# DRAFT

## Programmatic Environmental Assessment

## for the

## Recycle of Scrap Metals Originating from Radiological Areas

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# DRAFT
# DOE/EA-1919

**RESPONSIBLE AGENCY:** United States Department of Energy (DOE)

**TITLE:** Draft Programmatic Environmental Assessment (PEA) for the Recycle of Scrap Metal Originating From Radiological Areas (DOE/EA-1919)

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**Abstract:** On July 13, 2000, the Secretary of Energy imposed an agency-wide suspension on the unrestricted release of scrap metal originating from radiological areas at U.S. Department of Energy (DOE) facilities for the purpose of recycling. The suspension was imposed in response to public concerns about the potential effects of radioactivity in or on metal recycled from the Department's facilities. Other materials continued to be controlled and cleared for release under the requirements of DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. Initially, the suspension was to remain in effect until December 31, 2000, while the Department developed and implemented improvements, revised its directives and associated guidance documents applicable to scrap metal releases, and engaged the public in a dialogue regarding DOE radiological release practices through the NEPA process. In 2001, DOE announced its intention to prepare a Programmatic Environmental Impact Statement (PEIS) on the policy alternatives for disposition of metals from its sites. Although the suspension was considered to be a temporary measure, it has been in force since 2000, and the PEIS was not completed primarily because recycling and reuse alternatives were not considered or pursued. In February 2011, in part to implement the improved monitoring and release practices recommended in 2001, DOE replaced DOE Order 5400.5 with DOE Order 458.1, *Radiation Protection of the Public and the Environment*, which incorporated an improved scrap metals clearance process. From 2008 through 2010, the Department through an effort lead by the National Nuclear Security Administration (NNSA) and supported by the Offices of Health, Safety and Security; Science; and Environmental Management, reviewed numerous DOE programs across the complex to determine how the Secretary's improvements were being implemented. In April 2010, NNSA hosted an inter-site workshop that developed a DOE wide consensus regarding how all sites would implement the Secretary's improvements. Consequently, DOE has determined that a Programmatic Environmental Assessment (PEA) is appropriate to consider the alternatives for the disposition of uncontaminated scrap metal originating from these areas.

Metals with volumetric radiological contamination, and scrap metals resulting from Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) clean-up activities, are not included in the scope of the PEA. In addition, sites managed by the Office of Legacy Management are not included since these facilities do not generate potentially radiologically contaminated scrap metal that could be recycled. DOE plans to complete the PEA, and as appropriate, issue a Finding of No Significant Impact (FONSI) or prepare a PEIS prior to deciding whether to implement a change to the policy established by the July 13, 2000, memorandum.

**Public Comments:** A 30-day comment period on this document begins with posting of the Draft PEA on the DOE NEPA Website at http://energy.gov/nepa. To be considered, comments on this Draft PEA must be submitted electronically to: Scrap_PEA_Comments@hq.doe.gov. Alternatively, written comments may be sent by postal mail to: Dr. Jane Summerson, DOE NNSA, P.O. Box 5400, Bldg 401, KAFB East, Albuquerque, NM 87185. Late comments will be considered to the extent practicable.

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| | |
|---|---|
| AEC | Atomic Energy Commission |
| ALARA | As Low As Reasonably Achievable |
| ANSI | American National Standards Institute |
| ASER | Annual Site Environmental Report |
| BNFL | British Nuclear Fuels Limited |
| BNL | Brookhaven National Laboratory |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| $CO_2$ | Carbon Dioxide |
| dBA | decibels |
| DOE | U.S. Department of Energy |
| EE | U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy |
| EIS | Environmental Impact Statement |
| EM | U.S. Department of Energy, Office of Environmental Management |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| ETTP | East Tennessee Technology Park |
| FONSI | Finding of No Significant Impact |
| GHG | Greenhouse Gas |
| HPS | Health Physics Society |
| IAEA | International Atomic Energy Agency |
| ICRP | International Commission on Radiological Protection |
| INL | Idaho National Laboratory |
| KAPL | Knolls Atomic Power Laboratory |
| LANL | Los Alamos National Laboratory |
| LLNL | Lawrence Livermore National Laboratory |
| mrem | Millirem |
| NNSS | Nevada National Security Site |
| NAS | National Academy of Sciences |
| NCRP | National Council on Radiation Protection and Measurements |
| NEPA | National Environmental Policy Act |
| NHTSA | National Highway Traffic Safety Administration |
| NID | Negligible Individual Dose |
| NFRS | National Fatality Reporting System |
| NMR | DOE National Center for Excellence in Metal Recycle |
| NNSA | National Nuclear Security Administration |
| NOI | Notice of Intent |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | U.S. Nuclear Regulatory Commission |
| NRHP | National Register of Historic Places |
| ORISE | Oak Ridge Institute for Science and Education |
| ORNL | Oak Ridge National Laboratory |
| OSHA | Occupational Safety and Health Administration |
| PEA | Programmatic Environmental Assessment |
| PEIS | Programmatic Environmental Impact Statement |
| PNNL | Pacific Northwest National Laboratory |
| PPPL | Princeton Plasma Physics Laboratory |
| PSO | Program Secretarial Office |
| RCRA | Resource Conservation and Recovery Act |
| SLAC | SLAC National Accelerator Laboratory |
| SRS | Savannah River Site |
| TRU | Transuranic |

| | |
|---|---|
| TWPC | TRU Waste Processing Center |
| WIPP | Waste Isolation Pilot Plant |
| WNYNSC | Western New York Nuclear Service Center |
| WVDP | West Valley Demonstration Project |

## 1.0 INTRODUCTION

The U.S. Department of Energy (DOE) proposes modifying the Secretarial suspension on the unrestricted release for recycle of uncontaminated scrap metals originating in DOE "radiological areas" (as defined by 10 Code of Federal Regulations (CFR) Part 835.2, *Occupational Radiation Protection*), with the potential for surface, not volume, radioactivity. The candidate scrap metals would only be released following a clearance process to document that they meet requirements for unrestricted release contained in DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011). Scrap metals that do not meet these human health and safety standards would be identified as contaminated and would continue to be managed as radioactive material until disposed of as waste. Metals with volumetric radiological contamination, and scrap metals resulting from Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) clean-up activities, are not included in the scope of the PEA. In addition, sites managed by the Office of Legacy Management are not included since these facilities do not generate potentially radiologically contaminated scrap metal that could be recycled.

> **Unrestricted Release:** As used in this PEA, unrestricted release means the sale, transfer, or grant of scrap metals originating from DOE radiological areas to private industry for any purpose, including recycling, after the metals have been reviewed to ensure applicable human health and safety standards have been met.

DOE has determined that a Programmatic Environmental Assessment (PEA) is the appropriate level of review in accordance with Council on Environmental Quality regulations (40 CFR Parts 1500 to 1508) that implement the National Environmental Policy Act of 1969 (NEPA) (42 U.S. C. 4321 *et seq.*) and DOE NEPA implementing regulations (10 CFR Part 1021). After consideration of public comment on this draft PEA, DOE will finalize the PEA and determine whether it needs to prepare a programmatic environmental impact statement (PEIS), or whether it may issue a Finding of No Significant Impact (FONSI).

### 1.1 BACKGROUND

In September 1998, the DOE Oak Ridge Operations Office entered into a contract with British Nuclear Fuels Limited (BNFL) to decommission three large process buildings located at the Oak Ridge Gaseous Diffusion Plant (the K-25 Plant). This plant contained in excess of one million tons of structural, process, and electrical support equipment made from steel, aluminum, copper, and nickel. The contract allowed BNFL to underwrite a significant portion of the total project cost with proceeds from the decontamination and sale of uncontaminated scrap metal for recycle.

The large amount of metal to be recovered through the K-25 decommissioning project resulted in public concern about the reliability of the DOE release process for metals with a potential for contamination. This concern was associated with the ability of DOE to prevent radioactively contaminated materials from reaching the public through general commerce. The metals industry also expressed concerns about the potential loss of consumer confidence in domestic metal resources because of the possibility of inadvertent release of radioactive materials from DOE sites.

In response to public concerns, on July 13, 2000, Secretary of Energy Bill Richardson issued a memorandum (provided in Appendix B) that suspended the release of surplus and scrap metals originating from DOE radiological areas (DOE 2000). The suspension meant that DOE would not allow the release of scrap metals for recycling even if they were found to be uncontaminated and cleared under approved procedures. The suspension was to remain in effect until December 31, 2000, while the Department developed and implemented improvements to the clearance process, revised its directives and associated guidance documents applicable to scrap metal releases, and engaged the public in a dialogue regarding DOE radiological release practices through the NEPA process.

On January 19, 2001, the Secretary issued a Memorandum to the Heads of Department Elements on managing the release of surplus and scrap metals, stating:

> *Over the last year, the Department has grappled with how to improve its management and release of surplus and scrap material. Our reviews have not identified any evidence that the public might be harmed by releases from our sites, but we have determined that there is a need to improve radiation monitoring, independent verification, and record keeping and reporting. We must also better engage the public in our decision making and help them better understand our release practices.* (DOE 2001)

**Secretarial Memoranda**

- *Release of Surplus and Scrap Materials:* Suspension on release of scrap metals for recycle with the potential for detectable levels of radioactive materials on the metal surfaces – July 13, 2000 (DOE 2000, Appendix B).
- *Managing the Release of Surplus and Scrap Materials:* Extension of the suspension and definition of four elements of guidance to help DOE sites improve the clearance process – January 19, 2001 (DOE 2001, Appendix C).

The January 19, 2001 memorandum (provided in Appendix C) extended the suspension of the release for recycle of scrap metals originating from DOE radiological areas beyond the original six months and provided four elements of guidance to help DOE sites improve their monitoring and release practices. These elements included:

1. Clearly define areas and activities that can potentially contaminate property.
2. Clearly define release criteria, including measurement and survey protocols, for property released from areas or activities that have potential to contaminate.
3. Ensure that released property meets DOE requirements.
4. Better inform and involve the public and improve DOE reporting on releases. [1]

On February 11, 2011, DOE Order 458.1 (DOE 2011) replaced DOE Order 5400.5 (of the same title). DOE Order 458.1 incorporates clearance process improvements which have addressed the Secretary's guidance, as discussed above. The new Order requires documentation of the procedures and radiological monitoring or surveys used to demonstrate compliance. DOE Order 458.1 requires Field Element Managers to summarize information on the results of radiological monitoring and surveys of cleared property (including

**Independent Verification:** As part of the oversight program for the clearance of DOE metals for recycle, specific activities must be performed by individuals who are independent of the contractor performing the clearance process. These activities are termed independent verification and must, at a minimum, include periodic review of the site's radiological clearance processes, and/or material characterization reports or data, and as appropriate, may include independent surveys or sample analyses to verify compliance with the authorized limits.

[1] The January 19, 2001 Secretarial Memorandum also called for the preparation of an environmental impact statement (EIS) that would "…allow for an open, healthy discussion of the broadest range of concerns associated with metals cleared for recycle from DOE sites." The Office of Environmental Management (EM) was assigned the task of developing the EIS, in coordination with other Departmental elements. EM published the Notice of Intent (NOI) in the Federal Register on July 12, 2001 to *Prepare a Programmatic Environmental Impact Statement on the Disposition of Scrap Metals*. Although the process to prepare the Programmatic EIS was begun, the document was never completed.

the quantity of property cleared, and independent verification results) in each site's Annual Site Environmental Report (ASER).

In September 2008, under the leadership of the National Nuclear Security Administration (NNSA), a series of field reviews was undertaken to assess site compliance with the January 2001 Secretarial memorandum to improve radiological clearance program performance. The Office of Science joined the effort in 2009, with the inclusion of the SLAC National Accelerator Laboratory and the Thomas Jefferson National Accelerator Facility in the site review process. This process culminated with an inter-site workshop for field sites directed at developing a consistent strategy to implement and institutionalize the improvements to DOE's clearance process suggested by the Secretary. The April 2010 workshop was successful at achieving this goal, identifying specific good practices on how to achieve the aforementioned performance improvements. These recommendations are consistent with the requirements contained in DOE Order 458.1 subsequently issued and disseminated to field sites in February 2011 (DOE 2011).

On September 28, 2011, Secretary Steven Chu approved a staff recommendation to:

- Delegate authority to manage radiological clearance of scrap metal from radiological areas to each Under Secretary for sites under his or her cognizance, in accordance with the processes contained in DOE Order 458.1, contingent on the completion of the appropriate NEPA review.
- Execute this authority only after the site has implemented improvements to its radiological clearance processes according to the recommendations contained in the NNSA evaluation report (DOE 2010). These recommendations are consistent with the requirements contained in DOE Order 458.1 subsequently issued in February 2011 (DOE 2011).
- Establish an inter-program support function at DOE Headquarters to ensure the improvements are implemented and institutionalized across all field sites (DOE 2010).
- Better inform and involve the public at sites authorized to resume clearance of scrap metal for recycle. This outreach would be conducted and coordinated with local communities through existing frameworks established for public interaction (e.g., local government and regulatory agencies, site-specific advisory boards, or citizen advisory boards).
- Authorize the Department to proceed with the preparation of a PEA that would evaluate the potential environmental impacts of the proposed action.
- Allow for an open dialogue with the public through the PEA, regarding DOE's proposed action to resume clearance of uncontaminated scrap metal from radiological areas and considering the public comment and involvement that was specifically contemplated by Secretary Richardson prior to release of metals originating from DOE radiological areas.

## 1.2 PURPOSE AND NEED FOR U.S. DEPARTMENT OF ENERGY ACTION

The purpose and need for agency action is to allow DOE to better manage materials stored in radiological areas and no longer needed by the Department. These scrap metals have, and continue to be, accumulated at DOE sites since the 2000 Department-wide suspension on any unrestricted release for recycle of scrap metals originating from radiological areas at DOE facilities (DOE 2000).

## 1.3 PROPOSED ACTION

The proposed action, consistent with the principles of sustainable materials management as presented in Executive Order (E.O.) 13423, *Strengthening Federal Environmental, Energy and Transportation Management (January 27, 2007)*, and E.O. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance (October 5, 2009)*, is to allow for the recycle of uncontaminated scrap metal originating from radiological areas that meets the requirements of DOE Order 458.1.

## 1.4 SCOPE OF THIS PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

This PEA evaluates potential human health and environmental impacts associated with the proposed action, a disposal alternative, and a no-action (continued storage) alternative. DOE prepared this PEA in accordance with Council on Environmental Quality regulations (40 CFR Parts 1500 – 1508) that implement the National Environmental Policy Act of 1969 and DOE's NEPA Implementing Procedures (10 CFR Part 1021). Based on the PEA, DOE will determine whether to issue a FONSI and proceed with the proposed action or to prepare a PEIS. Metals with volumetric radiological contamination, and scrap metals resulting from RCRA and CERCLA clean-up activities, are not included in the scope of the PEA. In addition, sites managed by the Office of Legacy Management are not included since these facilities do not generate potentially radiologically contaminated scrap metal that could be recycled.

> **Clearance:** As used in this PEA, clearance is the removal of uncontaminated scrap metals from DOE radiological areas after they have been reviewed to ensure that the requirements in DOE Order 458.1 have been met. The results of this review to allow for unrestricted release to private industry for recycling will have been documented as described by the Clearance Process (described in the text box below).

> **Clearance Process:** The clearance process in DOE Order 458.1 requires documentation of the property considered; the appropriate authorized limits to be used; the procedures for conducting radiation surveys and the results of the surveys; notification of applicable Federal, State, or local regulatory agencies or tribal governments; and a comparison of the measured levels against the authorized limits that are shown to be protective of the public and the environment. This process helps ensure only materials meeting clearance standards will be released for unrestricted use.

