br>06-18-73F, 08- -73F<br>11- -73F, 06-17-75F<br>07-18-75F, 01-29-77F<br>09-16-77F, 07-09-78F<br>06-30-79F, 08-11-79F<br>08-12-79F, 08-27-79F | Both complete and partial failures noted. Data on standby power not given as a rule. Most power failures occur during summer storms. Durations vary froms few minutes to several hours. Lightning is the most common problem. Some examples include: |
| 02-20-73F | Outage due to operator error. |
| 06-17-75F | Emergency generator did not start; then started and then failed after "several hours." |
| 02-29-77F | Emergency generator failed during routine 30 minute weekly test. |
| 09-16-77F | Diesel generator failed to start during test. |
| 06-30-79F | Electrical power from substation during storm. Er-rgency power (apparently) shorted out. No power for 10 hours in portions of area. |
| 08-11-79F | Power completely out, including emergency power (briefly). Emergency supply stuck on. "Emergency feed breaker was smoking again." |
| 09-08-81F | Emergency generator failed to start due to failure of breaker and compressor motor. Normal power failed due to electrical storm. Emergency power failed. Two apparently independent reasons. Evaporator instrumentation also lost. (Total down time or consequences not cited.) |
| | F AREA LISTING ENDS |
| | H AREA LISTING BEGINS |
| 07-31-72H | Total loss of power to wells 44, 45 and 48 and waste management substation 254-14: Loss of process cooling water make up to 241, 242, and 285-H "for a short period of time." |

(no comment identified)

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POWER SUPPLY FAILURES, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 06-15-75H | Lightning. Main power down. Emergency on. Some emergency switch gear instruments and controls damaged by lightning. |
| 09-03-78H | Main power down due to lightning. One emergency generator failed to start. 3 segregation valves failed to close. Also much equipment, including emergency power related equipment, damaged. |

(no comment identified)

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TABLE 8

PUMP FAILURES

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 03-02-64F | Feed pump motor burn out (fairly common). |
| 02-27-67F | Evaporator feed pump failure. (Frequent pump failures.) |
| 01- -68F | Concentrate transfer system pump failure - 4th time in 9 months. |
| 02-00-68F | Flash tank pump "inadvertently left off." 8 to 12 feet water accumulated in evaporator cell. |
| 07-00-68F | Tank loop pump bearing failure - 5th in 4 months. No definite solution to problem. |
| 10-00-68F | 13 day evaporator outage due to repeated pump failures. |
| 01- -71F | Jacuzzi: feed pump failed, (frequent occurence), motor bad leaking packing. |
| 04- -72F | Evaporator down 39 hours due for replacement of feed pump control valve. Extensive valve problems in evaporator pumping area. |
| 05-10-79F | Concentrate Transfer System pump failed. Evaporator shut down. |
| 07-17-79F | Lightning struck near west pump house "knocking out power to all c.w. pumps" 2 blown fuses. Emergency power circuit was open (apparently due to lightning). Possible common mode failure. |
| 01-25-80F | "Evaporator feed pump failed." |
| 07-06-80F | Tank 26 feed pump failed, 242-16F. Evaporator down 334 hours, caused by motor winding short circuit. |
| 03-05-82F | Tank #26 feed pump failed March 5 after 1 year of operation. New pump failed in 6 days. Both due to short circuits in motor. "Ar/hr at 0.5 meter above open riser hole." |
| | F AREA LISTING ENDS |
| | H AREA LISTING BEGINS |
| 10-00-68H | Failed transfer pump being reconditioned for use. (These pumps are radioactive.) |
| 01-26-81H | "Evaporator-replaced chems pump -- 40 mrad/40/hr general area." Nature of problem and total exposure not given. |
| 08-05-81H | Evaporator 1-H: down 357.5 hours "primarily due to a failed CTS recirculating pump." Down again for 1 month (09-20-81 entry) due to pump failure. |

(no comment identified)

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(no comment identified)

TABLE 9

INSTRUMENT PROBLEMS

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 01-17-63F | "Extensive troubles: due to water and oil in instrument airlines. |
| 03-25-65F | Tank 7. "Necklace Alarm from heavy rains. Alarm disconnected." |
| 07-16-65F | Instrument air lost [Frequent air compressor problems.] |
| 08-10-65F | Entire alarm system inoperative. |
| 09-03-68F | "Mass spec. and explosimeter readings on H2 in tanks differ up to one decade." |
| 01- -71F | Tank 3 reel tape assembly failed. [Very frequent problems with reel tapes.] |
| 11-00-72F | "Reel tape reads erroneously when it comes into contact with salt." |
| 05-01-74F | "Serious problems" on new reel tapes for several tanks - "May hinder reliability in the future." |
| 06- -74F | Erroneous annulus alarm during heavy rain occur "very frequently." |
| 10-07-75F | High Activity alarm goes off. Apparently a false alarm. [Frequent occurence.] |
| 10-30-75F | "241-F South vamp is out of order." [Frequent problems with Vamp.] |
| 11-06-75F | On Tank 5, Vamp gave false alarm. Unplugged. |
| 07-06-76F | New solid state temperature recorders' performance "very poor." |
| 07-03-76F | Storm sewer radiation alarm. Activity less than "HS." Frequent. |
| 08-26-76F | South vamp monitor out. Fail safe light is out 5 days. |
| 05-05-77F | F area evaporator start-up. Several instrument failures due to freezing. |
| 07- -77F | Lightning damaged circuits in evaporator alarm system. Repan - 48 hours. |
| 08-02-77F | "Left palm on hand and shoe monitor will not respond to source." [Very frequent problem with these gauges.] |
| 10-26-78F | "Victoreen defective on 907-3F water monitor." [Frequent problems with victoreen.] |
| 11-09-78F | Reel for Tank 7 dropped. 4 shifts to replace tape and problem. No exposures given. |
| 01-18-79F | "Hand and foot counter in 242-F control room repaired." |

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INSTRUMENT PROBLEMS, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 05-17-79F | "Storm water monitor not operating." |
| 05-31-79F | "Amplifiers for radiation monitor...was returned to normal service." |
| 06-20-79F | "Tank 37 annulus alarm. No apparent cause, probably instruments." |
| 06-25-79F | A number of switches on a monitor shorted to ground. Probably lightning. |
| 11-21-79F | "Tank 28 hydrogen analyzes is out of service." |
| 05-29-80F | "Hydrogen analyser for Tanks 44-47 need more work [repairing]." [Frequent problems with and repairs needed for hydrogen analysers. Many entries beginning 1978, 1979. |
| 08-08-80F | "instrument power is off at 641-F (lightning)." |
| 10- -80F | Faulty measurement causes high level waste emitting 14R/hr to be put in high level waste dumpster. |
| 12-27-80F | Water in instrument airline freezing and stopping air flow. Annulus fans 1 to 3 and 33 and 34 went off 3 times during the day as a result. |
| 06-07-81F | "Vamp alarmed at Tank 18 at 10:30 a.m. No unusual radiation. |
| | F AREA LISTING ENDS |
| | H AREA LISTING BEGINS |
| 09-00-59H | Accidental transfer of acidic waste to Tank 16 because Tank 12.1 (acid waste tank) sampler was out of order. |
| 08-04-62H | "Rain caused tank 15 annulus alarm. Cause not determined before alarm ceased." |
| 06-27-69H | Faulty reel tape. [Frequent problems with reel tapes in H area as seil.] |
| 05-25-74H | Alarms inoperable during power outage. "600 gallons of desalt-descale flush water overflowed the CTS pump tank...." |
| 01-13-77H | "907-4H and 907-3H monitors giving much trouble. Getting hi-activity alarms due to spiking victoreen." |
| 07-14-77H | Tank 35 and D86. Air monitors did not respond to beta-gamma source during test. |
| 08-10-78H | Vamp at Tank 37 would not alarm at 100 mr/hr. [This instrument needs frequent attention.] |

