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July 29, 1983  
4410-83-L-0156

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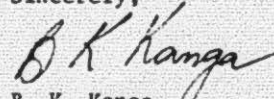
Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)  
Operating License No. DPR-73  
Docket No. 50-320  
Fuel Pool "A" Refurbishment Safety Evaluation Report

Attached for your review and approval is the Safety Evaluation Report for the refurbishment of Fuel Pool "A". The purpose of this refurbishment is to restore Fuel Pool "A" to its original pre-accident condition in preparation for removing the fuel from the TMI-2 reactor core. The purpose of this SER is to review the steps involved in the refurbishment of Fuel Pool "A" and demonstrate that the task can be performed without presenting undue risk to the health and safety of the public.

If you have any questions, please contact Mr. J. J. Byrne of my staff.

Sincerely,

  
B. K. Kanga  
Director, TMI-2

BKK/JJB:RDW/jep

Attachment

CC: Mr. L. H. Barrett, Deputy Program Director - TMI Program Office

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SAFETY EVALUATION REPORT  
FOR  
THE REFURBISHMENT OF FUEL POOL "A"

JUNE 1983

THREE MILE ISLAND  
UNIT 2



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## 1.0 INTRODUCTION

### 1.1 BACKGROUND

In order to provide a temporary shielded storage facility for the radioactive liquid wastes from the Reactor Building (RB) sump and the Miscellaneous Waste Holdup Tank (WDL-T-2), without contaminating the fuel transfer pool, the Fuel Pool Waste Storage System (FPWSS) was constructed. The FPWSS is comprised of two 25,000 gallon tanks and four 15,000 gallon tanks. The FPWSS is located in the New and Spent Fuel Transfer Pool of the Unit 2 Fuel Handling Building (FHB) which has been designated as Fuel Pool A (FPA). Shielding is provided by covering FPA with concrete slabs supported by 33" WF beams. Associated with the storage tanks are various valves, manifolds, pipes, and pumps which facilitate the transfer of liquid from one tank level to another as well as to the Submerged Demineralizer System (SDS). The SDS is located in the spent fuel storage pool which is designated as Fuel Pool B (FPB). Figures 1.1 - 1.3 show the FHB layout including the Truck Bay.

The tanks and all other associated components, which comprise the FPWSS, will be decontaminated (if required), dismantled, and removed from FPA to accommodate the storage of spent fuel in FPA upon defueling of TMI-2.

The impact on the reserve tankage requirements of the removal of the FPWSS is addressed in the submittal of License Amendment Request No. 3, via GPUNC letter, 4410-83-LO084, dated May 27, 1983.

### 1.2 PURPOSE

The purpose of this SER is to review the steps involved in the refurbishment of FPA and to demonstrate that the task can be performed without presenting undue risk to the health and safety of the public. The purpose of this task is to restore FPA to its original pre-accident condition in preparation for removing the fuel from the TMI-2 reactor core.

### 1.3 SCOPE

The following major activities and supportive operations are covered by this SER for the refurbishment of FPA:

- rigging and removal of the concrete shield slabs
- decontamination of the pool and FPWSS components
- dismantling of all FPWSS components
- rigging and removal of FPWSS components
- cleaning, inspecting, repairing (if necessary), and testing the fuel pool liner



Figure 1.4 is the detailed schedule for the refurbishment of FPA and is provided to show the proposed sequence of events only. This schedule is integrated with the refueling canal modifications, shown on sheet 4 of 6 of Figure 1.4 which are outside the scope of this SER. Modifications to the Fuel Transfer System and the Fuel Handling System with their associated components and hardware are outside the scope of this SER.

#### 1.4 ORGANIZATION

Section 2 of this SER describes the major activities associated with the refurbishment of FPA. The major activities are defined as 1) the modifications to SDS required to support removal of the tank farm; 2) the removal of equipment on the slabs above FPA, the slabs themselves, and the equipment in FPA; and 3) the cleaning, inspection, repairing, and testing of the fuel pool liner.

Section 3 of this SER describes the decontamination operations which are supportive to the major activities. The criteria employed and methods to be used in the decontamination of the items to be removed are presented, along with the nature, quantity, disposal and treatment of the wastes generated.

Section 4 of this SER describes the lifting operations and devices that will be used and the load tests that will be performed prior to the lifting of heavy loads. Included in this section are the load paths that have been considered and the rationale employed to decide on the chosen load path(s).

Section 5 of this SER addresses the safety concerns inherent to the lifting of heavy loads. The identification of loads and their targets are presented for postulated load drops. These postulated load drops are evaluated based on operational as well as radiological consequences. For the radiological consequences "worst case" scenarios are presented for both in-plant occupational exposure and off-site releases with their resulting consequences. Also included in this section are the evaluations to NUREG 0612 and 10 CFR 50.59.

Section 6 of this SER addresses the radiological considerations during the scope of the task as outlined in section 1.3. Both on-site occupational exposure and off-site releases with their resulting consequences are addressed. Also presented are the methods and precautions employed to show that the expected personnel exposure and environmental releases are as low as reasonably achievable (ALARA).

Section 7 of this SER presents the conclusions of this safety evaluation.

## 2.0 MAJOR ACTIVITIES

### 2.1 SDS MODIFICATIONS

To facilitate the removal operations required for the refurbishment of FPA, as well as to allow processing of the RB sump and other sumps integral to the SDS, modifications to the SDS are necessitated. The design criteria for the fabrication and installation of the piping systems required for the implementation of these SDS modifications will meet the criteria given in the SDS Technical Evaluation Report (TER). For details on these SDS modifications and their effects on SDS operation refer to the SDS TER (revised 1983). These SDS modifications are presented below.

#### 2.1.1 Rerouting of the Sump Sucker Piping

In order to remove the southern most row of concrete shield slabs from FPA, the sump sucker piping on the 347'-6" elevation inside the FHB must be removed. Figure 2.1 depicts the new flow path from the RB to the SDS system. This new line will utilize the existing 1 1/2" pipe at FHB penetration 1551 and run from the penetration along the platform above the annulus access door, drop down to the floor and run north along the FHB west wall to the SDS cask support platform. Here the piping turns east along the top of the cask support platform to the tie-in at the SDS RCS Manifold. All piping is either lead shielded or concrete brick shielded to limit whole body exposure rates in operations areas to 1mr/hr as required in Section 6.1.2 of the SDS TER.

#### 2.1.2 Rerouting of the SDS Offgas Separator Tank Return Line

In order to sever all influents to the tank farm, the SDS Offgas Separator Tank return line must be rerouted. The flow path is depicted on Figure 2.1. This pipe change will cause a change in the operation of the separator tank level system such that, rather than automatic pump down at high level, as the system previously operated, manual action must initiate tank pump down. Tank contents may be staged to either the Miscellaneous Waste Holding Tank (MWHT), or the "B" Reactor Coolant Bleed Tank (RCBT).

### 2.2 REMOVAL OPERATIONS

#### 2.2.1 Slab Removal

Sixteen, two-foot thick concrete shielding slabs are mounted over FPA for the purpose of protecting personnel from the radioactive liquid that was stored in the tank farm. With the draining and discontinued use of the tank farm, the shielding slabs will no longer be required. Radiation surveys indicate that these slabs are presently free from loose contamination. Further radiation surveys will be conducted in accordance with TMI-2 Radiological Controls (Radcon) procedures and, if needed, the slabs will be decontaminated prior to their storage.



In preparation for removal of these slabs, all cut lifting eyes will be weld repaired and hydraulically load tested to 1 1/2 times their rated load of 20,000 lbs. The twelve southernmost slabs may be removed at anytime after the tank farm is no longer used to meet the reserve tankage requirement, or the licensing requirement is deleted from the TMI-2 license. The four northernmost slabs may only be removed upon completion of tank farm decontamination since the decon water is processed through SDS via the pump manifold located on those slabs. The twelve southernmost slabs may be rearranged on the supporting I beams to provide work areas or access to specific areas of FPA. The design limit of the I beams will allow the stacking of one slab onto another provided that no more than three 20 ton slabs are stacked upon four 16 ton slabs.

Two sizes of slabs will be lifted; the first size weighs 20 tons (20' x 7' x 2') and the second size weighs 16 tons (16'6" x 7' x 2'). Two types of slab lifting operations are planned. The first operation is a "two-slab lift" consisting of a 16 and a 20-ton slab together. Four lifts of this type are required over FPA and are necessitated by the limit in the FHB crane coverage near the south wall. These slabs will be re-rigged, using the remaining slabs as a working platform to allow single slab removal from the TMI-2 FHB. Refer to Figure 2.2 for the lifting beam configuration.

The second operation is a single (20-ton max.) slab lift over FPA with the slab being transported horizontally at a fixed minimum elevation along the "west wall" past FPB to the truck bay.

#### 2.2.2 Waste Water Storage Tank Removal

Six tanks (see Figure 1.2), four 15,000 gallon and two 25,000 gallon capacity, are located in FPA. The 15,000 gallon tanks are suspended from 33" W.F. beams which bridge FPA and support the shielding slabs described in Section 2.2.1. Prior to tank removal, these tanks will be decontaminated to the radiation and contamination levels described in Section 3.0. Once decontamination is complete, the piping will be cut and all openings on the tanks will be sealed to prevent any leakage of the remaining contamination to the environment. Each of the upper tanks in turn will be removed from FPA. Once the lower tanks have been decontaminated, they will be cut from their supports and lifted from FPA.

#### 2.2.3 Structural Steel Removal

A steel structure was installed over FPA to support the shielding slabs described in Section 2.2.1 and the tanks described in Section 2.2.2. Removal of this structural steel will be performed after the removal of the shielding slabs and in conjunction with tank removal. Radiation surveys indicate that presently the structural steel is free from radioactive contamination. Once the tanks have been decontaminated and the shielding slabs removed, further surveys will be performed in accordance with TMI-2 Radcon procedures. If needed, decontamination will be performed prior to the handling and storage of this structural steel.

The structural steel will be lifted from FPA using either the main hook or the Auxiliary hook of the FHB crane depending whichever coverage area is most convenient for each particular lifting operation. The maximum weight any single 33" WF Beam (the largest piece of structural steel) is less than 7000 lbs. which is well below the certified ratings of either hook. The usage of the 3 and 5 ton mono-rail hoists will be restricted to local, light lifts over FPA within their certified limits since coverage down to the 305' elevation is not possible.

#### 2.2.4 Piping Removal

The tank farm piping will be removed in several stages starting with the disconnection from the water processing train in SDS and finishing with the removal of the waste water storage tanks as described in Section 2.2.2. Piping removal will be performed in accordance with TMI-2 Radcon procedures with the bulk of the piping being cut from the tank farm after completion of the inplace decontamination. The piping will be mechanically cut into convenient lengths and packaged to prevent the spread of contamination.

### 2.3 FUEL POOL LINER

#### 2.3.1 Inspection

A visual inspection of the FPA liner will be made for any cracks, tears or punctures which could leak water when the pool is filled. Any defects found will be repaired to assure the pool leak tightness.

#### 2.3.2 Repair

Any cracks, tears or punctures found during inspection will be weld repaired to return the pool to a water tight condition suitable for the storage of nuclear fuel.

