HEDL-7377

PLANNING STUDY
RESIN AND DEBRIS REMOVAL SYSTEM

THREE MILE ISLAND NUCLEAR STATION UNIT 2 MAKE-UP AND PURIFICATION DEMINERALIZERS

Hanford Engineering Development Laboratory

HANFORD ENGINEERING DEVELOPMENT LABORATORY
Operated by Westinghouse Hanford Company
P.O. Box 1970 Richland, WA 99352
A Subsidiary of Westinghouse Electric Corporation
Prepared for the U.S. Department of Energy
Assistant Secretary for Nuclear Energy
Office of Terminal Waste Disposal
and Remedial Action
under Contract No. DE-AC06-76FF02170
B&R No. AG-30-05

DISCLAIMER

Printed in the United States of America

HEDL--7377

DE83 017009

PLANNING STUDY
RESIN AND DEBRIS REMOVAL SYSTEM

THREE MILE ISLAND NUCLEAR STATION UNIT 2 MAKE-UP AND PURIFICATION DEMINERALIZERS

Hanford Engineering Development Laboratory

E.J. Renkey
W.W. Jenkins
June 1983

HANFORD ENGINEERING DEVELOPMENT LABORATORY
Operated by Westinghouse Hanford Company
P.O. Box 1970 Richland, WA 99352
A Subsidiary of Westinghouse Electric Corporation
Prepared for the U.S. Department of Energy
Assistant Secretary for Nuclear Energy
Office of Terminal Waste Disposal
and Remedial Action
under Contract No. DE-AC06-76FF02170
B&R No. AG-30-05

DISCLAIMER

CONTENTS

FIGURES

TABLES

SUMMARY

Various methods were evaluated to remove the resin and debris from the makeup and purification demineralizers. There are two preferred concepts. The existing waste disposal system should be utilized if some contamination of currently clean lines is acceptable. A skid mounted, temporary, upflow/downflow system should be utilized if the demineralizers and associated piping are to be cleaned to the maximum extent practicable with minimum contamination of the existing system. Both methods provide for removal of complex organic compounds from the effluent and elution of Cesium from the resin. The resin and debris will be diluted with concrete to be disposed of in accordance with 10CFR61 burial limits.

1.0 INTRODUCTION

1.1 OBJECTIVE

This study evaluates options for removing resins, fuel, and debris from the pressurized water make-up and purification demineralizers MU-K-1A and -1B. The method of removal must accomplish the following functions:

1. Remove complex organic compounds from the demineralizer prior to releasing the effluent to the submerged demineralizer system.

2. Elute or rinse the ^{137}Cs from the demineralizer and its contents to minimize the activity of the waste products prior to their removal.

3. Minimize fuel fine contamination of the SDS prefilters.

4. Remove, package and dispose of the demineralizer contents as commercial wastes.

5. Flush the system.

1.2 BACKGROUND

Various approaches have been considered for resin removal as described in Reference 1. Numerous activities directed at assessing the contents of the demineralizer resulted in the estimates shown in Table 1. Los Alamos National Laboratory has made independent fuel assessments of the demineralizers and concluded that the maximum contained in "A" is 15.5 lbs and in "B" is 1.6 lbs. Apparently shrinkage of the resin bed has occurred. The shrinkage observed is approximately that produced in Pacific Northwest Laboratory (PNL) experiments at 1.7×10^9 rads, i.e. -56%. Visual observations by GPU have shown that the "A" demineralizer contains a dry caked resin and debris bed while the "B" demineralizer is approximately half-full of highly radioactive water, resin and debris.

TABLE 1

ESTIMATED DEMINERALIZER LOADINGS
BASED UPON MID-OCTOBER 1982 CHARACTERIZATIONS
AND APRIL 1983 SAMPLING OPERATIONS

		Initial	A Vessel	B Vessel
1.	Resin			
	Volume, ft^3	50	22	22
	Weight, lb	2,139	1,025	1,025
	^{137}Cs, Ci	0	3,500	7,000
	^{134}Cs, Ci	0	270	540
2.	Liquid			
	Volume, ft^3	44	0	22
	Weight, lb	2,746	0	1,373
3.	Debris			
	U, lb		5	1
	Core Debris, lb		95	19
	^{137}Cs, Ci		177	35
	^{134}Cs, Ci		16	3
	^{106}Ru, Ci		21	4
	^{144}Ce, Ci		28	5
	^{125}Sb, Ci		116	23
	TRU, Ci		0.5[a]	0.1[a]
4.	Gas			
	Volume, ft^3		54	27
	Temp, ^{o}F		80	10.5
	Pressure, psig		11	10.5

