Rockwell International
Energy Systems Group

SUPPORTING DOCUMENT

GO NO.	S/A NO.	PAGE 1 OF	TOTAL PAGES	REV LTR/CHG NO SEE SUMMARY OF CHG	NUMBER
9180	7600	53	53		N918ER100001

PROGRAM TITLE

HALLAM FUEL DECLADDING

DOE/EV/70037--T4

DOCUMENT TITLE

PROGRAM SUMMARY REPORT, HALLAM FUEL DECLADDING

DOCUMENT TYPE

Engineering Report

KEY NOUNS

Fuel Decladding

ORIGINAL ISSUE DATE

REL. DATE

4-1-80 *LP*

APPROVALS

DATE

D. G. Mason *D. G. Mason* 3-5-80
W. R. McCurnin *W. R. McCurnin* 3/25/80
M. E. Remley *M. E. Remley*
J. C. Blake *J. C. Blake*

PREPARED BY/DATE

DEPT

MAIL ADDR

W. F. Dennison
W. F. Dennison

716-200

NB02

IR&D PROGRAM? YES ☐ NO ☒

IF YES, ENTER TPA NO.

DISTRIBUTION

*

NAME

MAIL
ADDR

* C. J. Adams	KB45
* D. C. Allen	NB13
* E. L. Babcock	T020
* W. F. Dennison (8)	NB02
* J. C. Blake	KB45
* J. M. Harris	T020
* D. G. Mason	NB02
* W. R. McCurnin (10)	T020
* J. R. Miller	T020
* M. E. Remley	NB08
* V. J. Schaubert	NB13
* F. C. Schrag	NB13
* R. J. Tuttle	NB13
* J. H. Walter	T006
* G. W. Meyers	LA10

ABSTRACT

This report summarizes the program of decladding the 150 Hallam fuel assemblies, removal of the sodium, and the packaging and shipment of the recovered fuel to Savannah River for eventual reprocessing.

MASTER

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not reflect those of the United States Government or any agency thereof.

This document is
PUBLICLY RELEASABLE

Bary Steel
Authorizing Official

Date: *10/31/86*

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MOU

RESERVED FOR PROPRIETARY/LEGAL NOTICES

**THIS REPORT MAY NOT BE PUBLISHED WITHOUT THE
APPROVAL OF THE PATENT BRANCH, DOE**

This report was prepared as an account of work sponsored by the United States Government. Neither the U. S. Government, nor any of its employees, nor any of its contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

* COMPLETE DOCUMENT

NO ASTERISK, TITLE PAGE/SUMMARY
OF CHANGE PAGE ONLY

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

CONTENTS

	<u>Page</u>
I. Introduction	4
II. Scope of Effort.	4
III. Fuel Description	5
IV. Compendium	8
V. Process Description	9
A. Fuel Receival, Transfer and Storage	9
B. Hot Lab Layout	12
C. Fuel Disassembly	12
D. Fuel Slug Cleaning	22
E. Fuel Slug Packaging	26
VI. Return Fuel Shipments.	30
VII. Material Accountability	30
VIII. Waste Disposal	30
IX. Records	33
X. Program Supporting Documents	34

APPENDICES

A. Fuel Assembly and Incoming Storage Can Reference	35
B. Hallam Decladding Operational Status	38
C. Hallam Decladding Fuel Shipping Canister Contents	44
D. Hallam Decladding Program — Supporting Documents	49

TABLES

1. Hallam Nuclear Power Facility Core I Irradiated Fuel	6
2. Hallam Fuel Shipment and Inventory Summary	31

FIGURES

	<u>Page</u>
1. Hallam Fuel Storage Canister	5
2. Hallam Fuel Element — U-Mo	7
3. Hallam Fuel Element — UC	7
4. Hallam Cask Aboard Tri-State's Special Built Tractor-Trailer Combination	10
5. Hallam Cask Being Removed From the Tri-State Trailer	10
6. Transfer Cask in Position Atop the Hallam Cask	11
7. Transfer Cask Mounted Atop an RMDF Vault Storage Hole	11
8. Storage Basket in Position Within a Storage Hole	13
9. Storage Basket Before Lowering Into a Hole	13
10. Transport Cask Aboard Fork Lift Ready for Moving to the Hot Lab . .	14
11. Transfer Cask Aboard the Hot Cell Dolly	15
12. Transfer Cask Mated to the Cell 4 Transfer Port	15
13. Detailed Hot Cell Layout — Building T-020	16
14. Progress Flow Chart — Hallam Fuel Decladding	17
15. Hot Lab Operating Gallery	18
16. Work Station for Opening Storage Cans With a Bandsaw	18
17. Fuel Bundle Being Positioned for Removal of the Lower End Fitting .	19
18. Lower End Fitting After Being Cut From the Fuel Bundle	19
19. Upper End Fitting After Being Cut From the Fuel Bundle	21
20. Fuel Rod Segmenting Operation	21
21. A Sodium Digestor Prior to Being Placed in Cell	22
22. Basket Inside the Bottom Half of a Sodium Digestor	23
23. Fuel Cleaning Area — Cell 2	23
24. Hallam Nuclear Power Facility — Fuel Slug Shipping Canister	25
25. Shipping Canister Being Loaded — Cell 4	25
26. In-Cell Welding of Loaded Shipping Canister	27
27. Remote Shipping Canister Welding System Being Tested Prior to Going In Cell	27
28. Post-Weld Leak Test Tank Being Checked Out Prior to Being Moved In Cell	29
29. Fuel Weighing Calibration System and Digital Readout	29
30. Cladding Tube Flattener	32

I. INTRODUCTION

The Hallam Nuclear Power Facility (HNPF) power generation was terminated in October 1964. The fuel was subsequently doubly encapsulated and shipped to the Department of Energy's Savannah River Plant during the period of February to July of 1968. The fuel, in the form of 150 assemblies, was stored in the Receiving Basin for Offsite Fuel (RBOF) until February 1977 when shipments to Atomics International (AI) were begun.

The objective of the Hallam Decladding Program was to prepare the fuel for reprocessing at the Savannah River Plant. The fuel was clad in stainless steel and had a sodium thermal bond between the fuel and clad. The presence of the elemental sodium in the quantities contained in the Hallam fuel rods precluded the use of the existing fuel separation process due to the hazardous reaction of the sodium. Additionally, the quantity of stainless steel represented by the double storage containers, cladding, and bundle assembly hardware prevented the use of the chemical dissolver process and would have required instead the electrolytic process. The requirement to remove the sodium also provided the opportunity to eliminate the stainless steel. The sodium-free declad fuel was repackaged in aluminum return-shipping canisters, thus making feasible use of the preferred chemical dissolution process.

II. SCOPE OF EFFORT

The scope of the Hallam Decladding Program was to: (1) receive the fuel shipments from Savannah River and store them in the Radioactive Materials Disposal Facility (RMDF) vaults, (2) transfer the fuel assemblies to the Rockwell International Hot Laboratory (RIHL), (3) open the storage canisters, disassemble the fuel bundles, remove the cladding and sodium bond, and repackage the fuel slugs into aluminum canisters, (4) return the packaged fuel to the RMDF for interim storage, and (5) ship the repackaged fuel back to the Savannah River RBOF.

III. FUEL DESCRIPTION

The fuel assemblies were stored in doubly encapsulated, welded, stainless steel containers, as shown in Figure 1. There were 140 uranium - 10 wt % molybdenum elements and 10 uranium carbide elements. The total U^{235} weight was 1020 kg, and the total power generation was 6.4×10^5 MWh.

The fuel element descriptions, including enrichment, assembly drawing number, number of elements of each type, and the element serial numbers are shown in Table I. The U-Mo elements, depicted in Figure 2, had 18 rods each with a fuel slug diameter of 0.590 in. and a cladding outside diameter (OD) of 0.660 in. The UC elements, depicted in Figure 3, had 8 rods each, with a fuel slug diameter of 0.872 in. and a cladding outside diameter of 0.952 in. The fuel slug lengths varied from 3 to 12 in., and all were sodium bonded to the cladding. The fuel rods were grid spaced, and the active fuel length was 159 in. for the U-Mo and 156 in. for the UC. The overall length of the fuel element was 188 in., and the overall bundle diameter was 4.175 in. The fuel weight was 220 kg for each U-Mo element and 165 kg for each UC element.

77-N21-95-5

Figure 1. Hallam Fuel Storage Canister

TABLE 1

HALLAM NUCLEAR POWER FACILITY
CORE I IRRADIATED FUEL

Fuel Material Type	Fuel Element Type	Description	Drawing Number	Quantity	Fuel Assembly Numbers
U - 10 Mo	I	U - 10 Mo, 3.6 wt % U^{235} (No thermocouples)	7518-D71835 Assembly-3	136	MF 1-6 MF 30-76 MF-78 MF 80-148 MF 150-162
U - 10 Mo	IA	U - 10 Mo, 3.6 wt % U^{235} (thermocoupled) 12 of the 18 fuel rods have thermocouples inter- nally plus 4 external thermo- couples in bundle	7518-D71860	3	MF 17 MF 18 MF 19
U - 10 Mo	II	U - 10 Mo, 3.45 wt % U^{235} (No thermocouples)	7518-D71835 Assembly-4	1	MF 20
UC	III	UC, 3.7 wt % U^{235} (No thermocouples)	7508-D71812 Assembly-3	7	CF 1-7
UC	IIIA	UC, 3.7 wt % U^{235} 8 thermocouples inter- nally (1 in each rod) plus 5 external in bundle	7508-D71813 Assembly-3	1	CF 8
UC	IV	UC, 4.9 wt % U^{235} (No thermocouples)	7508-71812 Assembly-4	2	CF 9 CF 10

77-N21-95-6

Figure 2. Hallam Fuel Element — U-Mo

77-N21-95-4

Figure 3. Hallam Fuel Element — UC

The stainless steel outer storage cans were 4-7/8 in. OD and 197-5/8 in. long. There was a lifting bail on each end. A serial number, which could be related to the fuel element serial number, was marked on the ends of the cans. A cross reference of the storage can numbers and the fuel elements they contained is given in Appendix A.