#### 2.3.3 Leak Test

Upon completion of pool inspection and repairs (as necessary), the pool will be slowly filled with water. As the filling process takes place, the "tell-tale" drains will be monitored to determine leakage rates and location. Whenever a leak is indicated, a vacuum box soap bubble test will be performed and repairs implemented as required to bring the fuel pool liner to its original pre-accident condition.



### 3.0 DECONTAMINATION

#### 3.1 CRITERIA

The decontamination criteria are as follows:

- ° All decontamination will be done in the pool
- ° The tanks and associated piping will be decontaminated to allow off site shipment as Type A.
- ° Tank decontamination by flushing and high pressure water sprays will continue as long as it is effective, i.e., it will not be stopped as soon as the shipping criteria are met

#### 3.2 METHODS

An iterative procedure will be used in decontaminating the internals of the tanks and associated piping, with radiological surveys performed at the end of each step to determine if further decontamination is necessary or effective. As a first step, the tanks and associated piping will be flushed with water. This will remove residual activity associated with the reactor building water and tank sludge. The second step will involve the use of high pressure water sprays inside the tank to dislodge loose particles and complete the sludge removal.

If these techniques fail to meet the Type A offsite shipping criteria then the use of chemicals for decontamination will be evaluated. Alternatively some mechanical technique such as abrasive blasting or grinding may be appropriate if the affected areas are small and localized. However, such alternate techniques are outside the scope of this evaluation since water techniques are expected to be successful and sufficient chemical evaluations have not been performed. If chemicals are to be used, engineering evaluations including safety evaluation will be performed on a case by case basis.

Tank farm piping will be flushed in conjunction with the flushing of the tanks. Since the piping is intended to be discarded as Type A waste, no special high pressure water sprays or other techniques will be used to attempt to release the piping for unrestricted use.

#### 3.3 WASTES GENERATED

##### 3.3.1 Liquid Waste

Approximately 100,000 gallons of liquid waste is expected to result from the water decontamination of these tanks. The waste will contain primarily insoluble with some soluble cesium and strontium compounds. Trace quantities of other isotopes may be present but are not considered to affect waste treatment. It is intended to process the liquid waste through SDS and/or EPICOR as indicated by sample analysis. The processed water used for decontamination will not require any special treatment after decontamination and prior to processing.

### 3.3.2 Solid Waste

Solid wastes are expected to result from discarding the tank farm piping and from the normal use of protective clothing. The tanks themselves are not expected to be discarded as waste. Rather, they are to be stored onsite for possible reuse or shipped to another facility for use. The solid waste resulting from ancillary operations and protective clothing will be segregated as radioactive or non-radioactive and further segregated as compactable or non-compactable. No special considerations will be required as these wastes are produced by plant operations in radiologically controlled areas. Since the majority of FPA is not a contaminated area the quantity of these wastes is expected to be minimal.



#### 4.0 LIFTING OPERATIONS

##### 4.1 REQUIREMENTS

All of the lifting operations being discussed in this SER are being performed in the TMI-2 FHB and the TMI-1 truck bay where no fuel is present. Consequently, those requirements which specifically deal with the handling of heavy loads around nuclear fuel are not applicable to these lifting operations. However, all other applicable requirements are used for these operations. The following is a listing of the documents whose guidance are applied to the FPA refurbishment lifting operations:

1. NUREG-0612                      Control of Heavy Loads at Nuclear Power Plants  
    (Para. 5.1.IV)
2. ANSI-B30.9-1971              Slings
3. ANSI-B30.2-1976              Overhead and Gantry Crane

All lifting operations will be performed in accordance with procedures which will minimize the possibility of, and mitigate the consequences of, a load drop accident.

See Table 4.1 for a listing of all heavy loads associated with FPA refurbishment.

During lifting operations that use the path near the SDS the following requirements will be imposed via procedures:

- o No tank decontamination in progress and tanks empty
- o No SDS processing in progress
- o No excess of personnel in FHB - El. 347 and the Truck Bay.

The FHB crane will be used within all of its prescribed and certified limits in accordance with both TMI-1 and TMI-2 procedures. All of the heavy load lifts planned, less than 40 tons maximum, are well within its rated and certified capacity of 110 tons.

##### 4.2 LOAD PATHS

The load paths within the FHB are shown on Figures 4.1 through 4.4. Because of the bulk of the tanks it is impossible to prevent the tanks from overhanging FPB during their removal. (See Figure 4.3 and 4.4).

Once these load paths were defined (as a function of load dimensions and weight), a matrix identifying the various loads and potential targets (Tables 4.2 and 4.3) was generated. The size and weight of the load being lifted determined which FHB crane hook is to be used and, consequently, the maximum distance from FPB to the load path. After a review of the various potential load drop effects, a west wall load path was selected for all lifts. This path was chosen to minimize the potential radiological consequences resulting from postulated drops of heavy loads being transported above FPB which contains the SDS. This path would also eliminate any impact upon the FHB ventilation plant

safety system. In addition, Figure 4.5 shows the TMI-1 heavy load lifting restriction applicable to the truck bay area which is shared with TMI-2. Due to this restriction, the FHB crane interlocks will be used for all loads over 15 tons once the FHB crane bridge leaves the TMI-2 FHB.

#### 4.3 CRANE OPERATIONS AND RIGGING EQUIPMENT

No repairs or modifications to the FHB crane are required for the FPA refurbishment program. Consequently, crane usage is within its rated and certified capacity meeting the requirements of ANSI-B30.2.0. All slings being used will be certified to comply with ANSI-B30.9 and reviewed to assure that a more than adequate safety factor exists. All lifting devices being fabricated have a design safety factor of five (5) with respect to the ultimate strength of the materials being employed and are being subjected to static load testing of 1 1/2 times rated load. (See Figure 2.2)

Crane movement will be administratively controlled so that no elevation or lateral (across building) motions being allowed above FPB. The elevation of loads will be the minimum required to safely clear obstacles in the load path.



Table 4.1  
Heavy Load Dimensions and Weights

Load	Dimension	Approximate Weight (Tons)
Concrete Slab (8)	2' x 7' x 16'	16
Concrete Slab (8)	2' x 7' x 20'	20
25,000 Gallon Tank (2)	13' Dia x 27'	9
15,000 Gallon Tank (4)	11'-6" Dia x 21'	6.5
33" WF beam	33" x 28'	3

TABLE 4.2  
DROPPED COMPONENT CATEGORIES  
(Consequences)

Targets West Wall Load Path	Two Slabs (37 Ton Max.)	One Slab (20 Ton Max.)	Tank (9 Ton Max.)	33" WF Beam (6,200 lbs. Max.)
FPA Bottom	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below
Fuel Transfer Tube Isolation Valves	FHS Penetration Sealed <sup>(2)</sup> on RCB Side, Damage to FHB Side Only	FHS Penetration Sealed <sup>(2)</sup> on RCB Side, Damage to FHB Side Only	FHS Penetration <sup>(2)</sup> Sealed on RCB Side, Damage to FHB Side Only	FHS Penetration Sealed <sup>(2)</sup> on RCB Side, Damage to FHB Side Only
Tank Farm	Release of Activity from 6 Tanks	Release of Activity from 4 Tanks	Release of Activity from 1 Tank	Release of Activity from 1 Tank
FPB Bottom	Not Possible <sup>(5)</sup>	Not Carried Over Pool, Not Possible	Buoyance of Tank Prevents Damage <sup>(3)</sup>	Not Carried Over Pool
SDS Liner	Not Possible <sup>(5)</sup>	Only Concrete Fragments leakage to Pool <sup>(4)</sup>	Buoyance of Tank Prevents Damage <sup>(3)</sup>	Not Carried Over Pool
SDS Filter	Not Possible <sup>(5)</sup>	Only Concrete Fragments leakage to Pool <sup>(4)</sup>	Buoyance of Tank Prevents Damage <sup>(3)</sup>	Not Carried Over Pool
SDS Piping	Sump Discharge Piping Damage	Damage Leakage on Floor	Damage Leakage on Floor	Damaged Leakage on Floor
SDS Post Filter	Not Possible <sup>(5)</sup>	Release to Pool	Release to Pool	Release to Pool
SDS Chem. Lab	Not Possible <sup>(5)</sup>	Release of Sample Quanti- ties of Activity	Release of Sample Quanti- ties of Activity	Release of Sample Quanti- ties of Activity



TABLE 4.2  
DROPPED COMPONENT CATEGORIES  
(Consequences)

Targets				
West Wall				33" WF Beam
Load Path (continued)	Two Slabs (37 Ton Max.)	One Slab (20 Ton Max.)	Tank (9 Ton Max.)	(6,200 lbs. Max.)
SPC N <sub>2</sub> Supply	Not Possible <sup>(5)</sup>	Bottle Ruptured, Loss of SPC Pressure Supply	Bottle Ruptured, Loss of SPC Pressure Supply	Bottle Ruptured, Loss of SPC Pressure Supply
Truck Bay Floor	Not Possible <sup>(5)</sup>	Collapse of Floor, Empty Room Below	Spalling of Concrete	Small Hole in Floor

5. Double slab lift over FPA only.
4. Slab falls on pool curb with fragments falling into pool.
3. Tank will not penetrate more than 15 feet into pool.
2. Penetration doubled sealed on RCB side with penetration passing through three concrete walls and an expansion joint.
1. Decay heat removal systems not in use, heat transfer to ambient. SPC system piping for boration control is also located below FPA.

TABLE 4.3  
DROPPED COMPONENT CATEGORIES  
(Consequences)

Targets East Wall Load Path	Two Slabs (37 Ton)	One Slab (20 Ton)	Tank (9 Ton)	33" WF Beam (6.2 K lbs.)
FPA Bottom	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below	Damaged, Decay Heat <sup>(1)</sup> Removal Piping Below
Fuel Transfer Tube Isolation Valves	FHS Penetration Sealed <sup>(2)</sup> on RCB Side	FHS Penetration Sealed <sup>(2)</sup> on RCB Side	FHS Penetration <sup>(2)</sup> Sealed on RCB Side	FHS Penetration Sealed <sup>(2)</sup> on RCB Side
Tank Farm	Release of Activity from 6 Tanks	Release of Activity from 4 Tanks	Release of Activity from 1 Tank	Release of Activity from 1 Tank
FPB Bottom	Not Possible <sup>(4)</sup>	Not Carried Over Pool	Buoyance of Tank Prevents Damage to SDS liners <sup>(3)(8)</sup>	Not Carried Over Pool
SDS Off Gas Liner	Not Possible <sup>(4)</sup>	Release Airborne Particu- late Matter to FHB	Release Airborne Particulate Matter to FHB	Release Airborne Particu- late Matter to FHB
SDS Ion Exchange Manifold	Not Possible <sup>(4)</sup>	Loss of SDS Operation Small Leakage to Pool	Loss of SDS Capability Small Leakage to Pool	Loss of SDS Operation Small Leakage to Pool
SDS Panels	Not Possible	Loss of SDS Operation	Loss of SDS Operation	Loss of SDS Operation
SDS Samples Boxes	Not Possible	Sample Quantities of Radiation Released to Building	Sample Quantities of Radiation Released to Building	Sample Quantities of Radiation Released to Building
SDS Chem. Lab	Not Possible <sup>(4)</sup>	Sample Quantities of Activity Released to Building	Sample Quantities of Activity Released to Building	Samples Quantities of Activity Released to Building
SPC System	Not Possible <sup>(4)</sup>	Loss of SPC Operation	Loss of SPC Operation	Loss of SPC Operation



TABLE 4.3  
DROPPED COMPONENT CATEGORIES  
(Consequence)

Targets	Two Slabs (37 Ton)	One Slab (20 Ton)	Tank (9 Ton)	33" WF Beam (6.2 K lbs.)
East Wall				
Load Path				
Various Electrical Trays	Not Possible <sup>(4)</sup>	Loss of Power to SDS and SPC	Loss of Power to SDS and SPC	Loss of Power to SDS and SPC
Truck Bay Floor	Not Possible <sup>(4)</sup>	Collapse of Floor, Empty Room Below	Spalling of Concrete	Small Hole in Floor

4. Double slab lift over FPA only.
3. Tank will not penetrate more than 15 feet into pool.
2. Penetration doubled sealed on RCB side with penetration passing through three concrete walls and an expansion joint.
1. Decay heat removal systems not in use, heat transfer to ambient. SPC system piping for boration control is also located below FPA.

