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Atomics International Division

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ABSTRACT

This report summarizes the task of decladding the SRE fuel assemblies, and shipment of the fuel to Savannah River for eventual reprocessing. The disposition of 16 unidentified RMDF storage canisters, is also covered.

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I. INTRODUCTION

A. HISTORY

Atomics International is engaged in the dismantling and disposal of the Sodium Reactor Experiment (SRE) as part of a broader decontamination and disposition program originally funded by ERDA through the Division of Waste Management and Transportation, and later by the Division of Environmental Controls Technology. This report summarized that part of the program which prepared the irradiated SRE fuel for shipment to and eventual recovery in the ERDA owned Savannah River Plant, Aiken, South Carolina, which is presently operated by E. I. duPont de Nemours & Co. A schematic of one of the fuel assemblies is shown in Figure 1.

The remaining irradiated SRE fuel had been stored in the irradiated fuel storage vault at the Radioactive Materials Disposal Facility (RMDF) since its removal from the SRE reactor. Core I was removed in 1959 after an incident which resulted in the overheating and failure of one or more fuel rods in a number of fuel assemblies. The 26 undamaged fuel assemblies were shipped to Oak Ridge National Laboratory and were reprocessed. The assemblies having damaged rods, along with miscellaneous fuel pieces which were retrieved from the reactor, were repackaged into stainless steel canisters and stored in the RMDF. This damaged Core I fuel was estimated to contain about 1300 kg of uranium, including 35 kg of U^{235}. The Core II fuel assemblies were removed from the reactor in 1964 and stored in the RMDF. This fuel, including some low enrichment experimental fuel, was estimated to contain about 227 kg of uranium, including some 148 kg of U^{235}. The total fuel recovered was 1686 kg of uranium metal, 190 kg U^{235}, and 608 grams of Pu^{239}.

Upon removal from the SRE reactor, the Core I fuel was placed in 34 stainless steel canisters, 3-1/2 in. in diameter by 120 in. long. During GFY 1972, the fuel canisters were examined, and limited

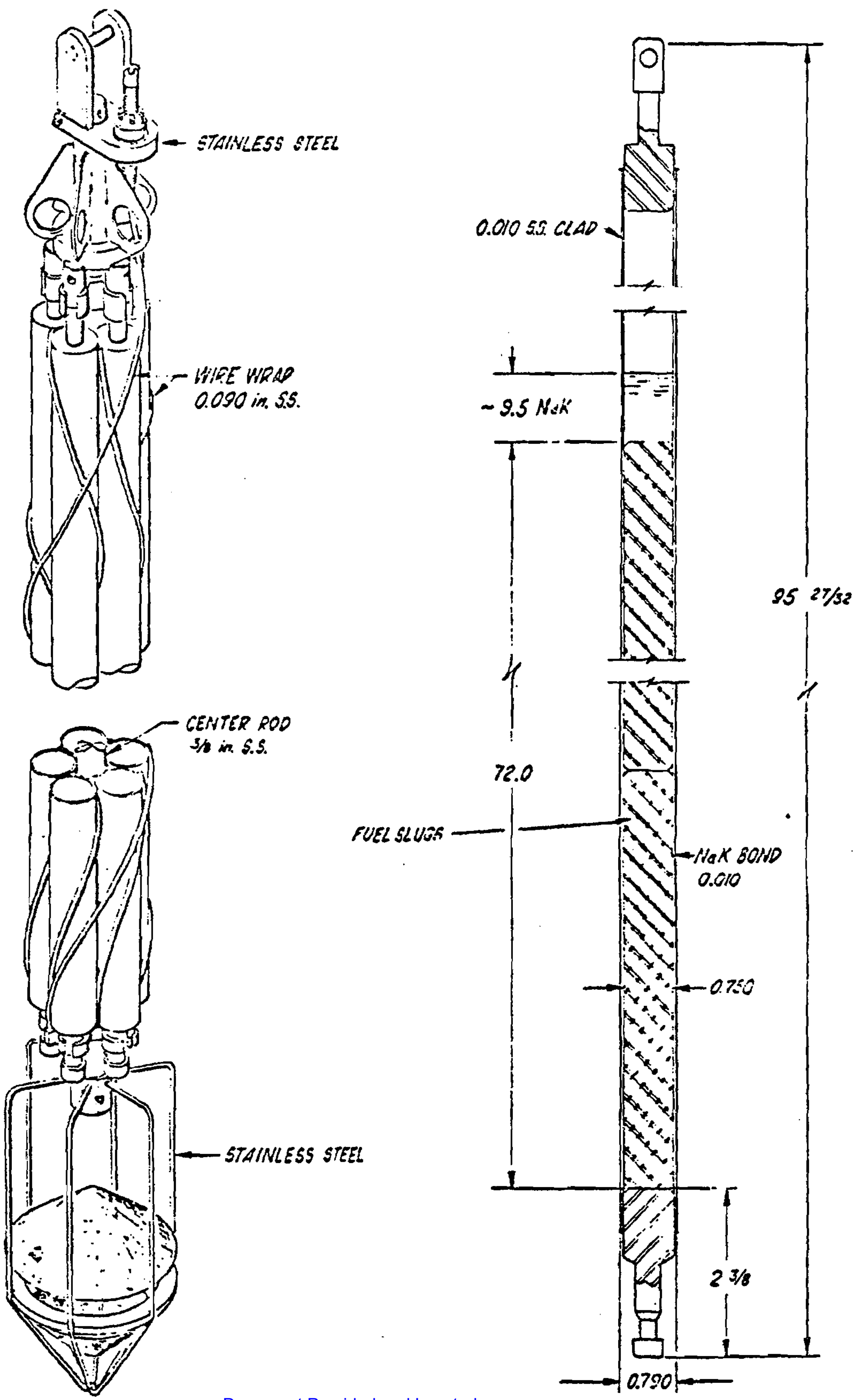

Figure 1. SRE Fuel Assembly and Rod Configurations

repackaging was performed, which reduced the number of canisters to 26. The Core II fuel assemblies, along with some experimental fuel assemblies, were stored in 68 carbon steel canisters of the same size as used for Core I, as depicted in Figure 2.

B. FUEL DESCRIPTION

The Core I fuel was unalloyed uranium metal, with a nominal 2.8% U^{235} enrichment (as fabricated), clad with Type 304 stainless steel, and NaK bonded. Core II contained a thorium - 7.6% uranium alloy, enriched to 92.3% U^{235}, and was also clad in Type 304 stainless steel and NaK bonded. In addition, several miscellaneous SRE experimental elements consisting of thorium - 5.4% uranium alloy, UO_2, U-Mo, and U-carbide were in storage at the RMDF.

The Core I fuel assemblies nominally consisted of 7-rod elements and Core II of 5-rod elements with each rod containing 12 fuel slugs. Each slug was 3/4-in. diameter by 6 in. long, making an active fuel column length of 6 ft. Wire wrap was used to space the rods within an assembly. The 6 experimental assemblies contained miscellaneous fuel slug sizes.

C. SCOPE OF EFFORT

The scope of effort for the SRE fuel decladding task was to place the fuel in an acceptable condition for reprocessing by means of acid or electrolytic dissolution at the Savannah River reprocessing plant. As stated previously, the fuel slugs were thermally bonded to the cladding with NaK. The presence of NaK represents a hazardous condition for the dissolution processes. As a result, the eventual reprocessing of this fuel required special head-end treatment involving the NaK removal. Inasmuch as the Division of Production does not have this special head-end capability, the processing was, therefore, performed at the AI Hot Laboratory.

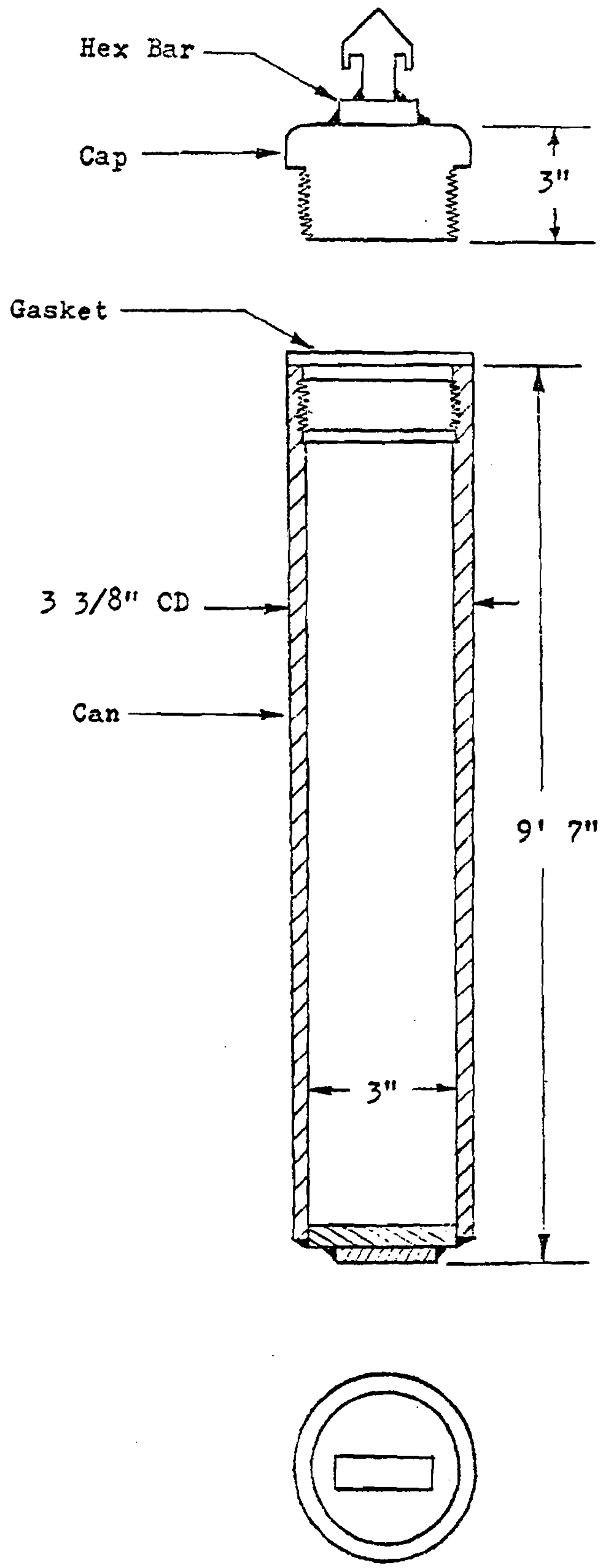

Figure 2. SRE Fuel Storage Cans Used in the RMDF

The major tasks comprising this effort consisted of:

1) On-site transfer of the fuel assemblies from the RMDF to the AI Hot Laboratory
2) Disassembly of the fuel elements
3) Decladding of the fuel rods
4) Removal of the NaK from the fuel slugs
5) Repackaging of the fuel slugs and weighing of the loaded shipping canisters
6) On-site transfer of the fuel from the Hot Laboratory to the RMDF for subsequent shipment
7) Planning, tooling, and process development for the above

II. COMPENDIUM

The SRE fuel decladding task began in July 1974 (FY 1975). The first tasks accomplished were the selection of the TREAT Loop Cask for off-site shipping, identification of the in-cell processes, preparation of the process safety study (Nuclear Safety Analysis), design of an aluminum shipping canister, and preparation of a criticality study for the decladding processes and the shipping canister. Following development of this initial information, the tooling requirements were established, the in-cell tooling layouts were made, and the tooling design, fabrication, and assembly were accomplished.

The disassembly tooling consisted of remote, in-cell devices for opening the storage containers, disassembling the fuel assemblies to separate the fuel rods, removing the wire wrap from the cladding, cutting the clad fuel rods to a convenient handling length, melting and removing the bulk NaK from the rod segments, and pushing the intact fuel slugs out of the cladding. The damaged fuel required the development of additional tools to manually strip the cladding from the fuel.

The tooling for NaK removal consisted of alcohol washing tanks, manual scrub brushes, ultrasonic alcohol cleaning tanks, and a NaK vacuum distillation furnace for residual NaK removal. The damaged fuel required the development of a hot alcohol bath process to remove the NaK from the porous surface, after extensive testing of the NaK distillation process proved impractical.

A weighing system, designed and fabricated by an outside contractor, was used to tare weigh the shipping canisters and spacers, and to weigh the seal-welded canister containing the declad fuel. The net weight was used for accountability. An in-cell welding system was developed for performing the shipping canister seal weld after the fuel had been loaded. The welder was programmed for automatic operation, using parameters developed and qualified in an out-of-cell test program. Weld repair parameters were also developed and qualified for in cell use. A leak test tank was also developed for use in the final quality assurance test of the integrity of the welded shipping canister.

Concurrent with the tooling preparation efforts, the Nuclear Material Management Plan and the Quality Assurance Functional Plan were developed. Test Plans were written for the NaK distillation and for the shipping canister weld development, and the testing was performed accordingly.

Early in the decladding program, the safeguards requirements of 10 CFR 73 for the licensed AIHL facility, and AECM-2405 for the ERDA owned RMDF facility were reviewed for application to the SRE Core II fuel. This fuel contained uranium enriched to 93 percent U^{235}. The basic requirements of these documents stated that fuel enriched to greater than 20 percent U^{235}, when present in quantities of greater than 5 kg of U^{235} must be provided physical protection. Exemptions to these safeguards requirements were requested on the basis of the radiation levels of 50 R/hr at 3 ft associated with the irradiated Core II fuel. The requests were denied due to the fact that such exemption requires that associated radiation levels be greater than 100 R/h at 3-ft distance. The AI Security Plan was therefore revised to include the decladding operations of the AIHL, and submitted to the NRC for approval. The AIHL was subsequently modified to incorporate the full safeguards requirements of 10 CFR 73, and the RMDF was modified per ERDA/SAN direction, to provide equivalent protection to AECM-2405 for the Core II fuel.

Since the AIHL required physical protection modifications before Core II could be declad, the program sequence was modified to begin the operations on the Core I fuel. Originally the Core II fuel was to have been declad first, as it was known to be intact and easier to clean. The experience on the Core II fuel would then have been useful to the more complex operations on the damaged Core I fuel.

Fuel decladding checkout operations began on the Core I fuel in May 1975, and full scale operations began in July 1975. The first year of SRE fuel decladding effort (FY 1975) culminated in completing all preparations necessary to begin full scale operations on the intact SRE fuel. The only development still in progress at the start of the second year (FY 1976) was the NaK cleaning for the damaged fuel.

The extent of the damage to the Core I fuel involved in the 1959 fuel-cladding melting incident was difficult to estimate prior to beginning the actual decladding efforts. Once operations began, it became obvious that the cladding removal process was inadequate in the case of the damaged fuel, the NaK removal process was not effective on the damaged material, and there was more damaged fuel than anticipated. The cladding had to be mechanically peeled from the fuel slugs due to a metallurgical bond which had formed, thus requiring the development of additional tools. The NaK had to be reacted from the pores of the damaged slugs using hot alcohol, as the total fuel surface area was too great to effectively distill the NaK in a vacuum distillation furnace which was initially tried. Additionally, the alcohol used in the initial wash was trapped in the pores and created a seemingly endless off-gasing in the vacuum furnace. This required the development of a hot alcohol bath process in an autoclave. Unfortunately, the requirements for the development of the hot alcohol bath developed after extensive time had already been spent on developing the NaK distillation. This added scope was reflected in the requirement for added mid-year funding to meet the forecast completion schedule for the Core I decladding.

In August 1975, 16 containers of fuel that were no longer being carried on the RMDF inventory were located in the facility vaults. A complete inventory of the vaults verified the absence of any additional fuel not listed in the RMDF records. A search of the accountability records revealed that most of the fuel in the 16 containers had been listed as previously disposed. A detailed accounting of the problem of the 16 containers is provided in Appendix A.

The Core I fuel, experimental fuel, and the 16 containers of low enrichment fuel was all processed and repackaged by December 1975. Cell cleanup was performed upon completion of the processing of the low enrichment fuel. Core II fuel processing was begun in January 1976, following revision of the Nuclear Safety Analysis and following NRC approval of the Safeguards and Security Plan.

The Core II decladding operations were completed in June 1976, and final cell cleanup was begun. The Appendix A submittals, required by Savannah River, were approved in June. The second year of the decladding effort (FY 1976) culminated in the completion of all SRE fuel processing operations and the return of all repackaged fuel to the RMDF for shipment to Savannah River.

The transition quarter (FY 1976T) saw the initiation and completion of the Core I and experimental fuel shipments to Savannah River in the TREAT Cask. Also, initiation of final cell cleanup, disposal of the fuel waste from the 16 containers, and preparation of the loading specification for the ERDA escorted Core II fuel shipments to Savannah River were accomplished. In FY 1977, cell cleanup was completed and Core II shipments to Savannah River were completed by ERDA escorted couriers.