IV. COMPENDIUM

The Hallam fuel decladding task began in August 1976 (FY 76T). The initial tasks were the selection of the in-cell processes, preparation of the Program Plan, Nuclear Materials Management Plan, Criticality Study, QA Plan, selection of the Hallam Cask for the fuel transport, and the design of the shipping canister for the declad fuel. The balance of FY 77 was devoted to the design and fabrication of the tooling for the in-cell and RMDF operations. The fuel handling tooling for the RMDF consisted of a handling and transfer cask including grappling mechanism, cask adapter plates, and baskets for the fuel storage vaults.

Disassembly tooling consisted of (1) remotely operated in-cell devices for opening the storage canisters, disassembling the fuel assemblies to separate the fuel rods, cutting the rods to shorter processing lengths, and removing the sodium from the rods and slugs, and (2) containers for storage and movement of the segmented rods and declad fuel slugs.

The tooling for the removal of the sodium consisted of alcohol-sodium digesters and rinse tanks. Small pans of alcohol and scrub brushes were used for minor residual cleanup as required.

A load cell type remote weighing system was built and used to weigh the empty shipping canisters and internal spacers and to weigh the loaded and seal welded canisters containing the declad fuel. The net fuel weights were required for Special Nuclear Materials (SNM) accountability. An in-cell welding system, developed on the Sodium Reactor Experiment (SRE) decladding program, was adapted for making the final weld closures on the loaded fuel canisters. 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, also developed on the SRE decladding effort, was used to bubble test the integrity of the welded shipping canisters.

Due to the low enrichment of the fuel, Nuclear Regulatory Commission (NRC) armed security was not a requirement for processing or for fuel shipments.

Fuel decladding checkout operations began in October 1977, and the first fuel element was taken in cell on October 25, 1977. The first fuel slugs were recanned on January 6, 1978. The last assembly was taken in cell on June 29, 1979, and was recanned on July 5, 1979.

The initial incoming fuel shipment from Savannah River was received on February 8, 1977, and the final one on June 19, 1978. The first return shipment of declad fuel to Savannah River departed on February 21, 1978, and the last on August 27, 1979.

Post-operations cleanup of the hot lab cells and disposition of the radioactive waste was completed in September of 1979.

V. PROCESS DESCRIPTION

A. FUEL RECEIVAL, STORAGE, AND TRANSFER

The 150 fuel assemblies were shipped from the RBOF at the Savannah River Plant to the RMDF at the Santa Susana Field Lab in the Hallam Cask. The cask's internal basket was modified by Du Pont at Savannah River to hold seven rather than six fuel assemblies. The cask was transported by a lightweight tractor-trailer combination which was designed, assembled, and operated by Tri-State Motor Transport Company of Joplin, Missouri. Because of the cask weight, 78,000 lb, the lightweight system was required to enable highway transport within "overload" permit restrictions. A conventional tractor-trailer would have produced axle weights in excess of that permitted in all states traveled in. A photograph of the cask aboard the tractor-trailer is shown in Figure 4. The original concept of rail transport was found to be cost prohibitive. Prior to Tri-State's development of their lightweight system, serious consideration was being given to transport by barge through the Panama Canal.

Removal of the cask from the trailer within the RMDF is shown in Figure 5. The cask was lowered in a vertical position into a pit, which placed the top end of the cask 5 ft above floor level at a reasonable working height.

7704-62800

Figure 4. Hallam Cask Aboard Tri-State's Special Built Tractor-Trailer Combination

7704-62744

Figure 5. Hallam Cask Being Removed from the Tri-State Trailer

7704-62755

Figure 7. Transfer Cask Mounted
Atop an RMDF Vault Storage Hole

Figure 6. Transfer Cask in Position
Atop the Hallam Cask

7704-62752

The individual storage cans were removed from the cask, moved to a storage hole, and then positioned in the hole by means of a smaller onsite transfer cask. Figure 6 shows the transfer cask mounted atop the Hallam cask, while Figure 7 shows the cask mounted on top of one of the vault storage holes. The men at the top of the photo are operating the grapple and hoist mechanism. Figure 8 is a view looking down into an empty storage hole. The top of the storage basket, which would hold three fuel cans, can be seen. Figure 9 shows a storage basket in full length, prior to insertion in a vault hole. These baskets were designed to hold both the incoming storage cans and the return shipping canisters of declad fuel.

Movement of the fuel to the hot lab for processing, and the return of the declad fuel to the RMDF was made in the transfer cask, which was carried by fork lift, as shown in Figure 10. At the hot lab, the transfer cask was positioned on a dolly, Figure 11, which then moved the cask into the building and mated it with the cell transfer port as shown in Figure 12. The long rod extending from the end of the cask in Figure 12 was inserted and used to push the storage can partially into Cell 4 where it was then grappled and pulled the remaining distance into cell by a small winch and cable.

B. HOT LAB LAYOUT

A layout of the hot lab for the Hallam Decladding Program is shown in Figure 13. Three of the four cells were used in the decladding operations, with the fourth cell (Cell 1) used occasionally for storage of tooling or materials. Figure 13 shows the location of the various work stations and items of equipment and tooling which will be referred to in this report. Figure 14 is a summary process flow chart which will aid in understanding the flow of material. Figure 15 is a view of the hot lab operating gallery.

C. FUEL DISASSEMBLY

After a storage can was brought into Cell 4, the leading end of the double-walled stainless steel container was removed by a single saw cut which exposed the end of the fuel assembly. The cut was made by a commercial bandsaw which was modified for remote operation, including changing of the blades. Figure 16 shows

Figure 8. Storage Basket
in Position Within a
Storage Hole
←

7704-62688

Figure 9. Storage Basket Before Lowering
Into a Hole
→

7704-62687

7704-62686

Figure 10. Transport Cask Aboard Fork Lift Ready for Moving to the Hot Lab

9180-92

Figure 11. Transfer Cask Aboard the Hot Cell Dolly

9180-21

Figure 12. Transfer Cask Mated to the Cell 4 Transfer Port

Figure 13. Detailed Hot Cell Layout for the Hallam Fuel Decladding

Figure 14. Progress Flow Chart —
Hallam Fuel Declassing

9180-112CN

Figure 15. Hot Lab Operating Gallery

9180-72

Figure 16. Work Station for Opening
Storage Cans With a Bandsaw

9180-69

Figure 17. Fuel Bundle Being Positioned for Removal of the Lower End Fitting

9180-74

Figure 18. Lower End Fitting After Being Cut From the Fuel Bundle

a shipping can being placed (pulled) into position within the bandsaw at work station WS4-3. Station WS4-1S could also be used for this operation.

After the fuel assembly from the storage can was pulled, the can was replaced in the transfer cask which was then removed from the cell transfer port. The can was then removed from the cask, bagged, and transported back to the RMDF along with the transfer cask. The cans were later disposed of as low-level waste.

The first step in disassembling the fuel bundle was to remove the end fittings. This was also accomplished with the bandsaws. Figure 17 shows a fuel bundle in a sling being positioned under the bandsaw of work station WS4-3 where the lower end fitting will be cut away. Figure 18 shows the end fitting in the manipulator jaws after being cut from the bundle. This was done with a single cut which also removed part of the rod end caps. In contrast, four cuts were required to remove the upper fitting, as shown in Figure 19. One cut was perpendicular to the bundle axis, and three cuts were parallel to the axis. In order to maintain the identification of the individual rods, which was stamped on the flat ends, none of the upper end caps was cut.

After the end fittings were removed, the individual rods were pulled through the rod spacers (or grids) and out of the bundle proper. There were 15 spacers, 12 in. apart, on each U-Mo bundle and 8 spacers, 18 in. apart, on each UC bundle. All but the last three or four rods could be removed in this manner. The remaining rods were freed by cutting the spacers. This operation took place at WS4-1S.

As the rods were separated from the bundle, they were taken into Cell 3. Here the rods were cut into ~3-ft long segments, and the end caps were removed. This operation, at WS3-1, is shown in Figure 20. The rods were held in a motor-driven 3-jaw chuck. A standard tubing cutter was used to cut through the stainless steel cladding tubes but not into the fuel slugs. A quartz lamp was used to heat the rods in the area of each cut in order to soften the sodium so that the cut off rod length could be separated from the rod proper. The rod segments were then placed into storage-transfer cans, which are also shown in Figure 20. Note that one can in the background is open and the inner basket containing segmented rods is partially removed. These cans were fitted with thermos bottle-type end

9180-67

Figure 19. Upper End Fitting After Being Cut From the Fuel Bundle

9180-79

Figure 20. Fuel Rod Segmenting Operation

plugs which provided a hermetic seal. The segmenting operation in Cell 3 was performed in a nitrogen atmosphere ($\sim 4\% O_2$) to prevent fires from the exposed sodium. When the thermos-type plug sealed the storage can, it also sealed in the nitrogen atmosphere. This was a safety precaution in the event the nitrogen cell atmosphere was lost for some reason.