## 5.0 SAFETY CONCERNS

To ensure that the refurbishment of FPA is conducted in a safe manner safety concerns have been evaluated with respect to both personnel and plant safety for all aspects of the refurbishment task. No hazardous or explosive materials are being handled for this task. All flame cutting will be conducted within the TMI-2 fire protection procedure No. 1410Y26, "Welding, Cutting, Grinding, and Open Flame Work Procedure for Fire Safety." Procedures are being written to detail all operations to ensure the safe handling and lifting of heavy loads. The tasks required for the refurbishment of FPA have been reviewed with only the postulated drops of heavy loads presenting potential consequences which could affect personnel and plant safety. Section 5.1 presents the heavy load drop evaluation for the refurbishment of FPA.

### 5.1 HEAVY LOAD DROP EVALUATION

#### 5.1.1 Identification of Loads

A number of various shapes and forms of loads (see Table 4.1) will be transported out of the FPA area to the truck bay. Several limiting case heavy lift loads were reviewed with each representing a category of dropped objects (See Table 4.2). The following is a discussion of each category of heavy load considered in this evaluation.

##### 5.1.1.1 Two Slab Load, 37-Ton Maximum

This category of load arises from the fact that the limits in FHB Crane Hook coverage prevents single slab lifts along the south wall of the FHB. Consequently, a lifting device was designed and will be fabricated to lift in combination, together as a single unit, a 20 ton and 16 ton slab. These lifts will be performed only over the FPA area and only with the southern eight (8) shielding slabs.

These "two-slab" lifts will be administratively controlled so as to be limited to one (1)-foot above the shielding slab elevation. Once lifted, the slabs will be set down on the remaining slabs where they will be re-rigged as single slab lifts which will then be transported to the TMI-1 truck bay.

##### 5.1.1.2 Single Slab Load, 20-Ton Maximum

This category of load arises from the need to lift the shielding slabs from the FPA area past FPB to the truck bay. Since the largest slab (20'L x 7'W x 2'T) weighs 20 tons, this slab is considered to be the limiting case for a potential shielding slab drop. The slabs will be moved at a one (1) foot elevation above the structural steel to the west-most limit of the main hook of the FHB crane. The actual lifting of the slabs will occur over the west curb of FPA to an elevation of 10'6" (+ 6") above the pool curbing. At this point, the slabs (taken one at a time) will be transported along the west curb past FPB to the truck bay. Once the slab reaches the receiving area adjacent to the truck bay, it will be lowered to an elevation within one foot above the floor.



#### 5.1.1.3 Waste Water Storage Tank Load, 9-Ton Maximum

This category of load arises from the need to lift the waste water storage tanks from FPA, over FPB, to the truck bay. Since the largest tank (27'L x 13 1/2'd) weighs slightly less than 9 tons, this tank is considered as the limiting case for a tank drop. The actual lifting of the tanks will occur over FPA to an elevation of 11'0" (+ 6") above the pool curb, then the tanks will be transported (one at a time) over FPB to the truck bay. Once the tank reaches the receiving area adjacent to the truck bay, it will be lowered to an elevation within one foot above the floor.

#### 5.1.1.4 33" W.F. Beam Load (6,200 lbs. Maximum)

This category of load arises from the need to lift structural steel and piping from FPA and transport them past FPB to the truck bay. The largest single piece is a 28 foot long 33" WF (6200 lb. Max. weight) which is considered to be the limiting case for all long slender objects, i.e. structural steel and piping, being removed from FPA. The actual lifting of structural steel and piping will occur over FPA to an elevation 10'-6" (+ 6") above the pool curbing, then moved to the west most limit of the FHB crane main hook, and transported along the west curb of FPB to the truck bay.

#### 5.1.2 Identification of Targets

The identification of targets was accomplished by reviewing the load path layouts for each of the loads identified in Section 5.1. As a result of this review, Tables 4.2 and 4.3 were generated for "west wall" and "east wall" load paths, with the "west wall" pathway being selected to minimize potential radiological consequences and impact to plant safety and operations in the event of a postulated load drop accident in the FHB. In fact, this load path selection was found to fall within earlier restrictions imposed on the handling of fuel shipping casks (15 tons or larger) within the FHB.

Two sets of potential targets were identified in the load path review. The first list of targets along the "west wall" of the FHB is:

1. Floor of FPA
2. Fuel Transfer Tube Isolation Valves
3. Waste Water Tanks
4. SDS Supply Piping
5. SDS Sample Box
6. SDS Dewatering Station
7. SDS Chemistry Laboratory
8. SPC Nitrogen Supply Tanks
9. SPC-Tank No. 5
10. Truck Bay and Receiving Area (TMI-1)

Also included in this list due to possible toppling or fragmentation of load on impact is:

11. Floor of FPB
12. SDS Post Filter
13. SDS Liner Storage Rack

The second list which is applicable to tank removal only includes the previous thirteen (13) items plus the following items:

14. SDS Filter Manifold
15. SDS Filter Rack
16. SDS Leak Containment Rack
17. SDS Ion Exchange Rack
18. SDS Exchange Manifold
19. SDS Sample Boxes
20. SDS Offgas Filter Unit

### 5.1.3 Consequences

The consequences presented below are divided into non-radiological and radiological consequences. Only consequences of postulated load drops along the chosen "west wall" load path, as given in Table 4.2, are presented.

#### 5.1.3.1 Non-Radiological

A review of Table 4.2 giving the consequences of various postulated load drops shows that some consequences could impact plant safety and/or operation which could cause a violation to the technical specifications of TMI-2 for the recovery mode. Presented below are the evaluations of those targets whose potential impacts with postulated load drops could lead to the most severe consequences with respect to plant safety or recovery mode operations. The size and weight of the actual load being dropped defines the severity of the damage, while the targets represent the actual loss of plant components or systems.

##### a) Floor of FPA

A postulated drop of a one foot "Two-Slab" lift could potentially impact the floor of FPA. The supporting steel and the tank farm will still be in FPA during these lifts which would absorb some, if not all, of the energy of the dropped slabs. The five foot thick reinforced concrete floor of FPA is expected to withstand the impact, should it occur, of the dropped slabs. However, since systems important to safety are located below the floor of FPA at El. 280'-6", the consequences to plant safety have been evaluated assuming structural collapse of the FPA floor. The systems located below FPA which are important to safety for the recovery mode of TMI-2 are listed below.

- i) Decay Heat Removal (DHR)
- ii) Mini Decay Heat Removal (MDHR)



- iii) Standby Pressure Control (SPC)
- iv) Make-up and Purification (MU&P)
- v) Class 1E Diesel Generator Electrical Distribution

The MDHR system, located below FPA, ties into one of the two 10" DHR inlet lines upstream of valve DH-V4B and the 12" DHR outlet line downstream of valve DH-V3. These DHR lines are also located below FPA. The loss of these DHR systems would not compromise the current mode of decay heat removal which is "loss to ambient" through the reactor vessel walls. Severance of the 12" DHR outlet line could result in the spillage of reactor coolant and the lowering of the reactor vessel water level to El. 314'-0" (bottom of the reactor vessel nozzles). The rise of the reactor coolant system (RCS) bulk temperature to between 149°F to 152°F resulting from the lowering of the reactor vessel water level to El. 314'-0" has been found acceptable. (Refer to the Addendum to the TMI-2 Decay Heat Removal Report of April 1982, Rev. 1 dated December 1982, prepared by G. A. Hipp, L. L. Losh, and E. R. Miller of Babcock & Wilcox for GPU Nuclear Corporation.) This loss of reactor coolant could be averted, however, by the closing of valve DH-V2 located inside the reactor building (RB). Severance of the two 10" DHR inlet lines would not cause the lowering of the reactor vessel water level because of the existence of check valves DH-V107A and B located inside the RB.

SPC is currently being used to supply borated water for boration control. SPC is located in the new fuel storage pit, but the supply line ties into the 4" MU&P inlet line located under the south end of FPA. From this point, two separate flow paths for supplying borated water to the reactor are available either thru the "A" or "B" pair of reactor coolant pumps. The flow path to the "B" reactor coolant pumps is through the Auxiliary Building i.e., not under FPA.

Assuming the unavailability of the lines under "FPA", the Waste Transfer System located in the Auxiliary Building is available to supply borated water through the "B" reactor coolant pumps to the reactor. The waste transfer pumps take suction from the reactor coolant bleed hold-up tank which contains water with 3500 ppm boron and discharges to the MU&P system. This water can be routed away from the FPA impact area by opening and closing the appropriate valves which will inject the borated water into the discharge piping of the "B" reactor coolant pumps.