(a) α activity only

A study by Westinghouse Hanford evaluated integrated doses at certain equipment locations within the "A" demineralizer cubicle. Results of this evaluation are shown in Table 2. Of particular concern for resin removal were the condition of the valves associated with the resin fill and sluice lines. The table shows that dose rates have not reached the range where operation would be affected. Dose rates were estimated from radiation surveys and extrapolated back to the accident based on GPU estimates of isotopic concentrations to establish integrated doses. If, as estimated, the "B" cubicle contains twice the activity in approximately the same location, integrated doses will approach twice the value shown for the "A" cubicle. Sampling operations in April 1983 demonstrated that the resin fill line valves in both cubicles would open using normal controls.

The amount of debris in the lines leading to each demineralizer is somewhat uncertain. Letdown flow has been circulated subsequent to the accident through the line which bypasses the demineralizers and their inlet filters. Flushing operations were performed in October 1980. However, the makeup and purification filters and demineralizers have been isolated for an extended period of time. Resin sampling operations conducted in March and April, 1983, through the resin fill lines, removed standing water. Gas sampling operations of both demineralizers were conducted in February 1983, using the normal inlet and outlet lines. The demineralizers were subsequently purged with nitrogen. Gas generation rate measurements are planned to be measured in the near future.

1.3 SCOPE

Various options for removal of resin and debris are identified in this study. The three options which were considered to best meet the technical objectives are evaluated in detail. Each option includes design, fabrication and installation of equipment; training and operation; and packaging, shipping and disposal.

TABLE 2

COMPONENT STATUS - "A" CUBICLE

Equipment #	USE	"A" CUBICLE CURRENT DOSE RATE,R/HR	INTEGRATED DOSE, 10^7 RADS	PROGNOSIS
MU-111A, GRINNEL	RESIN FILL VALVE	510	8.3	NORDELL DIAPHRAGM PROBABLY USABLE
MU-R5A, CROSBY	PRESSURE RELIEF	400	6.6	METAL OR BUNA-N SEAT - ACCEPTABLE
MU-V1116A, VELAN	GAS VENT	530	8.7	PROBABLY ACCEPTABLE
MU-217A, VELAN	GAS VENT	510	8.3	PROBABLY ACCEPTABLE
MU-V192A, VELAN	LIQUID SAMPLE TAP	500	8.1	PROBABLY ACCEPTABLE
MU-V194B, VELAN	ΔP Line	650	10.5	PROBABLY ACCEPTABLE
MU-V194A, VELAN	ΔP Line	250	4.2	PROBABLY ACCEPTABLE
MU-V193A, VELAN	LIQUID SAMPLE TAP	300	5.1	PROBABLY ACCEPTABLE
MU-V108A, GRINNEL	RESIN SLUICE	650	10.5	PROBABLY ACCEPTABLE
MU-V238A, GRINNEL	RESIN SLUICE	600	9.9	PROBABLY ACCEPTABLE
MU-V240A, VELAN	DRAIN LINE	300	5.1	PROBABLY ACCEPTABLE
MU-V109A, VELAN	DRAIN LINE	300	5.1	PROBABLY ACCEPTABLE
B&W MU-8 PI-1	DIFFERENTIAL PRESSURE SWITCH	200	3.	PROBABLY ACCEPTABLE

1.4 CRITERIA

Various technical and non-technical criteria were established for the purpose of evaluating the alternatives. These criteria are described below. The evaluation of each alternative has been based upon the assumption that the waste will be diluted, where possible, for commercial disposal in accordance with the standards established by 10CFR61.

1.4.1 Cost

Each alternative has been evaluated on a total cost basis, i.e., the cost of design, fabrication, installation, implementation, removal, shipment and disposal. The estimated costs of equipment and manpower requirements are based upon conceptual technical studies. Consequently, only a relative cost comparison is made.

1.4.2 Schedule

For the purposes of this study it has been assumed that all efforts to remove the resin and debris will be performed on a non-interference basis with other recovery efforts. The goal is to have the resin and debris removed from the demineralizers by late 1984.

