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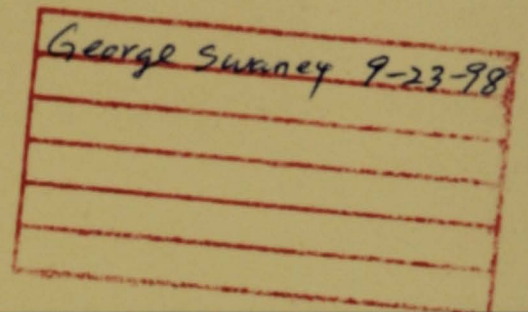
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TMI ABNORMAL WASTE PROJECT PLAN

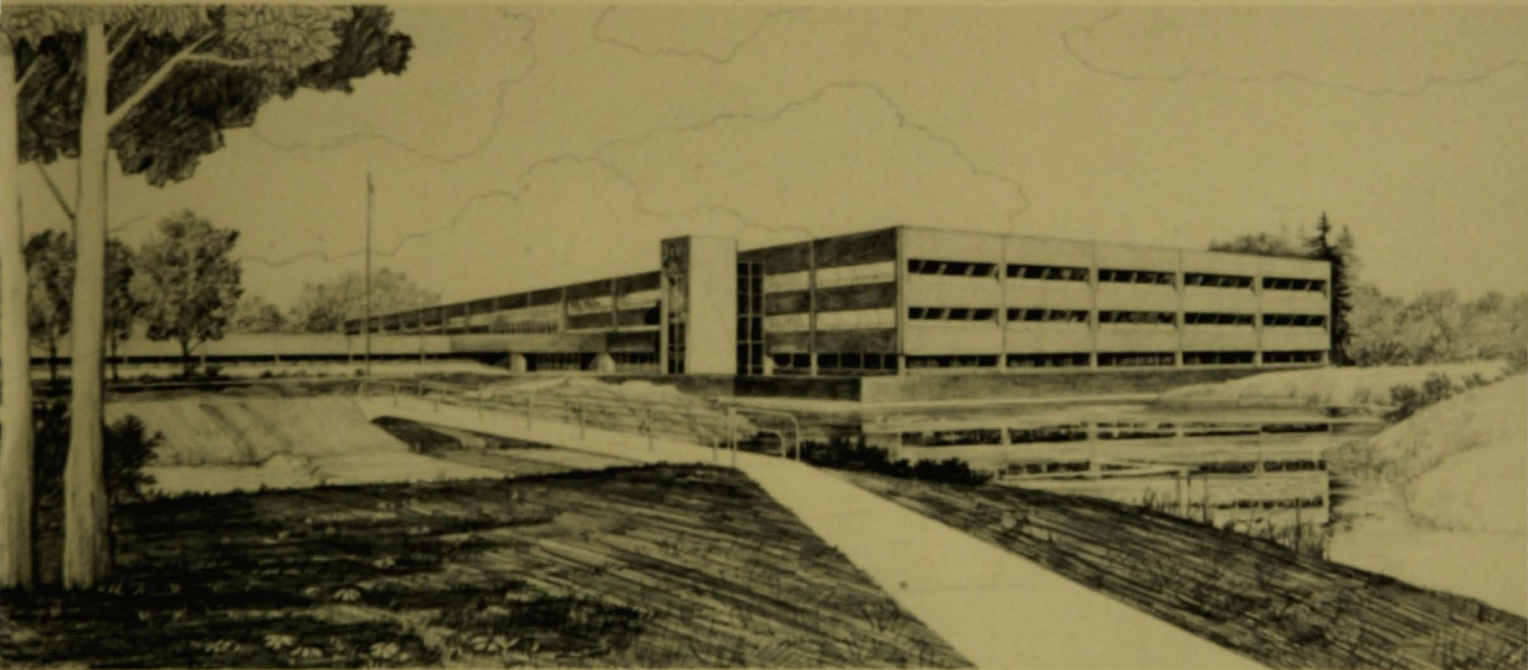
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A. L. (Ron) Ayers, Jr.

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Prepared for the
U.S. DEPARTMENT OF ENERGY
Under DOE Contract No. DE-AC07-76100570



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TMI ABNORMAL WASTE PROJECT PLAN

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June 1984

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Idaho Falls, Idaho 83415

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Idaho Operations Office
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ABSTRACT

This report discusses plans for the TMI Abnormal Waste Project, which is part of the EPICOR and Waste Research and Disposition Program and funded by the U.S. Department of Energy. The sequence proposed for disposition of Three Mile Island (TMI) abnormal wastes includes: (a) packaging at TMI, (b) shipment to the Idaho National Engineering Laboratory (INEL), (c) storage at INEL for up to 30 years, (d) processing for disposal, and (e) final disposal. Some wastes may be disposable immediately and would be processed and disposed without storage. Potentially, 930 ft³ of cartridge filters, Submerged Demineralizer System filters, sludges, ion-exchange resins, and miscellaneous plant equipment may be classified as abnormal waste. Some wastes may be deleted and others added as cleanup progresses at TMI. The first waste classified as abnormal is Makeup and Purification Demineralizer resin. This report outlines storage plans, procedures, project management, costs, and schedules for placement of those resins.

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TMI ABNORMAL WASTE PROJECT PLAN

INTRODUCTION

Significant quantities of radioactive wastes originated from Three Mile Island Unit 2 (TMI-2) as a result of the March 1979 accident. Some of those wastes contain higher levels of radioactivity than are allowable for disposal at commercial low-level waste disposal sites or transuranic (TRU) contamination significantly above the 100 nCi/g limit specified by both the U.S. Nuclear Regulatory Commission (NRC) and U.S. Department of Energy (DOE). An Environmental Impact Statement developed by NRC concluded [in part] that TMI is not a suitable site for long-term storage of those wastes.¹ A Memorandum of Understanding (MOU) was signed by NRC and DOE in March 1982 concerning removal and disposition of those wastes.² The MOU allows DOE to remove, store, and dispose of those wastes to the extent that General Public Utilities Nuclear Corporation (GPU Nuclear--owner/operator of TMI) provides reimbursement to DOE.

DOE already has provided for use and disposition of wastes from TMI-2 such as EPICOR II prefilters, Submerged Demineralizer System (SDS) zeolite absorbers, and core debris and fuel. A significant quantity of high beta-gamma, high TRU contaminated waste exists in addition to that covered by the above agreements. Those wastes are classified as TMI-2 abnormal wastes because their contamination levels exceed 10 CFR 61; therefore, the wastes cannot be disposed in their present form at commercial sites. Presently, that material consists of about 930 ft³ of wastes in the form of plant cartridge filters, SDS filters, ion-exchange resins, sludges, and miscellaneous contaminated plant equipment. Additional wastes of similar characteristics will be generated during the remainder of the TMI-2 cleanup.

