Nuclear

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April 14, 1982
4400-82-L-0059

TMI Program Office
Attn: Dr. B. J. Snyder, Program Director
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Recovery System Description and Technical Evaluation Report Update

GPU Nuclear's letter, 4400-82-L-0026, dated February 23, 1982 stated that the Interim Solid Waste Staging Module System Description would be provided in approximately one month. In accordance with this commitment attached is this system description which is now designated the Solid Waste Staging Facility System Description.

As discussed with Dr. R. Bellamy of your staff, the Submerged Demineralizer System Technical Evaluation Report Update, which is the only remaining update to be submitted, has been delayed and will be submitted shortly.

Sincerely,

J. J. Barton
Acting Director, TMI-2

JJB:JJB:djb

Attachment

cc: L. H. Barrett, Deputy Program Director, TMI Program Office

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THREE MILE ISLAND NUCLEAR STATION UNIT 2
RECOVERY PROGRAM
SOLID WASTE STAGING FACILITY
SYSTEM DESCRIPTION

Revision 0

TABLE OF CONTENTS
FOR
SOLID WASTE STAGING FACILITY

SYSTEM DESCRIPTION

OF

SOLID WASTE STAGING FACILITY (SWSF)

1.0 INTRODUCTION

The Solid Waste Staging Facility (SWSF) performs no active function. The facility is a passive system for temporary staging of nuclear radioactive waste prior to preparation for shipment and disposal to approved offsite burial grounds. The SWSF has been designed and will be operated in such a manner as to provide assurance that:

A. The health and safety of the public will be protected.

B. Occupational exposures will be as low as reasonably achievable (ALARA)

C. There will be no significant adverse impact on the environment.

2.0 DESIGN DESCRIPTION

2.1 Facility Function

2.1.1 The SWSF is used for the collection and temporary staging of the nuclear waste (solidified and/or Dewatered Resins) generated in processing the fluids during the Recovery cleanup operations at TMI Unit 2.

2.1.2 The SWSF is located as shown on Figure 1, South and East of Unit 2 Natural Draft Cooling Towers within the area protected by the Flood Control Dikes.

Space was allocated to accomodate six (6) modular structures; two (2) modules "A" and "B" are completed, the remaining space is available for additional modules as, or if, required.

2.1.3 Figure 2 shows the typical layout of the SWSF system.

2.1.3.1 Each Module is designed with Sixty (60) Cells forming the compartments for storing the radioactive waste generated during processing.

2.1.3.2 Each Cell is designed to stage the radioactive waste contained in either One (1) 6 ft. diameter by 6 ft. high liner, or Two (2) 4 ft. diameter by 4 ft. high liners, or Eighteen (18) 55 gallon, type DOT.17H Drums.

2.1.3.3 Each Module is designed to accomodate any combination of the radioactive waste containers as follows:

Container	Total Quantity	Wt of One Filled Container lb.
6 ft. dia. x 6 ft. H Liners	60 (1 per cell)	14,000
or		
55 gallon drums	1080 (18 per cell)	800
or		
4 ft. dia. x 4 ft. H Liners	120 (2 per cell)	4,500

2.1.3.4 A floor drainage system is incorporated into the module design which discharges into a common sump located between Modules "A" and "B". The total capacity of the sump is approximately 2750 gallons.

2.2 References

2.2.1 U.S. NRC Regulatory Guide 1.143, July 1978, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.

2.2.2 Design Criteria/Input Record. GAI W.O. #04-4283-070

2.2.3 Gilbert Associates, Inc. (GAI) Drawings:

2.2.3.1	Excavation and Grading Plan.	E-774-151.
2.2.3.2	Plant Layout	E-012-006 E-014-004.
2.2.3.3	Structural.	E-430-006 E-430-007 E-430-008 E-430-011 E-430-012 E-430-013 E-430-014 E-430-015
2.2.3.4	Building Services--Piping	E-311-873 E-311-874
2.2.3.5	Electrical	SS-308-417 B-256-031 E-266-011

2.3 Design Basis

2.3.1 The SWSF is designed to comply with the requirements of RG.1.143, July, 1978. The facility is designed to provide a controlled, but ready access for material handling operations and to ensure that the operator exposures are as low as reasonably achievable (ALARA).