The loaded storage cans were then transferred to Cell 2 where the sodium was reacted with alcohol and the fuel slugs were cleaned.

D. FUEL SLUG CLEANING

To react and clean the sodium from the annulus between the fuel slugs and the cladding tubes, a sodium digester (also referred to as a reactor or passivator) was designed, built, and used. One of the digesters, before being placed in cell, is shown in Figure 21. As can be seen, the digester consists of top and bottom sections which were then filled with alcohol to which 10% (by volume) water had been added. (The alcohol was actually "Solvent 900," a commercial mixture of 100 gal. of denatured ethyl alcohol, 10 gal. of isopropanol, and 1 gal. of

Figure 21. A Sodium Digester Prior to Being Placed In Cell

9180-60

Figure 22. Basket Inside the Bottom Half of a Sodium Digester

9180-83

Figure 23. Fuel Cleaning Area — Cell 2

methybisobutylketone.) A view looking down into the bottom of a digester showing the basket with no fuel is provided by Figure 22. A heater, located on the bottom of this half of the digester, was used to heat the alcohol to 140°F. The top portion of the digester (Figure 21) was a condenser which returned the vaporized alcohol to the bath in the bottom section. A digester, installed in cell, is shown in the left background of Figure 23 behind the row of fuel storage cans. Note the bubbler on the right side of the condenser which was used to monitor the alcohol-sodium reaction by the H₂ gas evolved. The digester was operated at 140°F for ~40 h per load.

After the sodium-alcohol reaction in the digester had ceased, the rods were rinsed in clean alcohol. A rinse tank is shown in the center of Figure 23. A total of four digesters and two rinse tanks were used in this operation at work stations WS2-1 and WS2-2.

After being rinsed, the fuel was brought to an inspection window in a transfer can. The basket was removed from the can and the fuel was examined by lifting the cladding tube off the stack of fuel slugs which it contained. If on occasion, a slug (or slugs) did not pass visual inspection for sodium removal, they were cleaned manually in a pan of alcohol.

The sodium removal process was witnessed and approved by Du Pont Savannah River personnel during a visit to the hot lab on January 10 and 11, 1978.

Occasionally, a slug might be found stuck in a cladding tube as a result of some distortion in the cladding. When this happened, the slug(s) were physically pushed out of the tube.

After passing inspection, the fuel slugs were returned to the cladding tube, then to the can basket, and the basket was returned to the transfer can for storage or to be moved to Cell 4 for loading into a shipping can.

Initially, the first few assemblies of UC material were processed like the U-Mo material. However, it was found that the extra care required in handling the UC material, due to its friable nature, made it more expeditious to deviate from the process for cleaning the U-Mo slugs. The segments of UC rods were heated with quartz lamps, a process which softened the sodium and thus allowed

77-N21-95-7

Figure 24. Hallam Nuclear Power Facility — Fuel Slug Shipping Canister

9180-114

Figure 25. Shipping Canister Being Loaded — Cell 4

the slugs to slip out. The sodium-covered slugs were then allowed to react in a pan of alcohol. When the reaction had ceased, the slugs were transferred to a pan of clean alcohol for rinsing. The slugs were then inspected, air dried, and loaded into 40.5-in.-long aluminum tubes (Reference: N918000007 Rev. J, Sheet 2) rather than put back into the cladding tubes. The fuel remained in these tubes for transfer, storage, and subsequent loading into the inner tubes of the shipping canister.

E. FUEL SLUG PACKAGING

The clean fuel slugs were recanned for shipment to Savannah River in aluminum canisters, as described in Drawing N918000007, Rev. J. This can, depicted in Figure 24 and shown being loaded in Figure 25, contained smaller aluminum tubes into which the fuel slugs were placed for restraint in transit and in the Savannah River Dissolver tank. The inner tubes were crimped on the ends to prevent the slugs from slipping out. Typically, each canister held the slugs from 1-1/3 U-Mo assemblies or 1 UC assembly.

The loaded canister was sealed with a welded end cap. The welding was performed remotely in cell, as shown in Figure 26. The setup is shown in more detail in the lab mockup area in Figure 27 where the equipment was being tested prior to going in cell. The power supply and programmer were located in the lab operating gallery on the opposite side of the wall from work station WS4-1. A reweld procedure had been qualified for welds which did not pass leak testing, but it was only required once out of 226 production welds (115 fuel and 111 waste cans).

Immediately after the welding, each canister was leak tested by immersion in a tank of water at $180^{\circ} \pm 5^{\circ}\text{F}$, for a minimum period of 10 min. The increase in temperature of the N_2 atmosphere in the can increased the pressure ~11 psi which, in the case of a leak, would be visible as bubbles emanating from the leaking area. Figure 28 shows the leak test tank being checked out in the mockup area of the hot lab. The hinged lid of the tank can be seen in the foreground of Figure 26, located in cell in front of the welding system at work station WS4-1.

9180-75

Figure 26. In-Cell Welding of Loaded Shipping Canister

9180-57

Figure 27. Remote Shipping Canister Welding System
Being Tested Prior to Going In Cell

After the welding and leak testing, a loaded can was weighed to determine the amount of fuel which it contained. After fabrication, each shipping canister and end cap was weighed to establish a tare weight. Since no filler metal was added during final closure welding, the difference between the loaded weight and the tare weight established the weight of the fuel.

The in-cell weighing system consisted of a 400 ± 0.01 kg load cell (Sensometric Model 601051) and a digital readout (Sensometric Model Z-121, 0.1 gram resolution). The load cell was attached to the in-cell crane hook used to lift either the calibration load or a sling attached to a loaded fuel canister, as shown in Figures 27 and 28. The load cell was calibrated before and after weighing each canister. The calibration system consisted of three weights enclosed in a protective housing as seen in Figure 29. The load cell was attached to a lifting eye at the top of the shaft extending from the top of the housing. The weight of the shaft and two weights inside the housing established three calibration points. The shaft alone, weighing 42.1 kg (92.8 lb), simulated the weight of an empty canister. When the shaft was elevated a few inches further, it engaged the first weight of 147.0 kg (324 lb) for a total of 189.1 kg (416.8 lb). This approximated the weight of a half-loaded canister. When elevated further, the shaft picked up the second weight of 179.2 kg (395 lb) for a total weight of 368.3 kg (811.8 lb) which approximated the weight of a fully loaded canister. Therefore, three calibration points were obtained before and after weighing each loaded canister. The calibrations and weighings were witnessed and signed off accordingly.

After the weighing operation, the loaded canisters were either stored temporarily in Cell 4 at WS4-3S or transported directly to storage in the RMDF to await shipment to Savannah River. The loaded canisters were stored in the same type basket in the RMDF as were the incoming storage cans.

Appendix B provides a summary weekly status report for the decladding operations.

9180-54

Figure 28. Post Weld Leak Test Tank
Being Checked Out Prior to
Being Moved In Cell

9180-52CN

Figure 29. Fuel Weighing
Calibration System and
Digital Readout

VI. RETURN FUEL SHIPMENTS

The 16 shipments of declad fuel to Savannah River were also made in the Hallam Cask by Tri-State Motor Company. The initial shipment was made on March 21, 1978, and the final on August 27, 1979. Table 2 provides a summary of both incoming and outgoing shipments. Appendix C provides a listing of the contents of each return shipping canister as abstracted from the nuclear material accountability records. A total of 32,346 kg (35.7 tons) of alloyed fuel were received, declad, and returned to Savannah River. In addition, 18 kg of SRE fuel slugs, recovered while decommissioning the SRE reactor, were included in two shipments. These slugs were U metal and packaged along with the Hallam fuel in the shipping canisters. However, separate "Appendix A's" were prepared for these canisters.

VII. MATERIAL ACCOUNTABILITY

The SNM accountability was conducted in accordance with N918NMP100-001, Rev. B, Nuclear Materials Management Plan for Decladding Hallam Fuel Assemblies. In general, the weight of the declad outgoing material was balanced against the shipper-furnished weight of the incoming material. No losses were incurred.

VIII. WASTE DISPOSAL

The waste generated by the program may be divided into four categories: (1) the emptied incoming fuel storage cans, (2) all fuel bundle assembly hardware, including cladding, (3) alcohol sludge from the digesters and evaporators, and (4) usual waste from the operations and cleanup.

The emptied incoming fuel storage cans exhibited low enough activity to permit manual handling, packaging, and disposal as low-level waste.