On 8 June 1983, F. E. Coffman (Director of DOE Office of Terminal Waste Disposal and Remedial Action) requested that T. E. Wade (Manager of the DOE Idaho Operations Office) have EG&G Idaho, Inc. proceed with plans for receipt of TMI-2 abnormal wastes at Idaho National Engineering Laboratory (INEL).³ Plans include storage of those wastes at INEL until a final repository is

developed and reimbursement to DOE by GPU Nuclear for storage, processing, and disposal. This project plan reflects current information and plans for receipt, interim storage at INEL, and disposal of TMI-2 abnormal wastes.

A MOU between the U.S. Environmental Protection Agency (EPA) and DOE (hereinafter referred to as the EPA-MOU) was signed in February 1984 concerning the management of hazardous waste and radioactive mixed waste.⁴ This project plan does not include special considerations for TMI abnormal wastes that may result from the EPA-MOU.

DISPOSAL SEQUENCE

The first abnormal wastes are expected to be removed from TMI-2 beginning in late 1984. Figure 1 shows the three-part sequence for disposition of those wastes. First, GPU Nuclear will package the wastes according to waste acceptance criteria prepared by INEL. Then GPU Nuclear will be responsible for transporting the wastes to INEL in shielded shipping casks, and INEL will store the wastes until a final repository for those commercial wastes is developed. Interim storage may be required for up to 30 years. If effective methods of disposal are developed earlier, or wastes can be used in DOE research and development (R&D) programs before the end of the storage period, the wastes will be removed from storage. At the end of the storage period, the wastes will be transported to a processor where they will be treated, repackaged, and transported to a final repository. In some cases, abnormal waste may be processed at INEL for immediate disposal in existing commercial facilities. Preference will be given by INEL to disposal (rather than storage sequences) where possible.

Funds for disposal of the wastes will be collected from GPU Nuclear before transporting the wastes from TMI-2. Funds will recover all costs, including those required for monitoring the waste during storage, retrieval from storage, processing for disposal, transporting, and final disposition.

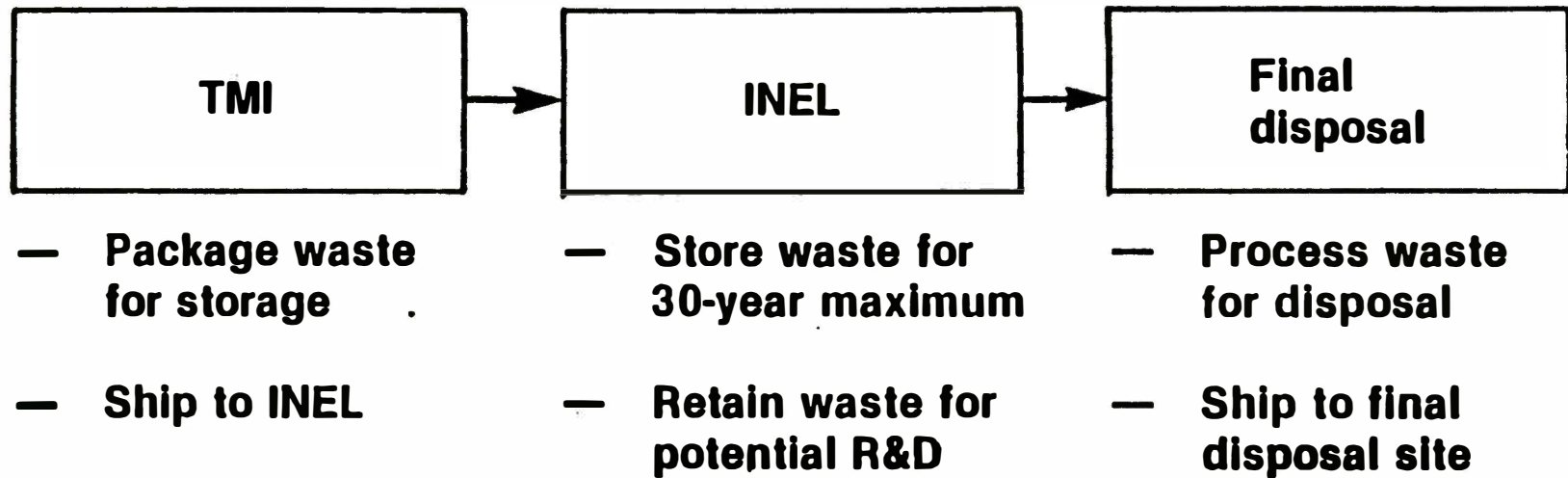


Figure 1. Disposal sequence developed for TMI abnormal waste.

DESCRIPTION OF TMI WASTES

Approximately 930 ft³ of radioactive materials have been identified as potential TMI-2 abnormal waste. The types of materials include plant cartridge filters, organic ion-exchange resins, sludges from various tanks and building sumps, cartridge- and sand-filter assemblies from the SDS, and miscellaneous contaminated pieces of hardware. Information necessary to determine characteristics of those wastes is not currently available. In addition, other waste types may be included as cleanup continues at TMI-2. However, before final acceptance, each waste package will be evaluated using waste acceptance criteria and interim storage requirements of INEL.

One example of waste expected to be classified as abnormal is organic ion-exchange resin from the Makeup and Purification Demineralizers (MUPD). The demineralizers were operating at the time of the TMI-2 accident; the resins therein were degraded severely because of a combination of thermal and radiation effects. Approximately 44 ft³ of resin exists in two vessels. The resin is contaminated with about 4 kg of fuel (3% U-235 maximum enrichment).

PREPARATION FOR SHIPMENT AND STORAGE

GPU Nuclear currently plans to load the MUPD resin into seven liners. The liners will have an external configuration similar to the SDS zeolite absorbers shown in Figure 2 and will be referred to as "2 x 4" liners. The interior configuration will be modified to facilitate loading of each liner at TMI-2. Each liner will be vacuum degassed to eliminate free-standing water. The degassing also will reduce buildup of radiolytic gases. At INEL, liners will be vented through individual filters to control internal pressures and contain radionuclides. Use of catalysts to recombine radiolytic gases also will be considered.

Estimated maximum radioisotopic content of each liner is shown in Table 1, although present plans propose elution of cesium from the resin at TMI by GPU Nuclear. Expected values after elution are also shown in Table 1. The elution process could remove up to 90% of the Cs-137 and Cs-134. [Eluted material will be disposed of by DOE at Hanford, Washington in SDS zeolite absorbers.] Maximum radiation fields are estimated to be as high as 2600 R/h on contact and 111 R/h at 3 ft. Elution of cesium will significantly reduce radiation fields to an estimated 103 R/h on contact and 10 R/h at 3 ft. The TRU contamination is expected at about 8900 nCi/g of Pu (including Pu-241) and 100 nCi/g of Am-241. Reportable quantities of special nuclear materials (SNM) are expected.