2.3.2 The facility is designed to maintain the dose rates in accordance with 10 CFR Part 20 and to meet the requirements of 40 CFR Part 190 at the site boundary and beyond.

2.3.3 The shielding thickness was calculated to limit the contact dose rates at the outer surfaces of the module walls and the top of the cell covers to within 0.5 mr/hr and 2.5 mr/hr, respectively. The analysis was based on the types of waste defined in Attachment 1. No credit was taken for the structure being partially underground.

2.3.4 Quality Assurance requirements for the design, operation and construction of the SWSF are consistent with those specified in Regulatory Guide 1.143.

2.4 Summary System Description

2.4.1 The concrete structure and individual cell covers provide the necessary shielding from the radioactive waste housed in the SWSF Module Storage Cells.

The cell covers with gaskets protect the waste containers from the elements and the ingress of precipitation. Slots and weep holes in the upper module structure are provided to direct rainwater to external drainage ditches. A drainage piping system prevents any spillage/leakage of fluids from accumulating in the cells (i.e., floor drain hub in each cell), the system manifold discharges into a common sump.

2.4.2 The sump compartment, a radwaste seismic concrete structure houses the pump, valves, piping, instrumentation, etc., necessary to perform the functions and control the disposal of any effluent which may collect in the sump. The compartment is divided into two levels, the upper operator level is shielded by a thick concrete floor from the sump. Operator access is a manhole in the concrete slab roof.

2.4.3 The flow diagram Figure 3 shows the pumping system for the sump effluent. All operations are local/manual. The local alarms and sump level indication are housed in a weatherproof instrumentation panel mounted outside adjacent to the sump compartment on Module "A" structure.

The sump pump, Solenoid Valve #WS-5 and three-way valve #WS-1 (extension spindle) are located in the lower sump while the electrical distribution and control panels, valves, etc. are mounted in the operators compartment.

Sump level is measured by a variable capacitance sensor (SWS-LE-01) which transmits the signal to local and remote (Unit-2 Control Room) alarms.

Sump influent flow alarms are provided. The sensing elements (conductivity) Nos. SWS-CE-07 and SWS-CE-08 are mounted in the Module "A" and "B" drain system manifolds.

2.4.3.1 Sump Pumping Operations (See Figure 3)

The SWSF sump is controlled and disposal of the effluent will be in accordance with Unit-2 Chemistry Procedure #1899 and Operating Procedure #2104.4.100. The sump compartment is posted as a radiological controlled area and surveillance is required prior to entry, to ensure operator exposure will be as low as reasonably achievable (ALARA).

On receipt of the alarm signal (approximately 50% sump level) in Unit-2 Control Room, the above procedures are put into effect and the sequence of operations are as follows:

2.4.3.1.1 Recirculation Mode (Sump effluent mixing to obtain representative sample for analysis).

A. All valves to be checked closed.

B. Operate three-way Valve WS-1 to route pump discharge returned to sump.

C. Start pump.

2.4.3.1.2 Sampling Mode (during Recirculation Mode)

NOTE: Radiologically monitor the collection of the sample with the appropriate instrument.

A. Solenoid Valve WS-5 open.

B. Valve WS-7 open.

C. Collect sample.

D. WS-5 and WS-7 closed.

E. Stop pump.

2.4.3.1.3 Discharge Mode (Only after sample analysis is completed).

A. All valves to be checked closed.

B. Connect hose to the tank truck (or portable vehicle) connection for effluent disposal.

C. Operate three-way Valve WS-1 to route pump discharge to truck discharge manifold.

D. Valve WS-4 (WS-3) open.

E. Start pump.

F. Stop pump, disconnect tank truck (or portable vehicle) connection, and allow contents of hose to drain back into sump.

G. Valve WS-4 (or WS-3) closed.

H. Operate three-way Valve WS-1 for recirculation mode and secure.

2.4.4 Major Equipment

A. Sump Pump (1.): Gould Model 3171 1 x 1-1/2 -6

Capacity	50 gpm
TDH	100 ft.
Fluid	Radioactive waste water/resin slurry pH approx. 7.
Materials	Cast iron/bronze fittings
Impeller	Open type
Discharge Conn.	Flanged above mtg. plate
Service	Intermittent 5 yr. life

B. Solenoid Valve (1):

1/2" nom. bore. 120 volt AC

C. Instrumentation: See Table 1.

2.4.5 Facility General Arrangement: See typical layout Figure 2. The general arrangement, layout and details of the SWSF systems are shown in the drawings referenced in Section 2.2.3.