## 1.5 ADDITIONAL CONSIDERATIONS

In this PEA, DOE has assumed that the clearance of metals would occur at the DOE site of origin as a routine activity already authorized under DOE NEPA implementing procedures (10 CFR Part 1021). Such activities include operation and maintenance of the physical plant; research, development and production; reconfiguration activities; and disposition of surplus, excess, and underutilized personal property, construction debris, and sanitary, mixed, and low level radioactive waste. The scrap metal addressed by this PEA is material that would have been eligible for release prior to the suspension if appropriately cleared or alternatively been designated as contaminated and disposed of as waste. Instead, this material has accumulated and remains stored in DOE radiological controlled areas.

The Proposed Action analyzed in this PEA would allow DOE to modify its policy to allow relief from the suspension for DOE sites that have demonstrated they have properly implemented the improvements directed by the Secretary and required by DOE Order 458.1. The Secretary would delegate authority to the Department's Under Secretaries to manage the radiological clearance process by determining whether sites under their jurisdiction are capable of carrying out the improved clearance process called for by DOE Order 458.1 to evaluate scrap metals originating from DOE radiological areas. The improvements to the clearance process emphasize better use, management, control and preservation of process knowledge used in the clearance process; independent verification of the quality and performance of contractor radiological clearance practices; and more detailed public reporting on the releases of uncontaminated scrap metal from DOE sites. The clearance process in DOE Order 458.1 requires

> **Authorized Limit:** In this document, a quantitative limit on the amount of radioactive material on the surfaces of property that has been shown to be protective of the human health and the environment, and selected consistent with the ALARA process. DOE specifies the process for establishing these limits in DOE Order 458.1 for DOE materials and sites.

development and application of authorized limits. For release of personal property[2], including uncontaminated scrap metal, for recycle, authorized limits are the concentrations of radioactive materials on surfaces that result in a total effective dose of 1 millirem (mrem), above background, per year (mrem/y), or less, to a member of the public based on As Low As Reasonably Achievable (ALARA) process evaluations (DOE 2011).[3] The effective dose is the sum of the dose from sources both external and internal to the human body. This individual dose is consistent with national and international recommendations for clearance (ANSI/HPS 1999, IAEA 2011, ICRP 1991) and is determined to be protective of human health and the environment. For comparison:

- The national and international standard for radiation protection of the public is 100 mrem in a year from all non-background sources of radiation and all exposure pathways. (ICRP 1991, ICRP 2007, NCRP 2002, 10 CFR Part 835, 10 CFR Part 20, DOE Order 458.1).
- The dose constraint for clearance of real property is 25 mrem/y (10 CFR Part 20, and DOE Order 458.1).
- The Environmental Protection Agency (EPA) has established a dose limit of 15 mrem/y for public exposure derived from geologic disposal of high-level radioactive waste and spent fuel (40 CFR Part 191).
- EPA has established a 25 mrem/y whole body dose limit for nuclear power operations (40 CFR Part 190).
- EPA has established a 4 mrem/y standard as part of its drinking water standards (40 CFR Part 141§66 2012).
- The EPA uses a 10 mrem/y standard as part of its Clean Air Act (CAA) regulations (40 CFR Part 61, 1996).
- 1 mrem/y of radiation dose is equivalent to about one day of exposure to natural radioactive sources found around us, referred to as background radiation (NCRP 2009).
- 1 mrem/y is the difference in cosmic radiation associated with a change in elevation of 500 feet; a person living at 500 feet above sea level receives a dose from cosmic radiation about 1 mrem higher than the person living at sea level (NCRP 2009).
- EPA estimated that cosmic radiation exposures from a cross-country flight result in a dose of 2 to 5 mrem (NCRP 2009).
- A person living in a brick or stone house receives a background radiation dose that is up to about 7 mrem/y more than an individual living in a wooden house (NCRP 2009).
- A dose of 1 mrem/y has been designated by the National Council on Radiation Protection and Measurements (NCRP) as a "negligible individual dose (NID)" or a dose below which further efforts to reduce the dose to an individual member of the public are "unwarranted" (NCRP 2002).

If radioactive materials are present on the surface of DOE scrap metals, they can be identified, characterized, quantified, and the results compared against the authorized limits described in DOE Order 458.1. Under the Proposed Action, scrap metal determined to be compliant with these limits would be considered for unrestricted release from radiological control for any purpose including recycling. Scrap metal not compliant with these limits would be maintained by DOE or disposed of as waste.

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[2] Real property is defined as land and anything permanently affixed to the land such as buildings. All other property is considered to be personal property. In the context of federal property regulations as well as this PEA, metals for recycle are considered to be personal property.

[3] This standard applies to each lot or stream of scrap cleared from an individual site.

As described in Appendix A, the authorized limits described by DOE Order 458.1, as well as the process to apply these limits, have been determined to be protective of human health and the environment. The limits and process described by this Order are also consistent with similar unrestricted release criteria imposed by the U.S. Nuclear Regulatory Commission (NRC) on its commercial licensees (AEC 1974, NRC 1987). Uncontaminated scrap metal or other personal property cleared from radiological areas from DOE sites under DOE Order 458.1 would not differ in radiological character from that released and recycled by commercial firms.

## 2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This PEA considers three alternatives for scrap metals originating from DOE radiological areas, discussed in detail below:

1. **Proposed Action:** Modifying the suspension policy to allow for the recycle of uncontaminated scrap metal originating from radiological areas, if cleared by the Under Secretary for sites under his or her cognizance according to the requirements of DOE Order 458.1.
2. **Disposal Alternative:** Designating all scrap metal originating from DOE radiological areas after July 13, 2000, as waste subject to disposal.
3. **No Action Alternative:** Continuing the suspension of scrap metals for unrestricted release originating from DOE radiological areas indefinitely.

### 2.1 PROPOSED ACTION – MODIFYING THE SUSPENSION POLICY TO ALLOW EVALUATION FOR CLEARANCE AND RELEASE

The proposed action is to modify DOE's suspension policy to allow the delegation of authority from the Secretary to the Under Secretaries to manage the radiological clearance process for uncontaminated scrap metals originating in DOE radiological areas. Scrap metal that meets the DOE Order 458.1 (DOE 2011) requirements for clearance for unrestricted release would be candidate for recycle. Scrap metal that does not meet these requirements would be identified as contaminated and maintained by DOE or disposed of as waste in an appropriate manner. Appendix E contains information provided by the DOE sites in response to a data call which gives the quantities of metals recycled and estimates of the quantities of material encumbered by the recycle suspension and currently being stored. The Proposed Action also includes recycle of appropriate scrap metal generated during future, ongoing site operations.

DOE Order 458.1, Section 4 (Requirements), Subsection k, provides requirements pertaining to the release and clearance of property. Both real property (land and buildings) and personal property (items, materials, and equipment) are included. Scrap metal originating from DOE radiological areas is considered to be personal property.

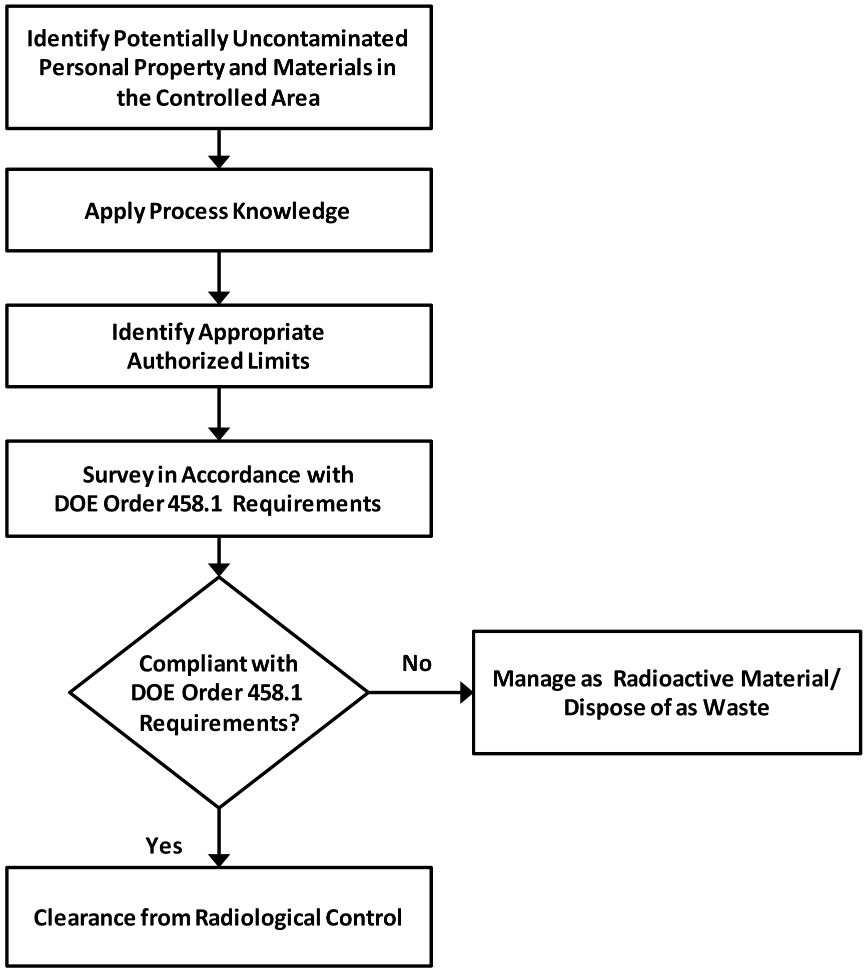
In addition, the DOE ALARA process requirements must be met before property can be cleared for release. The authorized limit is a level that shall not be exceeded. The actual conditions of release without ALARA will almost always be lower than the authorized limit. Application of ALARA can result in an even lower actual condition of release. The DOE ALARA process requirements include the following stipulations:

> **As Low As Reasonably Achievable (ALARA):** An approach to radiation protection to manage and control releases of radioactive material to the environment, and exposure to the work force and to members of the public so that the levels are as low as reasonably achievable, taking into account societal, environmental, technical, economic, and public policy considerations.

- Radiation doses to members of the public must be kept as low as reasonably achievable,
- Releases to the environment are kept as low as reasonably achievable,
- The ALARA process must include all DOE sources, modes of exposure, and all pathways which could result in the release of radioactive materials into the environment or exposure to the public, and
- The ALARA process must be applied to all routine radiological activities.

Figure 1 is a flow diagram depicting the process by which scrap metal would be cleared. In this figure, potentially uncontaminated personal property and materials (including scrap metals) are identified, assessed for risk of radiological contamination through evaluation of process knowledge, and surveyed for radiation against the authorized limits to provide the basis of responsible material management practices (including release for recycle). Only materials compliant with the authorized limits and other conditions imposed by DOE Order 458.1 could be cleared.

**Figure 1: Flow Diagram for Making Clearance Decisions**




The authorized limits for release of all personal property items, including scrap metals shown in Figure 1, require the use of process knowledge, documented radiation surveys, or a combination of these methods to ensure that the potential public radiation doses are less than 1 mrem/y, above background. As described in Section 1.4 and Appendix A, these limits originate from previous DOE guidance, have been shown historically to be protective of human health, are now included in a process to assure their use, and are consistent with similar criteria used by the NRC.

## 2.2 DISPOSAL ALTERNATIVE – DESIGNATING ALL SCRAP METAL ORIGINATING FROM DOE RADIOLOGICAL AREAS AS WASTE SUBJECT TO DISPOSAL

The Disposal Alternative would designate all scrap metal stored or originating from radiological areas at DOE facilities after July 13, 2000, as waste regardless of radiological character. These materials would not be recycled but would be subject to disposal following approved disposal methods at appropriate disposal sites.

## 2.3 NO ACTION ALTERNATIVE – CONTINUED STORAGE UNDER THE SUSPENSION

The No Action Alternative would continue the current agency-wide suspension of the unrestricted release of uncontaminated scrap metal currently being stored in the radiological areas at the DOE sites. Under the no action alternative, the Secretary would not delegate any decision making authority to the Department's Under Secretaries for the clearance and release of these scrap metals, DOE would continue to store materials in DOE controlled areas for an indefinite period of time and additional storage space may be required to accommodate future generation of uncontaminated scrap generated as some facilities. Routine security, monitoring, and maintenance of the storage areas at each DOE site would continue.

## 3.0 AFFECTED SITES, FACILITIES, AND CONDITIONS

This section describes the affected environment used as the baseline for evaluating the potential of the proposed action and alternatives and provides information on the quantities of material which could be affected by the proposed action. Section 3.1 identifies the affected DOE sites and facilities, organized by the cognizant Under Secretary. Section 3.2 provides information on the quantities of metals that did not originate from DOE radiological areas (i.e., metals not affected by the Secretarial suspension) that were recycled for each site or facility over the past seven years. Section 3.3 provides estimates of the quantity of metals from radiological control areas currently encumbered by the Suspension.

### 3.1 AFFECTED SITES AND FACILITIES

This PEA covers all DOE sites and activities managed by the Under Secretaries for missions related to the Office of Science, Nuclear Security, Nuclear Energy, and Environmental Management. There are a few small sites not listed in the following table of sites considered by this PEA which generate very small and sporadic amounts of scrap metal. These small sites are discussed in Appendix D. Metals with volumetric radiological contamination, and scrap metals resulting from RCRA and CERCLA clean-up activities, are not included in the scope of the PEA. In addition, sites under Legacy Management are not included since these facilities do not generate potentially radiologically contaminated scrap metal that would be recycled. A listing of the sites and facilities considered in this PEA appears below, as organized by the cognizant Under Secretary, and a summary description of the operations and activities at each of these sites/facilities is included in Appendix D.

**Sites Considered in this PEA**

**Under Secretary for Science**
- Ames National Laboratory
- Brookhaven National Laboratory
- Argonne National Laboratory
- Oak Ridge National Laboratory
- Thomas Jefferson National Accelerator Facility
- Pacific Northwest National Laboratory
- Lawrence Berkeley National Laboratory
- New Brunswick Laboratory
- Fermi National Accelerator Laboratory
- SLAC National Accelerator Laboratory
- Princeton Plasma Physics Laboratory
- Oak Ridge Institute for Science and Education

**Under Secretary for Nuclear Energy**
- Idaho National Laboratory

**Under Secretary for Nuclear Security**
**National Nuclear Security Administration**
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Nevada National Security Site
- Pantex Plant
- Sandia National Laboratory – California
- Sandia National Laboratory – New Mexico
- Y-12 National Security Site
- Bettis Atomic Power Laboratory
- Knolls Atomic Power Laboratory

**Environmental Management**
- East Tennessee Technology Park
- Hanford Site
- Paducah Plant
- ORNL TRU Waste Processing Center
- Portsmouth Plant
- Savannah River Site
- Waste Isolation Pilot Plant
- Small sites[4]

[4] Environmental Management Small Sites consists of the Energy Technology Engineering Center (ETEC) near Canoga Park, CA; West Valley Demonstration Project in West Valley, NY, and the Separations Process Research Unit near Schenectady, NY. To date ETEC has not generated salable scrap nor has stockpiled suspension policy encumbered scrap metal.

The sites covered by this analysis, as listed on page 10, are highly diverse. These sites range from research laboratories resembling small college campuses, located in close proximity to populated areas, to very large industrial manufacturing facilities, remotely located in less populated areas. A description of the environmental setting and issues at each of these facilities may be found in the site's ASER. The ASERs can be obtained from the Public Affairs contact of each individual DOE site. Many of the ASERs are available online. Additional site descriptions and information for contacting each site is given in Appendix D.