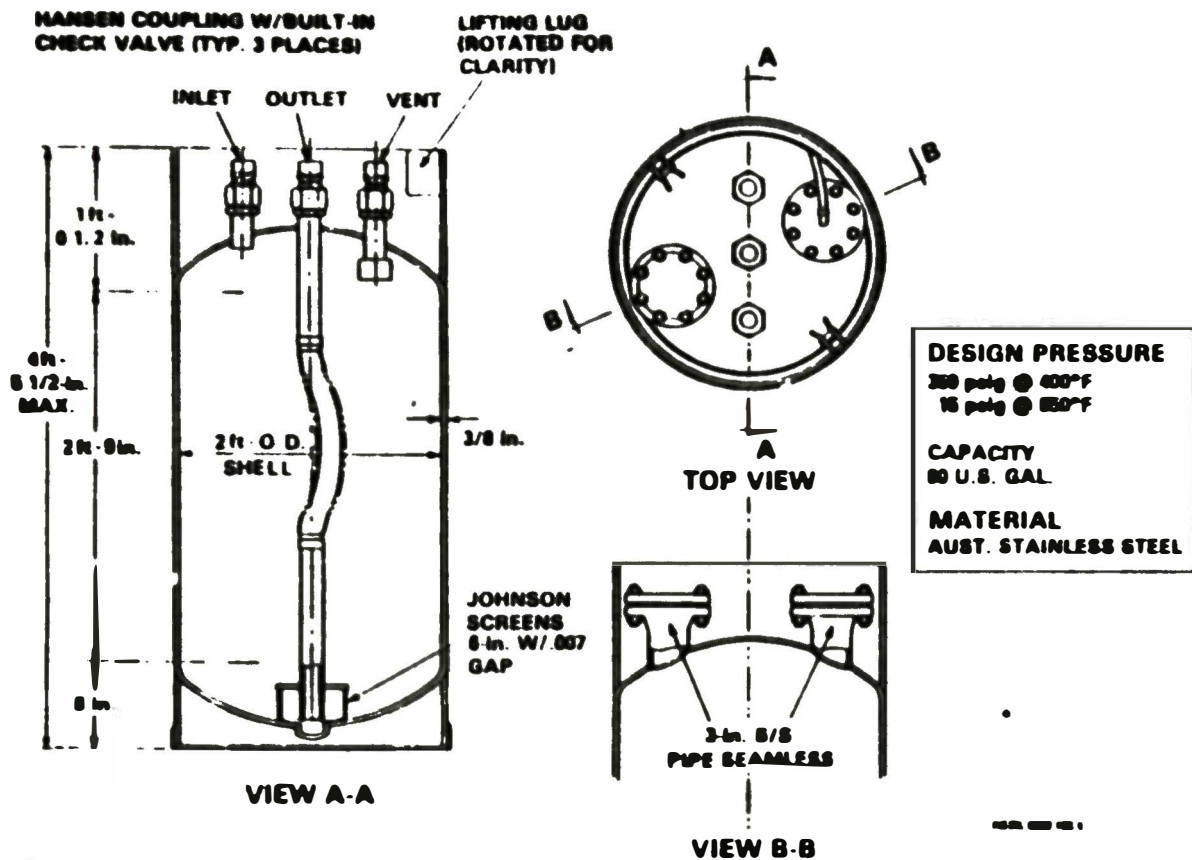


Figure 2. Diagram of the TMI-2 Submerged Demineralizer System zeolite absorber liner.

TABLE 1. ESTIMATED RADIOISOTOPIC CONTENT OF MAKEUP AND PURIFICATION
DEMINERALIZER RESINS IN EACH 2 x 4 LINER

<u>Isotope</u>	<u>Curie Content^a Per Liner (before elution)</u>	<u>Curie Content^b Per Liner (after elution)</u>	<u>Gram Content Per Liner</u>
¹³⁷ Cs	1481	149	
¹³⁴ Cs	64.9	6.49	
¹⁰⁶ Ru	1.37	1.37	
¹⁴⁴ Ce	1.36	1.36	
¹²⁵ Sb	13.9	13.9	
⁹⁰ Sr	486	486	
¹²⁹ I	0.0189	0.0189	
⁶⁰ Co	0.234	0.234	
⁶³ Ni	0.26	0.26	
²³⁵ U	2.90 E-5	2.90 E-5	13.5
²³⁸ U	1.90 E-4	1.90 E-4	572
²³⁸ Pu	3.00 E-5	3.00 E-5	negligible
²³⁹ Pu	5.70 E-2	5.70 E-2	0.92
²⁴⁰ Pu	1.40 E-2	1.40 E-2	0.06
²⁴¹ Pu	0.938	0.938	0.01
²⁴¹ Am	0.011	0.011	negligible

a. Values extrapolated to October 1984.

b. Expected values for shipment to INEL.

STORAGE AT INEL

The method selected for interim storage of abnormal wastes at INEL is in concrete casks near Test Area North (TAN). Figure 3 shows a temporary storage cask (TSC) used to store EPICOR II liners. TSCs of similar design have been used at TAN since the early 1960s with no sign of deterioration. The TSC can contain either one 4 x 4 liner, three 2 x 4 liners, three 55-gallon drums, or eight 30-gallon drums. Each TSC will be equipped with a vent port, drain, and rain cover. Tamper-proof seals will be applied by safeguards personnel for physical safeguard. Use of a carbon steel inner liner also is being considered. If either size drums are used for wastes, some form of corrosion control will be required for 30-year storage. Early assessment indicates that two hundred 30-gallon drums and nine 2 x 4 liners will require 28 TSCs. The total number of TSCs needed will depend on the amount of waste transported and the type of packaging chosen.

Figure 4 shows a tentative location for storage of 28 TSCs for 30 years at INEL. Other nearby locations at INEL also are being considered. The final location will depend on other planned activities or exclusion areas established for the area.

The TSCs will be placed on an asphalt pad with a gravel and sand base. A curb will be placed around the pad for drainage control. Rain and melt water will drain to a common point for monitoring of radioactivity. A fence will be placed around the asphalt pad at an appropriate distance to control radiation exposure to personnel and exclude uncontrolled access.