(no comment identified)

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(no comment identified)

TABLE 10

MISCELLANEOUS LEAKS

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| 06-26-64F | Tank 7-18 transfer line leak: 40 R/hr. on unshielded portion. |
| 07-14-64F | "Contamination line leak during test...spread contamination." |
| 01- -68F | Valve leak. 60 R/hr at 1 inch on top of riser. Tank #19. |
| 01-24-69F | "Heat exchanger. Leaking badly." |
| 09-00-70F | "Custom designed valves at end of the jumpers leaking profusely." |
| 09- -72F | Leak at valve "due to severely corroded valve plugs." |
| 09-00-73F | Contaminated water in leak detection sump. [Fairly frequent.] |
| 07- -75F | Chloride causes chipping of concrete of 2 waste liners. [Chloride cracking caused such severe problems that pipes with such coatings had to be taken out of service.] |
| 10-10-77F | Steam line leak. "Very badly" corroded. [Steam line leaks frequently.] |
| 08-03-79F | Leaking relief valve on Tank 34 Chromate cooling water piping. |
| 09- -79F | Leak in piping occured in July between diversion boxes 5 and 6 and pump pits 2 and 3. |
| 11-01-79F | Evaporator 242-F down 129 hr. due to leaking gaskets and replacement of pump motor starter. |
| 02-28-79F | "Catch tank collected 4800 gallons of groundwater that leaked into the concrete encasement." A jumper leak was found though it tested leak-free on 1/24/80. |
| 03-13-80F | Heavy rainfall flooded excavated trenches and cracked stainless steel liner of concentrate transfer system pump pit. This "constituted a loss of secondary containment for the CTS pump pit." |
| 01-26-81F | "Water dripping from steam line to evaporator in cell sump." Water reading 43,000 c/m. |
| 09-25-81F | "Waste line carbon steel jackets have suffered corrosion and one had ½ inch diameter hole in it. This is a breach of secondary containment protection required for SRP operations. The defective lines were replaced. Radiation was reduced from 1 R/hr at 5 cm to 100 mr/hr at 5 cm." |
| 08- -82F | 20,000 gallons of chromate cooling water leaked from pipe serving tanks 9-16. Leak apparently began July 9 and continued at 30-40 gallons per hour until repaired on July 29. [Chromate water losses are frequent.] 12,000 gallons lost again on 08-09-82 due to 360 break in pipe serving tanks 29-32. |

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MISCELLANEOUS LEAKS, Page 2

| DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|
| | F AREA LISTING ENDS |
| | H AREA LISTING BEGINS |
| 05-00-70H | "Substantial leakage...in the 241-H heat exchanger...The five leaking tubes were plugged." |
| 02-25-76H | Leaking valve inside pill box. Radiation levels up to 20 R/hr. at 2 inches of water flush line. |
| 01-21-78H | "Repaired many leaks in 3H water monitor. The cabinet handle broke off." |
| 02-08-78H | 40 yard section of process sewer line to seepage basin caved in, caustic soda passed through pipe. "No release of radioactive material." |
| 10-17-79H | Leak in or near preheater. Concrete pad under preheater radiated to 50 R/hr. |

(no comment identified)

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TABLE 11

MISCELLANEOUS

| TYPE OF OCCURRENCE | DATE AND AREA* | DESCRIPTION AND COMMENTS |
|---|---|---|
| GRASS FIRE | 06-29-59F | "Welding sparks caused dry grass to burn. Bucket brigade." |
| GRASS FIRE | 09-08-60F | Fire due to welding sparks. Dry chemical used to put it out. |
| VALVE FAILURES | 11-03-61F | Solenoid valve failure admitted compressed air into evaporator, emptying it. |
| VALVE PROBLEM | 12-00-64F | Valving error not discovered for 12 hours. |
| WASTE UNACCOUNTED FOR | 08-10-65F | 8,000 gallons of waste were unaccounted for in 5 days. |
| ELECTRICAL SHORT CIRCUIT | 11-28-66F | Cell spray of radioactive liquid shorted out electrical equipment. |
| SALT LOAD | 11-00-67F | Concern about salt load on cooling coils. "Thought to be safe." |
| ZEOLITE LOSS | 08-25-69F | Zeolite from Cs removal column lost in "gross" quantity. |
| PLUGGED SEWER | 07-00-71F | Could cause sewer water to flush into some tanks. |
| SNOW | 02-12-73F | "All operations shut down. Snow." |
| STEAM OUTAGE | 01- -74F | Area steam outage - 14.5 hrs. for evaporator. |
| GENERAL EVAPORATOR | 03-01-74F | 242-F evaporator down 70% of the month. Pump and instrument failures improper operation during operating period with high activity in the overhead stream. |
| VACUUM PUMP INLET CONTAMINATED | 07-25-75F | Irregular maintenance procedure. |
| CONCENTRATE TRANSFER SYSTEM VESSEL FAILURE | 08-14-75F | "Vessel radiated a maximum of 320 R/hr at side." |
| TANK ROOF LOADING | 02-10-77F | 10,000 lb. concrete cask placed on top of tank 3 without checking it loading acceptable. "Inadequate communications." No collapse. |
| FIRE ON CONSTRUCTION SITE | 03-12-77F | Fire near tank construction. Probably cause: cigarette. |
| WASTE UNACCOUNTED FOR | 04-12-77F | 900 gallons waste from canyon unaccounted for due to various problems. Transfer of waste from "canyon" to Tank Farm. |

(no comment identified)

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MISCELLANEOUS, Page 2

| TYPE OF OCCURRENCE | DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|---|
| GANG VALVE PROBLEMS | 10-03-77F | [Frequent.] |
| HIGH WIND | 01-25-78F | Earth collapse during excavation exposed 25' section of concentrate transfer pipe. CTS line sagged 6" and broke a 2" domestic water line. |
| EXCAVATION ACCIDENT | 10-17-78F | Breathing air line broken by heavy equipment during excavation. |
| EXCAVATION ACCIDENT | 10-24-78F | 1" water line broken by excavating equipment. |
| CONSTRUCTION ACCIDENT | 11-22-78F | "Construction truck driver backed over probe pipe to the Jacket South of tank 33." |
| EXCAVATION ACCIDENT | 11-27-78F | Excavation accidentally unearthed a 20' section of concentrate transfer line. "Soil under CTS collapsed allowing the CTS to sag about 10 inches. SI-78-12-138." |
| BURNED OUT MOTOR | 12-28-78F | Burned out motor on gate valve to creek removed but not replaced for 10 days. |
| INADEQUATE WASTE NEUTRALIZATION | 03-15-79F | High activity waste sent to tanks without adequate neutralization, in violation of the technical standards. |
| ASPHALT CAVING IN | 08-06-79F | "Asphalt is caving in at LDB 122 Tank 25." |
| PLASTIC COVERING CAVES | 11-02-79F | "Construction plastic covering over the end of core pipe gave way" allowing rainwater to flood several leak detection boxes. |
| SHOWER FLOODS BUILDING | 12-01-79F | "Somebody left the shower running in the ladies change room in the new building and flooded the building." |
| EVAPORATOR FAILURE | 08-13-80F | 242-F, evaporator #1 down. Evaporator put into service in 1969. Cause: Bundle tube failure. "There have now been 4 evaporator failures. 2 were in 242-F and 2 in 242-H. Service life has been 7-11 years between failures." |
| SUCK BACK TO GANG VALVE | 01-02-81F | Improper air blow leads to suckback of contaminated solution into gang valve discharge piping. "Radiation was 10 rads/10 R/hr. at 3 cms. on lower lance line in gang valve house." |
| COMPUTER PROBLEMS | 02- -81F<br>03- -81F | "Waste PHA out of service for several weeks with an inoperable floppy disk unit." "Approximately 6 hrs. downline experienced on the sample PHA." |
| CONTAMINATED WHEELS | 07-08-82F | Rear Wheels of trailer loaded with high level waste fell off. Radiation dose rate 10 mrems/hr at 3 feet from end of tank. |