1.4.3 Space Allocation

Equipment to remove the resin and debris must be located in areas where assembly, operation and removal activities will not conflict with other TMI-2 recovery activities. Tie-in points and piping runs must be accessible. Interim storage locations for removed resin must be available to allow decoupling of the resin removal process from shipping turnaround cycles.

1.4.4 Fuel/Radioactivity Removal

The capability of each approach to remote resin, fuel, and debris from the makeup and purification demineralizers, and also leave other TMI-2 systems clean, is evaluated for each approach.

1.4.5 Technical and Operational Risk

Several risks are inherent in the alternatives to be evaluated:

A. The condition of the demineralizer contents has been assessed by WHC, GPU and ORNL. These tests have provided much data, but uncertainties about resin sluicability, liquid organic compound content, resin elution capability, and fuel content cause any removal system concept to have some risk of not succeeding.

B. Some required plant systems or equipment have not been operational for over four years. These systems, in varying degrees, will have to be made operational for any resin removal system to operate effectively.

1.4.6 Exposure (Man-Rem)

Exposure can occur during equipment installation, operation or equipment removal. Although radiation surveys of each tie-in point have not been specifically made, general area surveys have been utilized to pick tie-in locations with low exposure. All of the systems under consideration would be shielded to allow routine access during operation. Therefore the degree of exposure is primarily dictated by the amount of temporary piping and equipment which must be subsequently disassembled and prepared for disposal. Exact Man-Rem values have not been calculated, but relative exposure amounts can be assessed.

1.5 APPROACH

There are various approaches to the resin and debris removal problem, with alternative methods of accomplishing each approach. The three most promising approaches are listed below:

Approach A — Install a hydro-mechanical device into the demineralizer through the resin fill line. Remove the contents to a container for dewatering and subsequent shipment.

Approach B — Utilize the existing waste disposal system by sluicing the demineralizer contents to the spent resin storage tank WDS-T-1B and then transferring the contents to a portable concreting system.

Approach C — Install a temporary processing system which will carefully control each removal operation. Resin and debris are removed to an interim storage container then subsequently transferred to a portable concreting system.

SECTION 2.0

2.0 RECOMMENDATION

Two methods of removing resin and debris from the make-up and purification demineralizers are considered to be preferred concepts. The existing waste disposal system should be utilized if some contamination of currently clean lines is acceptable. A skid mounted, temporary, upflow/downflow system should be utilized if the demineralizers and associated piping are to be cleaned to the maximum extent practicable with minimum contamination of the existing system. Both of these recommended alternatives will accomplish the functions listed in Section 1.1. Utilization of the existing system can be accomplished at a low relative cost and the shortest schedule while cleaning to the maximum extent practicable with the temporary upflow/downflow system is more expensive and has a longer schedule. Both of these methods require the operation of existing valves and control systems. The costs to make these operational have not been considered since it is assumed that these costs would be incurred as a part of other normal TMI-2 recovery efforts.

Table 3 provides a comparison of all considered approaches against the criteria described in Section 1.4.

TABLE 3

EVALUATION SUMMARY

	COST	SCHEDULE	SPACE ALLOCATION	FUEL/RADIOACTIVITY REMOVAL	TECHNICAL/ OPERATIONAL RISK	EXPOSURE
Mechanical Tank Removal	Highest. Need to replace tanks.	Greater than 24 MOS	No Interim Storage Avail.		Very High. May Not Be Able to Get Tanks Off Island	Very High
Chemical Treatment	High	Greater than 24 MOS	Not Evaluated	May Leave Some Debris in Tanks	Very High. Complex Temperature and Chemical Controls	Moderate
Hydro/ Mechanical	Low	12-15 MOS to Resin Removal	Equipment in Hays Gas Anal. Rm. (305' Elev.)	Hit/Miss System will leave some debris in tanks. Particle Size Limited	Requires design, fabrication and test of new equipment.	Moderate
Existing System	Low to Medium	9-12 MOS to Resin Remova	Portable Concrete Syst. in Model Rm (305' Elev.)	Will clean tanks. Drop-Out in Dead Legs Will Cause Hot Spots in Currently Clean Piping	Some chance of plugging sluice line. High technical risk for TRU measure device.	Lowest if liquid activity reduced or local shielding added in access areas.
Skid Mounted Upflow/ Downflow	High	15-18 MOS to Resin Removal	Skid in Hays Gas Anal. Rm (305 Elev.) or Outside Make-Up Pump Rm (280'6" Elev.). Portable Concrete Syst. in Model Rm (305' Elev.)	Best: Will Clean Tanks and Sluice Line. May Clean Inlet and Laterals	Low operational risk if sluiceable. High technical risk for TRU measure device.	Moderate. Long Runs of Contaminated Pipe Require Disposal