III. PROCESS DESCRIPTION

A. MATERIAL RECEIPT

The fuel material was received at the AI Hot Laboratory (AIHL) in a specially designed shielded transfer cask, known as the Babcock Cask, which is shown in Figures 3 and 4. The fuel container was removed from the cask directly into Cell 4 in the AIHL. The container was immediately transferred to a storage rack, which was designed for storage of three containers. As these cans were removed from the storage rack to be placed in work, additional fuel cans were received and moved to this storage rack to provide a continuous supply of input material to the disassembly station. Figure 5 is a facility layout of the AIHL. Figures 6 and 7 are expansions of the AIHL layout and shows the locations of the process steps for Cores I and II. Figure 8 depicts the material flow through the entire decladding and packaging operation.

B. FUEL ELEMENT DISASSEMBLY

At the disassembly station, the fuel was removed from the fuel can. Fuel rods were disassembled from element form by removing the holding cotter keys and lock wires. During the disassembly process, fuel serial numbers were verified to reconcile records. Discrepancies were resolved by the AIHL and the Nuclear Material Management Managers, before further disassembly of the discrepant items was initiated. The fuel rods were then transferred to a washing tank (Figure 9) containing Dowanol to remove any residual external Na or NaK. After washing, the fuel rods were transferred to the rod disassembly rack.

C. FUEL ROD DISASSEMBLY

The end plugs of the fuel rods were removed by making cuts with a tubing cutter. The rods were subsequently sectioned into approximately 18-in. long sections, also by use of the tubing cutter. The cutting station is shown in Figure 10. The fuel slugs were removed from the cladding

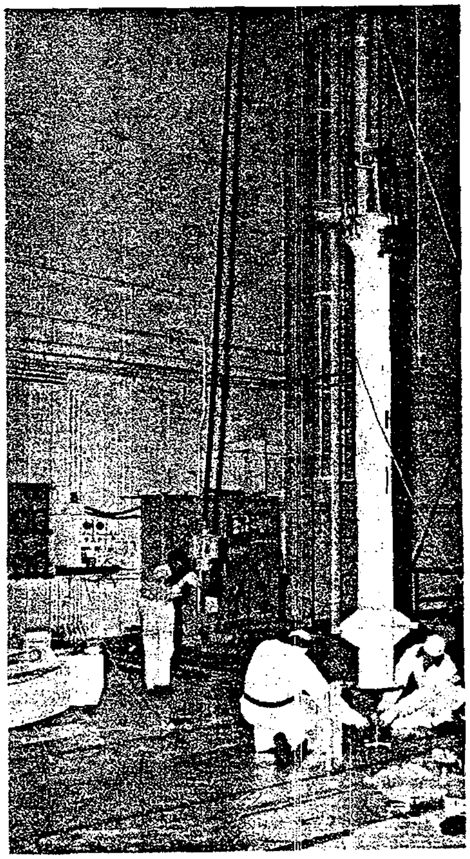

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Figure 3. Babcock Transfer Cask Being Loaded at the RMDF

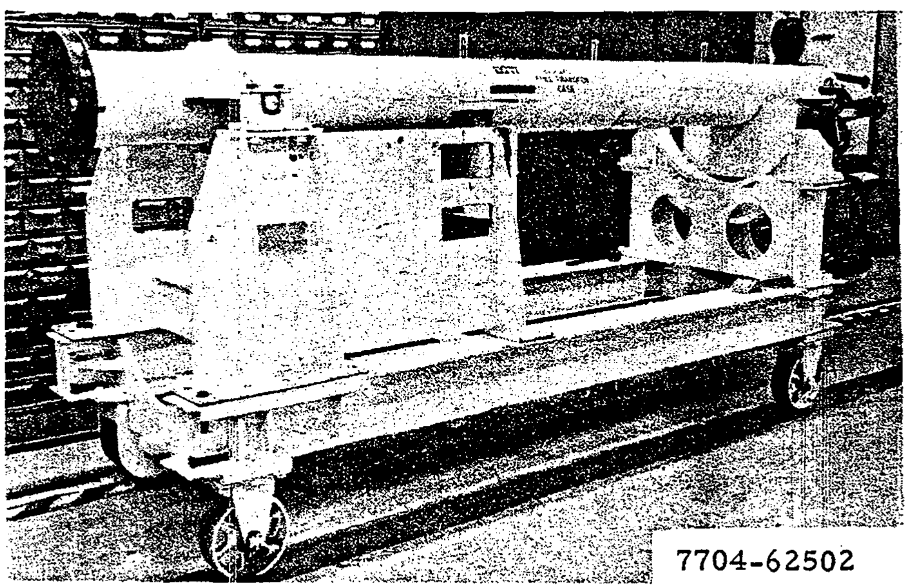

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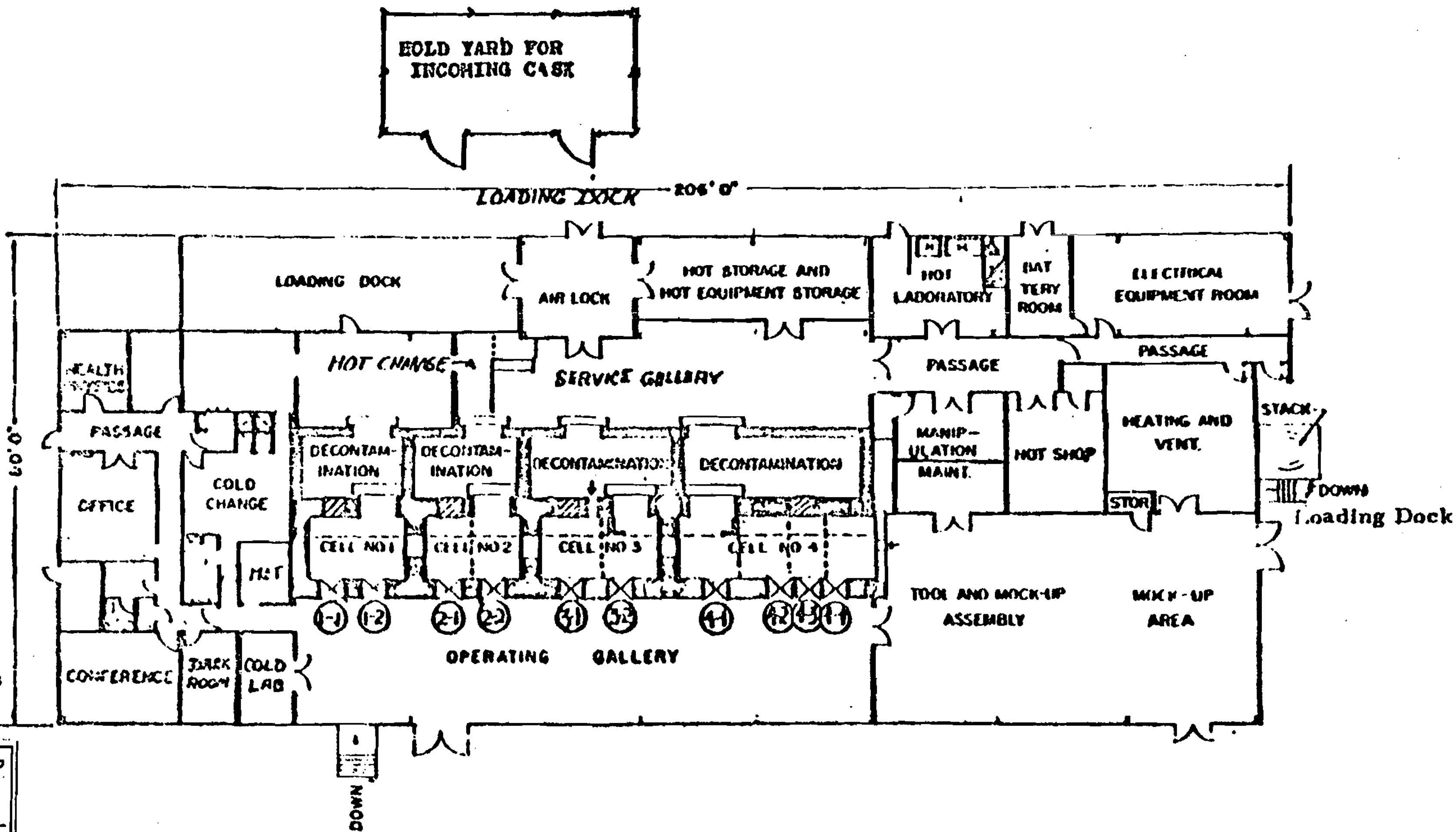
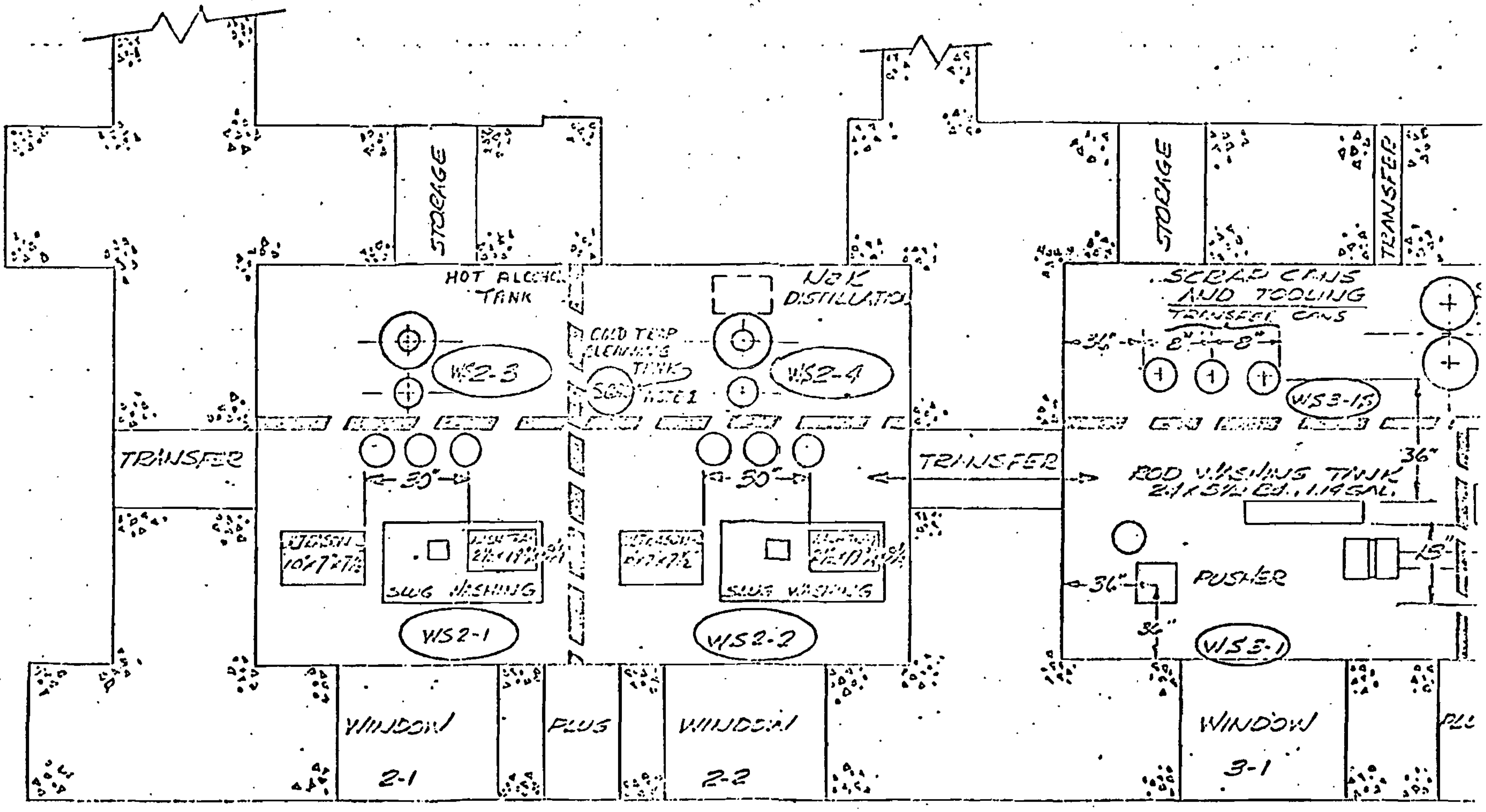
Figure 4. Babcock Cask on Dolly at the AIHL



Loading Dock

Figure 5. AI Hot Lab Facility Layout



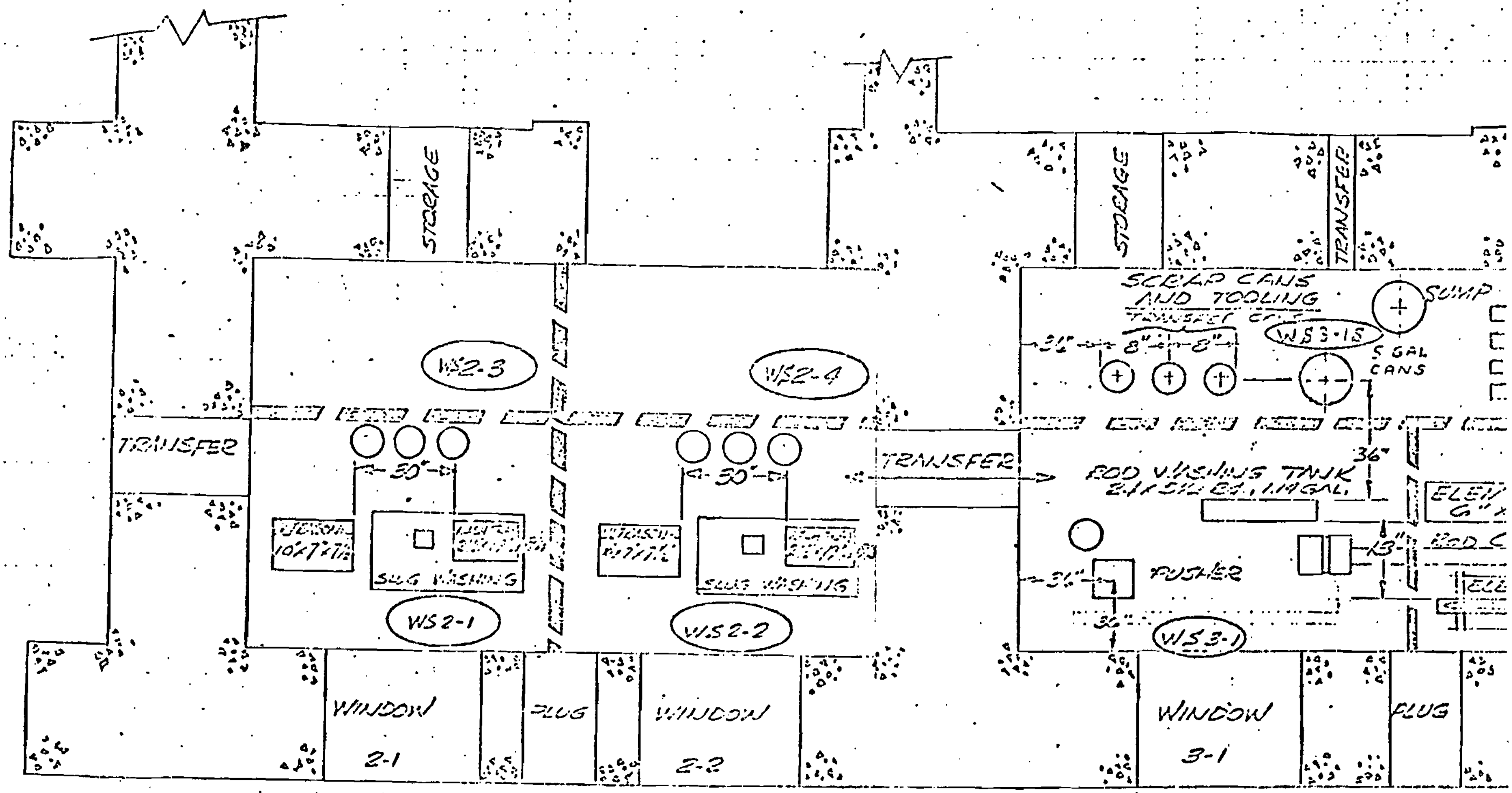
CELL 2 10'0" X 16'0"