(no comment identified)

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MISCELLANEOUS, Pa: .'

| TYPE OF OCCURRENCE | DATE AND AREA | DESCRIPTION AND COMMENTS |
|---|---|---|
| ACCIDENTAL CHEMICAL | 07-26-82F | "[illegible] discharged the halon fire suppressor system in the [illegible] area No. 2 evaporator control room." 4 people had to evacuate the building. |
| | F AREA LISTING ENDS | |
| | H AREA LISTING BEGINS | |
| INLEAKAGE OF RAINWATER | 05-00-65H | Pump pit #1 ~ 10 feet of water; pump tank had 4½ feet of water. Leakage of rainwater into operating areas was frequent. |
| PROBLEMS NOT RECORDED | 08-24-65H | "Prior to 8-24-65 information on instrument failure, pump failure, leaks in the waste tank system are not recorded unless the individual occurrence [sic] of particular interest. |
| NEW PIT CONTAMINATION | 02-13-80H | "New CTS pit - during air blowing of line, nozzle #24 leaked water contaminating wall to 1500 c/m and the floor to 3000 c/m beta-gamma." |
| FAILED VALVE DIAPHRAM | 07-09-80H | Failed diaphram on CTS valve. Radiation rate: 12 rad/2R/hr. "flush with open riser." |
| CONTAMINATED MOTOR | 08-05-80H | "Evaporator burped at about 9:00 pm, setting off Vamps on Tank 21 and CRC pump. Tank 5,500 mr/hr at 8 cms. and CRC tank 4,500 mr/hr at 8 cms." |
| CERIUM WINDOW SHATTERED | 01-04-82H | "15 psig argon gas was applied to the annulus of the repair cell shielded window [299-H] with the annulus vent valve closed. The pressure shattered a cerium glass section of the window." |
| VITRIFIED CLAY LINE | 03-12-82H | "The vitrified clay pipe seepage basin line in the H-area is being replaced with a new polyetheylene line." |
| MOTOR ROTATING BACKWARDS | 04-29-82H | Recirculating pump motor rotating backwards. Switched electrical connections. |
| WASTE BOX FIRE | 06-24-82H | "A waste box and its contents were ignited after coming in contact with hot metal slag in the 22-H warm sample isle. An explosion could have occurred along with the personnel injury due to the fire." |

(no comment identified)

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TABLE 1

Release Guides for Seperations Areas* 1978 (Curies/Year)

| Element | Release Guide to Seepage basins | Release Guide to atmosphere | Total |
|---|---|---|---|
| tritium | 39,000 | 75,000 | 114,000 |
| krypton-85 | - | 950,000 | 950,000 |
| strontium-89 | 0.7 | - | 0.7 |
| strontium-90 | 0.8 | - | 0.8 |
| iodine-131 | 1.5 | 0.5 | 2.0 |
| cesium-134 | 1.4 | .0005 | 1.4 |
| cesium-135 | 10.0 | .003 | 10.0 |
| uranium-235+ uranium-238 | - | 0.01 | 0.01 |
| plutonium-238 plutonium-239 | | 0.001 | 0.001 |

*Savannah River Plant

(no comment identified)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 12

OFFICE OF
EXTERNAL AFFAIRS

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SEP 18 1986 0243
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Mr. Jerry White, Director
Waste Management Division
Department of Energy
Richland, Washington 99352

Dear Mr. White:

In accordance with the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Department of Energy's (DOE) Draft Environmental Impact Statement (DEIS) for the Disposal of Hanford Defense
2.2.1 High-Level, Transuranic and Tank Wastes at the Hanford Site, Richland, Washington. This DEIS evaluates the environmental impacts of three options for the permanent disposal of these wastes, in addition to a "no action" option for continued waste storage in high-level tanks at Hanford. The DEIS also considers the impacts from disposal of transuranic (TRU) wastes buried both before and after 1970 and possible remedial action for TRU-contaminated soils. EPA supports DOE's efforts in this DEIS to address the regulatory and technical issues involved in disposal of these wastes in an environmentally safe manner.

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The DEIS has three disposal options. In the first of these options
3.3.4.1 ("Geologic Disposal"), most of the wastes would be solidified, packaged, and shipped to either the Waste Isolation Pilot Plant (WIPP) or a future commercial nuclear waste repository as established under the Nuclear Waste Policy Act. In the second option ("In Place Disposal"), all wastes would be left at Hanford with additional protective barriers against waste migration. The third option ("Combination Disposal") consists of solidifying and shipping to repositories those wastes that are retrievable, and disposal in place of those wastes that are not readily retrievable. Although the DEIS presents a "no disposal action" alternative, EPA does not consider this an environmentally viable option; it should serve only as a basis for comparison and to meet the requirement of NEPA for consideration of such an option.

Hanford has also been designated as one of the three final sites to undergo further site characterization for deep geologic disposal of commercial high-level radioactive wastes. It is EPA's understanding that the site studies for the possible repository at Hanford is a separate decisionmaking process and we have not considered the acceptability of Hanford as a repository site in our review.



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DOE is required under NEPA to relate its disposal options and their impacts to the requirements of local, state, and federal regulations. With regard to EPA's statutory authorities, we have identified a number 2.4.1.1
of EPA regulatory requirements that apply to the permanent disposal of these wastes: (1) EPA's Environmental Standards for Management and Disposal of Spent Nuclear Fuel, High-level, and Transuranic Radioactive Waste (40 CFR 191) are clearly applicable to the options presented in the DEIS, with the exception of the pre-1970 buried TRU wastes; (2) the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is also applicable to this project, particularly to those activities requiring remedial action involving transuranic wastes and soils; (3) finally, because some activities at Hanford (not necessarily the disposal actions at issue in this DEIS) will require permits under the Resource Conservation and Recovery Act (RCRA), significant remedial activities at Hanford on an installation-wide basis under RCRA §3004(u) will be required for all sites containing solid-waste management units.

At this point, however, it is not clear how provisions of RCRA will apply to specific elements of DOE's radioactive waste disposal program. Section 6.6 of the DEIS states that DOE believes that the wastes addressed 2.4.1.9
in the DEIS constitute "pure" byproduct material and thus would be regulated under the Atomic Energy Act and not RCRA. However, it should be noted that all materials in underground storage tanks are subject to Subtitle I of RCRA. In addition, if it is determined that the wastes at Hanford are RCRA hazardous wastes or radioactive mixed wastes (i.e., wastes containing both RCRA wastes and Atomic Energy Act wastes), the requirements of RCRA Subtitle C must be met (see 51 Federal Register 24504, July 3, 1986). DOE has stated in the DEIS that if it is determined that these wastes are subject to Subtitle C of RCRA, DOE will comply with all applicable RCRA requirements. We expect to work with DOE in making that determination. We understand that DOE would review the disposal alternatives to determine whether compliance with RCRA requirements would result in substantial changes to the proposed action or to the environmental impacts of that action. If so, DOE would prepare a Supplemental EIS describing those modifications and their effects, and how DOE would comply with RCRA (Subtitle C and I) and with other appropriate statutory requirements in place at that time, such as the reauthorization of CERCLA currently being considered by Congress.

DOE, EPA, and the Washington Department of Ecology are currently discussing settlement of an Administrative Order (dated February 5, 1986) concerning compliance with RCRA. These same parties have also met quarterly to review the Hanford Environmental Protection Program, and, at 2.4.1.9
one such meeting on April 9, 1986, "agreed to formulate a Memorandum of Agreement defining the process for resolution of environmental issues." Although EPA is not entirely satisfied with these efforts to resolve the environmental issues at Hanford, we do believe that it is important to address the technical and regulatory issues in a comprehensive manner. In the case of the contemplated program discussed in this DEIS, EPA strongly recommends that the proposed remedial activities be considered with other similar activities at Hanford for purposes of setting priorities

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and that the proposed actions be considered as part of the comprehensive long range environmental plan at Hanford. Accordingly, EPA recommends that the Final EIS discuss this program in the context of the contemplated agreement between DOE, EPA, and the Washington Department of Ecology. The Memorandum of Agreement may provide a useful forum for agreeing to mutual objectives in the proposed program.

