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SAFETY ASSESSMENT DOCUMENT WITH ENVIRONMENTAL
SYNOPSIS FOR SHIPPING HICS LOADED WITH EPICOR-II
LINERS FROM INEL TO RICHLAND DISPOSAL FACILITY

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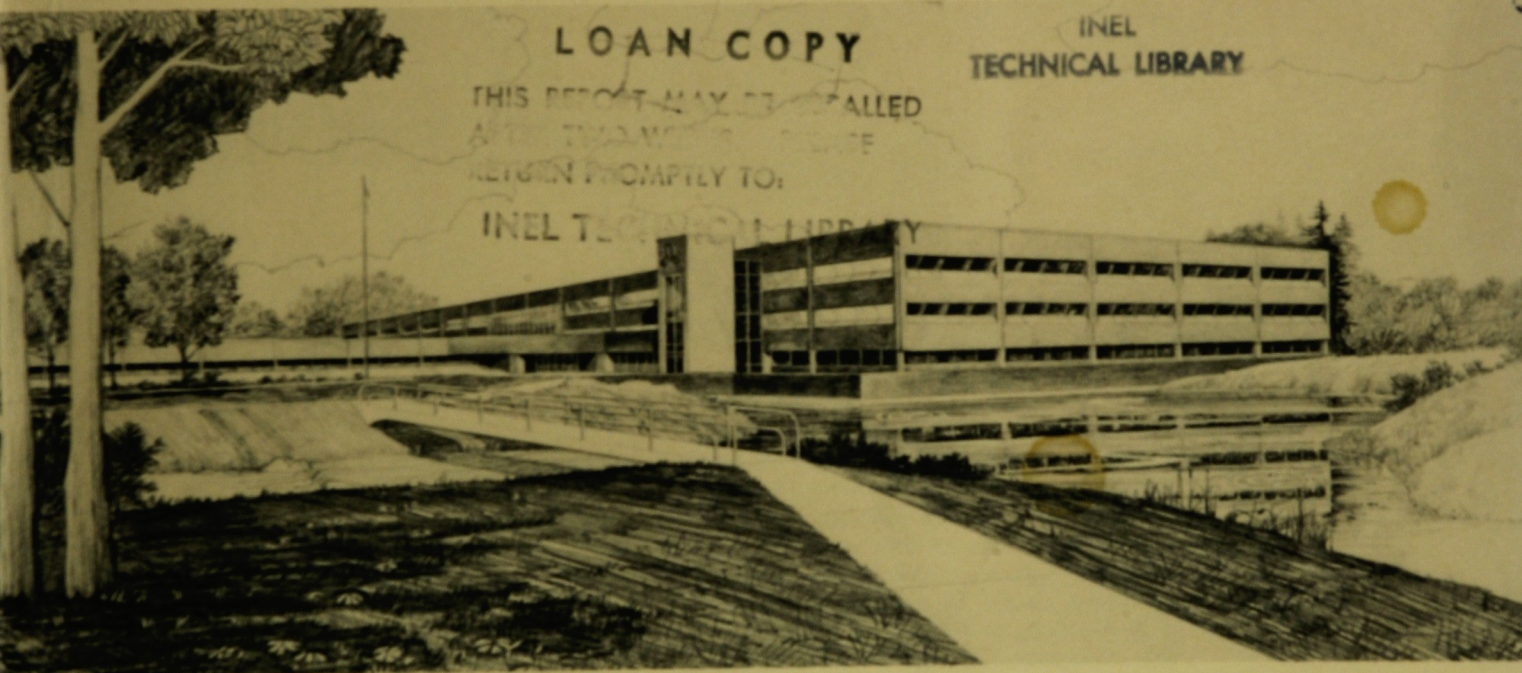
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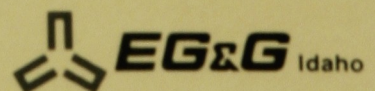
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Idaho Falls, Idaho 83415

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SUMMARY

The cleanup of Three Mile Island (TMI) Unit 2 produced 50 steel prefilter liners (denoted EPICOR-II liners) containing dewatered, radioactive ion-exchange resins and zeolites. The EPICOR-II liners were shipped to the Idaho National Engineering Laboratory (INEL) for interim storage. It has been determined that the liners will be permanently buried in the commercial radioactive waste disposal facility near Richland, Washington operated by U.S. Ecology, Inc. Prior to disposal each liner will be placed in a High Integrity Container (HIC) at INEL. The liner and HIC will be transported by truck in a certified, Type B cask to the disposal site. This report evaluates the safety and environmental aspects of transporting the 50 liners from INEL to the disposal site near Richland.

New radioactive transportation rules, effective July 1, 1983 require any vehicle transporting Type B packages containing large quantities of radioactive materials is subject to specific routing criteria. So "Highway Route Controlled Quantity" has been adopted for these shipments.

Two truck routes are considered for the shipment. The southern route (650 mi, 1050 km) is west across southern Idaho, northwest through eastern Oregon and north through Washington to the disposal site. The northern route (700 mi, 1130 km) is north in southeast Idaho, northwest in western Montana, west across northern Idaho and southwest across eastern Washington to the disposal site.

Safety analyses were prepared for general transportation accidents, explosion due to radiolytic decomposition of liner contents, fires, and radiation during both normal and accident conditions. Those analyses were based upon the following conditions:

- o The liner was purged with nitrogen and resultant gas sampled for residual combustible gases.
- o The liner was recapped with a porous metal plug and surveyed for radiation.

- o The liner was loaded in HIC and the epoxy seal cured.
- o The HIC was loaded into the cask and the cask appropriately sealed.
- o Radiation and safety inspections have been conducted on the shipment to ensure compliance with all applicable DOT, NRC, and DOE regulations.
- o Reports of radiation surveillance, gas sampling, and compliance inspections have been submitted to the appropriate EG&G Idaho Safety, Transportation, and program offices.

Truck accidents are very unlikely: only 0.06 accident is expected for all shipments. An "extra-severe" truck accident involving impact speeds greater than 50 mi/h (80 km/h) and fires lasting more than one hour is expected at a rate of 6×10^{-10} for all shipments. The tests required for certification show that the cask can withstand this type of accident without release of radioactivity. The cask can also withstand an intense fire for one-half hour without release of radioactivity. External radiation levels of the loaded cask are lower than maximum levels allowed by both DOT and DOE regulations for both normal and accident conditions, and they will be lower than those measured during transport of the liners from TMI to INEL due to the additional shielding provided by enclosure in the HIC.

The analysis of production of explosive gas indicates that a minimum of 74 days is required for gas concentrations to reach lower flammable limits. Eight days or less are required to load a liner into a HIC, cure the epoxy seal, load the HIC into the CNS 14-190 (USA/5026/B()), transport it to Richland (WA) and unload the cask. Since the load and transport time is much less than the time required to produce an explosive mixture, explosions are not possible during transport.

Environmental evaluations considered normal transport and accident conditions. Under either set of conditions consequences were determined to be no more severe than those associated with routine trucking conditions. Transport of the liners from INEL to the disposal site will be safer than transport of the liners from TMI to INEL due to the additional protection and shielding of the HIC. All 50 liners have now been transported to INEL without incident.

It is concluded that the EPICOR-II liners, when loaded in a HIC which in turn is loaded in the CNS 14-190 (USA/5026/B()) shipping cask, can be safely transported to the Hanford disposal site with no adverse environmental consequences.

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1. INTRODUCTION

The 28 March 1979 accident at Three Mile Island (TMI) Nuclear Station Unit 2 resulted in the accumulation of 370,000 gallons (1.4 million l) of water contaminated by fission products (primarily ^{90}Sr , ^{134}Cs , and ^{137}Cs) in the basement of the Auxiliary and Fuel Handling Buildings (AFHB). Another 200,000 gallons (760,000 l) of wash water was contaminated during the decontamination of the Auxiliary Building.¹

On 16 October 1979, the Nuclear Regulatory Commission (NRC) authorized use of the EPICOR-II demineralizer system for decontamination of water in the AFHB. That work was completed in August 1980 and 50 EPICOR-II liners were stored in concrete vaults at TMI. Each liner was loaded with 2200 Ci or less of ^{90}Sr , ^{134}Cs , ^{137}Cs , their daughter products, smaller amounts of Ru, Rh, Ba and trace amounts of U and transuranics. A summary of the curie loadings for EPICOR-II liners is given in Section 2.1.

The TMI vaults were used only as an interim storage facility for the EPICOR-II liners since the NRC concluded that TMI should not become a permanent radioactive waste disposal site. Transportation of the EPICOR-II liners to the Idaho National Engineering Laboratory for research and preparation for final disposition was determined to be the most appropriate course of action by DOE. It was decided that final disposal will be at Richland, Washington.

Two liners, PF-16 and PF-3, were first shipped to Battelle Columbus Laboratories (BCL) in Ohio for characterization. Those liners were subsequently sent to the Idaho National Engineering Laboratory (INEL), in April 1982 and January 1983 respectively, for interim storage in the TAN-607 hot shop. Shipment of the other 48 liners directly from TMI to the INEL commenced in August 1982 and is scheduled for completion in July 1983. A Safety Assessment Document² and an Environmental Evaluation,³ were prepared for the transport to INEL. An Environmental Evaluation⁴ and Amendments to the facility Final Safety Analysis Report (FSAR)^{5,6} were provided for the liner receipt, storage, and research at

INEL. This report assesses both safety and environmental aspects of transporting the EPICOR-II liners from INEL to the U.S. Ecology disposal site near Richland, Washington. Each liner will be loaded into a High Integrity Container (HIC) at INEL and the complete assembly will be shipped by truck in a shielded cask.

The EPICOR-II liners are currently property of DOE and will remain so until accepted at the disposal site. DOE is responsible for preparing the liners for shipment and for transportation to Richland, with the costs for transportation and burial to be borne by General Public Utilities Nuclear Corporation (GPUNC). The first shipment of a liner enclosed in a HIC will be in the nature of a demonstration. If no difficulties ensue, the preparation, transport and disposal of the remaining 49 liners will proceed as scheduled. Note, however, that liners continue to be researched so that only 46 are expected to be disposed in the initial campaign.

1.1 Purposes and Scope

The purpose of this document is to assess the safety aspects and evaluate potential environmental effects of transporting the 50 EPICOR-II liners individually enclosed in HICs from INEL to the commercial disposal site near Richland (WA). Separate Safety Assessment Documents and Environmental Evaluations were provided for shipping EPICOR-II liners from TMI to BCL, from BCL to INEL, and from TMI directly to INEL.^{2,3,7,8} An Environmental Evaluation was provided for research and storage of the liners at INEL.⁴ Safety documentation for the research and storage of the liners is contained in amendments to the FSAR for the Test Area North Building 607 (TAN-607) Hot Shop.^{5,6} The documentation appropriate to the disposal of the liners at Richland is contained in the license of U.S. Ecology.^{9,10}

1.2 Proposed Action

Plans call for transporting the EPICOR-II liners in HICs, one at a time, over a period of about 2 years, beginning September 1983 and ending September 1985. Each HIC, containing a liner, will be placed in a shipping

cask, which will be transported over public highways by truck from INEL to Richland. The shipping of liners in HICs will commence after EG&G Idaho has conducted and completed the following requirements:

- o Sampled the liner, purged it with nitrogen, and determined that the combustible gas generation rate is low enough so that the time allowed for transport and disposal is less than the minimum time required to reach the lower flammable limit.
- o Reinserted the porous metal plug in each liner.
- o Physically loaded the liner into a HIC.
- o Allowed sufficient time for the epoxy seal of the HIC to cure properly.
- o Loaded the HIC into the certified shipping cask.
- o Properly placed the lid on the shipping cask.
- o Had a health physicist survey the shipping cask to certify that the surface radioactive contamination is within allowable limits and that surface radiation levels are within allowable limits for transporting over public highways.
- o Properly labeled the shipping cask as to its content and surface emission levels according to DOT regulations.
- o Properly sealed the shipping cask according to DOT regulations.
- o Properly equipped the transport vehicle with placards according to DOT regulations.
- o Performed vehicle and tie-down inspections.

- o Properly verified a safe and legal shipment.
- o Concluded that the shipment meets all applicable DOE Safety and Security procedures and is located outside the INEL Test Area North perimeter fence.

In order to transport large quantities of low-level radioactive material, which includes EPICOR-II liners inside HICs, the transport package must be a certified package and its user must comply with the following items:

1. Have a copy of the Certification of Compliance and all documents referenced in the certificate, and
2. Comply with the terms and condition of the Certificate of Compliance.

The transportation of radioactive materials increases the exposure risk to those persons residing near the transportation route. An estimated 230,000 people reside between 100 feet and 1/2 mile on either side of the longest of the two EPICOR-II transportation routes between INEL and the Washington disposal site. This estimate is based upon an average population density of 330 persons per square mile¹¹ and a maximum transport distance of 700 mile (1130 km). The journey from INEL to Richland poses less risks than did the transport of the liners from TMI to INEL due to the additional protection and shielding provided by the enclosure of the liners in the HIC. The route from INEL to Richland is about one third the distance from TMI to INEL, and it passes through more sparsely inhabited country.

At the disposal site, a receipt inspection will be conducted. The HICs with the EPICOR-II liners will be unloaded and buried by U.S. Ecology. The shipping cask will be surveyed and decontaminated, if necessary, before being returned to INEL.

1.3 Agencies and Regulations Involved

The transportation of EPICOR-II liners involves DOE, NRC, and DOT. DOE is sponsoring the transfer, while NRC and DOT are involved via their regulations for packaging of radioactive materials. The packaging and transportation of radioactive materials within the United States is regulated by NRC, DOE, and DOT. Part 71 of Title 10 of the Code of Federal Regulations (CFR) contains applicable NRC rules and regulations concerning the packaging of radioactive materials. DOT regulations governing packaging of radioactive materials, which are consistent with NRC regulations, are found in 49 CFR, Parts 173 and 178. DOT (under the Department of Transportation Act of 1966, the Transportation of Explosives Act, the Dangerous Cargo Act, the Federal Aviation Act of 1958, and the Transportation Safety Act of 1974) has regulatory responsibility for safety in transportation. DOT regulations governing transportation of radioactive materials by rail, and by common contract or private carriers by public highway (e.g., truck) are found in 49 CFR, Parts 170-189. Additional regulations governing the transportation of radioactive materials are contained in DOE Order 5480.1, Chapter III.

There are basic safety requirements which must be met before and during transportation of radioactive materials.¹² They are as follows:

- o Adequate containment of the radioactive material;
- o Adequate control of the radiation emitted by the material;
- o Safe dissipation of heat generated in the process of absorbing radiation;
- o Adequate control of the generation of combustible gas within waste containers; and
- o Prevention of a nuclear criticality (i.e., prevention of the accumulation of enough fissile material in one location to result in a nuclear chain reaction).

EPICOR-II liners will be transported using Type B packaging as defined by 49 CFR 173.398. Type B packages are shielded heavily and designed to withstand severe accident conditions without any significant release of contents. Because vehicles transporting EPICOR-II liners are consigned for sole use, the following dose limits, as specified by DOT in 49 CFR Part 173 paragraph 173.393(j), apply:

- o 200 mR/h at any point on the external surface of the car or vehicle
- o 10 mR/h at any point 6 feet (1.8 m) from the vertical planes projected beyond the outer lateral surface of the car or vehicle; or if the load is transported in an open transport vehicle, at any point 6 feet from the vertical planes projected from the outer edges of the vehicle; and
- o 2 mR/h at any occupied position in the cab of the transport vehicle.

Until recently, the primary safety measures regulating transportation of radioactive materials were controls on packaging and related transportation parameters. However, DOT promulgated regulations (effective 1 February 1982) focus on routing and operational controls for highway transportation. Those regulations are revisions of 49 CFR, Parts 173 and 177. In brief, the regulations require the following:

- o The motor vehicle carrying radioactive material will be placarded and operated on a route which presents exposure risk to the fewest persons.
- o A more specific rule requires that the motor vehicle transporting a package containing a "Highway Route Controlled Quantity" of radioactive materials be operated on "preferred" highways in

accordance with a written route plan prepared by the carrier before departure. The driver must adhere to the prepared route plan insofar as possible. He is allowed to deviate from this route to follow detours set up by the state or local highway department or in case of unforeseen events such as flooding render the designated route impassable.

Although federal agencies principally are responsible for regulating transportation of radioactive materials, state transportation agencies regulate gross vehicle weights, dimensions, and other parameters for all commercial shipping through the issuance of permits. Indian (tribal) governments also possess some degree of control over the transportation of low-level wastes within their jurisdictions. Notification of the tribal governments is not required for these shipments since DOE shipments are exempt from this requirement.

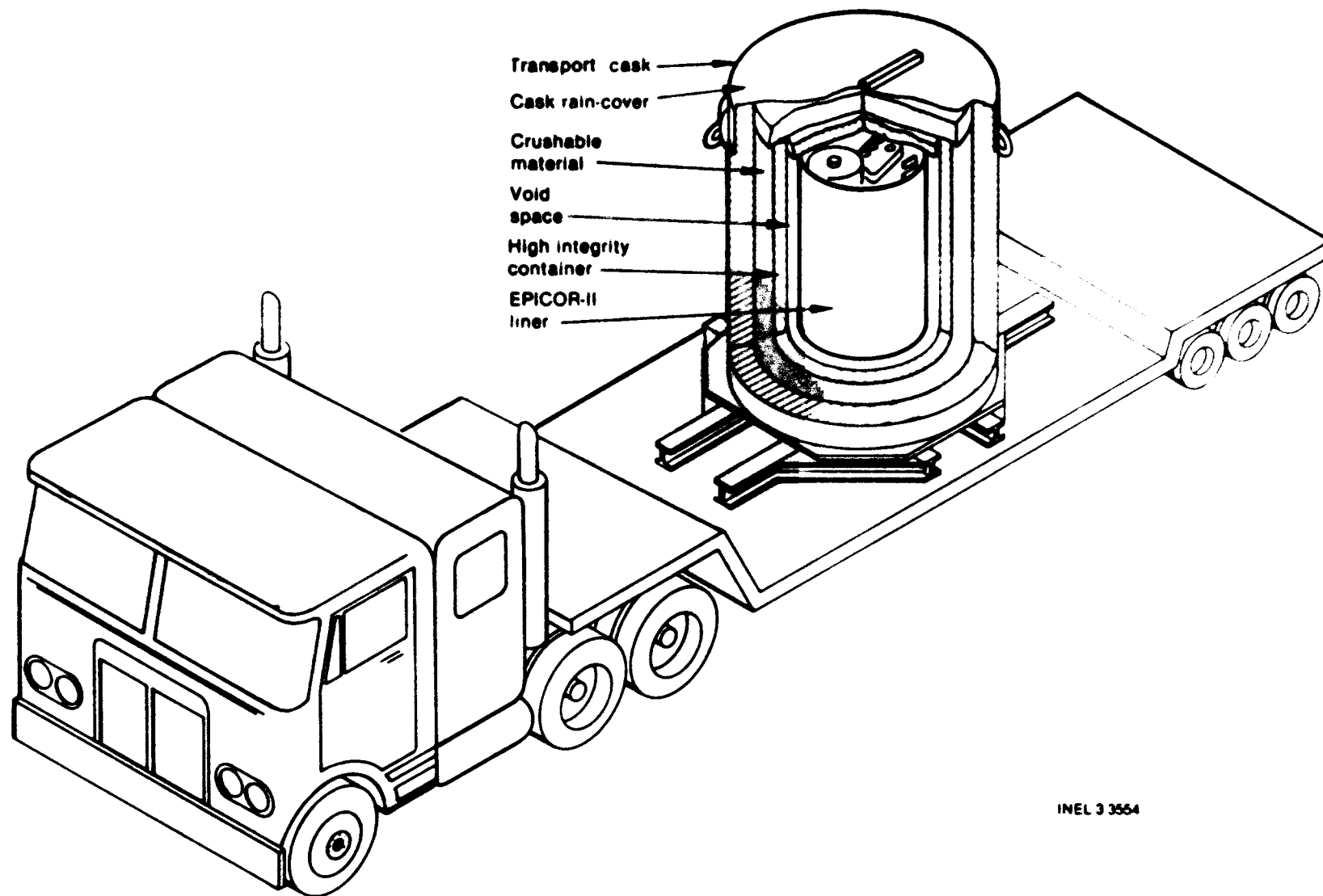
2. DESCRIPTION

The transport cask and High Integrity Containers (HICs) have been designed for safe shipping and disposition of EPICOR-II liners. Figure 1 shows the transport cask on the tractor trailer, the HIC inside the cask, and EPICOR-II liner inside the HIC. It also shows the crushable material placed between the HIC and cask to prevent shifting of the HIC during shipping and to reduce the consequences from impact in the event of an accident. Table 1 shows the dimensions of the transport cask, HIC and EPICOR-II liners.

Section 2.1 provides a physical description of the EPICOR-II liners, their contents, and results of integrity examination of two of the liners. Section 2.2 provides a physical description of the High Integrity Container including: structural features, venting features, weight, and mechanical properties of materials used for construction. Finally, Section 2.3 describes the transport cask to be used for shipping HICs containing EPICOR-II liners from INEL to the commercial low-level radioactive waste disposal facility near Richland, Washington.

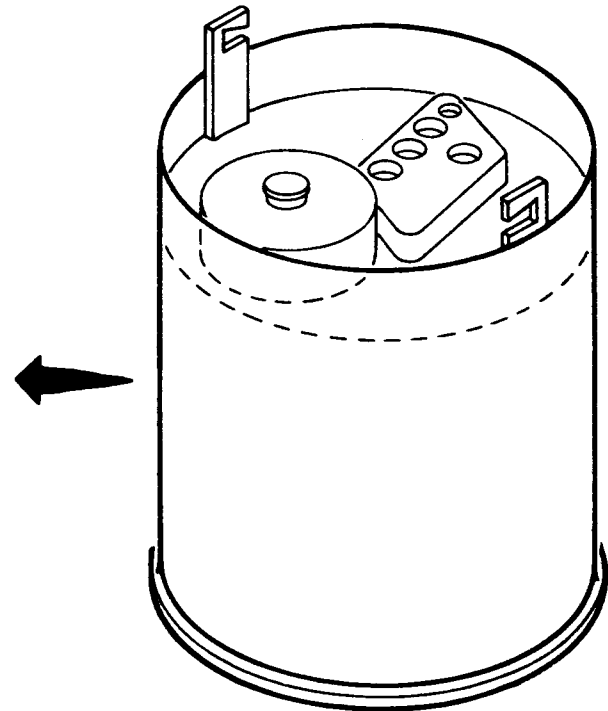
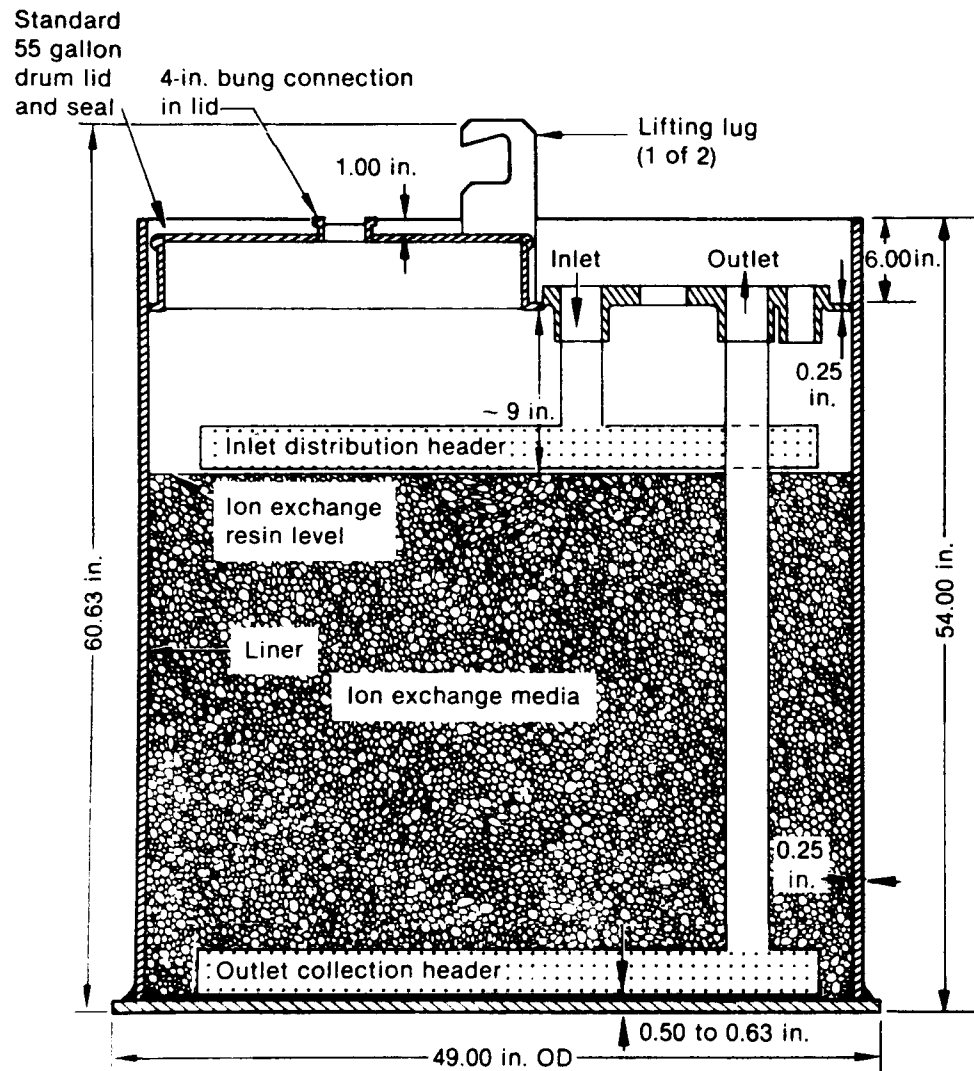
2.1 EPICOR-II Liners

Each EPICOR-II liner is a cylinder 48 inches (1.2 m) in diameter and 54 inches (1.4 m) tall fabricated from 0.25-inches (0.6 cm) welded steel (Figure 2). The top surface is recessed 6 inches (15 cm) below the edge of the side wall. In the top are threaded ports for the inflow and outflow of processed liquids, attachment of instrumentation, and ventilation. The inlet and outlet ports are connected individually to header systems inside the liner. The inlet header system was used to spread unprocessed water over the demineralizer material, while the outlet header system collected filtered water from under the ion exchange medium. At the present time, the small ports are closed by threaded steel plugs. Also in the top is a large manway port made from the end of a standard 55-gallon steel drum. The entire top of the drum-end may be removed to provide an opening about 22 inches (56 cm) in diameter. That opening is sealed by a standard



INEL 3 3554

Figure 1. A tractor trailer loaded with a transport cask, HIC and EPICOR-II liner ready for shipping to the commercial burial grounds.



INEL 2 0836

Figure 2. Schematic design of EPIROR-II liner.

TABLE 1. DIMENSIONS OF THE EPICOR-II LINER, HIC AND TRANSPORT CASK

Container	Width (in.)		Height (in.)	
	Inside	Outside	Inside	Outside
EPICOR-II Liner	47.50	49.00	47.25	60.63
High Integrity Container	49.50	62.50	61.50	84.00
Transport Cask (LMS 14-190)	73	94.25	88.25	104

55-gallons drum top and seal. The drum top contains a 4-inch (10.2 cm) hole which is sealed with a bung. The large port was used when the liner was fitted with the header systems and was filled with ion exchange medium. The bottom is constructed of a steel plate larger in diameter than the cylinder. As a result, the bottom plate is attached to the side wall via external and internal circumferential welds. Each liner is coated inside and out with Phenoline 368 paint to protect against corrosion. The liner weighs 1400 lbs (635 kg) empty and approximately 3400 lbs (1550 kg) when loaded with resin. Resin loadings range from 1290 lbs (585 kg) to 1940 lbs (880 kg). Each liner contains 30 ft³ (850 l) or less of either organic resins (liners 1-11) or a combination of organic ion exchange resins and inorganic zeolite absorbers (liners 12-50).

In processing water from the AFHB, each liner became loaded with radionuclides, mostly strontium-90, cesium-134 and -137, and their daughter products: small amounts of ruthenium-106, rhodium-106 and barium-137; and trace amounts of uranium-238 and some transuranic elements. Table 2 lists the type of resins, residual effluent pH, amount of contaminated water processed, and curie loading for each liner. Table 3 lists the range of radionuclide fractions in liners. The radiation field outside the hottest liner approaches 2800 R/h on contact. In those liners with organic resins only, the radioactivity presumably declines from the top to the bottom of the resin bed. In those containing both resin and zeolite, the radioactivity appears concentrated in the zeolite, which is the top layer in most liners.