CELL

WORK STATIONS FOR

SCALE: NONE

WS X-X



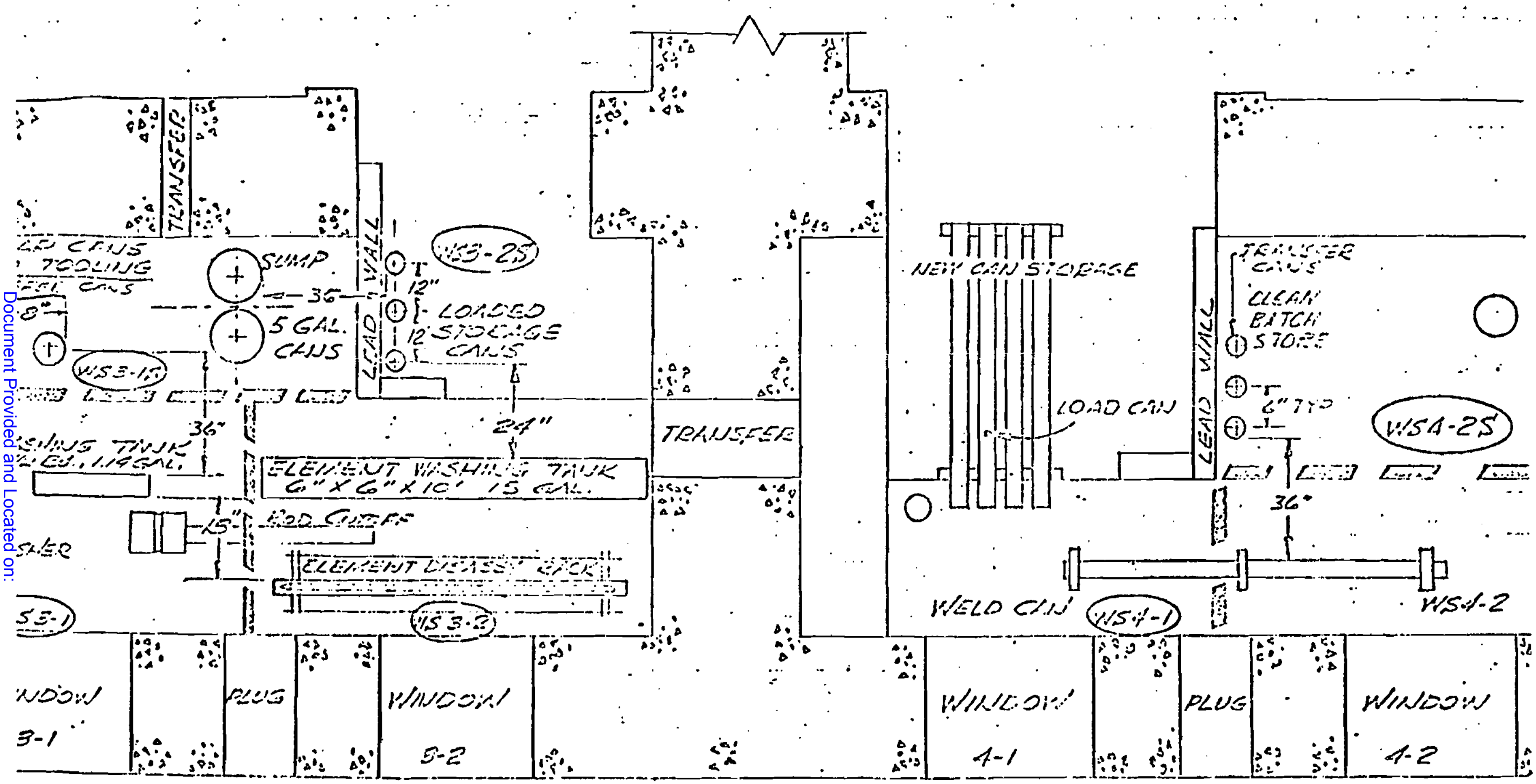
CELL 2 10'0" X 16'0"

CELL 3 1(

Figure 7

WORK STATIONS FOR SA

SCALE: NONE (WS X-X) = WO



CELL 3 10'0" X 20'0"

CEL

13b

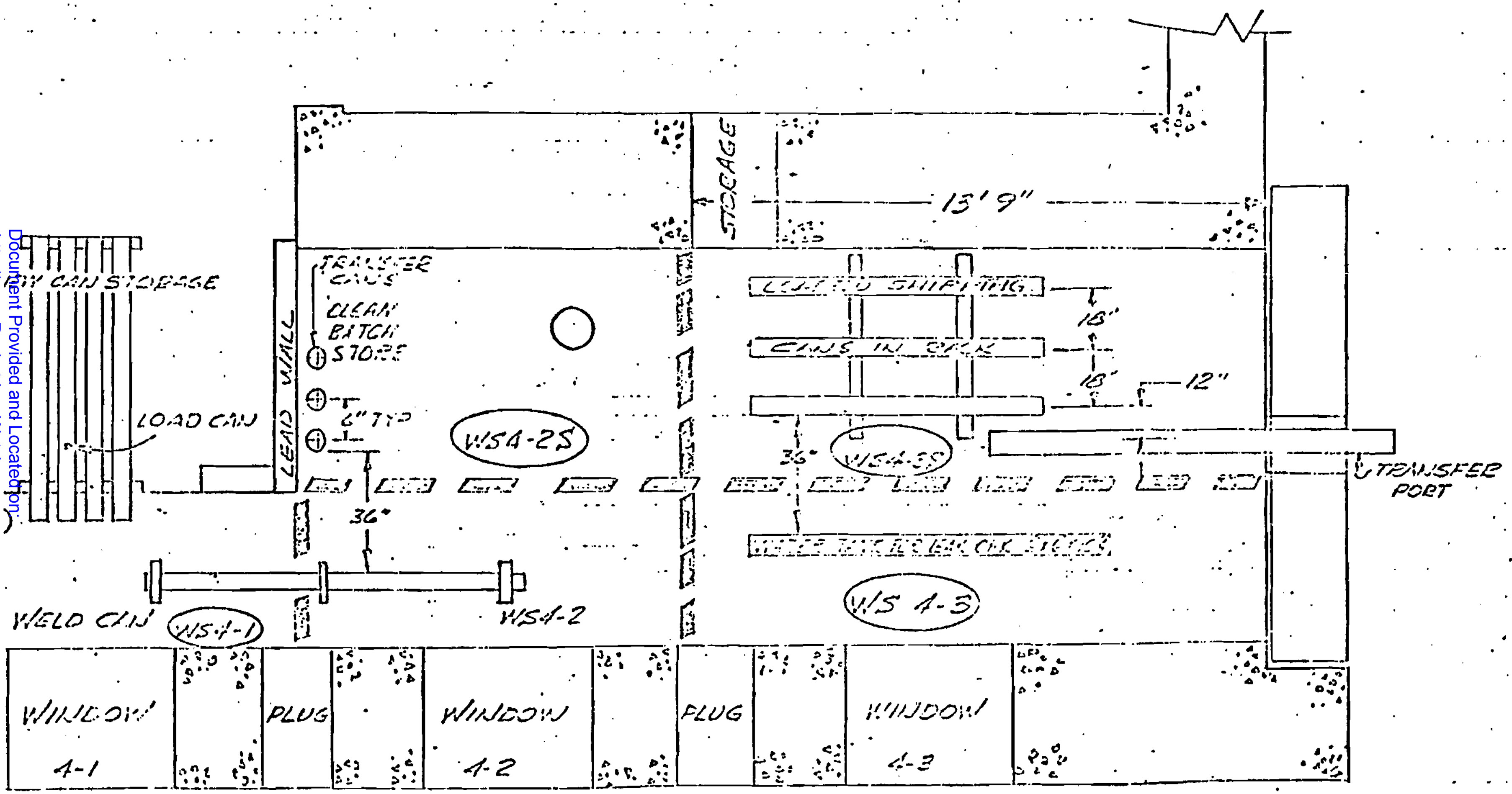
Figure 6

TIONS FOR SRE REPACKAGING CORE I

ONE (WS X-X) = WORK STATION

NOTE 1: MAY BE DOWANOL OR ALCOHOL

13



CELL A 10'0" X 33'6"

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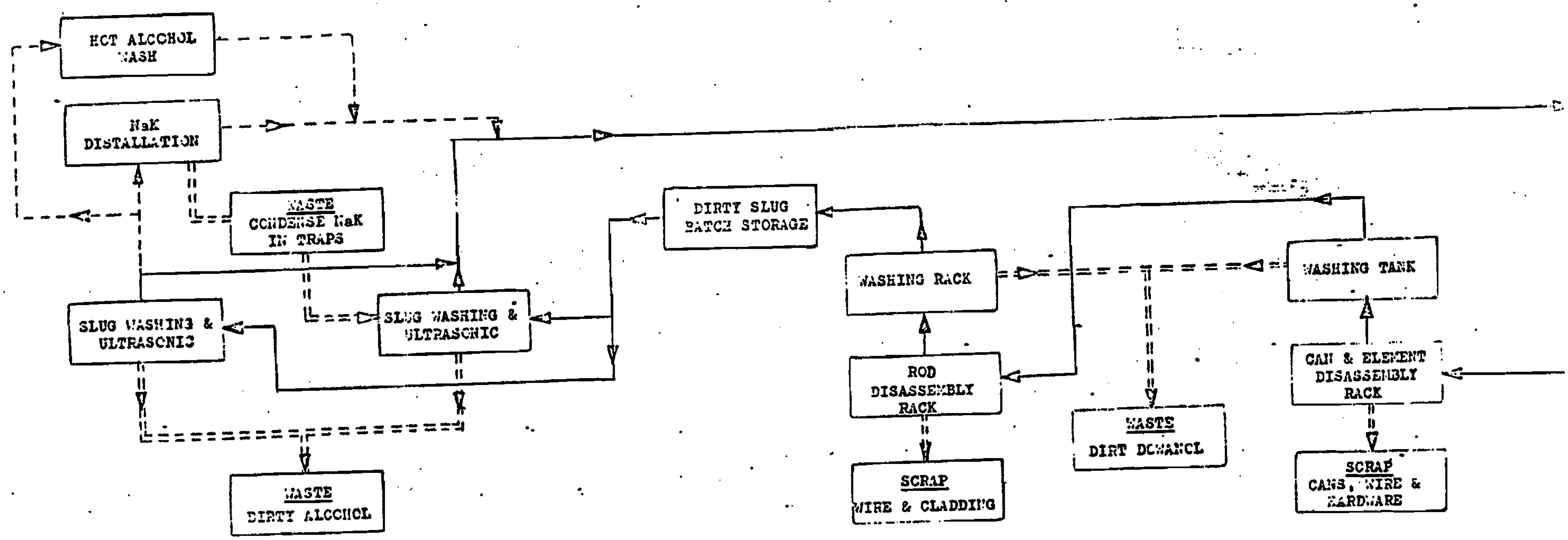
NOTE 1: MAY BE DOWANOL OR ALCOHOL

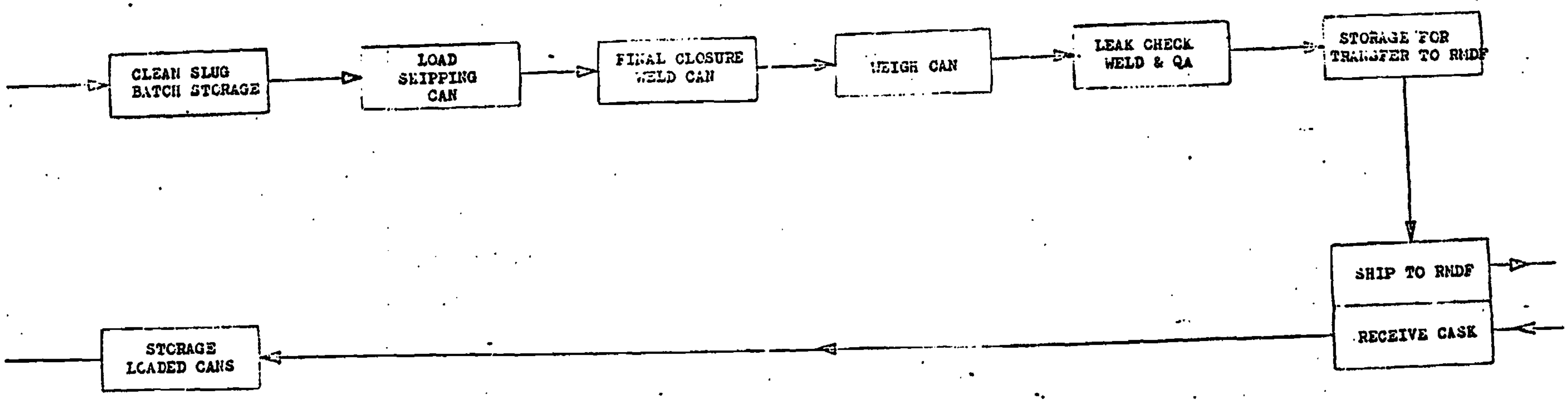
13 e.


HOT ALCOHOL WASH
NaK DISTALLATION
WASTE CONDENSE NaK IN TRAPS
SLUG WASHING & ULTRASONIC
SLUG WASHING & ULTRASONIC
WASTE DIRTY ALCOHOL
DIRTY SLUG BATCH STORAGE
WASHING RACK
ROD DISASSEMBLY RACK
SCRAP WIRE & CLADDING
WASTE DIRT DOWANOL
WASHING TANK
CAN & ELEMENT DISASSEMBLY RACK
SCRAP CANS, WIRE & HARDWARE

15

15.a

15b



15b

15c

Figure 8. SRE FUEL DECLAD PROCESS FLOW CHART

by holding the fueled section in a vertical position and pushing out the fuel slugs from the bottom up. The fixture for holding and pushing out the fuel slugs is also shown in Figure 10. Upon examination of the damaged Core I fuel in-cell, and attempts to remove the fuel slugs, it became obvious that additional tools and procedures were required. It was found that the cladding had to be mechanically cut and peeled from the fuel slugs due to a metallurgical bond which had formed between the two. One of the tools, used for chisel cutting the cladding, is shown in Figure 11.

After rod disassembly, the cladding and fuel slugs were washed in Dowanol to remove the NaK. The washing station is shown in Figure 12. The fuel slugs were allowed to soak in the Dowanol until there was no longer a visible reaction. The slugs were stored within the cell in the "dirty" batch store area until they could be transferred to the next operation in Cell No. 2.

Fuel element cladding from the removal operation, along with the wire-wrap wire and other hardware, were packaged in 10-gal. pails and eventually disposed of as high level waste. The cladding was visually checked during removal and/or before disposal to assure that any entrapped pieces of fuel had been removed.

The dirty Dowanol was poured from the washing tanks through a wire screen into a weir box trap. The contents of the weir box were pumped to a 55-gal. drum located in the adjacent decontamination room behind the cell for holdup. The liquid was later solidified for disposal as solid waste. A diagram of the Dowanol disposal systems are shown in Figures 13 and 14. Any pieces of fuel that were collected on the wire screen were placed in a previously tare weighed waste can which was identified and designated for that purpose. Any material collected in this system eventually was placed with identical material in the final shipping canisters.