The residual fuel bundle assembly hardware (end fittings, grid spacers, end caps, cladding tubing, etc.) were too hot to handle manually and were therefore packaged in cell for disposal. This material was packed into cans (Reference: Drawing N901000057) which were identical to the declad fuel shipping canisters

TABLE 2
HALLAM FUEL SHIPMENT AND INVENTORY SUMMARY

Shipment Number	Arrive RMDF	Depart RMDF	Cumulative Assemblies Received	Cumulative Returned		Assemblies on Hand
				Assemblies	Cans	
1	2-8-77	2-15-77	7			7
2	3-2	3-4	14			14
3	3-14	3-15	21			21
4	3-24	3-25	28			28
5	4-4	4-5	35			35
6	4-15	4-15	42			42
7	4-25	4-26	49			49
8	9-26	9-27	56			56
9	10-31	11-1	63			63
10	11-11	11-14	70			70
11	12-2	12-2	77			77
12	12-16	12-16	84			84
13	1-9-78	1-9-78	91			91
14	1-30	1-31	98			98
15	2-14	2-14	105			105
16	3-3	3-6	112			112
17	3-20	3-21	119	9-1/3	7	109-2/3
18	4-10	4-12	126	18-2/3	14	107-1/3
19	4-25	4-25	133	18-2/3	14	114-1/3
20	5-9	5-10	140	28	21	112
21	5-22	5-22	145	28	21	117
22	6-19	6-21	150	37-1/3	28	112-2/3
23	8-2	8-3		46-2/3	35	103-1/3
24	9-21	9-22		56	42	94
25	10-30	10-31		65-1/3	49	84-2/3
26	12-14	12-15		74-2/3	56	75-1/3
27	4-2-79	4-11-79		84	63	66
28	4-30	4-30		93-1/3	70	56-2/3
29	5-14	5-14		102-2/3	77	47-1/3
30	6-5	6-5		112	84	38
31	6-25	6-25		121-1/3	91	28-2/3
32	7-9	7-9		130-2/3	98	19-1/3
33	7-23	7-23		140	105	10
34	8-14	8-14		145	110	5
35	8-27	8-27		150	115	0

except that the waste cans were fitted with an 8-in. extension to prevent them from being mistaken for fuel cans or vice versa. To conserve space, the sections of cladding tubing were flattened by passing them through a motor-driven flattener, shown in Figure 30. One hundred eleven of these cans were required for the hardware from 150 fuel assemblies. The activity of this packaged material was high enough to require remote handling and transport to burial in the Hallam Cask. A can read ~160 mrem/h on the OD of the transfer cask; this reading was through 3 in. of lead and 1/2 in. of steel. The material was buried at the Nuclear Engineering Company (NECO) site at Beatty, Nevada, as was all other waste from the program. Special tooling was designed, built, and furnished to aid NECO in the off-loading operations as they lacked adequate crane capability to lift the Hallam Cask. It was unloaded in the horizontal position.

The alcohol used to react the sodium in the fuel rods was recycled in order to achieve a cost savings in view of the amount that was used. The dirty alcohol from the digesters was collected, and the complex sodium compounds which it contained were precipitated by the addition of H_2SO_4 . After the precipitate had

9180-94

Figure 30. Cladding Tube Flattener

settled, the alcohol was decanted off and processed through an evaporator (distillation process) for purification and reuse. The precipitate from the H_2SO_4 addition was air dried and then mixed with the sludge from the evaporation process. This mixture was solidified by the addition of Aquagel (bentonite) and portland cement. The solidified mass was then canned for transport and burial as low-level waste.

IX. RECORDS

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

1) RMDF

- a) In-Out log for fuel assemblies,
- b) In-Out log for declad fuel.

2) RIHL

- a) Laboratory Manufacturing Production Order (LMP0) — tailored after the Manufacturing Production Order (MPO) (Reference: QAOP 5.1) which detailed the step-by-step operation procedures, sequencing, and sign-offs,
- b) In-Process Status Log — maintained the in-process traceability of the fuel,
- c) Shipping Canister Loading Record,
- d) Laboratory Notebooks — used to collect process and inspection data, observations, and deviations from operational procedures.

3) NMM

The Nuclear Material Management records are explained in detail in N918NMP100-001, Rev. B, "Nuclear Materials Management Plan for Decladding Hallam Fuel Assemblies."

X. PROGRAM SUPPORTING DOCUMENTS

A list of the supporting program documents is presented in Appendix D.

Rockwell International
Energy Systems Group

NO . N918ER10001

PAGE . 35

APPENDIX A

FUEL ASSEMBLY AND INCOMING STORAGE CAN REFERENCE

FUEL ASSEMBLY AND INCOMING STORAGE CAN REFERENCE

Assembly Number	Original Canister Number	Type* Fuel	Assembly Number	Original Canister Number	Type* Fuel
MF-1	M-29	I	MF-58	M-106	I
-2	-140	I	-59	-41	I
-3	-20	I	-60	-104	I
-4	-22	I	-61	-124	I
-5	-14	I	-62	-121	I
-6	-13	I	-63	-125	I
-17	-134	IA	-64	-1	I
-18	-133	IA	-65	-113	I
-19	-135	IA	-66	-118	I
-20	-115	II	-67	-110	I
-30	-19	I	-68	-112	I
-31	-6	I	-69	-27	I
-32	-115	I	-70	-111	I
-33	-177	I	-71	-178	I
-34	-34	I	-72	-50	I
-35	-122	I	-73	-128	I
-36	-42	I	-74	-18	I
-37	-23	I	-75	-55	I
-38	-53	I	-76	-43	I
-39	-120	I	-78	-54	I
-40	-17	I	-80	-117	I
-41	-119	I	-81	-45	I
-42	-83	I	-82	-2	I
-43	-60	I	-83	-99	I
-44	-107	I	-84	-102	I
-45	-109	I	-85	-28	I
-46	-12	I	-86	-100	I
-47	-10	I	-87	-35	I
-48	-108	I	-88	-136	I
-49	-11	I	-89	-76	I
-50	-137	I	-90	-87	I
-51	-114	I	-91	-38	I
-52	-101	I	-92	-40	I
-53	-16	I	-93	-96	I
-54	-9	I	-94	-123	I
-55	-8	I	-95	-97	I
-56	-56	I	-96	-95	I
-57	-57	I	-97	-94	I

*See Table 1

Assembly Number	Original Canister Number	Type* Fuel	Assembly Number	Original Canister Number	Type* Fuel
MF-98	M-93	I	MF-135	M-64	I
-99	-92	I	-136	-63	I
-100	-91	I	-137	-62	I
-101	-90	I	-138	-130	I
-102	-89	I	-139	-61	I
-103	-88	I	-140	-129	I
-104	-48	I	-141	-39	I
-105	-72	I	-142	-116	I
-106	-47	I	-143	-21	I
-107	-37	I	-144	-105	I
-108	-31	I	-145	-15	I
-109	-4	I	-146	-7	I
-110	-75	I	-147	-3	I
-111	-36	I	-148	-24	I
-112	-25	I	-150	-26	I
-113	-84	I	-151	-98	I
-114	-82	I	-152	-131	I
-115	-81	I	-153	-30	I
-116	-80	I	-154	-51	I
-117	-139	I	-155	-103	I
-118	-79	I	-156	-44	I
-119	-78	I	-157	-77	I
-120	-86	I	-158	-126	I
-121	-85	I	-159	-58	I
-122	-138	I	-160	-127	I
-123	-33	I	-161	-132	I
-124	-42	I	-162	-68	I
-125	-74	I	CF-1	UC-8	III
-126	-73	I	-2	-9	III
-127	-71	I	-3	-10	III
-128	-49	I	-4	-5	III
-129	-70	I	-5	-2	III
-130	-69	I	-6	-4	III
-131	-67	I	-7	-6	III
-132	-5	I	-8	-7	IIIA
-133	-66	I	-9	-3	IV
-134	-65	I	-10	-1	IV

APPENDIX B

HALLAM DECLADDING OPERATIONAL STATUS

HALLAM DECLADDING OPERATIONAL STATUS*

Week Ending	RMDF Vault		AIHL Operations					RMDF Vault	
	Total Received	Available for Decladding	Taken Into Cell	Disassembled	Segmented	Passivated	Recanned And Weighed	Total Declad	Total Shipped to Savannah River
CY 1977									
10-28	56	55	1	1	-	-	-	-	-
11-4	63	61	1	1	1	-	-	-	-
11-11	70	63	5	2	1	-	-	-	-
11-18	70	63	-	-	1	2/3	-	-	-
11-23	70	63	-	-	1	-	-	-	-
12-2	77	70	-	3	-	2/3	-	-	-
12-9	77	70	-	-	-	2/3	-	-	-
12-16	84	77	-	-	-	1-1/3	-	-	-
12-23	84	77	-	-	-	2/3	-	-	-
CY 1978									
1-6	84	77	-	-	1	1-1/3	1-1/3	1-1/3	-
1-13	91	83	1	1	1	1	1-1/3	2-2/3	-
1-20	91	82	1	-	1-1/3	1	1-1/3	4	-
1-27	91	80	2	2	2/3	1	1-1/3	5-1/3	-
2-3	98	85	2	1	1-2/3	-	1-1/3	6-2/3	-
2-10	98	84	1	3	1/3	1-1/3	1-1/3	8	-
2-17	105	91	-	-	1	1-1/3	1-1/3	9-1/3	-
2-24	105	90	1	-	1-2/3	1-1/3	1-1/3	10-2/3	-
3-3	112	96	1	-	2/3	1-1/3	1-1/3	12	-
3-10	112	95	1	3	1	2/3	1-1/3	13-1/3	-
3-17	112	93	2	2	2	2	1-1/3	14-2/3	-

*Figures denote number of fuel elements.