TABLE 2. PROCESSING HISTORIES AND CHARACTERISTICS OF THE EPICOR-II
 PREFILTER LINERS^{13,14,15a}

Liner Number	Type ^b of Resin	Residual ^c Effluent pH	Water Processed (gal)	Curie ^d Loading
PF-1	0	5.15	19,380	1,500
PF-2	0	6.44	14,100	1,100
PF-3A ^e	0	7.33	17,700	1,900
PF-4	0	8.0	10,100	680
PF-5	0	8.27	4,280	160
PF-6	0	7.57	7,225	170
PF-7	0	7.09	12,235	1,400
PF-8	0	7.36	5,475	1,400
PF-9	0	7.58	5,500	1,400
PF-10	0	7.92	1,000	230
PF-11	0	8.05	4,000	910
PF-12	I/O	7.87	7,420	1,500
PF-13	I/O	7.7	6,820	1,400
PF-14	I/O	8.08	11,320	1,500
PF-15	I/O	7.75	8,000	1,500
PF-16A ^e	I/O	2.79	8,250	2,100
PF-17	I/O	3.52	7,053	1,800
PF-18	I/O	3.39	8,100	2,000
PF-19	I/O	3.13	7,952	2,000
PF-20	I/O	4.89	8,100	2,000
PF-21	I/O	6.3	8,100	2,000
PF-22	I/O	5.28	7,103	1,700

TABLE 2. (continued)

<u>Liner Number</u>	<u>Type^b of Resin</u>	<u>Residual^c Effluent pH</u>	<u>Water Processed (gal)</u>	<u>Curie^d Loading</u>
PF-23	1/0	7.56	11,300	1,400
PF-24	1/0	4.95	8,100	2,000
PF-25	1/0	5.07	8,100	2,000
PF-26	1/0	4.96	8,100	2,000
PF-27	1/0	4.82	8,100	2,000
PF-28	1/0	7.19	14,212	920
PF-29	1/0	5.55	8,100	2,000
PF-30	1/0	5.00	9,405	1,400
PF-31	1/0	5.12	5,100	1,800
PF-32	1/0	5.19	5,100	1,800
PF-33	1/0	5.66	5,100	1,800
PF-34	1/0	4.70	5,100	1,800
PF-35	1/0	5.34	5,100	1,800
PF-36	1/0	5.43	5,100	1,800
PF-37	1/0	5.08	5,100	1,800
PF-38	1/0	5.13	5,100	1,800
PF-39	1/0	5.53	5,100	1,800
PF-40	1/0	4.00	5,100	1,800
PF-41	1/0	3.80	5,100	1,800
PF-42	1/0	4.70	5,100	1,800
PF-43	1/0	3.67	5,100	1,800
PF-44	1/0	7.60	16,225	1,800
PF-45	1/0	6.89	17,900	2,000

TABLE 2. (continued)

<u>Liner Number</u>	<u>Type^b of Resin</u>	<u>Residual^c Effluent pH</u>	<u>Water Processed (gal)</u>	<u>Curie^d Loading</u>
PF-46	I/O	6.05	19,200	2,200
PF-47	I/O	7.82	28,600	1,900
PF-48	I/O	6.38	28,600	1,900
PF-49	I/O	3.79	32,731	1,800
PF-50	I/O	6.69	91,046	1,600

a. Data based upon GPUNC measurements and estimates.

b. O = organic
I/O = inorganic and organic

c. The value listed is the pH measured at the end of service of the prefilter liner in the EPICOR-II system.

d. As of April 1, 1982.

e. Original liners were used for the Liner Integrity Examination Project. The resins from PF-3 and PF-16 transferred into new EPICOR-II liners which are designated PF-3A and PF-16A, respectively.

TABLE 3. RANGE OF RADIONUCLIDE FRACTIONS IN EPICOR-II LINERS^{14,15,16}

<u>Isotope^a</u>	<u>Range of Values (Percent of Total Liner Activity)^b</u>	<u>Half-Life (yr)</u>
⁹⁰ Sr/Y.	1 to 23	28
¹³⁴ Cs	4 to 5	2.0
¹³⁷ Cs/Ba	72 to 91	30
²³⁹ Pu	1.2×10^{-9} to 7.4×10^{-6}	24,000
²⁴¹ Pu	2.2×10^{-8} to 1.4×10^{-4}	13.2

a. No other fission or activation products exceeded 1% of the total activity in an EPICOR-II liner. No other TRU isotope exceeded $5 \times 10^{-5}\%$.

b. As of April 1, 1982.

INEL has conducted integrity examinations on liners, PF-16 (containing organic resins and inorganic zeolites) and PF-3 (containing only organic resins).¹⁷ The examinations showed that PF-16 has greater paint deterioration than PF-3. The calculated life of the EPICOR-II liners is estimated to be greater than 300 years based upon this examination.

2.2 High Integrity Containers (HIC)¹⁸

The HIC is a reinforced-concrete cylindrical container designed for disposal of an EPICOR-II prefilter liner in a commercial low-level radioactive waste disposal facility. The container is designed to ensure safe, reliable, below ground disposal of the radioactive waste for a minimum period of 300 years (~10 half-lives of predominant isotopes).

Figure 3 illustrates the design configuration of the HIC. Corrosion resistance is provided by redundant corrosion barriers (i.e., from inside to out, polyethylene abrasion liner, phenolic-coated steel liner, and concrete) supplemented by aluminum hydroxide to reduce the chemical activity of corrosives. Each corrosion barrier provides a 300-year life to

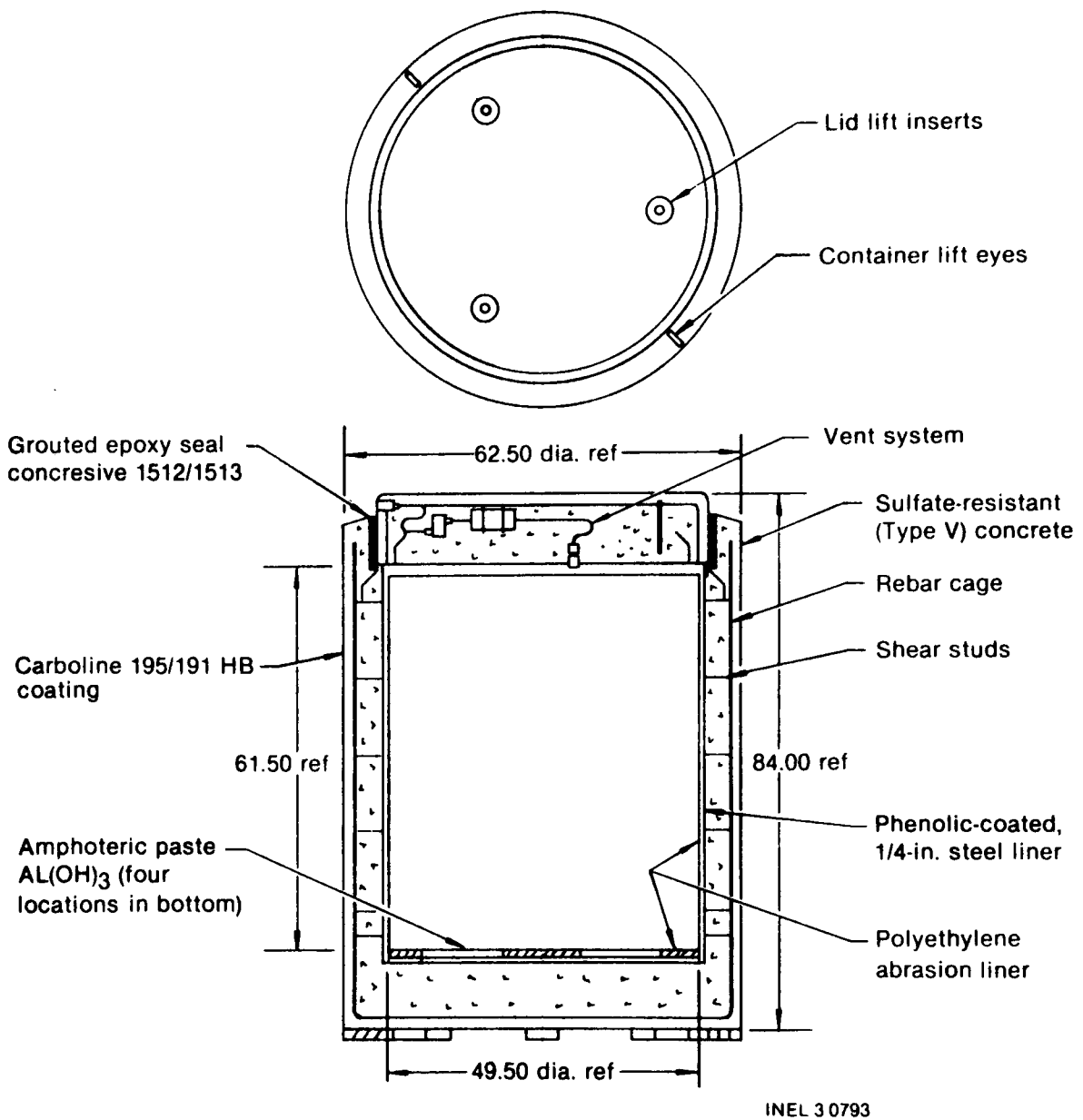


Figure 3. Design configuration of the high-integrity container without an enclosed EPICOR-II liner.

the container, so collectively those barriers give the HIC a life in excess of 1,200 years. The container lid is attached to the body by two separate materials, Concreasive AEX-1513 and Concreasive AEX-1512, which form permanent seals. Appendix A contains detailed drawings of the HIC.

The HIC is equipped with a vent system to allow the escape of gas produced in the EPICOR-II liner. (EPICOR-II liners will be vented during shipments.) The vent is cast into and protected by the reinforced concrete lid assembly. The HIC possesses sufficient burst strength to contain all the gas that may be generated without venting based upon a 300 year life. The concrete container attenuates radiation from the enclosed EPICOR-II liner by a factor of about nine; that is not enough shielding to permit hands-on operation but enough to simplify handling procedures and safety precautions. The center of gravity of the HIC is the geometric center of the body. Weights of the container and its ancillary paraphernalia are summarized in Table 4. The bulk specific gravity of the package is 1.84. Mechanical properties of materials for the HIC are listed in Table 5.

Each HIC will be inspected by EG&G Idaho Quality Division. The first disposal is a demonstration. The HIC will be purchased by EG&G Idaho with fabrication inspection under the control of the Quality Division. This inspection will consist of reviewing special processes such as welding, test results of the concrete, drawing configuration, and documentation. The remaining HICs will be purchased by GPUNC. GPUNC is a licensee of the NRC and will inspect HIC fabrication in accordance with the Quality provisions of that license. The Quality involvement will be equivalent to that performed by EG&G Idaho.

All HICs will be inspected by the EG&G Quality Division upon receipt at the INEL for shipping damage, parts accountability, and a verification of GPUNC data package.

Procedures are being developed for loading EPICOR-II liners into HICs. Appendix D has the procedures for loading the liner for the disposal demonstration. The procedure shows both Quality and Safety checks on the

operation. Similar procedures will be developed for disposal of the balance of the liners.

2.2.1 Structural Features

Concrete Structure. The cylindrical walls are 6 inches (15.2 cm) thick and the ends are 11 inches (27.9 cm) thick. The reinforced concrete is capable of withstanding an internal pressure of 250 psig and an external pressure of 150 psig. Composition of the concrete provides 6000 psi compression strength. A complex rebar cage is encapsulated in the concrete for strength. The rebar cage is constructed as follows:
side--22 circumferential wraps (1/4 inches rebar) and 20 longitudinal bars (No. 5 rebar); bottom--12 crisscrossing bars (No. 4 and No. 5 rebar); and lid--24 crisscrossing bars (No. 4 rebar).

The HIC is lifted by two 1-inch forged stainless steel eyebolts connected to rods embedded in the concrete. The details of construction are found in Appendix A. The eyebolts have a safety factor of 5.5 to 1 based upon ultimate strength. The embedded rods are designed with a safety factor of 7.7 to 1 based upon pullout capacity. The assembly is tested to 150% of design load.¹⁸

Seals.¹⁸ A redundant seal design bonds the lid securely and permanently to the container. The interior, or primary seal, is formed from Concreasive AEX-1513 which is a custom-formulated epoxy gel compatible with the phenolic coatings on the steel liner of the HIC. The primary seal is applied to the mating metal surface of the container body before the EPICOR-II prefilter liner is inserted.

The external, or secondary seal, is formed from Concreasive AEX-1512 (also a custom-formulated epoxy) which fills the gap between the lid and container body. That epoxy gel or grout is a flowable material, containing rounded aggregate (sand like material) to affect self leveling.

TABLE 4. SUMMARY OF HIC WEIGHTS

Components	Weights	
	(lb)	(kg)
Container body	11,096	(5,038)
Lio	2,531	(1,149)
Payload (EPICOR-II liner) (maximum)	3,400	(1,543)
Seals	110	(50)
Rub strips and amphoteric material	139	(63)
	17,276	(7,843)

TABLE 5. MECHANICAL PROPERTIES OF MATERIALS USED IN THE HIC¹⁸

Material	Yield Stress (psi)	Ultimate Stress (psi)	Young's Modulus (10 psi)
ASIM A-36	36,000	58,000	29
ASTM A-615 GR 60 REBAR	60,000	90,000	29
Concrete	--	6,000	4.42
Studs (A-100)	50,000	60,000	29

The seals are expected to receive a maximum total accumulated radiation dose of 200 Mrads. Chemically similar compounds have been tested to 350 Mrads without significant shrinking or reductions in flexure strength. Failure of seals is not expected until doses of greater than 900 Mrads are accumulated. Therefore, the seal should maintain integrity over the life of the HIC (~1200 years).

2.2.2 Impact Resistance

Actual testing has demonstrated that the HIC will retain its structural integrity under the conditions required for Type A containers as set forth in 10 CFR 71.35.

- o Corner impact on unyielding surface from a height of 3 feet (0.91 m)
- o Drop of penetration pin on container sidewall from a height of 3.3 feet (1.0 m).

The State of Washington requested a test of the HIC in a corner impact on soil from a height of 25 feet (7.6 m). The HIC survived those tests with little damage and no loss of functional capabilities.^{18,49} A corner drop onto an unyielding surface from 9 feet (2.73 m) also was conducted even though that test exceeded the design requirements by a factor of three (based upon energy considerations). The only major damage was degradation of the upper part of the seal between the body and lid. However, the lower part of the grout seal was undamaged and the lid remained firmly fixed to the body of the HIC.

2.2.3 Venting Features

The vent system can accommodate 0.15 moles of hydrogen per day, a flow rate nearly three times greater than the design basis. It consists of the following components:

1. A stainless steel, inline filter element with a 5-micron pore size. The filter ensures that solid (resin) particles will not escape from the container to the external environment.
2. A PVC water trap that self-purges any water by means of gases generated within the container.

3. A 70-micron polyethylene external filter, with large surface area. That filter, located in a recessed PVC pocket at the lid edge, functions as a screen against the entry of mud and debris.

2.3 Cask^{21,22}

A certified Type B transport cask, CNS 14-190 (USA/5026/B()), will be used to contain the HIC with its liner during transport by truck from INEL to Richland. The cask will be purchased by DOE specifically for this project. DOE ownership will persist until all 50 liners have been shipped. The tie-down systems are designed to comply with the Nuclear Regulatory Commission Regulation 10 CFR 71.31(d) governing tie-down devices.

The CNS 14-190 (USA/5026/B()) shipping cask (Figure 4) is a steel-encased, concrete shielded shipping cask. The cask is 94.25 inches (239 cm) in diameter by 103.75 inches (264 cm) in length. Reinforced concrete occupies the 7 inches (17.8 cm) annular space between the shells and the two base plates. The lid is a 4.75 inch (12.1 cm) thick laminated steel cover held in place by thirty-two, high strength 1.25 inches (3.18 cm) diameter bolts. A silicone O-ring is used to seal the joint between the lid and the cask body. The outer shell and base plate are 1/4 inches (0.6 cm) thick, while inner shell and base plate are 2 inches (5.1 cm) thick. The cask is reinforced at the top and bottom with steel rings and is equipped with lifting lugs. The lid is provided with two access ports. Empty weight of the cask is about 54,000 pounds (24,500 kg), and it has a maximum load of 23,000 lbs (10,400 kg).

A semitrailer is dedicated exclusively for use with the cask. The cask is held to the trailer by sixteen 1.25 inches (3.17 cm) bolts, see Figure 4. The empty weight of the cask, trailer and tractor is ~87,000 lbs (39,500 kg); the maximum loaded weight is ~103,000 lbs (46,700 kg) which requires highway overweight permits.

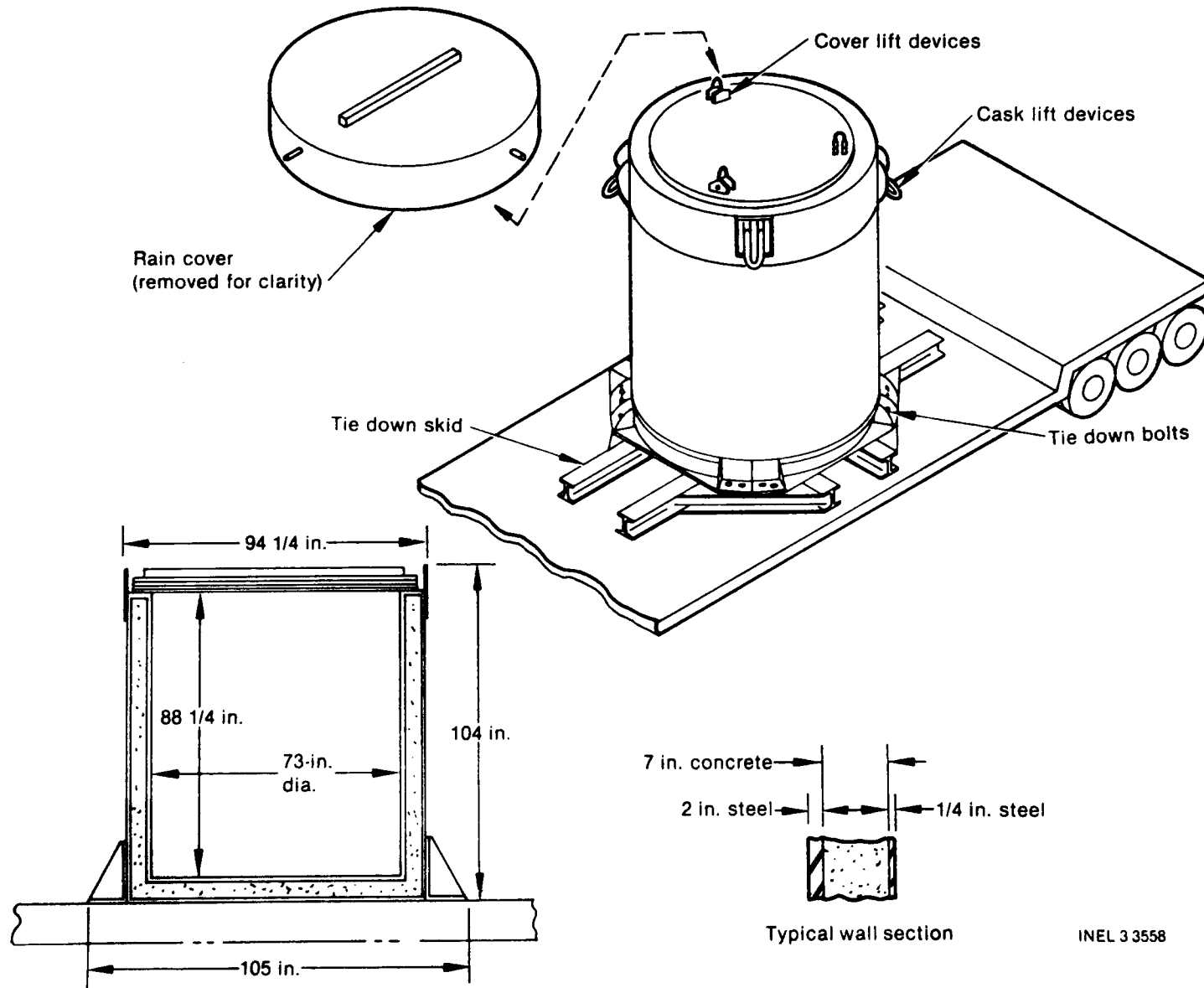


Figure 4. CNS-14-190 Type B transport cask.

A copy of the certificate of compliance for the CNS 14-190 (USA/5026/B()) cask is included as Appendix B. Shipments will only be made in a cask that has a current, valid certificate of compliance. The U.S. Nuclear Regulatory Commission certification of compliance states that the DOT requirements dealing with radiation shielding leak tightness, heat transfer characteristics, tie-downs, and response to hypothetical accident conditions have been met or exceeded by the transport cask.

The cask is being provided under similar procedure to that used to ship the SDS Zeolite Adsorbers from TMI to the Hanford Facility of DOE. The cask will be an EG&G-owned, NRC licensed cask. The cask is being fabricated under the quality standards of the license of the fabricator. Critical inspections such as weld testing and gamma scanning of the shielding were witnessed by EG&G Idaho Quality Division inspectors. Configuration conformance and documentations were also reviewed by the Quality Division. Routine inspections during service will be performed by the Quality Division. Routine maintenance will be performed by EG&G personnel. A receiving inspection will be performed by EG&G Operations personnel prior to loading a HIC. The Quality Division will assist in the resolution of any unused conditions found.

3. TRANSPORTATION

3.1 Documentation

Transportation documentation will include Form-ID 5480.1A (US DOE Idaho National Engineering Laboratory Off-Site Radioactive Material Shipment Record) with the following supporting documentation: radioactive material shipment checklist, radioactive waste shipment and disposal form, isotopic percent worksheet, curie content work sheet, vehicle survey, vehicle inspection checklist, low level radioactive waste shipment certification, radioactive waste shipment and disposal form, and a bill of lading. Those forms are attached in Appendix C.

3.2 Description of Routes

Two routes are proposed for transporting High Integrity Containers loaded with EPICOR-II liners from INEL to the commercial low-level waste burial grounds Richland, Washington. Both routes are DOT approved for this type of shipment. The Southern Route passes through the states of Idaho, Oregon, and Washington, passes through two Indian Reservations (Fort Hall Reservation in Idaho, and Umatilla Reservation in Oregon), and has a length of about 650 miles. The Northern Route passes through the states of Idaho, Montana, and Washington, does not pass through Indian Reservations, and is about 700 miles in length. The Southern Route does not utilize any of the routes described in the TMI FPEIS²³ with the exception of the last few miles from Kennewick (WA) to the disposal area. The northern route makes use of the approved route for transporting the liners directly from TMI to Richland from the junction of I-15 and I-90 (a few miles west of Butte, MT) to the disposal area. A detailed description of the two routes follows.

3.2.1 Southern Route

The Southern Route (Figures 5 and 6) travels south from TAN-607 within the INEL to the junction of US-26 and US-20 near the Central Facility Area. From that junction, it proceeds southeast on US-26 to its junction

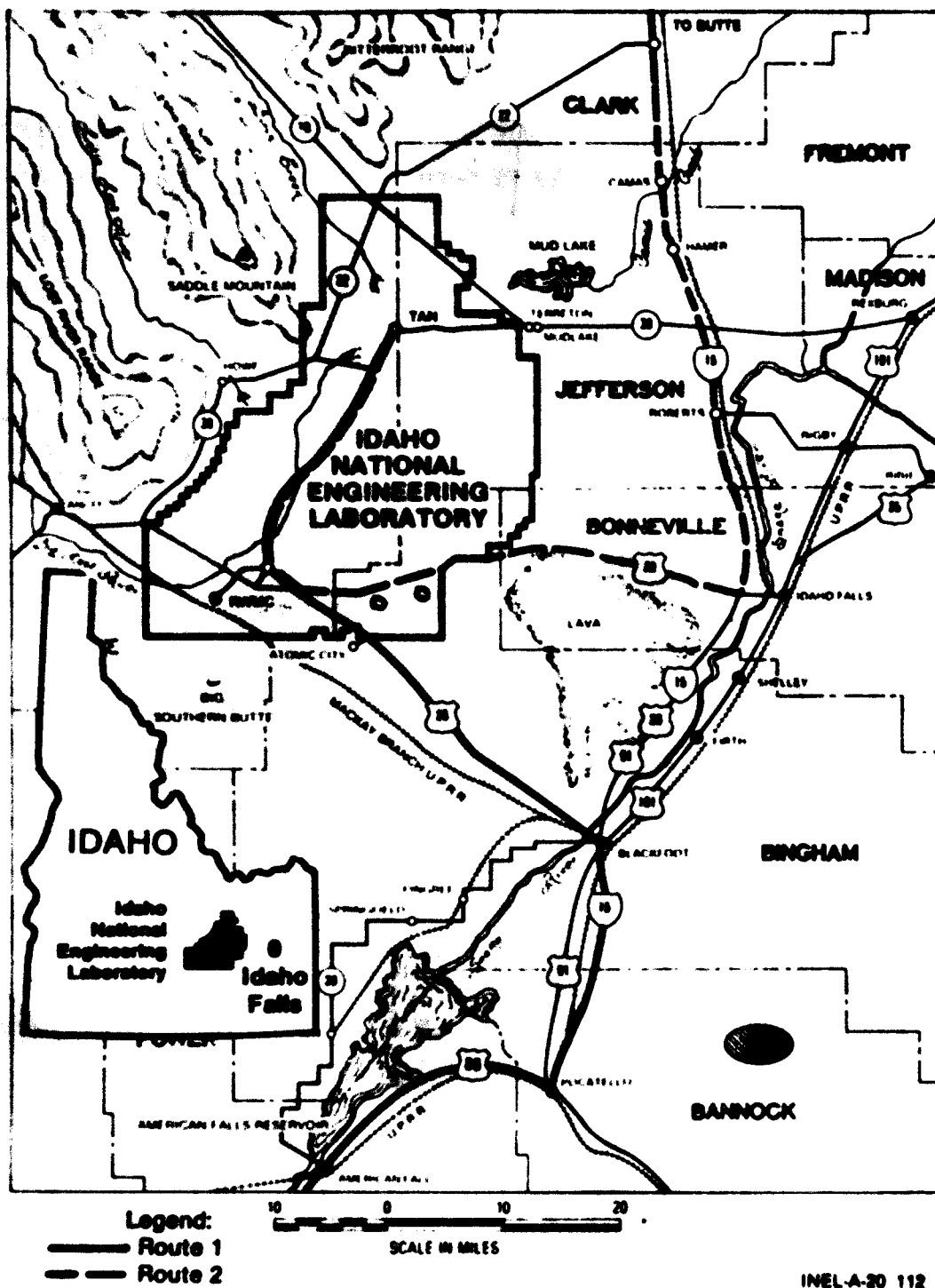
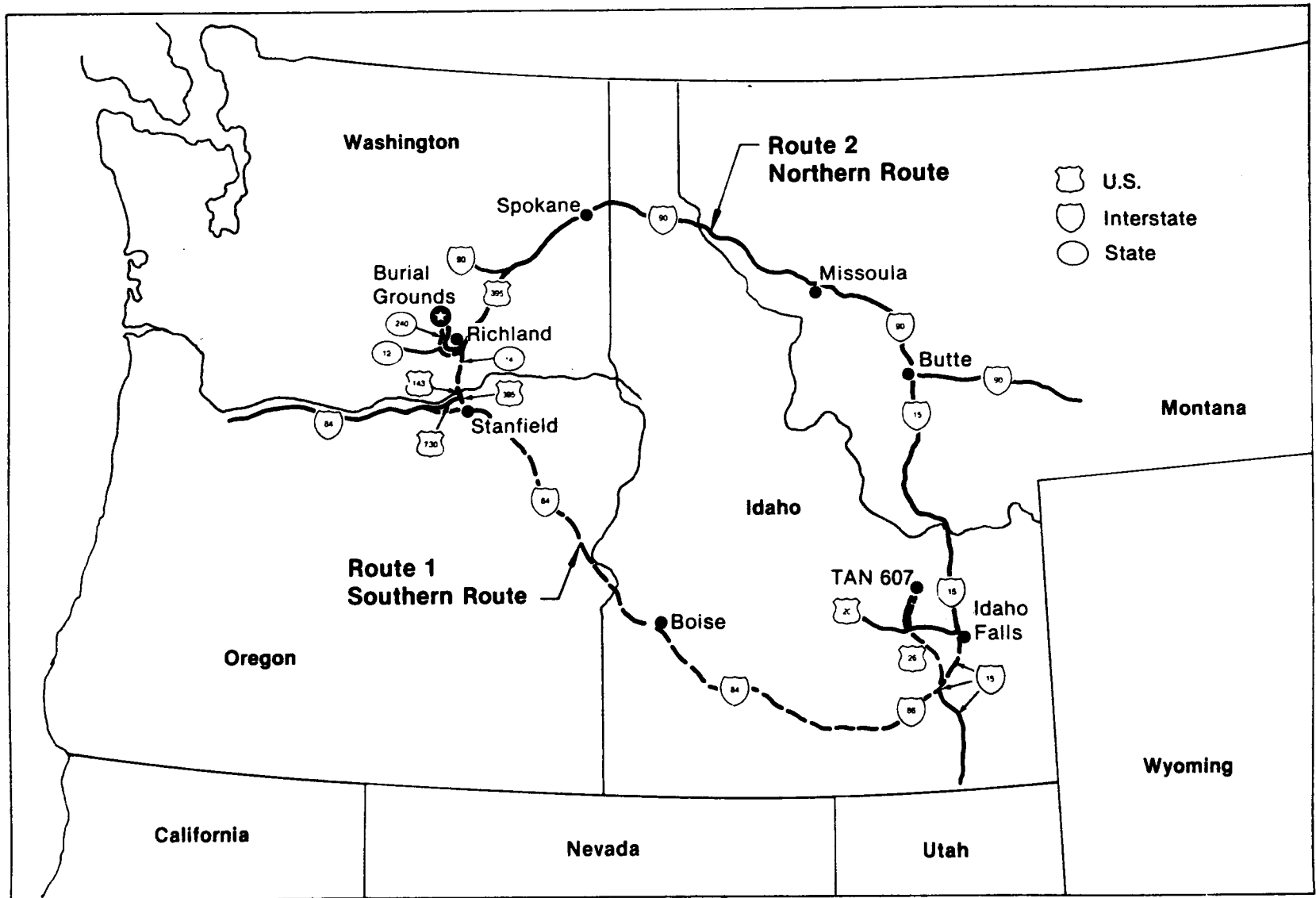


Figure 5. Idaho National Engineering Laboratory vicinity map.