2.4.6 Instrumentation and Controls

2.4.6.1 The SWSF has three (3) instrument loops as follows:

A. A level instrument string provides the alarm and level indication both local and remote. In addition, this loop provides a sump pump permissive at greater than 10 percent level.

B. The other two (2) instrument strings are conductivity flow loops providing local alarms. One loop senses input from the drain discharge manifolds from Module "A" and the other from Module "B".

2.4.6.2 Instrument Setpoint Index. See Table 2.

2.4.7 System Interfaces

There are six interfaces associated with this facility:

1. Processing Systems: Access road to and from waste and fluid processing facilities for transportation of materials and equipment.

2. Material Handling System: Facility will accept radioactive waste containers from the processing systems and are compatible with the transportation and lifting equipment, i.e., transfer shield and site cranage (Manitowoc 4000 W mobile crane or equivalent).

3. Cooling Water Pump (CWP) House: 480 V, 3 ϕ 200 A feeder cable from Bus 2-61 shall provide power for the following:

   A. 460 volts to the sump pump.

   B. 480 volt welding receptacle.

   C. 25 KVA, 240-120V power center to energize lighting, convenience receptacles, instrumentation, and control devices.

   NOTE: No permanent heat tracing required for sump compartments.

4. Control Room: Sump level alarm.

5. Chemistry Laboratories: Sump effluent samples for chemistry and radiological analysis prior to disposition.

   NOTE: The sump pump discharge is not directly connected to any plant systems, a local hose station is provided.

2.4.8 Operations-Radwaste Handling

The major operations performed at the SWSF is handling the radioactive waste containers while loading/unloading the individual cells in accordance with the types of containers specified in Section 2.1.3. Unit 2 Procedures (See Table 3), specifically written for these operations are strictly adhered to, using the Manitowoc Mobile Crane or equivalent and the transfer shield (Bell).

Each cell has an individual concrete cover 8'3" square x 3'0" deep. (Dwg. #8-430-015) weighing approximately Fourteen (14) tons, this is the maximum load handled by the lifting system. Only One (1) cover may be removed at any time from the cells containing radioactive waste containers within a module system.

2.4.9 Maintenance

All operations including Maintenance requires a RWP.

Inner surfaces of the cells and the sump are epoxy coated to ease decontamination of the facility.

2.4.10 Acceptance Testing.

2.4.10.1 Mechanical. Dwgs. #E-311-873 and E-311-874

A. Module "A" and "B" Drain Piping Systems.

(i) Leak Test in accordance with ANSI B31.1.1977.

Criteria: Static Head. (Fill System, water level top of drain hubs)

Holding Period. 10 minutes minimum.

Acceptance. No visual leakage.

(ii) Flow verification, allow leak test water to drain to sump.

Criteria: No visible fluid in system.

B. Sump Pump "A" and associated piping.

Initial Service Leak Test in accordance with ANSI B31.1, 1977.

Criteria: Pump discharge pressure

Acceptance. No visual leakage, all welded joints leaktight.