HALLAM DECLADDING OPERATIONAL STATUS*

Week Ending	RMDF Vault		AIHL Operations					RMDF Vault	
	Total Received	Available for Decladding	Taken Into Cell	Disassembled	Segmented	Passivated	Recanned And Weighed	Total Declad	Total Shipped to Savannah River
CY 1978									
3-24	119	99	1	1	1-1/3	1-1/3	1-1/3	16	9-1/3
3-31	119	97	2	2	1-2/3	1-1/3	1-1/3	17-1/3	9-1/3
4-7	119	94	3	2	1-2/3	1-1/3	2-2/3	20	9-1/3
4-14	126	100	1	1	2	2-2/3	1-1/3	21-1/3	18-2/3
4-21	126	98	2	3	2	1-1/3	1-1/3	22-2/3	18-2/3
4-28	133	104	2	1	2	2-2/3	2-2/3	25-1/3	18-2/3
5-5	133	102	1	2	1-1/3	1-1/3	1-1/3	26-2/3	18-2/3
5-12	140	107	2	2	1-1/3	1-1/3	1-1/3	28	28
5-19	140	104	3	2	2-2/3	2-1/3	2-2/3	30	28
5-26	145	107	2	1	1-2/3	2	1-1/3	32	28
6-2	145	106	1	3	1-2/3	2	1-1/3	33-1/3	28
6-9	145	103	3	3	1-2/3	1-1/3	1-1/3	34-2/3	28
6-16	145	103	-	-	1-1/3	1-1/3	2-2/3	37-1/3	28
6-23	150	106	2	2	1-2/3	1-2/3	-	37-1/3	37-1/3
6-30	150	103	3	-	2	2	2-2/3	40	37-1/3
7-7	150	103	-	3	2	2	1-1/3	41-1/3	37-1/3
7-14	150	101	2	0	2	2	1-1/3	42-2/3	37-1/3
7-21	150	99	2	3	2	2	1-1/3	44	37-1/3
7-28	150	96	3	4	2-2/3	2-2/3	2-2/3	46-2/3	37-1/3
8-4	150	93	3	1	1-2/3	2	2-2/3	49-1/3	46-2/3
8-11	150	92	1	2	2	1-1/3	1-1/3	50-2/3	46-2/3

*Figures denote number of fuel elements.

HALLAM DECLADDING OPERATIONAL STATUS*

Week Ending	RMDF Vault		AIHL Operations					RMDF Vault	
	Total Received	Available for Decladding	Taken Into Cell	Disassembled	Segmented	Passivated	Recanned And Weighed	Total Declad	Total Shipped to Savannah River
CY 1978									
8-18	150	90	2	3	3	2-2/3	1-1/3	52	46-2/3
8-25	150	89	1	1	1-2/3	1-1/3	2-2/3	54-2/3	46-2/3
9-1	150	87	2	1	1-1/3	2/3	1-1/3	56	46-2/3
9-8	150	85	2	1	1	1-1/3	1-1/3	57-1/3	46-2/3
9-15	150	84	1	2	2/3	1-1/3	1-1/3	58-2/3	46-2/3
9-22	150	83	1	1	2/3	-	-	58-2/3	56
9-29	150	83	-	-	1	-	-	58-2/3	56
10-6	150	81	2	2	2	2	2-2/3	61-1/3	56
10-13	150	79	2	-	1-2/3	2-2/3	1-1/3	62-2/3	56
10-20	150	77	2	4	2	2-2/3	1-1/3	64	56
10-27	150	75	2	-	1	2/3	2-2/3	66-2/3	56
11-3	150	74	1	3	2	1-1/3	1-1/3	68	65-1/3
11-10	150	73	1	-	1	2	1-1/3	69-1/3	65-1/3
11-17	150	71	2	2	2	2-1/3	2-2/3	72	65-1/3
11-24	150	71	-	3	-	-	1-1/3	73-1/3	65-1/3
12-1	150	70	1	1	2-1/3	2	1-1/3	74-2/3	65-1/3
12-8	150	65	5	3	2-1/3	2-2/3	2-2/3	77-1/3	65-1/3
12-15	150	64	1	3	2-1/3	2	2-2/3	80	74-2/3
12-22	150	62	2	2	2	2-1/3	2-2/3	82-2/3	74-2/3

*Figures denote number of fuel elements.

HALLAM DECLADDING OPERATIONAL STATUS*

Sheet 4 of 5

Week Ending	RMDF Vault		AIHL Operations					RMDF Vault	
	Total Received	Available for Decladding	Taken Into Cell	Disassembled	Segmented	Passivated	Recanned And Weighed	Total Declad	Total Shipped to Savannah River
CY 1979									
1-6	150	61	1	1	1-1/3	1-1/3	1-1/3	84	74-2/3
1-13	150	56	5	5	3	2-2/3	1-1/3	85-1/3	74-2/3
1-20	150	54	2	2	2-1/3	2-2/3	2-2/3	88	74-2/3
1-27	150	53	1	1	2-1/3	2-2/3	2-2/3	90-2/3	74-2/3
2-2	150	50	3	3	2-2/3	2-2/3	1-1/3	92	74-2/3
2-9	150	47	3	3	2-2/3	2-2/3	2-2/3	94-2/3	74-2/3
2-16	150	47	0	0	1-1/3	1-1/3	2-2/3	97-1/3	74-2/3
2-23	150	44	3	3	3	3	2-1/3	99-2/3	74-2/3
3-2	150	41	3	2	2	2	2-2/3	102-1/3	74-2/3
3-9	150	39	2	2	1-2/3	1-2/3	2-1/3	104-2/3	74-2/3
3-16	150	36	3	4	3-1/3	3-1/3	2-2/3	107-1/3	74-2/3
3-23	150	34	2	2	2-1/3	2-1/3	3-2/3	111	74-2/3
3-30	150	32	2	2	2-2/3	2-2/3	2-2/3	113-2/3	74-2/3
4-6	150	30	2	2	3-1/3	3-1/3	2-2/3	116-1/3	74-2/3
4-13	150	25	5	3	3-1/3	3-1/3	2-2/3	119	84
4-20	150	23	2	4	2-2/3	2-2/3	2-2/3	121-2/3	84
4-27	150	19	4	4	3-1/3	3-1/3	2-2/3	124-1/3	84
5-4	150	16	3	4	2-2/3	2-2/3	4	128-1/3	93-1/3
5-11	150	12	4	4	3-1/3	3-1/3	2-2/3	131	93-1/3
5-18	150	8	4	1	3-1/3	3-1/3	4	135	102-2/3
5-25	150	8	0	3	3-1/3	3-1/3	2-2/3	137-2/3	102-2/3

*Figures denote number of fuel elements.

Rockwell International
Energy Systems Group

NO . N918ER10001
PAGE . 42

HALLAM DECLADDING OPERATIONAL STATUS*

Week Ending	RMDF Vault		AIHL Operations					RMDF Vault	
	Total Received	Available for Decladding	Taken Into Cell	Disassembled	Segmented	Passivated	Recanned And Weighed	Total Declad	Total Shipped to Savannah River
CY 1979									
6-1	150	7	1	1	2-2/3	2-2/3	2-2/3	140-1/3	102-2/3
6-8	150	5	2	2	1	1	2-2/3	143	112
6-15	150	3	2	2	1-1/2	1-1/2	2	145	112
6-22	150	2	1	1	1	1	1	146	112
6-29	150	0	2	2	2-1/2	2-1/2	2	148	121-1/3
7-6	150	0	0	0	1	1	2	150	121-1/3
7-13	150	0	0	0	0	0	0	150	130-2/3
7-27	150	0	0	0	0	0	0	150	140
8-17	150	0	0	0	0	0	0	150	145
8-31	150	0	0	0	0	0	0	150	150

*Figures denote number of fuel elements.