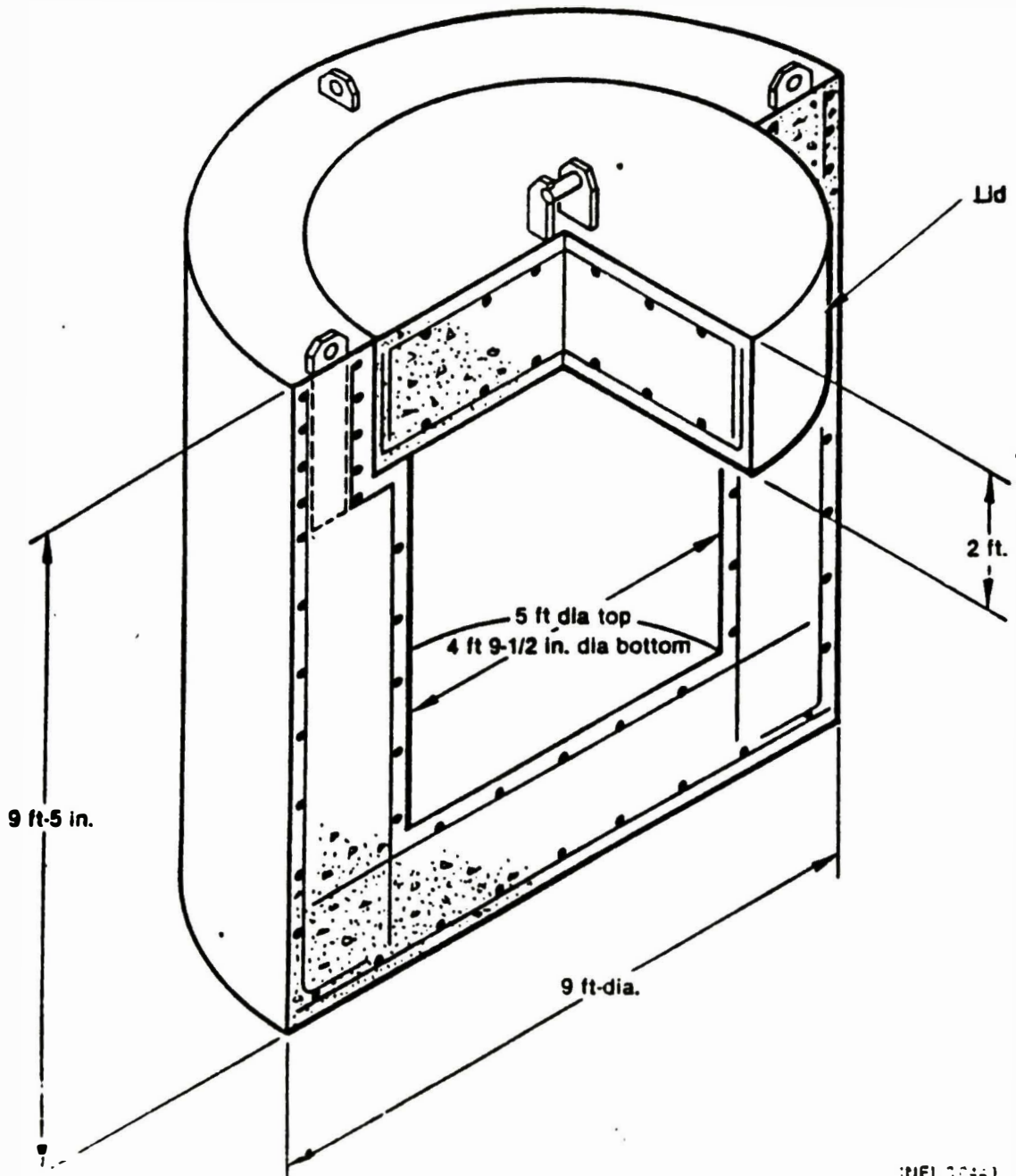
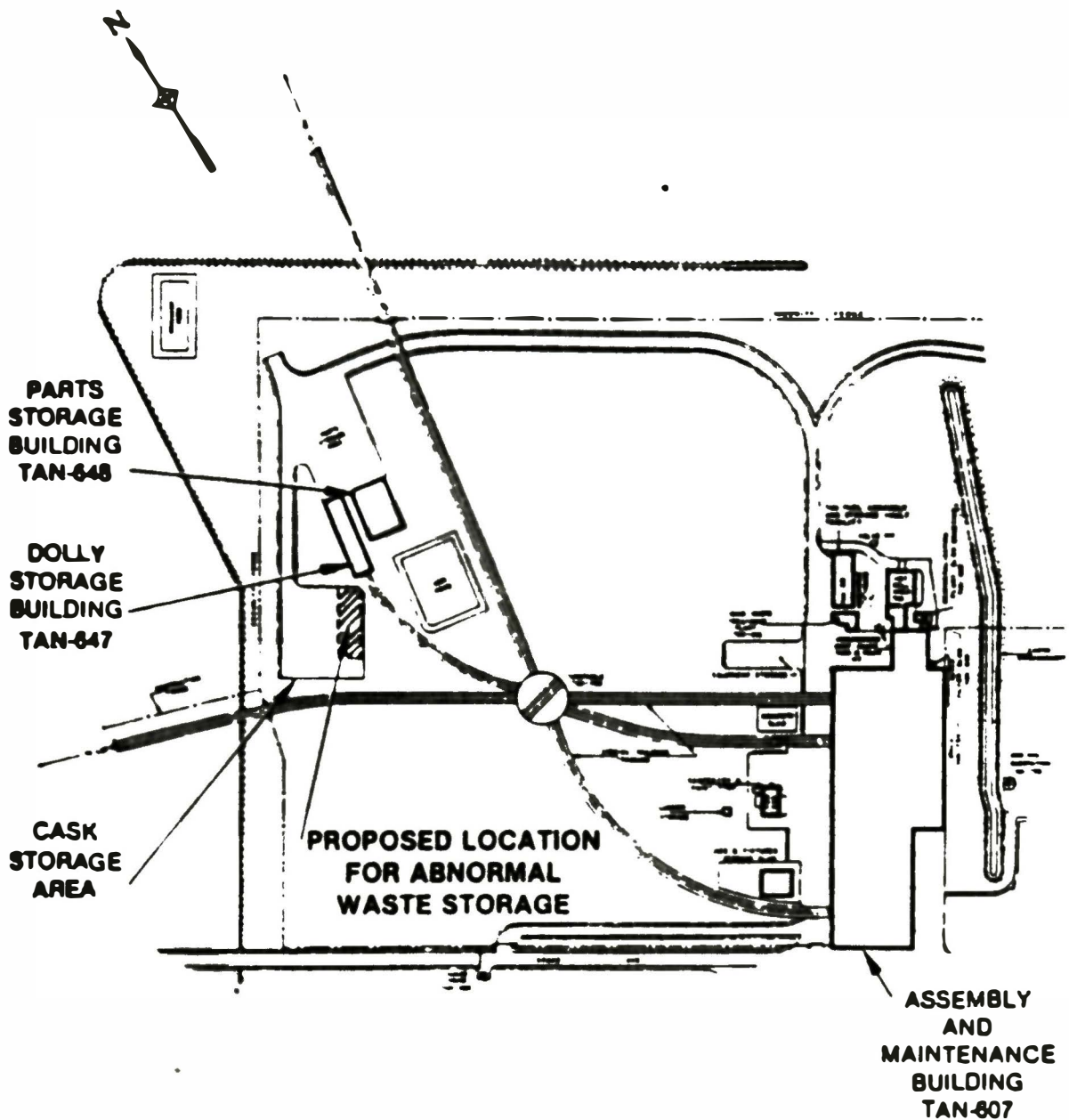


Figure 3. Schematic of a temporary storage cask for interim storage TMI-2 abnormal waste at INEL.