Damage to the FPA floor could also impact the conduits, routed below the FPA floor, which contain electrical power distribution cables from the Class 1E Diesel Generators. A broad separation of cabling to and from the Diesel Generator Building has been maintained with half of the conduits and cable trays passing underneath FPA and half passing underneath FPB. Due to the limited size of the largest load being transported from the building (20 Ton Slab, 20' x 7' x 2'), the area of potential damage cannot encompass both fuel pools from any one postulated drop. Therefore, the distribution system from one diesel generator is assured.

b) Fuel Transfer Tube Isolation Valves

Damage to either or both isolation valves would not cause a loss of primary containment integrity since bolted and gasketed closure plates are located on the flanges on the containment building side of the fuel transfer tube. If the flanges on the containment building side have been removed for work on the fuel transfer tubes, they could be replaced prior to any heavy load lifts which could impact the isolation valves should a drop occur. Containment integrity is assured.

c) SDS System

The largest single item carried over FPB is the 25,000 gallon tank which weighs slightly less than nine (9) tons. Due to the buoyancy of the tank, analysis has shown that its drop would not penetrate to a depth greater than 15 feet into FPB. However, a postulated drop above FPB could impact the SDS filter rack or the leakage containment rack which protrude above the pool surface. Such an impact may potentially cause rupturing of the filters or even the rupturing of the SDS liners located at the bottom of FPB. The consequences of all of the liners rupturing are evaluated in section 5.1.3.2. The tanks also travel above the various piping manifolds associated with SDS operation, the SDS operator area platform, and the SDS chemistry lab. A postulated drop impacting the areas stated above could affect SDS operation which could impact the recovery operations schedule until SDS operations are restored to allow the processing of reactor coolant or reactor building sump water. Any failure of the SDS or its components will not, in any way, affect plant safety.

d) SPC Nitrogen Supply Tanks

Damage to the nitrogen supply tanks would impact the operation of the SPC system and create a possible missile due to the sudden release of gas pressure. The nitrogen supply is maintained in two separate banks of six bottles each. As previously stated in the SDS TER, the nitrogen gas bottles are to be maintained at less than 700 psi to minimize the



consequences of missiles which could be generated. The SPC system is available for boration control. Rupture of the nitrogen supply bottles would not degrade this system's availability since the pumps SPC-P-1A and SP-P-1B would be available. The Mini-Decay Heat Removal (MDHR) system is the primary back-up to the SPC system and will be also available. Therefore, a loss of the SPC system nitrogen supply bottles will not impact plant safety since boration control is assured.

e) Truck Bay Floor (TMI-1 FHB)

The actual lowering of heavy loads, approximately 56' in elevation, will occur over the receiving area portion of the truck bay. These heavy loads will be handled in the truck bay within the constraints of the TMI-1 procedures for the FHB Crane which require the crane control interlocks to be operative so as to limit operations in the area "ABCD" shown in Figure 4.5. These heavy loads will be handled in the remainder of the truck bay at a maximum elevation of one foot above the receiving area floor thus limiting the potential for structural damage.

A review of the TMI-1 FHB structures was made to establish the constraints imposed by the TMI-1 FHB Crane. In addition, a review was undertaken of the structure immediately beneath the receiving area where the loads will be lowered to assure that the consequence of load drop will be minimal. A room (50' x 17') occupies the space immediately below the receiving area and above the Control Building air intake tunnel. Located within the room above the Control Building air intake tunnel is a 1 1/2" radwaste line joining TMI-2 liquid radwaste to the TMI-1 radwaste evaporator. This line has been "valved-off" so that no communication exists between the two units. Only one train of safety-related cabling is located in the air intake tunnel so in the unlikely event of a dropped load (20 ton shielding slab) penetrating through two levels of reinforced concrete only one safety train will be impacted since the other safety train is located in an adjacent tunnel north of the impact area.

5.1.3.2 Radiological Consequences

A review of Table 4.2 giving the consequences of various postulated load drops shows that some consequences could result in releases of radioactivity. Radiological consequences are evaluated for releases confined within the FHB and releases transported offsite. Radiological consequences to onsite personnel from releases confined within the FHB are evaluated for both external and internal exposure. External exposure to persons off-site from releases confined within the FHB are insignificant due to a combination of distance from the FHB to the site boundary and the shielding afforded by the fuel pool walls within the FHB and the FHB itself. Internal exposure is evaluated for persons off-site

from a release to the FHB atmosphere which is then exhausted to the environment via the FHB HVAC and transported to the site boundary assuming 5 percentile (accident) meteorological conditions.

#### 5.1.3.2.1 On-Site Personnel Exposure

Two cases are considered to envelope the radiological consequences to on-site personnel. The first case maximizes external exposure and the second case maximizes internal exposure. The exposures from these two cases are not additive since the instigating events for each case are from two different postulated drops.

To maximize the external exposure to on-site personnel a postulated drop of a heavy load into FPB is assumed to impact the SDS Ion Exchanger rack as well as the SDS Liner Storage rack. All the liners are conservatively assumed to rupture and to release their entire contents into FPB. The leakage containment system, if it were running, would fully mix the released liner activity within the pool water volume in approximately 10 days. For this dose analysis it is conservatively assumed that all of the released liner activity will be fully mixed within the pool water volume instantaneously. Table 5.1 gives the assumptions used and the estimate of the external exposure from the total rupture of all the SDS liners in FPB.

The resulting external dose is very conservative for the following reasons.

1. It is deemed incredible that from a single load drop all of the SDS liners in FPB would be ruptured (due to the spatial separation between the Ion Exchanger Rack and the Storage Rack).
2. The entire contents of all the liners are assumed released to the pool.
3. The released liner activity would not be mixed instantaneously throughout the pool volume so that a water shield would exist between the released liner activity and the pool surface allowing for corrective action to begin pool clean-up without subjecting personnel to the radiation field that has been calculated.

To maximize the internal exposure to on-site personnel a heavy load drop is assumed to occur above FPA causing the collapse of all six tanks in the tank farm below. One tenth of one percent of the curie inventory in the tanks is assumed airborne and dispersed uniformly throughout the TMI-2 FHB atmosphere. The FHB ventilation exhaust system purges the FHB atmosphere to the outside environment through HEPA filters. The offsite releases and resulting dose consequences are evaluated and presented in section 5.1.3.2.2. Table 5.2 gives the assumptions used in this analysis and the resulting dose due to inhalation assuming an occupancy time of ten



minutes following the postulated drop, since by procedures personnel are to evacuate the building should a drop occur. This analysis is conservative for the reasons stated below.

1. It is deemed incredible that a single load drop would collapse all six tanks.
2. Any particulate activity becoming airborne would be swept into the FPA HVAC registers, via the FHB exhaust fan.

#### 5.1.3.2.2 Off-Site Releases and Resulting Consequences

As stated in the previous section, the accident which envelopes the amount of radioactivity released to the FHB atmosphere is the postulated drop of a heavy load into FPB, causing the release of one tenth of one percent of the inventory for each of the six tanks in the tank farm. The assumptions given in Table 5.2 are also applicable for the determination of off-site release. The amount of activity airborne within the FHB atmosphere is assumed to be released in one hour to the environment through the HEPA filters in the FHB ventilation exhaust system. The amount of activity released to the environment is assumed to be 0.1% of the airborne activity based on a 99.9% efficiency of the HEPA filtration. The radiological consequences of the off-site release is dependent upon the meteorological conditions present at the time of release. A conservative approach is taken which assumes that the 5 percentile 0-1 hour atmospheric dispersion factor (X/Q) at the nearest site boundary exists. The 0-1 hour X/Q given in Appendix 2D of the TMI-2 FSAR is used in this analysis. Using the dose conversion factors given in USNRC Regulatory Guide 1.109, the 0-8 hour breathing rate given in USNRC Regulatory Guide 1.4 (scaled to the different age groups' breathing rates given in Table E-5 of Regulatory Guide 1.109), 0.1% of the activity in the FHB atmosphere, and the 0-1 hour X/Q; doses via inhalation of the passing plume were calculated for each organ in each age group. Table 5.3 gives the dose to the organ of the maximally exposed individual and the pertinent parameters employed to estimate this maximum dose.

This analysis is very conservative not only for the reasons given in Section 5.1.3.2.1 concerning the airborne release to the FHB atmosphere but also because the removal efficiency of the HEPA filtration system may be conservative by a factor of 1000 due to the placement of two HEPA filters in series in the filter train.

Table 5.1

Radiological Consequence  
From A Postulated Drop Of A Heavy Load  
Into FPS (Maximum External Exposure To On-site Personnel)

Total Cesium Inventory, Ci	5500
Inventory Released to Pool	100%
Pool water Volume, Gal.	240,000
Whole Body Gamma Dose Rate, R/Hr	5.8



Table 5.2

Radiological Consequence  
From A Postulated Drop Of A Heavy Load  
Into FPA (Maximum Internal Exposure To On-site Personnel)

Number of Tanks Ruptured	6
Inventory of Each Upper Tank, Ci	
Sr-90	4.5
Ru-106	0.62
Cs-134	0.34
Cs-137	4.5
Ce-144	1.3
Inventory of Each Lower Tank, Ci	
Sr-90	6.2
Cs-134	3.8
Cs-137	56.
Inventory Airborne	0.1%
FHB Net Free Volume, Cu. Ft.	410,700
Breathing Rate, Cu. Meter/Sec.	3.47 E-4
Critical Organ	Bone
Dose to Critical Organ (10 minute occupancy), rem	6.9

Table 5.3

Radiological Consequence  
From A Postulated Drop Of A Heavy Load  
Into FPA (Maximum Off-site Internal Exposure)

Airborne activity in FPA, Ci (Based on Table 5.2)	
Sr-90	3.0 E-2
Ru-106	2.5 E-3
- Cs-134	8.9 E-3
Cs-137	1.3 E-1
Ce-144	5.1 E-3
Airborne activity released to environment	0.1%
Atmospheric Dispersion Factor, Sec/Cu. Meter	6.1 E-4
Maximally Exposed Individual	Teenager
Breathing Rate, Cu. Meter/Sec	3.47 E-4
Critical Organ	Bone
Dose to Critical Organ, mrem	0.089



#### 5.1.4 NUREG 0612 Evaluation

The movement of heavy loads required for the refurbishment of FPA have been evaluated with respect to NUREG 0612. The results of this evaluation are presented below.

1. Safe Load Paths have been developed and are presented in section 4.2.
2. Procedures employed for the removal operations involving heavy loads are discussed in section 4.0.
3. Crane operators are trained and qualified in accordance with Chapter 2-3 of ANSI B30.2-1976, "Overhead and Gantry Crane." By procedure 2502-1.2 crane operator conduct is in accordance with Chapter 2-3 of ANSI B30.2-1976.
4. No "Special Lifting Devices" as defined by ANSI N14.6-1978, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4,500 kg) or more for Nuclear Materials," are employed for the refurbishment of FPA.
5. Lifting devices employed for the various removal operations are installed and used in accordance to the guidelines of ANSI B30.9-1971, "Slings", see Section 4.0.
6. Procedures have been implemented invoking the requirements of Chapter 2-2 of ANSI B30.2-1976 with respect to crane inspection, testing, and maintenance. No exceptions have been taken.
7. The Fuel Handling Building Crane was designed to the Electric Overhead Crane Institute (EOCI) Specification No. 61 for Class "A" indoor service. EOCI Specification No. 61 was the equivalent of CMAA Specification No. 70 at the time of the crane design (1968). This crane also meets the regulations of cranes, booms, and hoists as stated by the Commonwealth of Pennsylvania Department of Labor and Industry.

The general criteria of NUREG 0612, Section 5.1, are evaluated as delineated below.

1. Releases of radioactive material that may result from damage to spent fuel based on calculations involving accidental dropping of a postulated heavy load produce doses that are well within 10 CFR Part 100 limits of 300 rem thyroid, 25 rem whole body (analyses should show that doses are equal to or less than 1/4 of Part 100 limits).

Evaluation: Section 5.1.3.2.2 presents the off-site releases and the resulting radiological consequences for the "worst case" heavy load drop scenario. These consequences are extremely small compared to the 10 CFR 100 guidelines, and are well below the off-site dose limits given in Criterion I.

- II. Damage to fuel and fuel storage racks based on calculations involving accidental dropping of a postulated heavy load does not result in a configuration of the fuel such that  $k_{eff}$  is larger than 0.95.

Evaluation: There is no fuel being stored within the Unit 2 Fuel Handling Building. No crane movement required for FPA refurbishment will enter the Unit 1 Fuel Handling Building (except the Truck Bay), therefore precluding any heavy load drop which could affect fuel reconfiguration.