SECTION 3.0

EVALUATION

Various approaches to resin removal were evaluated by Westinghouse Hanford Co. An overview is given of the approaches which were judged to be unacceptable during the initial conceptual design studies. A more detailed evaluation is presented of the three approaches discussed in Section 2.0.

3.1 PHYSICAL TANK REMOVAL

Removal of the demineralizer tanks in shielded containers was evaluated but was eliminated early in the design process. The high radiation dose rates in the demineralizer cubicle would make access possible only by remote means. Pipes would have to be severed and capped, walls penetrated, shielding and transportation devices designed, fabricated and tested. It was concluded that personnel exposures would be high and building operations severely restricted because of the high potential for contamination.

Costs would be high since tank replacement and significant building modification would be required. A special interim storage area would have to be constructed on-site because of the high activity levels. Transportation off-site is probably not possible without reducing the activity of the demineralizer contents. The significance of these problems led to the conclusion that removal is not technically viable.

3.2 IN-SITU TREATMENT

Four areas of in-situ treatment were considered: dissolution; solidification; acid digestion; and chemical oxidation/dissolution. Of these, chemical oxidation/dissolution was determined to be the most feasible.

Laboratory scale tests showed that the most promising resin oxidation/ dissolution process was the iron-catalyzed, hydrogen peroxide system. The hydrogen peroxide reverses the polymeric process and breaks up the cross-linkages that link the resin monomers together. Resin reaction parameters determine the amount of degradation that occurs. Resin may merely be degraded to fine pumpable solids or the resin may be degraded to polymer chains small enough to completely dissolve in the reaction media. Several WHC lab tests were run with encouraging results. The resin was rapidly degraded at reasonable temperatures ($\leq 90^{0}C$) and concentrations ($\leq 15\%$ H_2O_2). The rate appeared to be controllable by manipulating temperature and concentration. However, this system may have difficulties converting melted or charred resin because of the reaction mechanisms.

Use of concentrated sodium hypochlorite solution (12-15% chlorine) was also investigated. Sodium hypochlorite apparently breaks up monomer chains as well as cross-linkages. It will also react with carbonized resin (elemental carbon). However, the overall reaction rate for the sodium hypochlorite system was substantially slower than for the corresponding hydrogen perioxide system.

If the resin is considered fully degraded and carbonized, then a high temperature dissolution such as sulfuric-nitric acid at about $250^{0}C$ ($480^{0}F$) is preferred. If this seems too difficult then the low temperature sodium hypochlorite dissolution should be considered with provision for lengthly digestion times and lots of liquid reactant.

The results of the resin characterization program indicated that the demineralizer contents would most likely be sluicable. Also, there was a major concern that liquid wastes would not be compatible with SDS. Therefore, this approach was not given further consideration.

3.3 HYDROMECHANICAL SYSTEM

The hydromechanical system provides for the removal of complex organic compounds from the demineralizer effluent prior to sending the effluent to the SDS and EPICOR-II water treatment systems. The hydromechanical removal system also provides for elution of the resin bed with chemicals and processed water to remove ^{137}Cs prior to transferring the resin and debris to the shipping containers. The concept uses a high velocity water stream to breakup the resin bed. A suction hose is used to remove the resin and debris. Waste is shipped in a dewatered form. Final steps in the process are a flushing operation with a high pressure water lance and a rinsing operation with demineralized water to wash residual resin and debris from the interior surface of the demineralizer vessel. The individual steps of the process are as follows:

3.3.1 Removal Procedure

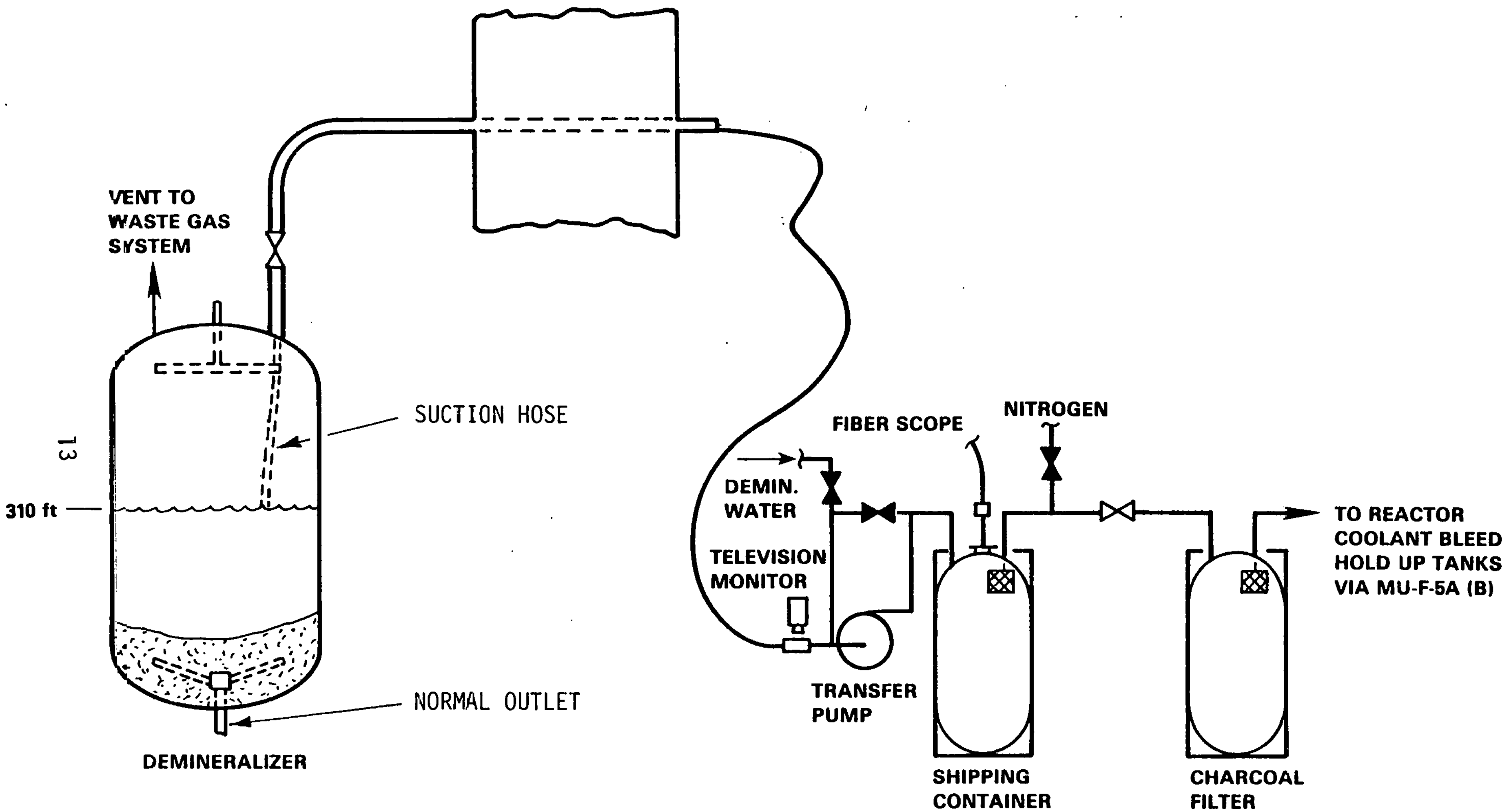
Step 1. Remove Complex Compounds and Cesium (See Figure 1)

Water is added to the demineralizer and a nitrogen sparge is initiated to break-up the resin bed. Water containing eluents is added to the demineralizer. After the bed has settled, liquid is removed very slowly (less than 5 gpm) through the suction hose and pumped through the shipping container and charcoal filter. The charcoal filter will capture any complex organic compounds prior to the effluent being sent to the reactor coolant bleed hold-up tanks for subsequent processing by SDS and EPICOR II. The fill, sparge, and drain sequence is repeated until no further reduction in gamma radiation is noted in the demineralizers.