While this DEIS may serve as a basis for environmental assessment,
we believe that further environmental analysis is necessary to demonstrate
2.4.1.1 compliance with 40 CFR 191. We further understand that DOE plans to
utilize a performance assessment to determine whether any further NEPA
review is required. EPA expects to review and comment on the assessment
documents in draft form. Accordingly, EPA's views in this letter should
not be interpreted as agreement that any of the proposed alternatives do
or do not comply with 40 CFR 191.

The DEIS considers a number of different activities with widely
ranging environmental and financial benefits and costs. For example,
the cost of encapsulating and disposing of the strontium and cesium
2.2.1 capsules is very small. On the other hand, excavating, treating, and
disposing the pre-1970 transuranic wastes and the waste in the single
shell tanks are costly. As we see it, DOE is faced with meeting multiple
objectives in this program: 1) the applicable environmental protection
2.3.2.3 requirements should be met; 2) compliance problems should be comprehensively
addressed; 3) as much waste as feasible should be retrieved for repository
disposal; and 4) disposal should proceed in a cost-effective manner
3.3.5.3 consistent with achievement of applicable environmental requirements.

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We are prepared to support at this time some of the activities for
3.3.5.3 the program discussed in this DEIS. For example, in our view, the
alternative of disposal of the strontium and cesium capsules in a
repository would not have major impacts. Similarly, EPA could support
a decision to process and ship the retrievable TRU and double-shell tank
wastes to WIPP or another repository at the completion of this process,
since these programmatic alternatives require construction of processing
facilities. However, for decisions concerning the single-shell tank
wastes, TRU-contaminated soils, and pre-1970 buried TRU wastes, data are
not available to show compliance with environmental requirements or to
show benefits consistent with the extremely high costs. Among other
activities, a tank-by-tank analysis for chemicals and radionuclides is
needed for all the single-shell tanks to help determine what regulations
apply and what remedial actions are necessary. We also recommend preparation
of appropriate NEPA documents to support the construction of a vitrification
facility (for high-level waste) and the Waste Receiving and Processing
Facility (for TRU wastes), should DOE decide to proceed with an alternative
that requires these facilities.

3.3.3.1 EPA supports a program for the proper disposal of these wastes
and we have presumed, for the sake of this analysis, that the reference
case of "Combination Disposal" is DOE's preferred alternative. However,





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because of the numerous regulatory and technical issues still to be resolved, we are rating this option as EC-2. (Environmental Concerns, Insufficient Information. A copy of EPA's rating scheme is enclosed). The basis for our environmental concerns regarding the preferred alternative (as well as the other disposal alternatives) pertain to questions raised in our detailed comments, as well as issues of compliance with applicable environmental requirements. Additionally, EPA recommends that the "Continued Storage" option not be pursued. We also consider the information presented in the DEIS to be insufficient, especially as it relates to regulatory compliance and groundwater protection issues. Our detailed comments request additional information concerning the chemical and radioactive constituents of the waste, groundwater flow and constituents, regulatory compliance with applicable requirements and other needed data.

We look forward to working with DOE on this project. I have asked Dr. W. Alexander Williams (FTS 382-5909) of my staff to contact you concerning follow-up actions to EPA's comments.

Sincerely,

David G. Davis, Acting Director
Office of Federal Activities

9011742 1094

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(no comment identified)

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SUMMARY OF RATING DEFINITIONS
AND FOLLOW-UP ACTION*

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Environmental Impact of the Action

LO--Lack of Objections
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC--Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO--Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alterna tive or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment.

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U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS
ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ON
DISPOSAL OF HANFORD DEFENSE HIGH-LEVEL,
TRANSURANIC AND TANK WASTES
(DOE/EIS-0113)

General Comments

1. There is no comparison with the assurance requirements of 40 CFR Part 191.14 for any of the alternatives. This comparison should be done in the Final EIS. 2.4.1.16 3.2.1.6

2. We do not consider the "no disposal action" option to be a viable long term solution. This option would apparently violate 191.13 and 191.15 and potentially violate parts of 191.14. Therefore, the Department of Energy (DOE) should consider it only insofar as inclusion of the "no action" alternative is a requirement of NEPA. Further, the analyses for comparing this option with 191.03 and 191.16 have not been presented. DOE may also wish to analyze the impacts and costs based on no improvements whatsoever, not as a possible alternative, but to establish an absolute baseline for costs and impacts. 3.3.4.1

3. Of the other three options, the reference alternative may be the most reasonable, pending the results of continued research on and collection of site-specific data. However, there are scenarios in which the potential exists for both the reference and in-place stabilization to exceed the limits in 191.15. All three leave questions of compliance with 191.14. Also, analyses for comparing the action with 191.03 and 191.16 have not been presented. Therefore, EPA has "environmental concern" for these three alternatives. 2.4.1.20 3.3.2.1

4. It is apparent that further research and data collection are needed in connection with the final disposal plan. Several examples of such data needs are: (1) further characterization of tank wastes to determine the contents in regard to their qualifying as mixed wastes, high-level wastes (HLW), and transuranic (TRU) wastes; (2) a more precise determination of the conditions of the single-shell tanks; (3) the final design for a protective barrier has not been chosen and even for the plan presented here there is no firm analysis of its 2.3.2.3 3.5.2.23 3.3.5.4

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effectiveness and longevity; (4) DOE states that there is no "confirmed statistical basis" even for retardation coefficients or average annual recharge rates; (5) a better understanding of the geohydrology and geochemistry is necessary; and (6) identification of all the pertinent chemicals and radionuclides is needed. We believe such information needs must be filled prior to being able to choose among the disposal alternative or to determine compliance with 40 CFR 191, CERCLA, RCRA, and other applicable environmental requirements.

2.3.2.3 As our cover letter points out, those issues, as appropriate should be addressed in the final or supplemental EIS. Those issues not ripe for discussion should be addressed through a comprehensive agreement among DOE, EPA, and the Washington Department of Ecology; further any detailed performance assessment of the alternative chosen should resolve any remaining technical issues.

3.1.3.22 5. Application to the DOE program of the EPA interim draft TRU guidance (expected to be finalized by the Agency within the next six months) to this is somewhat ambiguous in view of the fact that the guidance would specifically exclude application to contaminated soils within the boundaries of a controlled area. However, if one assumes that the disposal is intended to eventually permit unrestricted release to the public without further actions, then an evaluation and limitation in terms of projected dose rates of the Guidance would be required. It is unlikely that the proposed disposal options for pre-1970 TRU buried solid waste, TRU contaminated soil, and retrievably stored and newly generated TRU solid waste would meet the criteria for such decommissioning and ultimate release for unrestricted use.

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2.3.1.13 2.4.1.8 3.1.3.1 3.1.3.2 3.1.5.1 6. The statement is made or implied throughout the document that TRU wastes with TRU concentrations below 100 nanocuries per gram (nCi/g) will be treated and disposed in the same manner as low-level waste (LLW). While these wastes, based on 40 CFR 191, could be considered LLW, it may not be appropriate for some of them to be disposed of in near-surface burial facilities. This discussion of such LLW disposal options should be included in th inal EIS along with a presentation on all LLW handling at the facility.

2.4.1.16 2.4.1.21 7. From the work reported by DOE, all options meet the probabilistic standards in Subpart B of 40 CFR 191 except the no disposal alternative and one scenario of the geological disposal alternative. However, we consider this DEIS to be a preliminary analysis with many unsubstantiated assumptions and not sufficient to

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allow a determination of compliance with 40 CFR 191.