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Figure 6. Map showing the two routes for shipping HIC's from INEL to the Washington State commercial burial ground at Richland.

with I-15 near Blackfoot, Idaho. From that junction, it proceeds south on I-15 to its junction with I-86 near Pocatello, ID. From there, it proceeds southwest on I-86 where it merges with I-84 east of Burley, ID. On I-84, it proceeds northwest to its junction with US-395 at Stanfield, Oregon. From that junction, it proceeds north on US-395 to its junction with US-730 near Umatilla, Oregon. It proceeds west on US-730, a couple of blocks, to its junction with US-143. From that junction it proceeds north on US-143, crossing the Columbia River, to its junction with Washington State Highway 14. Proceeding northwest on Washington State Highway 14 it joins with US-12 near Kennewick, Washington. It proceeds west on US-12 to its junction with Washington State Highway 240 and proceeds northwest on Washington State Highway 240 to its destination at the commercial burial grounds.

3.2.2 Northern Route

The Northern Route (Figures 5 and 6) leaves TAN-607 by the same route as does Route 1 through the Central Facility Area. From there it proceeds east on US-20 to its junction with I-15 near Idaho Falls, ID. From that junction, it proceeds north on I-15 to its junction with I-90 a few miles west of Butte, Montana. From that junction, it proceeds northwest on I-90 to its junction with US-395 just west of Ritzville, Washington. It proceeds southwest on US-395 to its junction with US-12 (at Pasco, WA). At that point, it proceeds west on US-12 to its junction with Washington State Highway 240 where it follows Washington State Highway 240 northwest to the burial grounds.

4. SAFETY ANALYSIS

This chapter considers safety aspects of the shipment of EPICOR-II liners from INEL to Richland for disposal. Each liner will be placed in an HIC and transported individually to Hanford in a shielded cask. The cask is sealed and has been analyzed for severe accident conditions. Any radioactivity that might be released during transit is extremely remote.

As discussed in Section 1.1, safety assessments were prepared for shipment of the liners from TMI to INEL. A total of 50 of the liners have been transported to INEL without incident. The transport of liners from INEL to Richland is expected to pose even lesser risk because of additional protection and shielding being provided by the HIC and the route being both one third as long as that from TMI to INEL and situated in mostly rural areas.

Section 4.1 presents criteria which must be fulfilled before shipment can commence. Section 4.2 contains an accident analysis, comprising a consideration of accident occurrence and analyses of possible accidents--transportation, explosion, and fire. Section 4.3 presents maximum radiation levels expected outside the cask under normal and accident conditions.

4.1 Criteria Required for a Safe Shipment

The EPICOR-II liners differ from other common demineralizer radwaste in that quantities of radioactivity have been contained within the ion exchange media for over three years. Radiolysis produced hydrogen during the time liners were in storage. Therefore, certain criteria were developed to control combustible gas mixtures while the liners are in transit. Criteria for transport of liners from INEL to Hanford are much the same as those used to ensure safe transport of liners from TMI to INEL.² The criteria, when implemented, will ensure that concentrations of combustible gas mixtures greater than the lower limits of flammability will not exist within the liner or during shipment from the INEL to the

Washington disposal site. The liner will be in compliance with the applicable DOE, NRC, and DOT regulations. The EG&G Safety Division approved procedures required to satisfy the criteria are as follows:

- o After removing the liner vent plug, purge liner with commercial grade argon.
- o Recap the liner with a porous metal plug and make radiation surveys.
- o Load the liner into a HIC and allow time for the epoxy seal to cure.
- o Load the HIC into the cask and seal in the approved manner.
- o Conduct radiation and safety inspections of the cask shipment for compliance to all applicable DOT, NRC, and DOE regulations.
- o Submit results of radiation survey, gase sampling, and safety inspection to EG&G Idaho, Inc.

Upon determination of the combustible gas generation rates, an appropriate time window for shipment of the liner will be specified by EG&G Idaho, Inc. The shipping window will be the same as was used to ship the liners to the INEL from TMI.

4.2 Accident Considerations

4.2.1 Transportation Accidents

As in transport of any material, there is a certain amount of risk. The EPICOR-11 liners are classified as a low-level waste (Class C) and, because of their activity levels, they must be shipped in a certified Type B container, having adequate shielding and a maximum volume of 212 ft³ (6.0 m³). Shipments of the type planned are common in the United States.

"Past incident and accident experience in low-level waste transportation is documented in the Radioactive Materials Transportation Incident Data Base maintained by the Transportation Technology Center at Sandia National Laboratories, Albuquerque, New Mexico. That data base incorporates information from the Hazardous Materials Incident Reporting System (HMIR) instituted by DOT in 1971, from NRC short form and preliminary notification reports dating from 1976, and from supplementary data sources including the Emergency Operations Center of DOE and State radioactive materials control or radiation protection departments."²⁴ The incident and accident experience for the period 1971 to 1981 reflects the following statistics in low-level waste transportation safety:

- o Of an estimated 50,000 low-level waste shipments (all types) in the past nine years, there were 312 incidents (including accidents). That number of incidents leads to an approximate incident probability of 0.6% per shipment.²⁴
- o Of those 312 incidents, 27% (83) involved suspected releases of radioactivity which did not occur, 63% (199) involved trace surface contaminations, 10% (30) involved the release of limited quantities of radioactive materials, and 7% (22) were transportation accidents, none of which resulted in release of material.²⁴ The probability of a transportation accident based on past experience is 0.042% per shipment.²⁵

The accident rate for all shipments by truck is 1.7×10^{-6} accidents/mile.²⁶ Using a distance of 700 miles (1130 km) from INEL to Hanford and 50 shipments of individual liner, the probability of an accident occurring is approximately 0.06 during the transfer of all 50 liners. That is, any sort of transportation incident is very unlikely.

An "extra-severe" truck accident involving a collision at 50 mph or greater and resulting in a fire lasting more than one hour is expected every 6×10^{13} truck miles.²⁷ That frequency in an accident probability of 6×10^{-10} for all 50 shipments. Severe accident scenarios are considered as part of the Certificate of Compliance approval process

for the CNS 14-190 (USA/5026/B()) cask. Granting of the certificate ensures that the cask and its contents will survive these accidents with minimal significant consequences. The configuration of the HIC enclosed in the CNS 14-190 (USA/5026/B()) cask has been evaluated and shown to meet all the applicable requirements of 10 CFR 71.²¹ The HIC itself has been subjected to severe drop tests (see Section 2.2.1) and shown to maintain its integrity.²¹ Therefore, environmental concerns associated with a transportation incident are limited to nonradioactive effects (oil and fuel spillage, fire, etc.).

The probability of the safe shipment of all 50 liners is enhanced by a sound Program Plan²⁸ for all stages of the project with appropriate equipment and trained, experienced personnel to implement the plan. EG&G Idaho, Inc., the cask manufacturer, and the transportation firm are all experienced and trained to safely handle and transport radioactive materials. EG&G Idaho is a prime contractor at the INEL and has years of experience in the design, testing, and day to day operation of radioactive material handling systems. The cask manufacturer, and the transportation firm, have been involved in the packaging, transporting, and handling radioactive materials associated with commercial power production for many years. The firm selected to transport the liners to Washington will be selected using the same criteria. That experience, coupled with regulations governing the packaging and transportation of radioactive materials, provide a sound basis for the safe transportation of EPICOR-II liners from INEL to Richland.

Emergency preparedness is an important mitigative measure in case of accidents or hazardous incidents during transportation. If an accident occurred during transportation, the emergency plan developed by the appropriate state would be implemented. Also the Radiological Assistance Plan and the Federal Interagency Radiological Monitoring and Assessment Plan would be available to support the state plan. Moreover, each driver will receive detailed descriptions of the routes, instructions for drivers involved in accidents, emergency procedures for radioactive waste accidents, and emergency telephone numbers.

4.2.2 Possibility of Hydrogen Ignition

As indicated above (Section 4.1), the long storage times for the EPICOR-II liners have allowed hydrogen to be generated. Although no ignition source will be present inside the liner, HIC, or cask, the procedures listed in Section 4.1 preclude the occurrence of a combustible mixture during transit.

4.2.2.1 General Background. The first liner to leave TMI was PF-16 which was believed at that time to contain more radioactivity than any of the other 49 liners. Before being shipped to Battelle Columbus Laboratory (BCL) in May 1981, PF-16 first was moved from the staging facility to the Chemical Cleanup Building at TMI for examination. After the ventilation plug had been unscrewed four turns, combustible gas alarms in the building sounded, indicating that hydrogen may have been present. No gas sample was collected. The ventilation plug was removed and replaced the next day, and the liner packaged and readied for transportation to Columbus, Ohio. Two weeks later, when BCL opened the liner, no gas was detected; but an analysis of the atmosphere within the liner indicated about 12% hydrogen and minute amounts of oxygen (<1%). Examination of the resin in PF-16 suggested that the resin had not been altered physically.²⁹

A 25-day gas generation experiment was performed at BCL using liner PF-16. At the start the vapor space was filled with air (20.9% O₂ and negligible H₂). After 25 days the O₂ concentration had dropped to 16.7% and the H₂ concentration was 0.40%.³⁰

These developments indicated that combustible gas ignition should be considered in a complete Safety Assessment for the shipment of demineralizer resins which have accumulated a loading of about 1000 Ci or more and which have been in storage for periods on the order of a year.

For an explosion of gaseous fuels to occur, four general conditions must be met. They are as follows:

- o A combustible gas within a flammable or detonable concentration must be present within the liner.
- o An oxidizer such as air (oxygen) must be in admixture.
- o An ignition source must be present.
- o Chain carrier radicals (ions) must be produced within the flame front which propagate the combustion reaction.

The reduction to a safe level or elimination of any one of those four conditions prevents a gas phase explosion.

4.2.2.2 Research Results. Brookhaven National Laboratory (BNL) conducted a literature search of the state-of-the-art of knowledge on radiation effects on organic ion exchange resins in 1977.³¹ Two laboratory studies and two updated reviews were reported in 1980.^{32,33,34,35} The experimental results reported through 1980 have been for either organic resins or inorganic (zeolite) materials, but not for mixtures of the two types. Generally, the laboratory studies found that organic resins in radiolytic environments produce combustible gases, such as hydrogen and methane, and also of carbon dioxide and, in lesser amounts, carbon monoxide. The inorganic resins in radiolytic environments produce hydrogen and oxygen via radiolysis of water present in the resin bed.

Two studies published in 1981 find effects on ion exchange media in radiolytic environments not previously reported or addressed.^{36,37} The first study reported that, although elevated H_2 , CO_2 , and CO concentrations were measured in an EPICOR liner, the oxygen concentration measured was two orders of magnitude lower than the concentration present in ambient air. The concentration of oxygen present in the liner was below that necessary to form a combustible mixture with hydrogen. The latter study found that resins in stainless steel containers irradiated by gamma and electron sources showed depletion of oxygen and that container

pressures first decreased below initial values before increasing with increased dose. Since stainless steel containers were used, the oxygen could not have been depleted via corrosion.

The most recent resin irradiation studies at INEL indicate that, for integrated doses of 0.75 to 1.5 megarad using a fuel element irradiation source, oxygen concentrations are depleted in excess of 90% in an organic resin environment while oxygen concentrations are depleted between 10 and 20% in an inorganic resin environment.³⁸ Therefore, removal of all the oxygen in the gas space of the liner before sealing will preclude combustion since no oxidizing agent will be available to react with the hydrogen.

Hydrogen generation tests were performed at TMI by GPUNC on some of the liners before the shipment to INEL. The tests were made over periods of several weeks. The available data are summarized in Table 6. The hydrogen generation-rate was proportional to the curie loading. The average rate is approximately $1.64 \times 10^{-6} \text{ cm}^3/\text{Ci-s}$.³⁹ In addition to the hydrogen generation-rate study, studies at BCL and TMI have verified that oxygen is almost entirely absent in the liners because of an oxygen depletion mechanism. Subsequent to the gas generation studies, each liner sent to the INEL had the initial atmosphere sampled, was purged with nitrogen, and then had the hydrogen generation-rate measured, over a period of 2-4 days. That was done to demonstrate that the liner atmosphere would have hydrogen and oxygen concentrations less than the lower limits of flammability during the maximum shipping period.⁴⁰ The lower limits of flammability are a hydrogen concentration of $0.052 \text{ g-moles/ft}^3$ and an oxygen concentration of $0.063 \text{ g-moles/ft}^3$.⁴¹

4.2.2.3 Analysis for Shipment. Before shipment, each liner is purged with nitrogen and then closed with a porous plug. The porous portion of this plug is a sintered metallic material containing passages on a microscale which allow gases to escape but precludes the escape of particulate material. Such a flow path does not promote the mixing of the air from the free volume of the HIC with the nitrogen, and any hydrogen

TABLE 6. HYDROGEN GENERATION IN THE TMI-2 EPICOR-II PREFILTER LINERS

<u>Liner Number</u>	<u>Activity (Curies)</u>	<u>Hydrogen Generation Rate</u>		<u>Calculated^a (days)</u>
		<u>(cm³/Ci-s)</u>	<u>(g/h)</u>	
1	1498	1.558 E-6	0.00844	89.8
2	1052	2.197 E-6	0.00832	91.4
3	1878	1.464 E-6	0.00990	90.1
6	166	<0.0001	<0.0001	>150
7	1402	1.337 E-6	0.00675	132
32	1767	1.651 E-6	0.0105	85
35	1767	1.651 E-6	0.0105	85
36	1767	1.651 E-6	0.0105	85
39	1767	1.651 E-6	0.0105	85
40	1767	1.651 E-6	0.0105	85
42	1767	1.651 E-6	0.0105	85
46	2184	1.526 E-6	0.012	74

a. Time to reach lower flammability limit.

that is generated in transit, in the liner. Nonetheless, since a gaseous flow path exists from the liner to the HIC (through the porous plug) and from the HIC to the cask (through the vent system of the HIC), the possibility of an air-hydrogen mixture forming must be considered. The most conservative assumption is that the nitrogen in the liner is somehow replaced with air, while the hydrogen remains in the liner. That allows the hydrogen to mix into the smallest volume of air.

The minimum free volume in any of the liners is 714 l. This is for the liner with the most resin and includes void space. Using this volume and a hydrogen generation rate of $1.64 \times 10^{-6} \text{ cm}^3/\text{Ci-s}$ as given above, the flammability limit would be reached in 74 days in the liner. Thus there is well over two months to transport each liner to Hanford and dispose it before hydrogen ignition is possible. In actuality, placement in the HIC, transport, and disposal is only expected to take about one week.

Note that this analysis conservatively assumed that the hydrogen remained in the liner and air passed through the porous plug to replace the nitrogen which passed out through the same plug. In reality, the increased pressure in the liner due to the hydrogen generation is likely to force some of the H_2 and N_2 out of the liner and very little mixing of air into the liner will occur. In this case, with the larger HIC free volume and only part of the hydrogen available, the time to obtain a combustible mixture will probably be one or two years.

4.2.3 Fire

One severe accident considered feasible is collision of the truck carrying the liner with a truck containing a flammable liquid such as gasoline. Conceivably, following an accident the trailer and cask could end up near the center of the fire due to the ignition of vapors from the pool of spilled liquid fuel. The cask is completely constructed of non-combustible material, and the 7 inches (17.8 cm) of concrete in the wall provide a substantial thermal barrier for periods approaching an hour. Tests on actual type B casks have shown that they can withstand fires of this type without leakage. For the CNS 14-190 (USA/5026/B()), this type of accident is considered in more detail in the SAR.²² 49 CFR 173 specifies a radiant heat source at 1475°F (802°C) for 30 minutes, after which an environmental temperature of 130°F (54.4°C) holds. The maximum temperature attained on the inside surface of the cask was less than 200°F (93.3°C).

4.3 Radiation

This subsection consists of three parts. First, the radiation field outside the shielded cask is considered to demonstrate that there is no risk to the general public. Secondly, the radiation exposure of the drivers is computed to show that their dose is well below specified limits. Finally, radiation levels following a postulated accident are shown below appropriate limits.

Radiation levels outside a shipping cask containing a HIC and liner will be below those measured during transport of liners from TMI to INEL. That is due to the additional shielding, about a factor of 9, provided by the HIC. Actual tests have shown that the HIC is structurally sound and retains its integrity in any credible accident.²¹

4.3.1 General Radiation

A radiological analysis was done for the EPICOR-II liner in transit configuration, i.e., with the liner inside the HIC which in turn is within the sealed CMS 14-190 (USA/5026/B()) cask.^{42,43} The analysis was done using liner PF-46, the liner with the highest remaining inventory⁴⁴ corrected for decay to September 19, 1983. The inventory is shown in Table 7. The geometry used is as shown in Figure 7. The calculations were done using the computer code ISUSHLD-II.⁴⁵

The maximum field at the side of the cask was calculated to be 50 mR/hr at contact, falling off to 10 mR/hr at 3 feet. Maximum fields from the cask top were calculated to be 10 mR/hr at contact and 5 mR/hr at 3 feet respectively. These are well within the 10 CFR 49 Section 173.393 (i,j) limits of 200 mR/hr at contact, and 10 mR/hr at 6 feet from the vertical planes projected from the edge of the vehicle. The fields are also within EG&G Safety Manual limits for radioactive shipments. Since those radiation levels are well below the appropriate limits, the hazard to the general public, who will neither be in contact with the cask nor in its general vicinity for any appreciable period of time, is minimal.

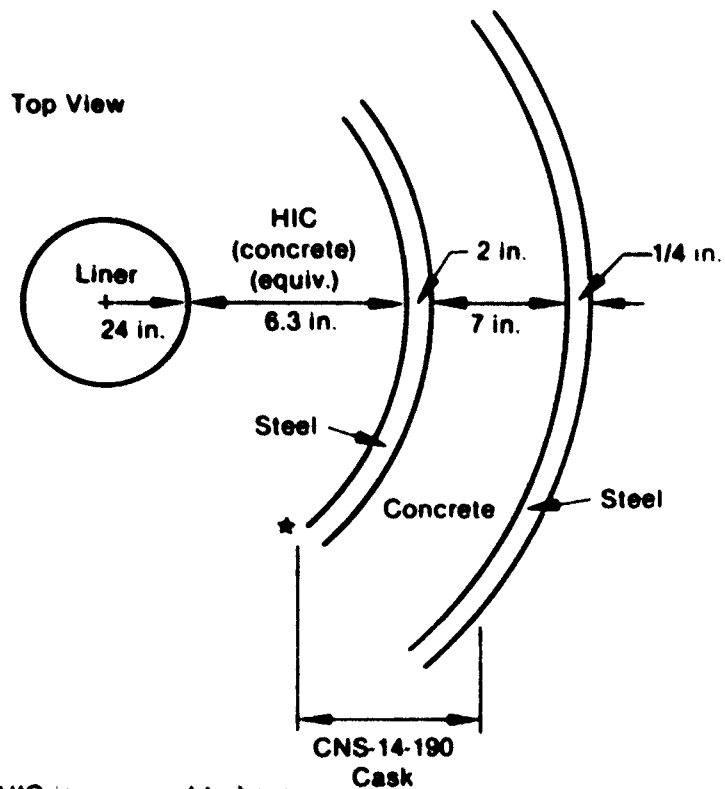
TABLE 7. RADIOISOTOPIC INVENTORIES USED FOR SHIELDING CALCULATIONS^a

<u>Isotope</u>	<u>Inventory (Ci)</u>
Cs-137	934
Ba-137 ^b	934
Cs-134	57
Sr-90	94
Y-90	<u>94</u>
Total	2113

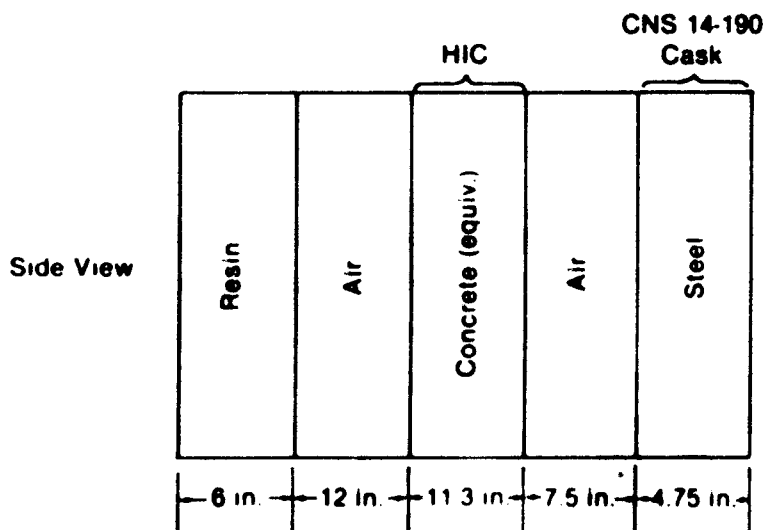
a. Other radioisotopes present in the liner add an insignificant external radiation dose.

b. Ba-137 is a decay product of Cs-137. Since it has a much shorter half-life than Cs-137, it is in equilibrium with Cs-137.

The final Programmatic Environmental Impact Statement (PEIS) for the TMI accident indicated that the population dose to people (estimated 700,000) living along a 2,750 mile (4,427 km) route from TMI to the disposal site would range from 17 to 50 person-rem for all TMI waste and fuel shipments. Thus, the average dose to an individual living along this route would range from 0.02 mrem to 0.1 mrem. The population dose and average individual dose rates would be lower for the shipments of liners from INEL to Richland because: (1) the route is much shorter; (2) the radiation fields around the casks are greatly attenuated due to the HICs; (3) less waste is being shipped than was considered in the PEIS; and (4) the population along the route is much lower than that used in the PEIS calculations. Thus, normal transport of EPICOR-II liners should not pose a radiological health hazard.



★ NOTE - The HIC is assumed to have shifted directly against cask side for conservatism.



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Figure 7. Shielding geometry of CNS-14-190 shipping cask containing HIC and EPICOR-II liner.

The radioactivity decay heat generation rate in any shipment will be less than 8 watts, and external radiation readings will be a small fraction of the design shielding limit of the cask.^{13, 14, 15, 16} The dose rates for each shipment will be verified by measurement after the liner is loaded in the shipping cask.

4.3.2 Exposure of the Drivers

Unlike the general public along the transit route, the drivers will be relatively close to the cask for extended periods of time. By utilizing two drivers the shipment will go straight through to Richland with only food and fuel stops. Maximum truck travel time is estimated to be 20 hours, which allows for an average of 35 mph via the longer route. [Driving time could be as short as 12 hours, if a 55 mph average is maintained for the shorter route.] Only the truck travel time is used in computing the dose to the drivers, because the drivers are expected to be away from the truck during stops. If severe winter weather or other road closures cause the trip to be interrupted, one driver is required to remain with the shipment at all times. This contingent dose has not been assessed due to the unknown duration of the interruption; it, however, may approach an equivalent to the dose of one additional trip that is shown below as a small fraction of the allowable annual dose.

As shown in Figure 8, the driver closest to the cask will be the one resting in the sleeper portion of the truck cab. For simplicity it is assumed that both drivers are only 20 feet (6.1 m) from the front of the cask although the minimum distance (depending on the tractor used) will be at least 22 feet (6.7 m). A shielding analysis done for 20 feet showed the radiation level to be 0.54 mR/hr for the highest inventory cask.⁴⁶ This is significantly below the DOT limit (10 CFR 49 173.393j) of 2 mR/hr at any occupied cab location. Therefore, the maximum dose per shipment is 11 mR. Two teams of drivers will be used to transport the 50 casks, so the maximum dose received by any one driver (25 trips) is 270 mR. That is well below the maximum occupational dose (whole body) of 5000 mR/yr set by DOE.⁴⁸

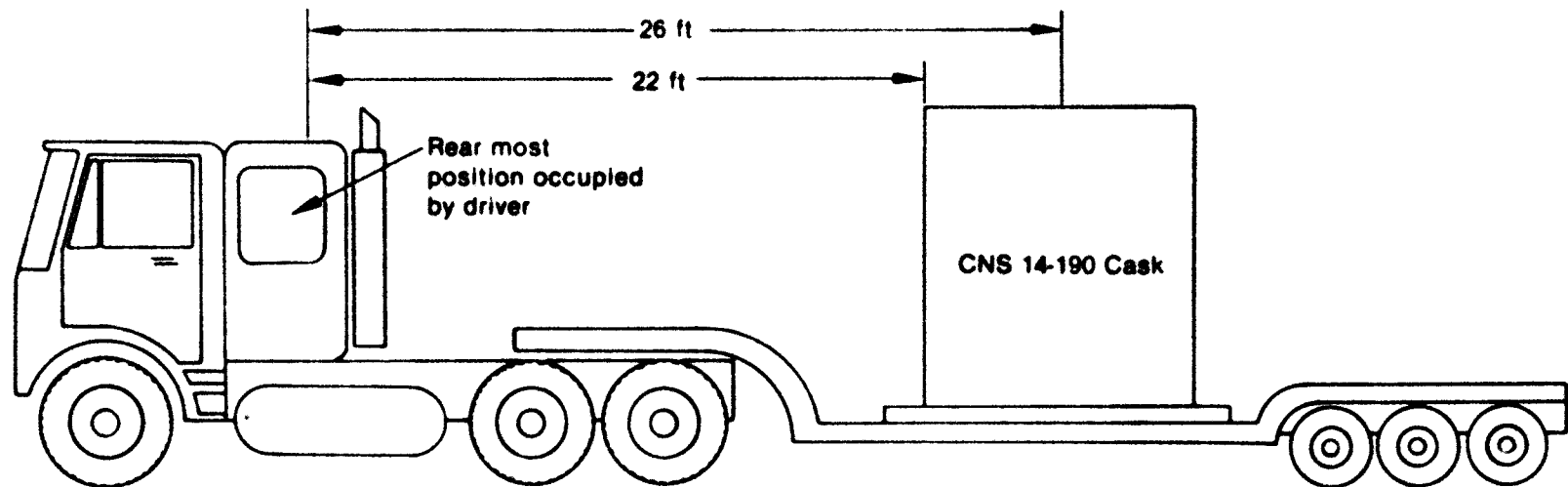


Figure 8. Complete vehicle as loaded for transport of EPICOR-II liner and MIC in CNS-14-190 cask from INEL to Richland.

4.3.3 Radiation Levels Following an Accident

The CNS 14-190 (USA/5026/B()) cask which will be used to ship the EPICOR-II PF liners from INEL to Richland is a licensed type B cask meeting all applicable DOT, NRC, and DOE requirements. Figure 4 illustrates the cask. A copy of the certificate of compliance (SAR) is contained in Appendix B. Details are contained in the Safety Analysis Report for the cask.²²

Analysis for the CNS 14-190 (USA/5026/B()) cask, described in the SAR, demonstrates that the reduction of shielding caused by imposing the hypothetical accident condition loads as specified in Appendix B of 10 CFR 71 will not increase the external dose rate to more than 1000 mR/hr at 3 feet from the external surface of the package and that none of the contents would be released from the package. The hypothetical accident conditions specified in Appendix B of 10 CFR 71 were applied sequentially to determine their cumulative effect on the cask package.

As discussed above, the cask will retain its integrity and its contents under severe accident conditions. The worst case accident condition is that both the liner and HIC have ruptured (although highly unlikely) and the resin has escaped and flowed to the bottom of the cask which is lying on its side. The lower surface of the resin will conform to the curved cask wall and the top surface may be irregular. This resin distribution has been modeled for ISOSHLD-II as a rectangular block 7.35 feet by 3.46 feet by 1.26 feet high. The source material is assumed to be homogeneously distributed through this block. Considering only the shielding provided by the cask, the maximum field outside the cask was found to be 630 mR/hr at the cask surface and 400 mR/hr 3 feet from the cask. These are well below the 1000 mR/hr at 3 feet specified by 10 CFR 71.36(a). Note that this assumes that the person is located directly below the cask and that the HIC has lost its structural integrity, both of which are highly unlikely. For more probable occurrences, the dose rate would be much lower than the calculated values.

Recent estimates indicate that current shipments involve approximately 2,500,000 packages of radioactive materials per year in the U.S. There have been no known deaths or serious injuries to the public or transportation industry personnel as a result of any radioactive material shipment.⁴⁷ Therefore, considering the designed curie limit of the cask, the low curie content of the liners, the history of radioactive shipments, and the minimal risk of contamination or release, it is concluded that these shipments will not compromise the safety of people living along the proposed routes.

4.4 Safety Assessment Summary

Criteria have been prepared to ensure that each shipment will meet all applicable requirements and that each shipment will be adequately prepared to reach Richland safely. An analysis of an estimated 50,000 shipments of radioactive material over a nine year period shows that only 312 incidents of any sort happened. Only about 10% of transport incidents resulted in more than minor surface contamination, and there has been no case in which a major release of radioactivity occurred. Based on the historic accident rate, the occurrence of an accident in the transport of all 50 liners to Hanford is very unlikely. All of the 50 liners have been shipped from TMI to INEL without incident.

In the unlikely event that a serious accident should occur, the construction of the cask is such that leakage of radioactive material from the cask is extremely remote. Tests have shown that the HIC did not lose its structural integrity due to impact loadings typical of a severe accident.^{1d}

The possibility that enough hydrogen may be generated by radiolysis within the liner to create the required conditions for ignition has been carefully considered. Under the worst possible assumptions, the measured rates of hydrogen production will not cause the H₂ concentration to reach the lower flammable limit in less than 74 days. Under the most time-consuming scenario, only two weeks will elapse between installation of the

porous plug in the liner at INEL and burial at Richland. Therefore, the hydrogen concentration will be below the lower flammable limit for the entire shipment.

The radiation fields in the vicinity of the cask have been computed and shown to be well below the applicable limits, under both normal and accident conditions. The dose received by the drivers is only a small fraction of the allowable occupational dose.

The requirements for a safe shipment have been met and 50 EPICOR-II liners can be transported from INEL to Richland without undue risk to either the general public or the personnel involved.