Step 2. Remove Resin and Debris (See Figure 2)

A water lance and the suction hose are inserted to the surface of the resin bed. The bed is agitated by the high pressure (approx. 1000 psi) water lance and nitrogen sparging. Resin and debris are removed through the suction hose into the shipping container. A 10 micron filter separates the resin from the effluent which flows through the charcoal bed containing a 1 micron filter. The lance and suction hose are moved about until no further resin and debris are observed in the removal line. Demineralizer tank interior cleanliness is visually checked with fiber optics equipment.

REMOVE COMPLEX COMPOUNDS AND CESIUM



HEDL 8305-098.1

FIGURE 1. Remove Complex Compounds and Cesium.

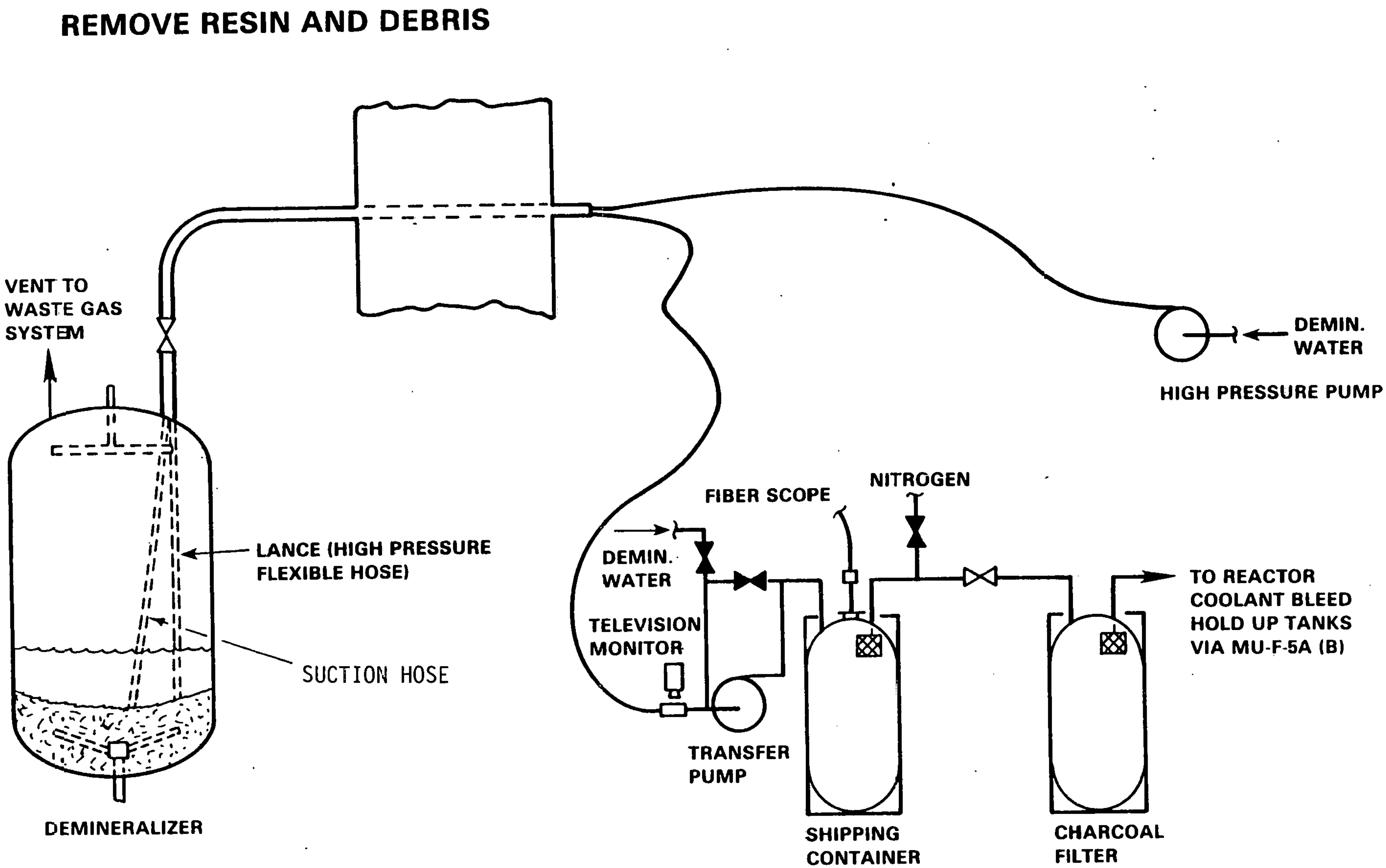


FIGURE 2. Remove Resin and Debris.