8. We recommend the Final EIS present an analysis, for each of the alternatives, of radionuclide concentrations in groundwater for the purpose of addressing the requirements in 191.16. 2.4.1.20 3.5.5.34

9. Section 6.6. of the DEIS states that the Department of Energy believes that the wastes addressed in the DEIS constitute "pure" byproduct material and therefore are not subject to RCRA. The DEIS further states that if it is subsequently determined that these wastes are subject to Subtitle C of RCRA, DOE will comply with all applicable RCRA requirements. We note that the status of the wastes addressed in the DEIS has not yet been definitively determined with regard to RCRA and will not be determined during the EIS process. If the wastes are subsequently determined to be RCRA hazardous wastes or radioactive mixed wastes, i.e., wastes that contain both RCRA wastes and Atomic Energy Act wastes, the RCRA requirements must be met (see 51 Federal Register 24504 (July 3, 1986)). 2.4.1.9

10. While DOE states in the DEIS that any applicable RCRA requirements will be met, a preliminary review of the DEIS alternatives suggests that this may be difficult without changing the alternatives. We note the following examples of aspects of the DEIS alternatives which could be problematic under RCRA, should it develop that the wastes involved are under RCRA jurisdiction. (EPA is not stating that resolution could not be reached; for example, RCRA 1006 could allow a variance from RCRA requirements if the AEA and RCRA rules are inconsistent.) Rather, we are simply pointing out areas where the DEIS alternative may not comply with RCRA, if it is later determined that RCRA applies: 2.4.1.9

- RCRA 3004(b)(1) prohibits placement of any non-containerized or bulk liquid hazardous waste in any salt dome or bed formation, underground mine or cave unless EPA determines it would be protective of human health and the environment, promulgates performance and permitting standards and issues a permit. RCRA 3004(b)(2) prohibits placement of all other types of hazardous waste (e.g, solids) in such formations unless EPA issues a permit. Bulk liquids are also prohibited by DOE acceptance criteria. These provisions could conflict with DOE's geologic disposal alternative. EPA has taken no steps to date toward making a finding that noncontainerized or liquid wastes (if any of the DOE alternatives involve such wastes) can safely be disposed underground. As for solidified wastes under RCRA 3004(b)(2), the current RCRA rules probably would not contain any standards by which a permit could be issued (conceivably the alternative could be described as a landfill, but then it would require a double liner, groundwater monitoring, etc.). We intend to propose in mid-September 1986 a new "Subpart X" to the RCRA permitting rules, (to be finalized in the spring of 1987)

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for miscellaneous hazardous waste treatment, storage and disposal units. (Note: RCRA 3004(b)(4) states that the Waste Isolation Pilot Project is exempt from this requirement. Further, it does not appear that solidified high-level waste is a RCRA waste because a glass does not exhibit a hazardous characteristic.)

° If one assumes that the wastes would be subject to RCRA, there may be potential conflicts for the in-place stabilization option also. This alternative involves disposal of some of the wastes in singleshelled tanks. RCRA does not allow any disposal in tanks, and it requires treatment and storage tanks to have secondary containment. As with the geologic alternative, the forthcoming Subpart X regulations may be the appropriate mechanism to review this alternative.

3.5.3.25 11. Ground-water effects are the most important component of the long-term health effects calculation. As the DEIS aptly states, "The only important pathway for radionuclides and inextricably intertwined chemicals to the affected environment is via groundwater" (Page 5.17). We believe the ground-water analysis needs to be strengthened. Our reasons are as follows:

3.5.2.24 ° While the analysis of contaminant migration in the DEIS is good and uncertainties are stated, we question the utility of any approach to modelling site-specific processes in the subsurface when parameters selected are representative of regional (macro-scale) processes. Uncertainties increase for models which use macro-scale factors to evaluate local processes, such as contaminant transport. We have seen evidence of the highly porous nature of the surficial sediments at Hanford. For example, there is evidence of contaminant migration at locations within the facility where migration should not be occurring.

° The EPA, NRC, DOE, and the Nuclear Waste Policy Act all focus on the national program to dispose of commercially-generated radioactive waste in mined geologic repositories. The EPA has carefully evaluated the capabilities of mined geologic repositories and concluded they are capable of performing very well in providing protection to current and future populations for at least 10,000 years after disposal. Because of the high performance expectations for geologic disposal, the DOE must assume an extraordinarily high burden of proof in showing that alternative disposal methods (like in-place stabilization) are acceptable to provide equivalent protection over 10,000 years. The inherent uncertainties are surely greater for other alternative methods of permanent disposal. 2.2.5

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° To strengthen the high quality of the modeling done in the DEIS, and remove uncertainties remaining for this project, we would like to recommend a tighter sensitivity analysis on the base case analysis. "Ground-truthing" the key parameters to assure that the model is representative for the specific disposal site is also needed, since a small scale, localized geological anomaly, such as a buried stream channel deposit could have profound environmental consequences. 3.5.3.25 3.5.3.6

12. The main text often expresses in relatively certain terms conclusions that are discussed with some degree of uncertainty in the appendices. We suggest presenting some supporting data and calculations along with conclusions in the main text to make major points. The appendices are, in general, not well organized and not clearly correlated to sections in the main text to which they relate. 4.1.10



<u>Specific Comments</u>:

1. Pp. 1.10 - 1.11: The calculational method for the hazard indices in Table 2 should be shown. 3.5.5.39 4.1.27

2. P. 1.10, Table 1: The radionuclide quantities should be expressed in curies (Ci) as well as tons.

3. P. 1.14, 3rd full paragraph: How does the basalt rip-rap discourage farming when there is five feet of soil over it? It seems the best chance of discouragement is the use of above ground markers. Explain this situation more clearly. 3.5.1.94

4. Pp. 1.20 - 1.21, Tables 3 and 4: The meaning of "health effects," e.g., fatal cancers or genetic effects, should be footnoted. 3.5.5.39

5. P. 3.4, Section 3.1.7: To what program of in-tank immobilization is this Section referring? Is this a past, present, or future operation? 4.2.3 3.1.4.34

6. P. 3.7, Section 3.2.2: Have the HLW and TRU wastes from the other facilities referred to in this Section been included in the analysis including those TRU wastes which may exceed 100 nCi/g after concentration? 3.1.3.30

7. P. 3.8, Section 3.2.2: The impacts from extended production of special nuclear material beyond 1995 should be indicated in the appropriate places in Section 3.4.3 rather than simply noted here almost 60 pages from that section. 4.2.4

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2.5.1 8. P. 3.10, Section 3.3: What is the basis for choosing the year 2190 for loss of active institutional controls? The assurance requirement at 191.14(a) allows credit for no more than 100 years of active institutional controls.

2.4.1.16 9. Pp. 3.19 - 3.28, Sections 3.3.2 and 3.3.3: Disposal of TRU wastes makes those wastes subject to 40 CFR 191. In scenarios where those wastes are disposed of in-place, we are concerned that compliance with 40 CFR 191 assurance requirements d, e, and f may not be achieved. Therefore, EPA believes that further consideration and analyses are necessary to evaluate the appropriate alternative for these wastes including the finalization of a design for the protective barrier and research and analysis of its longevity and long-term effectiveness.

3.1.3.31 Further, for TRU wastes disposed of previously, EPA encourages further action for their stabilization. We also believe that in the course of determining an appropriate action the resulting risks of all the considered alternatives should be compared in a cost-effectiveness analysis using the requirements of 40 CFR 191 as a baseline.

3.4.1.5 10. P. 3.34, Section 3.4.1.1: Annual doses to individuals need to be discussed in this Section.

4.2.55 11. P. 3.43, Section 3.4.1.8: The reference to 40 CFR 191 should be removed. First, there are no population standards in 40 CFR 191 and, second, 40 CFR 191 is not applicable to the process of decontamination and decommissioning.