## 3.2 ANNUAL METAL RECYCLING

Consistent with Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* and EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, DOE has a policy of recycling and reusing materials whenever possible. In the course of normal operations, DOE sites generate and release metals for recycle that did not originate from radiological areas (i.e., metals that were not affected by the Secretarial suspension). Based on currently available information, DOE metal recycle, in metric tonnes[5] for each major type of metal, for the years 2005 through 2011, is provided in Appendix E for the sites and facilities considered in this PEA. Major types of metal offered for recycle include stainless steel, copper, iron/steel, and aluminum. The data reflect the best available information from the sites and show significant variability, depending on the site-specific conditions and operations conducted in any given year. Some sites are able to segregate uncontaminated scrap metal by type of metal before release, but many sites simply accumulate and release unsorted metal, requiring the recycle contractor to sort the specific materials.

The 7-year annual average, and 7-year total metal recycle amounts, in metric tonnes, by DOE site are summarized in Table 3-1. These data indicate that the site that released the largest total quantity of metal for recycle was Savannah River Site (SRS), with a 7-year total of about 10,420 metric tonnes. SRS also had the largest 7-year average annual release of about 1,489 metric tonnes. By contrast, Oak Ridge Institute for Science and Education (ORISE) had the lowest quantity of metal released for recycle with a total of about 25 metric tonnes over the past seven years, for a 7-year annual average release of about 3.5 metric tonnes. The annual amount of materials recycled by the DOE sites may be found in Appendix E, Table E-1.

## 3.3 METALS POTENTIALLLY AFFECTED BY THE PROPOSED ACTION

To help understand the potential impacts of the proposed action and alternatives, DOE conducted an internal survey to estimate how much metal would be suitable for recycle or disposal should there be a change in policy delegating the Secretary's decision-making authority to the Department's Under Secretaries. Table E-2, in Appendix E, provides the information obtained through the survey in terms of metric tonnes of suspension impacted metal originating from DOE radiological areas. The estimated total of suspension encumbered metal accumulated during ten years (since the suspension was imposed) from 2001 through 2010 is shown in Appendix E (Table E-3) as 13,790 metric tonnes for all of the sites. The majority (about 70%) of this scrap metal is stored at two sites – Brookhaven National Laboratory in New York and Fermi National Accelerator Laboratory in Illinois. This is based on the best information available and gathered from the DOE sites during the Spring of 2012. The 13,790 metric tonnes of metal in storage at all of the sites encumbered by the suspension as of 2010 is considerably less than the 84,098 metric tonnes of metal not encumbered by the suspension that was generated and released over a 7-year period from 2005 through 2011. In addition to the existing 13,790 metric tonnes of scrap metal encumbered by the suspension, based on historical scrap metal generation rates, it is estimated that from 5

[5] A metric ton is equivalent to 2204 pounds while a short ton is equivalent to 2000 pounds. Metric tonnes are sometimes referred to as "long tons."

to 10 percent of this quantity, or from 700 to 1,400 metric tonnes, would be covered by the suspension on an annual basis.

### 3.4 CURRENT INDUSTRY INFORMATION

To assist in the understanding of the potential additive effects of the proposed action and alternatives, the broader context of metal recycled in the United States has been compiled for analysis. A summary of the production and recycle of metals within the United States for the period 2005 through 2010, with the annual average over this period are provided in Table 3-2. The annualized data are shown in Appendix E, Table E-3. The top seven rows of this table provide total metal production (in metric tonnes) while the bottom three rows provide total metal recycle (also in metric tonnes). The table shows production of steel, broken down by carbon steel, stainless steel, and other alloy steel, iron, aluminum, and copper. For metal recycle, the metal categories are aluminum, copper, iron, and steel.

The 13,790 metric tonnes of suspension-encumbered uncontaminated scrap metal quantities that could be allowed to be recycled if the suspension were to be modified by decision of an Under Secretary is an extremely small fraction (of the order of 0.004 percent) of the total metal recycled during the five years from 2005 through 2009 in the United States, which totaled 335,272,000 metric tonnes (see Table 3-2).

### Table 3-1: Recycle of Metal Not Encumbered by the Suspension

| | Quantities by Site ** (metric tonnes) | |
|---|---|---|
| | 7-Year Total | 7-year Average |
| **Office of Science Sites** | | |
| Ames National Laboratory | 74.6 | 10.7 |
| Argonne National Laboratory* | 1,334.7 | 190.7 |
| Brookhaven National Laboratory | 1,947.8 | 278.3 |
| Fermi National Accelerator Laboratory | 2,918.8 | 417.0 |
| Lawrence Berkeley National Laboratory | 1,251.3 | 178.8 |
| Oak Ridge Institute for Science and Education | 24.7 | 3.5 |
| Oak Ridge National Laboratory | 1,996.5 | 285.2 |
| Pacific Northwest National Laboratory | 872.5 | 124.6 |
| Princeton Plasma Physics Laboratory | 3,206.0 | 458.0 |
| SLAC National Accelerator Laboratory | 1,087.7 | 155.4 |
| Thomas Jefferson National Accelerator Facility | 333.1 | 47.6 |
| **NNSA Sites** | | |
| Bettis Atomic Power Laboratory | 3,095.2 | 442.2 |
| Knolls Atomic Power Laboratory | 2,751.6 | 393.1 |
| Lawrence Livermore National Laboratory | 9,484.3 | 1354.9 |
| Los Alamos National Laboratory | 3,710.0 | 530.0 |
| Nevada National Security Site | 2,848.6 | 406.9 |
| Pantex | 2,514.8 | 359.3 |
| Sandia National Laboratory – California | 756.5 | 108.1 |
| Sandia National Laboratory – New Mexico | 7,953.6 | 1136.2 |
| Y-12 National Security Site | 6,113.3 | 873.3 |
| **Office of Nuclear Energy Sites** | | |
| Idaho National Laboratory | 516.5 | 73.8 |
| **Office of Environmental Management Sites** | | |
| East Tennessee Technology Park | 3,321.2 | 474.5 |
| Hanford Site | 4,950.0 | 707.1 |
| Paducah Plant | 500.1 | 71.4 |
| Portsmouth Plant | 8,760.1 | 1251.4 |
| Savannah River Site | 10,420.0 | 1488.6 |
| West Valley | 844.4 | 120.6 |
| WIPP | 510.1 | 72.9 |
| Not Encumbered by Suspension | 84,098 | 12,014.0 |

* Data for New Brunswick Laboratory are included in totals for Argonne National Laboratory
** This information was generated as a result of a data call asking the sites to provide this specific information

**Table 3-2: Production and Recycle of Metals within the United States**

| | Row # | Metal | Type | 5 Year Total |
|---|---|---|---|---|
| TOTAL METAL PRODUCTION | 1 | Steel[1] | Carbon steel | 392,200,000 |
| | 2 | Steel[1] | Stainless steel | 10,380,000 |
| | 3 | Steel[1] | All other alloy steel | 25,440,000 |
| | 4 | Steel[1] | Raw Steel Production Grand Total | 428,100,000 |
| | | | | |
| | 5 | Iron[1,2] | Pig Iron Production | 153,700,000 |
| | | | | |
| | 6 | Aluminum | Primary Production | 9,395,600 |
| | 7 | Copper | Primary Production | 5,870,000 |
| | | | Total of Rows 4, 5, 6, & 7 | 597,065,600 |

| | Row # | Metal | Type | 5 Year Total |
|---|---|---|---|---|
| TOTAL METAL RECYCLED | 8 | Aluminum | Recycled | 16,400,000 |
| | 9 | Copper | Recycled | 4,472,000 |
| | 10 | Iron & Steel | Recycled | 314,400,000 |
| | | | Total of Rows 8, 9, & 10 | 335,272,000 |

Notes:

All units are metric tonnes; the source of data is shown in Appendix E from http://mineral.usgs.gov.

[1] Steel and Iron data in the source were rounded to three significant digits and presented in units of thousands. For purposes of comparison the data are presented as whole numbers; apparent errors in the totals are a result of rounding.

[2] More than 95% of iron made is transported in molten form to steelmaking furnaces located at the same site.

# 4.0 ENVIRONMENTAL CONSEQUENCES

## 4.1 ENVIRONMENTAL RESOURCE IMPACTS

The expected environmental impacts associated with the No Action Alternative, the Proposed Action Alternative, and the Disposal Alternative as described in Chapter 2 are discussed, below, by specific environmental resource area.

The environmental resource areas include:

- Land Use
- Greenhouse Gas Impacts and Climate Change
- Geology and Soils
- Noise
- Air Quality
- Water Resources
- Environmental Justice
- Historic and Archeological and Native American Resources
- Biological Resources
- Human Health and Safety
- Traffic
- Socioeconomic

### 4.1.1 LAND USE

Under the Proposed Action Alternative, there would be no need for additional long-term storage capacity and, accordingly, no new land development required. Materials are presently stored in existing facilities for which processing, packaging, handling, and transport access already exist. It is expected that the resumption of recycling these materials would free-up land resources presently committed to the storage of these materials at sites where disposal of these materials is not routinely practiced. As these materials are recycled, existing storage requirements would be reduced and land previously committed for such purposes would be freed up for other use. Under the Proposed Action Alternative, if decided by an Under Secretary, materials that would be routinely disposed of would be recycled and make disposal capacity otherwise required for the disposal of this material available for other uses. Under the Proposed Action Alternative, the amount of land used for mining the metal ores would be reduced as a result of the recycling of these metals.

Under the Disposal Alternative, as these materials are disposed of, existing storage requirements would be reduced and land previously committed to the storage of encumbered uncontaminated scrap metal would be freed up for other use. However, this alternative, by eliminating the recycle option for uncontaminated scrap metal, would require allocation of additional disposal capacity to accommodate these materials. Use of existing disposal capacity for uncontaminated materials would necessitate allocation of additional land resources, approximately 20 square feet per metric tonne, to accommodate disposal of non-recyclable materials.

Under the No Action Alternative, as additional material is generated, if not disposed of, more long term storage capacity would be required. This would require additional allocations of land at most, if not all, sites hosting radiological operations. On average, it is estimated a metric tonne of scrap metal requires about 20 square feet of storage space. Accordingly, the land use associated with the storage of from 20 to 10,000 metric tonnes at any one facility is small and would not constitute significant allocation of land resources. This alternative could also require the clearing of additional, temporary laydown areas to be used to store equipment and materials during construction of additional storage capacity.

### 4.1.2 GEOLOGY AND SOILS

Under the Proposed Action Alternative, depending on the decisions of the cognizant Under Secretary, there would be no need for additional long term storage capacity and, accordingly, no disturbance of geology and soils at the sites, as no new land development would be required. Land resources previously used to store encumbered materials would be freed up for alternate use or conservation as the materials presently being stored are cleared and transported off-site for recycling. Under the Proposed Action Alternative the amount of geology and soils disturbed by the mining of metal ores would be reduced as a result of the recycling of these metals.

The Disposal Alternative impacts to geology and soils would be minimal, since the scrap metal would be disposed of in existing landfills within existing disturbed areas.

Under the No Action Alternative, as additional material is generated, if not disposed of, additional long term storage would be required. This would require additional allocation of land, clearing and preparation of additional laydown areas, and the potential construction of new storage facilities. These activities would entail the disturbance of soils, and possibly the disruption of soil to clear temporary, construction laydown areas. Such soil disturbance would be minimal, short-lived, and would not be expected to have significant impacts on the environment.

### 4.1.3 NOISE

Under the Proposed Action Alternative, depending on the decisions of the cognizant Under Secretary, it is not expected that noise levels would appreciably differ from the existing levels at the sites or at the site boundaries. The normal over the road gross weight limit for trucks is 80,000 pounds (DOT 2012). Accounting for the weight of the truck (average of 30,000 pounds) this would allow fully loaded truckloads of 50,000 pounds per shipment. Based on the quantities of material identified in Appendix E, Table 2, at an approximate load of 12.5 to 25 tons per truck, it is estimated that the removal of the accumulated material from all of the DOE sites would require approximately 610 to 1,200 truckloads. It is estimated that from 25 to 50 truckloads per year would be required to transport the amount of newly generated uncontaminated scrap metal expected to be generated from all of the DOE facilities on a regular basis. Although fully loaded trucks would result in a fewer number of shipments, the higher numbers of 1,200 initial shipments, and 50 annual shipments for each year thereafter are used for this analysis to account for partial loads which may take place at the convenience of the recyclers or in consideration of local highway load limitations. The estimates of 1,200 initial truckloads and 50 truckloads each year thereafter, nationwide, will account for these considerations. Most of the initial shipments would occur at the DOE sites having the highest amounts of accumulation of encumbered metals. Over the first year these initial shipments would amount to about five truckloads per working day on average, nationwide, although more transportation activity can be expected at Fermi National Accelerator Laboratory and Brookhaven National Laboratory due to higher accumulations of encumbered scrap stored at these sites. Once this accumulated amount of material is removed, it is estimated that a maximum of approximately 50 truckloads a year, nationwide, or about 4 truckloads a month would be required to remove newly generated scrap materials from all DOE sites. As with the initial shipment estimates, this estimate of 50 truckloads is substantially higher than what would be required should every truckload be fully loaded to capacity (25 truckloads). Transportation activity associated with newly generated material is expected to be evenly distributed across all DOE sites nationwide, although some year to year differences could occur.

The noise emitted by light traffic is approximately 50 decibels (dBA) at a distance of 50 feet, and for a heavy truck is approximately 88 dBA at 50 feet (FHWA 1996; USEPA 1971). The Occupational Safety and Health Administration (OSHA) has a noise exposure standard that is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 decibels averaged over eight hours (29 CFR 1910.95). A 24-hour exposure level of 70 dBA is indicated by EPA as the level of environmental noise at which any measurable hearing loss over a lifetime may be prevented, and levels of 55 dBA outdoors and 45 dBA indoors are defined as preventing activity interference and annoyance to human receptors (EPA 1974). The noise emitted by the estimated additional trucks required to transport the recyclable materials would add to background traffic noise in an intermittent fashion; however, it is not expected to significantly increase the 24-hour noise exposure levels at any of the DOE sites as a result of the proposed action alternative.

Under the Disposal Alternative, noise emission impacts would be similar to those of the Proposed Action Alternative.

Under the No Action Alternative, it is not expected that the continued storage of these materials would contribute to noise levels that appreciably differ from the existing noise levels at the facilities or their boundaries. The noise emitted by the small number of truckloads and for any construction required would be within acceptable levels, of short but recurring duration, and would originate from isolated locations. It is not expected that this would have any impact on normal noise emission patterns of the sites or surrounding communities.

### 4.1.4 GREENHOUSE GAS IMPACTS AND CLIMATE CHANGE

Under the Proposed Action Alternative, depending on the decisions of the cognizant Under Secretary, small amounts of the GHGs (i.e., carbon dioxide, carbon monoxide, methane, and nitrous oxide) would be released to the environment from the emissions of the vehicles used in the loading and transport of these materials. Based on the quantities of material identified in Appendix E, Table 2, at an approximate load of 12.5 to 25 tons per truckload, it is estimated that the removal of the accumulated material from all of the DOE sites would require as many as 1,200 truckloads, or about five truckloads per working day, on average (see Section 4.1.3, Noise, for additional detail). It is estimated that as many as 50 truckloads per year would be required to transport the amount of newly generated uncontaminated scrap metal expected to be generated from all of the DOE facilities, on a regular basis. Since existing recyclers will compete and bid for this material and are located at varying distances from the generating sites, it is not possible to estimate the trip mileage for these shipments. Such a small number of shipments and the associated mileage (estimated in Section 4.1.11, Traffic Safety) would contribute only a small amount to the total GHG emissions of the sites (also see Section 4.1.5 Air Quality) , and would not be expected to be of the magnitude to have a measurable effect on air quality or an effect on climate, irrespective of the mileage variances which could occur. Selection of the Proposed Action Alternative would allow for the recycling of metals which would reduce the GHG and other emissions associated with the mining and smelting of that amount of raw ore required for a corresponding amount of metals, although precise estimates of reductions in emissions would be difficult to determine.