2.4.10.2 Electrical/Instrumentation: Dwgs. #E-256-031, E-248-011 and SS-261-011

A. Continuity and Megger tests were performed for all circuits.

B. Instrument and Control were tested and calibrated in accordance with MTX 507.

C. Sump Pump "A", tested in accordance with Electrical Preoperational Test Procedure WG-E01.

D. Solenoid Valve #WS-V05, tested in accordance with Electrical Preoperational Test Procedure WG-E02.

Table 1

Solid Waste Staging Facility Instrumentation

Instrument Designator	Model or Type	Locations	Functions
SWS-LE-01	Drexelbrook 700-2-57	Mod A Sump	Sump Level Sensor
SWS-LT-11	Drexelbrook 408-6230	Mod A Opr. Floor	Sump Level Transmitter
SWS-LI-01	370-1104-401	Mod A Opr. Floor	Sump Level Indication
SWS-LI-01A	International Instr. 1151	Mod A Top Panel	Sump Level Indication
SWS-LSL-01	SETCON 401-100x	Mod A Top Panel	Sump Level Switch Low (Pump Permissive)
SWS-LSH-01	SETCON 401-100x	Mod A Top Panel	Sump Level Switch High
SWS-LAH-01	PANALARM	Mod A Top Panel	Sump Level Alarm High
SWS-LAH-01A	PANALARM	CR Panel 17E-24	Sump Level Alarm High
SWS-CE-07	Level Lance 14-115V	Sump	Influent Flow Conductivity Element
SWS-CAH-07	PANALARM	Mod A Top Panel	Influent Flow Alarm
SWS-CE-08	Level Lance 14-115V	Sump	Influent Flow Conductivity Element
SWS-CAH-08	PANALARM	Mod A Top Panel	Influent Flow Alarm

Table 2

Instrument Setpoint Index

Instrument Tag No.	Instrument Description	Component Type	Setpoint Descrip.	Action
SWS-LSL-01 (GAI: LB-S-4)	Solid Waste Staging Facility Sump Level Switch Low (Sump Pump Permissive)	Current Switch	10% level (5.6 ma) Increasing	Contact Closure
SWS-LSH-01 (GAI: LB-S-3)	Solid Waste Staging Facility Sump Level Switch High	Current Switch	42% level (11.2 ma) Increasing	Contact Closure
SWS-CE-07 (GAI: CE-S-7)	Solid Waste Staging Facility Sump Influent Flow Module 'A' Conductivity Element	Conductivity Element	Maximum Sensitivity	Contact Closure
SWS-CE-08 (GAI: CE-S-8)	Solid Waste Staging Facility Sump Influent Flow Module 'B&C' Conductivity Element	Conductivity Element	Maximum Sensitivity	Contact Closure

Table 3

OPERATING PROCEDURES

Proc. No.	Description
2104.4.53	Transfer Spent Filters 4' x 4' liner from FHB to SWSF.
2104.4.68	Stacking 4' x 4' liners at SWSF.
2104.4.73	Removal of 6' x 6' liners from Interim Staging Facility and transfer to SWSF.
2104.4.100	SWSF sump pumping operation.
2104.4.103	EPICOR II 4' x 4' liner transfer and shipping cask loading
2104.4.107	On-site transfer of Radioactive 6' x 6' resin liners from EPICOR II to SWSF/Ship.
2104.4.108	On-site transfer of Radioactive 6' x 6' resin liners from SWSF to Transporter/Ship.
2104.4.118	On-site transfer of Radioactive 4' x 4' resin liners from EPICOR II to SWSF/Ship.
2104.4.119	On-site transfer of Radioactive 4' x 4' resin liners from SWSF to Transporter/Ship.
2104.4.120	Transfer of Solidified Resin Liners from Unit II to SWSF.

Attachment 1

Shielding Analysis - Types of Waste

Types of waste considered are given below. A 3 month decay period was used in the analysis.

I) Natural Circulation Evaporator with Solidification

Waste Form: 55 gallon drums (solidified)

Design Basis for Cell: C-D waste @VR* = 4.5, η** = .6

18 drums per storage cell

C-D waste analysis is given below

or 2) Forced Circulation Evaporator/Crystallizer with Solidification

Waste Form: 55 gallon drum (solidified)