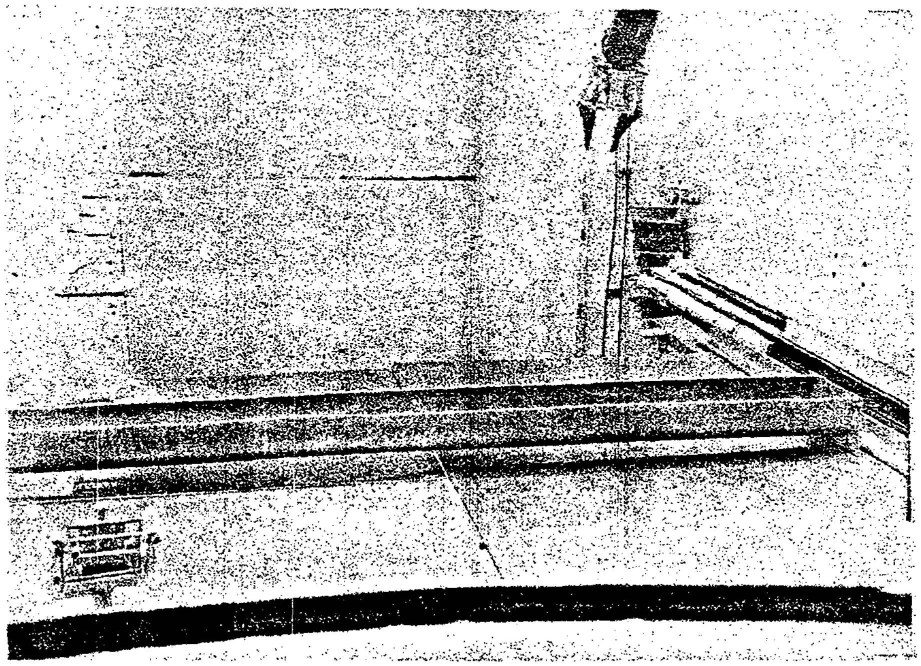


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Figure 9. Fuel Rod Washing Tank In-Cell

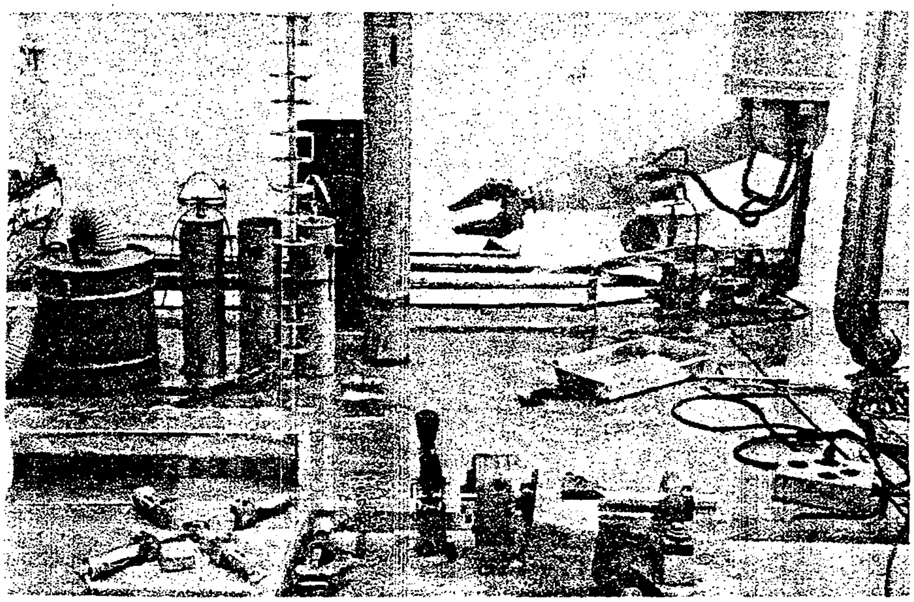

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Figure 10. Chuck and Tubing Cutter, and Fuel Slug Remover

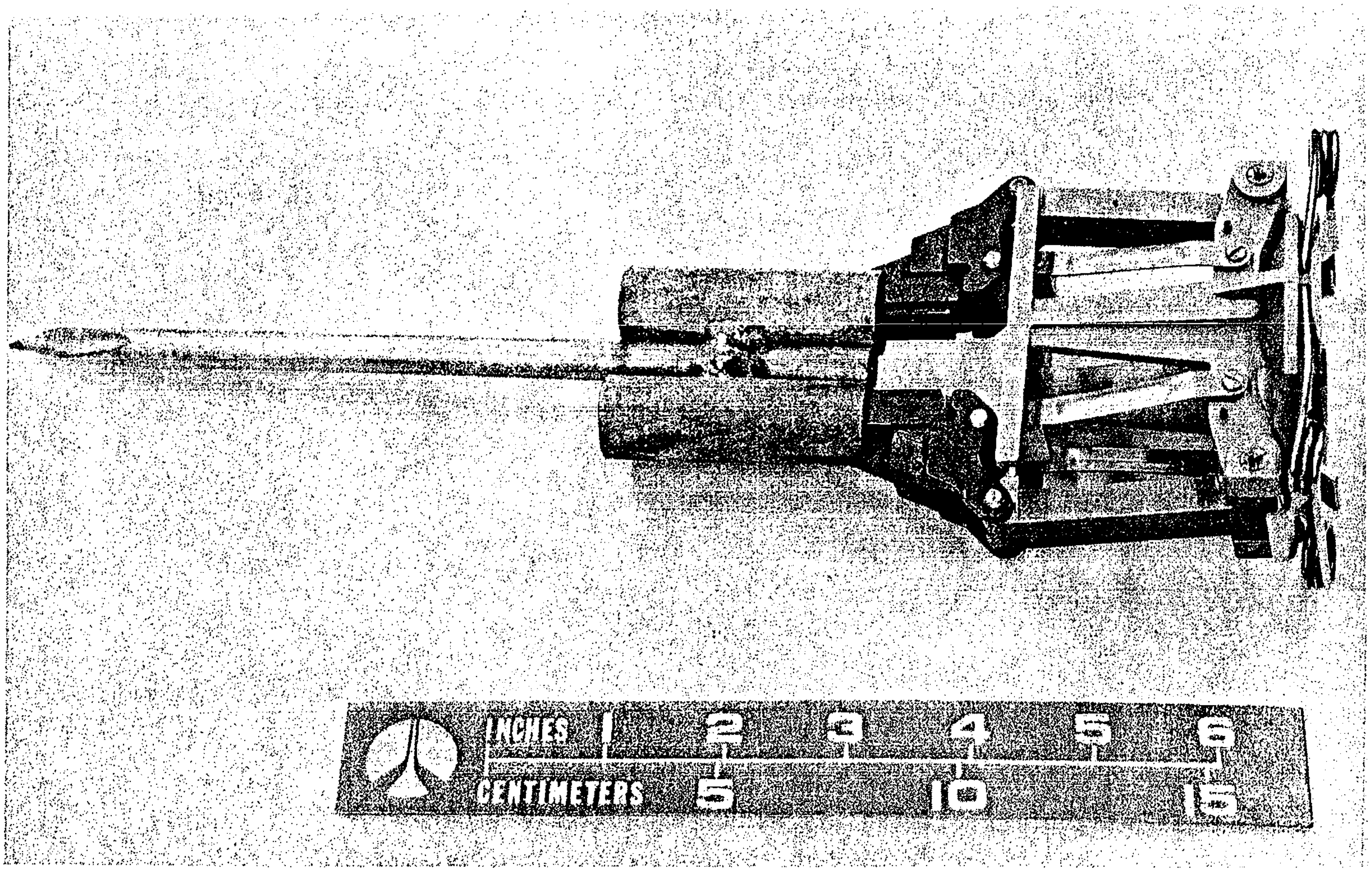

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Figure 11. Cutting Chisel Tool Used to Remove Damaged Cladding

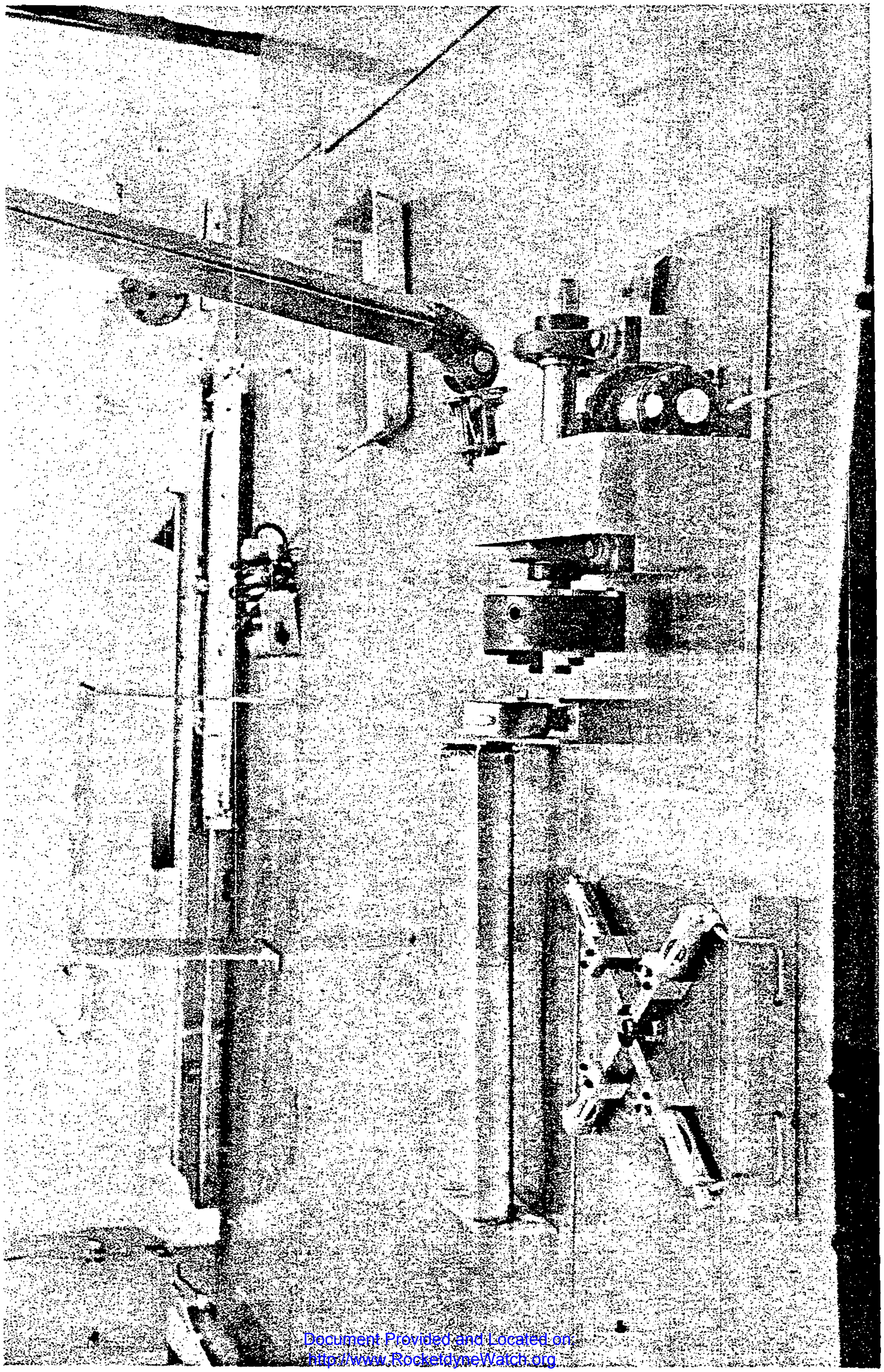

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Figure 12. Fuel Slug Washing Tray

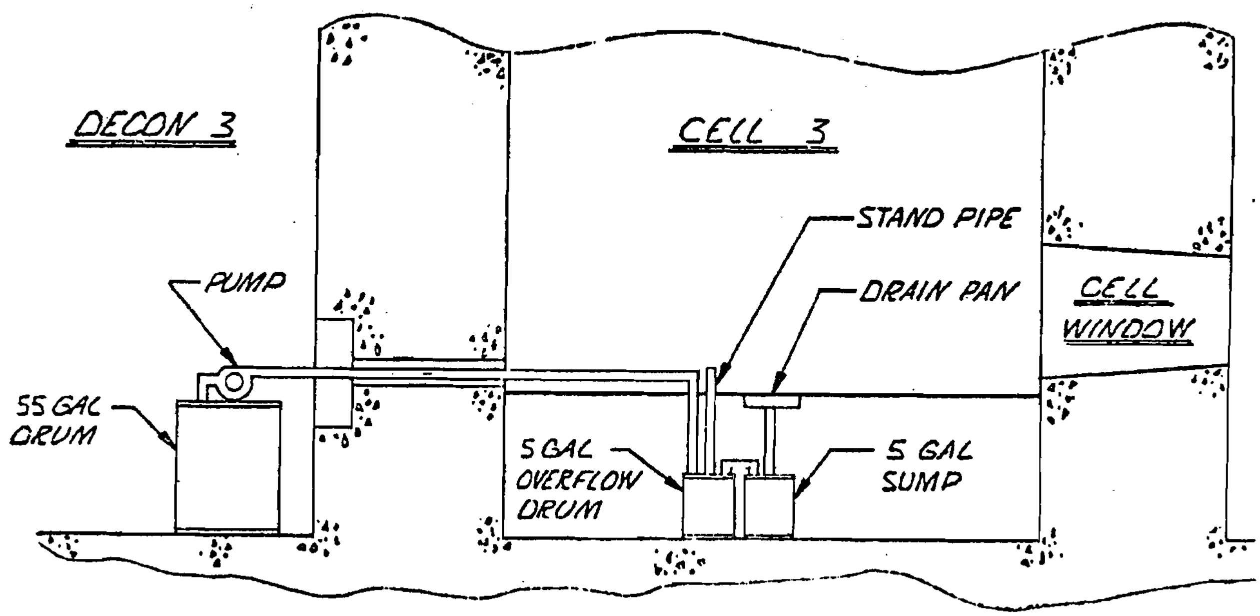

Figure 13. Dowanal Disposal System — Core I

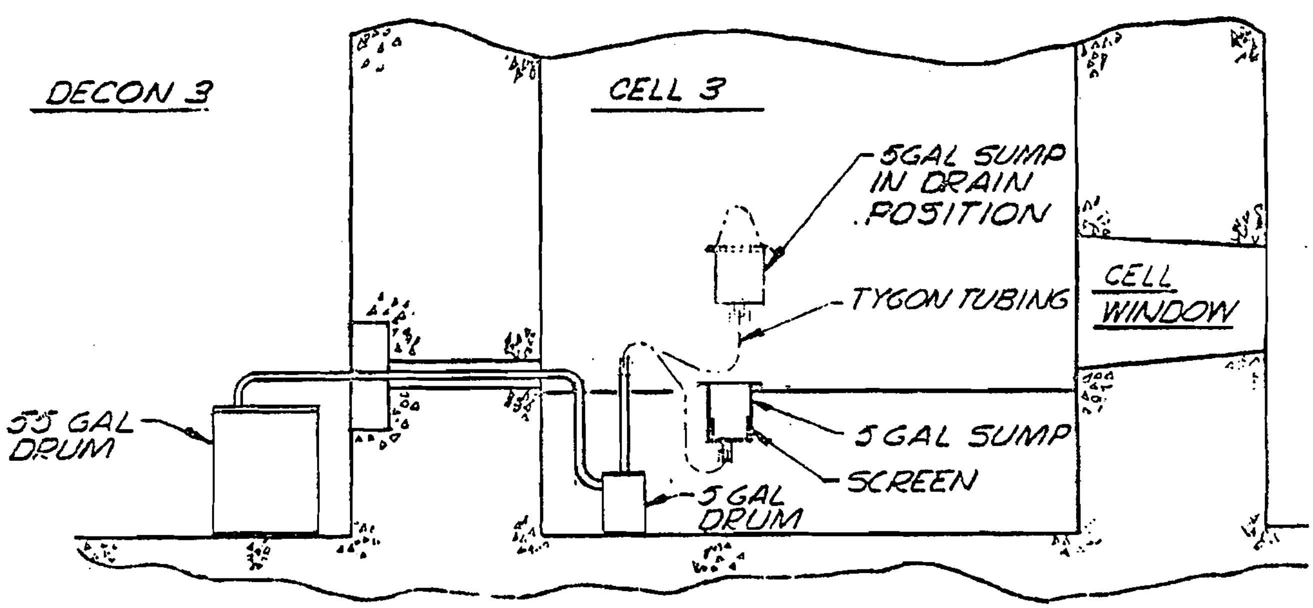

Figure 14. Dowanol Disposal System — Core II

The empty cans which contained the incoming fuel assemblies were disposed of as low level waste.

D. FUEL SLUG CLEANING

The "dirty" fuel slugs were received into this operation from the "dirty" fuel slug storage area. The slugs were removed from the container and placed into the slug washing tank where they were cleaned in alcohol. Stubborn deposits of bonding material were removed by brushing the fuel slug with a nylon brush. The slugs were then placed in an ultrasonic tank for a final alcohol cleaning. Previous studies and subsequent operations conducted by Atomics International demonstrated that alcohol has no discernible reaction with uranium or uranium alloys.

To assure that all residual NaK had been removed, the batches of fuel slugs which were suspect of exhibiting NaK after the previous cleaning steps were processed through an additional cleaning step which consisted of a NaK distillation or a hot alcohol bath. The initial NaK cleaning process was NaK distillation. However, it was found that this method was impractical for use on the damaged fuel slugs taken from the overheated fuel elements. These slugs exhibited cracks and pockets which contained NaK in quantities too large to be handled by the distillation technique. More detail is provided in N704-ER-990-002, "Selection of NaK Removal Process for SRE Fuel," dated October 2, 1975.

For the NaK distillation, a basket of fuel slugs was loaded into a retort and the retort placed in a furnace. The distillation parameters were: (1) Vacuum — 50 microns or better, (2) Temperature — 750° - 850° F, and (3) Time — 1 hr. A cold trap was located between the retort and the vacuum pump to condense the NaK vapor. The cold traps were periodically removed to react any NaK which had been collected. After the distillation cycle, the fuel slugs were considered NaK free when there was no NaK visible on the cold trap. The slugs were then transferred to a clean in-cell transfer container and were moved to the "clean" batch storage area in the adjacent Cell No. 4. The NaK distillation system is shown in Figure 15.

For the hot alcohol bath process, six racks, each containing six fuel slugs were loaded into an autoclave containing 4-1/2 gal. of ethyl alcohol and 8.6 ounces of acetic acid. A condenser was provided to keep a liquid cover on the fuel at all times. The alcohol was heated and maintained at 140°F. The hydrogen gas that evolved was vented through a liquid bubbler. The fuel slugs were considered NaK free in 20 hours, or when no more bubbles were seen in the bubbler during a 6-min. interval, whichever occurred first. The fuel racks were transferred to a clean in-cell transfer container, and were moved to the "clean" batch storage area in Cell No. 4.