Step 3. Final Flush of Demineralizer (See Figure 3)

By inserting the suction hose to the bottom of the tank while raising and lowering the water lance, the walls of the demineralizer can be cleaned. The success of this operation can be verified by use of the fiber optics.

Step 4. Shipping Container Change-out

Since the demineralizer contents exceed the volume of the shipping container (modified SDS liner), several shipping containers will be required for each demineralizer. When the shipping container is found to be full, it will be backflushed with nitrogen, a check will be made on resin level, and then an empty container will be installed.

This procedure is based upon the assumption that the resin is shipped for disposal in a dewatered state. The resin could also be solidified in concrete by utilization of the systems described later in this study.

3.3.2 Advantages and Disadvantages

The hydromechanical system has the following advantages and disadvantages:

Advantages

1. The required equipment (including temporary piping) is minimal; therefore, cost is relatively low.

2. Equipment is small in size; therefore, all items could be located in the Hays gas analyzer room without removing knock out walls and instrumentation. The ability to place all process equipment in the Hays gas analyzer room eliminates possible interference with other clean-up operations at TMI-2.

3. Tie-in points to existing piping system are readily accessible.

FINAL FLUSH OF DEMINERALIZER

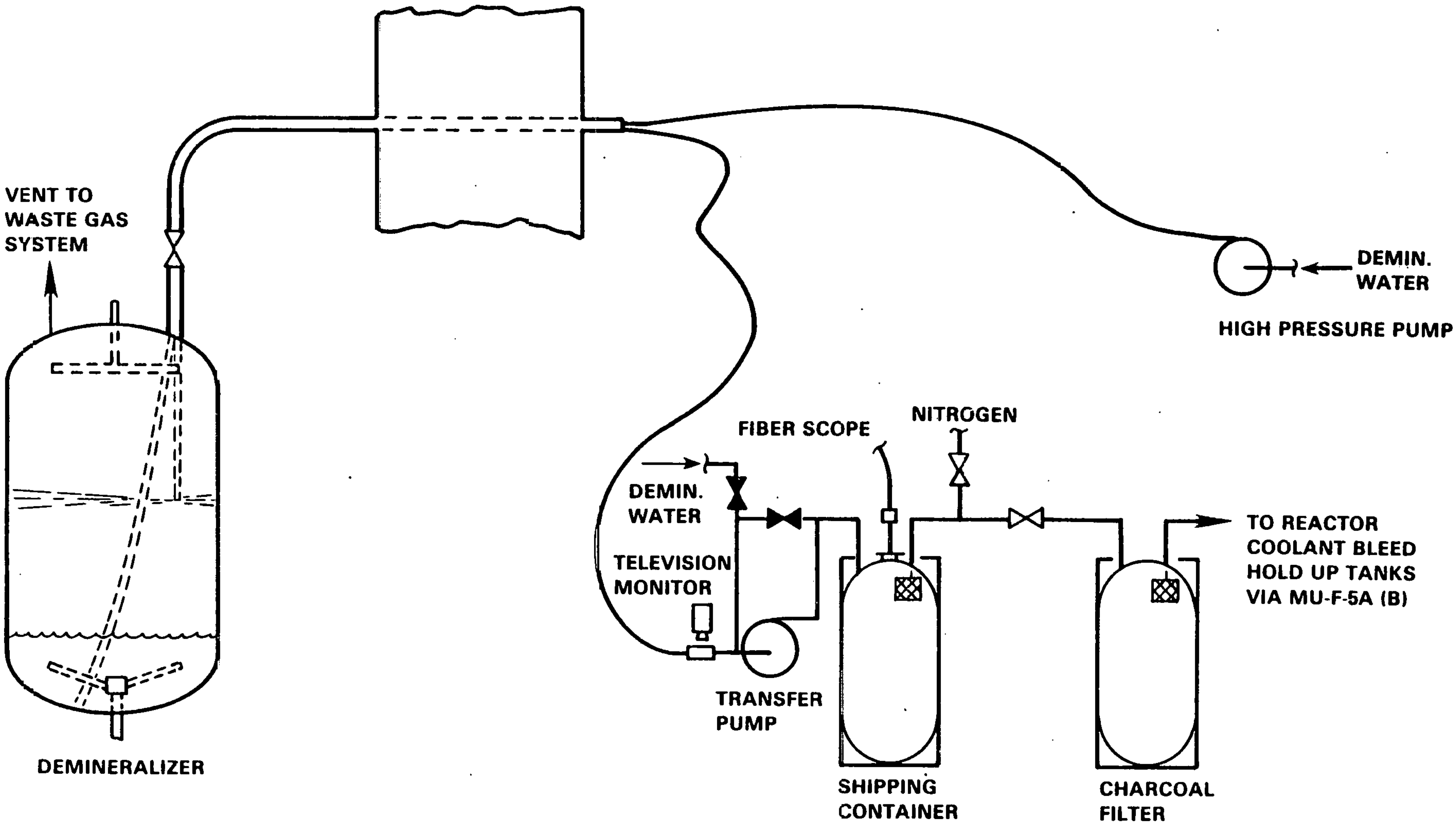


FIGURE 3. Final Flush of Demineralizer.

Disadvantages

1. System operators cannot see the resin bed or the position of the lance. The process will be very time consuming (hit and miss) with regard to resin and debris removal. A Fiberscope will be required to inspect the interior of the demineralizer visually to determine progress of clean-up operation.

2. Resin and debris cannot be removed from the 3-inch diameter resin outlet line at bottom of demineralizer.

3. Water level or water volume inventory system must be employed to assure that demineralizer is not overfilled with resultant spill of contaminated water out the resin fill line.

4. Requires use of existing vent lines from top of demineralizers to vent cover gas. The valves in these vent lines may not be operable.

5. There is a risk that the lance could get hung-up and be impossible to remove.

Based upon the above discussion and the GPU experiences during resin sampling, this approach is not considered acceptable.

3.4 TEMPORARY UPFLOW/DOWN FLOW REMOVAL SYSTEM