Design Basis for Cell: C-D waste @ VR = 22, η = .6

18 drums per storage cell

or 3) Epicor II Charcoal Filter

Waste Form: Activated Charcoal in 4 ft. diameter x 4 ft. high liner

Design Basis for Cell: 2500 R/hr on contact

Two liners per cell

or 4) Epicor II Demineralizer Resins

Waste Form: Dewatered Resins in 4 ft. diameter x 4 ft. high liner

Design Basis for Cell: B-C waste @ VR = 543

B-C waste analysis is given below

*VR - volume reduction

** η - Packaging efficiency: ratio of volume of waste to total container volume.

A) Quantities; C-D Waste

83,000 gallon - Reactor Coolant Bleed Tank - A

83,000 gallon - Reactor Coolant Bleed Tank - B

250,000 gallon - Reactor Building Sump

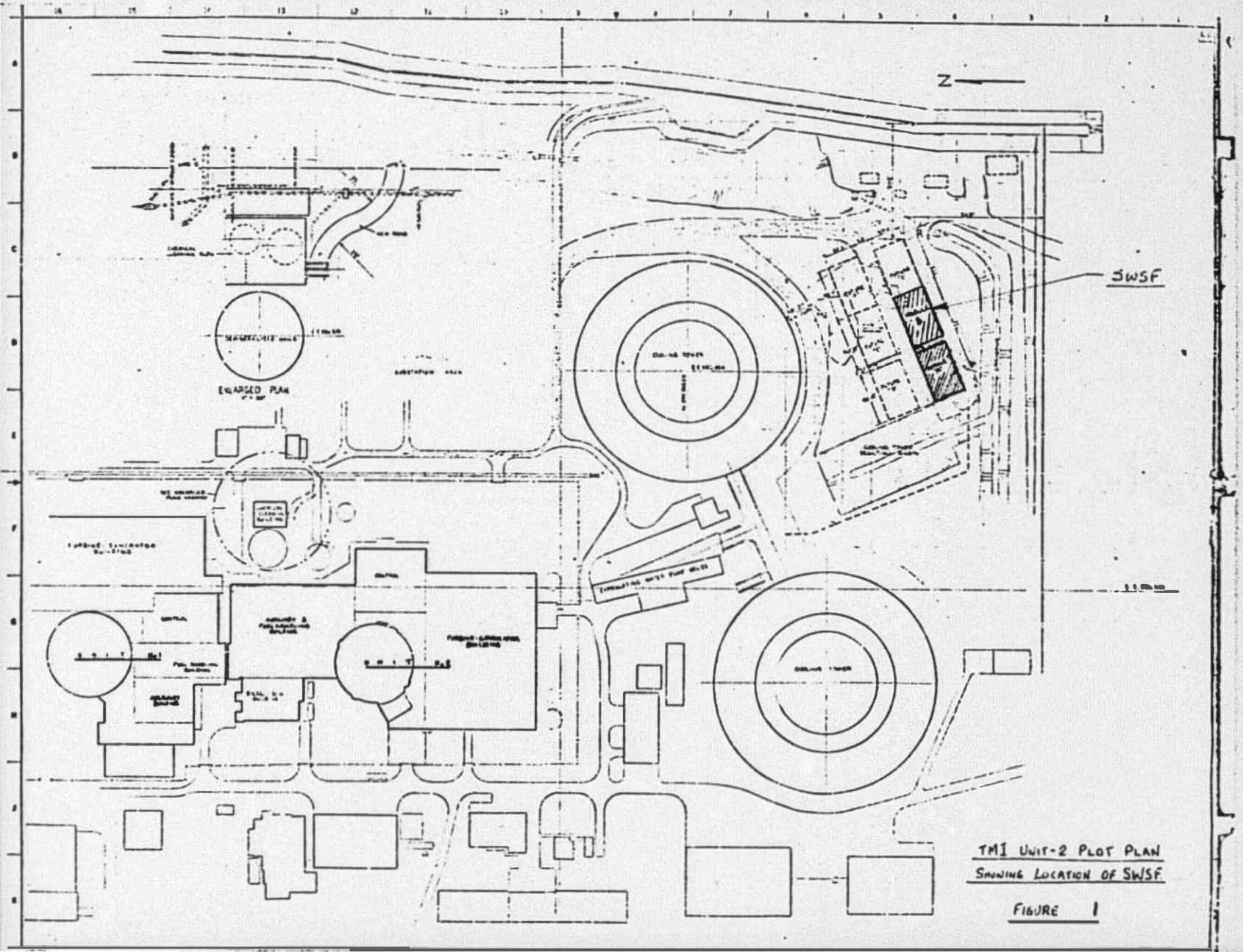
B) Isotopic Analysis (μCi/ml) - Design Basis; C-D Waste