Under the Disposal Alternative, emissions of GHGs and impacts to climate change would be similar to those of the Proposed Action Alternative, since the number of truck shipments and the associated mileage required to transport this material to an appropriate disposal facility/landfill would be roughly the same as the number of shipments and associated mileage necessary to transport the scrap metal to recycling facilities.

Under the No Action Alternative, there would be small amounts of GHG released to the environment from the emissions of vehicles used in the loading and transport of materials to the storage facilities or in clearing new storage areas. Such emissions would be infrequent and spread over a long period of time. This would contribute a small amount to the total GHG emissions of the sites, but would not be expected to be of the magnitude to have a measurable effect on air quality or an effect on climate.

### 4.1.5 AIR QUALITY

Under the Proposed Action Alternative, if the cognizant Under Secretary were to decide to release uncontaminated scrap metal, it is not expected that air quality would be impacted. Emissions from the small number of truckloads used in the transport of previously accumulated material, as well as future material, would generate small amounts of GHG, which would be released to the environment. Under the current EPA Tier 1 standards, diesels and larger vehicles have less stringent standards than do gasoline powered passenger vehicles. For large diesel trucks, nitrous oxide emission standards range from 0.4 to 1.5 grams/mile, and particulate matter emissions range from 0.08 to 0.12 grams/mile (ORNL 2009). As described in Sections 4.1.3 and 4.1.4 above, the number of truckloads and associated mileage required to remove this material is small. Using the mileage estimates used in Section 4.1.11, Traffic Safety (which are illustrative and have no basis in fact), this would amount to 243 to 1,820 kilograms of nitrous oxide, and 49 to 146 kilograms of particulate matter, nationwide, in the first year. Using these same estimates, emissions would amount to 20 to 75 kilograms of nitrous oxide and from 4 to 6 kilograms of particulate matter, nationwide, each year thereafter. Accordingly, the increased emissions resulting from this action would be small, of a temporary nature, and would not be expected to degrade the existing air quality of the sites or the surrounding communities. Under the Proposed Action Alternative, the amount of particulate matter and emissions from trucks and equipment used in the mining and smelting of metal ores would be reduced as a result of the recycling of these metals.

Under the Disposal Alternative, impacts to air quality would be similar to those of the Proposed Action Alternative, since the number of truck shipments and associated mileage required to transport this material to the appropriate disposal facilities/landfills would be roughly the same as the number of shipments and associated mileage necessary to transport the scrap metal to a recycling facility.

Under the No Action Alternative, it is not expected that air quality would be impacted. If additional storage facilities were required, construction and the associated soil disturbance could cause minimal, localized dust emissions. Standard dust suppression methods, such as water spraying, would be used to minimize the effects of such emissions. Trucks and equipment would generate small amounts of particulate matter, GHG, and other emissions that would be released to the environment. Such additional emissions, however, would be temporary, small, and would not be expected to have long-term impacts to the air quality of the sites or surrounding communities.

### 4.1.6 SOCIOECONOMIC

Under the Proposed Action Alternative, if the cognizant Under Secretary decided to allow the release of uncontaminated scrap metal, it is not expected that there would be any significant socioeconomic impacts. Inspection, assessment, certification, packaging, and loading for transport would be conducted by existing personnel at the various sites, and the transport of these materials would be conducted by local commercial transportation companies. No new jobs would be created or lost as a result of this action. Recyclers would receive additional income from the purchase, transport, and resale, and/or reuse of these materials; however, the level of increased income would not be expected to have measurable impacts on the local, regional, or national economies at any of the sites.

Under the Disposal Alternative, the local economies would not benefit from the additional income generated as a result of the purchasing, transportation, resale, and or reuse of these materials. However, as stated in the Proposed Action Alternative, the amount of lost income from these activities is small and would not be expected to have measurable impacts on the local, regional, or national economies.

Under the No Action Alternative, it is not expected that there would be any socioeconomic impacts. If additional storage facilities were to be required, it is not expected that any more than 20 construction jobs would be created in any year at any one site. This category and number of jobs could readily be filled by the existing labor force at each of the sites. In addition, no influx of new workers or corresponding burden on the local socioeconomic infrastructures would be expected at any of the sites. Socioeconomic impacts resulting from the selection of this alternative would not be expected to have measurable impacts on the local economies of the DOE sites. Indefinite storage would also incur additional costs to DOE and the taxpayer for monitoring, security, recordkeeping and upkeep.

### 4.1.7 WATER RESOURCES

Under the Proposed Action Alternative, if the cognizant Under Secretary were to decide to allow the release of uncontaminated scrap metal, no water usage would be required and no activities which have the potential to degrade water resources would be conducted in surrounding communities. Under the Proposed Action Alternative, the amount of water used in the mining and smelting of metal ores would be reduced as a result of the recycling of these metals.

Impacts to water resources under the Disposal Alternative would occur within the permitted parameters for the disposal facilities/landfills selected for receipt of the scrap metal.

Under the No Action Alternative, it is not expected that water resource quality would be impacted. Surface water runoff from storage facilities is managed in compliance with the facility National Pollutant Discharge Elimination System (NPDES) permits. Any additional storage facility construction would be designed to control and contain surface water runoff in compliance with the NPDES permits for the sites. Preventive measures would be employed during construction to catch and retain surface water runoff, to minimize the potential for the contamination of surrounding surface water or ground water. Any new construction of storage facilities would take into account the locations of waterways (e.g., ponds, lakes, rivers, and streams), identify the 100- and 500-year floodplains, and be conducted in compliance with the requirements of EO 11988, *Floodplain Management*. Any construction of new storage facilities would also take into account any wetland areas and be conducted in compliance with the requirements of EO 11990, *Protection of Wetlands*. In addition, any new construction would also be conducted pursuant to the requirements of 10 CFR, Part 1022, *Floodplain/Wetland Environmental Review Requirements*.

### 4.1.8 HISTORIC ARCHEOLOGICAL AND NATIVE AMERICAN RESOURCES

Under the Proposed Action Alternative, it is not expected that the activities required to resume recycling of the materials would have any impacts on historic, archeological, or Native American resources. The transport of materials would utilize existing storage facilities, existing processing facilities, and existing roads.

Under the Disposal Alternative, impacts to historical, archeological and Native American resources would not be anticipated, since disposal of the scrap metal would occur at existing facilities/landfills within existing disturbed areas.

Under the No Action Alternative, it is not expected that historic, archeological, or Native American resources would be impacted. Storage facilities and roads used in the transport of these materials are currently in place. In the event that additional storage facilities or roads were to be required, the location of known historical, archeological, and Native American resources would first be determined before initiating any construction. Prior to any construction DOE would consult with the appropriate State Historic Preservation Office and Tribal Leaders. During construction, a qualified cultural resources monitor would be used to identify any additional cultural sites, and at such time as such sites are identified, construction would be halted, and a course of action to comply with the requirements of the National Historic Preservation Act of 1966 would be taken. Construction of any storage facilities or laydown areas would be conducted in a way such that any fugitive dust emissions would not degrade known archeological or cultural resources.

### 4.1.9 BIOLOGICAL RESOURCES

Under the Proposed Action Alternative, it is not expected that there would be any impacts to biological resources other than the increased risk of vehicular mortality as a result of increased traffic. The number of vehicles attributable to this action is small in relation to the normal vehicular volume at each of the DOE facilities considered by this analysis

Under the Disposal Alternative, impacts to biological resources resulting from vehicular mortality would be similar to those of the Proposed Action Alternative, because disposal of metal as waste would require the same number of shipments. Impacts to biological resources associated with the burial of the scrap metal would be small since disposal would occur in existing disposal facilities/landfills on land dedicated for this use.

Under the No Action Alternative, the clearing of land and the construction of new storage facilities could temporarily displace terrestrial wildlife due to the removal of vegetation and the disturbance of soil by construction equipment. It could also eliminate potential habitats, but would be unlikely to adversely affect species of concern at any of the sites. There could be minor short term harm to wildlife and vegetation by degrading air quality during construction activities, as discussed in section 4.1.5. Such incidents would be localized, affect very small areas, be temporary, and of short duration. It is not expected that any aquatic biota would be impacted. It is not expected that there would be any impacts to migratory or other bird species.

### 4.1.10 HUMAN HEALTH AND SAFETY

The U.S. Department of Energy (DOE) proposes modifying the Secretarial suspension on the unrestricted release for recycle of uncontaminated scrap metals originating in DOE “radiological areas” (as defined by 10 CFR Part 835.2, *Occupational Radiation Protection*), with the potential for surface, not volume, radioactivity. The candidate scrap metals would only be released following a clearance process to document that they meet requirements for unrestricted release contained in DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011). Scrap metals that do not meet these human health and safety standards would be identified as contaminated and would continue to be managed as radioactive material until disposed of as waste.

DOE Order 458.1 offers protection consistent with national and international recommendations for the clearance of materials originating from controlled areas (NCRP 2002, ANSI/HPS 1999, IAEA 2011, ICRP 1991) and considered to be protective of human health and the environment. As stated in DOE Order 458.1, personal property can only be cleared from controlled areas if it can be shown that clearance will result in acceptable authorized limits which are less than 1 mrem above background to a member of the public in any one calendar year. To further reduce the level of risk, DOE requires a documented process to be implemented to optimize control and management of radiological activities so that doses are kept as far below the dose limits and constraints as is practicable through implementation of the ALARA process. Additional information on such requirements which assure that scrap metal and materials cleared for release from controlled areas are protective of human health and the environment may be found in Appendix A.

The exposure of members of the public to all DOE sources of radiation is limited by DOE to levels that shall not cause, in a year, a total effective dose greater than 100 mrem outside of controlled areas on DOE sites and off of DOE sites. Demonstration of compliance with this limit is documented by a combination of measurements and calculations for the maximally exposed individual by using models or methods approved by the Environmental Protection Agency and stipulated by DOE Order 458.1. The DOE provides a level of protection for persons consuming water from a public drinking water supply by complying with the drinking water criteria in 40 CFR 141 and DOE Order 458.1 which limits the effective dose equivalent to levels which meet public water system concentration limits.

Under the Proposed Action Alternative, impacts to the public would be limited to those occupational injuries associated with the transportation of the scrap metal and the processes by which the metal is transformed into useful product, and would not expected to be significant. For the Disposal Alternative, impacts to the public would be the same as those associated with the use of existing landfills and disposal facilities.

Under the No Action Alternative, impacts to the public would not be expected. Under the No Action Alternative, as well as the other two alternatives, workers have the potential to be exposed to radiation due to the location of storage of the scrap metals in radiological areas. In the event that radioactive materials were present, DOE's worker radiation protection program includes training, measurement of dosages, history of worker dose, constant review of these histories, and a host of other protective measures that have resulted in an excellent record of radiation worker safety. Foremost among these practices is ALARA, discussed in Chapter 2. Furthermore, DOE workers operating in controlled areas have cumulative dose limitations. Work conducted as a result of this alternative would not change those limits, therefore, it is not expected that there would be an increased risk of exposure for DOE workers under this alternative. Since the materials would remain in controlled areas, it is not expected that there would be an increased risk of exposure to the public. The construction of additional storage facilities at the sites, which could be required by the No Action Alternative, would entail some level of occupational health risks to workers. DOE safety and health requirements would be expected to minimize these risks to acceptable levels. Nevertheless, the potential for work-related accidents resulting in harm or even death to construction workers exists.

### 4.1.11 TRANSPORTATION SAFETY

Under both the proposed action alternative and the disposal alternative, the use of heavy trucks to transport recycled materials could entail accidents and fatalities. Driver education and driver improvement programs can minimize such accidents and fatalities but cannot eliminate them. The Department of Transportation's National Highway Traffic Safety Administration (NHTSA) compiles and publishes statistics on transportation accidents. Table 4-1, shows the number heavy truck fatalities per 100 million vehicle miles traveled (VMT) for the five-year period, 2006 to 2010, as collected by the NHTSA's National Fatality Reporting System (NFRS) (NHTSA 2012). These fatalities include the drivers of the trucks as well as the drivers and passengers other vehicles involved in accidents.

**Table 4-1: Heavy Truck Fatalities**

| Year | 2006 | 2007 | 2008 | 2009 | 2010 | Average |
|---|---|---|---|---|---|---|
| Fatalities per 100 million VMT | 2.14 | 1.52 | 1.32 | 1.11 | 1.22 | 1.46 |

Source: NHTSA

As discussed in Sections 4.1.3, Noise, 4.1.4, Greenhouse Gas Impacts and Climate Change, and 4.1.5, Air Quality, it is estimated that for both the proposed action alternative and disposal alternative that as many as 1,200 truckloads in the first year, and as many as 50 truckloads each year thereafter would be required to transport the recyclable materials. Because it is not possible to know the precise recyclers who will transport this material or the facilities they will transport this material to, it is not possible to determine the precise distances involved for each shipment. An estimate of 1,000 miles per round trip is used to give a representation of the magnitude of potential transportation safety impacts associated with these two alternatives (use of this number is illustrative and has no basis in fact). Based on the 1,000 mile round trip estimate, and using the average annual NHTSA fatalities per 100 million VMT for the five year period 2006 to 2010, 1.46 fatalities, the proposed action alternative and the disposal alternative would each be expected to result in 1.77 fatalities in the first year, and 0.00009 fatalities each year thereafter.

### 4.1.12 TRAFFIC

Under the Proposed Action Alternative, the quantity of materials to be recycled and thus trucked away from the sites would be small in relation to the normal amounts of material transported, on a regular basis, to and from these sites. As discussed in Sections 4.1.3, 4.1.4, 4.15, and 4.1.11, and based on illustrative trip millage, it is estimated there would be approximately five truckloads per working day, on average, nationwide, in the first year, and about 4 truckloads a month, each year thereafter, as a result of the proposed action alternative. Accordingly, it is not expected that this action would burden the existing transportation infrastructure of any of the sites or surrounding communities.

Under the Disposal Alternative, impacts to traffic would be similar to those of the Proposed Action Alternative.

Under the No Action Alternative, the construction of new storage facilities would result in increased traffic resulting from workers commuting to the site, deliveries of construction materials, and construction vehicles being transported to and from the construction sites. Such storage facility construction areas would be small, employ less than 20 workers, and would be expected to last less than a year. Such projects could easily be accommodated by the existing transportation infrastructure without impacting existing traffic patterns.

### 4.1.13 ENVIRONMENTAL JUSTICE

The February 11, 1994, EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires Federal agencies to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

Under the Proposed Action Alternative, it is not expected that there would be any off-site environmental impacts affecting water or air quality or resulting in adverse health effects. Processing and commoditization of uncontaminated scrap metals would be accomplished using established commercial sector capabilities. Potential construction would not be of the magnitude to create measurable socioeconomic impacts. Thus, there would be minimal or no impacts to populations residing near the sites, as well as along transportation corridors. Accordingly, it is not expected that selection of this alternative would have any disproportionately high and adverse impacts on minority populations, or low-income populations.

Under the Disposal Alternative, for reasons similar to those of the Proposed Action Alternative, it is not expected that selection of this alternative would have any disproportionately high and adverse impact on minority populations, or low-income populations.

Under the No Action Alternative, it is not expected that there would be any off-site environmental impacts affecting water or air quality or resulting in adverse health effects. Potential construction would not be of the magnitude to create measurable socioeconomic impacts. Accordingly, it is not expected that selection of this alternative would have any disproportionately high and adverse impact on minority or low-income populations in proximity to these sites.

## 4.2 CUMULATIVE IMPACTS

Cumulative impacts are those potential environmental impacts that result "from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions." Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

All of the sites considered by this PEA have planned activities that have the potential to affect the environment. Some of the sites have private development projects on or near the site. In addition several of the sites have varying levels of highway construction projects nearby. DOE routinely reviews these plans. Nevertheless, due to the small potential impacts of the No Action Alternative, the Proposed Action Alternative and the Disposal Alternative, DOE does not expect that any of these alternatives would have the potential to contribute to creating a significant cumulative environmental impact.