5. ENVIRONMENTAL SYNOPSIS

The purpose of this section is to evaluate potential environmental effects associated with the transport of EPICOR-II liners from the INEL to a commercial radioactive waste disposal facility at Richland, Washington for final disposal. The overall environmental concerns associated with the TMI accident were addressed by the final Programmatic Environmental Impact Statement (PEIS) that was prepared by the NRC.¹ Furthermore, an Environmental Synopsis was prepared in 1982³ for transport of 50 EPICOR-II liners from TMI to the INEL. Thus, this is the final phase of program to evaluate and then dispose of EPICOR-II liners.

5.1 Description of Environment

5.1.1 Route 1

Route 1 is 650 miles (1,000 km) long and passes through southern Idaho, northeastern Oregon and then goes north from Hermiston, Oregon to the disposal site at Richland, Washington. Approximately 70% of the route occurs in agricultural or sagebrush/grassland areas and the remainder (30%) passes through the forested mountains of northeastern Oregon. Most of the areas along the route are used for farming and ranching. Approximately 210,000 people live within 0.5 miles (0.8 km) of this proposed route. This estimate is based upon an average population density of 330 people/mile² (127 people/km²).¹

This route does not bisect any major cities but does skirt the edge of Pocatello and Boise, Idaho and Baker, LeGrande, and Pendleton, Oregon before reaching Richland, Washington. The route does not pass through any major recreational areas but does occasionally follow the Snake River in southern Idaho.

5.1.2 Route 2

Route 2 is about 700 miles (1,100 km) long and passes through southeastern Idaho, western Montana, and eastern Washington. Approximately 65% of the route traverses forested, mountainous areas in all 3 states. The remainder of the route passes through farmland and areas dominated by sagebrush and grassland. The areas along the route are primarily used for agriculture, ranching and timber harvesting. Based on an average of 330 people/mile² (127 people/km²)¹ approximately 230,000 people live within 0.5 miles (0.8 km) of this proposed route.

The proposed route bisects Spokane, Washington and borders Missoula, Montana, Coeur D'Alene, Idaho, and Pasco, Washington. Coeur D'Alene is a popular recreation area.

5.3 Potential Environmental Impacts

5.3.1 Transportation

The transportation of EPICOR-II liners from the INEL to the Richland Site is not expected to have noticeable environmental effects. Vehicle emissions, engine noise, and heat will be produced as part of normal trucking operations. These effects will be temporary and not cause a significant changes in the existing air quality along the highway. Under normal transportation and storage conditions, no routine effluents or releases from the casks or transport vehicles are expected.¹ "Normal" transportation is the situation when transportation occurs without unusual delay, loss, or damage to the package, or an accident¹¹ involving the transport vehicle. The impact on the environment is considered negligible under this condition.

As previously stated, EPICOR-II liners will be transported from the INEL to Richland in HICs. This is the only transport condition that differs from those described in the previous Environmental Evaluation prepared for transport of EPICOR-II liners from TMI to the INEL.³ The

use of HICs should further decrease the chance of accidentally releasing radionuclides to the environment. Thus, another safety feature has been added.

5.3.2 Transportation (Incident Conditions)

Incident frequency is discussed in Section 4. An incident involving the release of radionuclides was considered highly unlikely in the previous Environmental Evaluation for EPICOR-II liners³ and is even less likely now because of the use of HICs. Therefore, environmental concerns associated with a transportation incident are limited to nonradioactive effects (oil and fuel spillage, fire, etc). These effects would be similar to those from any large truck accident and should have little effect on the environment.

5.3.3 Radiation Exposure

The principal environmental impacts from normal transport and disposal conditions are radiological. These impacts include direct radiation exposure to workers, truck drivers, and bystanders along the route. Radiation exposures have been discussed in Section 4.

5.3.4 Mitigative Measures

The use of HICs also provide an important mitigative measure and have been discussed previously in this report. These conditions are discussed in Section 4.

The most effective mitigative measure is developing a sound project plan for all stages of the project with appropriate equipment and trained, experienced personnel to implement the plan.

5.4 Anticipated Benefits and Alternatives

5.4.1 Benefits

Using HICs to transport waste may be the most important benefit of this action. The successful use of HICs should demonstrate a safe, environmentally sound method of transporting radioactive waste.

Furthermore, the proposed action will remove radioactive waste from the INEL. Transportation of the liners to Richland will also result in the disposal of TMI waste.

5.4.2 Alternatives

The U.S. Ecology disposal site at Richland is the only facility that will currently accept TMI waste. The radioactive waste management sites at the INEL and Nevada Test Site will only accept defense related waste. The waste disposal site at the Savannah River plant will not accept TMI waste because of public sentiment. Therefore, transportation of EPICOR-II liners to another facility is not possible at this time.

5.4.2.1 Mode of Transportation. Shipments by truck or intermodal rail/truck are alternatives for the transport of EPICOR-II liners to Richland. Trucks can depart from the INEL and go directly to the disposal location at the Richland Site. Availability of shielded rail casks is limited; there are constraints imposed on rail shipments that create logistics problems and increase shipment duration; and intermodal shipments may involve higher exposure levels to handlers than do single mode shipments because of the transfers required. Therefore, truck transportation from the INEL to the disposal location at Richland is considered the most acceptable mode of transport for EPICOR-II liners.

5.4.2.2 Routes. Only two routes available for shipping EPICOR-II liners from the INEL to Richland have been described. Other routes could be used but they are much longer and/or not suitable for a heavy or radioactive shipment.

5.4.2.3 No Action. The no action alternative would result in the liners being retained at the INEL. Although the INEL has a waste disposal complex, this facility is not presently authorized to accept commercial waste. Therefore, this alternative is unavailable at this time.

6. CONCLUSIONS

6.1 General Conclusion

It is proposed to ship 50 EPICOR-II liners, each loaded and sealed in a HIC, to a commercial disposal site near Richland, Washington. Each liner and HIC will be shipped as a certified truck shipment in a CNS 14-190 (USA/5026/B()) shielded cask. Specific conclusions for the Safety Analysis and the Environmental Synopsis are listed below. Based upon those conclusions it is concluded that the liners can be safely shipped as proposed with no adverse environmental effect.

6.2 Safety Analysis Conclusions

Based upon the safety analysis of Section 4 it is concluded that:

1. The probability of a traffic accident while shipping the liners is very low. Fifty EPICOR-II liners already have been transported from TMI to INEL without incident. The distance from TMI to INEL is about three times as great as that from INEL to Richland.
2. The cask would contain the radioactive contents of the liner, if an accident were to occur. It is also highly unlikely that the HIC would rupture.
3. The combustible gases will not reach the lower flammable limit during shipment of the liner.
4. There are minimal consequences of a fire following an accident.
5. Radiation fields are below prescribed standards for both normal and accident conditions. The HIC reduces the radiation levels to a fraction of those measured during shipment of the liners from TMI to INEL.

Therefore it is concluded that the liners can be safely shipped.

6.3 Environmental Synopsis Conclusions

Based upon the environmental synopsis of Section 5 it is concluded that:

1. If no accident occurs, the environmental effects are limited to routine highway trucking. No adverse impacts have been observed in the transport of all 50 liners from TMI to INEL, a journey about three times that from INEL to Richland.
2. Should an accident occur during transport environmental effects are limited to those common to routine trucking. The HIC and the cask will prevent the escape of any radioactive materials and provide adequate radiation shielding even under accident conditions.
3. Measures exist to mitigate the environmental impacts in the unlikely event of a radiological release.
4. The benefits of trucking the liners to Hanford exceed those of the other alternatives.

Therefore it is concluded shipping the liners as proposed has no adverse environmental effects.

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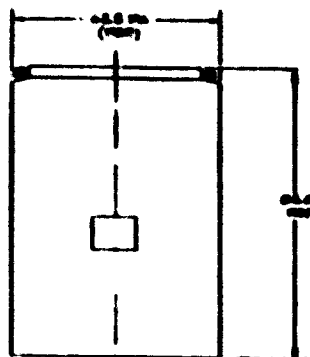
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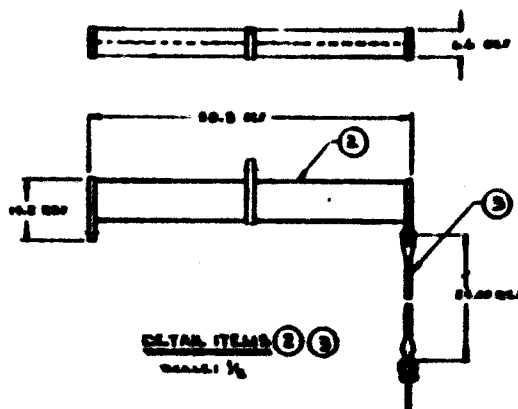
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APPENDIX A

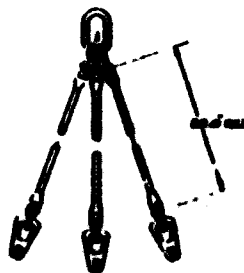
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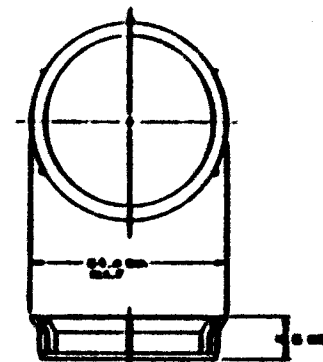
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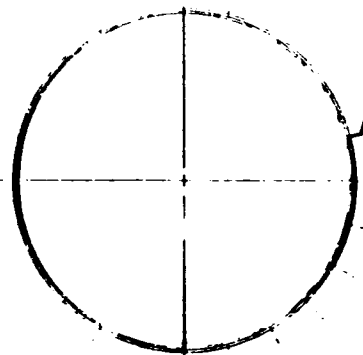


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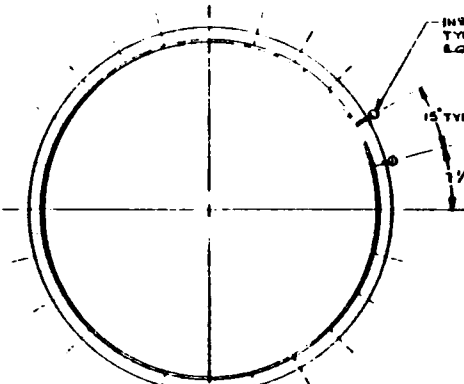
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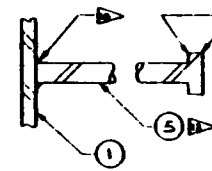
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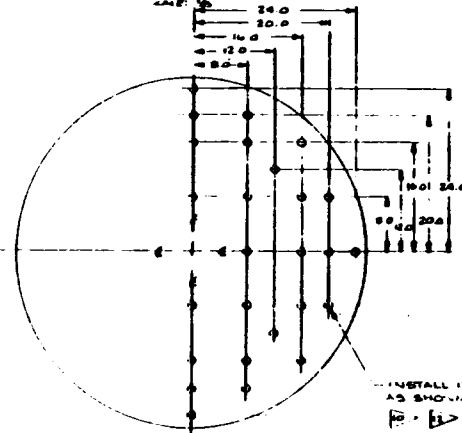
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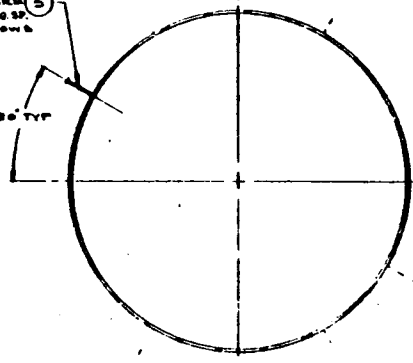
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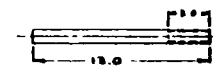
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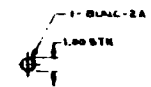
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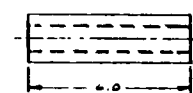
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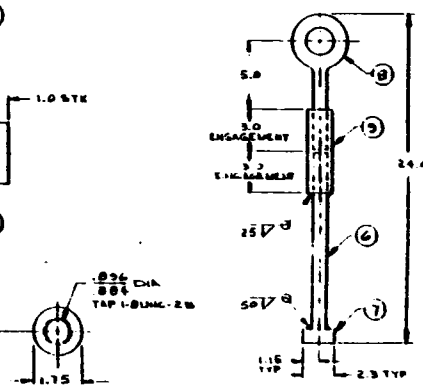
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DETAIL ITEM (7)
SCALE: $\frac{1}{2}$



DETAIL ITEM (9)
S-ALL: V₂



ASSEMBLY (A2)
SCALE: 1/4"

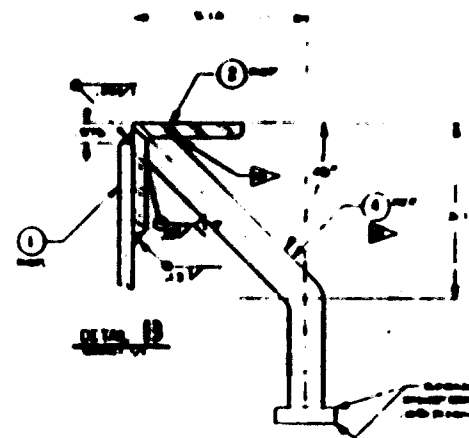
1 - COMPANY NAME 2 - ADDRESS 3 - CITY 4 - STATE 5 - ZIP 6 - PHONE 7 - FAX 8 - E-MAIL 9 - WEBSITE 10 - COUNTRY 11 - COMMENTS	ASSIGNED TO: <u>UNCLASSIFIED</u>		ITEM: <u>12</u>	PART: <u>NO</u>	DESCRIPTION:	MATERIAL:
	UNCLASSIFIED BY: <u>SP4 CJS</u>		LIST OF MATERIALS			
	UNCLASSIFIED DATE: <u>10/10/00</u>		NUCLEAR PACKAGING, INC. TACOMA, WASHINGTON			
	UNCLASSIFIED BY: <u>SP4 CJS</u>		STEEL CORROSION BARRIER FAB. DETAILS CONTAINER BODY			
12 - DATE OF REVIEW 13 - REVIEWER 14 - REVIEWER 15 - REVIEWER 16 - REVIEWER 17 - REVIEWER 18 - REVIEWER 19 - REVIEWER 20 - REVIEWER	21 - DATE OF REVIEW 22 - REVIEWER 23 - REVIEWER 24 - REVIEWER 25 - REVIEWER 26 - REVIEWER 27 - REVIEWER 28 - REVIEWER 29 - REVIEWER 30 - REVIEWER	31 - DATE OF REVIEW 32 - REVIEWER 33 - REVIEWER 34 - REVIEWER 35 - REVIEWER 36 - REVIEWER 37 - REVIEWER 38 - REVIEWER 39 - REVIEWER 40 - REVIEWER	41 - DATE OF REVIEW 42 - REVIEWER 43 - REVIEWER 44 - REVIEWER 45 - REVIEWER 46 - REVIEWER 47 - REVIEWER 48 - REVIEWER 49 - REVIEWER 50 - REVIEWER	51 - DATE OF REVIEW 52 - REVIEWER 53 - REVIEWER 54 - REVIEWER 55 - REVIEWER 56 - REVIEWER 57 - REVIEWER 58 - REVIEWER 59 - REVIEWER 60 - REVIEWER	61 - DATE OF REVIEW 62 - REVIEWER 63 - REVIEWER 64 - REVIEWER 65 - REVIEWER 66 - REVIEWER 67 - REVIEWER 68 - REVIEWER 69 - REVIEWER 70 - REVIEWER	71 - DATE OF REVIEW 72 - REVIEWER 73 - REVIEWER 74 - REVIEWER 75 - REVIEWER 76 - REVIEWER 77 - REVIEWER 78 - REVIEWER 79 - REVIEWER 80 - REVIEWER

SECTION A-A

1. What is the purpose of the study?
2. How was the study conducted?
3. What are the results of the study?

- [illegible]

16. (ANALYSIS UNIT) OF 1974: AFTER WORKING
ON A 10-DAY AND 10-NIGHT SCHEDULE OF 10-DAY



- [illegible]

6. FIELD 4. RELATIONSHIP AND COUNTRY. REPORTED BY
FIELD NUMBER IN 5 AND 6
7. FIELD 5. RELATIONSHIP AND COUNTRY. REPORTED BY
FIELD NUMBER IN 5 AND 6
8. FIELD 6. RELATIONSHIP AND COUNTRY. REPORTED BY
FIELD NUMBER IN 5 AND 6

- STATE OF TEXAS. COUNTY OF _____
 I, _____, Clerk of the Court,
 do hereby certify that _____
 is a true and correct copy of the _____
 of _____, _____, 19____.

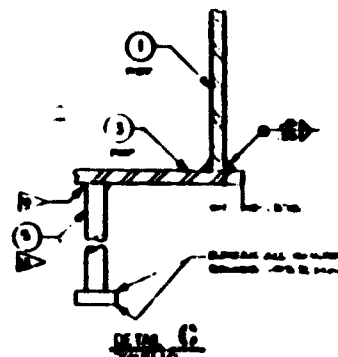
- ▶ OTHER LAW ENFORCEMENT AGENCIES ARE ADVISED BY THE FBI OF ANY INFORMATION THAT MAY BE OF INTEREST TO THEM.

- [illegible]

- [illegible]

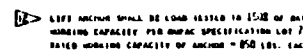
- [illegible]

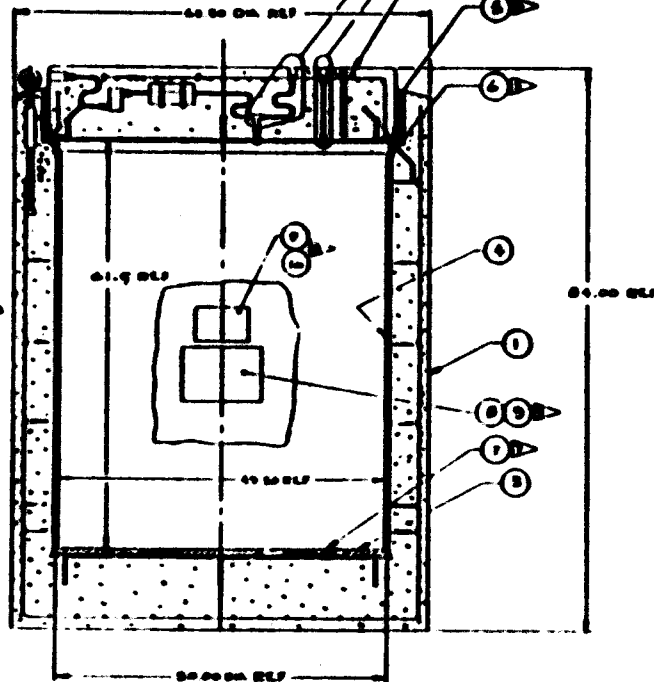
- [illegible]



2. ALL CONCRETE WALLS SHALL BE FORMED PLACEMENT COMPLETED ON FINAL PILING TO ACCOMPLISH THE SAME ONE SECTION ARE. SPACING MAXIMUM 20. NOTED ON THIS AND SECTION 4. ANCHOR 2.
3. ALL WELDED CONNECTIONS AND PLACEMENT SHALL BE COMPLETED ON ANCHORAGE AND BE IN A GOOD CASE. SECTION 2. WALL CONNECTIONS SHALL BE AVAILABLE FOR ASSET ON REVIEW.

[illegible][illegible]



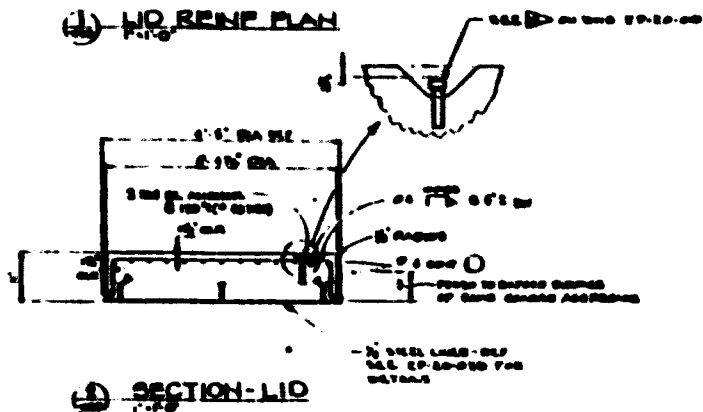


▶ THE COMPANY IS WORKING TO GET THE NEW POWER PLANT UP AND RUNNING AS SOON AS POSSIBLE. THERE IS A CHANCE THE PLANT WILL BE UP AND RUNNING BY THE END OF THE YEAR.

NOTE: THIS IS AN UNCLASSIFIED COPY

ASSEMBLY (A) SECTION A-A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 8
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ALL INFO. OF-20-1000 A112

✓ 441 000. L.P.-22-0125

44-38861-1 (SF-20, 1020, 1021)

④ SECTION - VENT ASSEMBLY

~~(U) NO BENE PLAN~~

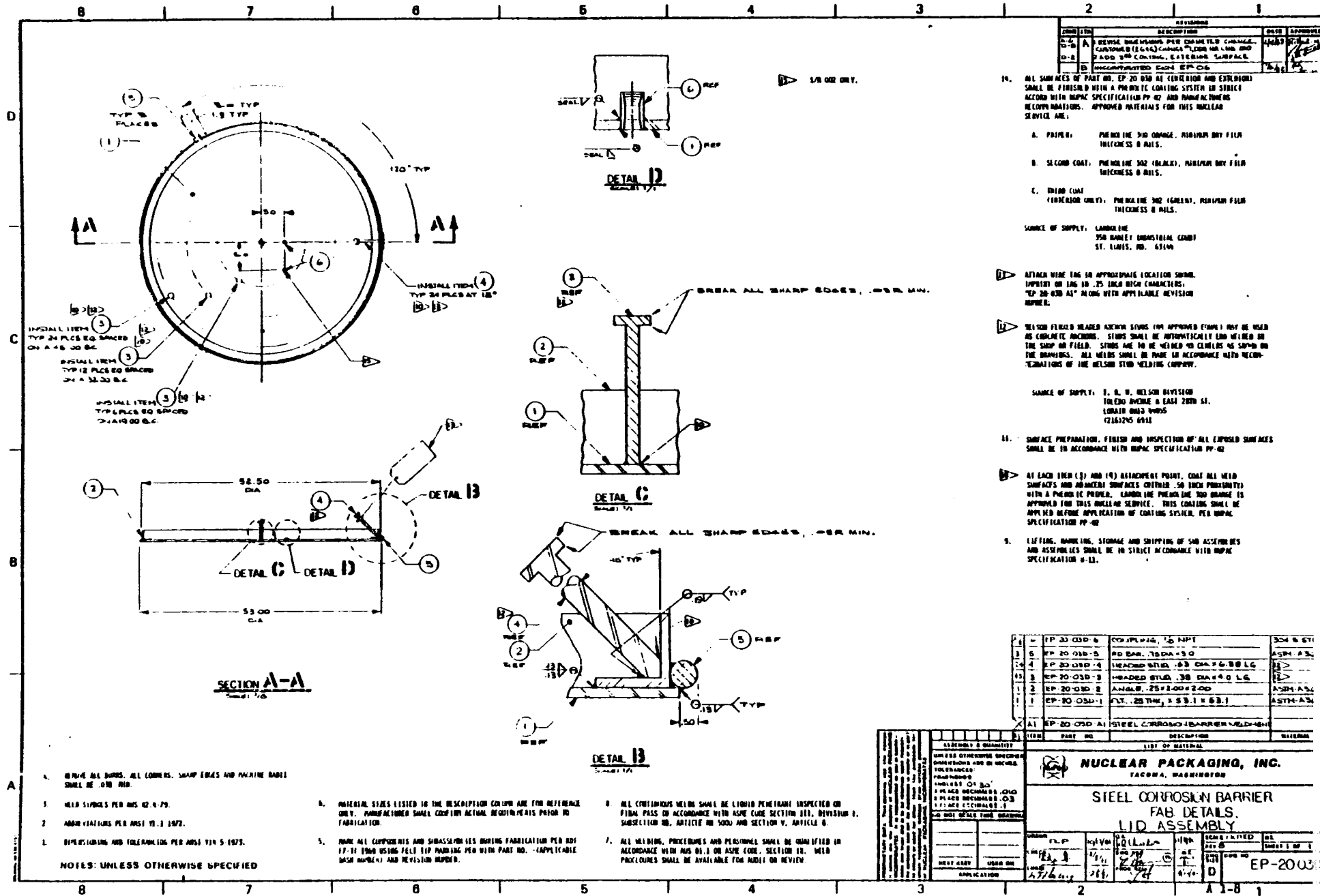
SECTION-LID

- 25 WALK LANE - NEW
WALK. R.P. 20-040 FROM
NEW YORK

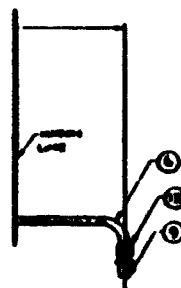
FOR OFFICIAL USE ONLY

1. NAME OF THE COMPANY NUCLEAR PACKAGING, INC. ADDRESS PO BOX 100000		2. NAME OF THE PROJECT NUCLEAR	
3. NAME OF THE CLIENT U.S. DEPARTMENT OF ENERGY		4. NAME OF THE CONTRACTOR U.S. DEPARTMENT OF ENERGY	
5. NAME OF THE DESIGNER U.S. DEPARTMENT OF ENERGY		6. NAME OF THE ARCHITECT U.S. DEPARTMENT OF ENERGY	
7. NAME OF THE ENGINEER U.S. DEPARTMENT OF ENERGY		8. NAME OF THE INSPECTOR U.S. DEPARTMENT OF ENERGY	
9. NAME OF THE FABRICATOR U.S. DEPARTMENT OF ENERGY		10. NAME OF THE INSTALLER U.S. DEPARTMENT OF ENERGY	
11. NAME OF THE MAINTAINER U.S. DEPARTMENT OF ENERGY		12. NAME OF THE OPERATOR U.S. DEPARTMENT OF ENERGY	
13. NAME OF THE REPAIRER U.S. DEPARTMENT OF ENERGY		14. NAME OF THE REMOVER U.S. DEPARTMENT OF ENERGY	
15. NAME OF THE DISPOSER U.S. DEPARTMENT OF ENERGY		16. NAME OF THE RECYCLER U.S. DEPARTMENT OF ENERGY	
17. NAME OF THE REFINER U.S. DEPARTMENT OF ENERGY		18. NAME OF THE RESEARCHER U.S. DEPARTMENT OF ENERGY	
19. NAME OF THE DEVELOPER U.S. DEPARTMENT OF ENERGY		20. NAME OF THE MANUFACTURER U.S. DEPARTMENT OF ENERGY	
21. NAME OF THE DISTRIBUTOR U.S. DEPARTMENT OF ENERGY		22. NAME OF THE RETAILER U.S. DEPARTMENT OF ENERGY	
23. NAME OF THE END USER U.S. DEPARTMENT OF ENERGY		24. NAME OF THE FINAL DESTINATION U.S. DEPARTMENT OF ENERGY	

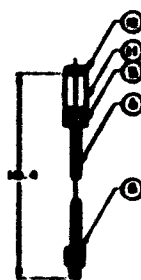
NOTE: UNLESS OTHERWISE SPECIFIED



ASSEMBLY



ASSEMBLY 

**APRIL 1991**

- CLASSIFIED BY: 6032
DECLASSIFY ON: 25X

- NAME OF VENDOR: (NAME) HOLDINGS, INC.
1000 W. BROADWAY, CA 94104
CITY: SAN FRANCISCO, CA 94104

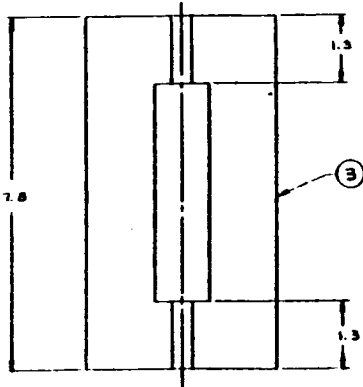
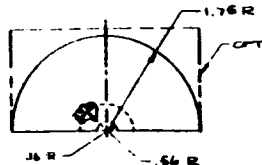
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NUCLEAR PACKAGING, INC.
140044, WASHINGTON

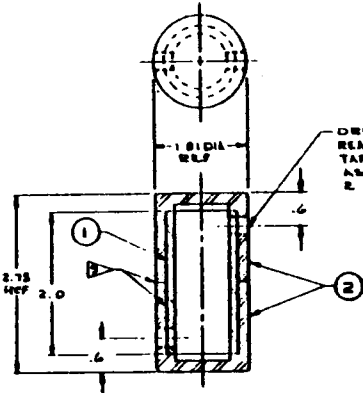
**SYSTEM VENT
ASSEMBLY**

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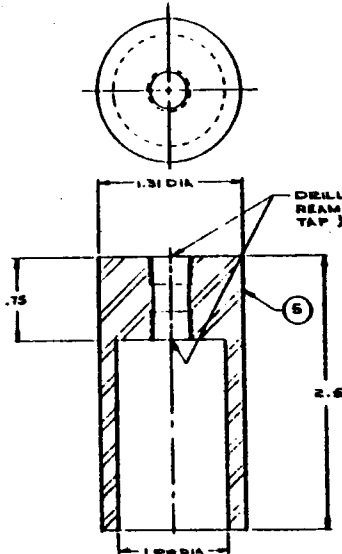
REVISIONS		DATE	APPROVED
A	REVISED ON LENGTH OF ASSEMBLY		
B	INCORPORATED SDP: 2622-EP-114		
C	SEE DCM		



FABRICATION DETAIL (A3)
SCALE: FULL



FABRICATION DETAIL (A1)
SCALE: FULL



FABRICATION DETAIL (A2)
SCALE: 2/1

1. MATERIALS LISTED IN THE DESCRIPTION COLUMN ARE FOR REFERENCE ONLY. MANUFACTURER SHALL CONFIRM ALL REQUIREMENTS PRIOR TO FABRICATION.
2. FROM ALL COPPIES AND SUBASSEMBLYS DURING FABRICATION PER DDC 17-31-1949 USING FELT TIP MARKING PER WITH PART NO. APPLICABLE TO-20 NUMBERED AND REVISION NUMBER.
3. REMOVE ALL BURRS, ALL CORNERS, SHARP EDGES AND PAINTING SHALL BE .030 MINIMUM.
4. ALL PAINTED SURFACES SHALL BE .025 PER ANST DMS-1-1962 UNLESS OTHERWISE SPECIFIED.
5. ABBREVIATIONS PER ANST 11-1-1972.
6. DIMENSIONING AND TOLERANCING PER ANST 119-5-1973.