Rockwell International
Energy Systems Group

NO . N918ER10001

PAGE . 44

APPENDIX C

HALLAM DECLADDING FUEL SHIPPING CANISTER CONTENTS

HALLAM DECLAD FUEL SHIPPING CANISTER CONTENTS

Shipment Number	AI Canister Number	Contents	Container Gross Weight (kg)	Fuel Net Weight (kg)	Uranium (g)	U ²³⁵ (%)	U ²³⁵ (g)	Pu (g)	Pu ²⁴⁰ (%)	Pu ²³⁹⁺²⁴¹ (g)
1 3-21-78	AIH-01	18 Rods from MF-138 and 6 Rods from MF-160	333.28	291.90	262,434.68	3.534	9,275.08	69.49	1.784	68.25
	AIH-02	12 Rods from MF-160 and 12 Rods from MF-126	333.60	292.13	262,529.96	3.533	9,275.22	71.16	1.925	69.79
	AIH-03	18 Rods from MF-140 and 6 Rods from MF-126	333.68	292.18	262,471.36	3.531	9,267.83	73.11	1.819	71.78
	AIH-04	18 Rods from MF-73 and 6 Rods from MF-94	334.08	292.70	263,202.36	3.533	9,298.93	70.66	1.925	69.30
	AIH-05	12 Rods from MF-94 and 12 Rods from MF-129	333.38	293.00	262,549.36	3.527	9,258.86	77.18	1.840	75.76
	AIH-06	18 Rods from MF-40 and 6 Rods from MF-129	333.48	292.10	261,805.40	3.468	9,079.88	138.60	1.760	136.16
	AIH-07	18 Rods from MF-150 and 6 Rods from MF-130	333.28	291.92	262,575.74	3.534	9,279.43	69.76	1.677	68.59
			2,334.78	2,045.93	1,837,568.86		64,735.23	569.96		559.63
2 4-12-78	AIH-08	12 Rods from MF-30 and 12 Rods from MF-162	333.98	292.22	262,300.04	3.532	9,263.41	72.62	1.887	71.25
	AIH-09	18 Rods from MF-132 and 6 Rods from MF-162	333.28	291.89	262,245.32	3.528	9,252.40	75.36	1.778	74.02
	AIH-10	18 Rods from MF-82 and 6 Rods from MF-64	334.29	292.67	263,297.34	3.540	9,320.72	63.88	1.785	62.74
	AIH-11	12 Rods from MF-64 and 12 Rods from MF-147	334.02	292.41	262,874.84	3.539	9,303.16	64.76	1.761	63.62
	AIH-12	18 Rods from MF-132 and 6 Rods from MF-147	333.31	291.77	262,047.02	3.537	9,267.30	66.96	1.658	65.85
	AIH-13	18 Rods from MF-109 and 6 Rods from MF-75	334.02	292.52	263,062.72	3.535	9,297.97	69.46	1.814	68.20
	AIH-14	12 Rods from MF-75 and 12 Rods from MF-56	334.15	292.49	263,177.56	3.532	9,295.40	71.92	1.669	70.72
			2,337.05	2,045.97	1,839,004.84		65,000.36	484.96		476.40
3 5-19-78	AIH-15	18 Rods from MF-135 and 6 Rods from MF-56	333.56	292.17	262,577.12	3.532	9,273.58	72.02	1.777	70.74
	AIH-16	18 Rods from MF-131 and 6 Rods from MF-137	334.13	292.01	262,491.02	3.531	9,267.27	73.46	1.742	72.18
	AIH-17	12 Rods from MF-137 and 12 Rods from MF-69	334.12	292.66	262,976.92	3.529	9,279.17	75.64	1.560	74.46
	AIH-18	18 Rods from MF-136 and 6 Rods from MF-69	333.84	292.37	262,817.46	3.526	9,268.20	78.20	1.714	76.86
	AIH-19	18 Rods from MF-38 and 6 Rods from MF-133	333.65	292.16	262,440.74	3.530	9,263.52	74.78	1.685	73.52
	AIH-20	12 Rods from MF-133 and 12 Rods from MF-43	333.70	292.18	262,518.80	3.524	9,251.12	80.58	1.936	79.02
	AIH-21	18 Rods from MF-159 and 6 Rods from MF-43	333.56	292.16	262,421.76	3.522	9,242.53	82.64	1.646	81.28
			2,336.56	2,045.71	1,838,243.82		64,845.39	537.32		528.06
4 6-21-78	AIH-22	18 Rods from MF-78 and 6 Rods from MF-154	333.91	292.46	262,833.66	3.526	9,266.21	78.74	1.740	77.37
	AIH-23	12 Rods from MF-139 and 12 Rods from MF-154	332.75	291.68	262,108.70	3.522	9,230.21	82.54	1.817	81.04
	AIH-24	18 Rods from MF-33 and 6 Rods from MF-139	332.96	291.79	262,145.74	3.521	9,230.78	83.22	1.670	81.83
	AIH-25	18 Rods from MF-72 and 6 Rods from MF-57	334.21	293.12	263,327.76	3.517	9,262.55	87.44	1.784	85.88
	AIH-26	12 Rods from MF-57 and 12 Rods from MF-134	333.83	292.33	262,879.48	3.524	9,263.86	80.02	1.775	78.60
	AIH-27	18 Rods from MF-128 and 6 Rods from MF-134	333.83	292.07	262,299.06	3.523	9,240.80	80.54	1.778	79.10
	AIH-28	18 Rods from MF-117 and 5+ Rods from MF-141	333.52	290.59	261,013.00	3.526	9,204.49	76.96	1.767	75.60
		14 SRE Fuel Slugs		10.83	10,823.54	2.696	291.80	4.23	1.5	4.17
			2,343.89	2,044.04	1,836,607.40		64,698.90	569.46		559.42
5 8-3-78	AIH-29	12 Rods from MF-141 and 12 Rods from MF-34	333.56	293.76	263,966.06	3.529	9,314.13	75.52	1.933	74.06
	AIH-30	18 Rods from MF-59 and 6 Rods from MF-34	334.46	292.54	263,278.04	3.525	9,281.20	77.95	1.655	76.66
	AIH-31	18 Rods from MF-71 and 6 Rods from MF-42	334.17	292.63	263,031.08	3.523	9,265.92	81.50	1.791	80.04
	AIH-32	12 Rods from MF-42 and 12 Rods from MF-122	332.81	291.72	261,866.70	3.522	9,222.99	82.07	1.755	80.63
	AIH-33	18 Rods from MF-89 and 6 Rods from MF-122	333.09	292.03	262,037.42	3.521	9,226.96	82.68	1.778	81.21
	AIH-34	18 Rods from MF-125 and 6 Rods from MF-114	333.55	292.47	262,514.66	3.514	9,224.81	91.08	1.812	89.43
	AIH-35	12 Rods from MF-114 and 12 Rods from MF-105	333.04	291.66	262,331.30	3.507	9,198.66	98.58	1.694	96.91
			2,336.68	2,046.81	1,839,025.26		64,734.67	589.38		578.94

Rockwell International
Energy Systems Group

NO
N918ER10001
PAGE 45

HALLAM DECLAD FUEL SHIPPING CANISTER CONTENTS

Shipment Number	AI Canister Number	Contents	Container Gross Weight (kg)	Fuel Net Weight (kg)	Uranium (g)	U ²³⁵ (%)	U ²³⁵ (g)	Pu (g)	Pu ²⁴⁰ (%)	Pu ²³⁹⁺²⁴¹ (g)
6 9-22-78	AIH-36	18 Rods from MF-17 and 6 Rods from MF-105	331.37	290.29	260,482.14	3.458	9,007.22	148.55	1.777	145.91
	AIH-37	18 Rods from MF-50 and 6 Rods from MF-112	333.15	291.72	262,595.12	3.504	9,200.67	100.88	1.715	99.15
	AIH-38	12 Rods from MF-112 and 12 Rods from MF-36	334.20	293.16	262,647.52	3.472	9,117.86	135.18	1.724	132.85
	AIH-39	18 Rods from MF-81 and 6 Rods from MF-36	334.06	292.73	263,176.86	3.449	9,076.94	159.54	1.780	156.70
	AIH-40	18 Rods from MF-5 and 6 Rods from MF-46	333.11	291.91	262,059.14	3.457	9,058.78	150.54	1.754	147.90
	AIH-41	12 Rods from MF-46 and 12 Rods from MF-144	333.60	292.28	262,616.72	3.463	9,095.70	144.82	1.775	142.25
	AIH-42	18 Rods from MF-88 and 6 Rods from MF-144	332.76	291.53	262,279.44	3.463	9,082.10	144.34	1.739	141.83
			2,332.25	2,043.62	1,835,856.94		63,639.27	983.85		966.59
7 10-31-78	AIH-43	18 Rods from MF-2 and 6 Rods from MF-60	333.51	292.49	262,755.36	3.473	9,125.43	134.28	1.765	131.91
	AIH-44	12 Rods from MF-60 and 12 Rods from MF-48	334.04	292.82	262,908.26	3.451	9,072.95	157.38	1.722	154.67
	AIH-45	18 Rods from MF-155 and 6 Rods from MF-48	333.26	292.05	262,181.78	3.463	9,078.73	144.44	1.724	141.95
	AIH-46	18 Rods from MF-49 and 6 Rods from MF-47	333.81	291.97	262,609.58	3.462	9,091.54	145.46	1.774	142.88
	AIH-47	12 Rods from MF-84 and 12 Rods from MF-47	333.40	292.27	262,478.82	3.462	9,088.21	144.98	1.697	142.52
	AIH-48	18 Rods from MF-44 and 6 Rods from MF-84	333.51	292.41	262,312.70	3.458	9,070.24	149.86	1.762	147.22
	AIH-49	18 Rods from MF-58 and 6 Rods from MF-68	333.93	292.39	262,773.42	3.467	9,110.35	140.16	1.712	137.76
			2,335.46	2,046.40	1,838,019.92		63,637.45	1,016.56		998.91
8 12-15-78	AIH-50	12 Rods from MF-68 and 12 Rods from MF-45	333.32	292.24	262,721.56	3.461	9,092.78	147.26	1.779	144.64
	AIH-51	18 Rods from MF-80 and 6 Rods from MF-45	333.99	292.89	263,178.12	3.454	9,088.87	154.78	1.757	152.06
	AIH-52	18 Rods from MF-65 and 6 Rods from MF-67	334.16	292.69	262,739.92	3.450	9,064.55	158.74	1.751	155.96
	AIH-53	12 Rods from MF-67 and 12 Rods from MF-70	334.17	292.89	263,109.64	3.457	9,095.71	150.94	1.683	148.40
	AIH-54	18 Rods from MF-51 and 6 Rods from MF-70	333.82	292.46	262,720.04	3.448	9,057.28	160.72	1.823	157.79
	AIH-55	18 Rods from MF-20 and 6 Rods from MF-35	334.20	292.92	263,568.98	3.345	8,817.50	149.84	1.742	147.23
	AIH-56	12 Rods from MF-35 and 12 Rods from MF-107	333.69	292.61	262,771.38	3.461	9,094.45	146.48	1.768	143.89
			2,337.35	2,048.70	1,840,809.64		63,311.14	1,068.76		1,049.97
9 4-11-79	AIH-57	18 Rods from MF-158 and 6 Rods from MF-107	333.14	292.11	262,364.74	3.462	9,082.46	145.58	1.896	142.82
	AIH-58	18 Rods from MF-61 and 6 Rods from MF-62	333.73	292.72	263,017.00	3.457	9,091.19	151.18	1.879	148.34
	AIH-59	12 Rods from MF-62 and 12 Rods from MF-66	333.69	292.58	262,881.96	3.448	9,062.87	160.64	1.712	157.89
	AIH-60	18 Rods from MF-41 and 6 Rods from MF-66	333.65	292.67	262,708.26	3.439	9,035.19	170.09	1.805	167.02
	AIH-61	18 Rods from MF-39 and 6 Rods from MF-142	333.39	292.05	262,489.68	3.449	9,053.90	159.16	1.740	156.39
	AIH-62	12 Rods from MF-142 and 12 Rods from MF-124	333.43	292.18	262,208.38	3.484	9,134.04	122.51	1.845	120.25
	AIH-63	18 Rods from MF-63 and 6 Rods from MF-124	334.00	292.75	262,905.72	3.471	9,126.02	136.02	1.853	133.50
			2,335.03	2,047.06	1,838,575.74		63,585.67	1,045.18		1,026.21
10 4-30-79	AIH-64	18 Rods from MF-31 and 6 Rods from MF-6	333.17	292.11	262,553.48	3.464	9,094.88	143.38	1.716	140.92
	AIH-65	12 Rods from MF-6 and 12 Rods from MF-152	332.50	291.48	262,640.72	3.464	9,097.88	143.58	1.776	141.03
	AIH-66	18 Rods from MF-91 and 6 Rods from MF-152	332.55	291.48	261,860.00	3.460	9,061.01	147.20	1.800	144.55
	AIH-67	18 Rods from MF-86 and 6 Rods from MF-52	333.98	292.55	262,665.98	3.459	9,086.92	148.59	1.770	145.96
	AIH-68	12 Rods from MF-52 and 12 Rods from MF-19	330.56	289.21	259,482.06	3.477	9,021.64	128.19	1.779	125.91
	AIH-69	18 Rods from MF-83 and 6 Rods from MF-19	332.07	290.63	261,585.96	3.466	9,066.03	141.14	1.757	138.66
	AIH-70	18 Rods from MF-97 and 6 Rods from MF-98	332.66	291.64	262,119.30	3.468	9,090.27	138.85	1.736	136.44
			2,327.49	2,039.10	1,832,907.50		63,518.63	990.93		973.47