## 4.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource or limit those factors that are renewable only over long periods of time. An irreversible commitment of resources refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. While an action may result in the loss of a resource that is irretrievable, the action may be reversible. Irreversible and irretrievable commitments of resources are small and primarily related to construction activities.

Under the Proposed Action Alternative, depending on the decisions of the cognizant Under Secretary, resources consumed in the transportation of materials, such as labor, and fossil fuels, would be committed for some period of time until there were no more materials requiring transport. Nonrenewable fossil fuels would be irretrievably lost through use of gasoline and diesel powered transportation equipment. There would be a benefit to the environment from a decrease in the need for the mining and refining of metals due to the recycling of these materials. Mining and smelting activities are large users of water and power, both of which would be reduced by the recycling of these materials. In addition, there would be benefits to the environment resulting from reduced land use, reduced disturbance of geology and soils, reduced GHG and other emissions, and reduced occupational injuries associated with the reduced need for mining and refining of metal ores attributable to the recycling of these materials. Finally, storage areas used to manage encumbered materials would be rehabilitated and be available for other uses.

Under the Disposal Alternative, metal that would otherwise be recyclable from DOE sites would be sent to appropriate waste disposal facilities (e.g., industrial, sanitary, or low level radioactive waste (LLW). For scrap metal that is not contaminated and may be disposed of in a sanitary or industrial landfill, a contractual commitment from the waste disposal facility operator that this scrap metal will not be retrieved and recycled will be obtained. Resources consumed in transportation of materials, such as labor, and fossil fuels, would be committed over some period of time until there is no more material requiring disposal. Nonrenewable materials and fossil fuels would be irretrievably lost through disposal of recyclable materials and use of gasoline and diesel powered transportation equipment. In addition disposal facility capacity would be consumed by the disposal of this material, which could have been recycled. Loss of this disposal resource would require additional commitments of land to replace this capacity.

Under the No Action Alternative, resources consumed in the construction of additional storage facilities such as labor, fossil fuels, and construction materials would be committed over the life of the construction project. Additional mining and smelting activities (although very small), which are large users of water and power, would be required. Nonrenewable fossil fuels would be irretrievably lost through use of gasoline and diesel powered construction equipment. Land would be irreversibly committed for as long as these storage facilities exist.

## 4.4 UNAVOIDABLE ADVERSE IMPACTS

Under the Proposed Action Alternative, it is not expected that there would be any measurable unavoidable adverse impacts to the environment. There would be a benefit to the environment from a decrease in the need for the mining and refining of metals attributable to the recycling of these materials. Mining and smelting activities are large users of water and power, both of which would be reduced by the recycling of these materials. In addition, there would be benefits to the environment resulting from reduced land use, reduced disturbance of geology and soils, reduced GHG and other emissions, and reduced occupational injuries associated with the reduced need for mining and smelting of metal ores resulting from the recycling of these materials.

Under the Disposal Alternative, it is not expected that there would be any measurable unavoidable adverse impacts to the environment. Small commitments of land for the disposal of these materials would be expected to occur.

Under the No Action Alternative, it is not expected that there would be any measurable unavoidable adverse impacts to the environment. The impacts associated with the construction of new storage facilities in terms of additional land disturbance, noise, emissions, and traffic, would be small and short-lived.

## 5.0 REFERENCES

| | |
|---|---|
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| | |
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# APPENDIX A: SURFACE ACTIVITY RELEASE CRITERIA

## DOE's Directive Covering Clearance of Property

DOE Order 458.1 *Radiation Protection of the Public and the Environment*[6], Section 4.k, *Release and Clearance of Property* (DOE 2011), provides the requirements associated with clearance of materials from radiological control. Real property is defined as land and anything permanently affixed to the land such as buildings. All other property is considered to be personal property. In the context of this PEA, metals for recycle are considered to be personal property. As stated in DOE Order 458.1, personal property can be cleared from controlled areas if it can be shown that the release will result in less than 1 millirem (mrem) above background to a member of the public in any calendar year. Stated otherwise, any personal property that potentially contains residual radioactive material can only be cleared from DOE control if it is demonstrated *to not have* residual radioactive material that would result in radiation exposure of 1 millirem per year (mrem/y) or more above background. This determination must be based on process and historical knowledge, radiological surveys/monitoring, or a combination of these methods. When property is surveyed, the types and quantities of residual radioactive materials and the levels of removable and total residual radioactive material on its surfaces are determined, including residual radioactive material under any type of coating such as paint.

## Authorized Limits

DOE Order 458.1 requires that Authorized Limits; that is, the limit on the concentration or quantity of residual radioactive material on the surface of the property, must be established and approved to provide reasonable assurance that the dose to an individual will not exceed 1 mrem/y above background. This individual dose is consistent with national and international recommendations for clearance (NCRP 2002, ANSI/HPS 1999, IAEA 2011, ICRP 1991) and is protective of human health and the environment. For comparison:

- The national and international standard for radiation protection of the public is 100 mrem in a year from all non-background sources of radiation and all exposed pathways (ICRP 1991, ICRP 2007, NCRP 2002, 10 CFR Part 835, 10 CFR Part 20, DOE Order 458.1).
- The dose constraint for clearance of real property is 25 mrem/y (10 CFR Part 20, and DOE Order 458.1).
- The Environmental Protection Agency (EPA) has established a dose limit of 15 mrem/y for public exposure derived from geologic disposal of high-level radioactive waste and spent fuel (40 CFR Part 191).
- EPA has established a 25 mrem/y whole body dose limit for nuclear power operations (40 CFR Part 190).
- The U.S. Environmental Protection Agency (EPA) has established a 4 mrem/y standard as part of its drinking water standards (40 CFR Part 141§66 2012).
- The EPA uses a 10 mrem/y standard as part of its Clean Air Act regulations (40 CFR Part 61, 1996).
- 1 mrem/y of radiation dose is equivalent to about one day of exposure to natural radioactive sources found around us in nature, referred to as background radiation (NCRP 2009).
- 1 mrem/y is the difference in cosmic radiation associated with a change in elevation of 500 feet; a person living at 500 feet above sea level receives a dose from cosmic radiation about 1 mrem higher than the person living at sea level (NCRP 2009).

[6] DOE Order 458.1 is available at: https://www.directives.doe.gov/directives/0458.1-BOrder-admc2/view

- EPA estimated that cosmic radiation exposures from a cross-country flight result in a dose of 2 to 5 mrem (NCRP 2009).
- A person living in a brick or stone house receives a background radiation dose that is up to about 7 mrem/y more than an individual living in a wooden house (NCRP 2009).
- A dose of 1 mrem/y has been designated by the National Council on Radiation Protection and Measurements (NCRP) as a "negligible individual dose (NID)" or a dose below which further efforts to reduce the dose to an individual member of the public are "unwarranted" (NCRP 2002).

**Implementation of Authorized Limits**

Case-specific authorized limits for residual radioactivity on the surface of scrap metal established in accordance with the requirements of DOE Order 458.1 are derived from the 1 mrem/y above background dose constraint. To further reduce the level of risk, DOE requires a documented process be implemented to optimize control and management of radiological activities so that doses are kept as far below the dose limits and constraints as is practicable through implementation of the As Low As Reasonably Achievable (ALARA) process. The ALARA process serves as a management and decision-making tool designed to maximize the total benefits of the radiation protection provisions of a DOE activity that may expose members of the public to ionizing radiation.

The authorized limits for clearance of metals with the potential for residual radioactive materials on surfaces can be derived using radiation exposure pathway modeling. Alternately, pre-approved authorized limits for surface contamination can be used. Pre-approved authorized limits in the form of surface activity guidelines that apply to all personal property, including metals, are shown in Table A-1.The surface activity guidelines shown in Table A-1 are consistent with the values in Regulatory Guide 1.86 (AEC 1974) used by the Atomic Energy Commission and its successor, the NRC to control radioactive materials on surfaces by its commercial licensees.

The pre-approved authorized limits for residual radioactivity shown in Table A-1 for material on surfaces are in units of disintegrations per minute per 100 square centimeters of surface area (dpm/100 $cm^2$) (DOE 1993). The pre-approved authorized limits may be adopted for use at a DOE site with the following conditions:

- Their use is documented in the environmental radiological protection program for a site.
- Application must be approved by the responsible DOE Field Element Manager.
- The approved authorized limits and supporting documentation must be made available to the public. DOE Field Element Managers must, as appropriate, include information on site clearance policies, protocols and programs into effective public notification and communications programs.
- DOE elements responsible for radiological clearance of property must ensure that final radiological monitoring or surveys are conducted and that documentation is prepared that shows that the clearance meets applicable requirements.
- DOE Field Element Managers responsible for oversight must implement programs to verify that the clearance requirements have been met, and determine activities necessary to independently verify compliance.
- A summary of the types and quantities of property cleared, and independent verification results must be summarized in the Annual Site Environmental Report (ASER).

**Perspective on DOE's Overall and Surface Dose Limit and Surface Criteria**

As stated above and shown in the ALARA Text Box on page 4 of this document, DOE's system for protection of the public and environment is a combination of dose limits and requirements to control exposures such that doses to the public are controlled through application of ALARA process. Considering *<u>all</u> sources and pathways*, the primary dose limit for public protection is 100mrem /y total effective dose; this total limit is consistent with national and international guidelines and federal guidance. To put the total DOE dose limit in perspective, the 100 mrem/y limit is significantly lower than the average natural background (i.e., excluding medical, consumer, and industrial products, and occupational exposures) in the United States of approximately 311 mrem/y (background in Denver, Colorado is 700 mrem/y) and is equivalent to the average effective dose delivered from one spinal x-ray. The effective dose received from a medical computed tomography (CT) scan ranges from about 100 mrem up to a few thousand mrem (Mettler 2008, NCRP 2009).

For certain specific sources and pathways, DOE establishes more limiting dose constraints to provide assurance that exposure to multiple sources and pathways will not exceed the all sources/all pathways limit of 100 mrem in a year. To ensure that the DOE limit is not exceeded for release of personal property, DOE uses a dose constraint which is 1 mrem in a year total effective dose above background.

**<u>Comparison with Other Guidance and Standards</u>**

Table A-2 compares DOE's guidelines for surface contamination for a variety of radionuclides with the Nuclear Regulatory Commission guidance and a standard published by the American National Standards Institute. ANSI/HPS N13.12 (1999) provided a comparison of modeling-derived surface screening levels (authorized limits) with the NRC Regulatory Guide 1.86 values. In the table, the DOE pre-approved authorized limits are compared with these two in units of dpm/100 $cm^2$. The NRC and DOE values are identical. Both are consistently less than the ANSI/HPS N13.12 values for the physical form of elementally pure isotopes found at DOE sites. From this comparison, DOE concludes that the surface activity authorized limits for clearance are protective of human health and safety, and that adoption of these authorized limits would result in a maximum dose to an individual of less than 1 mrem/y above background.

The 1 mrem/y value is considered by the National Council on Radiation Protection and Measurements (NCRP) to be a "negligible" individual dose (NCRP 1993) and by the National Academies of Sciences (NAS) to be a "reasonable starting point" for the process of considering options for a dose-based standard for clearance of solid materials (NAS, 2002). It is also the value recommended by the International Atomic Energy Agency for clearance and exemption of practices and sources from radiological control requirements (IAEA 2011).

### Table A-1: Release Criteria for Surface Activity (dpm/100 $cm^2$) [a,b]

| Radionuclides[c] | Avg[d,e] | Max[d,e] | Removable[f] |
|---|---|---|---|
| Group 1 – Transuranics, $^{125}I$, $^{129}I$, $^{227}Ac$, $^{226}Ra$, $^{228}Ra$, $^{228}Th$, $^{230}Th$, $^{231}Pa$ | 100 | 300 | 20 |
| Group 2 – Th-natural, $^{90}Sr$, $^{126}I$, $^{131}I$, $^{133}I$, $^{223}Ra$, $^{224}Ra$, $^{232}U$, $^{232}Th$ | 1,000 | 3,000 | 200 |
| Group 3 – U-natural, $^{235}U$, $^{238}U$, associated decay products, alpha emitters | 5,000 | 15,000 | 1,000 |
| Group 4 – Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except $^{90}Sr$ and others noted above[g] | 5,000 | 15,000 | 1,000 |
| Tritium (applicable to surface and subsurface)[h] | N/A | N/A | 10,000 |

[a] The values in this table (except for tritium) apply to radioactive material deposited on but not incorporated into the interior or matrix of the property. No generic concentration guidelines have been approved for release of material that has been contaminated in depth, such as activated material or smelted contaminated metals (e.g., radioactivity per unit volume or per unit mass). Authorized limits for residual radioactive material in volume must be approved separately.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by counts per minute measured by an appropriate detector [corrected]* for background, efficiency, and geometric factors associated with the instrumentation.

[c] Where radioactive materials on surfaces from both alpha-emitting and beta-emitting radionuclides exists, the limits established for alpha-emitting and beta-emitting radionuclides should apply independently.

[d] Measurements of average levels of radioactive materials on surfaces should not be averaged over an area of more than 1 $m^2$. Where scanning surveys are not sufficient to detect levels in the table, static counting must be used to measure surface activity. Representative sampling (static counts on the areas) may be used to demonstrate by analyses of the static counting data. The maximum levels of radioactive materials on surfaces apply to an area of not more than 100 $cm^2$.

[e] The average and maximum dose rates associated with radioactive materials on surfaces resulting from beta-gamma emitters should not exceed 0.2 millirad per hour (mrad/h) and 1.0 mrad/h, respectively, at 1 cm.

[f] The amount of removable material per 100 $cm^2$ of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable radioactive materials on objects with surface areas less than 100 $cm^2$ are determined, the activity per unit area should be based on the actual area, and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable levels of radioactive materials if direct scan surveys indicate the total residual radioactive materials on surfaces are within the removable radioactive material limits.

[g] This category of radionuclides includes mixed fission products, including the $^{90}Sr$ that is present in them. It does not apply to $^{90}Sr$ that has been separated from the other fission products or mixtures where the $^{90}Sr$ has been enriched.

[h] Measurement should be conducted by a standard smear measurement but using a damp swipe or material that will readily absorb tritium, such as polystyrene foam. Property recently exposed or decontaminated should have measurements (smears) at regular time intervals to the buildup of radioactive materials on surfaces over time. Because tritium typically penetrates material it contacts, the surface guidelines in group 4 do not apply to tritium. Measurements demonstrating compliance of the removable fraction of tritium on surfaces with this guideline are acceptable to ensure non-removable fractions and residual tritium in mass will not cause exposures that exceed DOE dose limits and constraints.