Isotope	μCi/ml				
Mo 99	- 180	Cs 136	- 120	Ce 144	- 100
I 131	- 8200	Ba 140	- 290	H 3	-1.2
I 132	- 20	La 140	- 160		
Cs 134	- 82	Sr 89	- 1400		
Cs 137	- 330	Sr 90	- 120		

C) Isotopic Analysis (μCi/ml) - Design Basis; B-C Waste

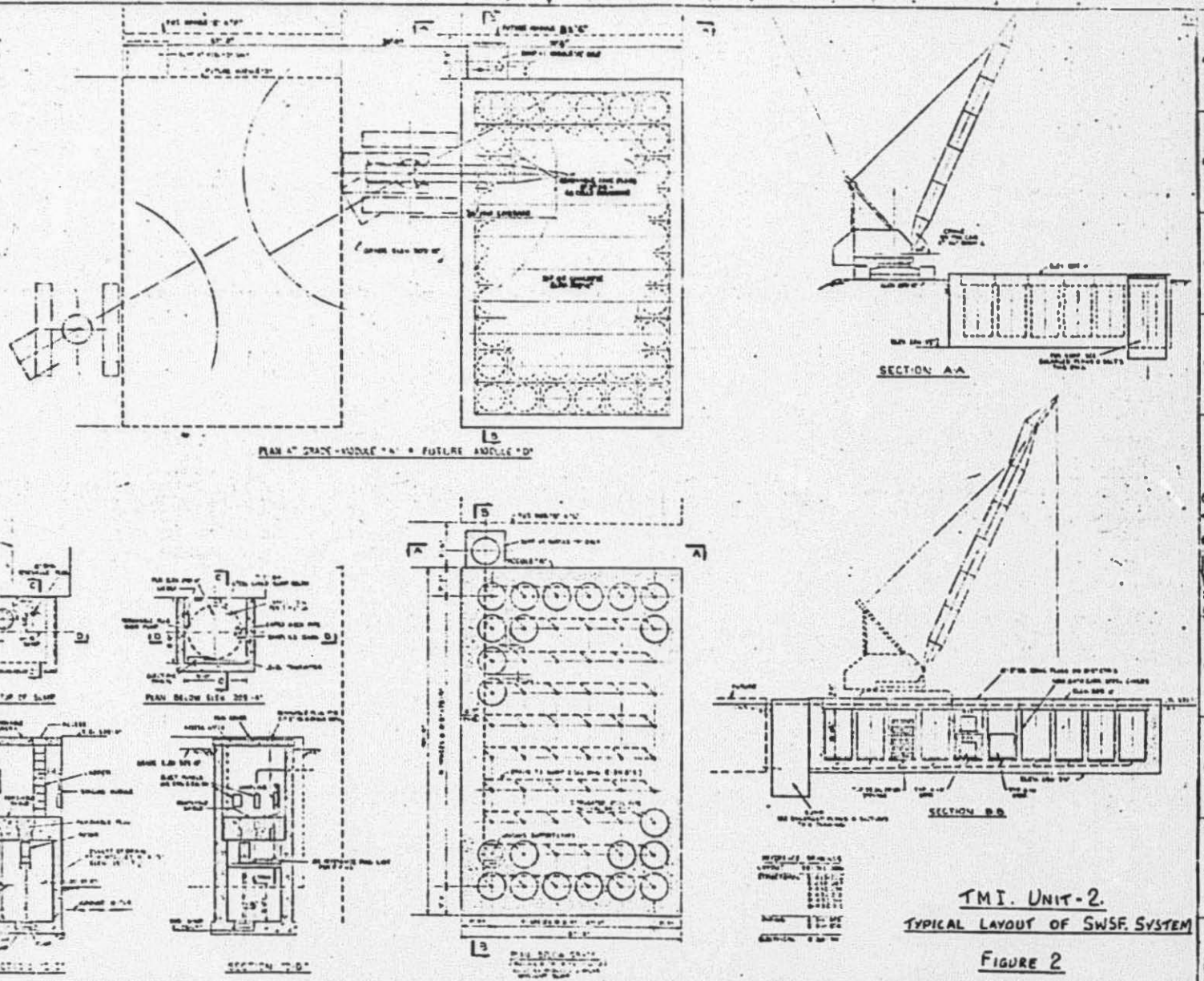
B-C Waste

Isotope	μCi/ml	Isotope	μCi/ml
Ba 133	2 E - 1	Ba 140	7.5 E - 1
Co 60	1.4 E - 4	La 140	2.4 E + 0
Cs 134	1.6 E - 1		
Mo 99	2.7 E - 1		
I 131	2.3 E + 1		
Bi 207	2.2 E - 2		
Co 58	1.2 E - 3		
Cs 137	7 E - 1		