7. LIBERALLY COAT ALL EXTERIOR SURFACES OF ITEM (1) AND ENDS OF ITEM (2) WITH ITEM (5) AND ASSEMBLE THESE PRIOR TO DRILLING AND TAPPING ASSEMBLY.
8. DRILL STAMP WITH 10% STRESS IMPRESSION STAMP USING .25 IN HIGH CHARACTERS WITH EP 20 050 (5) OR (3) AND APPLICABLE REV. OR.
9. FINISHED ASSY AND ALL INTERIOR SURFACES SHALL BE CLEANED AND VISIBLELY AIR WIPE TEST INSPECTED IN ACCORDANCE WITH ASFA A 301.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY	UNIT	DESCRIPTION	MATERIAL
1	5	PVC CEMENT	
1	4	PVC BAR 1/4 DIA X 1/4	
1	3	REMOVED	
2	2	LEAD .00-LITRE GED A DEC	
1	1	PVC CAP 1.00 DIA X .50 H	
1	1	PVC PIPE 1.00 DIA X .50 H X 5.00 L	
1	1	FLTR SHIELDING ASSY	
1	1	PRE FILTER HOUSING ASSY	
1	1	FLUID TRAP ASSY	

NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

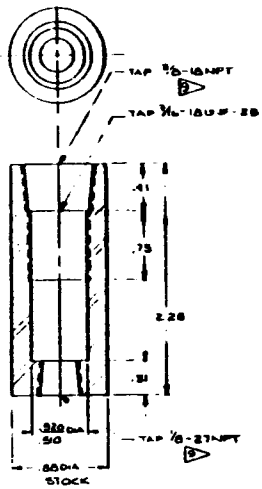
MISCELLANEOUS
FAB DETAILS
VENT ASSEMBLY

NAME	DATE	BY	DATE	BY
CLARK	10-15-73	W. J. B.	10-15-73	W. J. B.
DR. H. P.	10-15-73	W. J. B.	10-15-73	W. J. B.
10-15-73	10-15-73	W. J. B.	10-15-73	W. J. B.
10-15-73	10-15-73	W. J. B.	10-15-73	W. J. B.

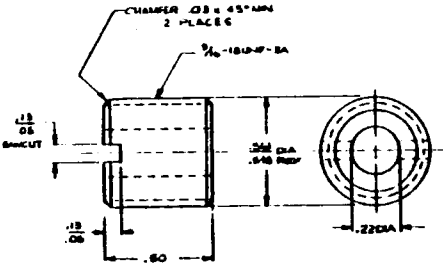
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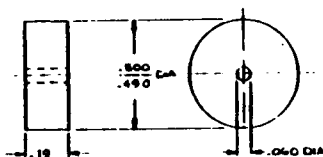
REV		DESCRIPTION	DATE	APPROVED
1	A	CHANGE APF DETAIL 1 ALTERED P-12L	10/1/77	10/1/77



DETAIL ITEM ①



DETAIL ITEM ②



DETAIL ITEM ③

1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

2. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

3. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

4. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

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10. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

11. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

12. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHALL BE IN INCHES AND DECIMALS THEREOF.

ITEM	PART NO.	DESCRIPTION	REVISION
1	EP-20-07D-1	ROD BAR .800 DIA X .20	TYPE BOLT
2	EP-20-07D-2	MAKE FROM 316-1000F-2A BOLT	TYPE BOLT
3	EP-20-07D-3	ROD BAR .800 DIA X .20	TYPE BOLT

REVISIONS		LIST OF MATERIAL	
1	2	3	4

NUCLEAR PACKAGING, INC.
FACOM, WASHINGTON

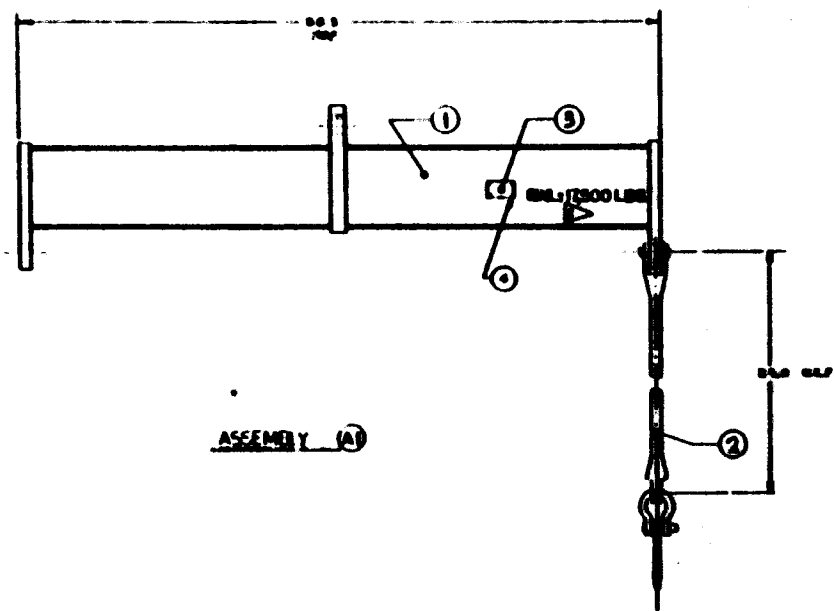
**FILTER HOUSING
FABRICATION DETAILS**

ITEM	PART NO.	DESCRIPTION	REVISION
1	EP-20-07D-1	ROD BAR .800 DIA X .20	TYPE BOLT
2	EP-20-07D-2	MAKE FROM 316-1000F-2A BOLT	TYPE BOLT
3	EP-20-07D-3	ROD BAR .800 DIA X .20	TYPE BOLT

ITEM	PART NO.	DESCRIPTION	REVISION
1	EP-20-07D-1	ROD BAR .800 DIA X .20	TYPE BOLT
2	EP-20-07D-2	MAKE FROM 316-1000F-2A BOLT	TYPE BOLT
3	EP-20-07D-3	ROD BAR .800 DIA X .20	TYPE BOLT

NOTES: UNLESS OTHERWISE SPECIFIED

1	GENERAL REQUIREMENTS AND MATERIALS
2	DESIGN, CONSTRUCTION AND TESTING
3	OPERATION AND MAINTENANCE
4	SAFETY
5	ENVIRONMENTAL TESTS
6	QUALITY CONTROL
7	PACKAGING
8	TRANSPORTATION
9	INSTALLATION
10	DECOMMISSIONING



ASSEMBLY (A)

1. DESIGN THE WEIGHT AND CAPACITY OF MATERIALS TO BE HANDLED BY THE EQUIPMENT. THE WEIGHT OF THE EQUIPMENT SHALL BE 1.00 TON OR LESS. THE WEIGHT OF THE MATERIAL SHALL BE 1.00 TON OR LESS.
2. DESIGN THE EQUIPMENT TO BE CAPABLE OF HANDLING THE WEIGHT OF THE MATERIAL TO BE HANDLED BY THE EQUIPMENT. THE WEIGHT OF THE EQUIPMENT SHALL BE 1.00 TON OR LESS.

NOTES: UNLESS OTHERWISE SPECIFIED

1	GENERAL REQUIREMENTS AND MATERIALS
2	DESIGN, CONSTRUCTION AND TESTING
3	OPERATION AND MAINTENANCE
4	SAFETY
5	ENVIRONMENTAL TESTS
6	QUALITY CONTROL
7	PACKAGING
8	TRANSPORTATION
9	INSTALLATION
10	DECOMMISSIONING

1	GENERAL REQUIREMENTS AND MATERIALS
2	DESIGN, CONSTRUCTION AND TESTING
3	OPERATION AND MAINTENANCE
4	SAFETY
5	ENVIRONMENTAL TESTS
6	QUALITY CONTROL
7	PACKAGING
8	TRANSPORTATION
9	INSTALLATION
10	DECOMMISSIONING

NUCLEAR PACKAGING, INC.
LIFT & TRUST EQUIPMENT
ASSEMBLY

EF-70-1000

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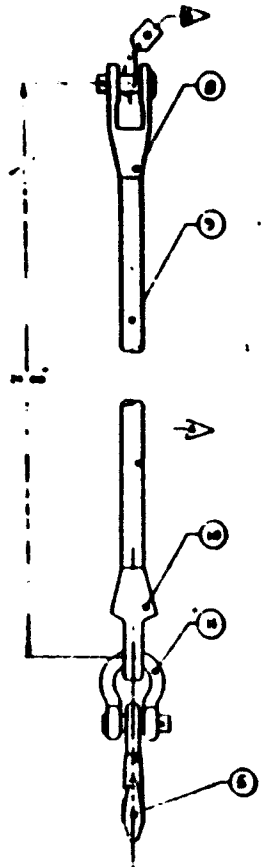
- 1

3. SUPERSTITION AND TOLERANCE FOR MIST 014, 5-1979.

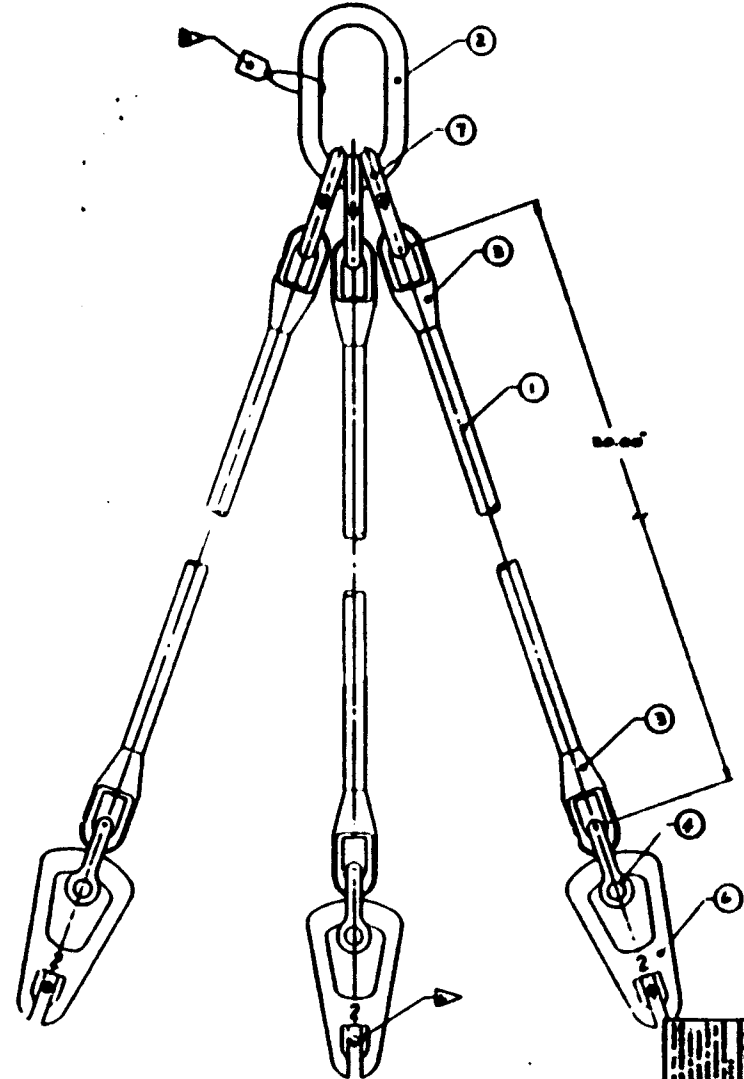
8

[illegible]

2 1 A 2-14 1



ASSEMBLY A1
1-2031



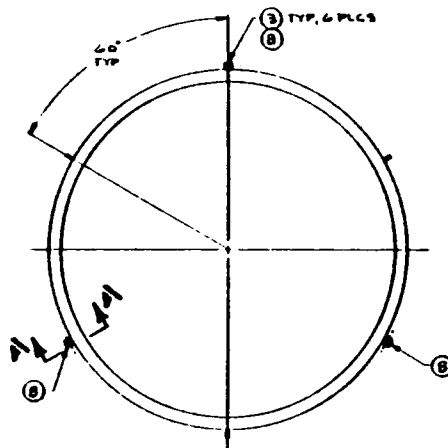
ASSEMBLY A2

- ▽ NOTE: 1. HANDLE FOR
- ▽ NOTE: 2. HANDLE FOR
- ▽ NOTE: 3. HANDLE FOR
- ▽ NOTE: 4. HANDLE FOR
- ▽ NOTE: 5. HANDLE FOR
- ▽ NOTE: 6. HANDLE FOR
- ▽ NOTE: 7. HANDLE FOR

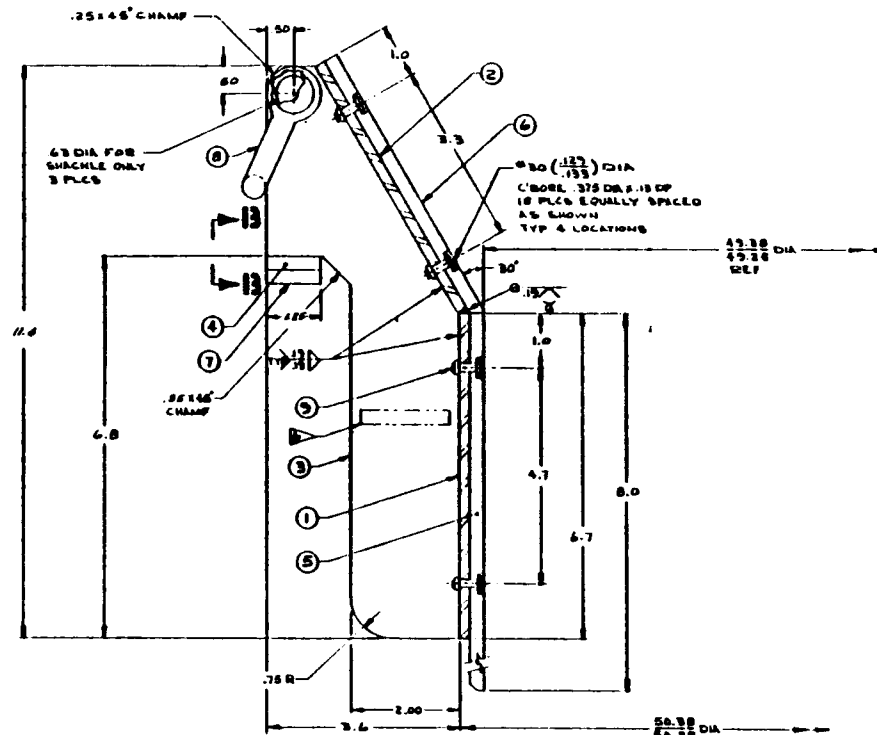
ITEM	QTY	DESCRIPTION	UNIT	REMARKS
1	1	HANDLE FOR		
2	1	HANDLE FOR		
3	1	HANDLE FOR		
4	1	HANDLE FOR		
5	1	HANDLE FOR		
6	1	HANDLE FOR		
7	1	HANDLE FOR		

NUCLEAR PACKAGING, INC. TACOMA, WASHINGTON	
LIFT LIMS FAB DETAILS	
1-2031 1-2032 1-2033 1-2034 1-2035 1-2036 1-2037 1-2038 1-2039 1-2040 1-2041 1-2042 1-2043 1-2044 1-2045 1-2046 1-2047 1-2048 1-2049 1-2050	1-2051 1-2052 1-2053 1-2054 1-2055 1-2056 1-2057 1-2058 1-2059 1-2060 1-2061 1-2062 1-2063 1-2064 1-2065 1-2066 1-2067 1-2068 1-2069 1-2070

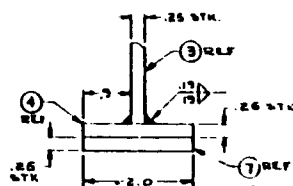
NOTES UNLESS OTHERWISE SPECIFIED



ASSEMBLY (A1)
SCALE 1/8"



SECTION A-A
SCALE 1/8"



VIEW 13-13
SCALE 1/8"

1. ALL WELDING, PROTECTORS AND PERSONNEL SHALL BE QUALIFIED IN ACCORDANCE WITH AWS D1.1 OR ASME CODE, SECTION IX. WELD PROTECTORS SHALL BE AVAILABLE FOR AMBIT OR REVIEW.
2. ALL WELDS SHALL BE VISUALLY INSPECTED IN ACCORDANCE WITH AWS D1.1 PART 8.15.
3. ONE STAMP WITH LOW STRESS IMPRESSION STAMP USING .25 IN. DEEP CHARACTERS WITH EP 70 AND AS AND APPLICABLE REV. NO. IN APPROPRIATE LOCATION SHOWN.
4. MATERIAL SIZES LISTED IN THE DESCRIPTION COLUMN ARE FOR REFERENCE ONLY. FABRICATOR SHALL CONFIRM ACTUAL REQUIREMENTS PRIOR TO FABRICATION.
5. MAKE ALL LUGS AND SUBASSEMBLIES DURING FABRICATION PER DET 13-13 USING SELF TAP DRILLING PER DET 13-13. (APPLICABLE DETAIL NUMBER) AND REVISION NUMBER.
6. IN FINE ALL DIMENSIONS. ALL CORNERS, SHARP EDGES AND FINISHES SHALL BE .030 IN.
7. ANNOTATIONS PER AWS D1.1 1972.
8. DIMENSIONS AND TOLERANCES PER AWS D1.1 1972.

1. SOURCE OF SUPPLY: CARBOLINE F-1
JON HANLEY INDUSTRIAL CO.
ST. LOUIS, MO 63104
2. SOURCE OF SUPPLY: ENHANCED
POP BOWEN DIVISION
550 BOWEN ROAD
SHELTON, CT 06484
3. BOND STEPS: 7 AND 10 (STEP 10) USING CARBOLINE F-1. (ITEM 10)
4. PAINT ALL EXPOSED CARBON STEEL SURFACES AS FOLLOWS:
PRIMER
A. MUST CLEAN, DRY, IF SURFACE VERY DIRTY, 1-2 MILS DRY.
B. 7777, IF SURFACE CLEAN, DEGREASED OR SANDBLASTED, 1-2 MILS DRY.
TOP COAT
A. MUST CLEAN, DRY, IF SURFACE VERY DIRTY, 1-2 MILS DRY.
B. 7777, IF SURFACE CLEAN, DEGREASED OR SANDBLASTED, 1-2 MILS DRY.

NOTES: UNLESS OTHERWISE SPECIFIED

REV	DATE	DESCRIPTION	BY	APPROVED
1		REDESIGN		
2		11.0 10.0 10.0		
3		11.0 10.0 10.0		

REV	DATE	DESCRIPTION	BY	APPROVED
1		CARBOLINE F-1		
2		POP BOWEN DIVISION		
3		550 BOWEN ROAD		
4		SHELTON, CT 06484		
5		11.0 10.0 10.0		
6		11.0 10.0 10.0		
7		11.0 10.0 10.0		
8		11.0 10.0 10.0		
9		11.0 10.0 10.0		
10		11.0 10.0 10.0		

REV	DATE	DESCRIPTION	BY	APPROVED
1		CARBOLINE F-1		
2		POP BOWEN DIVISION		
3		550 BOWEN ROAD		
4		SHELTON, CT 06484		
5		11.0 10.0 10.0		
6		11.0 10.0 10.0		
7		11.0 10.0 10.0		
8		11.0 10.0 10.0		
9		11.0 10.0 10.0		
10		11.0 10.0 10.0		

REV	DATE	DESCRIPTION	BY	APPROVED
1		CARBOLINE F-1		
2		POP BOWEN DIVISION		
3		550 BOWEN ROAD		
4		SHELTON, CT 06484		
5		11.0 10.0 10.0		
6		11.0 10.0 10.0		
7		11.0 10.0 10.0		
8		11.0 10.0 10.0		
9		11.0 10.0 10.0		
10		11.0 10.0 10.0		

CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIALS PACKAGES

PACKAGE NUMBER	PACKAGE NAME	PACKAGE IDENTIFICATION NUMBER	THIS PACKAGE	TOTAL NUMBER PACKS
1086	8	USA/503579(1)	1	3

This certificate is issued to certify that the packaging and contents described herein comply with the applicable requirements of Title 10, Code of Federal Regulations, Part 71, "Packaging of Radioactive Materials For Transport and Transportation of Radioactive Material Under Certain Conditions."

This certificate does not relieve the transporter from compliance with any provisions of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any foreign country, in which the package will be transported.

This certificate is issued on the basis of a SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN ON APPLICATION
SUBMITTED BY OWNER AND SHIPPER

Chem-Nuclear Systems, Inc.
40 Stoneridge Drive
Columbia, SC 29210

Chem-Nuclear Systems, Inc.
Application dated November 19, 1979,
APPENDIX B

CERTIFICATE OF COMPLIANCE FOR THE CNS 14-190 SHIPPING CASK

CONSTRUCTION
This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71 in application and the conditions specified below.

(a) Packaging

(1) Model No.: CNS-14-190

(2) Description

The packaging is a steel-encased, concrete shielded shipping cask. The cask is 94-1/4 inches in diameter by 103-3/4 inches in length. Reinforced concrete occupies the 7-inch annular space between the shells and the two base plates. The lid is a 4-3/4 inches thick laminated steel cover held in place by 32, high strength 1-3/4-inch diameter bolts. A silicone O-ring is used to seal the joint between the lid and the cask body. The outer shell and base plate are 1/4 inch thick, while inner shell and base plate are 2 inches thick. The cask is reinforced at the top and bottom with steel rings and is equipped with lifting lugs. The lid is provided with two stress ports. Gross weight is about 71,000 pounds.

(3) Drawings

The package is constructed in accordance with the following ATCOR, Inc. Drawing Nos.: 1000-D-0049; 0146-B-0004, Rev. E; 0146-B-0009; 0146-D-0025, Rev. A; 0146-D-0020-1, Rev. A; and 0146-C-0018, Rev. E.

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIALS PACKAGES**

a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. PACKAGE IDENTIFICATION NUMBER	d. PAGE NUMBER	e. TOTAL NUMBER PAGES
5026	8	USA/5026/B()	1	3

2. PREAMBLE

- a. This certificate is issued to certify that the packaging and contents described in item 5 below, meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71 "Packaging of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions."
- b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

a. PREPARED BY (Name and Address):

Chem-Nuclear Systems, Inc.
240 Stoneridge Drive
Columbia, SC 29210

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Chem-Nuclear Systems, Inc.
Application dated November 19, 1979,
as supplemented.

c. DOCKET NUMBER 71-5026

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71 as applicable and the conditions specified below.

(a) Packaging

(1) Model No.: CNS 14-190

(2) Description

The packaging is a steel-encased, concrete shielded shipping cask. The cask is 94-1/4 inches in diameter by 103-3/4 inches in length. Reinforced concrete occupies the 7-inch annular space between the shells and the two base plates. The lid is a 4-3/4 inches thick laminated steel cover held in place by 32, high strength 1-1/4-inch diameter bolts. A silicone O-ring is used to seal the joint between the lid and the cask body. The outer shell and base plate are 1/4 inch thick, while inner shell and base plate are 2 inches thick. The cask is reinforced at the top and bottom with steel rings and is equipped with lifting lugs. The lid is provided with two access ports. Gross weight is about 71,000 pounds.

(3) Drawings

The package is constructed in accordance with the following ATCOR, Inc. Drawing Nos.: 1000-D-0049; 0146-B-0004, Rev. E; 0146-B-0009; 0146-D-0025, Rev. A; 0146-D-0020-1, Rev. A; and 0146-C-0010, Rev. E.

Page 2 - Certificate No. 5026 - Revision No. 8 - Docket No. 71-5026

(b) Contents

(1) Type and form of material

- (i) Byproduct material in the form of solids and solidified waste contained within secondary container(s).
- (ii) Radioactive material in the form of activated reactor components packaged in secondary containers.

(2) Maximum quantity of material per package

Greater than Type A quantity of radioactive material, not to exceed 20 thermal watts and 23,000 pounds including weight of the contents, secondary container(s) and shoring. The contents may include fissile materials provided the mass limits of 10 CFR §71.7 are not exceeded.

- 6. The dose rate from the loaded cask shall not exceed 10 mrem/hr at six feet from the surface of the cask.
- 7. The access plugs shall be appropriately plugged and sealed prior to transport.
- 8. Shoring shall be placed between the secondary container(s) and the cask cavity to prevent movement during accident conditions of transport.
- 9. Prior to each shipment, the packaging lid silicone O-ring shall be inspected. The O-ring shall be replaced with a new silicone O-ring if inspection shows any defects or every six (6) months, whichever occurs first.
- 10. Packages fabricated after July 31, 1983, shall be constructed of A-516, Grade 70 carbon steel instead of A-36 and A-516, Grade 60 carbon steels.
- 11. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR §71.12.
- 12. Expiration date: January 31, 1985.


Page 3 - Certificate No. 5026 - Revision No. 8 - Docket No. 71-5026

REFERENCES

Chem-Nuclear Systems, Inc. application dated November 19, 1979.

Supplements dated: April 14 and June 17, 1983.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION


Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety, NMSS

Date: JUL 11 1983

Page 3 - Certificate No. 8020 - Revision No. 3 - 1983

REFERENCE

then-located systems, and registration dates November 1983 and June 1983.

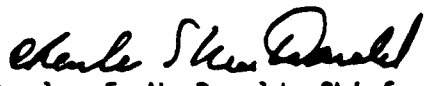
UNITED STATES DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION
WASHINGTON, D.C. 20535

Page 3 of 3
JUL 14 1983

U.S. Nuclear Regulatory Commission
Transportation Certification Branch
Approval Record
Model No. CNS T4-T90 Package
Docket No. 71-5026

By application dated June 17, 1963, Chem-Nuclear Systems, Inc. requested that the certificate be amended to allow the fabrication of future packages from A-516, Grade 70 carbon steel rather than the currently authorized A-36 and A-516, Grade 60 carbon steels. The applicant has shown that A-516, Grade 70 carbon steel has better mechanical properties for use in shipping packagings.

The staff is in agreement with the applicant that the proposed material of construction will improve the overall quality of future packagings.


Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety, NMSS

Date: JUL 14 1963

1. The first of these is the fact that the Commission has not yet received any information from the Government of the United Kingdom regarding the proposed changes to the law of the sea. This is a serious matter, as the Commission is unable to proceed with its work until it has received the necessary information.

1993



US DOE OFF-SITE RADIOACTIVE MATERIAL SHIPMENT REPORT

Shipment No. _____ Date _____
Origin _____ Destination _____
Material Name _____ Quantity _____
Container Type _____

APPENDIX C

TRANSPORTATION DOCUMENTATION

1. Material Description: _____
2. Quantity: _____
3. Container Type: _____
4. Transport Mode: _____
5. Route: _____
6. Date of Shipment: _____
7. Shipper: _____
8. Receiver: _____
9. Signature: _____
10. Date: _____



DOE F 5480.1A
(Rev. 07-82)

US DOE OFF-SITE RADIOACTIVE MATERIAL SHIPMENT RECORD

Shipment From: _____

Log No. _____

References:

DOE 5480.1A Chap III.