INEL 3 0407

Figure 4. Tentative location for interim storage of TMI-2 abnormal waste at INEL.

OUTLINE OF STORAGE PROCEDURES

Wastes will be transported from TMI-2 in shielded shipping casks. For 2 x 4 liners, the shipping cask could be the CNS-1-13C cask used to transport SDS zeolite absorbers to Hanford (Figure 5).

The method of placement of waste in a TSC at INEL will depend on surface radiation fields as follows:

1. If the surface of the waste container has a radiation field of 30 R/h or less, a direct transfer similar to that used at the Radioactive Waste Management Complex of INEL will be performed. The TSC will be placed on the asphalt pad at its storage location, the truck and shipping cask located next to the TSC, the cask opened, and waste transferred by crane. Long-handled tools and video equipment can assist in rigging and liner venting.
2. Liners with radiation readings between 30 and 100 R/h will be transferred in a similar manner, but a concrete sleeve or transfer bell will be used to reduce radiation exposure to personnel.
3. Liners with radiation readings greater than 100 R/h will be transferred to the TSC inside the TAN-607 Hot Shop. The TSC will be delivered to the Hot Shop on a trailer or rail car, the truck with the shipping cask backed into the Hot Shop, the trailer uncoupled, and the tractor removed from the Hot Shop. After draping the trailer and its cask with plastic for contamination control, the TSC and shipping cask will be opened, and the waste transferred to the TSC. Both casks will be closed and the shipping cask removed from the Hot Shop. If the TSC is to be loaded with more than one waste package, the TSC will be placed on the Hot Shop floor until filled, or it will be removed from the Hot Shop between loadings. In the latter instance, the TSC will be stored outside on a trailer or rail car. Operations will be repeated until the TSC is filled. Then the TSC will be transported to the storage area by truck or rail and unloaded onto its storage pad by crane.

Figure 5. Schematic of the CNS-1-13C shipping cask.

PROCEDURES FOR FINAL DISPOSAL

The following two methods will be used for final disposal of abnormal wastes:

- o Wastes that are acceptable for direct processing will be received, processed, shipped, and disposed in accordance with plans prepared before waste acceptance. Those wastes will be shipped to existing commercial low-level, shallow-land burial sites for final disposal.
- o Those wastes that are in interim storage will be retrieved using the reverse of the storage procedures. The waste packages will be loaded into transportation casks for delivery to a processing facility. If facilities exist for processing the waste at INEL, those facilities will be used where practical. At the processing facility, the waste will be repackaged to meet criteria for final disposal. Then the waste will be transported to a repository for final disposal. The repository may be a greater confinement disposal facility (similar to that being developed at the Nevada Test Site), a TRU repository [similar to the Waste Isolation Pilot Plant (WIPP)], or a high-level waste repository. A low-level waste disposal facility could be used if the waste meets acceptance criteria at the time of retrieval.

PROJECT MANAGEMENT AND INTERFACES

The TMI Abnormal Waste Project is an element of the EPICOR and Waste Research and Disposition Program (EWRO). EWRO is the responsibility of the Programs Section of the TMI Technical Support Branch (TSB) of EG&G Idaho. TSB was organized as an element of the DOE TMI-2 Technical Information and Examination Program (TI&EP). The TMI Technical Integration Office (TIO) was established in accordance with the terms of the GEND^a Coordination Agreement (Reference 5) and functions within guidelines established by the DOE TMI-2 Program Management Plan. The relationship between TI&EP and TSB is described in the TSB Management Plan.⁶

The functional organization of the TMI Abnormal Waste Project is shown in Figure 6. The project is responsible for management and control of all activities at INEL involving TMI abnormal waste. Activities include obtaining DOE approvals, establishing project requirements and criteria, identifying and authorizing tasks, establishing and controlling direct budget and schedule requirements, monitoring and reporting to DOE and EG&G Idaho management on project performance, and maintaining liaison with TIO. TIO will be responsible for all contacts and interfaces with GPU Nuclear including contract negotiations and exchange of technical information.

Typically, a request by GPU Nuclear to include a particular waste as abnormal waste will be received by TIO. The request will be controlled by, and include information required in, the TMI Abnormal Waste Acceptance Criteria (AWAC), which is being developed by EG&G Idaho. The request will be forwarded to DOE-ID for review and tentative approval.

If acceptable, the request will be forwarded to the TSB of EG&G Idaho. TSB will compare the request with the AWAC, develop disposal scenarios, provide cost estimates, and recommend acceptance or rejection of the waste as abnormal. The cost estimates and disposal scenarios then will be returned to

a. The acronym GEND identifies the following four organizations: GPU Nuclear, Electric Power Research Institute, NRC, and DOE.