- III. Damage to the reactor vessel or the spent fuel pool based on calculations of damage following accidental dropping of a postulated heavy load is limited so as not to result in water leakage that could uncover the fuel, (makeup water provided to overcome leakage should be from a borated source of adequate concentration if the water being lost is borated).

Evaluation: For the reasons stated in the evaluation of Criterion II, any heavy load drop which could result in water leakage, resulting in the possibility to uncover fuel, is precluded.

- IV. Damage to equipment in redundant or dual safe shutdown paths, based on calculations assuming the accidental dropping of a postulated heavy load, will be limited so as not to result in loss of required safe shutdown functions.

Evaluation: The required safe shutdown functions that apply to the TMI-Unit 2 reactor in its current cooling mode and core configuration are:

- 1) the capability to maintain subcriticality;
- 2) decay heat removal, and
- 3) the capability to maintain the integrity of components whose failures could result in excessive off-site releases.

The reactor coolant pressure boundary needs only to be maintained insofar as reactor coolant must be maintained in the RCS for decay heat removal and reactivity control.



Required safe shutdown functions unique to TMI-2 are addressed in the same order as above:

- 1) Due to the configuration of the TMI-2 core, the only credible mechanism by which criticality control could be compromised is deporation of the water in the Reactor Coolant System. Systems within load impact areas which contain unborated water have been investigated and found that any system failure or loss resulting in the draining of their contents into the RCS is precluded.
- 2) As stated in section 5.1.3.1, the Decay Heat Removal System and the Mini-Decay Heat Removal System are assumed to be non-functional after a heavy load drop is assumed to impact the FPA floor directly above them. However, the decay heat production rate has diminished greatly during the time since the accident to a point at which active heat removal systems are no longer required (and in fact have not been required for some time). The present mode of decay heat removal is by natural losses to amoiemt via the reactor coolant system with the main pumps idle.
- 3) Excessive off-site releases are considered to be those releases whose dose consequences approach 10 CFR 100 guidelines. As given in section 5.1.3.2.2 the off-site releases from the "worst case" scenario results in dose consequences orders of magnitude below 10 CFR 100 guidelines.

## 5.2 10 CFR 50.59 EVALUATION

### REGULATION

According to paragraph 50.59 of 10 CFR the holder of an operating license may make a change to the facility provided that it does not entail a modification to the technical specifications and that there is no unreviewed safety question.

A proposed change involves an unreviewed safety question if:

- i) the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased; or
- ii) a possibility for an accident or a malfunction of a different type than any evaluated previously in the safety analysis report may be created; or
- iii) the margin of safety, as defined in the basis for any technical specification, is reduced.

## EVALUATION

All of the planned activities required for the refurbishment of FPA have been found not to entail modifications to the existing recovery mode technical specifications nor do they result in any unreviewed safety questions since:

- i) With the absence of fuel in the FHB, the consequences of all postulated load drops, associated with the planned activities, are bounded by analyses previously evaluated in the Safety Analysis Report;
- ii) Criticality control through high boron concentration in the reactor coolant and decay heat removal through losses to ambient are not affected by any planned activities and their associated postulated load drops; and
- iii) Review of the bases for the TMI-2 recovery mode technical specifications have found that no planned activities will decrease the safety margins stated in these bases.



## 6.0 RADIOLOGICAL CONSIDERATIONS

### 6.1 ON-SITE PERSONNEL EXPOSURE

#### 6.1.1 External Exposure

The total whole body exposure for the Fuel Pool 'A' refurbishment is calculated to be 170 man-rem. The activities included in this calculation are those associated with:

- Decon of the Upper Tanks (2900 MH's @ <30 mR/hr)
- Decon of the Lower Tanks (1900 MH's @ <30 mR/hr)
- Upgrade of Access to Upper Tanks (240 MH's @ <30 mR/hr)
- Upgrade of Access to Lower Tanks (100 MH's @ <30 mR/hr)
- Disassembly of the Structural Steel (Upper Tanks) (1000 MH's @ <10 mR/hr)
- Disassembly of the Associated Piping (1000 MH's @ <10 mR/hr)

Due to the uncertainty in both the man-hour estimate and the dose rate fields, it is estimated that the total exposure could vary by up to +50 percent. Considering the uncertainties associated with the man-rem estimate, 80 to 250 man-rem is selected as the estimate for the refurbishment of FPA.

Decon of the tanks will be done with hydrolasers inserted through the manways. When the decon has proceeded to an acceptable level, internal decon of the tanks may be conducted manually.

Disassembly of the associated piping will not be done until the decon of the tanks is complete. It is expected that radiation levels will be less than 10 mR/hr at that time. The disassembly of the structural steel will not be done until the decon is complete.

#### 6.1.2 Internal Exposure

The exterior surfaces in FPA are currently uncontaminated except for one area in the southeast corner and all decon operations will be conducted to maintain them so, therefore, internal exposure is expected to be negligible. The opening of any tank or piping will be done using glove bags, containments, or other suitable enclosures, or as directed by Rad Con to prevent the spread of contamination. The assembly and disassembly will be done using good radiological work practices.

No releases to the general public are expected as a result of normal decon activity. As stated, all system openings will be enclosed in containments which will use HEPA filters (as required) on the vents or other means such as air flow, to prevent the spread of contamination.

Disassembly operations will not be done until the tanks are cleaned to an acceptable level for shipment. It is, therefore, expected that internal contamination levels will be minimal.

### 6.1.3 ALARA Considerations

All evolutions in radiation areas will be sequenced to reduce overall radiation exposures. As determined by procedure, the workers will be briefed and trained to a level commensurate with the expected radiation levels and resultant exposures and the level of difficulty of the associated task.

For programmatic support of the As Low As Reasonably Achievable (ALARA) concept the following decisions were made in the overall planning of the tasks.

- o Decontamination of the tanks will be done in place.
- o Decontamination will be done prior to disassembly.
- o Decontamination will be done with water which will be processed by SDS.
- o The tanks will be decontaminated to offsite shipping criteria so that the ultimate destination of the tanks does not influence this task.

The following practices will be observed in the execution of each task to ensure that exposures are ALARA.

- o Protective clothing and respirators will be worn as appropriate.
- o Mockup training and photographs may be used to ensure worker familiarity with work and work environment.
- o Radiation area signs will be clearly posted so workers may minimize stay time in hot areas and stand in a low-radiation zone whenever practical.
- o The use of remote or long-handled tools will be considered as a means to avoid contact with the tanks.
- o All work non-essential to the removal of the tanks will be performed after they have been removed, when the dose rates in the pool will be lower.
- o The tanks will be flushed and partially filled with processed or demineralized water to lower the radiation levels.
- o Containments, glove bags, etc. will be used to prevent the spread of contamination.

Additionally, the use of alternate methods and temporary shielding will be actively explored by the radiological engineering group through every phase of work.

### 6.2 OFF-SITE RELEASES AND CONSEQUENCES

There are no expected releases from the decon or disassembly activity. As stated earlier, the decon will be done in an enclosed system and the wastes processed through SDS. Any releases due to SDS operation are expected to be well within the analysis provided in the SDS TER.