The dirty Dowanol and alcohol were dumped into the radioactive liquid waste system in Cell No. 3. The alcohol was first poured through a wire mesh screen to collect any pieces of fuel which remained in the ultrasonic tanks. The contaminated nylon brushes were visually checked for fuel pieces before being disposed of as waste.

E. FUEL SLUG PACKAGING

The fuel slugs from the "clean" batch storage area were transferred into a shipping canister. Two canisters were used — EX-N704000025, Rev. A, SRE-Savannah River Core I Shipping Can, and EX-N704000065 N/C, SRE-Savannah River Core II Shipping Can. The canisters contained spacer tubes of the appropriate diameter of fuel slugs. The slugs were loaded into the spacer tubes until the tubes were filled to capacity. The lid was placed on the canister and the unit moved directly to the weld station where the final closure weld was made. The lid was welded to the canister using tungsten inert gas welding. The welding station is shown in Figure 16. The welding development and resultant parameters are described in N704-TR-990-001 N/C, "Closure Weld Development Test Report, SRE Fuel Decladding," dated September 2, 1975. The welded canister was then

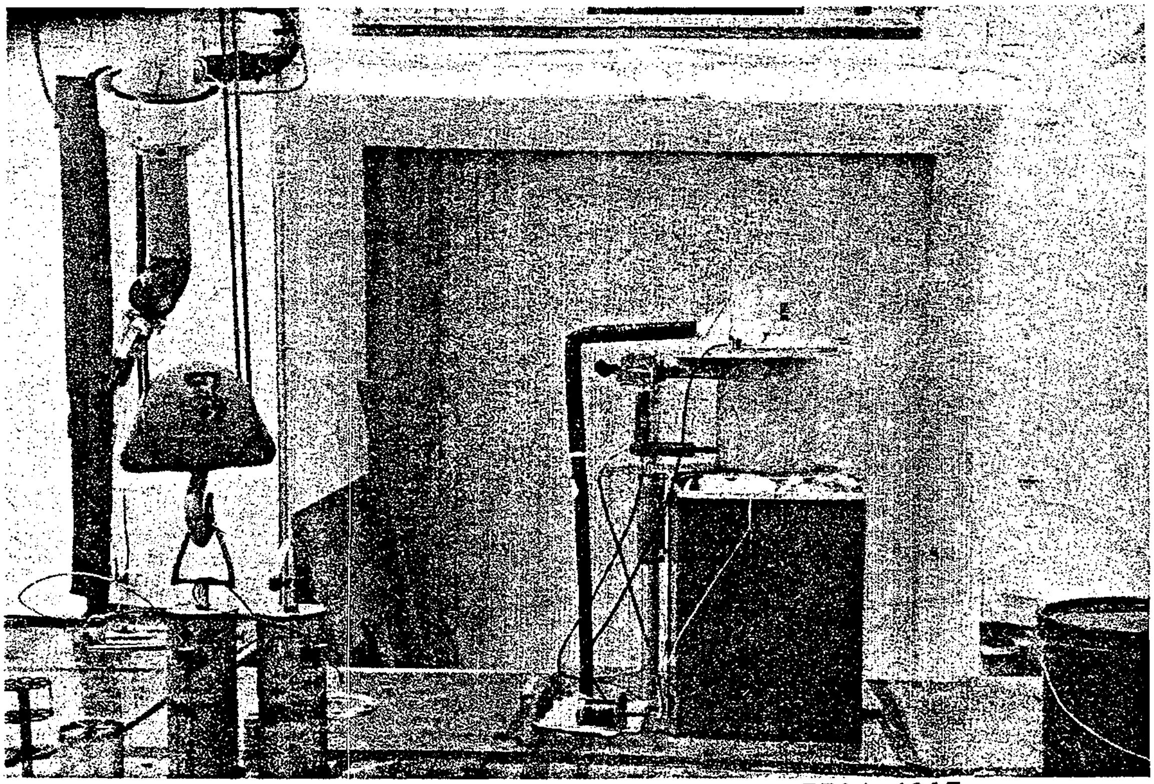

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Figure 15. NaK Distillation System

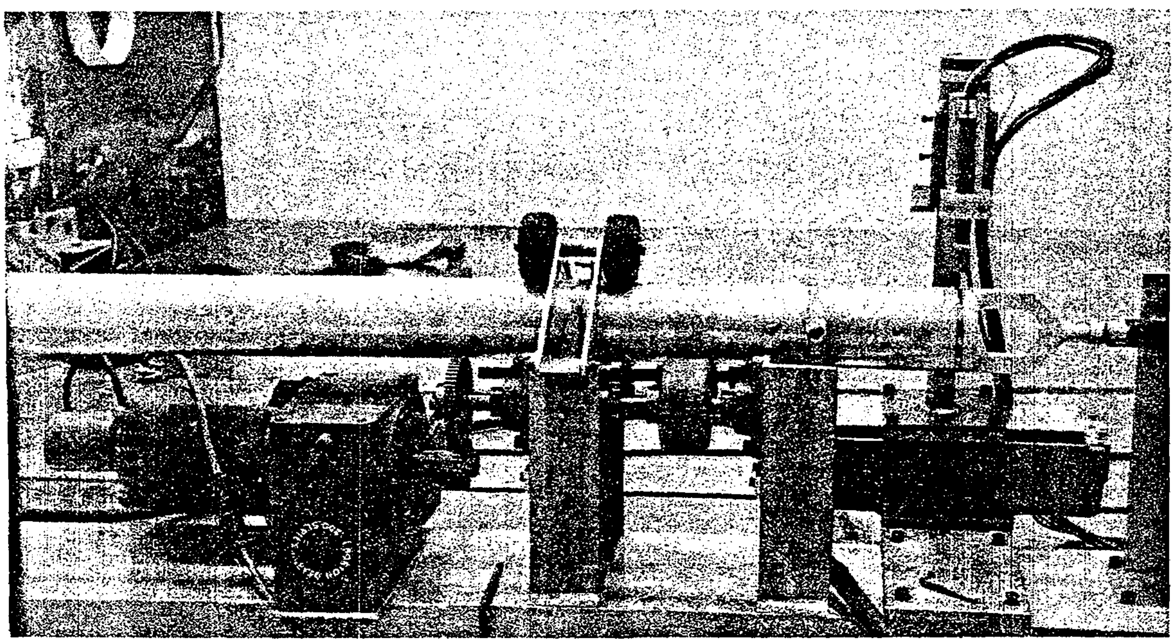

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Figure 16. Final Closure Weld System for Shipping Canisters

weighed to ±0.01 lb using a load cell. The previously determined tare weights of the canister, lid, and spacer tubes were subtracted from the total weight, with the difference being the amount of fuel contained in the loaded canister.

After the welding and weighing operations were completed, the shipping canister was moved to the leak check water tank. The tank is shown in Figure 17. The canister was immersed in the water which was approximately 150°F. The elevated temperature pressurized the gas sealed in the canister, and the canister was visually observed to determine if a leak existed as manifested in the form of bubbles. The container was then allowed to dry and then moved to the "loaded storage canister" rack for subsequent transfer to the RMDF.

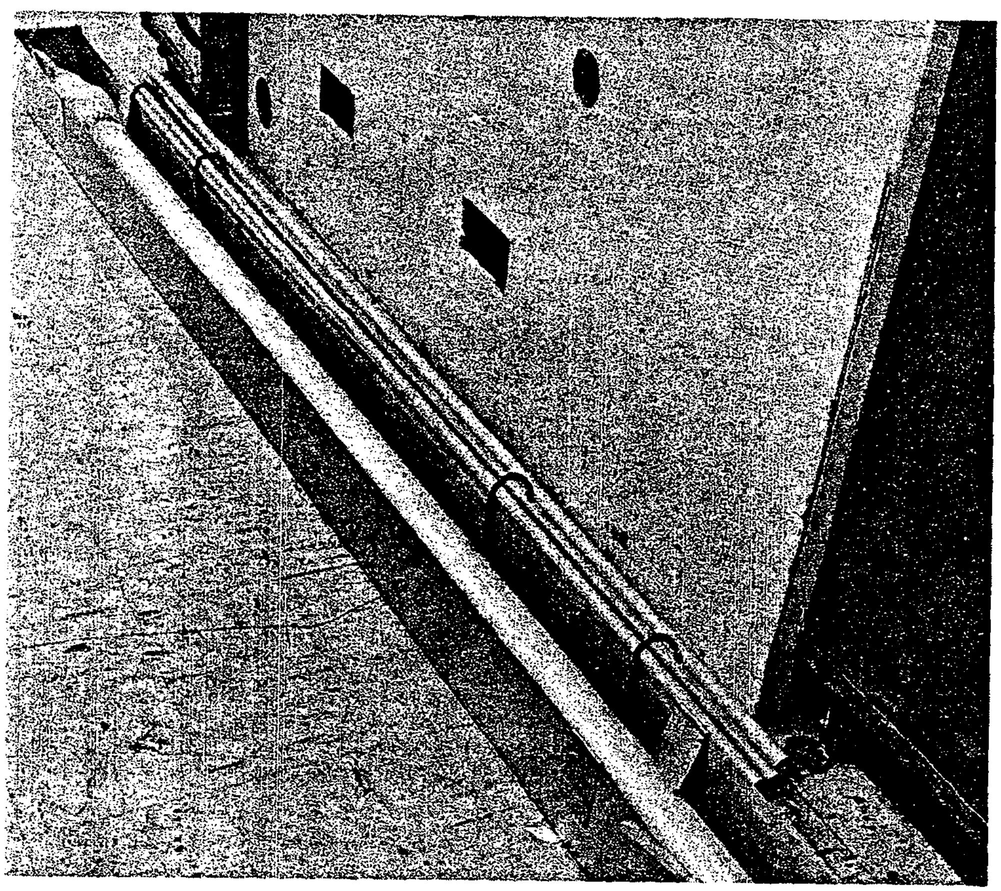

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Figure 17. Weld Leak Check Water Tank

IV. SHIPPING

Shipments of the declad fuel to Savannah River were made in the TREAT Loop Cask. Four shipping canisters, contained in the cask, comprised a shipment. The Core I and experimental fuel were transported by common carrier truck (Tri State Motor Transit Co.) in five shipments. The Core II fuel, due to enrichment, required movement by government (ERDA) truck in nine shipments. The fourteen total shipments are summarized in Table I. The TREAT Loop Cask, loaded for shipment, is shown in Figure 18. The Babcock Cask, which was also required for transfer of the fuel from the TREAT Cask at Savannah River, accompanied each fuel shipment, and is shown in Figure 19. Figure 20 shows a Tri State shipment in progress.

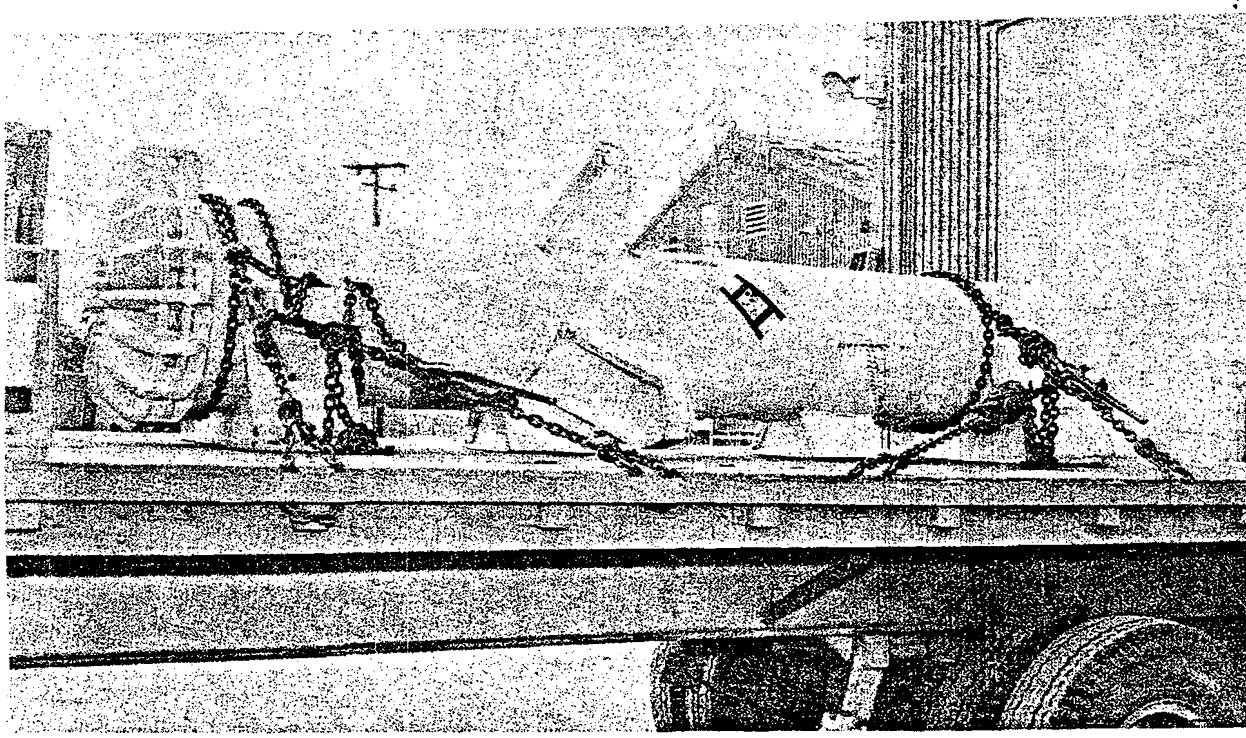
The requirements and procedures for loading and shipping the SRE declad fuel are contained in N704-ACR-990-009 N/C, N704-DWP-990-013 N/C, and NK396-00002, Rev. A.

A summary of the contents of each shipping canister is presented in Table II.

TABLE I

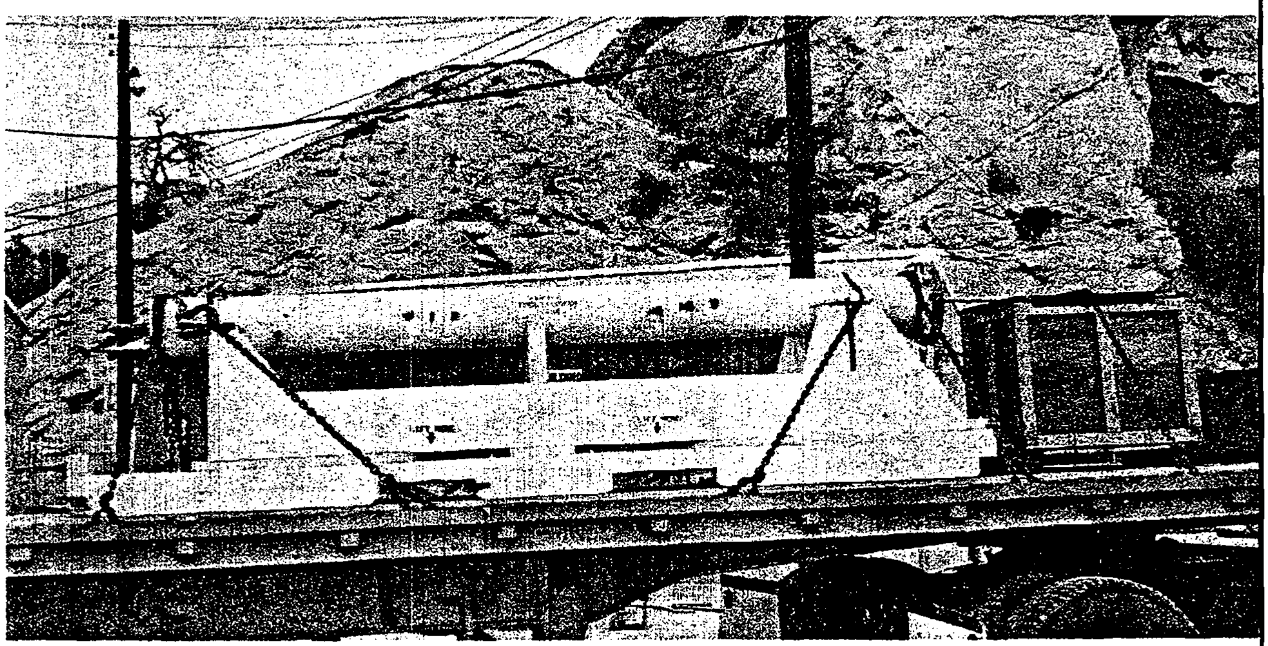
LIST OF DECLAD FUEL SHIPMENT TO SAVANNAH RIVER