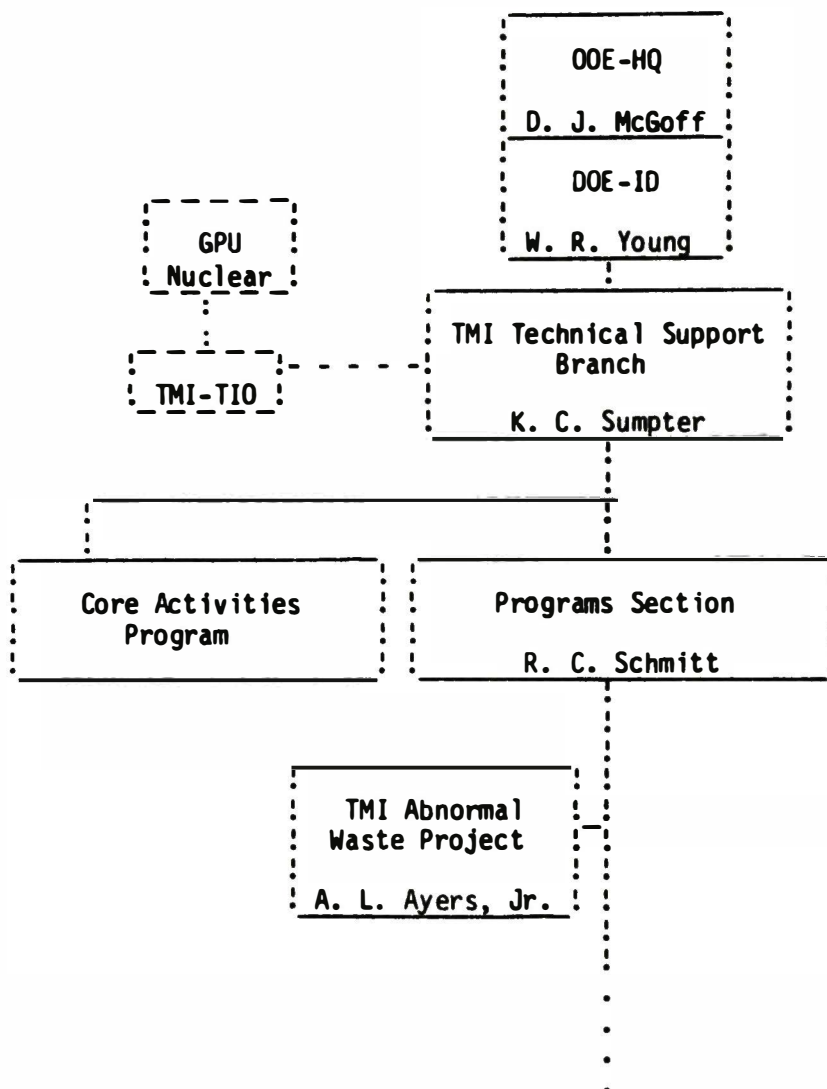


Figure 6. Functional organization of the TMI Abnormal Waste Project.

TIO (by way of DOE-ID) for negotiation with GPU Nuclear. Upon completion of negotiations, handling of the waste will be included and controlled as a task within the project. GPU Nuclear then will package the waste in accordance with the AMAC submittal. Review and approval of specific GPU Nuclear procedures by the Quality Division of EG&G Idaho will be part of that packaging (as required by the AMAC). Meanwhile TSB will prepare for receipt and handling of the waste. When both GPU Nuclear and EG&G Idaho are prepared, the waste will be transported to INEL at GPU Nuclear expense. At INEL, processing will be in accordance with the disposal scenario developed for the waste.

SAFETY, QUALITY, AND ENVIRONMENT

Safety

Safety aspects of the project will be addressed in accordance with the EG&G Idaho Safety Manual. Safety reviews will be performed for each proposed waste and disposal scenario. Interfaces with the Safety Division will be identified as part of the previously defined acceptance step. Implementation of those interfaces will continue throughout the review, receipt, processing, storage, and disposal stages. The amount of fissile material in the storage area will exceed minimum quantities for criticality control. Therefore, the storage area will be classified as a Fissile Material Control Area (FMCA).

Quality

Quality aspects of the project will be addressed in accordance with the EG&G Idaho Quality Manual. To facilitate interfacing with GPU Nuclear, the overall quality standard will be 10 CFR 50, Appendix B. A Quality Program Plan applicable to the TMI Abnormal Waste Project has been prepared for TMI activities. Quality at TMI will be addressed in accordance with the GPU Nuclear Recovery Quality Assurance Plan, which has been reviewed by NRC. The Quality Division of EG&G Idaho will review packaging procedures before those operations are begun at TMI and will witness those operations, as required.

Environmental

Environmental aspects of the project will be reviewed in accordance with DOE-ID Order 5440.1 and the Environmental Review and Documentation sections of the EG&G Idaho Safety Manual. Supporting documentation will be provided as identified in that review.

SAFEGUARDS AND SECURITY

TMI abnormal waste is expected to contain significant quantities of SNM, as indicated in Table 1. The SNM will require special safeguards, inventory control, and physical protection of the wastes.

Safeguards

Requirements governing the EG&G Idaho safeguards program are derived from the DOE Order 5630 series. Interpretation of those orders by the Safeguards and Material Management Branch of EG&G Idaho is given in the Nuclear Materials Custodian Handbook (NMCH). That document (a) establishes safeguards criteria for receipt, shipment, and storage of all accountable material in the possession of EG&G Idaho, (b) delineates nuclear material accountability requirements for the Nuclear Material Custodians (NMCs) who have operational control over those materials, and (c) includes methods for internal control, recordkeeping, and physical inventory.

Receipt of TMI abnormal waste will require (a) appointing a NMC by the responsible TMI program or branch manager, (b) establishing an additional Material Balance Area if an existing one is not used, (c) establishing a recordkeeping system for tracking material, and (d) complying with inventory requirements for that category of material. TMI abnormal waste will, in all probability, be considered Category III material (as defined in the NMCH). Therefore, inventory requirements will be a semiannual records check and verification of tamper indicating devices.

Internal control refers to the responsibilities of management and the NMC in areas such as shipments, receipts, internal transfers, and notification. Records include reporting units, source documents, and custodian log books. Physical inventory involves the techniques used when conducting inventories of the various types of accountable nuclear material.

Each shipment of waste from TMI containing accountable quantities of SNM will be accompanied by a DOE/NRC-741 Transfer Document. That document will contain the following information:

1. Gross weight of each container
2. Net weight of material in each container
3. Description of contents of each container
4. Estimated total quantity (in grams) of U-235 and plutonium per container
5. Estimated quantities (in grams) of U-235, Pu-239, and Pu-241 per container
6. Percent enrichment of U-235 and Pu-240 after burnup
7. Individual identification number for each container.

Items 4 and 5 above will be best engineering estimates based on the description of the contents of each container.

Security

Requirements for physical protection are stated in DOE Order 5632.2 "Physical Protection of Special Nuclear Material." MUPD resin wastes are expected to contain reportable quantities of SNMs and therefore require physical protection. SNM are expected to be distributed throughout the resin. The maximum fuel enrichment is 3%.

The resins will be packaged in 2 x 4 liners (a substantial pressure vessel with 3/8-in. thick stainless steel walls). The radiation field for each liner is expected to be 103 R/h at contact but could be as high as 2600 R/h. The liners will be placed in concrete TSCs at INEL, and each loaded TSC will weigh about 80,000 lb. The lid alone will weigh about 9500 lb. The TSC is constructed of 2-ft thick reinforced concrete. A rain cover will be bolted to the TSC and provided with tamper-proof seals. The casks will be placed in a lightly fenced area inside the TAN Support Facility (TSF) perimeter fence. TSF has an established physical security system.

Special conditions of DOE Order 5632.2 allow a reduced level of protection for SNM when one or more of the following conditions exist:

- a. "The SNM is not readily separable from other radioactive material and the combination of the SNM and other radioactive material delivers an external radiation dose of approximately 100 rems per hour or more at 1 meter from any accessible surface without intervening shielding material.
- b. The SNM is contained in material that has been declared as waste.
- c. The SNM is in a chemical, isotopic, or physical form or is within isolated in-process, or remote inaccessible, containment which provides comparably effective protection, to that specified herein, against malevolent use or theft."

The physical protection of SNM more than adequately covers the requirements of DOE Order 5632.2 as follows:

- a. The SNM will be contained in MUPO resins and is not readily separable. Radiation fields expected from the resins are less than those listed in DOE Order 5632.2. However, if the resins are transported to INEL without prior cesium elution, the radiation will be above 100 R/h at 3-ft distance.
- b. The SNM is contained in material that has been declared as waste.
- c. The SNM is of a physical form and in a containment system that provides effective protection against malevolent use or theft.