4.2.6 12. P. 3.43, Section 3.4.2, second paragraph, lines 8 and 9: DOE needs to recognize here, as is done in other places in the paragraph, the difference between active and passive institutional controls. To simply state that institutional control would make intrusion accidents unrealistic is not acceptable. Active controls may be considered viable but only for a limited time (100 years maximum). As stated later in the text, EPA has never assumed that passive controls will ever prevent any type of intrusion but rather that they may significantly reduce the chance of systematic intrusion. In light of this, the statement needs to be clarified and an explanation given for why intrusion accidents would not be realistic.





13. Pp. 3.55 - 3.58, Tables 3.14 - 3.17: Many of the values exceed 191.15 even though only the drinking water pathway is considered; however, there is no time given for when these doses occur in Tables 3.15 and 3.16. For the purposes of 40 CFR 191, all potential pathways need to be identified and analyzed and the maximum annual doses occurring in the first 1,000 years identified. This is true for both whole-body and organ dose estimates. 3.5.5.43 4.2.55

14. Pp. 3.56 - 3.57, Tables 3.15 - 3.16: The units of measurement need to be given.

15. Pp. 3.59 and 3.61, Tables 3.18 and 3.19: There should be an indication as to whether the reported dose equivalents are the maximum or some other measurement. 3.5.5.18

16. Pp. 3.59, 3.61, and 3.62, Tables 3.18 - 3.20: It is noted that the "no disposal action" alternative violates 191.15 in all three tables when averaged annually over 70 years. The same is true in Table 3.20 for the "in-place" and "reference" alternatives. 4.2.7

17. Pp. 3.61 and 3.64, section 3.4.2.3, final sentence: There is no substantiation for the statement that intrusion accidents following the choice of the no disposal action alternative would not be realistic if DOE chose that alternative. The implication is that active institutional controls will always be present. While that may be DOE's desire, it should not be assumed that will be possible in the future simply because DOE chooses the alternative. Further, that reason should not be used to rule out the scenario. This entire subject is the reason that EPA requires that active institutional controls be given credit for no more than 100 years of effectiveness. 4.2.6

18. P. 3.68, Table 3.26: The meaning of the footnote is uncertain and needs to be clarified. 4.2.55

19. P. 3.70, Table 3.28: First, the unit "2 L/day/yr" is confusing, "2 L/day" is sufficient since the total-body dose is described as annual. Second, it is noted that the dose equivalents on the bottom line for in-place stabilization and the reference alternative exceed the limits in 191.15. 4.2.7

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4.2.6 20. P. 3.71, Table 3.28, footnotes (e) and (j): See Comments 12 and 17 above.

4.2.55 21. P. 4.3, Table 4.1: The units of measurement should be "pCi/m$^3$" not "pCi/m$^2$."

22. P. 4.16: Direct hydraulic connection between the upper unconfined aquifer (Ringold/Hanford formations) and underlying confined
3.5.3.14 aquifer materials (Ellensburg formation) in the area north of the 200 east area is noted here but implications for contaminant transport are not included.

3.5.1.78 23. P. 4.18,4.19: Figures 4.8 and 4.9 should have scales.

24. P. 4.18: Previous studies that suggest no recharge are questionable.

3.5.3.2 25. P. 4.19: Recharge rate estimates are critical to contaminant transport calculations and conclusions for vadose zone migration. The uncertainty can be reduced in current modeling efforts by waiting four to five years for the results of ongoing recharge rate studies.

3.5.3.16 26. P. 4.21: Statements asserting that observed migration of contaminants from the unconfined aquifer to the upper confined aquifer is inconsequential are unsubstantiated. Direct evidence should be discussed. Transport of contamination from relatively local aquifer units to extensive underlying confined aquifers is a matter of concern.

3.5.3.23 27. P. 4.21: Section 4.4.2, final paragraph: While the existing text gives part of the necessary information for 40 CFR 191, DOE needs to expand the information to identify any "significant" or "special" sources of groundwater as defined in 191.12 (n) and (o), respectively.

3.5.2.33 28. P. 5.23: Calculated concentrations in the 5 km well do not reflect additional contaminants attributable to past disposal in cribs, trenches, and injections wells.

4.2.12 29. P. 5.58: Loss of institutional controls due to abandonment of the site would not necessarily occur in association with depopulation of the region. War, insurrection, governmental collapse or anarchy may not necessarily reduce surrounding population.

3.4.1.5 30. Pp. 5.10, 5.27, 5.42, and 5.53, Tables 5.2, 5.12, 5.21, and 5.31: First, all the options appear to meet the Subpart A standards for routine operations; however, for accidents they all potentially exceed those standards. Such actual accidental



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releases would be in non-compliance with 191.03. Second, the values need to be more specific than "less than 100 mrem" for a one-year exposure. Also, in order to evaluate compliance with 40 CFR 191, the maximum annual dose should also be given. 3.4.3.2

31. P. 5.37, line 26: Is 7,000 years when the maximum dose occurs? 3.5.5.46

32. P. 5.38, Section 5.3.4.4: Using the stated health effects conversion factors (Table N.4), the estimated health effects should be 0-2 for 2,000 man-rem and 0-4 for 3,600 man-rem. 3.5.5.35

33. P. 5.54, Section 5.5.2.2: The most severe accident resulted in a 70-year population dose of 7,000 man-rem for the other disposal alternatives (see Tables 5.2, 5.12, and 5.21). DOE needs to point out that the explosion of ferrocyanide precipitates, which is the worst accident for the other three alternatives, is not credible for the "no disposal" alternative (if in fact it is not), and that the dose due to failure of a diversion box valve for the "no disposal" alternative is the same as for this same incident for the other alternatives. 3.4.3.3

34. P. 8.19: The "transuranic waste" definition is unclear. Why is the waste activity measured at the "end of the institutional control periods?" EPA sees no reason to refer to any institutional control period; rather, the determination of what is TRU waste should be made at or before the time the decision is made to dispose of it. Finally, what is the meaning of the final sentence regarding WIPP and of what significance is it? 3.1.3.32

35. Volume 2, p. xxv: Were any Monte Carlo predictions used to pick values for a "bounding analysis"? 3.5.6.49

36. Volume 2, p. xxxiv, introduction: From the presentation, EPA finds no reason to assume that no dissolution or movement will take place. References and more discussion of the statements concerning the longevity and containment ability of the single-shell tanks need to be given. 3.1.4.9

37. Volume 2, pp. xxxix - xi, "Features of this Approach": The final paragraph of this Section is misleading by saying the "uncertainty" is less than 2. Uncertainty is usually applied as a plus or minus factor. In Table 4, if the ratio is reversed, i.e., ICRP-30 over ICRP-2, the uncertainty is 5 to 25. The text should be changed to reflect this situation. 3.5.5.44

38. P. F.9, Section F.2: The phrase "realistic but conservative" should be explained. 3.5.5.20

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3.5.5.2 39. P. F.12, equation F.2: Are the last two terms within the brackets of the equation used only for plants growing directly above with roots going into buried wastes?

4.2.29 40. P. F.36, Section F.3.3.8: There is no entry for "EPA 1982" in the references section.

3.5.5.38 41. P. F.36, Section F.3.3.8: The data used for the EPA calculations were chosen to yield generally realistic results for a generic repository. Conservative values and assumptions were chosen only where a high degree of uncertainty existed.

3.5.5.38 42. P. F.38, definitions of factors: $RI_{np}$ values were not calculated using AIRDOS-EPA. Models similar, but not identical, to those listed in AIRDOS-EPA were used to compute $RI_{np}$ values.

3.5.5.38 43. P. F-41, Table F.20: For the "Hanford-specific DITTY" calculations, how did DOE estimate fatal cancers and what risk conversion factors were used?