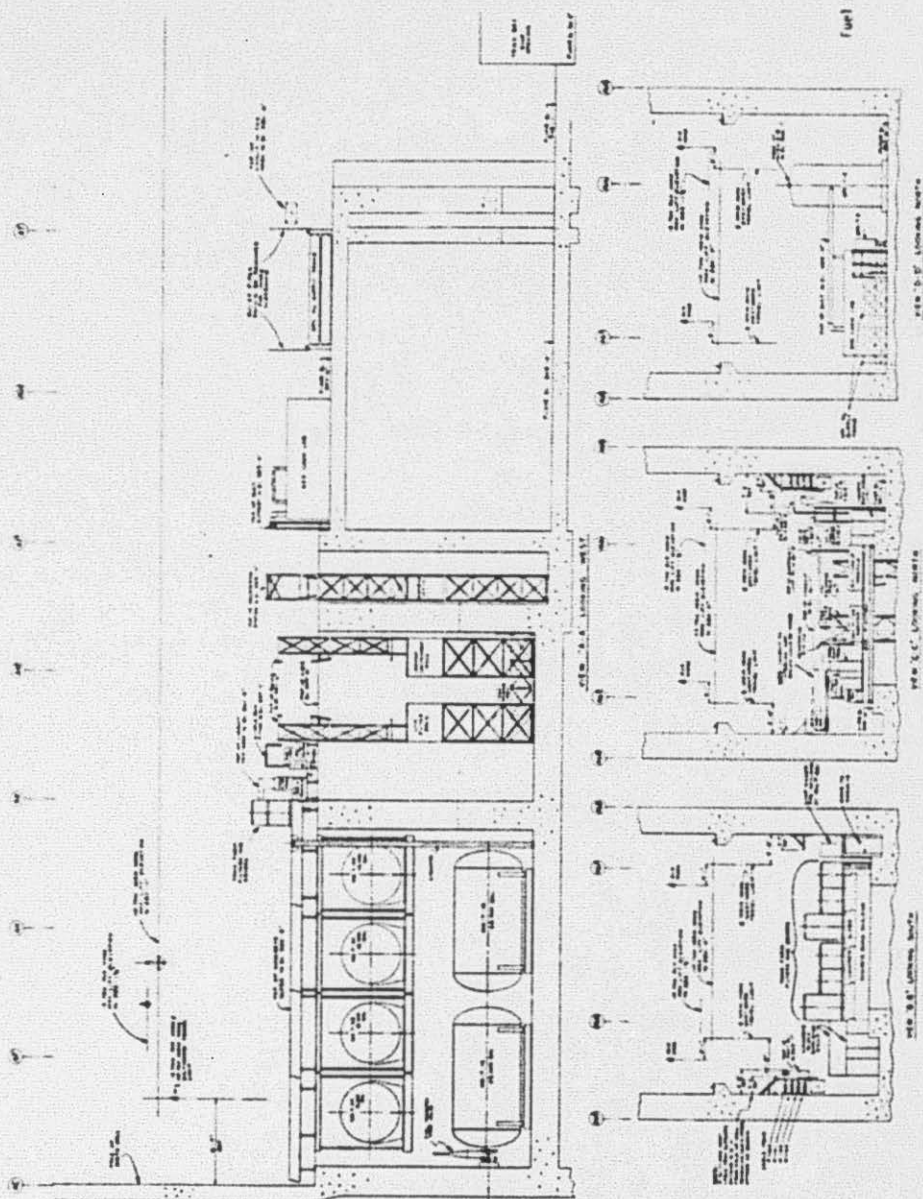
## 7.0 CONCLUSIONS

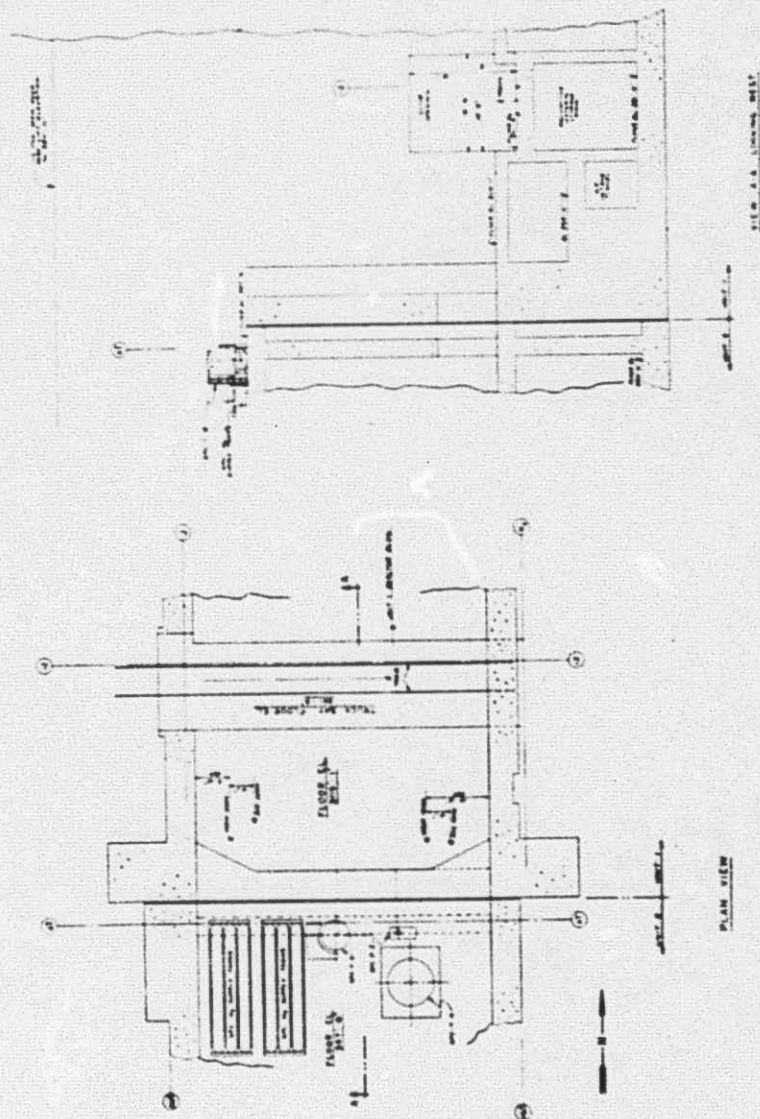
This SER has evaluated the planned activities associated with the refurbishment of FPA to determine their effects upon plant operation, continued stabilization of the TMI-2 reactor core, and environmental releases of radioactivity. Of paramount consideration has been the development of load paths that would minimize any consequence of a postulated drop of a heavy load. To this end all lifting devices and rigging equipment employed for the defined scope of this SER have been designed, engineered, and followed-up with detailed lifting procedures to ensure, to the fullest extent possible, that a heavy load drop is to be considered a highly unlikely, if not incredible, event. Nonetheless, heavy load drops have been postulated with the most severe consequences shown not to adversely affect plant operations nor the continued stabilization of the reactor core, and not to result in any significant radioactive release which could present an undue risk to the health and safety of the public.





TM-2  
Fuel Handling Building  
Sections  
Figure 1.2

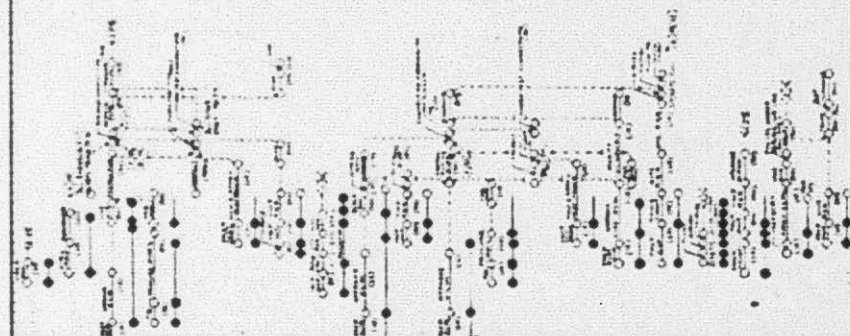




TM-2  
PHB Truck Bay  
Plan and Section  
Figure 1.2



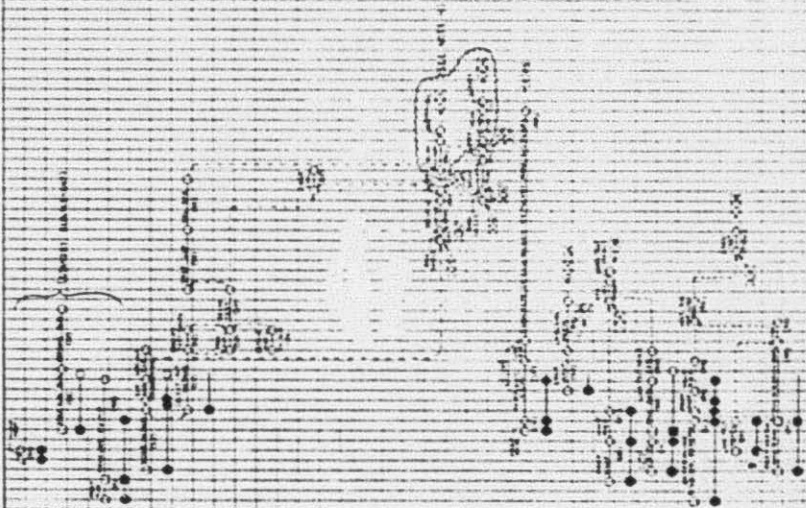
SCHEDULE DESCRIPTION		19
1	MANAGEMENT AND SERVICES	1.0
2	GENERAL CONTRACTOR	1.0
3	MECHANICAL	1.0
4	ELECTRICAL	1.0
5	PLUMBING	1.0
6	PAINTING	1.0
7	LANDSCAPE ARCHITECTURE	1.0
8	ARCHITECTURAL	1.0
9	ENGINEERING	1.0
10	CONSTRUCTION MANAGEMENT	1.0
11	GENERAL	1.0
12	GENERAL	1.0
13	GENERAL	1.0
14	GENERAL	1.0
15	GENERAL	1.0
16	GENERAL	1.0
17	GENERAL	1.0
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100	GENERAL	1.0



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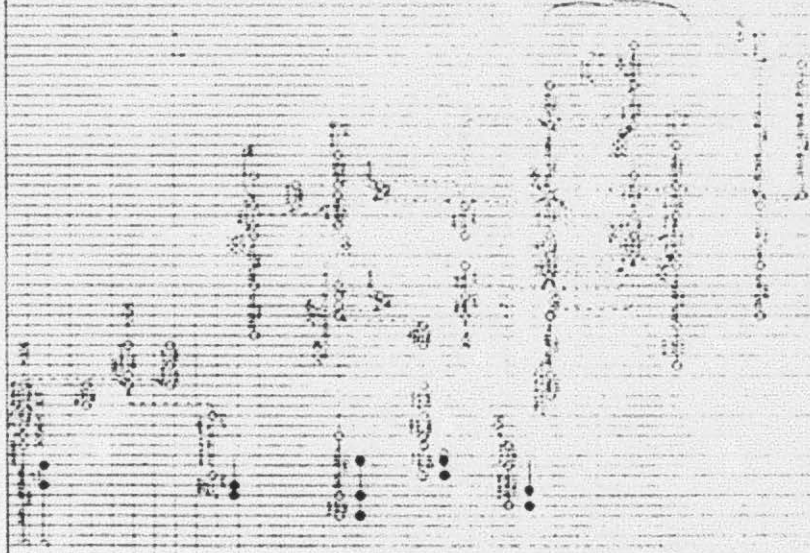
SCHEDULE DESCRIPTION	
01	GENERAL
02	FOUNDATIONS
03	CONCRETE
04	STEEL
05	WOOD
06	PAINTS AND FINISHES
07	MECHANICAL
08	ELECTRICAL
09	TELEPHONE
10	TELEVISION
11	RADIO
12	TELETYPE
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99	RADIO
100	TELETYPE



1000

☐ A. I have a good idea of what I want to do.  
☐ B. I have a general idea of what I want to do.  
☐ C. I have a very general idea of what I want to do.  
☐ D. I have no idea of what I want to do.  
☐ E. I have a very general idea of what I want to do, but I am not sure.

SCHEDULE DESCRIPTION		QTY	UNIT
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1500

1. ☐ I am a member of the American Medical Association.  
 2. ☐ I am a member of the American College of Surgeons.  
 3. ☐ I am a member of the American Society of Plastic Surgeons.  
 4. ☐ I am a member of the American Society of Hand Surgeons.  
 5. ☐ I am a member of the American Society of Podiatric Surgeons.  
 6. ☐ I am a member of the American Society of Orthopedic Surgeons.  
 7. ☐ I am a member of the American Society of Otolaryngologists and Head and Neck Surgeons.  
 8. ☐ I am a member of the American Society of Obstetricians and Gynecologists.  
 9. ☐ I am a member of the American Society of Pediatric Surgeons.  
 10. ☐ I am a member of the American Society of Urologists.  
 11. ☐ I am a member of the American Society of Dermatologists.  
 12. ☐ I am a member of the American Society of Radiologists.  
 13. ☐ I am a member of the American Society of Anesthesiologists.  
 14. ☐ I am a member of the American Society of Ophthalmologists.  
 15. ☐ I am a member of the American Society of Neurologists.  
 16. ☐ I am a member of the American Society of Psychiatric Surgeons.  
 17. ☐ I am a member of the American Society of Plastic Surgeons.  
 18. ☐ I am a member of the American Society of Hand Surgeons.  
 19. ☐ I am a member of the American Society of Podiatric Surgeons.  
 20. ☐ I am a member of the American Society of Orthopedic Surgeons.  
 21. ☐ I am a member of the American Society of Otolaryngologists and Head and Neck Surgeons.  
 22. ☐ I am a member of the American Society of Obstetricians and Gynecologists.  
 23. ☐ I am a member of the American Society of Pediatric Surgeons.  
 24. ☐ I am a member of the American Society of Urologists.  
 25. ☐ I am a member of the American Society of Dermatologists.  
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 27. ☐ I am a member of the American Society of Anesthesiologists.  
 28. ☐ I am a member of the American Society of Ophthalmologists.  
 29. ☐ I am a member of the American Society of Neurologists.  
 30. ☐ I am a member of the American Society of Psychiatric Surgeons.

THI-2  
Fuel Pool A  
Refurbishment  
Schedule  
Figure 1.4  
Sheet 3 of 6



SCHEDULE DESCRIPTION	
01	Base 1000 Street SW, 100000
02	Base 1000 Street SW, 100000
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DOI: 10.1002/pola.23111

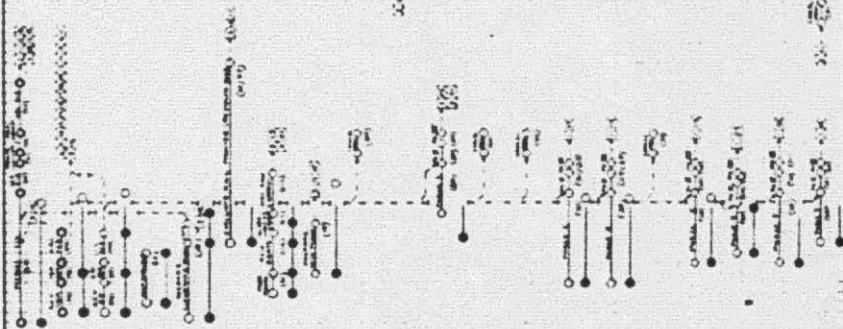
$$\lim_{n \rightarrow \infty} \int_{\mathbb{R}^d} \phi(x) \, d\mu_n(x) = \int_{\mathbb{R}^d} \phi(x) \, d\mu(x)$$

Handwritten chemical structures for 1,2,3,4,5,6-hexachlorocyclohexane isomers. The structures are labeled with 'a' and 'b' and show various chlorine and hydrogen atom arrangements on a cyclohexane ring.