DELIVERABLES

The TMI Abnormal Waste Project deliverables will consist of project documentation, funds for monitoring and disposing of waste, and certain physical items.

Documentation

The TMI Abnormal Waste Project will generate the following documents:

- o The TMI Abnormal Waste Acceptance Criteria (AWAC) document will be provided to define criteria for reimbursable receipt and storage of TMI-2 abnormal wastes at INEL and provide a baseline for INEL acceptance of those wastes.
- o A Waste Management Plan (WMP) for interim storage of abnormal waste (as required by DOE Order 5820.2) will be provided early in the project. The plan will be updated annually throughout the period that waste is accepted from TMI. Use of the existing INEL Waste Information System will be explored for long-term retention of records.
- o A Safety Assessment Document (SAD) will document safety aspects of the TMI Abnormal Waste Project. That document will discuss radiation levels, monitoring plans, environmental effects, operational aspects, SNM safeguards analyses, physical security analyses, and accidents such as fires, floods, earthquakes, dropping of waste packages during transfer, and dropping of TSCs.
- o An Operational Safety Requirements Document (OSRD) will define safety limits within which the storage area will be operated.
- o Documentation to establish a FMCA and provide inventory and physical safeguards of SNM will be provided as required by DOE Orders.

- o Detailed Operating Procedures (DOP) will be provided for unloading the transportation cask, loading the TSC, and placing the TSC on the storage pad. Additional DOPs will be provided for those wastes that are to be processed and disposed.
- o A Radiological Hazards Analysis (RHA) will be performed for transfer of each waste type. The RHA will identify monitoring, expected radiation, and emergency action levels.

A document file will be provided for the TMI Abnormal Waste Project. The file will contain (as a minimum) copies of the AWAC, WMP, SAD, OSRD, DOPs, RHA, and detailed information on each waste package. The information on each waste package will include copies of all shipping documents, procedures supplied by GPU Nuclear, waste package configuration, radiological/chemical/physical data on the waste, data on accountable quantities of SNM, quality assurance reports, documentation on the TSC used to store the package, and references to specific procedures used to unload and store the waste package. The file also will contain sufficient information to permit reconstruction of any specialized equipment used to unload and store the waste. The file will be maintained until final disposal of the waste. The organization responsible for retaining the file will be determined at a later date.

Financial

An escrow account will be provided to maintain funds for monitoring and final disposal of TMI abnormal waste.

Physical Items

The TSCs and gravel base asphalt pad will be provided as required to store TMI abnormal waste. The exact number of TSCs and the size of the pad will be determined by the volume and types of wastes transported from TMI. Fences and monitoring equipment required by Safety, Physical Security, and Safeguards organizations of EG&G Idaho also will be provided. All equipment and hardware required to store, process, transport, and dispose of DOE accepted abnormal waste will be provided.

COSTS AND SCHEDULE

The costs and schedule for the TMI Abnormal Waste Project are variable. DOE funding for the project in FY-1984 is \$79.5K for developing the AWAC, providing some cost estimates, and assisting in developing a Work for Others Contract between DOE and GPU Nuclear. The balance of the cost will be reimbursable from GPU Nuclear. As each particular waste is identified and documented in accordance with the AWAC, GPU Nuclear will request that DOE consider the waste as abnormal. Costs and schedules for INEL will be developed by EG&G Idaho for the waste documented in the GPU Nuclear request. Estimates will include costs to receive, unload, process, and dispose of the waste as follows:

- o For those wastes requiring 30-year storage, estimates for monitoring during storage, transportation after storage, processing, and disposal will be on a "best-guess" basis. When DOE and GPU Nuclear agree on cost, scope, and schedule, disposal of the specific waste will be added as a task to the TMI Abnormal Waste Project. Work then can begin on the project in anticipation of reimbursement from GPU Nuclear. Costs to receive and place the waste in storage then will be recovered immediately upon payment by GPU Nuclear. Funds for monitoring, transportation, processing, and disposal after long-term storage will be placed in an escrow account to accumulate interest over the storage period. Use of the escrow account will insure that funds are available in appropriate amounts at the time of disposal.
- o Funds for tasks that require processing and disposal immediately will be dispersed as required to cover receipt, unloading, processing, transportation, and disposal.

Costs and schedule for MUPD resin disposal are given in Appendix A.

REFERENCES

1. Final Programmatic Environmental Impact Statement related to decontamination and disposal of radioactive wastes resulting from March 28, 1979, accident Three Mile Island Nuclear Station, Unit 2, NUREG-0683, Vol. 1, March 1981, (p. ii).
2. "Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy Concerning the Removal and Disposition of Solid Nuclear Wastes from Cleanup of the Three Mile Island Unit 2 Nuclear Plant," 15 March 1982.
3. F. E. Coffman letter to T. E. Wade, "Storage of Three Mile Island (TMI) Abnormal Wastes," DOE Office of Terminal Waste Disposal and Remedial Action, 8 June 1983.
4. "Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Environmental Protection Agency for Hazardous Waste and Radioactive Mixed Waste Management," 22 February 1984.
5. "Coordination Agreement TMI Unit 2 Information and Examination Program," 26 March 1980.
6. Management Plan for the Technical Support Branch of the Nuclear Materials Evaluation Programs Division of EGG Idaho, Inc., EGG-TMI-6504, December 1983.

APPENDIX A

COSTS AND SCHEDULE FOR MAKEUP AND PURIFICATION DEMINERALIZER RESINS

APPENDIX A

COSTS AND SCHEDULE FOR MAKEUP AND PURIFICATION DEMINERALIZER RESINS

Table A-1 lists estimated disposition costs for Makeup and Purification Demineralizer (MUPD) resins from Three Mile Island (TMI). Of the unescalated \$985K total, about \$465K will be placed in escrow, \$150K will be nonrepeatable documentation and analysis costs to prepare the facility, and \$370K will be for the asphalt pad, temporary storage casks (TSCs), and operations. After escalation, the total cost will increase to about \$3.55M. Table A-2 lists assumptions used in developing the estimates.

Figure A-1 shows the schedule for development of temporary storage for MUPD resins. Similar schedules will be developed for each abnormal waste task. The schedule depends on successful completion of a contract between DOE and GPU Nuclear. The nominal time required to prepare for storage is six months after the contract is placed. However, the project involves laying asphalt, which requires warm weather. At Idaho National Engineering Laboratory (INEL), winter weather prevents the laying of asphalt between November and April, and project completion could be delayed until Spring.