Shipment No.	Canister Numbers	Fuel Type	Date Shipped	Curie Content
1	AI-10, 11, i6, 19	Core I	8-9-76	1612
2	AI-4, 8, 12, 17	Core I & Exp.	8-20-76	1861
3	AI-5, 6, 7, 9	Core I	8-31-76	1914
4	AI-1, 2, 3, 15	Core I & Exp.	9-11-76	1705
5	AI-13, 14, 18, 53	Core I & Exp.	9-20-76	828
6	AI-20, 21, 22, 29	Core II	10-30-76	4018
7	AI-23, 25, 26, 27	Core II	11-8-76	4010
8	AI-24, 28, 45, 46	Core II	11-19-76	4034
9	AI-36, 47, 51, 52	Core II	12-2-76	3723
10	AI-33, 34, 35, 38	Core II	12-12-76	4051
11	AI-30, 31, 32, 37	Core II	1-7-77	4051
12	AI-39, 40, 41, 42	Core II	1-22-77	4051
13	AI-43, 44, 48, 49	Core II	2-4-77	4043
14	AI-50, 54, 55, 56	Core II	2-19-77	3079



7704-62569

Figure 18. TREAT Loop Cask Loaded for Truck Shipment



7704-62572

Figure 19. Babcock Cask Loaded for Truck Shipment

7704-62574

Figure 20. SRE Fuel Shipment Enroute to Savannah River

TABLE II

SRE SHIPPING CONTAINER CONTENTS
(Sheet 1 of 3)

Shipping Canister No.	Piece Count 6-in. Slugs (equiv.)	Net Weight (gm)	Avg % U	U Weight (gm)	Avg % U^{235}	U^{235} Weight (gm)	Avg % Pu	Pu Weight (gm)	Avg % Th	Th Weight (gm)	Original Fuel Assembly Identity Number	Remarks
AI-01	119	98,041.10	99.89	97,933.15	2.696	2,640.28	0.039	38.24	-	-	SU-1-42, -45	Unalloyed Uranium Metal
AI-02	115	98,884.05	99.89	94,779.68	2.696	2,555.26	0.039	37.01	-	-	SU-1-42, -16	Unalloyed Uranium Metal
AI-03	114	93,441.60	99.89	93,338.81	2.696	2,516.41	0.039	36.44	-	-	SU-1-42, -39, -7	Unalloyed Uranium Metal
AI-04	112	92,321.20	99.89	92,219.65	2.696	2,486.24	0.039	36.01	-	-	SU-1-13, -7	Unalloyed Uranium Metal
AI-05	116	95,591.66	99.89	95,486.51	2.696	2,574.32	0.039	37.28	-	-	SU-1-13, SU-23-4, -5	Unalloyed Uranium Metal
AI-06	110	92,942.64	99.89	92,840.40	2.696	2,502.98	0.039	36.25	-	-	SU-1-3, -7, SU-23-5	Unalloyed Uranium Metal
AI-07	(108)	89,245.80	99.89	89,147.63	2.696	2,403.42	0.039	34.81	-	-	SU-1-47, -17, -32, SU-1-9, -31, -12	Unalloyed Uranium Metal (Some fragments)
AI-08	112	92,121.62	99.89	92,020.29	2.696	2,480.87	0.039	35.93	-	-	SU-1-25, -38, -3, SU-23-5, 71520-035	Unalloyed Uranium Metal
AI-09	117	93,060.58	99.89	92,958.21	2.696	2,506.15	0.039	36.29	-	-	SU-1-3, -40, 71520-035	Unalloyed Uranium Metal
AI-10	(74)	58,995.22	99.89	58,930.33	2.696	1,588.76	0.039	23.01	-	-	SU-1-15, 71520-035	Unalloyed Uranium Metal (Some fragments)
AI-11	(106)	87,386.04	99.89	87,289.92	2.696	2,353.34	0.039	34.08	-	-	SU-1-47, -31, -12, -16	Unalloyed Uranium Metal (Some fragments)
AI-12	18 + 15 + Misc	83,879.71	99.89	83,787.44	2.696	2,258.91	0.039	32.71	-	-	SU-3-1, 18 Hollow Cylinder + Misc	Unalloyed U-Metal-18-4 in. Cyls, 15 slugs, Misc Pieces
AI-13	(60)	26,018.50	89.55	23,299.57	5.978	1,392.58	0.072	18.73	-	-	SU-9-3	Uranium-10% Molybdenum Alloy (Some fragments)
AI-14	Pellets	22,947.62	88.04	20,203.08	7.74	1,563.72	0.039	8.95	-	-	SU-7-1	Uranium Oxide—with SS cladding intact
AI-15	Misc Pos	44,920.00	95.11	42,723.41	9.80	4,186.89	0.035	15.57	-	-	SU-20-X, SU-20-X	Uranium Carbide—with SS cladding intact
AI-16	118	93,491.49	99.89	93,388.65	2.696	2,517.76	0.039	36.46	-	-	SU-12-1, 71520-035	Unalloyed Uranium Metal
AI-17	112	92,049.04	99.89	91,947.79	2.696	2,487.91	0.039	35.90	-	-	SU-1-20, SU-1-38	Unalloyed Uranium Metal
AI-18	(99)	89,359.20	99.47	88,885.60	2.696	2,396.36	0.039	34.85	-	-	77 U-Metal slugs, 22 equiv U-Mo slugs	Unalloyed U-Metal & U-Mo Alloy (1.2, 1.8 & 3.0% Mo)
AI-19	18 + Misc	74,281.53	96.67	71,807.96	2.696	1,935.94	0.039	28.97	-	-	SU-3-2, 18 Hollow Cyls + Misc	Unalloyed U-Metal—18-4in. cyls., 3-2 in. acid bath slugs, 1-6 in. fire slug, 2-30 in. tube fines
AI-20	119	60,941.16	7.43	4,527.93	92.625	4,193.99	Negl.	-	92.355	56,282.21	SU-22-03, SU-22-08	Thorium - 7.6% Uranium Alloy
AI-21	119	60,809.62	7.476	4,546.13	92.722	4,215.26	Negl.	-	92.375	56,172.89	SU-22-04, SU-22-06	Thorium - 7.6% Uranium Alloy
AI-22	119	61,172.50	7.454	4,559.80	92,684	4,226.21	Negl.	-	92.365	56,501.98	SU-22-07, SU-22-02	Thorium - 7.6% Uranium Alloy

TABLE II

SRE SHIPPING CONTAINER CONTENTS

(Sheet 2 of 3)

Shipping Canister No.	Piece Count 6-in. Slugs (equiv.)	Net Weight (gm)	Avg % U	U Weight (gm)	Avg % U^{235}	U^{235} Weight (gm)	Avg % Pu	Pu Weight (gm)	Avg % Th	Th Weight (gm)	Original Fuel Assembly Identity Number	Remarks
AI-23	119	61,104.46	7.478	4,569.39	92.818	4,241.22	Negl.	-	92.372	56,443.41	SU-22-05, -06, -02, -08, -11	Thorium – 7.6% Uranium Alloy
AI-24	119	61,000.12	7.275	4,437.76	92.139	4,088.91	Negl.	-	92.330	56,321.41	SU-22-10, -09, -11	Thorium – 7.6% Uranium Alloy
AI-25	119	61,666.92	7.4996	4,624.77	92.802	4,291.88	Negl.	-	92.376	56,961.74	SU-22-09, -01, -12	Thorium – 7.6% Uranium Alloy
AI-26	119	60,845.90	7.3195	4,453.62	92.217	4,106.99	Negl.	-	92.335	56,182.06	SU-22-13, -01, -12, -14	Thorium – 7.6% Uranium Alloy
AI-27	119	61,163.42	7.351	4,496.12	92.333	4,151.40	Negl.	-	92.336	56,475.86	SU-22-15, -14, -16	Thorium – 7.6% Uranium Alloy
AI-28	119	61,657.85	7.299	4,500.91	92.222	4,150.37	Negl.	-	92.33	56,928.69	SU-22-17, -16, -18	Thorium – 7.6% Uranium Alloy
AI-29	119	61,739.50	7.341	4,532.30	92.360	4,186.03	Negl.	-	92.327	57,002.23	SU-22-19, -18, -20	Thorium – 7.6% Uranium Alloy
AI-30	119	61,730.42	7.422	4,581.63	92.608	4,242.96	Negl.	-	92.349	57,007.43	SU-22-21, -20, -22	Thorium – 7.6% Uranium Alloy
AI-31	119	61,617.02	7.33	4,516.53	92.365	4,171.69	Negl.	-	92.33	56,890.99	SU-22-23, -22	Thorium – 7.6% Uranium Alloy
AI-32	119	61,635.17	7.491	4,617.09	92.817	4,285.44	Negl.	-	92.365	56,929.32	SU-22-26, -25	Thorium – 7.6% Uranium Alloy
AI-33	119	61,630.63	7.38	4,548.34	92.432	4,204.12	Negl.	-	92.35	56,915.89	SU-22-28, -27	Thorium – 7.6% Uranium Alloy
AI-34	119	61,612.49	7.364	4,537.14	92.332	4,189.23	Negl.	-	92.34	56,892.97	SU-22-29, -30	Thorium – 7.6% Uranium Alloy
AI-35	119	61,630.63	7.35	4,529.85	92.402	4,185.67	Negl.	-	92.33	56,903.56	SU-22-31, -32	Thorium – 7.6% Uranium Alloy
AI-36	119	61,603.42	7.461	4,596.23	92.839	4,267.09	Negl.	-	92.35	56,890.76	SU-22-33, -35	Thorium – 7.6% Uranium Alloy
AI-37	119	61,585.27	7.327	4,512.04	92.227	4,161.32	Negl.	-	92.335	56,864.76	SU-22-34, -35, -36, -30, -32, -25, -27	Thorium – 7.6% Uranium Alloy
AI-38	119	61,594.34	7.34	4,521.02	92.34	4,174.71	Negl.	-	92.33	56,870.05	SU-22-36, -37, -38	Thorium – 7.6% Uranium Alloy
AI-39	119	61,621.56	7.29	4,492.21	92.24	4,143.61	Negl.	-	92.32	56,889.02	SU-22-38, -39, -40	Thorium – 7.6% Uranium Alloy
AI-40	119	61,571.66	7.50	4,617.87	92.86	4,288.15	Negl.	-	92.37	56,873.74	SU-22-40, -41, -42	Thorium – 7.6% Uranium Alloy
AI-41	119	61,598.88	7.36	4,533.68	92.426	4,190.30	Negl.	-	92.34	56,880.41	SU-22-42, -43, -44	Thorium – 7.6% Uranium Alloy
AI-42	119	61,626.10	7.39	4,554.17	92.49	4,212.15	Negl.	-	92.41	56,948.68	SU-22-44, -45, -46	Thorium – 7.6% Uranium Alloy
AI-43	119	61,598.88	7.37	4,539.84	92.40	4,194.81	Negl.	-	92.36	56,892.73	SU-22-46, -47, -48	Thorium – 7.6% Uranium Alloy
AI-44	119	61,571.66	7.41	4,562.46	92.59	4,224.38	Negl.	-	92.35	56,861.43	SU-22-48, -49, -50	Thorium – 7.6% Uranium Alloy
AI-45	119	61,671.46	7.36	4,539.02	92.441	4,195.92	Negl.	-	92.34	56,947.43	SU-22-50, -51, -52	Thorium – 7.6% Uranium Alloy
AI-46	119	61,558.06	7.37	4,536.83	92.41	4,192.48	Negl.	-	92.33	56,836.56	SU-22-52, -53, -55	Thorium – 7.6% Uranium Alloy
AI-47	119	61,544.45	7.41	4,560.44	92.57	4,221.60	Negl.	-	92.34	56,830.15	SU-22-54, -55, SU-23-01	Thorium – 7.6% Uranium Alloy
AI-48	119	61,648.78	7.51	4,629.82	92.896	4,300.92	Negl.	-	92.38	56,951.14	SU-22-56, SU-23-01, -02	Thorium – 7.6% Uranium Alloy
AI-49	119	61,412.90	7.46	4,581.40	92.751	4,249.29	Negl.	-	92.37	56,727.10	SU-22-56, -57, -99	Thorium – 7.6% Uranium Alloy
AI-50	119	60,673.54	5.40	3,276.37	93.13	3,051.28	Negl.	-	94.60	57,397.17	SU-2-02, SU-25-01, Can U-12	Thorium – 5.4% Uranium Alloy

TABLE II

SRE SHIPPING CONTAINER CONTENTS
(Sheet 3 of 3)

Shipping Canister No.	Piece Count 6-in. Slugs (equiv.)	Net Weight (gm)	Avg % U	U Weight (gm)	Avg % U^{235}	U^{235} Weight (gm)	Avg % Pu	Pu Weight (gm)	Avg % Th	Th Weight (gm)	Original Fuel Assembly Identity Number	Remarks
AI-51	119	61,521.77	7.526	4,630.38	93.403	4,324.90	Negl.	-	92.391	56,840.69	-	Thorium – 7.6% Uranium Alloy
AI-52	81	41,903.57	7.58	3,176.29	93.048	2,955.47	Negl.	-	92.40	38,718.90	-	Thorium – 7.6% Uranium Alloy
AI-53	(36)	28,241.14	97.88	27,642.43	2.767	764.87	0.039	10.78	-	-	-	Uranium-Molybdenum Alloy (1.2, 1.8 & 3.0% Mo)
AI-54	82	42,352.63	7.41	3,138.33	92.56	2,904.84	-	-	92.34	39,108.42	-	Thorium – 7.6% Uranium Alloy
AI-55	81	40,565.45	5.35	2,170.25	92.82	2,014.43	-	-	94.46	38,318.31	-	Thorium – 5.4% Uranium Alloy
AI-56	79	40,737.82	5.32	2,167.25	92.857	2,012.44	-	-	94.56	38,521.68	-	Thorium – 5.4% Uranium Alloy
TOTALS		3,679,139.75		1,685,545.72		189,524.43		608.27		1,972,017.77		

V. RECORDS

The primary records which were maintained for the declad program consisted of the following:

<u>RMDF</u>

1. In-Out Log — for fuel assemblies
2. In-Out Log — for declad fuel

<u>AIHL</u>

1. Laboratory Manufacturing Production Order (LMPO) - tailored after the MPO (Ref: QAOP 5.1) which detailed the step-by-step operational procedures and sequencing.
2. In Process Status Log — maintained the in-process traceability of the fuel.
3. Shipping Canister Loading Record
4. Laboratory Notebooks — used to collect all process and physical inspection data, along with deviations from operational procedures.

<u>NMM</u>

The Nuclear Material Management records are explained in detail in NMP-704-990-001 Rev. A, "SRE Fuel Decladding NMM Plan".

VI. PROGRAM DOCUMENTS

A summary of the supporting program documents is presented in Table III.

TABLE III

SRE FUEL DECLADDING PROGRAM
(SUPPORTING DOCUMENTS)

Documents	Revision	Title
PP-704-990-002	Rev A	Decontamination and Disposition of Facilities Program Plan
QFP-704-990-001	Rev A	SRE Fuel Decladding Quality Assurance Functional Plan
NMP-704-990-001	Rev A	SRE Decontamination Nuclear Materials Management Plan
TI-704-990-018	Rev A	Criticality Study - SRE Cores I and II Fuels
NSA-704-990-001	Rev B	SRE Fuel Decladding Nuclear Safety Analysis
N704-NSA-990-002	N/C	SRE Core II Fuel Decladding Nuclear Safety Analysis
OP-001-140-001	N/C	Radiation Safety Procedures for Atomics International Hot Laboratory
RPA-704-990-001	Rev C/4	Engineering Release Plan of Action for the Decontamination and Disposition of Facilities Program
TP-704-990-001	N/C	NaK Distillation Test Plan
TP-704-990-002	N/C	SRE Fuel Decladding-Closure Weld Development Test Plan
N704-ER-990-002	N/C	Selection of NaK Removal Process for Damaged SRE Fuel
TR-704-990-001	N/C	SRE Fuel Decladding - Closure Weld Development Test Report
N704-TR-990-002	N/C	SRE Fuel, Acid, and Water Bath Reaction Test Report
N704-ACR-990-009	N/C	Activity Requirement for Loading and Shipping SRE Fuel
N704-DWP-990-013	N/C	Detailed Working Procedure for Loading and Shipping SRE Declad Fuel
NK396-00002	N/C	Tiedown Specification, Truck Shipment, TREAT and Transfer Casks, SRE Fuel
N704-OP-990-002	Rev A	SRE Fuel Transfer With Babcock Cask
Drawings		
EX-N704000025	Rev A	SRE - Savannah River Core I Experimental Shipping Can
EX-N704000065	N/C	SRE - Savannah River Core II Shipping Can
EX-N704000067	N/C	SRE - Savannah River Lazy Susan Container
EX-N704000068	N/C	Guide Plate - Lazy Susan Container
EX-N704000069	N/C	Bottom Plate - Lazy Susan Container
EX-N704000070	N/C	Eye Support, Tubing, Lazy Susan Container

APPENDIX A

DISPOSITION OF CONTENTS FROM

16 UNIDENTIFIED RMDF STORAGE CONTAINERS

INTRODUCTION

Fuel from both Core I and Core II of the Sodium Reactor Experiment has been stored in the Radioactive Materials Disposal Facility (RMDF) at Atomics International. As part of the Decontamination and Disposition of Facilities (D&D) Program, AI was funded to declad all the stored fuel from SRE Cores I and II (including some SRE experimental fuel), remove the NaK bond, and repackage the fuel for shipment to Savannah River for reprocessing

From Nuclear Materials Management (NMM) records, it appeared that the Core I fuel was packaged in 23 storage containers at the RMDF. During the initial Core I phase of the decladding task, discrepancies were encountered between the Source and Special (SS) Nuclear Material transfer records and the actual contents removed from the storage containers. This situation led to a visual examination of all 280 storage holes in Vault I of the RMDF. As a result of the examination, sixteen of the holes were found to contain storage cans that did not have SS material transfer vouchers or other records to identify the contents.