3.4.2.19 44. P. I.24, Table I.11: Discussion leading up to this table, e.g., Section I.5.1 and Table I.10, have indicated there is a range of radiological risk (100 to 1,000 health effects per million man-rem). This range is not reflected anywhere in Table I.11. Either the range should be used or, if the range is not used, the value used should be explained, e.g., geometric mean of range or arithmetic mean of range.

3.4.2.14 In addition, in Table I.11, the risk is driven by the risk associated with Sr/Cs capsules, 6 health effects. Since the risk from this waste species is about four orders of magnitude higher than any other risk in the table, it stands out. It would be helpful to provide some discussion in section I.5.2. of this species of waste and why the associated risk is so high in section I.5.2.

4.2.33 45. Pp. J.2 - J.3: A more detailed description of the RECON model is needed. From the information given it is not possible to review the assumptions or the methodology used to generate the cost numbers presented for the alternative disposal methods under the various environmental conditions. Further, there is no cost-effectiveness analysis for the various alternatives; this would be an important input to the final decision-making process.

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46. P. M.26, Section M.7: It is noted that the protective barrier system described in the EIS is only one possible candidate. We anticipate that, if a protective barrier proves necessary, that DOE will present a specific proposed design with in-depth analysis and ask for comments at that time. 3.5.1.1

47. P. M.26, Section M.7: There is little substantiation for the statement that the barrier is "durable and long-lasting." This implies that it will remain effective for at least several thousand years but there is no analysis to support that implication. 3.5.1.57

48. Pp. M.11 - M.16, Section M.4: The risk reduction factors for intrusion mitigation are a very important aspect of the analysis and further documentation and collaboration with other experts on this subject is necessary prior to finalizing the EIS. We expect this to be done when specific alternatives and designs are proposed, as well. 3.5.1.69

49. P. N.1, Introduction, lines 26 - 29: It should be noted that our inability to demonstrate effects in low-level animal exposures is not related to the absence of an effect. The problem with the animal studies is our inability to have a large enough group of animals exposed. If the number of animals in a study is small compared to the expected risk of effects, it is unlikely that effects will be observed. 3.5.5.21

50. P. N.1, Introduction, lines 31 - 37: The NCRP statement on interpreting extrapolated risk as "actual risks" should be set in perspective by citing ICRP 26: "These risk factors are intended to be realistic estimates of the effects of irradiation at low annual dose equivalents (up to the Commission's recommended dose-equivalent limits)." (Ann. ICRP 2/1, 1978) [emphasis added] Or, DOE could cite UNSCEAR on the 1977 risk estimates, "...namely, that the risk of fatal cancer induction for X- and gamma rays is on the order of $2 \times 10^{-5}$ for an effective dose equivalent corresponding to one year of natural background, as an average for both sexes and all ages." (UNSCEAR 1982, p. 11, par. 53) 3.5.5.22

Both the ICRP and UNSCEAR passages suggest some level of confidence in the realism of the estimated hazards.

51. P. N.2, Introduction, first paragraph: The use of comparing dose equivalents with natural background is acceptable in terms of setting the perspective. However, we do not believe that one should use such a comparison to judge a "risk's acceptability." DOE needs to clarify its intentions with regard to the comparisons with natural background radiation exposures. 3.5.5.23 2.5.5.12

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3.5.5.36 52. P. N.2, Section N.1, third paragraph: Although, as stated, in most epidemiological studies human exposures are to relatively large total doses or high dose rates, this is no longer true for radon daughter exposures. Some recent occupational studies and some animal studies report excess lung cancer at cumulative occupational exposures at or below average lifetime environmental exposures. In addition, some individual environmental exposures to radon daughters have been as high as the highest occupational exposures.

3.5.5.24 53. P. N.3, Section N.1, first full paragraph: The support for the linear-quadratic dose response is based on non-human data. It should be pointed out that for those cancers in man for which there are adequate data to determine the dose response (breast, thyroid, and, more recently, stomach) the dose response relationship is linear. Perhaps the linear estimate is not particularly conservative after all.

3.5.5.25 54. P. N.7, Section N.1, lines 1 - 4: The changes in dosimetry in Japan affect not only the quadratic model argument but that for linear-quadratic, too. The linear-quadratic model for solid tumors for the A-bomb survivors was constrained, i.e., forced, to fit both gamma-ray and neutron parameters from the linear-quadratic model for leukemia. The leukemia model, in turn, is quite strongly affected by the neutron dose. Since the neutron dose in Japanese A-bomb survivors is radically changed in the new dosimetry, especially at high exposures, the linear-quadratic model may no longer be a viable alternative for human dose-response models. This should be addressed.

3.5.5.26 55. P. N.7, Section N.2, general: At some point the section on genetics should discuss the recent reports on genetic studies on Japanese A-bomb survivors, viz., C. Satoh et al., "Genetic Effects of Atomic Bombs," pp. 267-276 in Human Genetics, Part A, "The Unfolding Genome," A.R. Liss, Inc., 1982; W.J. Schull, et al., "Genetic Effects of the Atomic Bombs: A Reappraisal," Science 213: pp. 1220-1227, 1981; W.J. Schull and J.K. Bailey, "Critical Assessment of Genetic Effects of Ionizing Radiation on Pre- and Postnatal Development," pp. 325-398 in Issues and Review in Teratology, Volume 2, H. Kalter, editor, Plenum Press, NY, 1984). These reviews suggest that the genetic risk in man is at least four times lower than is calculated in BEIR III or UNSCEAR 1982.

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56. P. O.2: The assumption for modeling purposes that the unconfined aquifer is hydrologically isolated from the underlying confined aquifer is convenient but incorrect according to information in Chapter 4, which noted direct hydraulic connection north of the 200 area. 3.5.3.15

57. P. O.2-O.5: The thickness and regional extent of Ellensburg formation interbeds (confined aquifer(s)) should be described. 3.2.1.8

58. P. O.5: A comment in the first paragraph of Section O.2 concerning "structural complexity" of the surficial (unconfined) aquifer and vadose zone is very vague. This requires elaboration as great potential for influencing ground-water flow is wrought by such "complexities"; most models cannot easily account for such variability in aquifers. Specifically, what is the evidence for such complexity and how will it affect contaminant transport? It should also be noted that the water table is a two-dimensional surface, not a point. Finally, The last sentence appears to have a typographical error in referring to the "upper confined saturated zone" when apparently meaning "...unconfined..." 3.2.1.1

59. P. O.6: The contention that there is no contaminant transport between the surficial unconfined aquifer and underlying confined aquifers is questionable, especially considering the stated physical interconnection. 3.5.3.14

60. P. O.7: Assumptions of instantaneous equilibrium and reversibility for retardation calculations are not necessarily conservative; neither is the assumption of spatial and temporal invariability of the "chemical environment." More geochemical data should be obtained to avoid reliance upon these assumptions. 3.5.2.28

61. P. O.9: Some attempt should be made to assess or quantify the "small degree" of lateral movement of water through the vadose zone under the barrier. 3.5.2.48

62. P. O.10: Neglecting horizontal migration in the vadose zone is a conservative assumption when calculating times to reach the saturated zone; but horizontal vadose zone travel should be considered on its own as a means of spreading contaminants. 3.5.2.48

63. P. O.11: The contention that the interface below the unconfined aquifer is impermeable is an inference only and is unsubstantiated. Evidence for this should be discussed in detail. 3.5.3.15

64. P. O.11: The assumption that the unconfined aquifer discharges to the Columbia River is tenuous--this should be investigated by installation of water table piezometers adjacent to the river. 3.5.2.14

° Effluent rivers (i.e., rivers fed by ground water) do not occur in arid areas; in this area, one would instead expect the water table to lie beneath the river bed.

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- Basalt formations may have secondary porosity (i.e., joining, fractures, bedding planes) which could transmit great quantities of ground water; the assumption of impermeability is inappropriate and unwarranted.

- Along the Columbia and Yakima Rivers, the water table may not coincide with river elevation. In arid areas, rivers are usually influent and considerably higher in elevation than the water table.