TABLE A-1. COST ESTIMATES FOR TMI ABNORMAL WASTE
(Makeup and Purification Demineralizer Resins)

	<u>Unescalated^a</u>		<u>Escalated^b</u>	
Storage Pad and Casks				
Labor	51,000		51,000	
Nonlabor	<u>179,000</u>		<u>179,000</u>	
Subtotal		230,000		230,000
Documentation and Analysis				
Labor	150,000		150,000	
Nonlabor	<u>0</u>		<u>0</u>	
Subtotal		150,000		150,000
Storage of Waste				
Labor	130,000		130,000	
Nonlabor	<u>10,000</u>		<u>10,000</u>	
Subtotal		140,000		140,000
Monitoring				
Labor	48,000		160,000	
Nonlabor	<u>0</u>		<u>0</u>	
Subtotal		48,000		160,000
Retrieval from Storage				
Labor	120,000		820,000	
Nonlabor	<u>0</u>		<u>0</u>	
Subtotal		120,000		820,000
Shipping, Processing, and Final Disposal				
Labor	52,00		360,000	
Nonlabor	<u>245,000</u>		<u>1,690,000</u>	
Subtotal		<u>297,000</u>		<u>2,050,000</u>
		<u>985,000</u>		<u>3,550,000</u>

a. Costs to GPU Nuclear.

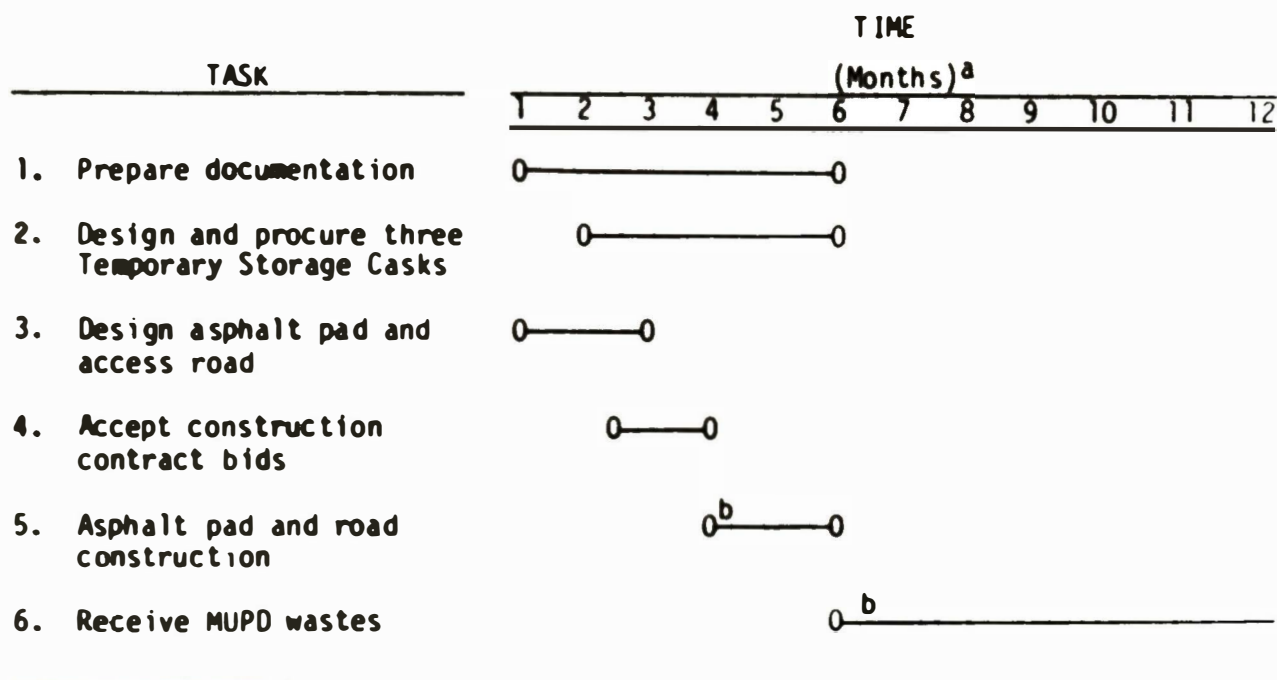
b. Project costs after 30-year storage.

TABLE A-2. ASSUMPTIONS USED IN DEVELOPING COST ESTIMATES FOR TMI ABNORMAL WASTE
(Makeup and Purification Demineralizer Resins)

1. The Makeup and Purification Demineralizer resins are to be shipped to the INEL as described in the B. K. Kanga (GPU Nuclear) letter of April 6, 1984 to Dr. W. W. Bixby (DOE-TMI).
2. The resins will be shipped in seven 2 x 4 liners. These liners will be constructed identically to the zeolite absorber vessels used in the SDS.
3. Sufficient radioactivity will be removed from the resin so that the maximum radiation from the liners will be about 103 R/hr. The maximum heat generation will be less than 10 watts.
4. Liner transfers from the shipping cask to the temporary storage cask will be made inside the Hot Shop using remote equipment.
5. Temporary storage casks will be transported by truck to storage locations.
6. The gas generated inside the liners is sufficiently high as to require continuous venting through a filter (provided with liner).
7. Each liner contains insignificant amounts of pathogenic, pyrophoric, toxic, hazardous, flammable, or explosive materials.
8. It is assumed that DOE will allow INEL storage of radioactive waste which has hazardous contaminants listed by the EPA in 40CFR261. Costs for establishing a mixed hazardous/radiological storage area (should this be required based upon testing of the resin) are not included in the estimate.
9. Three liners when placed in a temporary storage cask will be critically safe.
10. Each liner has no free standing water.
11. The cost to transport the liners from TMI to the INEL is not included.
12. After 30 years, a commercial facility will exist to process the waste to repository standards. The processing costs are based upon projections provided by Battelle Columbus's NMTS program. Transportation distance was 1000 miles.
13. After 30 years, a repository will exist to dispose of the resins. The disposal costs are based upon WIPP forecasts, emplacement costs, 20 year amortization of the facility and an 11% profit. Transportation distance was 1000 miles.

TABLE A-2. (continued)

14. Documentation costs include:
 - a) TMI Abnormal Waste Project Plan
 - b) Waste Management Plan
 - c) Safety Analysis Report with Environmental Synopsis
 - d) Operational Safety Requirements Document
 - e) Fissile Material Control Area Documentation
 - f) Special Nuclear Material Documentation
 - g) ALARA Statement
15. There will be no change to the estimate as a result of the DOE-ID review of the TMI Abnormal Waste Acceptance Criteria.
16. There will be no change to the estimate as a result of reviews of the TMI Abnormal Waste Project Plan.
17. Unescalated costs are constant FY-1984 dollars. The estimate will be valid for 120 days.
18. Escalation is based upon the FAST-E computer model used by DOE-HQ.
19. Estimate does not include depreciation (7%) or DOE-ID added factor (15%), as per current guidelines set within the DOE-ID Pricing Manual.



a. Months after notification to proceed.

b. Completion of asphalt pad and subsequent tasks constrained by weather. Pad cannot be constructed from November through April.

Figure A-1. Schedule for receipt of MUPD resins.