**Table A-2: Comparison of Authorized Limits for Surface Activity (dpm/100 cm$^2$)**

| Radionuclide | DOE Surface Release Criteria | Regulatory Guide 1.86 | ANSI/HPS Standard N13.12 |
|---|---|---|---|
| $^{14}C$ | 5,000 | 5,000 | 600,000 |
| $^{22}Na$ | 5,000 | 5,000 | 6,000 |
| $^{24}Na$ | 5,000 | 5,000 | 60,000 |
| $^{51}Cr$ | 5,000 | 5,000 | 6,000 |
| $^{55}Fe$ | 5,000 | 5,000 | 6,000 |
| $^{58}Co$ | 5,000 | 5,000 | 6,000 |
| $^{60}Co$ | 5,000 | 5,000 | 6,000 |
| $^{59}Fe$ | 5,000 | 5,000 | 60,000 |
| $^{63}Ni$ | 5,000 | 5,000 | 6,000 |
| $^{89}Sr$ | 5,000 | 5,000 | 6,000 |
| $^{90}Sr$ | 1,000 | 1,000 | 6,000 |
| $^{94}Nb$ | 5,000 | 5,000 | 6,000 |
| $^{99}Tc$ | 5,000 | 5,000 | 600,000 |
| $^{109}In$ | 5,000 | 5,000 | 6,000 |
| $^{124}Sb$ | 5,000 | 5,000 | 6,000 |
| $^{131}I$ | 1,000 | 1,000 | 60,000 |
| $^{134}Cs$ | 5,000 | 5,000 | 6,000 |
| $^{137}Cs$ | 5,000 | 5,000 | 6,000 |
| $^{144}Ce$ | 5,000 | 5,000 | 60,000 |
| $^{147}Pm$ | 5,000 | 5,000 | 6,000 |
| $^{152}Eu$ | 5,000 | 5,000 | 6,000 |
| $^{154}Eu$ | 5,000 | 5,000 | 6,000 |
| $^{192}Ir$ | 5,000 | 5,000 | 6,000 |
| $^{198}Au$ | 5,000 | 5,000 | 60,000 |
| $^{210}Pb$ | 5,000 | 5,000 | 600* |
| $^{210}Po$ | 5,000 | 5,000 | 600* |
| $^{226}Ra$ | 100 | 100 | 600 |
| $^{228}Ra$ | 100 | 100 | 600 |
| $^{232}Th$ | 100 | 100 | 600 |
| $^{235}U$ | 5,000 | 5,000 | 6,000 |
| $^{238}U$ | 5,000 | 5,000 | 6,000 |
| $^{239}Pu$ | 100 | 100 | 600 |
| $^{241}Am$ | 100 | 100 | 600 |

***** The ANSI/HPS Standard N13.12 values shown for the $^{210}Pb$ and $^{210}Po$ radionuclides in this table are based on a physical form of elementally pure isotopes if they were separated from other radionuclides. This form for these radionuclides has never been found to be present in or on metal at DOE facilities. If found to be present at DOE facilities, $^{210}Pb$ and $^{210}Po$ would exist in extremely small concentrations and would be comingled with other radionuclides present in the radioactive decay chain leading to their existence. In such cases the level of radiation from the other radionuclides will be more limiting for clearance and thus more protective than the $^{210}Pb$ or $^{210}Po$ limits.

## APPENDIX B. SECRETARIAL MEMORANDUM OF JULY 13, 2000

**The Secretary of Energy**
Washington, DC 20585

July 13, 2000

MEMORANDUM FOR HEADS OF DEPARTMENTAL ELEMENTS

FROM: BILL RICHARDSON

SUBJECT: Release of Surplus and Scrap Materials

The Department of Energy's (DOE) management of surplus and scrap materials has evolved over many years. Effective management of these materials has become more complicated over the past decade because the Department has begun generating them in larger quantities as it closes many facilities and expands its environmental management activities. Moreover, since much of this material was once used in nuclear operations, our management of it must continue to take into account safety and security issues, but we also want to address recently voiced public concerns that are not faced by most other Federal Agencies or by private industry.

For several months, we have been actively reviewing ways to improve our management of materials which might be released from departmental control. My goal has been to identify ways to better ensure protection of public health and the environment, openness and public trust, and fiscal responsibility.

I thank the Reuse and Recycling Task Force I established last winter for their contribution to the Department's review. While the work of the task force is now complete, many of its members will be involved over the coming months further developing and implementing changes to our policies and procedures.

On January 12, 2000, I placed a moratorium on the Department's release of volumetrically contaminated metals pending a decision by the Nuclear Regulatory Commission (NRC) whether to establish national standards. The NRC continues to review the issue, and the moratorium remains in effect.

Today, I am hereby directing further action in four areas: improvement of the Department's release criteria and monitoring practices; expansion of efforts to promote reuse and recycling within the complex of DOE facilities; improvement of the Department's management of information about material inventories and releases; and the accelerated recovery of sealed sources. Also, I am suspending the unrestricted release for recycling of scrap metals from radiation areas within DOE facilities. This suspension will remain in effect until improvements in our release criteria and information management have been developed and implemented as described below.

Our existing release criteria, described in DOE Order 5400.5, limit the potential for radiation exposure to the public to levels well below applicable requirements. Our experience using these criteria, however, demonstrates that even this very low potential exposure is not fully acceptable to the public. Our experience with existing criteria also shows that most scrap metal released is either not contaminated at all or has residual levels of surface contamination well below the current DOE standard.

Henceforth, the Department will not allow the release of scrap metals for recycling if contamination from DOE operations is detected using appropriate, commercially available monitoring equipment and approved procedures. To implement this decision, I am directing the Assistant Secretary for Environment, Safety and Health, with appropriate resource support, to revise DOE directives and associated guidance documents applicable to scrap metal releases through a public process, as described below, by December 31, 2000.

The Department will publish proposed changes to DOE directives and guidance for at least sixty days of public review and comment. The changes will describe conditions whereby the Department uses appropriate, commercially available technology and the most appropriate monitoring and decontamination procedures to ensure that no detectable contamination from DOE operations remains on any scrap metal released into commerce for recycling from any portion of our facilities. The revised DOE directive will establish a review cycle to develop future updates to guidance consistent with lessons learned, advances in monitoring or decontamination technology and procedures, and new information such as any future rulemaking activity by the NRC.

Changes will also be made to DOE's requirements and guidance to improve the collection, maintenance, and reporting of information associated with releases of surplus equipment, scrap metals, and other excess personal property. We need better records on inventories of these materials; contamination, security, and other concerns associated with them; and the basis for decisions authorizing their release. This information needs to be maintained in a way that makes it easily accessible to the public (consistent with classification and other security requirements) and readily available to meet the needs of project and program managers.

Once the revised directives and guidance are in place, the Department will require each DOE site to have local public participation before the site may resume the unrestricted release for recycling of scrap metals from radiation areas. These public participation requirements must address each of the above mentioned elements associated with release criteria and information management. In addition, the Department will require individual sites to certify, through the responsible Program Secretarial Officer (PSO), that they have met all requirements of the revised order before the release of scrap metal from radiation areas for recycling can resume. In addition, each affected PSO will implement an independent verification program to ensure that site activities continue to comply with the new requirements.

While updated release criteria and record keeping procedures are being developed and implemented, the Department will undertake several activities to promote internal reuse and recycling. All DOE programs and sites should expand their efforts to reuse and recycle materials within the Department. I direct the Assistant Secretary for Energy Efficiency and Renewable Energy to lead completion of a feasibility study on the potential use of a dedicated mill to recycle steel for reuse within the DOE complex. The study is to be completed within ninety days, after which I will receive the study's recommendations and determine if the Department will pursue the project further. Also, I direct the Chief Financial Officer to develop a set of proposed actions that will institutionalize incentives for internal reuse and recycling when such activities are cost-effective and protective of workers, the public, and the environment. The Chief Financial Officer will forward these recommended actions to me within 120 days for approval.

Finally, I direct the Assistant Secretary for Environmental Management to accelerate the Department's program to recover radioactive sources. The goal should be to recover over the next four years the backlog of commercial sources for which the Department has authority.

## APPENDIX C. SECRETARIAL MEMORANDUM OF JANUARY 19, 2001

The Secretary of Energy
Washington, DC 20585

January 19,200 1

MEMORANDUM FOR HEADS OF DEPARTMENT ELEMENTS

FROM: BILL RICHARDSON

SUBJECT: Managing the Release of Surplus and Scrap Materials

Over the last year, the Department has grappled with how to improve its management and release of surplus and scrap material. Our reviews have not identified any evidence that the public might be harmed by releases from our sites, but we have determined that there is a need to improve radiation monitoring, independent verification, and record keeping and reporting. We must also better engage the public in our decision making and help them better understand our release practices.

There is clearly expressed public concern and interest regarding the procedures and requirements under which materials leave our sites for recycling, reuse, or other disposition. I have taken steps to address these concerns while we improve our release policies and procedures. Last January, I placed a moratorium on the unrestricted release of volumetrically contaminated metals pending a decision by the Nuclear Regulatory Commissjon whether to establish national standards. In July, I suspended the unrestricted release for recycling of all metals from radiation areas within Department of Energy (DOE) facilities until improvements in release criteria and related information management have been implemented. Both these prohibitions remain in effect.

The Department has, over the last several months, been developing procedures which, when implemented, would allow unrestricted releases for recycling of metals without detectable radioactive contamination. Internal and public comments on these proposed changes raised significant and substantive issues. Consequently, additional deliberation is necessary, and the new requirements are not complete.

Moreover, in light of these comments, I have determined that the Department should prepare an environmental impact statement (EIS). This will allow an open, healthy discussion of the broadest range of concerns associated with the unrestricted release of materials from our sites. The Office of Environmental Management, in coordination with other Departmental elements, should prepare a Notice of Intent to begin this EIS, to be published within 60 days.

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Finally, I am forwarding the guidance below to help our sites improve their monitoring and release practices. These steps are consistent with existing provisions of DOE Order 5400.5 and should be incorporated into your existing release programs.

**1) Clearly define areas and activities that can potentially contaminate property:** I want to emphasize the importance of evaluating activities and areas for potential radiological contaminationbefore property is released from them. DOE has both the authority and responsibility for regulating the radiological release of property under our radiological control. It is necessary that we establish and document clear process-knowledge-based procedures for those releases that have no potential to violate our radiological protection requirements. In addition, there should be opportunity for public participation in establishing and implementing these procedures.

**2) Clearly define release criteria, including measurement and survey protocols, for property released from areas or activities that have potential to contaminate:** Property that cannot be certified for release through process knowledge procedures must be reviewed using our authorized limit-based release procedures consistent with existing DOE Order 5400.5 requirements and associated guidance, as well as the prohibitions mentioned above. All such property must be appropriately surveyed, and its compliance with DOE-approve authorized limits confirmed.

Authorized limits you approve must be well documented. The documentation should address the rationale for selecting them (including as low as reasonably achievable, ALARA, considerations), the scope of their applicability, and measurement procedures and protocols for demonstrating compliance. Such documentation is necessary even if the surface activity guidelines from DOE Order 5400.5 or the Office of Environment, Safety and Health's (EH) November 17, 1995 guidance is being used. A complete understanding of the limits is needed to ensure that contractors understand the requirements and for DOE to fulfill its **regulatory** responsibility when evaluating contractor performance. It will also help in ensuring that our process to clear materials for release is open to public scrutiny. The approval process for authorized limits should be implemented consistent with the requirements of DOE Order 5400.5 and the EH guidance.

**3) Ensuring that released property meets DOE requirements:** As I have stated, DOE has both the authority and responsibility for regulating the radiological release of property under our radiological control. Line management, in particular the Field Offices, have the responsibility to ensure that contractors and DOE personnel comply with DOE requirements. As such, I encourage line management to internally review their property release and control systems to ensure they are compliant with DOE directives. It should be clear that DOE contractors or DOE elements are responsible for conducting final surveys and the preparation of documentation to demonstrate that property releases meet DOE requirements. In addition, DOE field offices, working with their lead program office should establish independent verification programs to further confirm that survey and evaluation processes are in place, being appropriately implemented and that property released from DOE radiological control meets authorized limits. The level and scope of the verification effort should be commensurate with the potential for contamination, as well as the complexity and hazard, and it should appropriately address real and personal property releases. If DOE personnel responsible for independent verification use contractors, the contractors must be independent of the operating contractor managing the property or responsible for the release survey or decontamination of the property.

**4) Better inform and involve the public and improve DOE reporting on releases:** All DOE sites are already responsible for having and implementing public involvement and communications programs. Field Office Managers should incorporate information on property control and release programs including information on authorized limits, certification and verification survey programs, and process knowledge decisions into site public involvement and communications programs. Site release policies and protocols shall be coordinated with the public, and public input considered in DOE's development and approval of site release programs. Responsible field offices must make the documentation on releases available to the public and those receiving the property.

In addition, field offices should report annually on their release programs. The Office of Management and Administration should work with EH and the program offices to develop a system that will allow headquarters to track releases by category. DOE Order 5400.5 and DOE M 43 1.1 already require annual site environmental reports to contain information on DOE releases of radioactive material and potential doses to the public. Therefore, I am directing Field Office Managers to ensure that they include information on the authorized limits being used at their facilities, and surveys and independent verification program results, in the site's annual environmental reports.

## APPENDIX D: FACILITY DESCRIPTIONS

This appendix describes the U.S. Department of Energy (DOE) sites addressed in this Programmatic Environmental Assessment (PEA) that are currently encumbered by the suspension on recycling scrap metal from radiologically controlled areas.

# Office of Science

### Ames National Laboratory

- http://www.ameslab.gov/

The Ames Laboratory is located on the Iowa State University campus in the town of Ames, Iowa. The Ames Laboratory was established in the 1940's to develop efficient uranium production processes for the Manhattan Project. The Laboratory's programs now emphasize research in the preparation, characterization, and evaluation of properties of metals and their alloys, especially rare earth metals. Ames Laboratory also performs materials research, high-performance computing, and environmental science and management efforts. Past operations at the Laboratory, principally as a result of waste disposal practices, led to contamination of soils and ground water. Contaminants of concern include: uranium, thorium, tritium, mercury, thallium, potassium, lithium, and kerosene.

### Brookhaven National Laboratory (BNL)

- http://www.bnl.gov/

Brookhaven National Laboratory (BNL) covers 5,265 acres in Upton, New York, about 60 miles east of New York City. Used by the Army as Camp Upton during World Wars I and II, BNL has been operated since 1947 by Associated Universities, Inc., under contract first to the Atomic Energy Commission and now to DOE). BNL is involved in design, construction, and operation of large facilities such as particle accelerators and nuclear reactors used for research in high energy nuclear physics, energy-related life and environmental sciences, and material, chemical, and biological sciences. Most of the principal facilities are near the center of the site. Outlying facilities occupy about 550 acres. Among them are the Hazardous Waste Management Facility (HWMF), current landfill, former landfill/chemical holes area, sewage treatment plant, and a former ash fill area near an old incinerator. Areas where some accidental contamination has occurred include the Building 650 sump, HWMF, and the Central Steam Facility. Soil in several small areas contains low levels of radioactivity resulting from past landscaping activities, according to BNL.

### Argonne National Laboratory

- http://www.anl.gov/

Established in the 1940s the Argonne National Laboratory occupies 600 hectares (1,500 acres) in Southern DuPage County, Illinois. The Argonne site is completely surrounded by the 830-hectare (2,040-acrre) DuPage County Waterfall Glen Forest Preserve, which is used as a public recreation area, nature preserve, and demonstration forest. The Argonne site is approximately 43 kilometers (27 miles) southwest of downtown Chicago and 39 kilometers (24) miles west of Lake Michigan.

### Oak Ridge National Laboratory (ORNL)

- http://www.ornl.gov/

The facility that later became Oak Ridge National Laboratory was established as part of the Clinton Engineer Works for the Manhattan Project in 1943 during World War II. DOE operates three sites on the reservation: the East Tennessee Technology Park (formerly the K-25 Site), Oak Ridge National Laboratory, and the Y-12 National Security Complex. The three sites are government-owned, contractor-operated facilities; under DOE guidance, private companies manage the day-to-day operations of the sites according to federal laws, DOE orders, and state laws and regulations. In 2003, the TRU Waste Processing Center (TWPC) was constructed on the ORNL campus. The mission of this facility is to manage, treat, package, and ship many forms of TRU waste generated and stored in the Oak Ridge Reservation for final disposal at the Waste Isolation Pilot Plant in New Mexico. TWPC also manages and treats low-level and mixed low-level waste generated at ORNL.