3.5.2.32 65. P. 0.12: Again, basic data confirming actual discharge to the Columbia River by the unconfined aquifer has not been presented. Also, dispersion can act to result in contaminant transport times greater than advective rates.

3.5.2.23 66. Pp. 0.15 - 0.16: The lack of site-specific data for the major soil horizons, including retardation factors, prevents the use of models with enough sensitivity to accurately predict migration pathways. Further, the state-of-the-art as regards geochemical knowledge at the Hanford site makes modeling the solute transport very difficult. However, these factors are very important to predicting performance and DOE needs to continue research and data collection to better quantify them.

3.5.2.23 67. P. 0.16: Studies should be done to obtain site specific data on soil characteristic curves for major soil horizons of the vadose zone, to facilitate model application.

3.5.2.3, 4.2.43 68. P. 0.16-0.17: Are all equations from Richards (1931)?

3.5.2.14 69. P. 0.18: The assumption of the soil moisture profile draining to equilibrium in a negligible time is tenuous.

4.2.55 70. P. 0.16-0.23: Section 0.4.1 (Moisture Movement and Diffusive Contaminant Release in the Vadose Zone) is organized in a confusing manner.

3.5.1.32 71. P. 0.23: The barrier is unlikely to effectively eliminate infiltration for 10,000 years.

3.5.2.14 72. P. 0.24: As previously discussed, field evidence is absent or does not support model boundary condition assumptions concerning:

- Head along river boundaries
- Water flux at aquifer boundaries (lateral)
- (Zero) Water flux at (underlying) "impermeable" boundary

Boundary condition assumptions remain highly questionable until demonstrated otherwise.



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73. P. 0.25: Calibration and transmissivity value calculations need to be explained in detail. 3.5.2.14

74. P. 0.26: An explanation of why data are insufficient to calibrate an advection-diffusion model should be provided. In general, a detailed inventory of what types of data are available should be in the DEIS, perhaps in an additional appendix. 3.5.2.21

75. P. 0.27: Hydrogeologic and geochemical data can be obtained by field and laboratory investigations. Absence of such data leads to simplified analysis and inability to validate models used. This data should be collected. 3.5.2.23

76. P. 0.28: Understanding of hydraulic conductivity distributions should be increased as rapidly as possible to allow calibration of the VTT (Ground Water) Model. Confident simulations of contaminant transport should wait until the VTT Model is fully calibrated. A detailed discussion of how the transport model estimates advective and dispersive components of transport from the VTT Model, which only predicts advection travel time, is needed. 3.5.2.14

77. P. 0.32: Attempts should be made to incorporate transverse dispersion effects into the transport model, considering the possibility of this actually resulting in faster than anticipated contaminant transport rates. 3.5.2.9

78. P. 0.35: The statement that unconfined aquifer sediments are well weathered is unsubstantiated. 3.5.2.2

79. P. 0.2: Soils data for unsaturated zone is not included. It should be added to the Final EIS. 3.5.2.51

80. Figures Q.2, Q.3, Q.5, Q.6, Q.7 should have scales and north arrows. 4.2.55

81. P. Q.6: This paragraph appears to refer to vadose zone transport modeling only. 3.5.2.51

82. P. Q.31, Section Q.8: The identification of Figure Q.4 in the second paragraph is incorrect. 3.5.2.50

83. Appendix R, General Comment: It will be necessary for DOE to demonstrate that the barriers work as well as they have assumed in this DEIS. A review of the dosimetry tables in this appendix shows some individual doses which substantially exceed 191.15 and 191.16. If the true barrier performance is somewhere between the "no degradation" and the "failure" scenarios, the individual and/or groundwater protection requirements of 40 CFR 191 could be exceeded. 3.5.1.57

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2.3.2.3 2.3.2.4 84. P. S.1 second paragraph: Since there is no firm statistical basis for several of the key parameters, it is expected that DOE will proceed with further data collection and research that such data and analyses will be available for public comment prior to selecting any future plans.

3.5.6.50 85. P. S.3, equation S.2: What is the basis of the assumed 5,000 MWd burnup?

3.5.6.51 86. P. S.5, Tables S.1 and S.2, and pp. S.27 - S.30, Table S.8 - S.11: There needs to be sample calculations showing how the values in the tables were calculated.

3.5.6.47 87. P. S.9 and Figure S.3: DOE needs to provide justification of their assumption that the "drier" climate is nine times more likely that the "wetter" climate.

4.2.47 88. P. S.23, Figure S.9: The statement immediately above the figure is confusing. One could imply that only the "no disposal action" alternative meets the standards by saying the EPA standards are shown as the cross-hatched area. The standards are the stair-step function -- it should be explained that the cross-hatched area is where the standards are exceeded.

3.5.6.44 89. P. S.25, Section S.5: The statement, "However, the EPA standard makes provisions for assigning a larger release limit" needs further explanation. Indicate the mechanism and where in the standards it is located.

3.2.3.2 4.2.49 90. Appendix T: This appendix provides insufficient information to check emission calculations. It is especially important that TSP emissions be accurately depicted. It is noted that there are apparently some significant sources of $SO_2$. The sources of $SO_2$ should be described.

3.2.3.2 There is insufficient information to determine whether source characterizations in the air quality model are appropriate. Horizontal dimensions of volume sources are not given. A map of the sources should be provided.

3.2.3.3 91. P. T.6: Urban mixing heights instead of rural mixing heights were used. This needs to be explained. How does this affect the model results? The meteorological data that is used is questionable. EPA does not recommend (delta T/delta Z) lapse rate to estimate stability class. Old data from 1960 to 1964 was used. Wind directions were only reported from 16 directions, probably reduced by hand with urban mixing heights from Spokane. One year of recent on-site data is preferred with wind direction reported to the nearest degree by data logger. DOE has doppler acoustic sounders which can report on site mixing height. Sigma theta or sigma phi or sigma w could also be used to determine stability class.

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92. P. U.1: The impact of spills or improper disposal of spent solvents and petroleum products needs to be appraised in the DEIS. Groundwater samples should be analysed for such compounds. The CERCLA Coordination Program results should be incorporated in the Final EIS. 3.1.6.1

93. P. V.1: This appendix refers to the disposal activities in terms of cribs, trenches, french drains, and reverse wells. The ramifications of the Underground Injection Control (UIC) Regulations (40 CFR 144 and 40 CFR 146) should be discussed in the final EIS (Chapter 6), especially since those regulations prohibit the disposal of hazardous waste or radioactive waste into, or above, underground sources of drinking water. The state program should be discussed also since the primary enforcement responsibility was delegated to the Washington Department of Ecology. 2.4.1.14

94. P. V.1: Mention of lab wastes suggests that a variety of organic chemicals may have been disposed of in cribs. Disposal of organic wastes are documented on page V.6 for 216-Z-1A crib, and page V.17 for 216-Z-9 trench. The fate of such contaminants should be addressed by the final EIS. 3.1.6.1

95. P. V.3: Mentioning of the total number of cribs would be appropriate here, along with a location map. 3.1.5.7

96. P. V.17: This description of unexpectedly high velocity horizontal contaminant movement, due to site stratigraphic characteristics, followed by rapid vertical transport around a well casing (due to poor construction methods) is representative of the kind of complication that can render modeling efforts meaningless. 3.5.3.5

97. P. V.20: The number and locations of French drains should be given. 3.1.5.7

98. P. V.20: Stratigraphic complexities, ignored for this interpretation of plutonium and americium distributions, can greatly alter anticipated effects, as seen on page V.17. 3.2.1.4

99. P. V.20: "Reverse well" should be explicitly termed injection well to avoid any confusion. 4.1.5

100. P. V.29: Statements to the effect that there has been limited radionuclide migration from reverse well 216-B-5 are questionable. 3.5.3.4

101. P. V.29: Low-level waste water should not be referred to as "relatively uncontaminated." 4.2.55