49 CFR 100-199

To _____

Charge No. _____ Collect ☐ Prepaid ☐

Carrier(s) _____

Sole Use ☐ INEL Long Haul ☐ Other ☐

Consignee is Authorized to Receive Shipment ☐

Material(s): (Proper DOT Shipping Name)

Consignee Notified ☐ Date _____

Chemical Form: _____

Weight _____ Vol. _____

Container Used (describe): _____

DOT Identification No. _____

Physical Form: Solid ☐ Liquid ☐ Gas ☐

Type of shipment

Packaging:

Principal
Nuclide(s)

Curies (Ci)

Limited Quantity ☐

Rad. Article ☐

A₁ ☐ A₂ ☐

Greater than:

A₁ ☐ A₂ ☐

Highway Route

Controlled ☐

LSA ☐

Empty ☐

Industrial ☐

DOT Spec. _____

Type A ☐ B ☐ B(U) ☐ ☐

C of C No. _____

Size _____

Weight _____

Transport Index _____

Other _____

Seal No.(s) _____

FISSILE MATERIALS: Not Applicable ☐ Fissile Shipment ☐ Fissile Exempt ☐

Fissile Materials: U _____ gms Pu _____ gms Other _____ gms

Fissile Exempt ☐ Class I ☐ Class II ☐ Trans. Index _____

Class III ☐ Controls: _____

(No more than _____ packages may be loaded on any vehicle or storage location)

ACCOUNTABLE NUCLEAR MATERIALS: Not Applicable ☐ Applicable ☐

DOE/NRC F 741 No. _____ Remarks: _____

Originator

Health and Safety

Signatures

Trans

tie-downs Adequate ☐ Remarks: _____

Radiation: (surface) _____ mrem/hr (3 feet) _____ mrem/hr

Contamination: (Averaged over any 300 cm² Package Surface)

Beta-Gamma _____ dis/min/100 cm²

Alpha _____ dis/min/100 cm²

Additional Surveys: Vehicle ☐ Driver ☐ Other _____

Remarks _____

LABELS

None Required ☐ White I ☐

Yellow II ☐

Yellow III ☐

Pelegro ☐

Empty ☐

Other(s) _____

VEHICLE PLACARD(s)

None Required ☐

Radioactive ☐

Highway Route Controlled ☐

Other(s) _____

Loader _____ Date _____

Seal Applicator _____ Date _____

Safety Insp _____ Date _____

Criticality Safety _____ Date _____

Rad. Surveyor: (Package(s)) _____ Date _____

(Driver and Vehicle) _____ Date _____

(Fissile and/or Accountable Nuclear Material only)

Safeguards Rep _____ Date _____

Security Rep _____ Date _____

This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled, and in proper condition for transportation according to the applicable regulations of the Department of Transportation and DOE ☐

Originator _____ Date _____ Area Supervisor _____ Date _____

Carrier Rep _____ Date _____

Traffic Agent _____ Organization _____ Date Released _____

(DIRECTIONS ON REVERSE SIDE)

RADIOACTIVE MATERIAL SHIPMENT CHECKLIST

DATE SHIPPED _____

MATERIAL BEING SHIPPED: _____

SHIPPING CONTAINER TYPE: _____

NUMBER OF CONTAINERS: _____

CASK MODEL: _____ D.O.T.# _____

CASK CERTIFICATION CHECKED BY: _____ DATE: _____

CURIE CONTENT CALCULATION PERFORMED BY: _____ DATE: _____

(ATTACH WORK SHEETS)

RECEIVING FACILITY: _____ LICENSE # _____

FACILITY LICENSE CHECKED BY _____ DATE: _____

SHIPMENT ACCEPTABILITY VERIFIED WITH RECEIVING FACILITY:

PERSON CONTACTED _____ DATE: _____

CONTAMINATION SURVEY PERFORMED BY: _____ DATE: _____

BETA/GAMMA SURVEY PERFORMED BY: _____ DATE: _____

VEHICLE SURVEY PERFORMED BY: _____ DATE: _____

SHIPPING FORMS PREPARED BY: _____ DATE: _____

RECEIVING AGENT: _____

CARRIER: _____

SCHEDULED TO ARRIVE AT RECEIVING SITE: _____

(date)

ACTUAL ARRIVAL DATE: _____

D.O.T. NOTIFIED -- NAME: _____ DATE: _____

COVER SHEET TO ACCOMPANY CNSI'S RADIOACTIVE WASTE
SHIPMENT AND DISPOSAL FORM

1. Consignee's State License Number _____
2. Consignee is authorized to receive this radioactive material _____

Waste Management

3. Shipment Number _____
4. Vehicle Type _____
5. Placard _____
Operator _____
6. Proper Shipping Name _____
7. Vehicle Radiation Survey
Highest Contact _____ mr/hr
6FT Reading _____ mr/hr
Occupied Area _____ mr/hr
Technician _____

Signature

8. Total Contents of Shipment _____ Curies
9. Instructions for Maintenance of Exclusive Use Controls (Exclusive Use Vehicle Only).

This vehicle shall not be used to carry packages from another consignee. The packages on this vehicle shall be unloaded by the consignee designated on the shipping forms or his designated agent only.

Signature of Vehicle Driver

Date

10. Sealed _____
11. The recorded package contents and radiation and contamination data have been reviewed.

HP Foreman/Supervisor

12. Consignee Acknowledgement of Receipt

Consignee, please sign and return a copy of the cover sheet to the consignor, as indicated on the Radioactive Shipment Record Form, to indicate receipt of this shipment.

Consignee Signature and Title

Date

CALCULATION WORKSHEET FOR ISOTOPE PERCENT

1. Calculations for _____
2. Shipment number _____
3. Reference document used for calculations _____

4. Calculations

4.1 Total Activity

Calculated by _____ Date _____

Isotope Activity

Verified By _____ Date _____

Total Activity _____

4.2 Percent calculations

a. Activity of isotope

total activity

(_____)
x 100

(_____) _____ %

(_____)
x 100

(_____) _____ %

(_____)
x 100

(_____) _____ %

(_____)
x 100

(_____) _____ %

(_____)
x 100

(_____) _____ %

(_____)
x 100

(_____) _____ %

(_____)
x 100

(_____) _____ %

CURIE CONTENT WORKSHEET FOR SAMPLE SHIPMENTS

1. Shipment number _____

2. Reference document used for calculations

3. Calculations:

Isotope	Activity
---------	----------

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be a standard notebook page.

$$\text{TOTAL (} \underline{\hspace{2cm}} \text{) } \times \text{ (} \underline{\hspace{2cm}} \text{)}$$

Sample volumes

Calculated by _____ Date _____

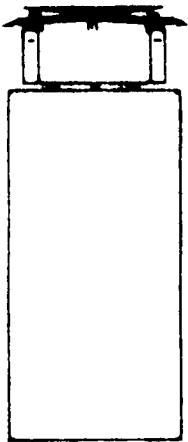
Verified by _____ Date _____

VEHICLE SURVEY

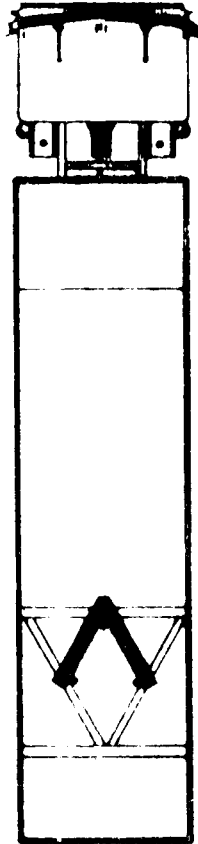
LOG # _____

INCOMING ☐

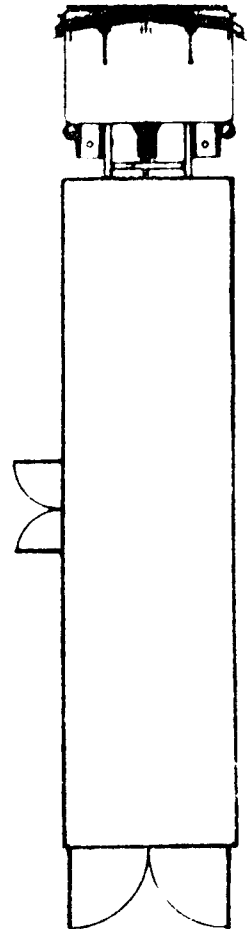
OUTGOING ☐



TRUCK
IDENTIFICATION



TRUCK & TRAILER
IDENTIFICATION



TRUCK & TRAILER
IDENTIFICATION

SHIPMENT IDENTIFICATION _____

SURVEY DATE _____

SURVEY TIME _____

TYPE SURVEY _____

INSTRUMENT SER. # _____

SIGNATURE _____

SURVEY RESULTS _____

VEHICLE INSPECTION CHECKLIST

FRONT INSPECTION:

- WINDSHIELD WIPERS
- IDENTIFICATION LAMPS
- CLEARANCE LAMPS
- HEAD LAMPS
- REAR VIEW MIRRORS
- TURN SIGNALS
- ILLUMINANT OPERATION
- SUSPENSION
- OPERATIVE BRAKES
- BRAKE HOSES DAMAGED
- CONNECTION AIR LINES
- WHEEL LUGS
- TIRE TREAD DEPTH
- OTHER DEFECTS
- STEERING
- MIRRORS
- WHEEL
- OPERATIVE BRAKE
- TIRE TREAD
- OTHER DEFECTS
- SUSPENSION
- EMERGENCY AND SERVICE HOSE COUPLINGS
- Pressure Relief Valve
- FUEL TANKS
- FUEL LINES
- REFLECTOR LEFT SIDE
- NEAR FRONT
- CLEARANCE LAMPS
- END MARKER LAMP
- BACKSTOP AND TAIL LAMPS
- OPERATIVE BRAKE
- FRAME CRACKS
- REFLECTOR MIDWAY
- MIDWAY SIDE MARKER LAMP
- NO ESCAPING
- NO CONNECTION LINES
- OTHER AIR LINES
- SUSPENSION
- OPERATIVE BRAKES
- TIRE TREAD
- OTHER DEFECTS
- BEAR SIDE MARKER LAMP
- BEAR SIDE REFLECTOR
- BEAR CLEARANCE LAMPS
- BEAR IDENTIFICATION LAMPS
- BEAR TAIL LAMP
- BEAR STOP LAMP

REAR INSPECTION:

- EXHAUST LEAKS
- FIFTH WHEEL MOUNTINGS
- SEAT BELTS
- WARNING DEVICES FOR STOPPED VEHICLES
- FIRE EXTINGUISHER
- WINDSHIELD DAMAGED OR OBSTRUCTED
- DEPROBILES
- HORN
- BEAR END PROTECTION

VEHICLE INFORMATION:

Check vehicle as indicated
 A= Acceptable
 B= Reject

Truck or Truck-Tractor
 Make: _____
 License: _____
 State: _____

Trailer
 Make: _____
 License: _____
 State: _____

Truck Shipment
 No: _____

Inspected By: _____

Date: _____

*Comments on Reverse side

10-11-68

1990

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1991-02-18

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Age Group	1970	1980	1990	2000	2010	2020
0-14	25	22	18	15	12	10
15-24	18	16	14	12	10	8
25-34	12	10	8	6	4	3
35-44	8	7	6	5	4	3
45-54	5	4	3	2	1	1
55-64	3	2	1	1	1	1
65-74	10	12	15	18	22	25
75+	2	3	4	5	6	7

Figure 1. The structure of the proposed model.

the 1990s, the number of people in the United States who are 65 years of age or older is projected to increase from 20 million to 30 million, and the number of people 75 years of age or older is projected to increase from 10 million to 15 million (U.S. Census Bureau, 1996). The number of people 85 years of age or older is projected to increase from 2 million to 4 million (U.S. Census Bureau, 1996). The number of people 90 years of age or older is projected to increase from 500,000 to 1 million (U.S. Census Bureau, 1996). The number of people 95 years of age or older is projected to increase from 100,000 to 200,000 (U.S. Census Bureau, 1996). The number of people 100 years of age or older is projected to increase from 10,000 to 20,000 (U.S. Census Bureau, 1996).

1990

LOW-LEVEL RADIOACTIVE WASTE SHIPMENT CERTIFICATION FOR THE FEDERAL GOVERNMENT AS A GENERATOR/PACKAGER, AND ITS BROKERS AND CARRIERS

The following certification, completed as applicable, is made to the State of Washington:

Certification is hereby made to the State of Washington that Radiation Shipment Record No. _____ of low-level radioactive waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection has revealed no items of non-compliance with all applicable laws, rules and regulations.

As determined under the provisions of the Federal Tort Claims Act (28 USC § 2671-2680), the undersigned shall be liable for and hold harmless the State of Washington from any and all claims, suits, losses, damages or expenses on account of injuries to any and all persons whomsoever, and any and all property damage, arising or growing out of or in any manner connected with any activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION A:

FOR THE GENERATOR/PACKAGER: _____
(Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE _____ BY: _____

TITLE _____

Certification is hereby made to the State of Washington that Radiation Shipment Record No. _____ of low-level radioactive waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection have revealed no items of non-compliance with all applicable laws, rules and regulations.

The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed \$1,000,000.00 per individual who may be injured, provided that indemnification shall not exceed \$5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, damage, injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION B:

FOR THE BROKER: _____
(Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE _____ BY: _____

TITLE _____

SECTION C:

FOR THE CARRIER: _____
(Company Name)

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE _____ BY: _____

TITLE _____



**LOW-LEVEL RADIOACTIVE WASTE SHIPMENT
CERTIFICATION FOR COMMERCIAL GENERATOR/PACKAGERS,
AND BROKERS AND CARRIERS**

The following certification, completed as applicable, is made to the State of Washington:

Certification is hereby made to the State of Washington that Radiation Shipment Record No. _____ of low-level radio-active waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection has revealed no items of non-compliance with all applicable laws, rules and regulations.

The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed \$1,000,000.00 per individual who may be injured, provided that indemnification shall not exceed \$5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, damage, injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION A:

FOR THE GENERATOR/PACKAGER: _____
(Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

SECTION B:

FOR THE BROKER: _____
(Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

SECTION C:

FOR THE CARRIER: _____
(Company Name)

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____



☐ P.O. Box 878
Beatty, NV 89003
(702) 841-2203

[illegible]**GRAND TOTALS**

THIS IS TO CERTIFY THAT THE ABOVE NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION AND ARE IN COMPLIANCE WITH ALL FEDERAL APPLICABLE AT THE ORIGINATED OFFICIAL SITE

Autonomous Institutions

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DISPOSAL SITE COPY

APPENDIX D

DISPOSAL DEMONSTRATION PROCEDURES

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WORK PACKAGE TASK

TITLE: EPICOR II LINER DISPOSAL DEMONSTRATION

Work Package No.: HCN-83-16

Task No.: 1

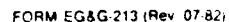
Test Engineer G. A. Williams

REVIEW AND APPROVAL REQUIREMENTS

ORGANIZATION	SIGNATURE	DATE	CHANGE CONCURRENCE (all, none, or or section numbers)
APPROVED BY:			
Branch Manager	<i>L. D. Crift</i>	<i>9/22/83</i>	<i>All</i>
REVIEWED BY:			
Test Engineer Supervisor	<i>K. C. Sumpter</i>	<i>9-22-83</i>	<i>All</i>
Operations Supervisor	<i>J. G. Kung</i>	<i>9/26/83</i>	<i>All</i>
Safety	<i>D. W. Marshall</i>	<i>9/26/83</i>	<i>All</i>
Quality	<i>M. A. Lee</i>	<i>9/26/83</i>	<i>All</i>
Independent Safety	<i>M. M. Morgan</i>	<i>9/23/83</i>	<i>All</i>
Task Support Representative	<i>R. L. Chapman</i>	<i>9/23/83</i>	<i>All</i>
ISSUED BY:			
Document Control	<i>Nancy J. Johnson</i>	<i>9/26/83</i>	<i>All</i>

PROCEDURE FIELD CHANGES

DRR Number	Date	DRR Number	Date	DRR Number	Date
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____



Date SEPTEMBER 13, 1983

Date _____

HOT CELL SAFETY QUESTIONNAIRE

FORM EG&G-2017 (Rev. 05-82)

Requester R. L. Chapman Organization 3440 WR Date 5/16/83
 Experiment number or other designation _____
 Summary of requested services(1) Place EPICOR liner PF-18 in a HIC, seal the lid in place,
and cure the sealant (48 hours)

Experiment Description

• 101D 1.59 m diam.
 A. Drawing No. NuPac EP-20- (attach Dwg. or sketch); Dimensions x 2.13 m high mm; Wt. 7,300 kg
 B. Check as applicable: Fissile () Flammable () Acidic () Stn. Stil ()
 " Moderated () Pyrophoric () Caustic () Aluminum ()
 Pressurized () Reactive () Toxic () Zirconium ()
 Volatile () Explosive () Carcinogen () Beryllium ()
 Gaseous () Liquid Metal () Tantalum ()

Describe items checked above (quantity, composition, pressure, flash point, TLV, etc.)(1)

C. Construction & Physical condition (describe)(1) EPICOR liners are carbon steel filled approximately
2/3 full with ion exchange media. HIC is reinforced concrete container with 6 inch wall.
11 inch base and 11 inch lid.

Fissile Material(2) 4.5 x 1.0 x
 Quantity ^{235}U 10⁻⁷ Ci g. Pu 10⁻³ Ci g. Enrichment ^{235}U 2.5 % Pu % Total $\text{U} + \text{Pu}$ 1.0 x 10⁻³ Ci
 Est. burnup % 3165 MWd/tU; Chemical Form ion exchange media

Radioactivity:

Total Curies *2025; Reactor Discharge Date 3/28/79; Decay Heat 8×10^{-3} kW as of 5/16/83 (date)
 Est. Direct Radiation (@ 1 ft in air); 100 R/h β - γ ; Est. Surface Contamination 0 dpm β - γ . 0 dpm α

Principal Hazardous Nuclides(3)

Isotope	(*)Activity	Gaseous (Check)	Isotope	(*)Activity	Gaseous (Check)
^{131}I (total)	-0-		Ru^{106}	29.8 Ci	
^{131}I (free state)			Cs^{134}	91.6 Ci	
^{85}Kr	-0-		Cs^{137}	925.9	
Sr^{90}	35.01 Ci		Ba^{137}	875.2	
Y^{90}	35.01 Ci		Rh^{106}	29.8	

As of 4/1/82 (date)*

Shipment to Hot Cells:

A. Cask or container identification CNSI 14-190
 B. Secondary container description HIC + PF-18
 C. Packaging: Dry () Wet () Describe Dewatered ion exchange media
 D. Special handling precautions required 1000 R/h surface reading on liner 170 R/h HIC surface
 Disposition of materials after examination Ship to commercial burial at Hanford, Washington
 Special precautions & additional comments(1)

NOTE:

The purpose of this questionnaire is to describe materials and identify potential hazards associated with the services requested. Completion of this form is required before work planning will be initiated.

(1) Add separate sheet if necessary

(2) State total fissile material, attach itemized list for multiple fuel rods or other units.

(3) Include Principal Isotopes of Ag, Be, ^3H , Hf, Hg, Ru, Sr, Ta, Transuranics.

* Calculated fission product inventory by ISOSHLD-II or other computer code may be provided in lieu of listing the principal nuclides.

HOT CELL SAFETY ANALYSIS SUMMARY

Work Package No. HCN-83-16 Task(s) 1 Date 9/13/83 By G. A. Williams
Experiment number or other designation EPICOR-II Liner Disposal (Demonstration)
Job Description(1) Remove PF-18 from TSC-2, dewater, vent, purge, place in HIC, cure HIC & ship.

Facility the analysis was made for TAN 607

Fissile Material:(2)

Quantity ^{235}U 4.5×10^{-7} g, ^{239}Pu 1.0×10^{-3} g Enrichment ^{235}U 2.5 %, ^{239}Pu --
Est. Burnup 3165 % MWd/tU: Chemical Form ion exchange media

Radioactivity:(1)

Total Curies 2025; Reactor Discharge Date 3/28/79; Decay Heat 8×10^{-3} kW as of 5/16/83 (date)

Est. Direct Radiation (@ 1 ft in air): 100 R/h β - γ ; Est. Surface contamination 0 dpm β - γ , 0 dpm α

Facility Hazards:(3) Radiation and contamination exposure.

Personnel Hazards:(4) Radiation and contamination exposure.

Experiment Damage Hazards:(1) Maintain identity of liner

Shipping Cask, Hazards & Precautions:(1) Care must be exercised while handling the cask on the transporter.

Special Controls:

Additional comments:

- NOTES:
- (1) See Safety Questionnaire for details necessary to complete this Analysis and attach for reference.
 - (2) State total fissile material, attach itemized list for multiple fuel rods or other units.
 - (3) Evaluate for potential hazards to facility including fire, explosion, excessive gamma heat or radiation, criticality, contamination spread, effluent releases, and general plant safety.
 - (4) Evaluate for potential hazards to personnel including radiation exposure, airborne contamination, toxic materials, chemical reactions, and general personnel safety.

SUMMARY

This task provides instructions for bringing the TSC-2 (Temporary Storage Container) into the Hot Shop and unloading PF-18. Instructions are also provided to de-water and purge PF-18 before loading it into a High Integrity Container (HIC). The cured HIC will then be loaded in the CNS 14-190 Transport Cask and shipped to Hanford for disposal.

WORK PACKAGE GENERAL INSTRUCTIONS

Title: EPICOR II Liner Disposal Demonstration

Work Package: HCN-83-16

Task Number: 1

Date: 9-23-83

1. REFERENCES

Materials Technology Division SPs

1. 1.3.11, Detailed Operating Procedures
2. 1.3.1, Document Revision Requests.

Hot Cell Branch Directives

1. HCN-100, TAN 607 Hot Shop Hoisting and Rigging Requirements
2. HCN-108, Access Control for TAN Hot Shop

Miscellaneous

1. Section 5000, EG&G Idaho Safety Manual, Radiation Safety (all sections except 5050, 5060, 5070, and 5110)
2. EG&G Hoisting and Rigging Manual

3. TAN HCN Operational Safety Requirements Document (OSRD)
Sections 8 (except 8.2), Sections 9.1 and 10 (except 10.5,
10.6, 10.7, 10.9, 10.10, 10.13, 10.14, 10.16, and 10.17).
4. Handling procedures for Chem-Nuclear Systems, Inc., (CNSI).
Transport Cask Number CNS 14-190 (BC-48-220)

Drawings

Nuclear Packaging, Inc., Drawings

<u>TITLE</u>	<u>NUMBER</u>
High Integrity Container System	EP-20-100 D
Container assembly	200-101
Spreader bar fabrication details	EP-70-01 D
Lift links fabrication details	DP-70-02 D
Interface collar fabrication details	EP-70-03 D
Lift and hoist equipment assembly	EP-70-100 D

B. Forms (attached)

Comment Sheet

* Briefing Log

LIFT EQUIPMENT RECORD SHEET

II. General

This work package provides instructions for bringing the TSC-2 into the Hot Shop for the HIC demonstration. Instructions are provided for removing PF-18 from the TSC-2, the de-watering and purging of PF-18 and for loading PF-18 into a HIC. The HIC will be allowed to cure, then loaded and shipped in the CNS 14-190 cask as directed in Task 2.

The following provisions apply to this procedure:

1. The Operation Supervisor or test engineer may each assign alternates and note this on the Comment Sheet.
2. Nonapplicable steps will be marked "N/A", initialed and dated, and the reason recorded on the Comment Sheet by: (a) the originator prior to issue, or (b) the Operations Supervisor during execution of the procedure.
3. All changes to this procedure will be made by DRR in accordance with SP 1.3.1, Document Revision Requests.
4. Procedure steps or sections may be performed out of sequence as follows:

Operations Supervisor marks the steps/sections to be performed out of sequence "OOS", and records the reason on the Comment Sheet. At the exit point of the original procedure mark "EXIT TO _____", and enter in the blank the first step number of the OOS series. After the last OOS step, mark "EXIT TO _____", and enter in the blank the number of the step being returned to in the original sequence (the original exit point to the OS series).

Technician dates and initials (a) the last step performed before starting the OOS series, (b) each OOS step as performed, and (c) the first step performed after returning to the original sequence.

5. Asterisked (*) blanks are to be filled in by the Test Engineer prior to starting work. If spaces are not applicable, mark "N/A", initial and date (the reason need not be recorded on Comment Sheet).

6. Designated steps will be initialed and dated when completed.
7. Verification and inspection steps will be performed by Technicians unless otherwise noted.

III Materials and Equipment

1. Liner Lifting Fixture
2. Slings and Lifting Fixtures.
3. Venting Assembly.
4. Plastic and/or Blotting Paper
5. Argon Purge Gas
6. Modified LINER Integrity Examination (LIE) Equipment (see Figure 1)
7. Resin Catch Pan
8. TV Camera and Monitor
9. Electrical Grounds for Liner and Venting Assembly
10. T-Bar Assembly for Lifting Spent Resin Liner
11. High Integrity Container (HIC)
12. HIC Spreader Bar
13. HIC Lid Lifting Links
14. Interface Collar
15. Primary Sealant (3)
16. Epoxy A/B and Aggregate
17. Pouring Assembly
18. Mixing Pails (2)
19. Drill
20. Mixing Blade
21. Grout Pouring Container
22. Ramps for Hot Shop Rails
23. Adapter for Lower Distribution Port
24. Adapter for Vent Port
25. Water Sample Container

IV. SPECIFIC PRECAUTIONS AND LIMITATIONS

1. All lifting, rigging, and handling of components requiring lifting equipment shall be done per EG&G Hoisting & Rigging Manual, Branch Directive HCN-100, and attached rigging diagrams. The cranes and lifting equipment will be inspected and certified in current load test status.
2. For the duration of each crane lift involving the loaded EPICOR liner, and all critical lifts, a duly briefed person will be stationed at the main crane breaker, in radio contact with crane operator in case of unexpected crane movement. At completion of each lift, notify and remove the person from breaker.
3. Use plastic sheet to prevent contamination spread of equipment and materials during this procedure.
4. Do not open Hot Shop doors if wind is in excess of 15 mph.

V. PREREQUISITES

NOTE: Prerequisites may be performed in any sequence.

Init Date

- _____ 1. All necessary lift equipment and rigging gear is available and certified in current load test status by Quality Division (QD), on the LIFT EQUIPMENT RECORD SHEET.

NOTE: A crane and slings as needed (see Figures 6 and 10) will be available for any lifts conducted outside the Hot Shop.

Init Date

- ____ 2. All necessary tooling and supplies as listed in
Section III are available where needed in Hot Shop.
Tools and supplies for operations outside the Hot Shop
will also be in place where needed.
- ____ 3. Crane emergency release service pedestal pig-tail is in
position.
- ____ 4. SES shielding doors are open, SES personnel doors are
closed, and Hot Cell door is closed.
- ____ 5. Operability of locomotive and rail car to transport
concrete storage container has been verified, if
transfer to temporary storage is required.
- ____ 6. The O-MAN and any other necessary remote tools are in
position.
- ____ 7. Blanks in asterisked procedure steps have been filled
in.
- ____ 8. Forms EG&G-2612 and 2612A, Radiation Hazards analysis
and Radiological Control, have been prepared and are
included in the work package, and the requirements have
been met.
- ____ 9. Hot Shop personnel have been briefed on this procedure,
applicable sections of the Hot Cells North facilities
OSRD, and the radiological controls specified in
item 8, above, and have signed the Briefing Log. The
Hot Shop entry team is ready.

Init Date

- ____ 10. Hot Waste box is in the Hot Shop.
- ____ 11. Configuration of liner to be vented (see Figure 2) has been determined during loading operation and is recorded in work package (Comment Sheet). If configuration A, spacers (see Drawing 415928-22) must be removed from venting assembly legs. For configurations B and C, spacers must be in place.
- ____ 12. Vent port location has been identified during loading operation and is recorded in work package. Guide brackets (see Drawing 415928-16) on venting assembly have been positioned for the appropriate port as shown in Figure 3.

Configuration _____

Figure 3, Sheet _____ of 3.

- ____ 13. De-watering equipment has been set up per Figure 1.
4
- ____ 14. Work areas have been covered with plastic and/or absorbent paper.
- ____ 15. A video record of the HIC demonstration will be made with the color system, if available. If color system is not available, use the black and white system.
- ____ 16. Assure rail stops are in place.
- ____ 17. Position portable radiation measuring instrument for use in determining liner radiation level.

Init Date

_____ 18. The HIC is in the Hot Shop and the lid vent plug is open.

IV PROCEDURE

_____ 1.0 Verify that all prerequisites have been met.
OS

Procedure started: Technician _____ Date _____

_____ 2.0 Receive TSC-2 and unload PF-18.

_____ 2.1 Enter Hot Shop to perform the following:

_____ 2.1.1 Cover working areas with plastic or absorbent paper.

_____ 2.1.2 Plug in and check out the light used with the TV camera for viewing the venting operation.

_____ 2.1.3 Clean window of vent tool.

_____ 2.1.4 Check and remove any foreign material on the vent tool drive system. Remove old plug if necessary.

_____ 2.1.5 Perform the preventive maintenance on the vent tool, oiling if necessary. Check housing gasket and replace if necessary.

_____ 2.1.6 Verify the vent tool is directly connected to Hot Shop exhaust system.

Init Date

2.1.7 Verify the vent tool argon supply is connected to the Hot Shop system.

2.1.8 Verify a no-load operability of all controls and corresponding assembly functions for the vent tool.

2.2 Remove plastic rain cover from TSC-2

2.3 Open Hot Shop Doors.

2.4 Using spacer car between locomotive and flat car, move flat car with TSC-2 into Hot Shop.

2.5 Survey spacer car; if necessary, decontaminate to acceptable limits.

2.6 Uncouple spacer car from carrier and remove from Hot Shop.

2.7 Close Hot Shop doors.

2.8 Clear Hot Shop of personnel for subsequent remote operation.

2.9 Rig to lid of TSC-2 per Figure 5, observing Precaution #2, remove lid and place as directed by the Operations Supervisor. Uncouple the crane hook.

2.10 Raise alarm points on RAMs in the Hot Shop to level predetermined by IAN Safety.

Init Date

2.11 Remove liner from TSC-2 as follows:

QD

2.11.1 Rig T-bar to 10-ton crane hook, Figure 6 and, using O-MAN, rotate T-bar as needed to engage the lifting lugs. Visually verify engagement.

QD

2.11.2 Observing Precaution #2, raise liner from TSC-2, and move to the east side of the south silo. Disengage from liner and place T-bar in designated area.

QD

2.12 Rig to TSC-2 lid per Figure 5. Observing Precaution #2, replace lid on TSC-2. Uncouple crane hook from lid.

HP

2.13 Health Physics (HP) enter the Hot Shop and perform a preliminary radiological survey of Hot Shop work area. Survey and smear carrier, TSC-2, and lid for external contamination and general radiation levels; decontaminate as required by HP.

2.14 Open Hot Shop doors.

2.15 Using shielded locomotive with spacer car attached, remove carrier with TSC-2 from Hot Shop.

2.16 Install and secure weather cover (plastic) on TSC-2.

2.17 Move TSC-2 to an outside storage area, as determined by the HP based on radiation readings. Chock wheels of rail car.

Init Date

2.18 Cover area with plastic and place ramps over Hot Shop door rails.

2.19 Attach snorkel to tractor exhaust.

2.20 Back transporter into Hot Shop.

2.21 Rig the HIC spreader bar to the 100-ton crane.

QD

2.22 Attach spreader bar lifting hooks to the HIC lifting slings.

2.23 Observing Precaution #2, lift HIC, move laterally and place it on the plastic sheet as directed by the Operations Supervisor.

QD

2.24 Remove spreader bar lifting hooks from HIC lifting slings and place spreader bar on clean plastic on Hot Shop floor.

2.25 Survey and remove transporter with cask from Hot Shop. Remove snorkel from tractor exhaust.

2.26 Remove ramps from Hot Shop door rails and store. Close Hot Shop doors.

3.0 PF-18 Distribution Port Plug Removal

3.1 Rig T-bar to 10-ton crane hook, Figure 6 and hook to PF-18 lifting lugs. Verify engagement.

QD

Init Date

QD

3.2 Observing Precaution #2, raise liner from behind silo and move laterally to floor adjacent to C window. Disengage T-bar from liner.