### Thomas Jefferson National Accelerator Facility (TJNAF)

- https://www.jlab.org/

Jefferson Lab was founded in 1984 to operate the Continuous Electron Beam Accelerator Facility. Located on 169 acres in Newport News, Virginia, the facility is comprised of 63 buildings and employs 720 full time workers. The primary purpose of this facility is to advance accelerator science. The accelerator complex portion of the Lab includes an underground electron accelerator, the Continuous Electron Beam Accelerator Facility (CEBAF), which is TJNAF's primary research tool.

### Pacific Northwest National Laboratory (PNNL)

- http://www.pnl.gov/

The Laboratory was originally named Pacific Northwest Laboratory and served as an independent research entity from Hanford Site operations in Richland, Washington. PNNL scientists conduct basic and applied research and development to strengthen U.S. scientific foundations for fundamental research and innovation; prevent and counter acts of terrorism through applied research in information analysis, cyber security, and the nonproliferation of weapons of mass destruction; increase the U.S. energy capacity and reduce dependence on imported oil; and reduce the effects of human activity on the environment.

### Lawrence Berkeley National Laboratory (Berkeley Lab)

- http://www.lbl.gov/

Berkeley Lab, located on a 200 acre (80 hectares) site, was founded as the Radiation Laboratory of the University of California in 1931, as a site for centering physics research around the cyclotron. Berkeley Lab conducts unclassified scientific research. The Lab's fourteen scientific divisions include: earth sciences, genomics, life sciences, chemical sciences, environmental energy technologies, materials science, physical biosciences, computational research, accelerator and fusion research, engineering, nuclear science, nuclear medicine and physics.

### Fermi National Accelerator Laboratory (Fermilab)

- http://www.fnal.gov/

The Fermilab site is located 38 miles (61 kilometers) west of downtown Chicago, Illinois on 6,800 acres. The Fermilab facilities are a light industrial setting supporting high-energy research, including underground accelerator rings and beam tunnels, and the Central Laboratory Area. The Laboratory specializes in high-energy particle physics.

### SLAC National Accelerator Laboratory

- http://www.slac.stanford.edu/

SLAC is a national research laboratory operated by Stanford University under contract to DOE. SLAC is located on 426 acres (172 hectares) of the San Francisco Peninsula, about halfway between San Francisco and San Jose, California. Current research and scientific user facilities are in the areas of photon science, particle physics, particle astrophysics, accelerator physics, and accelerator research and development.

### Princeton Plasma Physics Laboratory (PPPL)

- http://www.pppl.gov/

PPPL is located at Princeton University's Forrestal Campus, approximately three miles north of the University's main campus. PPPL grew out of the top secret Cold War project to control thermonuclear reactions, called Project Matterhorn. In 1961, after declassification, Project Matterhorn was renamed the Princeton Plasma Physics Laboratory. The DOE Princeton Plasma Physics Laboratory works with collaborators to develop fusion as an energy source, and conducts research on plasma science and technology. PPPL researchers are conducting work on an advanced fusion device – the National Spherical Torus Experiment. Staff is applying knowledge gained in fusion research to a number of theoretical and experimental areas including materials science, solar physics, chemistry, and manufacturing.

### Oak Ridge Institute for Science and Education (ORISE)

- http://orise.orau.gov/

ORISE, located in Oak Ridge, Tennessee, is a DOE institute managed by Oak Ridge Associated Universities (ORAU). ORISE addresses national needs by assessing and analyzing environmental and health effects of radiation, beryllium and other hazardous materials and maintaining medical and national security radiation emergency management and response capabilities.

### New Brunswick Laboratory (NBL)

- http://www.nbl.doe.gov/

The New Brunswick Laboratory (NBL) is a Government-owned, Government-operated center of excellence in the measurement science of nuclear materials.

NBL is located, as a Federal enclave, on the site of Argonne National Laboratory (ANL) about 40 kilometers (25 miles) southwest of Chicago, Illinois. NBL is part of the Department of Energy's Office of Science Chicago Office.

NBL is the U.S. Government's Nuclear Materials Measurements and Reference Materials Laboratory and the National Certifying Authority for nuclear reference materials and measurement calibration standards. As an internationally recognized Federal laboratory, NBL provides reference materials, measurement and inter-laboratory measurement evaluation services, and technical expertise for evaluating measurement methods and safeguards measures in use at other facilities for a variety of Federal program sponsors and customers. NBL functions as a Network Laboratory for the International Atomic Energy Agency (IAEA).

# National Nuclear Security Administration

## Lawrence Livermore National Laboratory (LLNL)

- https://www.llnl.gov/

LLNL is a multidisciplinary research facility engaged in a variety of programs for the National Nuclear Security Administration (NNSA), DOE, other government agencies, and the private sector. The lab is located on 790 acres (320 hectares) in Livermore, California, about 45 miles east of San Francisco. Its primary mission is implementation of the Stockpile Stewardship Program (SSP). Other missions involve related emergency response, arms control, and nonproliferation activities. LLNL conducts research and development (R&D) activities in the basic sciences, mathematics, and computing, with application to these mission areas, and to a broad range of programs including: non-nuclear defense; nuclear and non-nuclear energy; high-energy density physics; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment. With respect to nuclear weapons, LLNL is responsible for the design of the nuclear explosive package in certain weapons (Los Alamos National Laboratory has this responsibility for the other weapons). LLNL maintains research, design, development, testing, surveillance, assessment, and certification capabilities in support of Stockpile Stewardship.

## Los Alamos National Laboratory (LANL)

- http://www.lanl.gov/

LANL was established as a nuclear weapons design laboratory in 1943. Its facilities are located on approximately 28,000 acres about 25 miles northwest of Santa Fe, New Mexico. LANL is a multidisciplinary research facility engaged in a variety of programs for NNSA, DOE, other Government agencies, and the private sector. Its primary mission is the implementation of the SSP. Other missions involve emergency response, arms control, nonproliferation, and environmental activities. LANL conducts research and development of nuclear weapons; designs and tests advanced technology concepts; designs weapons; provides safety and reliability assessments of the stockpile; maintains interim production capabilities for limited quantities of plutonium components (e.g., pits); and manufactures nuclear weapon detonators for the stockpile. LANL maintains Category I/II quantities of special nuclear materials (SNM) associated with the nuclear weapons program and material no longer needed by the weapons program.

## Nevada National Security Site (NNSS)

- http://www.nv.doe.gov/

NNSS occupies approximately 880,000 acres in southern Nevada. It is located about 65 miles northwest of Las Vegas. It is a remote, secure facility with restricted airspace that maintains the capability for conducting underground testing of nuclear weapons and evaluating the effects of nuclear weapons on military communications systems, electronics, satellites, sensors, and other materials. Since the signing of the Threshold Test Ban Treaty in 1974, it has been the only U.S. site used for nuclear weapons testing. Approximately one-third of the land (located in the eastern and northwestern portions of the site) has been used for nuclear weapons testing; one-third (located in the western portion of the site) is reserved for future missions, and one-third is reserved for R&D, nuclear device assembly, diagnostic canister assembly, and radioactive waste management.

NNSS maintains the capability to conduct underground nuclear testing; conducts experiments involving nuclear material and high explosives; provides capability to disposition a damaged nuclear weapon or improvised nuclear device; conducts non-nuclear experiments; and conducts research and training on nuclear safeguards, criticality safety and emergency response. The site also maintains Category I/II quantities of SNM associated with the nuclear weapons program.

### Pantex

- http://www.pantex.com/

Pantex is located approximately 17 miles northeast of Amarillo, Texas, on 15,997 acres. Its missions are research and development of chemical high explosives for nuclear weapons; fabrication of high-explosives components essential to nuclear weapon function; assembly, disassembly, maintenance, and surveillance of nuclear weapons in the stockpile; dismantlement of nuclear weapons being retired from the stockpile; and interim storage of plutonium components from dismantled weapons. Weapons activities involve the handling (but not processing) of uranium, plutonium, and tritium components, as well as a variety of nonradioactive hazardous or toxic chemicals. Dismantles retired weapons; fabricates high-explosives components; assembles high explosive, nuclear, and non-nuclear components into nuclear weapons; repairs and modifies weapons; and evaluates and performs non-nuclear testing of weapons. The site maintains Category I/II quantities of SNM for the weapons program and material no longer needed by the weapons program.

### Sandia National Laboratory (SNL)

- http://www.sandia.gov/

SNL was established as a non-nuclear design and engineering laboratory separate from LANL in 1949. The principal laboratory is located in Albuquerque, New Mexico (SNL/NM); a division of the laboratory (SNL/CA) is located in Livermore, California, near LLNL. SNL conducts multidisciplinary research and engineering activities in a variety of programs for NNSA, DOE, other Government agencies, and the private sector. Its primary missions for NNSA are implementation of the SSP and related systems engineering and non-nuclear component design and engineering, and system qualification testing for Stockpile-to-Target Sequence environments. Other missions involve arms control and nonproliferation activities. In addition, SNL conducts R&D activities in advanced manufacturing, electronics, information, pulsed power, energy, environment, transportation, and biomedical technologies; conducts system engineering of nuclear weapons; designs and develops non-nuclear components; conducts field and laboratory non- nuclear testing; conducts research and development in support of the nuclear weapon non-nuclear design; manufactures non-nuclear weapon components; provides safety and reliability assessments of the stockpile; and manufactures neutron generators for the stockpile. The site also maintains Category I/II quantities of SNM associated with the nuclear weapons program.

### Y-12 National Security Site

- http://www.y12.doe.gov/

Y-12 is one of three primary installations on the DOE Oak Ridge Reservation (ORR), which covers a total of approximately 35,000 acres in Oak Ridge, Tennessee. The other installations are the Oak Ridge National Laboratory (ORNL) and the East Tennessee Technology Park (formerly the Oak Ridge K-25 Site). Construction of Y-12 started in 1943 as part of the World War II Manhattan Project. Y-12 consists of approximately 800 acres. The early missions of the site included the separation of uranium-235 from natural uranium by electromagnetic separation and the manufacture of weapons components from uranium and lithium. Y-12 is the primary site for enriched uranium processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Y-12 manufactures nuclear weapons secondaries, cases, and other weapons components; evaluates and performs testing of weapon components; maintains Category I/II quantities of SNM; conducts dismantlement, storage, and disposition of nuclear weapons materials; and supplies SNM for use in naval reactors.

### Bettis Atomic Power Laboratory

- http://www.bettislab.com/

Bettis Atomic Power Laboratory is located in the Pittsburgh suburb of West Mifflin, Pennsylvania on approximately 207 acres (83 hectares). The laboratory focuses solely on the design and development of nuclear power for the U.S. Navy. The laboratory's work is part of the Naval Nuclear Propulsion Program, which is a joint U.S Navy-DOE program responsible for the research, design, construction, operation and maintenance of U.S. nuclear-powered warships.

Much of the work at the laboratory does not involve chemicals or radioactivity but is conducted in office and computer spaces employing scientists and engineers in propulsion plant design, operator training development, and procedure preparation activities. Physical work involving the development of improved materials and components for Naval nuclear propulsion plants is conducted in several Bettis Pittsburgh facilities.

### Knolls Atomic Power Laboratory (KAPL)

- http://www.knollslab.com/

KAPL operates two sites in the Schenectady, New York area: the Knolls site in Niskayuna and the Kenneth A. Kesselring site in West Milton. KAPL is a research and development facility dedicated to the support of the US Naval Nuclear Propulsion Program. KAPL is responsible for the research, design, construction, operation, and maintenance of U.S. nuclear-powered warships. Niskayuna is the primary site for KAPL, focusing on the design and development of naval propulsion plants and reactor cores. The Kesselring site is engaged solely in research and development for the design and operation of naval nuclear propulsion plants. It operates two prototypes of submarine nuclear propulsion plants for the operational testing of new designs and new technologies under typical operating conditions before introducing them into the fleet. Current activities include operation of the Modifications and Additions to Reactor Facilities (MARF) Nuclear Prototype Training Unit in Ballston Spa that is used primarily for naval nuclear propulsion training. These plants are also used to test reactors, reactor plant systems, and reactor steam and electric plant components.

## Office of Nuclear Energy

### Idaho National Laboratory (INL)

- https://inlportal.inl.gov/

INL is an 890 sq mi (2,300 sq km) complex located in the high desert of eastern Idaho, between the town of Arco to the west and the cities of Idaho Falls and Blackfoot to the east. The federal research facility was established in 1949 as the National Reactor Testing Station. INL's mission is to ensure the nation's energy security with safe, competitive, and sustainable energy systems and unique national and homeland security capabilities.

## Office of Environmental Management

### East Tennessee Technology Park (ETTP)

- http://www.oakridge.doe.gov/

ETTP is on the Oak Ridge Reservation, the DOE's multi-facility complex in Oak Ridge, Tennessee. ETTP was originally built during World War II as part of the Manhattan Project. Known as the K-25 Site, its primary mission was to enrich uranium for use in atomic weapons. After the war the mission was changed to include the enrichment of uranium for nuclear reactor fuel elements and recycling of spent fuel. The name was changed to the Oak Ridge Gaseous Diffusion Plant. In the 1980s, a reduction in the demand for nuclear fuel resulted in the shutdown of the enrichment process, and production ceased. The emphasis of the mission then changed to environmental management and restoration operations, and the name was changed to the East Tennessee Technology Park. Environmental management and remediation operations consist of such operations as waste management, the cleanup of outdoor storage and disposal areas, the demolition and/or cleaning up of the facilities, land restoration, and environmental monitoring.

### Hanford

- http://www.hanford.gov/

Hanford sits on 586 sq mi (1,517 sq km) of land in southeastern Washington State. Prior to 1988, the primary Hanford Site mission was the production of plutonium for national defense purposes. The current primary Hanford Site mission is environmental remediation and cleanup, including the remediation of contaminated areas and the decontamination and decommissioning of Hanford Site facilities. There are two DOE offices at the Hanford: The Richland Operations Office oversees the cleaning up projects of the reactors, the soil, the groundwater, and the solid waste burial sites, as well as demolition of facilities, and the disposition of the remaining plutonium. The Office of River Protection manages the liquid and semi-solid nuclear and chemical waste in 177 underground tanks on the Site, as well as the construction of the Waste Treatment Plant (aka the Vitrification Plant). Hanford is also the home of the Hazardous Materials Management and Emergency Response (HAMMER), recently renamed for Sam Volpentest, a long-time community leader and advocate of the Hanford Site who passed away in 2005 at the age of 101. HAMMER provides the training opportunities and facilities that support the Hanford Site missions as well as other DOE sites and municipal emergency response organizations.

### Paducah Plant

- http://www.pppo.energy.gov/paducah.html

The Paducah Gaseous Diffusion Plant is located on 750 acres (300 hectares), approximately 10 miles west of the City of Paducah, Kentucky. The past and present mission of the Paducah Diffusion Plant has primarily focused on the separation of uranium isotopes by gaseous diffusion. The process produces enriched uranium used as fuel in commercial power plants. Although the plant is leased and operated by the U.S. Enrichment Corporation, environmental restoration and related waste management activities are conducted by DOE as the agency with property responsibility.

### Portsmouth Plant

- http://www.usec.com/gaseous-diffusion/portsmouth-gdp

The Portsmouth Gaseous Diffusion Plant occupies about 1,200 acres (485 hectares) in Pike County, Ohio, in southern central Ohio. The Portsmouth Plant was the last of three large gaseous diffusion plants initially constructed to produce enriched uranium to support the nation's nuclear weapons program and later enriched uranium used by commercial nuclear reactors. The site operates a facility to convert depleted uranium hexafluoride into a more stable form of depleted uranium oxide suitable for reuse or disposition. Decades of uranium enrichment and support activities generated hazardous, radioactive, mixed, and sanitary wastes. Past operations also resulted in soil, groundwater, and surface water contamination at several sites located within plant boundaries.