A. APPROACH

AI's Nuclear Material Management was contacted and detailed search into old records revealed that eight (8) of the RMDF storage holes in Vault I had contained unidentified SS material, which was reported as disposed of by burial as of November 4, 1964. This discrepancy led to the conclusion that any or all of the sixteen unidentified storage cans could contain special nuclear material. A program was undertaken to transfer the unidentified storage containers to the AI Hot Laboratory Facility (AIHL) for examination of the contents. All of the cans were found to contain fuel material. All of the fuel was examined for identifying numbers. When numbers were found on identifiable fuel rods, slugs, or elements, the NMM records were searched to determine the quantity and composition of the material. Table A-1 presents the contents and disposition of the materials contained in the sixteen unidentified containers. Seventeen line items are shown in the table, since can U-3 contained a "hollow" experimental element which had SS material transfer vouchers for content: however the position in the RMDF storage vault had been incorrectly recorded.

B. DISPOSITION

All fuel that was visually identified as SRE form material was declad, cleaned, and the NMM records searched in an attempt to identify the material. Fuel material that was positively identified as low enriched uranium metal or uranium-molybdenum was weighed and repackaged for reprocessing by Savannah River along with the other SRE Core I fuel. Fuel material positively identified as high enriched uranium-thorium Core II fuel, which Savannah River could also reprocess, was weighed and returned to the RMDF for packaging with SRE Core II fuel. Material which was identified as UZr was weighed and returned to the RMDF for disposal. SRE form material which could not be positively identified was also weighed and returned to the RMDF for disposal. The three storage cans (U-14, U-16 and U-17) which contained materials experiments not related to the SRE were returned to the RMDF for disposal in the original storage containers.

C. ACCOUNTABLE FUEL QUANTITIES

SRE-form fuel containing a total of 10,395.92 grams U^{235} was accounted for as a result of this inspection and repackaging task. This total is composed of 6,921.34 grams U^{235} in identified unalloyed uranium slugs and 704.94 grams of U^{235} in identified U-Mo slugs for recovery with the scheduled Core I fuel reprocessing, and 628.90 grams of U^{235} in enriched thorium-uranium fuel for recovery with the Core II SRE fuel; for a total of 8255.18 grams of recovered U^{235}. The balance of the SRE-form U^{235} accounted for is 2,140.74 grams of unidentified uranium metal, thorium-uranium, and uranium-molybdenum .

TABLE A-I
UNIDENTIFIED STORAGE CANISTER CONTENTS

Can	Material Type	Quantity	Disposition	
U-1	Unidentified SRE form	7.5 slugs equivalent	Disposal "No ID" Can(1)	1 slug labeled 62-J, indicating that the material might be from rod 583 and consist of U 1.8% Mo enriched 2.778.
U-2	U	60 slugs	Recovery AI-16(2)	Remainder of missing portion of element 71520-035 identified under NMM ticket No. 033451 (hole 20).
U-3	U-Hollow	12 cylinders	Recovery AI-19	SU-3-2, single rod hollow element, located in different storage slot than indicated by records.
U-4	U	60 slugs	Recovery-58 slugs AI-16 2 slugs AI-17	SU-12-1, U metal, repackaged for recovery.
	U-Zr	24 slugs	Disposal "UZr" Can(1)	SU-12-1, material originally believed to have been disposed of as waste under NOL 207
U-5	Unidentified SRE form	1 slug very bad 2 qt fines	Disposal "No ID" Can	Disintegrated upon examination
U-6	U	3 slugs	1 slug Recovery AI-17 2 slugs Disposal "No ID" Can	
	Unidentified SRE form	1-2 in. pc	Disposal "No ID" Can	
U-7	U	60 slugs	Recovery AI-17	SU-1-38 (5 rods received and identified)
U-8	U	72 slugs	Recovery-36 slugs AI-17 36 slugs AI-18	6 rods from SU-1-20
		12.5 equiv. slugs	Disposal "No ID" Can	
U-9	Th-U	4 equiv slugs	Recovery "SNAP" Can(3)	Rod 532 SU-2-5
U-10	Unidentified SRE form	16 slugs and 1-4 in. pc	Disposal "No ID" Can	
U-11	U-Mo	3 slugs	Recovery - AI-18	Rod 584
	U-Mo	3 slugs	Recovery - AI-18	Rod 603
	U-Mo	13-1 in. slugs	Recovery - AI-18	Rod 544
	U-Zr	4 slugs	Disposal-"UZr" Can	Rod 556 } SU-2-3 Material originally dropped from inventory on NOL 207
	U-Zr	6 slugs	Disposal-"UZr" Can	Rod 557
	TH-U	1 slug	Recovery-"SNAP" Can	Rod 534
	Th-U	8-1/12 equiv slugs	Recovery-"SNAP" Can	Rod 535
U-12	U	12 slugs	Recovery - AI-18	Rod 205
	U	12 slugs	Recovery - AI-18	Rod 226
	U	12 slugs	Recovery - AI-18	Rod 592
	U-Mo	72-1 in. pcs	Recovery - AI-18	Rod 541
	U-Mo	12 equiv slugs	Recovery - AI-18	Rod 570
	U-Zr	12 equiv slugs	Disposal-"UZr" Can	Rod 551
	Th-U	12 equiv slugs	Recovery	Held at Hot Laboratory for Core II repackaging.
U-13	U	6 slugs 5 slugs 11-3/4 equiv slugs	Recovery - AI-17 Recovery - AI-18 Disposal-"No ID" Can	
U-14	U-10 Mo	Net wt 4964 gm; U 4468 gm; %Ux 6.42; Ux 287 gm	Disposal(4) SU-9	Not SRE fuel. By records NMM was authorized for disposal years ago. Material originally dropped from inventory NOL 33A. ERDA-SAN has authorized disposal as waste.
	UC	539; 514; 10.02; 52	Disposal(4) NAA 81-3	
U-15	U	8 slugs	7-Recovery - AI-17 1-Disposal-"No ID" Can	Slug E-35? } Material originally dropped from inventory as NOL 33A.
		U-Mo	1-1in. slug - Recovery AI-18	
U-16	UC	Net 757; U 718; %Ux 10.02; Ux 72	Disposal(4)	NAA-81-1 } Not SRE fuel. Material originally dropped from inventory as NOL 33A. ERDA-SAN has authorized disposal as waste.
		Net 112; U 107; %Ux 25.603; Ux 27		NAA-74-2
		Net 422; U 402; %Ux 9.95; Ux 40		AI-3-9
U-17	UC	Net 934; %U 95.60; U 415; %Ux 7.000; Ux 29	Disposal(4)	AI-24-1 } Not SRE fuel. Material originally dropped from inventory as NOL-1. ERDA-SAN has authorized disposal as waste.
		Net 393; %U 87.70; U 345; %Ux 9.355; Ux 32		OMRE 4-3
		Net 756; %U 98.82; U 664; %Ux 9.490; Ux 63		OMRE 4-5 and 4-3

(1) "---" Can denotes ID given to storage container pending disposal of contents as waste.
(2) AI-XX denotes serial number of AI shipping canister containing repackaged fuel for Savannah River reprocessing.
(3) Returned to RMDF for processing and repackaging with SRE Core II fuel.
(4) Returned to RMDF in storage container pending disposal as waste.

Additionally, several non-SRE identifiable material experiments were found, containing 602.0 grams of U^{235}, per identifiable records. The unidentified SRE-form fuel and the non-SRE identifiable materials total 2742.74 grams of U^{235}. This material experiment fuel was designated for disposal by land burial. The details of this "waste" fuel is contained in Table A-2.

The grand total weight of U^{235} accounted for as a result of this task was 10,997.92, of which 8255.18 grams was recovered and 2742.74 grams was disposed of by land burial. The status of all fuel material at the end of the repackaging operations is shown in Table A-3.

TABLE A-2

FUEL WASTE FROM 16 UNIDENTIFIED CANISTERS

Fuel Form	Uranium (gm)	U-235 (gm)
U metal fragments, fines, etc (Unidentified SRE-form)	44,203.87	1,227.98
U-Zr	31,921.54	886.78
$U-O_2$ (OMRE)	1,009	95
U-C (NAA 81-3)	514	52
U-C (NAA 81-1)	718	72
U-C (NAA 74-2)	107	27
U-C (AI-3-9)	402	40
U-C (AI-24-1)	415	29
U-Th	27.89	25.98
U-Mo	4,468	
Total	83,786.3	2,742.74

TABLE A-3

SUMMARY OF CURRENT STATUS
(Sheet 1 of 2)

Repackaged Container Identity	Net Wt (grams)	U (%)	U^{235} (%)	U_x	U	Comments
AI-16	93491.49	100	2.778	2597.19	93491.49	118 slugs, U-metal, all from the 16 cans; 60 slugs from U-2 (5 intact rods), 58 slugs from U-4 (5 intact rods)
AI-17	92049.04	100	2.778	2557.12	92049.04	112 slugs, U-metal, all from the 16 cans; 2 slugs from U-4, 1 slug from U-6, 60 slugs from U-7 (5 rods), 36 slugs from U-8 (3 rods), 6 slugs from U-13 and 7 slugs from U-15
AI-18	89359.20	99.58	2.778	2471.97	88983.89	U-metal and U-Mo, all from the 16 cans; 36 slugs from U-8 (3 rods), 6 slugs from U-11 U-Mo (damaged element), 13 1-in. pcs U-Mo from U-11, 36 slugs from U-12, 72 1-in. slugs U-Mo from U-12, 12 slugs U-Mo from U-12, 5 slugs U from U-13 and 1 1-in. slug U-Mo from U-15
AI-19	68666.0	100	2.696	1851.23	68666.0	18 hollow U-metal experimental slugs from U-3, material on RMDF inventory but placed in wrong storage location
Hanford* Burial	44720.42	100	2.778	1253.96	44231.76	Material, alloy U content, or enrichment unknown; contains all fines from the 16 cans (6267 grams), 7.5 slugs from U-1, 1 slug labeled 62J, 2 slugs and 1 2-in. pc from U-6, 12.5 equiv slugs from U-8, 12 slugs, and 5 pcs (4 6-in. pcs and 1 4-in. pc) from U-10, 1 slug (E-35?) from U-15, and 11-3/4 equiv slugs from U-13; placed in "NO ID" can and returned to RMDF

*Returned to AIHL from RMDF, repackaged into 6M drums, shielded with soil, and shipped to the licensed land burial site at Hanford, Washington; buried in January 1976.

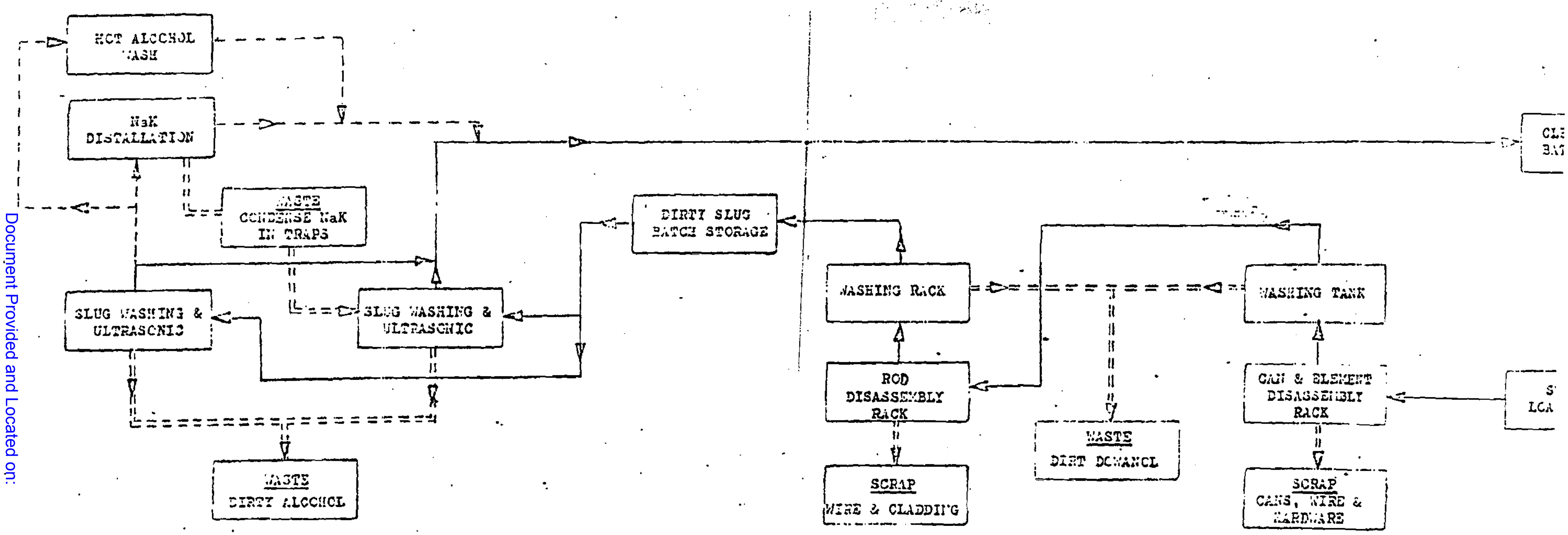
TABLE A-3

SUMMARY OF CURRENT STATUS

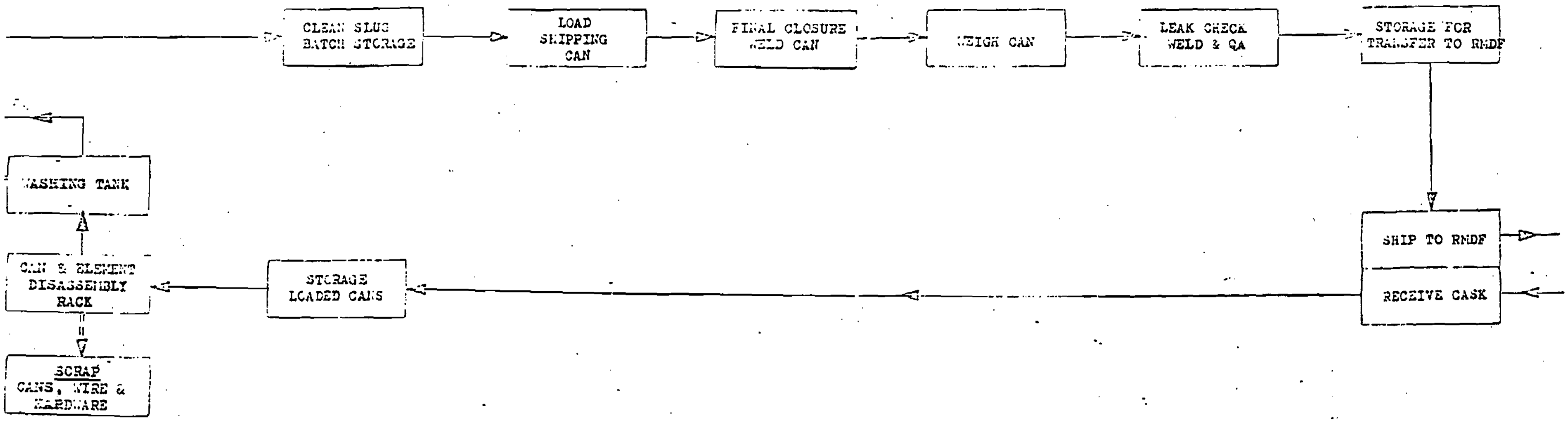
(Sheet 2 of 2)

Repackaged Container Identity	Net Wt (grams)	U (%)	U^{235} (%)	U_x	U	Comments
Hanford* Burial	32573.01	98	2.778	886.78	31921.54	46 slugs, U-Zr: 24 slugs from U-4; 4 slugs (Rod 556) and 6 slugs (Rod 557) from U-11; 12 equiv slugs (Rod 550) from U-12; placed in "U-Zr" can and returned to RMDF
AI-55	6767.71	5.4	93.13	340.34	365.45	13-1/2 slugs, Th-U; 4 equiv slugs (Rod 532) from U-9; 9-1/2 equiv slugs (Rods 534 and 535) from U-11; became part of contents in AI-55, thorium - 5.4% uranium
AI-50	5889.84	5.4	93.12	288.56	318.05	12 slugs (Rod 529) from U-12; became part of contents in AI-50, thorium - 5.4% uranium
Hanford* Burial				602	7633	Non-SRE materials experiments, returned to RMDF in original storage containers, U-14, U-16, and U-17

*Returned to AIHL from RMDF, repackaged into 6M drums, shielded with soil, and shipped to the licensed land burial site at Hanford, Washington; buried in January 1976.