QD

3.3 Lift venting assembly using O-MAN, Figure 7.

3.4 Install venting assembly on liner and remove plug to lower distribution port (effluent) as follows:

3.4.1 Using separate leads with magnetic ends, ground both the liner and the assembly to a convenient location of railroad rail in floor. Move assembly into position above liner, observing Prerequisites 11 and 12 and lower until the two guide brackets engage the liner lifting lugs. Continue to lower, observing directly or by TV camera, until lower end of toolhousing is about 5 in. above the liner.

3.4.2 Position the tool tip and engage it in the recess of the 2-in. pipe plug in the liner by performing the following actions as required:

<u>Desired Movement</u>	<u>Procedure</u>
Lower tool tip toward plug.	Move valve V10 to "TORQUING" position. To stop downward travel, return valve to central (unlabeled) position.

Desired Movement**Procedure**

**Raise tool tip
up off the plug.**

With air pressure adjusted to 90 psi, slowly move valve V10 to the RAISE position. When the tool tip is at the desired elevation, return valve to the unlabeled position. To lower tool tip, slowly move valve to the TORQUING position and return it to the unlabeled position when desired elevation is obtained.

Rotate tool tip.

Place valve V9 in the LOOSEN position. Slowly turn valve V15 toward ON position. Return V15 to the OFF position when desired tool tip orientation is obtained. Tool rotation can be reversed by placing valve V9 in the TIGHTEN position.

**Move tool tip to
the X direction.**

Place valve V12 in either the + or - DIRECTION position as desired. Slowly turn valve V16 toward the ON position and observe the movement of tool tip. Return valve to OFF position when desired position is obtained. Tool movement direction can be reversed by placing V12 in the other DIRECTION position.

Desired Movement

Procedure

Move tool tip in the Y direction.

Place valve V13 in either the + or the - DIRECTION position as desired. Slowly turn valve V17 toward the ON position and observe the movement of the tool tip. Return valve to OFF position when desired position is obtained. Tool movement direction can be reversed by placing V13 in the other DIRECTION position.

Forcing tool tip into square hole of plug.

If rust or other foreign material prevents the tool tip from entering the square hole of the plug and the tool tip is correctly positioned, a downward force can be applied by slowly moving valve V11 to the LOWER position. Return V11 to the TORQUING position.

Init Date

- 3.4.3 Verify complete engagement of the tool tip in the plug. This is indicated by the seating of the tool tip holder's shoulder and magnets on the plug.

Init Date .

- 3.4.4 Place or verify that the control panel valves are in the position listed below:

<u>Valve</u>	<u>Position</u>
V15	OFF
V9	LOOSEN
V16	OFF
V17	OFF
V11	TORQUING
V10	TORQUING

- 3.4.5 Lower venting assembly until housing is seated against the liner.

- 3.4.6 Adjust air pressure down to 25 ± 5 psi.

- 3.4.7 Record rotational position of the tool drive shaft. _____ (Indexing marks are visible through window in assembly).

- 3.4.8 Open valve on argon purge gas line to permit flow through venting assembly into exhaust line.

Init Date

3.4.9 Slowly turn valve V15 toward ON position while observing tool shaft rotation. At first indication of shaft rotation, leave V15 in its existing position and monitor shaft rotation until at least 2 revolutions are made or the plug drops slightly as it rides up the last thread and plug is fully unscrewed from the port. Return V15 of OFF position.

NOTE: If plug does not move when valve V15 is fully open, valve must be returned to OFF position, air pressure increased by 10 psi, and the plug removal operation performed again. This sequence may be repeated, if necessary, at 10 psi air pressure increments up to a maximum 70 psi pressure.

3.4.10 Raise plug out of liner port by adjusting air pressure to 70 ± 6 psi and placing valve V10 in RAISE position. When plug is clear of liner port, return V10 to central (unlabeled) position.

3.5 Remove plug and venting tool from liner per the following sequence:

3.5.1 Remove electrical ground leads from liner and venting tool assembly.

• 3.5.2 Lift and remove venting tool from liner.

3.5.6 Remove plug from liner, if necessary. Relocate venting tool on floor adjacent to C window, disengage O-MAN.

Init Date

4.0 DE-WATER AND PURGE PF-18

- _____
QD

- 4.1 Use prerigged T-bar, Figure 6 and, using O-MAN and/or wallmount, engage T-bar to the liner lifting lugs. Visually verify engagement.
- _____
QD

- 4.2 Observing Precaution #2, move liner laterally and lower onto resin catch pan for de-watering, (see Figure 1). Disengage T-bar from liner.
- 4.3 Place T-bar as directed by the Operation Supervisor and remove T-bar from crane hook.

NOTE: All remote handling will be performed using either the wallmount or O-MAN, or both, as appropriate, except as otherwise noted.

- _____

- 4.4 Place adapter on lower distribution port and connect plug to vacuum system, as shown in Figure 1.

- _____

- 4.5 Remove water from liner as follows:

NOTE: De-water for 1 h. Stop process for 1 h. Repeat 3 times for a total of 6 h de-watering time.

- _____

- 4.5.1 Close Valves V-1 and V-3, (see Figure 1). Position Valve V-2 so that the vacuum pump is connected to the 55-gal drum.

- _____

- 4.5.2 Turn on vacuum pump and establish an 8 in. vacuum in drum. Use vacuum gauge on drum lid.

Init Date

_____ 4.5.3 Open valve V-1 to establish water and
_____ air flow from liner.

_____ 4.5.4 When 55-gal drum is full, Valve V-4,
_____ (see Figure 1) will open.

_____ 4.5.5 Drain the tank as follows:

_____ 4.5.5.1 Shut off the vacuum pump.

_____ 4.5.5.2 Close Valve V-1 and reposition
_____ Valve V-2 to vent drain to
_____ atmosphere.

CAUTION: Allow approximately 500 ml of water to remain in the water sample
collection device for pH analysis.

_____ 4.5.5.3 Open Valve V-3 to drain the
_____ tank.

_____ 4.5.5.4 Close Valves V-3 and V-4 to
_____ reposition Valve V-2 to
_____ connect vacuum pump to drum.

_____ 4.5.5.5 Turn on vacuum pump to
_____ establish vacuum in drum.

_____ 4.5.5.6 Open Valve V-1 to continue
_____ vacuuming liner.

_____ 4.5.5.7 After 1 hr of de-watering,
_____ shut off the vacuum pump for
_____ 1 hr.

Init Date

4.5.5.8 Repeat steps 4.5.1 through
4.5.5.7 a minimum of three
times.

NOTE: It may be necessary to perform additional de-watering cycles.
Consult with the Test Engineer and/or Operation Supervisor.

4.6 Open 4-way valve on vacuum system, (see
Figure 1).

4.7 Place adapter on vent port and connect to purge
line.

CAUTION: Watch gage closely, and do not exceed 5 psi during liner purging.

4.8 Purge liner for approximately 6 hr, as directed
by the Operations Supervisor. (Minimum flow
1 cfm.) Turn off system.

4.9 Disconnect purge and vacuum lines and remove
adapter from distribution port and adapter from
vent port.

4.10 Place porous plug on vent port.

4.11 Place 2-in. solid plug on lower distribution
port.

4.12 Rig T-bar to 10-ton crane hook (see Figure 6) and
hook to PF-18 lifting lugs. Verify engagement.

QD

Init Date

- _____
QD
- 4.13 Observing Precaution #2, raise liner and move laterally to the east side of the south silo. Disengage T-bar from liner.
- _____

4.14 Place T-bar as directed by the Operation Supervisor and disengage from crane hook.
- _____
HP
- 4.15 HP enter Hot Shop and perform radiological survey of work area for HIC loading preparations.
- _____

4.16 Perform pH analysis as follows:
- _____
4.16.1 Remove water sample from collection device and move sample to labyrinth door.

NOTE: If reading on the sample container exceeds 500 mR/h at contact, consult HP Supervisor.

- _____
4.16.2 HP survey the sample and with HP concurrence remove the sample from the Hot Shop.
- _____
QD
- 4.16.3 Determine pH and record results _____. Quality Division to verify.

5.0 HIC LOADING AND CURING

NOTE: Steps in this section may be performed simultaneously to perform work in time allowed.

- _____
5.1 Set up scaffolding for HIC loading.

Init Date

QD

5.2 Rig the HIC spreader bar to 100-ton crane and attach the spreader bar lifting hook to the HIC lifting slings, as shown in Figure 8.

QD

5.3 Observing Precaution #2, lift HIC and place it on the plastic sheet in the scaffolding.

5.4 Remove spreader bar lifting hooks from HIC lifting slings and place spreader bar on plastic sheet in Hot Shop floor.

5.5 Attach HIC lid lifting links to 10-ton crane, as shown in Figure 9.

5.6 Attach lifting links to HIC lid.

5.7 Verify that the vent plug on bottom of HIC lid is open.

5.8 Remove HIC lid and place on Hot Shop floor.

5.9 Verify installation of polyethylene sleeve and base disk.

5.10 Verify presence of aluminum hydroxide paste in base disk cutouts.

5.11 Remove lift links from 10-ton crane.

5.12 Rig insertion collar to O-MAN, Figure 10.

Init Date

_____ 5.13 Mix three batches of primary sealant per the
QD following instructions:

NOTE: Mixing instruction are also provided with kit.

_____ 5.13.1 REmove tri-seal cap.

_____ 5.13.2 Screw dasher rod clockwise into barrier.

_____ 5.13.3 Remove tape band and pull rod to top of
cartridge, squeeze side of cartridge at
barrier to release barrier, then push
rod to bottom to displace barrier.

_____ 5.13.4 Mix material (50 strokes minimum by
hand) by turning dasher rod clockwise
while making full stroke from top to
bottom of cartridge.

_____ 5.13.5 Pull rod to top of cartridge and remove
by turning counterclockwise.

_____ 5.13.6 Remove F-Cap from bottom of cartridge,
screw nozzle into top and insert into
retainer.

_____ 5.14 Record time and date _____.
QD

CAUTION: Steps 5.15 through 5.26 are to be performed in approximately 1 h.

_____ 5.15 Apply 1/2-in. bead of primary sealant to the top
of the I.D. of the HIC lid step.

Abstract

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Init Date

NOTE: Prepare surfaces of lid and HIC for grouting by removing dirt, grease, and any material that would adversely affect the bond.

_____ 5.27 Record the time of day _____.

QD

_____ 5.28 Remove lifting links from the HIC lid and 10-ton crane and place on clear plastic.

_____ 5.29 Outside the Hot Shop, in the change room, mix two batches of EPOXY A/B and aggregate grout with the drill and mixing blade, per the following instructions:

QD

NOTE: Mix binder per manufacturers instructions to achieve a free-flowing consistency.

_____ 5.29.1 Mix the A and B component thoroughly with a paint stirrer attached to a drill. Carefully scrape sides and bottom of container.

_____ 5.29.2 Mix for at least 3 minutes and/or until the mixture is free of streaks.

_____ 5.29.3 Add mortar (from Step 5.29.3) to sand and mix for at least 3 minutes until a free-flowing consistency is achieved.

_____ 5.30 Record the time of day and date _____.

QD

Init Date

5.31 Pass the two mixing pails into the labyrinth.

5.32 Pour the grout into the grout pouring container.

CAUTION: Steps 5.33 through 5.37 are to be performed in approximately 1 hr.

5.33 Using the O-MAN place the grouting assembly onto the HIC.

5.34 Pass the grout pouring container to the O-MAN at the labyrinth/Hot Shop door.

5.35 Alternately, pour the grout into the grouting assembly funnels and change funnel position as desired. Also fill lid lift recesses with grout.

5.36 Bring the grout pouring container back to the labyrinth/Hot Shop door.

QD

5.37 Repeat steps 5.29 to 5.36 until the HIC/lid void is full of grout. Verify level of grout as specified in Item 5 of Figure 11.

QD

5.38 Record time and date _____.

5.39 Remove the grouting assembly from the HIC, and place it on clean plastic.

Init Date

QD

5.40 Rig the HIC spreader bar to the 100-ton crane and attach the spreader bar lifting hooks to the HIC lifting lugs.

QD

5.41 Observing Precaution #2, lift HIC, move laterally and place behind South silo on plastic sheet. HIC will cure for two days.

QD

5.42 Remove spreader bar lifting lugs and place on clean plastic on Hot Shop floor.

NOTE: HIC will cure for two days. If HIC is to be cured in TSC-2, proceed to Section 6. If it is not, NA steps in Section 6.

6.0 TRANSFER OF HIC TO TSC-2

HP

6.1 HP enter and survey Hot Shop. Have work area decontaminated, if necessary.

HP

6.2 Remove plastic rain cover from TSC-2.

HP

6.3 Open Hot Shop doors.

HP

6.4 Using spacer car between locomotive and flat car, move flat car with TSC-2 into Hot Shop.

HP

6.5 Survey spacer car; if necessary, decontaminate to acceptable limits.

HP

6.6 Uncouple spacer car from carrier and remove from Hot Shop.

Init Date

- ____
- ____
- ____
- QD
- ____
- QD
- ____
- ____
- QD
- ____
- ____
- 6.7 Close Hot Shop doors.
- 6.8 Clear Hot Shop of personnel for subsequent remote operation.
- 6.9 Rig to lid of TSC-2 per Figure 5. Remove lid and place as directed by the operation supervisor. Uncouple the crane hook.
- 6.10 Rig the HIC spreader bar to the 100-ton crane and attach the spreader bar lifting hooks to the HIC lifting slings.
- 6.11 Observing precaution #2, lift HIC, move laterally and lower into TSC-2.
- 6.12 Remove spreader bar lifting lugs and place on clean plastic on Hot Shop floor leaving slings attached to HIC.
- 6.13 Rig to TSC-2 lid per Figures 5, and observing Precaution #2, replace lid on TSC-2. Uncouple from crane hook.
- 6.14 HP enter the Hot Shop and perform a preliminary radiological survey of Hot Shop Work area. Survey and smear carrier, TSC-2, and lid for external contamination and general radiation levels; decontaminate as required by Health Physics.
- 6.15 Open Hot Shop doors.
- ____

Init Date

- ____
- 6.16 Using shielded locomotive with spacer car attached, remove carrier with TSC-2 from Hot Shop.
- ____
- 6.17 Install and secure weather cover (plastic) on TSC-2.
- ____
- 6.18 Move TSC-2 to an outside storage area, as determined by the HP based on radiation readings, Chock wheels on rail car.

Procedures ended: Technician _____ Date _____

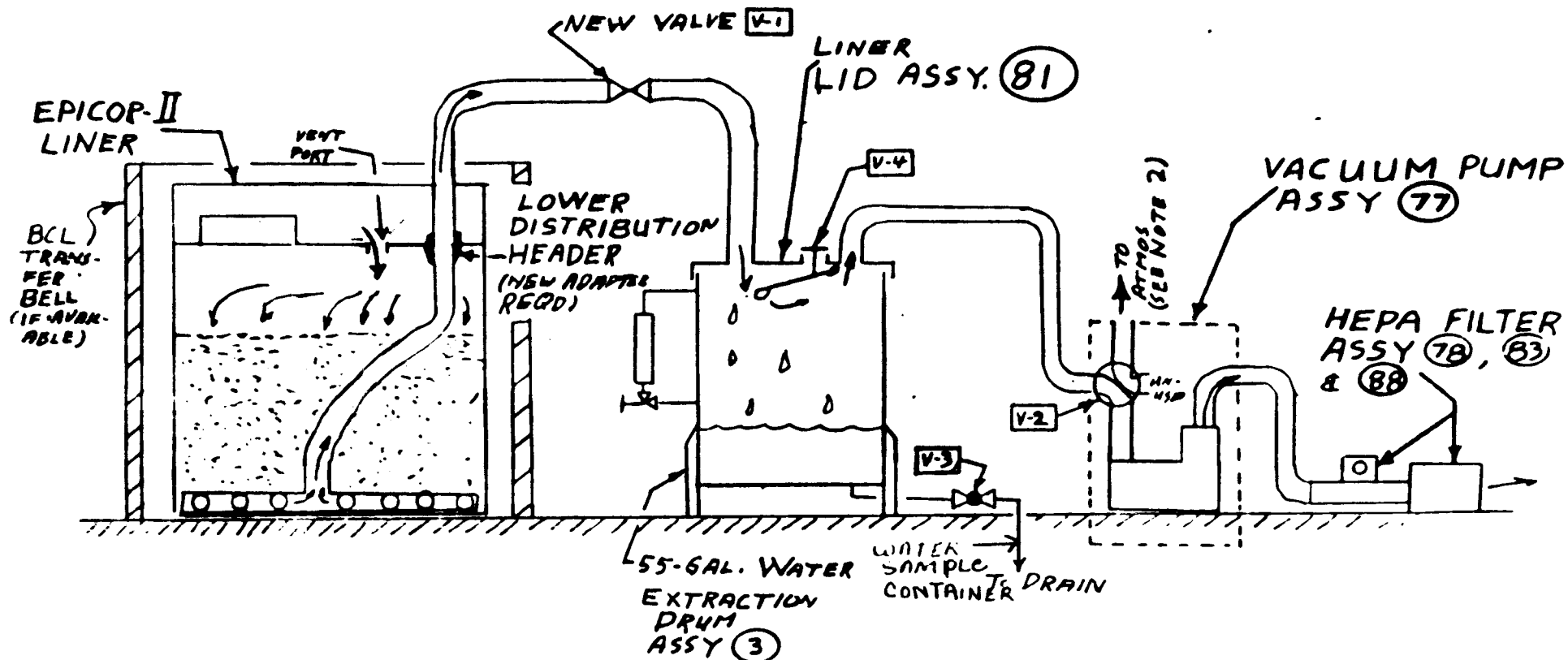
NOTES:

229
9-6-83
REV 1 9-24

1. BASED UPON DW6 E-417240 (ITEM NOS CIRCLED)

'EPICOR' LINER EXAMINATION EQUIPMENT
INSTALLATION AND DETAILS:

2. GAS WILL DISCHARGE UNFILTERED THROUGH
THIS PORT DURING THE INERT GAS PURGE.



SKETCH #1
DEWATERING
EQUIPMENT

Figure 1. Modified Liner Integrity
Examination Equipment

REFERENCE Dwg. ELC1979

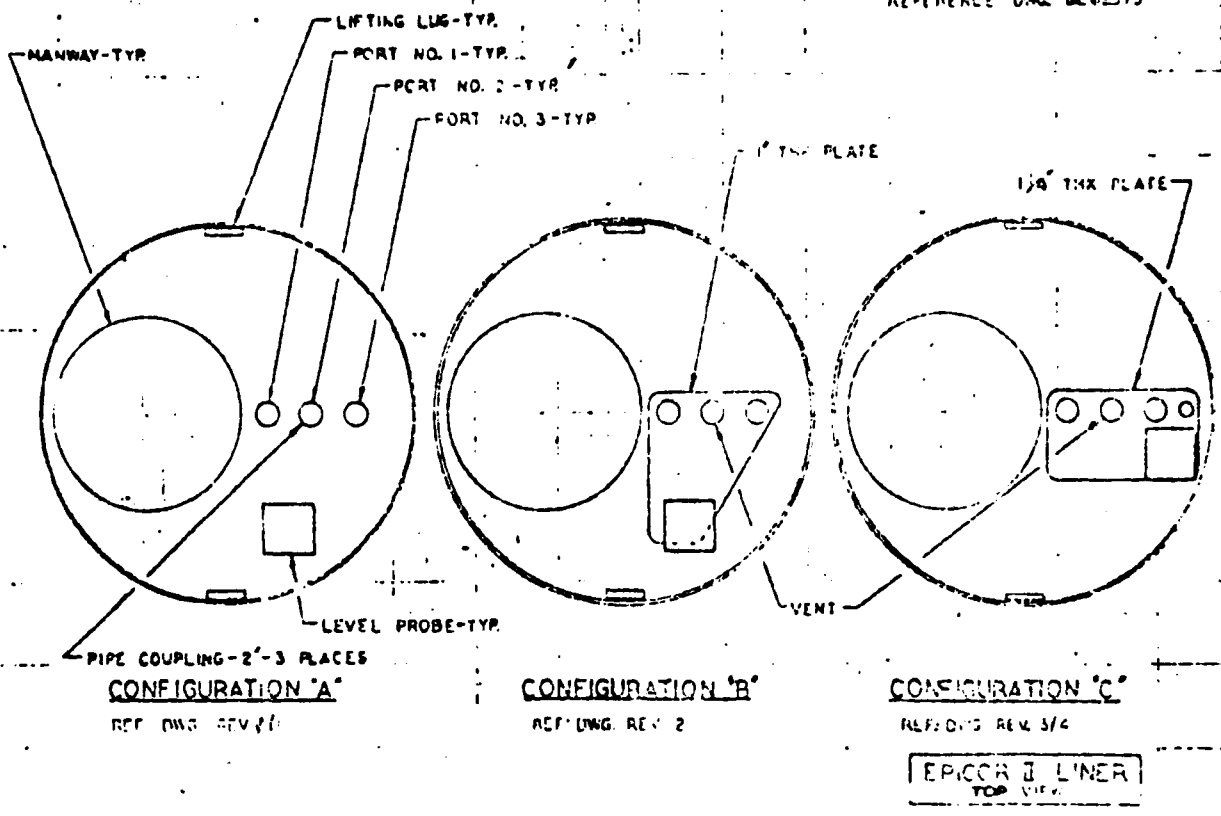


Figure 2.