1997

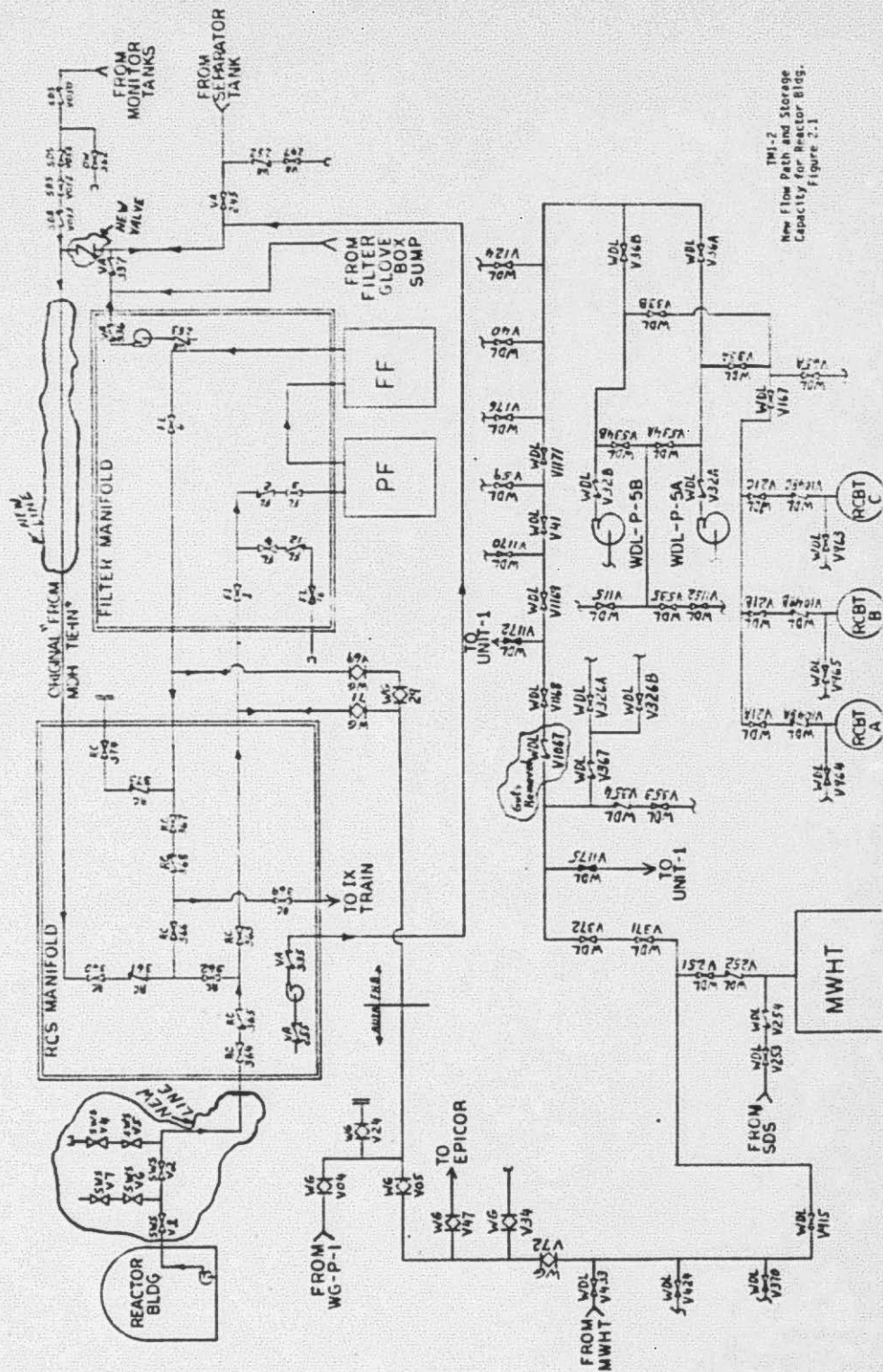
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SCHEDULE DESCRIPTION	
01	PAVING EXISTING AND NEW
02	5.03 TIE
03	5.05 6" ASPHALT OVERLAPPING
04	PAVING ROAD SURFACE MATERIAL
05	PAVING LANE & SHOULDER WITH ASPHALT
06	Asphalt Paving Study
07	PAVING WITH ASPHALT
08	PAVING ROAD SURFACE WITH ASPHALT
09	PAVING ROAD SURFACE WITH ASPHALT
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[illegible]







TM-2  
New Flow Path and Storage  
Capacity for Reactor Bldg.  
Figure 2.1

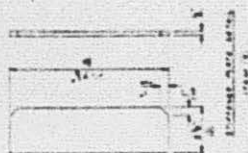


TABLE 1. MATERIAL

ITEM	DESCRIPTION	QUANTITY	UNIT
1	Concrete	1.00	CU YD
2	Reinforcing Steel	1.00	TON
3	Formwork	1.00	SQ YD
4	Gravel	1.00	CU YD
5	Sand	1.00	CU YD
6	Water	1.00	CU YD
7	Oil	1.00	CU YD
8	Paint	1.00	CU YD
9	Other	1.00	CU YD

1. The concrete was prepared in accordance with the following specifications:

2. The concrete was prepared in accordance with the following specifications:

3. The concrete was prepared in accordance with the following specifications:

4. The concrete was prepared in accordance with the following specifications:

5. The concrete was prepared in accordance with the following specifications:

6. The concrete was prepared in accordance with the following specifications:

7. The concrete was prepared in accordance with the following specifications:

8. The concrete was prepared in accordance with the following specifications:

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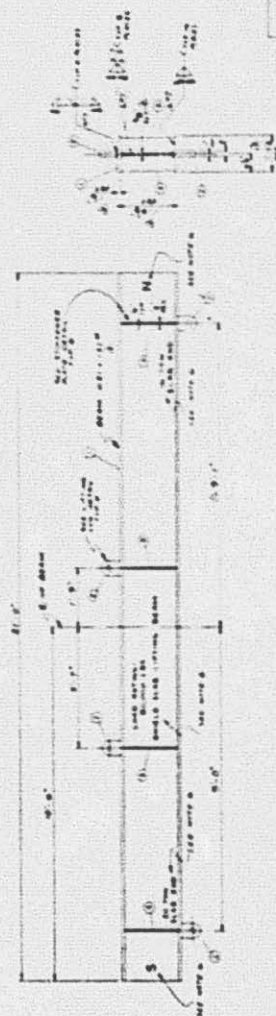


FIG. 1. BEAM CROSS SECTION

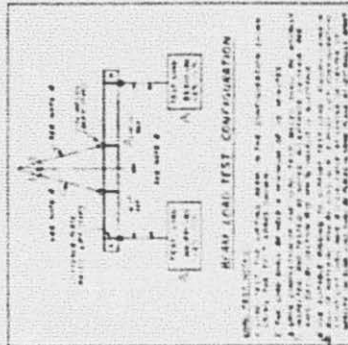


FIG. 2. BEAM CROSS SECTION

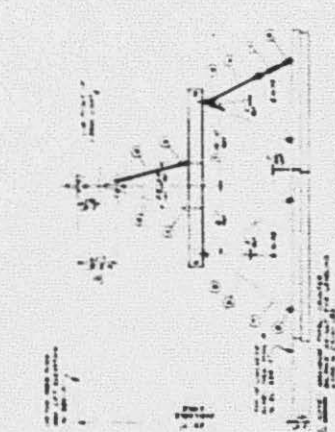


FIG. 3. BEAM CROSS SECTION

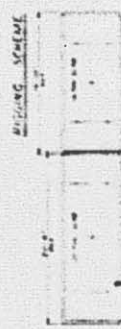
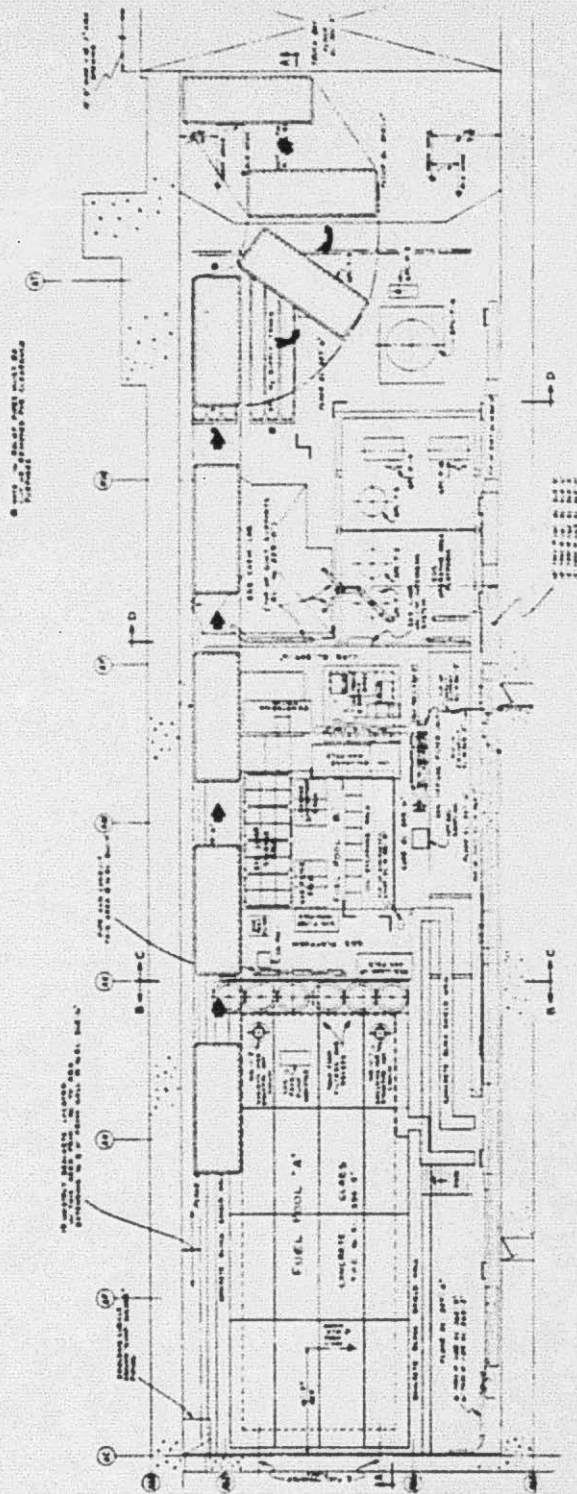