Rockwell International
Energy Systems Group

NO
PAGE 46
N918ER10001

HALLAM DECLAD FUEL SHIPPING CANISTER CONTENTS

Shipment Number	AI Canister Number	Contents	Container Gross Weight (kg)	Fuel Net Weight (kg)	Uranium (g)	U ²³⁵ (%)	U ²³⁵ (g)	Pu (g)	Pu ²⁴⁰ (%)	Pu ²³⁹⁺²⁴¹ (g)
11 5-14-79	AIH-71	12 Rods from MF-98 and 12 Rods from MF-102	333.44	292.45	262,728.38	3.482	9,146.89	124.97	1.832	122.68
	AIH-72	18 Rods from MF-93 and 6 Rods from MF-102	332.81	291.85	262,210.46	3.462	9,077.61	145.21	1.735	142.69
	AIH-73	18 Rods from MF-95 and 6 Rods from MF-151	333.90	292.78	263,140.88	3.477	9,149.47	129.96	1.731	127.71
	AIH-75	12 Rods from MF-151 and 12 Rods from MF-99	333.91	292.54	262,751.94	3.479	9,139.88	128.67	1.756	126.41
	AIH-76	18 Rods from MF-18 and 6 Rods from MF-99	328.86	287.74	257,997.14	3.466	8,941.71	139.03	1.791	136.54
	AIH-77	18 Rods from MF-3 and 6 Rods from MF-90	333.76	292.83	262,697.46	3.454	9,072.91	154.78	1.738	152.09
	AIH-78	12 Rods from MF-90 and 12 Rods from MF-53	333.67	292.26	262,358.08	3.453	9,060.49	154.26	1.750	151.56
			2,330.35	2,042.18	1,833,884.34		63,588.96	976.88		959.68
12 6-5-79	AIH-80	18 Rods from MF-92 and 6 Rods from MF-53	333.62	292.27	262,482.86	3.456	9,070.15	152.06	1.776	149.36
	AIH-81	18 Rods from MF-156 and 6 Rods from MF-54	333.68	293.21	262,227.26	3.457	9,065.87	150.54	1.767	147.88
	AIH-82	12 Rods from MF-54 and 12 Rods from MF-145	333.02	291.55	262,491.40	3.458	9,076.99	150.32	1.770	147.66
	AIH-83	18 Rods from MF-143 and 6 Rods from MF-145	333.84	292.36	262,233.84	3.460	9,073.89	146.54	1.726	144.01
	AIH-85	18 Rods from MF-1 and 6 Rods from MF-145	333.26	291.76	261,920.46	3.461	9,065.75	145.16	1.702	142.69
	AIH-86	12 Rods from MF-146 and 12 Rods from MF-76	333.51	291.97	262,324.22	3.462	9,082.95	144.04	1.770	141.49
	AIH-87	18 Rods from MF-148 and 6 Rods from MF-76	333.57	292.25	262,191.82	3.463	9,079.70	143.10	1.649	140.74
			2,334.50	2,045.37	1,835,871.86		63,515.30	1,031.76		1,013.83
13 6-25-79	AIH-89	12 Rods from MF-74 and 12 Rods from MF-85	333.21	291.75	262,058.20	3.467	9,086.85	139.38	1.729	136.97
	AIH-91	18 Rods from MF-96 and 6 Rods from MF-4	333.56	291.87	262,588.36	3.474	9,121.01	134.01	1.731	131.69
	AIH-92	12 Rods from MF-106 and 12 Rods from MF-4	333.84	292.24	262,486.10	3.475	9,121.43	131.90	1.721	129.63
	AIH-94	18 Rods from MF-104 and 6 Rods from MF-127	333.76	292.28	262,379.74	3.486	9,145.90	120.50	1.776	118.36
	AIH-106	18 Rods from MF-120 and 6 Rods from MF-121	333.28	291.78	262,128.32	3.509	9,198.77	95.29	1.774	93.60
	AIH-107	12 Rods from MF-121 and 12 Rods from MF-123	332.66	291.29	261,580.00	3.511	9,183.99	93.43	1.787	91.76
	AIH-108	18 Rods from MF-161 and 6 Rods from MF-123	333.61	292.12	262,243.87	3.499	9,174.62	105.39	1.774	103.52
			2,333.92	2,043.51	1,835,464.59		64,032.57	819.90		805.53
14 7-9-79	AIH-88	18 Rods from MF-55 and 6 Rods from MF-85	333.40	291.97	262,147.12	3.466	9,086.03	141.28	1.692	138.89
	AIH-90	18 Rods from MF-87 and 6 Rods from MF-74	333.71	292.23	262,630.98	3.470	9,112.65	137.14	1.772	134.71
	AIH-93	12 Rods from MF-37 and 6 Rods from MF-106	333.46	291.94	262,834.84	3.476	9,135.44	132.04	1.749	129.73
	AIH-95	12 Rods from MF-127 and 12 Rods from MF-30	333.95	292.55	262,319.48	3.495	9,169.31	110.24	1.742	108.32
	AIH-96	18 Rods from MF-103 and 6 Rods from MF-30	333.42	292.00	262,289.98	3.481	9,131.02	125.19	1.789	122.95
	AIH-98	12 Rods from MF-108 and 12 Rods from MF-100	338.59	297.23	266,933.30	3.487	9,307.83	121.48	1.795	119.30
	AIH-99	18 Rods from MF-110 and 6 Rods from MF-100	333.21	292.19	262,477.64	3.491	9,164.35	114.57	1.719	112.60
			2,339.74	2,050.11	1,841,633.34		64,106.63	881.94		866.50
15 7-23-79	AIH-97	18 Rods from MF-153 and 6 Rods from MF-103	336.29	287.74	258,398.16	3.484	9,002.65	121.24	1.831	119.02
	AIH-97	9 SRE Fuel Slugs		7.17	7,174.23	2.778	199.30			
	AIH-100	18 Rods from MF-157 and 6 Rods from MF-111	333.64	292.20	262,344.66	3.493	9,164.36	112.30	1.763	110.32
	AIH-101	12 Rods from MF-111 and 12 Rods from MF-101	333.91	292.54	262,798.70	3.497	9,188.76	109.20	1.758	107.28
	AIH-102	18 Rods from MF-113 and 6 Rods from MF-101	333.28	292.22	262,292.64	3.497	9,173.68	108.26	1.792	106.32
	AIH-103	18 Rods from MF-116 and 6 Rods from MF-119	333.04	291.58	261,887.17	3.499	9,163.41	106.33	1.721	104.50
	AIH-104	12 Rods from MF-118 and 12 Rods from MF-119	333.13	291.64	261,949.96	3.499	9,166.93	105.20	1.730	103.38
	AIH-105	18 Rods from MF-115 and 6 Rods from MF-118	333.65	292.27	262,630.68	3.506	9,207.86	98.65	1.845	96.83
			2,336.94	2,040.19	1,832,301.97		64,067.65	761.18		747.65