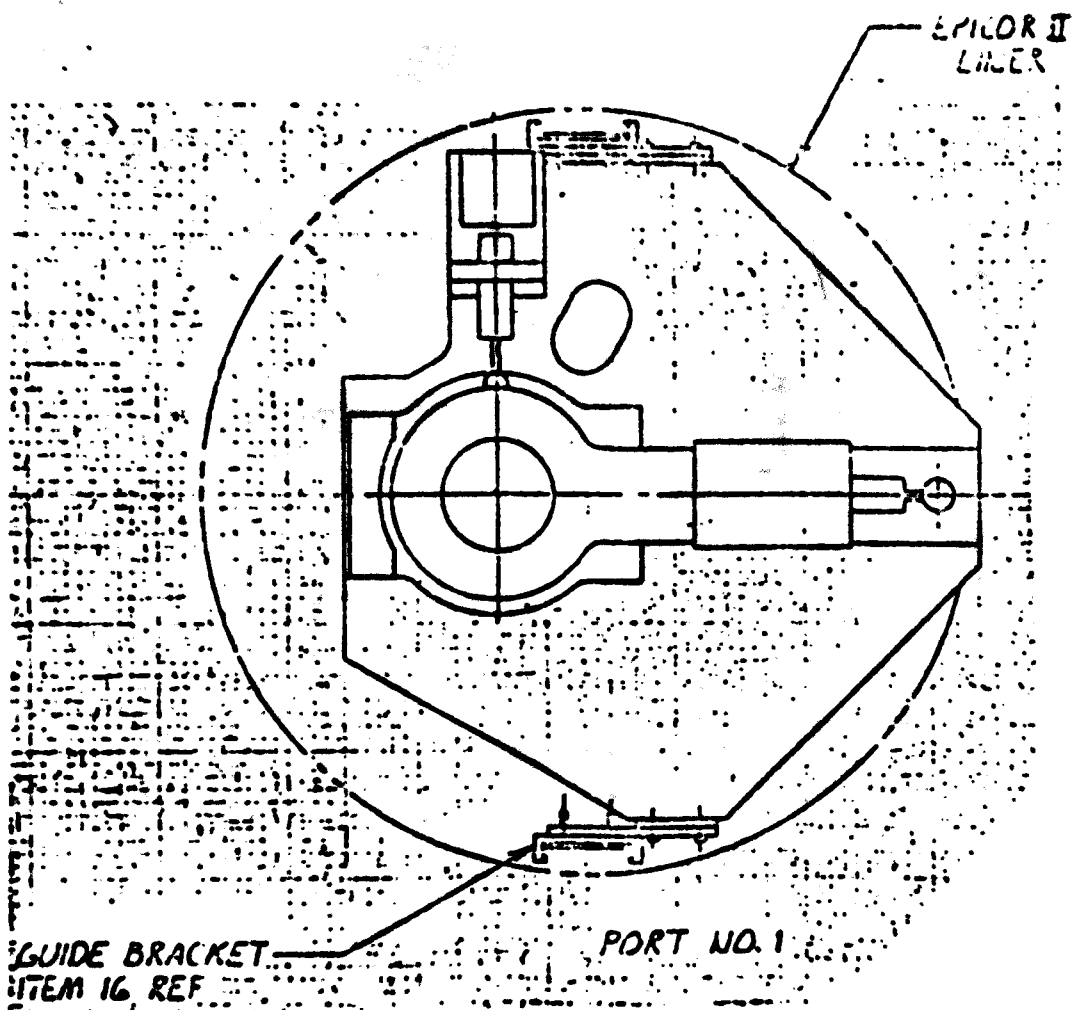


Figure 3.
Sheet 1 of 3

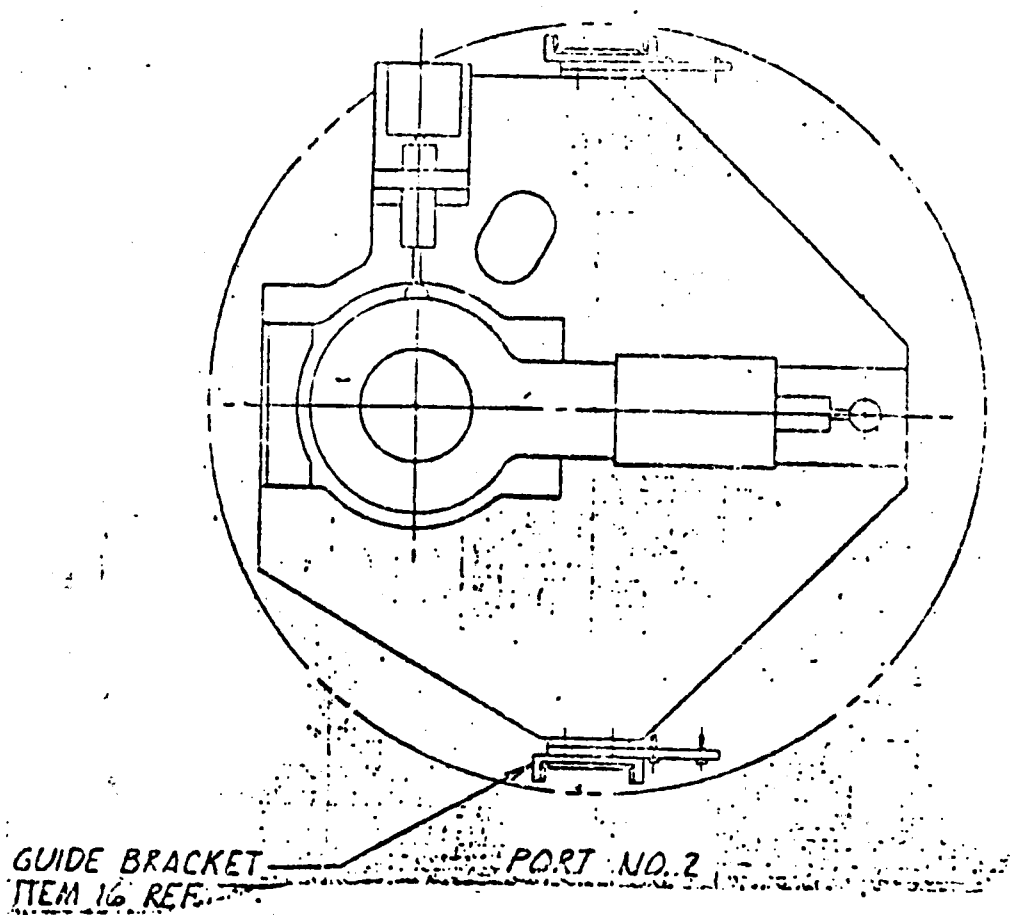


Figure 3.
Sheet 2 of 3

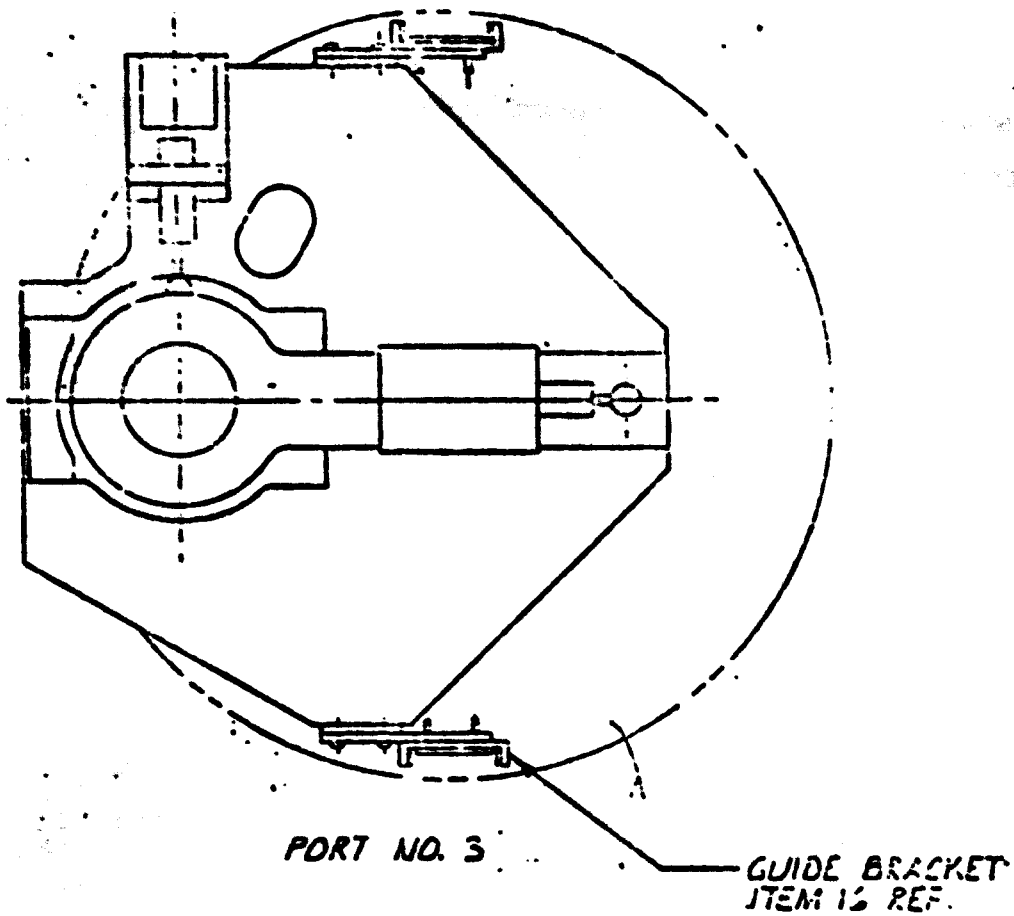


Figure 3.
Sheet 3 of 3

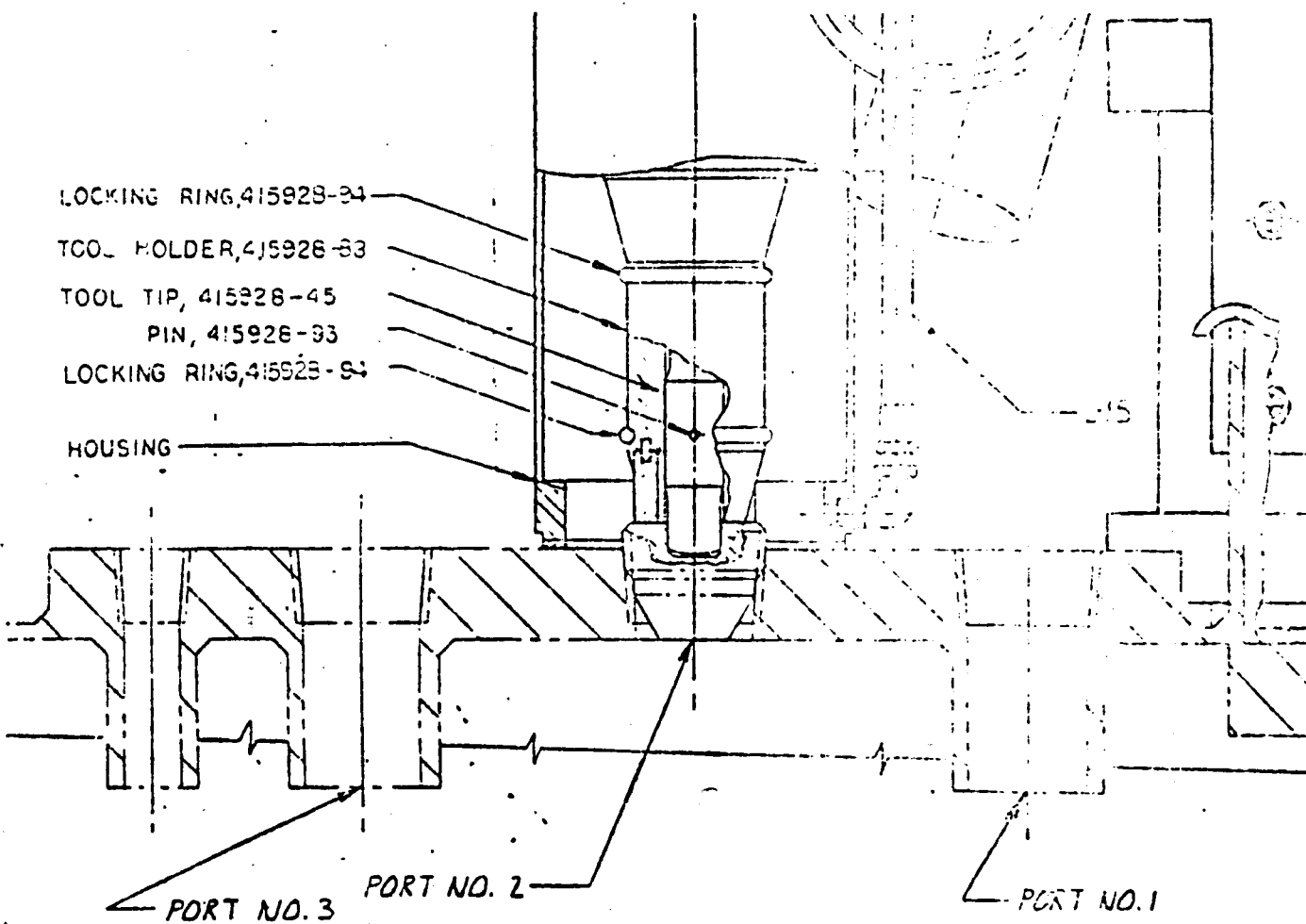
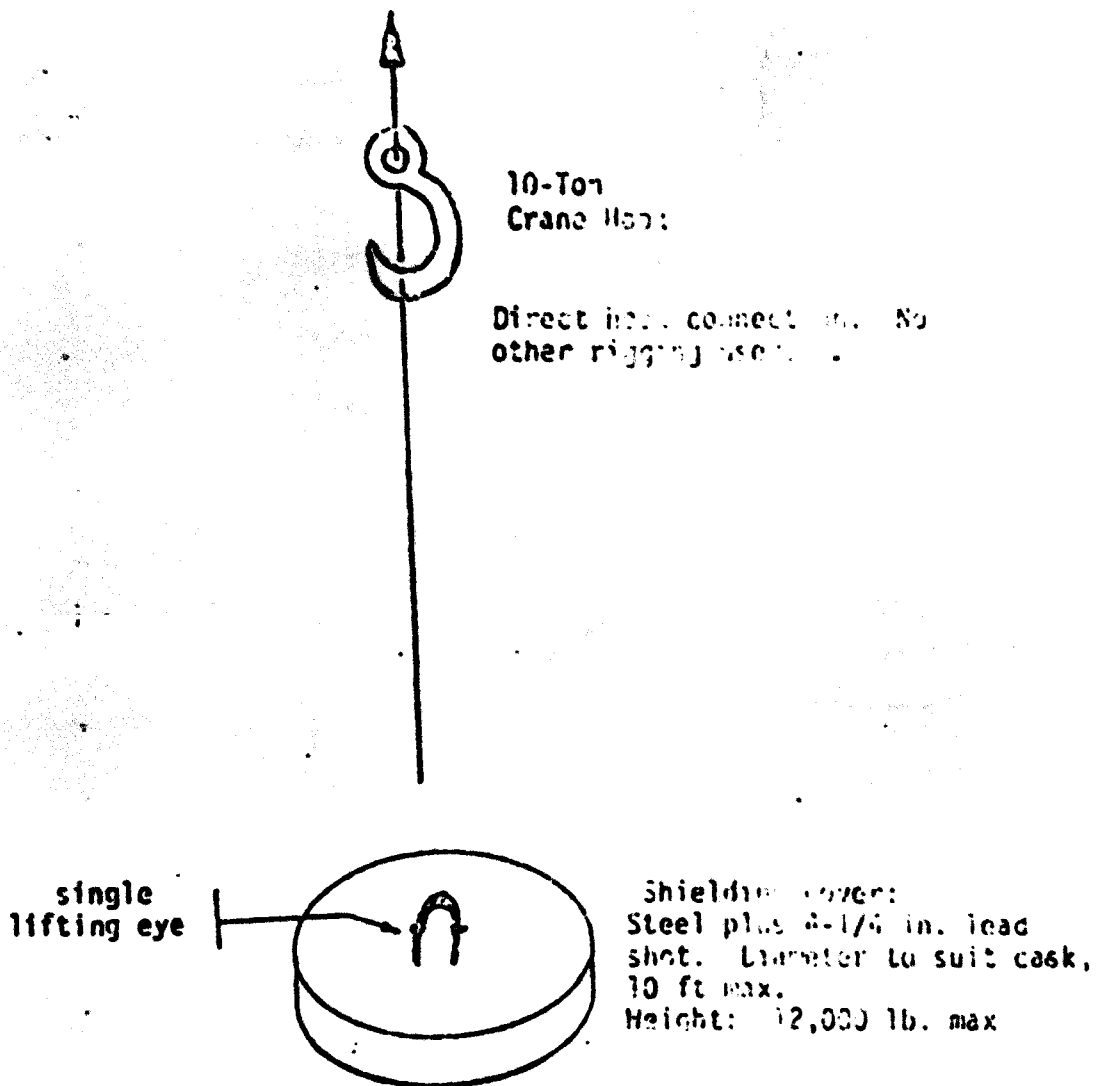


Figure 4.



**Figure 5. Rigging for Temporary Storage
Container Lid**

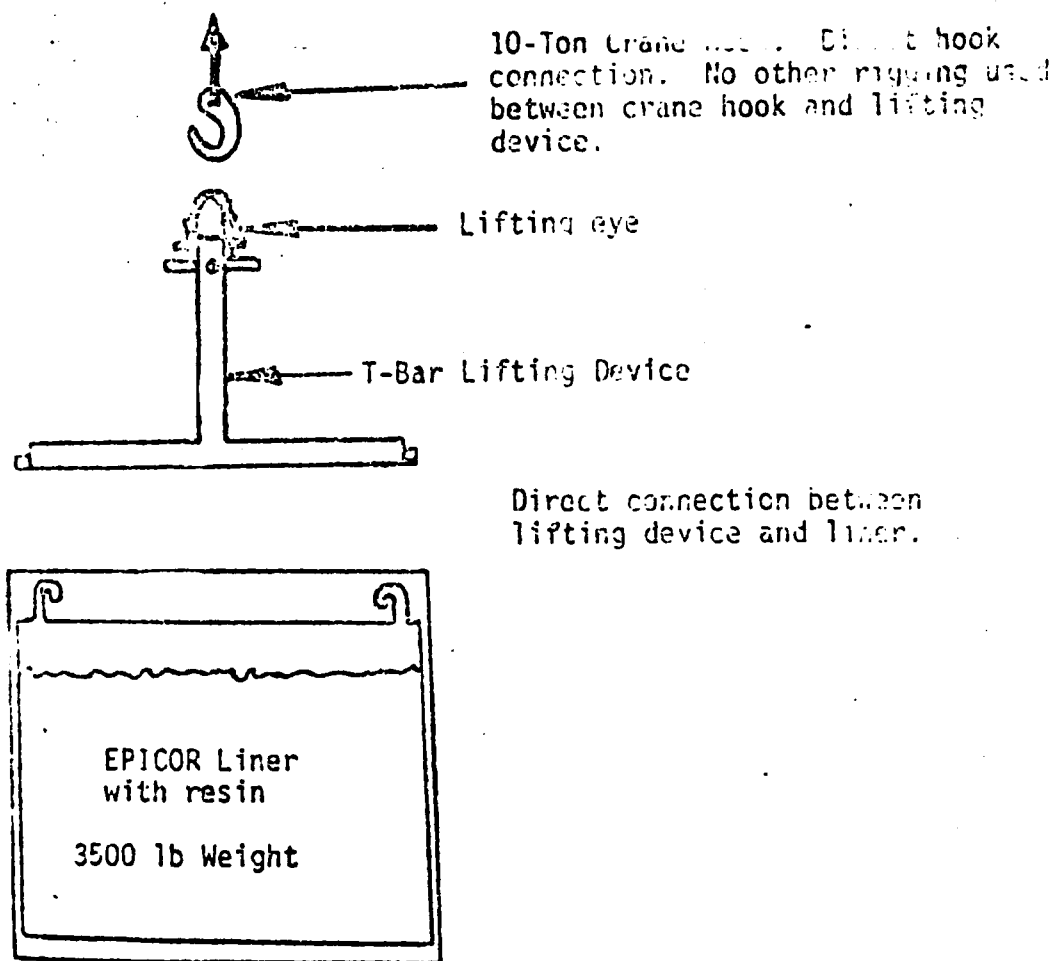


Figure 6. Rigging for T-Bar Lifting Device

Single Point Lift

Weight: Under
1500 lb.

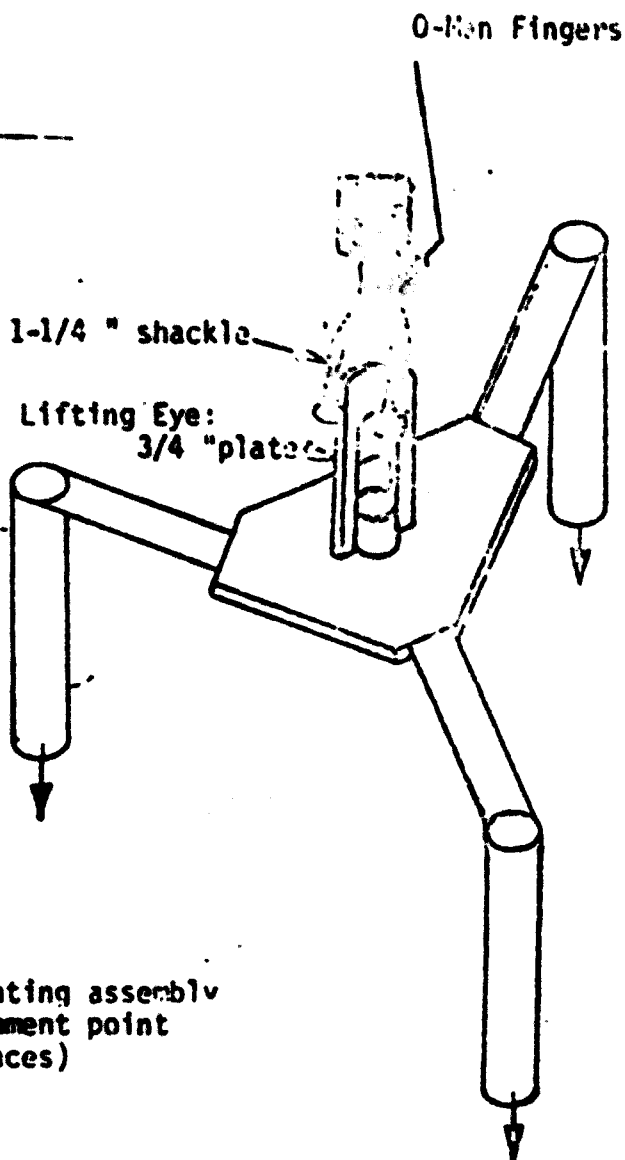
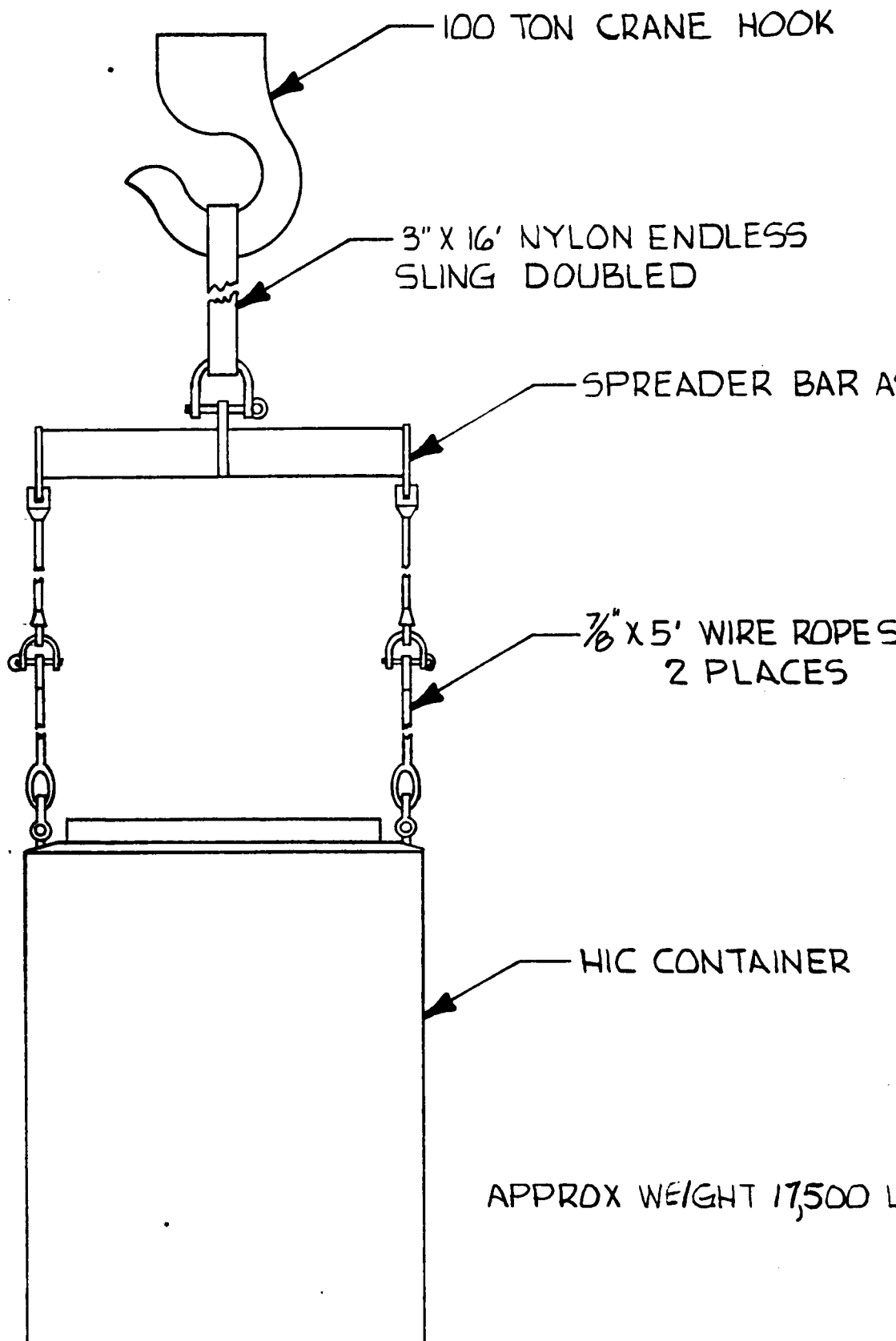
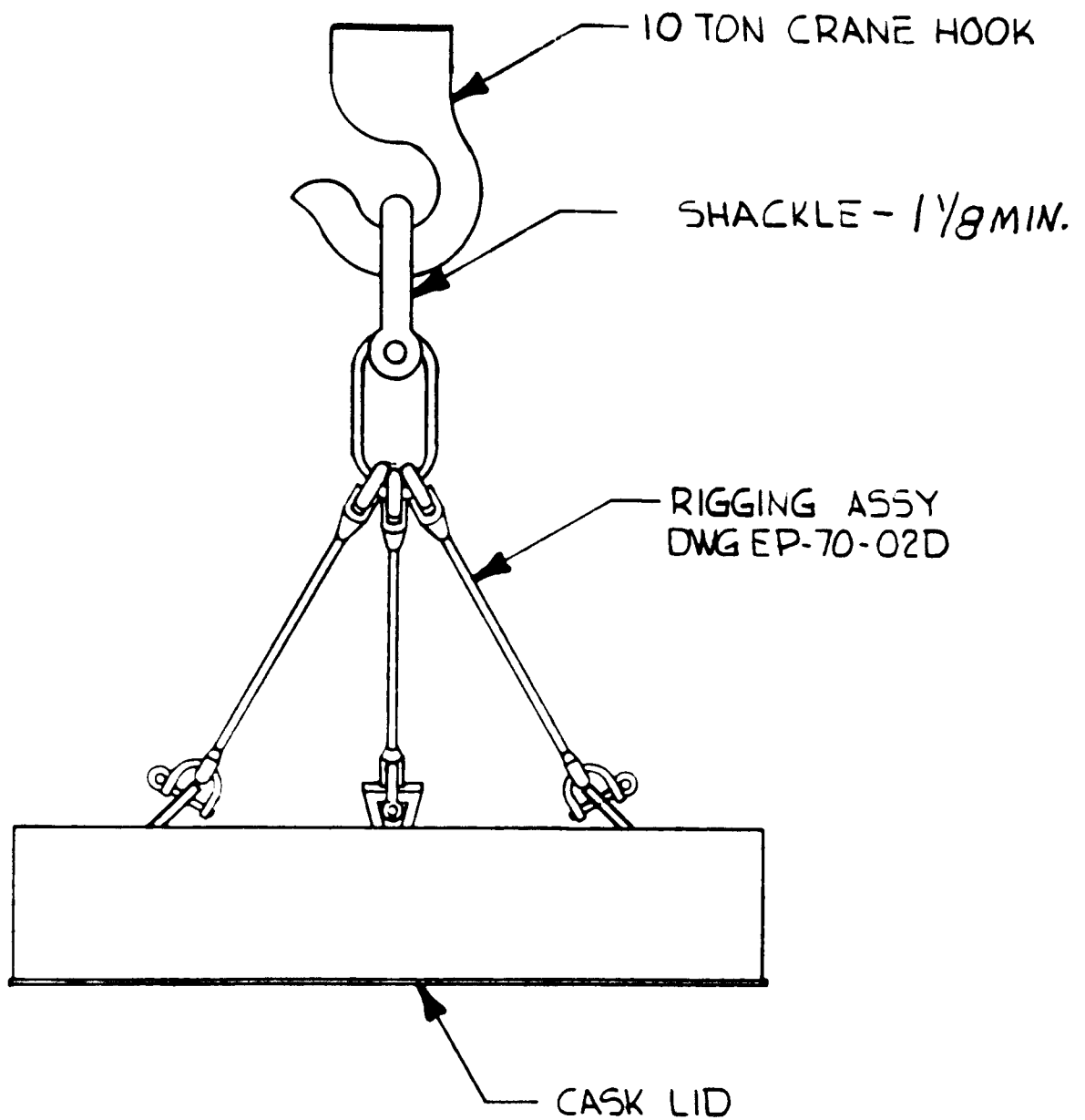


Figure 7. Rigging for Venting Assembly Fixture



HIC CONTAINER RIGGING

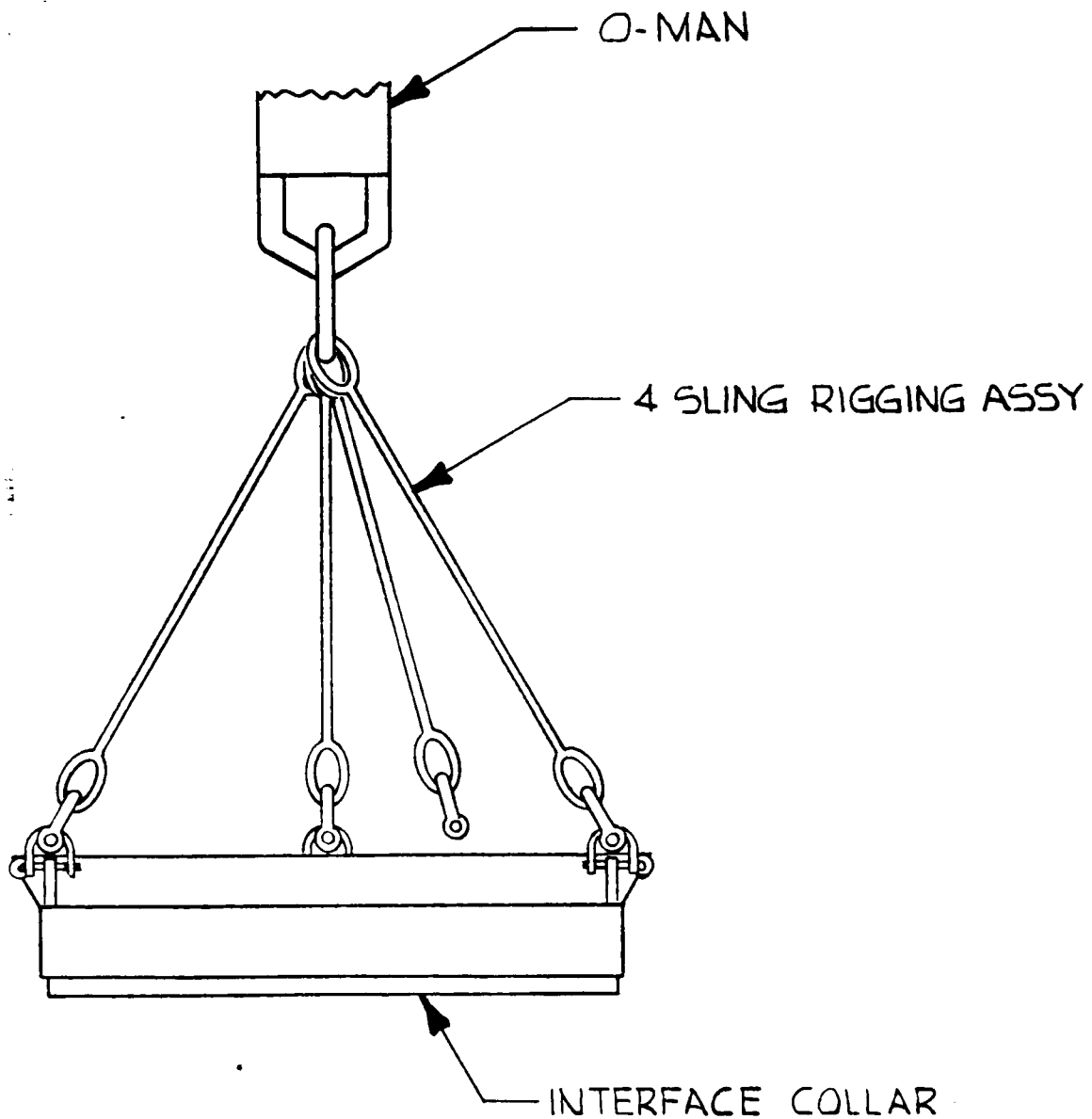
FIG. 8



APPROX WEIGHT 2650 LBS

HIC CONTAINER LID RIGGING

FIG. 9



APPROX WEIGHT - 160 LBS

INTERFACE COLLAR RIGGING
FIG. 10

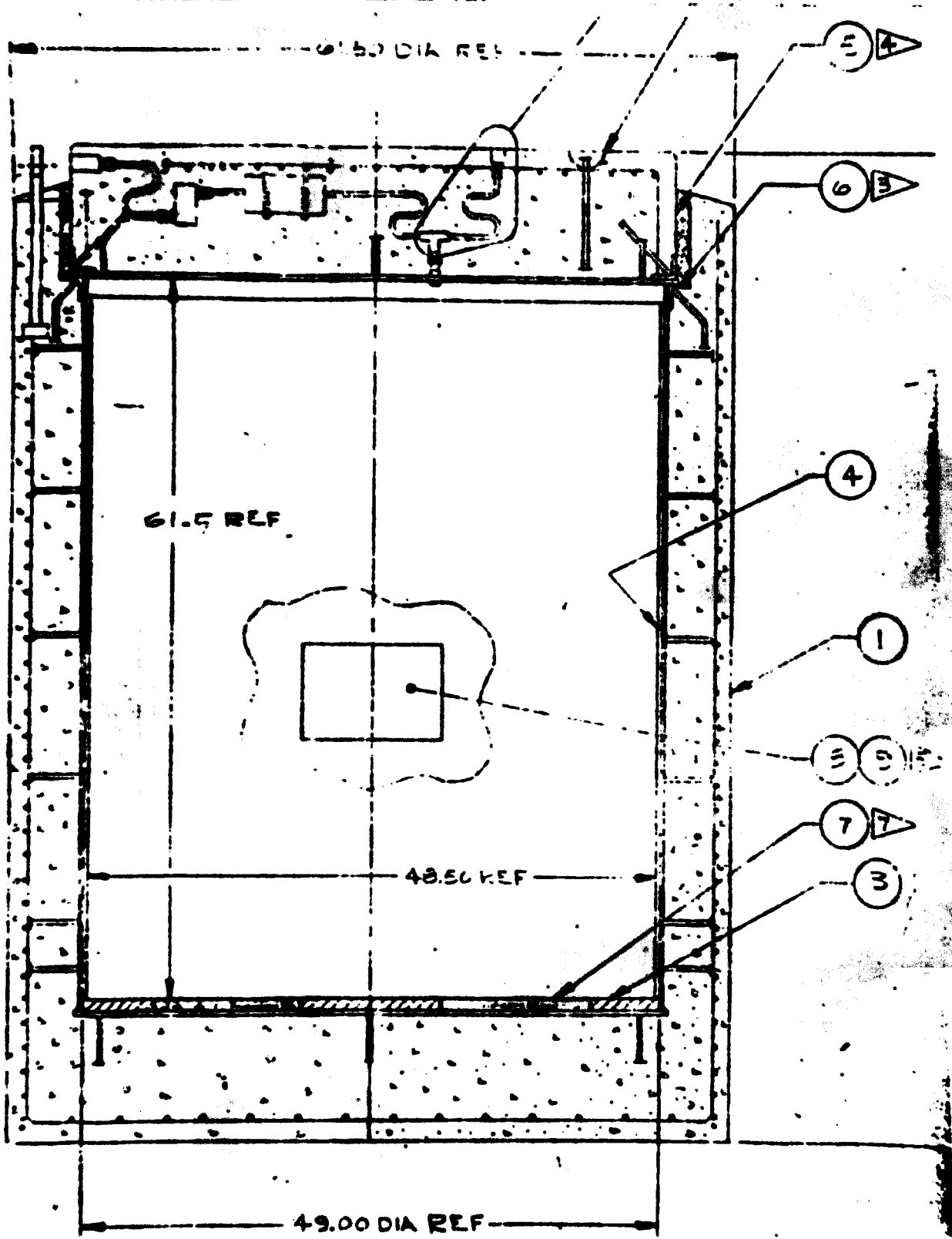


FIGURE 11

SP 1012-4