HOT ALCOHOL WASH
NaK DISTALLATION
WASTE CONDENSE NaK IN TRAPS
SLUG WASHING & ULTRASONIC
SLUG WASHING & ULTRASONIC
WASTE DIRTY ALCOHOL
DIRTY SLUG BATCH STORAGE
WASHING RACK
ROD DISASSEMBLY RACK
SCRAP WIRE & CLADDING
WASTE DIRT DOWANOL
WASHING TANK
CAN & ELEMENT DISASSEMBLY RACK
SCRAP CANS, WIRE & HARDWARE

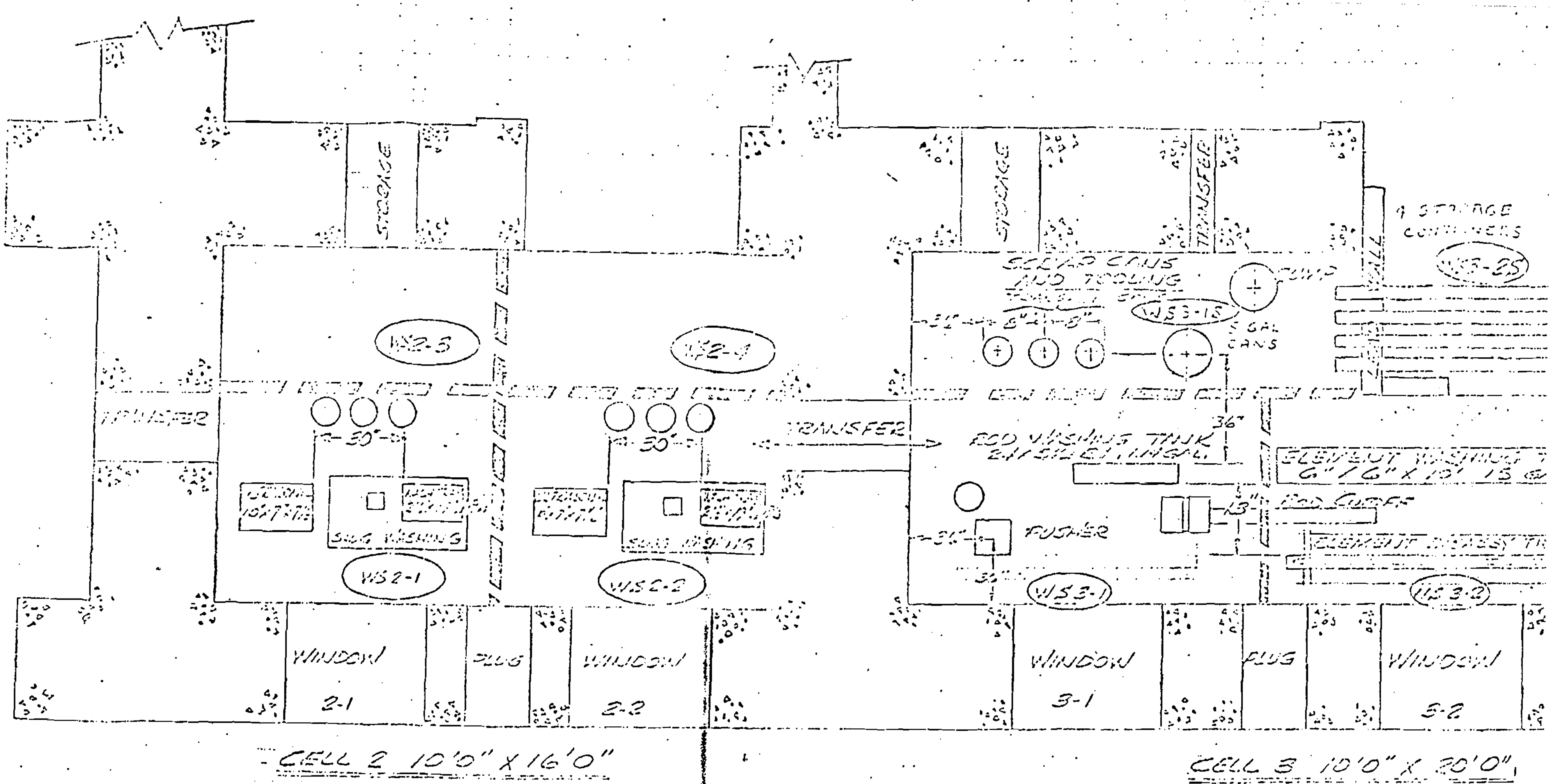
15
15a
15b



15b

15c

Figure 8. SRE FUEL DECLAD PROCESS FLOW CHART

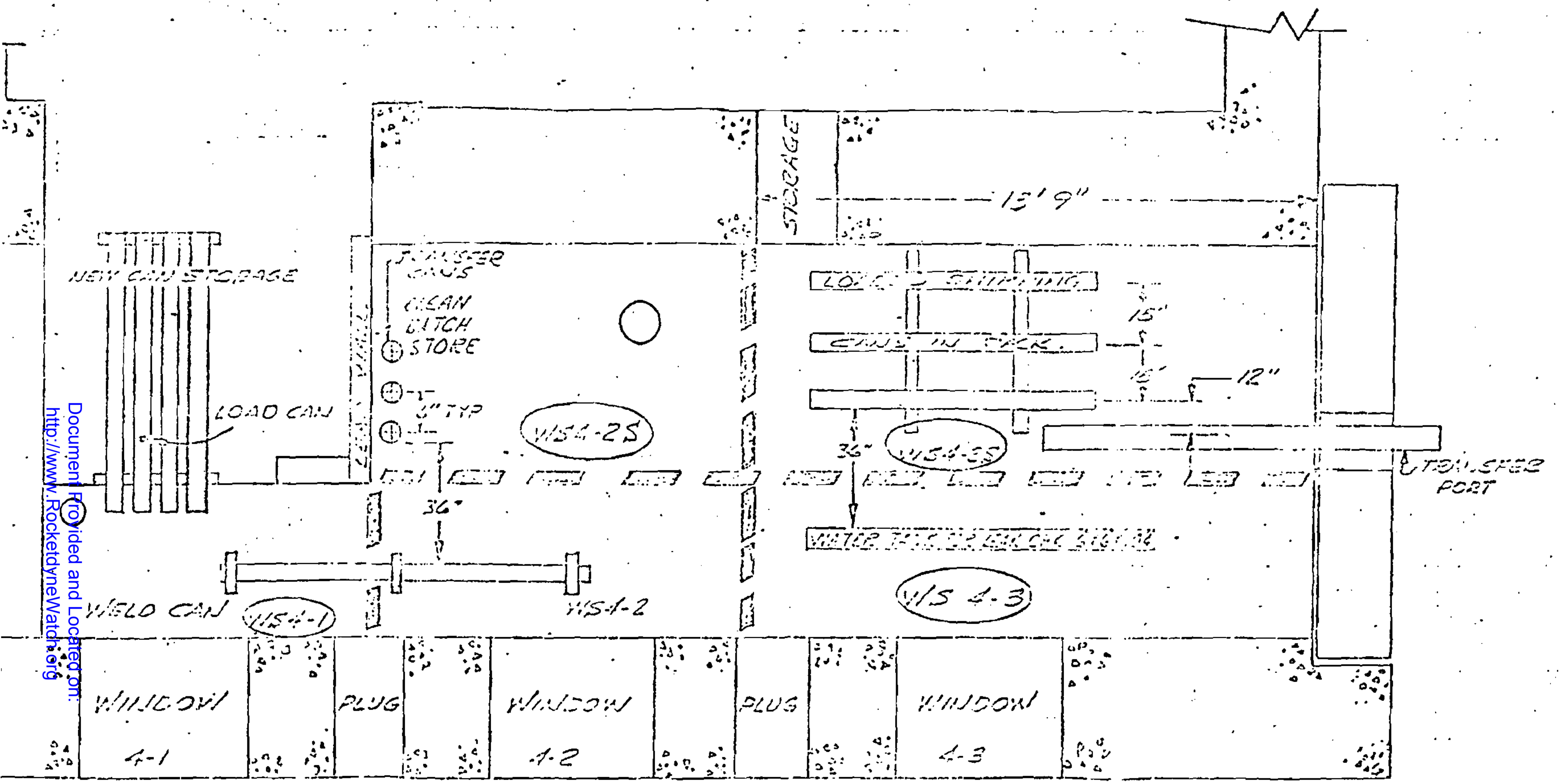


14

Figure 7

WORK STATIONS FOR SRE REPACK

SCALE: NONE (WS X-X) = WORK STATION

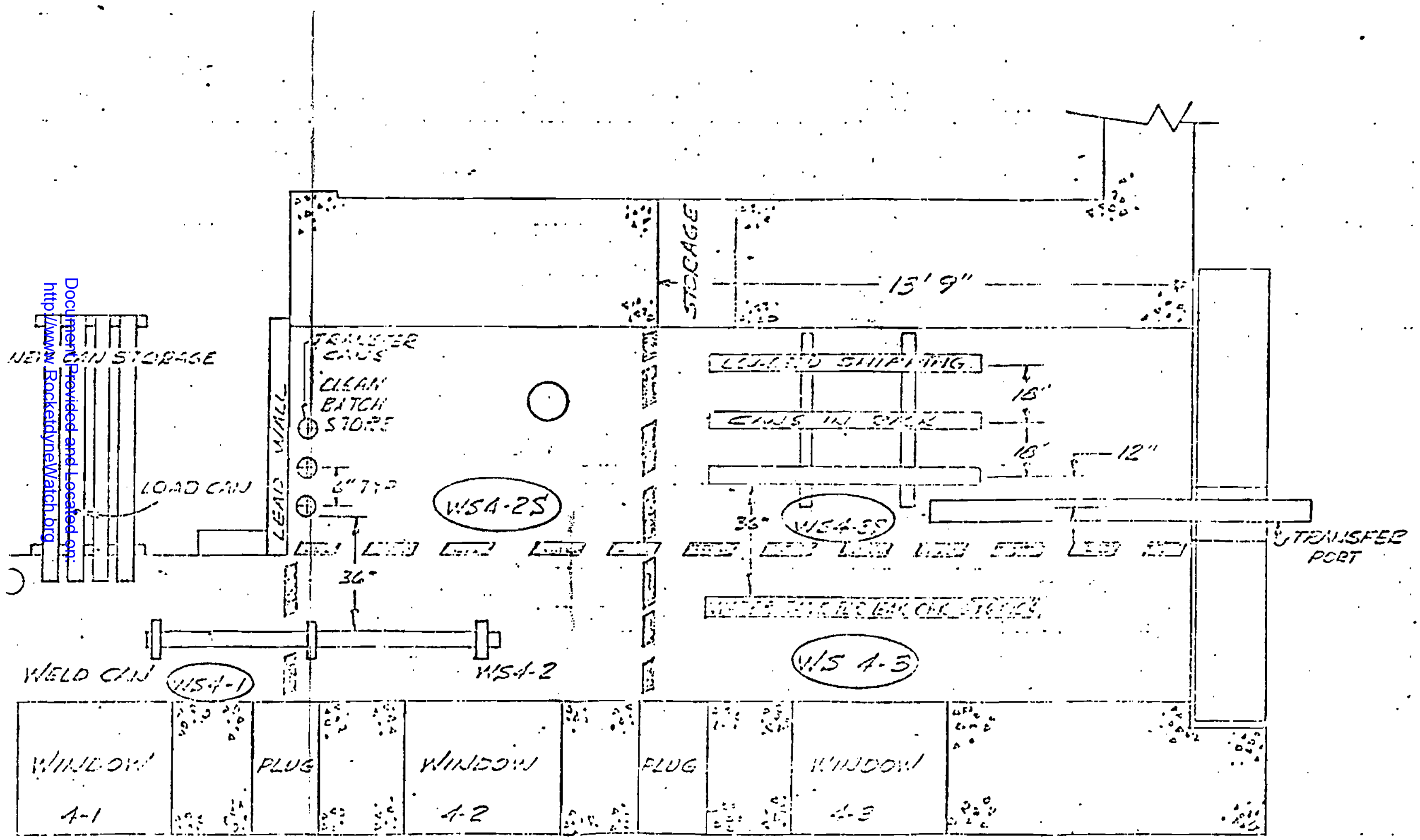


CELL 4 10'0" X 33'6"

15 JAN 1976

14C

14d



CELL A 10'0" X 55'6"

13 d

22 JULY 75
REV 5-13-75

NOTE: MAY BE DOWNMOL OR ALCOHOL

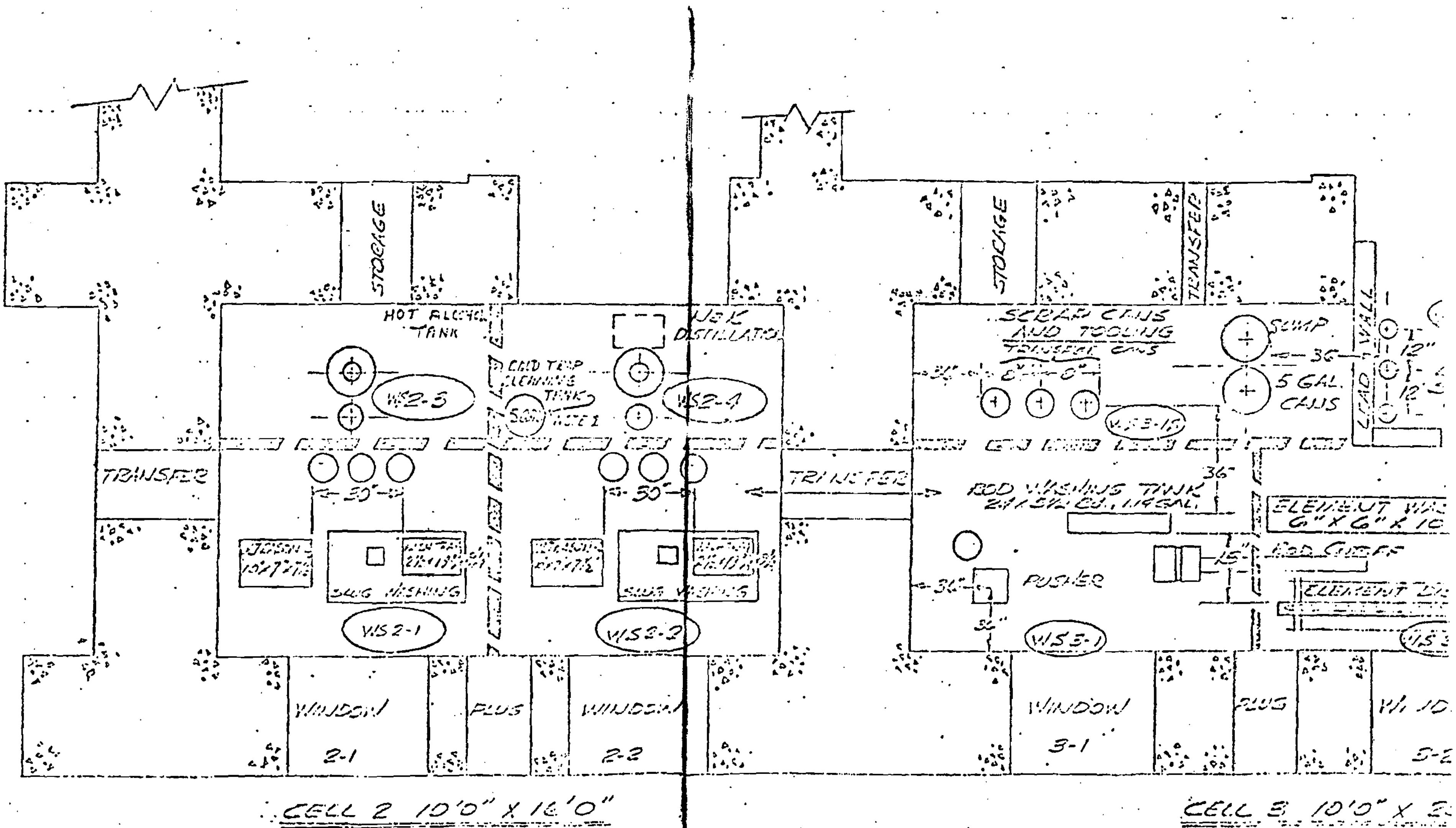


Figure 6

WORK STATIONS FOR SRE RE

SCALE: NONE W/S X-X = WORK ST