### Savannah River Site (SRS)

- http://www.srs.gov/general/srs-home.html

SRS is located in south-central South Carolina and occupies approximately 198,420 acres. The site was established in 1950 and is approximately 15 miles southeast of Augusta, Georgia, and 12 miles south of Aiken, South Carolina. The major nuclear facilities at SRS have included fuel and target fabrication facilities, nuclear material production reactors, chemical separation plants used for recovery of plutonium and uranium isotopes, a uranium fuel processing area, and the Savannah River National Laboratory, which provides technical support. The initial mission at SRS was production of heavy water and strategic radioactive isotopes (plutonium-239 and tritium) in support of national defense. Today, the main weapons mission at SRS is tritium supply management and R&D.

### West Valley Demonstration Project (WVDP)

- http://www.wv.doe.gov/

WVDP is located on a 5 $mi^2$ (12 $km^2$) tract of land approximately 30 miles south of Buffalo, New York. It is also the location of the Western New York Nuclear Services Center (WNYNSC). The plant, which reprocessed uranium and plutonium from spent nuclear fuel, generated approximately 600,000 gallons of liquid high-level waste that was stored in underground tanks. In 1972, nuclear fuel reprocessing operations were discontinued. WVDP is completing the environmental remediation of legacy and active sites by stabilizing and dispositioning low-level and transuranic waste and decontaminating and decommissioning excess facilities, tanks, and equipment.

### Waste Isolation Pilot Plant (WIPP)

- http://www.wipp.energy.gov/

WIPP is located in the Chihuahuan Desert, 26 miles southeast of Carlsbad, New Mexico on 100 acres (40 hectares). The WIPP is a series of rooms excavated out of a salt-bed formation about 2,100 ft. (650 meters) below the surface. The WIPP mission is to provide for the safe, environmentally sound disposal of defense TRU radioactive waste left from research, development, and production of nuclear weapons. In 1999, WIPP received the first TRU waste shipment from Los Alamos National Laboratory.

### Energy Technology Engineering Center (ETEC)

- http://www.etec.energy.gov/

The Energy Technology Engineering Center (ETEC) is located within Area IV of the Santa Susana Field Laboratory. The ETEC occupies 90-acres within the 290 acre site. The Santa Susana Field Laboratory is located 30 miles north of Los Angeles, California, near Canoga Park, California. Area IV was primarily used for the DOE's research and development activities.

The ETEC's historic mission involved nuclear research and development for the U.S. Atomic Energy Commission, a predecessor to DOE. In the mid-1950s, a part of Area IV was set aside for nuclear reactor development and testing – primarily related to the development of nuclear power plants and space power systems, using sodium and potassium as coolants. In the mid-1960s, the ETEC was established as a DOE laboratory for the development of liquid metal heat transfer systems to support Office of Nuclear Energy Liquid Metal Fast Breeder Reactor program. Other operations focused on applied engineering and development of emerging energy technologies to include solar and fossil energy as well as developing an energy conservation methodology.

The ETEC site has been closed and is now undergoing characterization, building removal, and environmental remediation.

### Separations Process Research Unit (SPRU)

- http://spru.energy.gov/

The U.S. Department of Energy's (DOE) Environmental Management Separations Process Research Unit (SPRU) Field Office in Niskayuna, New York, has taken possession of the former SPRU nuclear facilities at the Knolls Atomic Power Laboratory (KAPL) site. SPRU is a group of inactive facilities and structures, safely maintained at KAPL, located near Schenectady, New York. These facilities had previously been managed by contractors for the DOE Office of Naval Reactors, which maintains the majority of the KAPL site. SPRU was part of KAPL's early history, when KAPL was a general-purpose laboratory for the U.S. Atomic Energy Commission.

SPRU was built in the late 1940s and operated through the early 1950s to conduct pilot tests for recovery of uranium and plutonium. The nuclear facilities at SPRU consist of a process research and office building (known as G2), a waste processing building (H2), and associated tanks, tunnels and outbuildings. Following cessation of SPRU operations, KAPL converted some of Building G2 to office space, and continued using Building H2 for waste processing. In 1999, KAPL announced that it had no further use for the SPRU facilities. The following year, DOE began characterizing the SPRU areas as part of the SPRU Disposition Project.

In December 2007, DOE-EM initiated work to decontaminate the SPRU facilities, demolish them, remove contaminated soil around the facilities, and remove the resulting waste from the site. This project will clean up about 15 acres of contaminated soil at KAPL, transport about 6,000 cubic yards of waste to an off-site disposal area, and make the land available for future use. Two former processing and waste treatment buildings totaling about 50,000 square feet will be removed and the associated waste will be shipped for disposal.

## APPENDIX E: DATA

### Table E-1: Total Recycle of Metal Not Encumbered by the Suspension

| | Totals by Site (metric tonnes) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 7 Year Total | 7 Year Average |
| **Office of Science Sites** | | | | | | | | | |
| Ames National Laboratory | 19.9 | 6.0 | 16.0 | 4.5 | 1.7 | 7.6 | 18.9 | 74.6 | 10.7 |
| Argonne National Laboratory | 0.0 | 365.7 | 436.0 | 171.0 | 94.4 | 127.9 | 139.7 | 1,334.7 | 190.7 |
| Brookhaven National Laboratory | 508.9 | 118.4 | 323.0 | 463.0 | 94.8 | 199.8 | 239.8 | 1,947.8 | 278.3 |
| Fermi National Accelerator Laboratory | 739.1 | 580.1 | 289.0 | 331.1 | 236.0 | 540.1 | 203.6 | 2,918.8 | 417.0 |
| Lawrence Berkeley National Laboratory | 104.4 | 106.6 | 98.0 | 208.0 | 263.1 | 228.8 | 242.3 | 1,251.3 | 178.8 |
| Oak Ridge Institute for Science and Education | 9.8 | 0.0 | 4.1 | 6.4 | 2.5 | 1.3 | 0.7 | 24.7 | 3.5 |
| Oak Ridge National Laboratory | 333.7 | 149.9 | 156.1 | 259.3 | 541.0 | 344.2 | 212.4 | 1,996.5 | 285.2 |
| Pacific Northwest National Laboratory | 75.5 | 137.6 | 86.1 | 119.1 | 121.8 | 103.8 | 228.7 | 872.5 | 124.6 |
| Princeton Plasma Physics Laboratory | 145.8 | 77.0 | 152.6 | 92.3 | 62.5 | 201.1 | 2,474.7 | 3,206.0 | 458.0 |
| SLAC National Accelerator Laboratory | 259.0 | 177.6 | 90.2 | 117.4 | 150.4 | 121.0 | 172.2 | 1,087.7 | 155.4 |
| Thomas Jefferson National Accelerator Facility | 18.0 | 33.7 | 31.2 | 44.3 | 90.3 | 63.0 | 52.5 | 333.1 | 47.6 |
| **NNSA Sites** | | | | | | | | | |
| Bettis Atomic Power Laboratory | 586.1 | 400.9 | 336.0 | 520.5 | 424.6 | 424.5 | 402.5 | 3,095.2 | 442.2 |
| Knolls Atomic Power Laboratory | 342.9 | 386.4 | 417.6 | 365.5 | 405.1 | 469.5 | 364.5 | 2751.6 | 393.1 |
| Lawrence Livermore National Laboratory | 1,833.7 | 1,411.9 | 1,379.2 | 1,409.3 | 1,339.4 | 1,167.5 | 943.3 | 9,484.3 | 1,354.9 |
| Los Alamos National Laboratory | 1,475.0 | 367.0 | 451.0 | 217.0 | 500.0 | 200.0 | 500.0 | 3,710.0 | 530.0 |
| Nevada National Security Site* | 514.2 | 495.1 | 1,006.6 | 213.2 | 57.6 | 154.9 | 406.9 | 2848.6 | 406.9 |
| Pantex | 417.6 | 376.1 | 207.7 | 669.3 | 327.9 | 289.9 | 226.3 | 2,514.8 | 359.3 |
| Sandia National Laboratory - California | 143.0 | 136.9 | 185.5 | 92.4 | 60.0 | 92.9 | 45.8 | 756.5 | 108.1 |
| Sandia National Laboratory - New Mexico | 1,126.0 | 881.4 | 753.0 | 1,871.3 | 1,555.2 | 1,371.0 | 395.7 | 7,953.6 | 1,136.2 |
| Y-12 National Security Site | 901.5 | 818.8 | 1,355.5 | 604.5 | 398.6 | 970.7 | 1,063.7 | 6,113.3 | 873.3 |
| **Office of Nuclear Energy Sites** | | | | | | | | | |
| Idaho National Laboratory | 22.3 | 22.1 | 1.3 | 4.7 | 21.7 | 226.8 | 217.7 | 516.5 | 73.8 |
| **Office of Environmental Management Sites** | | | | | | | | | |
| East Tennessee Technology Park | 561.2 | 225.8 | 115.6 | 175.0 | 478.6 | 1,651.9 | 113.1 | 3,321.2 | 474.5 |
| Hanford | 843.4 | 1,363.0 | 235.1 | 497.9 | 793.0 | 295.5 | 922.1 | 4,950.0 | 707.1 |
| Paducah Plant | 0.0 | 203.1 | 7.7 | 0.0 | 175.3 | 50.2 | 63.8 | 500.1 | 71.4 |
| Portsmouth Plant | 15.6 | 58.6 | 0.0 | 401.8 | 1.3 | 0.0 | 8,282.8 | 8,760.1 | 1,251.4 |
| Savannah River Site | 2,128.9 | 1,733.2 | 1,122.9 | 2,096.8 | 628.2 | 1,169.0 | 1,541.0 | 10,420.0 | 1,488.6 |
| West Valley | 133.3 | 218.4 | 392.2 | 51.8 | 12.7 | 14.4 | 21.7 | 844.4 | 120.6 |
| WIPP** | 81.3 | 98.8 | 87.7 | 46.1 | 50.5 | 72.9 | 72.9 | 510.1 | 72.9 |
| Not Encumbered by Suspension | 13,340.0 | 10,950.0 | 9,736.9 | 11,053.2 | 8,888.1 | 10,560.6 | 19,569.3 | 84,097.8 | 12,014.0 |

*For the Nevada site, the 6 year average was used for 2011

**For the WIPP site, the 5 year average was used for 2010 and 2011

**Table E-2: Estimated Recyclable Metal Encumbered by the Suspension as of 2010**

| | Metric Tonnes |
|---|---|
| **Office of Science Sites** | |
| Ames National Laboratory | 0 |
| Argonne National Laboratory | 28.0 |
| Brookhaven National Laboratory | 4,988.0 |
| Fermi National Accelerator Laboratory | 4,808.0 |
| Lawrence Berkeley National Laboratory | 0 |
| New Brunswick Laboratory | 0 |
| Oak Ridge Institute for Science and Education | 1.0 |
| Oak Ridge National Laboratory | 62.0 |
| Pacific Northwest National Laboratory | 0 |
| Princeton Plasma Physics Laboratory | 16.3 |
| SLAC National Accelerator Laboratory | 1,089.0 |
| Thomas Jefferson National Accelerator Facility | 0 |
| **NNSA Sites** | |
| Bettis Atomic Power Laboratory | 24.5 |
| Knolls Atomic Power Laboratory | 6.4 |
| Lawrence Livermore National Laboratory | 338.7 |
| Los Alamos National Laboratory | 350.0 |
| Nevada National Security Site | 34.9 |
| Pantex | 1.8 |
| Sandia National Laboratory - California | 0 |
| Sandia National Laboratory - New Mexico | 0 |
| Y-12 National Security Site | 1,886.2 |
| **Office of Nuclear Energy Sites** | |
| Idaho National Laboratory | 81.6 |
| **Office of Environmental Management Sites** | |
| East Tennessee Technology Park | 0 |
| Energy Technology Engineering Center | 0 |
| Hanford | 0 |
| Paducah Plant | 0 |
| Portsmouth Plant | 0 |
| Savannah River Site | 0 |
| Separations Process Research Unit | 73.5 |
| West Valley | 0 |
| WIPP | 0 |
| Total | **13,789.9** |

**Table E-3: Production and Recycle of Metals within the United States**

| | Row # | Metal | Type | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 5 Year Total |
|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL METAL PRODUCTION | 1 | Steel[1] | Carbon steel | - | 89,500,000 | 89,800,000 | 84,100,000 | 55,200,000 | 73,600,000 | 392,200,000 |
| | 2 | Steel[1] | Stainless steel | - | 2,460,000 | 2,170,000 | 1,930,000 | 1,620,000 | 2,200,000 | 10,380,000 |
| | 3 | Steel[1] | All other alloy steel | - | 6,190,000 | 6,140,000 | 5,810,000 | 2,620,000 | 4,680,000 | 25,440,000 |
| | 4 | Steel[1] | Raw Steel Production Total | - | 98,200,000 | 98,100,000 | 91,900,000 | 59,400,000 | 80,500,000 | 428,100,000 |
| | 5 | Iron[1,2] | Pig Iron Production | - | 37,900,000 | 36,300,000 | 33,700,000 | 19,000,000 | 26,800,000 | 153,700,000 |
| | 6 | Aluminum | Primary Production | - | 2,284,000 | 2,554,000 | 2,658,000 | 1,727,000 | 172,600 | 9,395,600 |
| | 7 | Copper | Primary Production | 1,210,000 | 1,210,000 | 1,270,000 | 1,220,000 | 1,110,000 | 1,060,000 | 5,870,000 |
| | | | | | | | | | Total of Rows 4, 5, 6, & 7 | 597,065,600 |

| | Row # | Metal | Type | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 5 Year Total |
|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL METAL RECYCLED | 8 | Aluminum | Recycled | 3,030,000 | 3,540,000 | 3,790,000 | 3,330,000 | 2,710,000 | - | 16,400,000 |
| | 9 | Copper | Recycled | 953,000 | 968,000 | 925,000 | 852,000 | 774,000 | - | 4,472,000 |
| | 10 | Iron & Steel | Recycled | 65,600,000 | 65,300,000 | 64,000,000 | 66,400,000 | 53,100,000 | - | 314,400,000 |
| | | | | | | | | | Total of Rows 8, 9, & 10 | 335,272,000 |

Notes:
All units are metric tonnes; source of data is on the following page.
[1] Steel and Iron data in the source were rounded to three significant digits and presented in units of thousands. For purposes of comparison the data are presented as whole numbers; apparent errors in the totals are a result of rounding.
[2] More than 95% of iron made is transported in molten form to steelmaking furnaces located at the same site.

| Row # | Link to source of information | Location within the source |
|---|---|---|
| 1 | http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/myb1-2010-feste.pdf | Table 1. Page 37.5 |
| 2 | http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/myb1-2010-feste.pdf | Table 1. Page 37.5 |
| 3 | http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/myb1-2010-feste.pdf | Table 1. Page 37.5 |
| 4 | http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/myb1-2010-feste.pdf | Table 1. Page 37.5 |
| 5 | http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/myb1-2010-feste.pdf | Table 1. Page 37.5 |
| 6 | http://minerals.usgs.gov/minerals/pubs/commodity/aluminum/myb1-2010-alumi.pdf | Table 1. Page 5.10 |
| 7 | http://minerals.usgs.gov/ds/2005/140/ds140-coppe.pdf | Page 3 |

| Row # | Link to source of information | |
|---|---|---|
| 8 | http://minerals.usgs.gov/minerals/pubs/commodity/recycle/myb1-2009-recyc.pdf | Table 1. Page 61.2 |
| 9 | http://minerals.usgs.gov/minerals/pubs/commodity/recycle/myb1-2009-recyc.pdf | Table 1. Page 61.2 |
| 10 | http://minerals.usgs.gov/minerals/pubs/commodity/recycle/myb1-2009-recyc.pdf | Table 1. Page 61.2 |