TMI UNIT-2 PLOT PLAN
SHOWING LOCATION OF SWSF

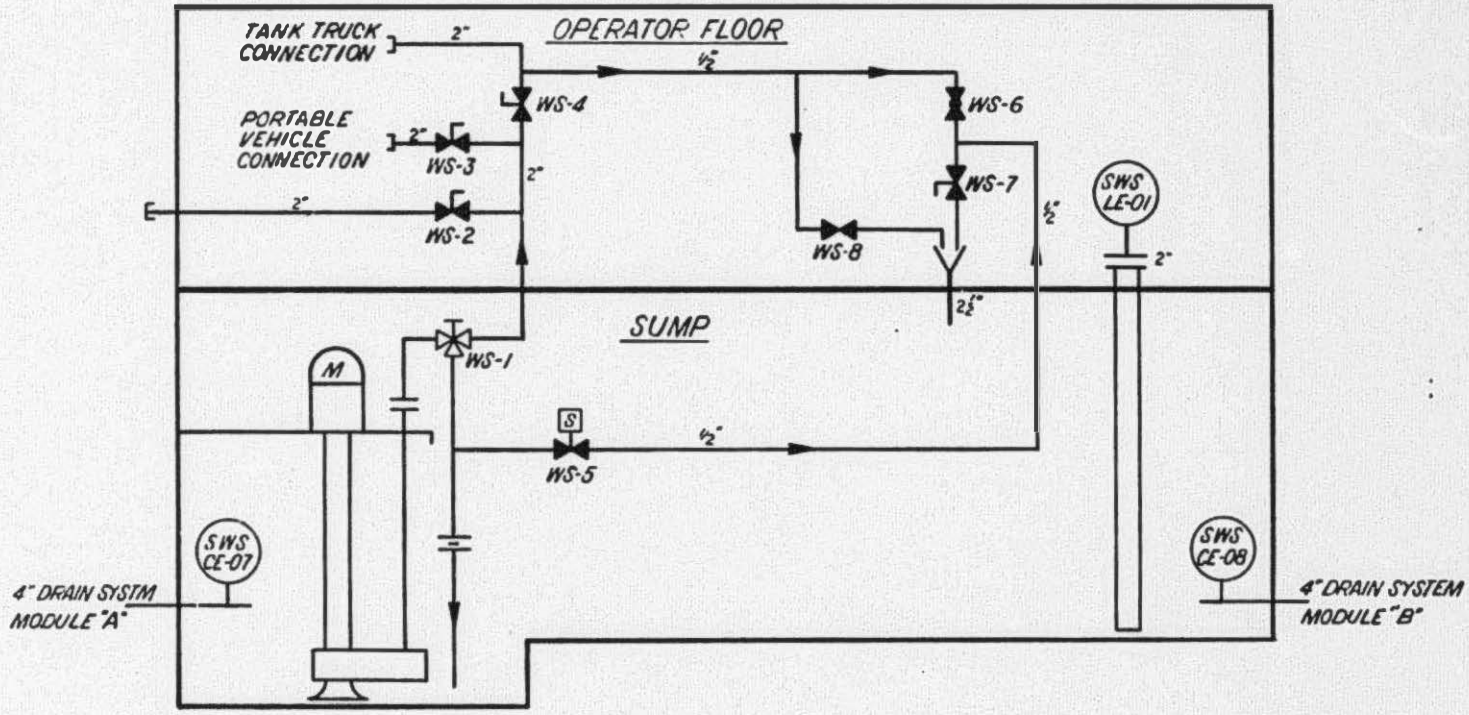
FIGURE 1



TMI. UNIT-2.

TYPICAL LAYOUT OF SWSF. SYSTEM

FIGURE 2



TMI UNIT 2
SWSF SUMP FLOW DIAGRAM

Figure).