FIG. 4. BEAM CROSS SECTION

TABLE 2. MATERIAL

ITEM	DESCRIPTION	QUANTITY	UNIT
1	Concrete	1.00	CU YD
2	Reinforcing Steel	1.00	TON
3	Formwork	1.00	SQ YD
4	Gravel	1.00	CU YD
5	Sand	1.00	CU YD
6	Water	1.00	CU YD
7	Oil	1.00	CU YD
8	Paint	1.00	CU YD
9	Other	1.00	CU YD

FIG. 5. BEAM CROSS SECTION

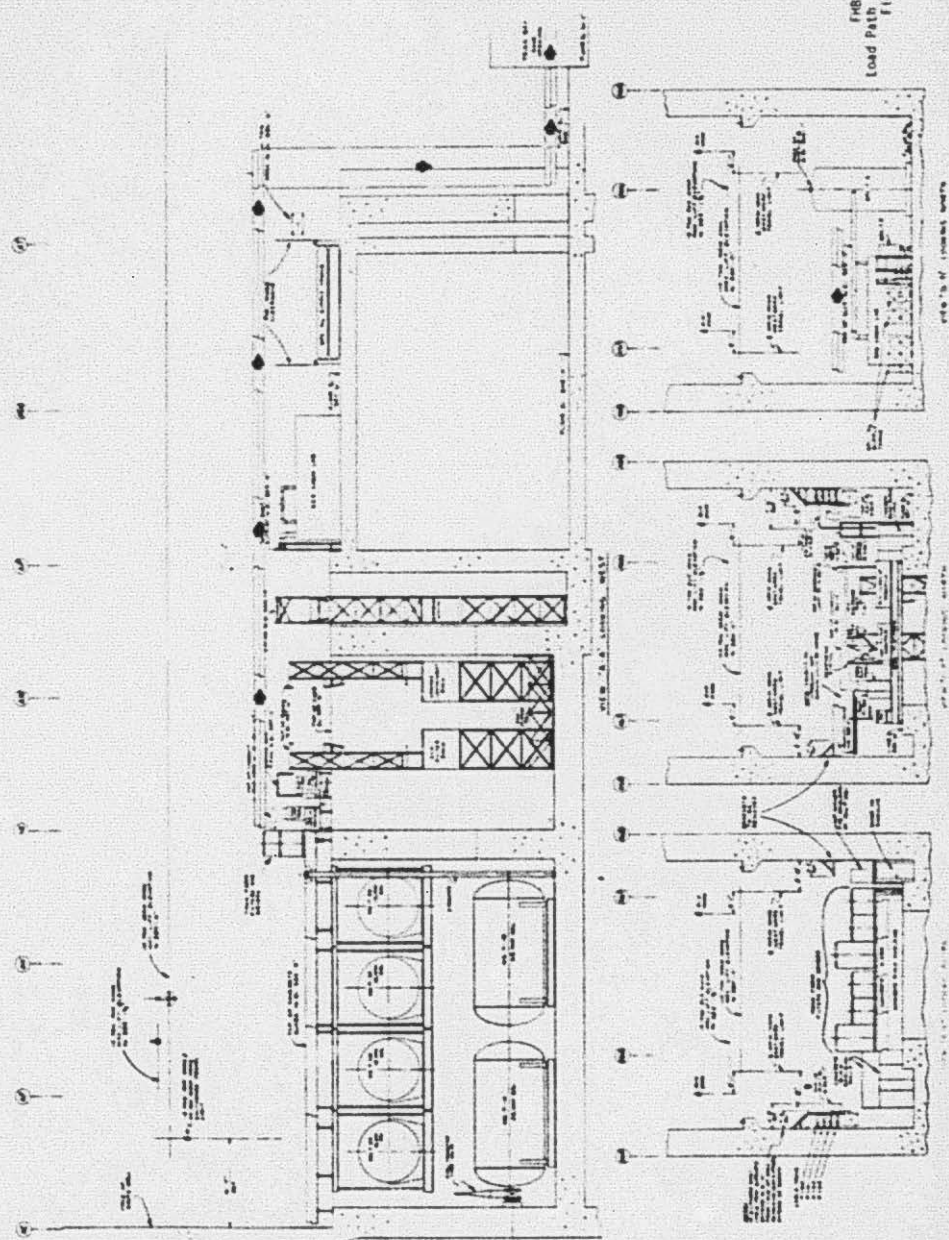


Approved: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Project: \_\_\_\_\_  
 Drawn by: \_\_\_\_\_  
 Checked by: \_\_\_\_\_  
 Title: \_\_\_\_\_

# CONCRETE SLAB LOAD PATH

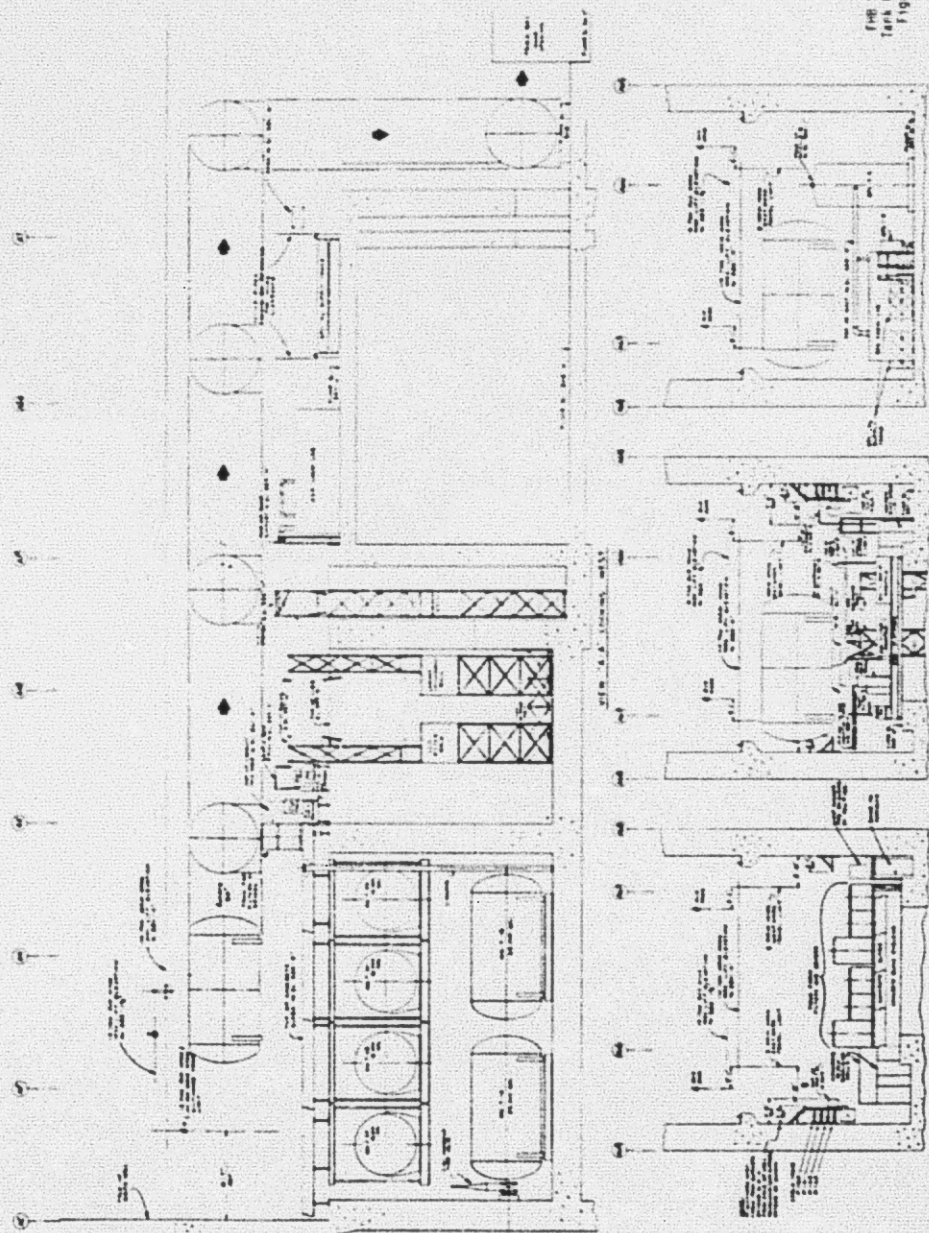
TM-2  
 For Elevation 337'6"  
 Load Path (Excluding Tanks)  
 Figure 4.1





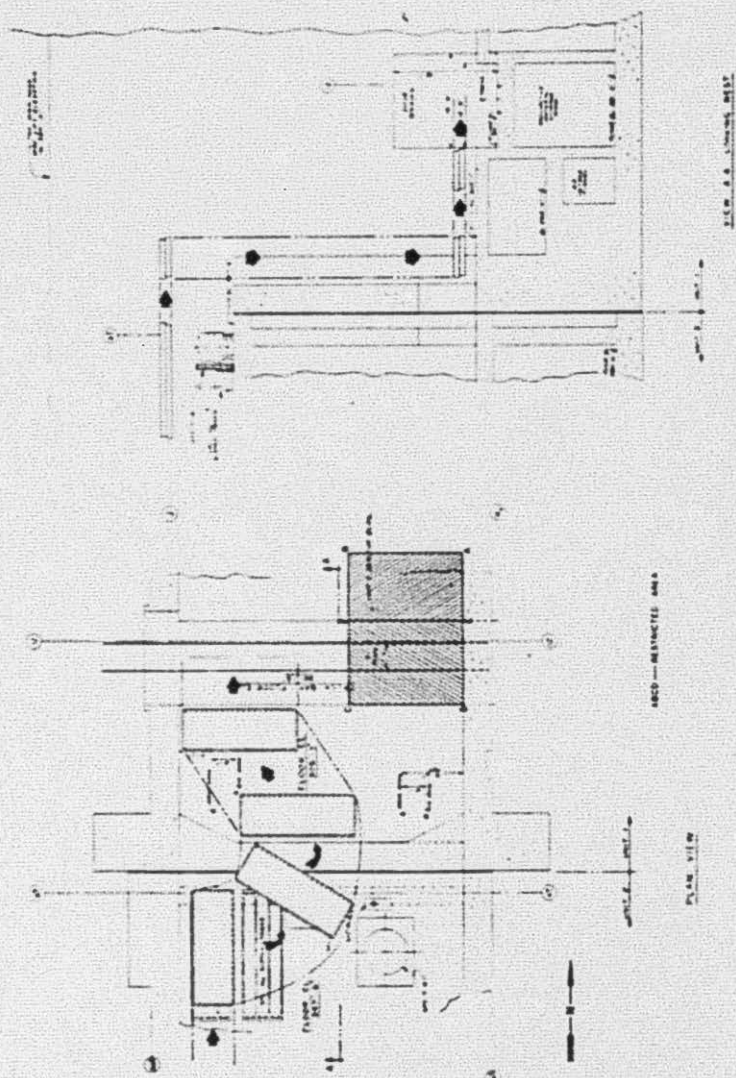
TM-2  
PHS Sections  
Load Path (Including Tanks)  
Figure 4.2





TMI-2  
FHR Sections  
Task Load Path  
Figure 4.4





LOAD PATH FOR CONCRETE SLABS

THI-2  
Load Path for  
Concrete Slabs  
THI-1 Truck Bed  
Figure 4.5