Rockwell International
Energy Systems Group

NO
N918ER10001
PAGE 47

HALLAM DECLAD FUEL SHIPPING CANISTER CONTENTS

Shipment Number	AI Canister Number	Contents	Container Gross Weight (kg)	Fuel Net Weight (kg)	Uranium (g)	U ²³⁵ (%)	U ²³⁵ (g)	Pu (g)	Pu ²⁴⁰ (%)	Pu ²³⁹⁺²⁴¹ (g)
16 8-14-79	AIH-74	7 Rods from CF-4	185.28	144.49658	137,465.71	3.520	4,838.81	63.99	1.750	62.87
	AIH-79	8 Rods from CF-8 and 1 Rod from CF-4	224.02	182.70546	173,424.79	3.500	6,070.71	94.85	1.782	93.16
	AIH-84	8 Rods from CF-5	207.02	166.58332	157,433.00	3.492	5,497.56	91.00	1.758	89.40
	AIH-109	8 Rods from CF-3	205.98	165.36899	157,348.00	3.501	5,508.75	85.80	1.760	84.29
	AIH-110	8 Rods from CF-2	206.24	166.12597	157,757.20	3.502	5,524.66	84.90	1.755	83.41
			1,028.54	825.28032	783,428.70		27,440.49	420.54		413.13
17 8-27-79	AIH-111	8 Rods from CF-7	205.53	164.92074	155,883.20	3.501	5,457.47	84.60	1.773	83.10
	AIH-112	8 Rods from CF-1	206.56	165.83292	160,131.10	3.506	5,614.20	83.90	1.764	82.42
	AIH-113	8 Rods from CF-10	206.53	166.21685	156,858.20	4.725	7,411.55	80.00	1.775	78.58
	AIH-114	8 Rods from CF-6	204.82	164.21254	155,786.20	3.508	5,464.98	79.90	1.777	78.48
	AIH-115	8 Rods from CF-9	207.74	166.99333	156,952.20	4.727	7,419.13	79.30	1.765	77.90
			1,031.18	828.17638	785,610.90		31,367.33	407.70		400.48
LAL-DZA-1 6-15-78		Sample UMo Slug (From MF-129)			291.98		10.29	.09		.09
LAL-DZA-2 9-7-78		Sample UC Slug (From CF-04)			123.70		4.35	.06		.06
		HALLAM TOTALS	37,091.71	32,328.16	29,125,231.30		1,019,840.28	13,156.41		12,924.55
		SRE TOTALS		18.00	17,997.77		491.10	4.23		4.17
		GRAND TOTALS	37,091.71	32,346.16	29,143,229.07		1,020,331.38	13,160.64		12,928.72

Rockwell International
Energy Systems Group

NO . N918ER10001
PAGE . 48

Rockwell International
Energy Systems Group

NO . N918ER10001
PAGE . 49

APPENDIX D

HALLAM DECLADDING PROGRAM – SUPPORTING DOCUMENTS

HALLAM DECLADDING PROGRAM — PLANS AND PROCEDURES

N918PP1000001	A	Hallam Fuel Decladding Program Plan
N918QFP100001	E	Hallam Fuel Decladding Quality Assurance Functional Plan
N918RPA100001	C	Engineering Release Plan of Action for the Hallam Fuel Decladding Program
N918CS100001	F	Configuration Summary, Hallam Fuel Decladding
N918NMP100001	B	Nuclear Material Management Plan, Hallam Fuel Decladding
N918NSA100001	D	Nuclear Safety Analysis, Hallam Fuel Decladding
AI-74-44 (11-10-77)		Supplement 2, Special Nuclear Material Control Program for Hallam Fuel Decladding
N918TI100001	C	Criticality Study for Hallam Fuel Decladding
N918TI100002	A	Hot Cell and Decontamination Room Entry Procedure
N918TI100003	N/C	Evaluation of Processes for Removal of Sodium From Hallam UC Fuel Rods
NO01OP140008	N/C	Radiation Safety Procedures for Atomics International Hot Laboratory T020
N918OP100001	N/C	Operating Procedure for Hallam Alcohol Evaporator
N918OP100002	A	Onsite Hallam Fuel Transfer With LOST Cask
N918OP100003	N/C	HNPF Fuel Shipping Cask Unloading Procedure
N918OP100004	A	Operating Procedure for Hallam Shipping Can Weighing Procedure
N918OP100005	N/C	Operating Procedure for Hallam Sodium Digestive System
N918OP100006	A	HNPF Fuel Shipping Cask Loading Procedure for Hallam Fuel Element Waste Containers
N918OP100007	A	HNPF Fuel Shipping Cask Loading Procedure for Hallam Decladding Fuel Element Canisters
N918TR100001	N/C	Test Report — Sodium Cleaning
N918TR100002	N/C	Test Report — Shipping Can Closure Weld Development
N918TR100003	N/C	Hallam Sodium Digester Process Checkout
NA0107-019	A	Non-Critical Fusion Welding Specification
ST0115NA0021	B	Helium Leak Detection Specification
- -	3	Safety Analysis Report for Packaging on Hallam Nuclear Power Facility (HNPF) Spent Fuel Shipping Cask, to United States Nuclear Regulatory Commission, September 1978, by E.I. Du Pont de Nemours and Company, Inc.

HALLAM DECLADDING PROGRAM — TOOLING DRAWINGS

N918000001	-	Voided
N918000002	B	HNPf Fuel Shipping Canister Storage Basket, Bldg. T022
N918000003	B	HNPf Canister Storage Basket Adapter Plate
N918000004	A	HNPf Cask Adapter Plate
N918000005	A	HNPf Onsite Transfer Container Assembly
N918000006	B	Grapple Assembly, HNPf Fuel Transfer Container
N918000007	J	HNPf Fuel Slug Shipping Canister
N918000008	N/C	HNPf Cask Adapter Plate Shielding
N918000009	N/C	Guide Pin, Onsite Transfer Container
N918000010	N/C	Onsite Transfer Container Hoist Assembly, HNPf
N918000011	A	HNPf Fuel Slug Shipping Canister Test Model
N918000012	N/C	Canister Storage Basket Support Plate
N918000013	-	Hallam Decladding Process Flow Diagram (Not Released)
N918000014	N/C	Cask Transfer Dolly Modification
N918000015	B	HNPf Remote Welder Assembly
N918000016	N/C	Release Cable Pulley Stand, HNPf
N918000017	A	Fuel Holding Basket and Transfer Can, HNPf
N918000018	N/C	Cask-to-Cell Adapter Assembly
N918000019	A	Cell 4 Saw Guide Track, HNPf
N918000020	A	Canister Handling Clamp, HNPf
N918000021	N/C	Band Saw Vise Jaw, Details
N918000022	N/C	HNPf Fuel Canister Push Rod Assembly
N918000023	N/C	Element Transfer Rack

HALLAM DECLADDING PROGRAM — TOOLING DRAWINGS (Continued)

N918000024	N/C	Cell 4 Winch Mounting Assembly
N918000025	A	Band Saw Support, Stationary
N818000026	N/C	Band Saw Support, Indexing
N918000027	N/C	Cell 4 Equipment Installation
N918000028	N/C	Chip Tray, Indexing Band Saw
N918000029	N/C	Vise Jaw Details, Indexing Band Saw
N918000030	A	Leak Test Tank Assembly
N918000031	N/C	Cladding Crusher
N918000032	A	Storage Rack, Cell 4
N918000033	A	Fuel Element Storage Rack, Cell 3
N918000034	N/C	Fuel Rod Transfer Channel
N918000035	N/C	Transfer Can Racks
N918000036	A	Hallam Sodium Digestive System Assembly
N918000037	B	Alcohol Vessel, Hallam Sodium Digestive System
N918000038	C	Hallam Alcohol Rinse Can
N918000039	N/C	Cell False Floor Panel Assembly
N918000040	A	Alcohol Condenser, Hallam Sodium Digestive System
N918000041	N/C	HNPf Fuel Slug Shipping Canister Test Model
N918000042	N/C	Hallam Fuel Canister Load Cell Weight Standard
N918000043	N/C	Fuel Slug Shipping Canister Installation, Cell 4
N918000044	B	Hallam Evaporator
N918000045	-	Voided
N918000046	N/C	Hot Cell Through Tube
N918000047	-	Voided
N918000048	N/C	Condenser Pedestal
N918000049	N/C	Storage Rack Stand

HALLAM DECLADDING PROGRAM — TOOLING DRAWINGS (Continued)

N918000050	N/C	Push Rod Wrench
N918000051	N/C	Alcohol Trough
N918000052	N/C	Push Rod Collar
N918000053	A	Fuel Holding Basket Assembly
N918000054	N/C	Tubing Crusher
N918000055	N/C	Cell 4 Fuel Holding Basket Cradle Assembly, Installation
N918000056	N/C	Fuel Holding Basket Cradle Assembly
N918000057	N/C	HNPF Waste Shipping Canister
N918000058	N/C	Tube Cutter
N918000059	N/C	Hallam Cask Snorkel, Waste Removal System
N918000060	N/C	Hallam Cask Lid Counter Balance, Waste Removal System
N918000061	N/C	Hallam Carbide Fuel Holding Basket
N918000062	N/C	Hallam Carbide Fuel Dummy Basket
N918000063	N/C	Hallam Carbide Fuel, Eliminator for U-Mo Sodium Digesters
N918000064	N/C	Hallam Carbide Fuel, Sodium Digester Configuration
N918000065	N/C	Hallam Sodium Difestive System Work Tray
N918000066	N/C	Crane Mount, Cell 2, Hallam Fuel Decladding