The temporary upflow/downflow method of resin and debris removal is accomplished in three phases. Phase I provides for the removal of complex organic compounds and cesium. During Phase II the resin and debris are removed to a transfer container. The resin and debris are mixed with concrete for shipping and disposal in Phase III. The temporary upflow/downflow removal system provides for control of each aspect of the removal process with a minimum contamination of existing TMI-2 piping.

3.4.1 Phase I (See Figure 4)

Complex organic compounds and cesium are removed from each demineralizer by the addition of water (and chemicals, if necessary) through the normal outlet. The resin bed is agitated by a nitrogen sparge. After the bed has settled the water is removed, filtered, and sent to the reactor coolant bleed hold-up tank. The water addition, agitation, settling and removal steps are repeated until the organic compounds and cesium are removed. All flows during this phase are at less than 5 gpm to minimize any carry-over of resin and debris. Should any carry-over occur, it will be captured by a 1 micron filter and subsequently back-flushed into the demineralizer.

3.4.2 Phase II (See Figures 5 & 6)

Upon completion of Phase I, resin and debris removal can be initiated. The equipment to accomplish this phase can be located in the Hays gas analyzer room (305' elev.) or outside the make-up pump room (280'6" elev.).

The recirculation pump is started to establish a fast (120 gpm) flow rate in an upward direction through the demineralizer. Some resin and debris will overflow into the resin fill line (tests indicate approximately 700% expansion of resin bed). Resin and large particles of debris that overflow will be collected in the resin transfer container which includes built-in 100 mesh (150 micron) screen to retain resin beads. Most debris (including fuel fines) will settle to bottom of the resin transfer container. Some fuel fines and debris smaller than 150 microns will pass through the 100 mesh screen and will be recirculated through the demineralizer. This process continues until gamma radiation levels in the demineralizer cubicle stabilize, which indicates that no additional resin is being transferred from the demineralizer. The remaining resin and debris must be removed by downflow.

Downflow is initiated by lowering the water level in the 300 gallon surge tank. Water is then injected into the bottom of the demineralizer through the normal outline line to create a slurry in the demineralizer. In parallel with this

REMOVE COMPLEX COMPOUNDS AND CESIUM

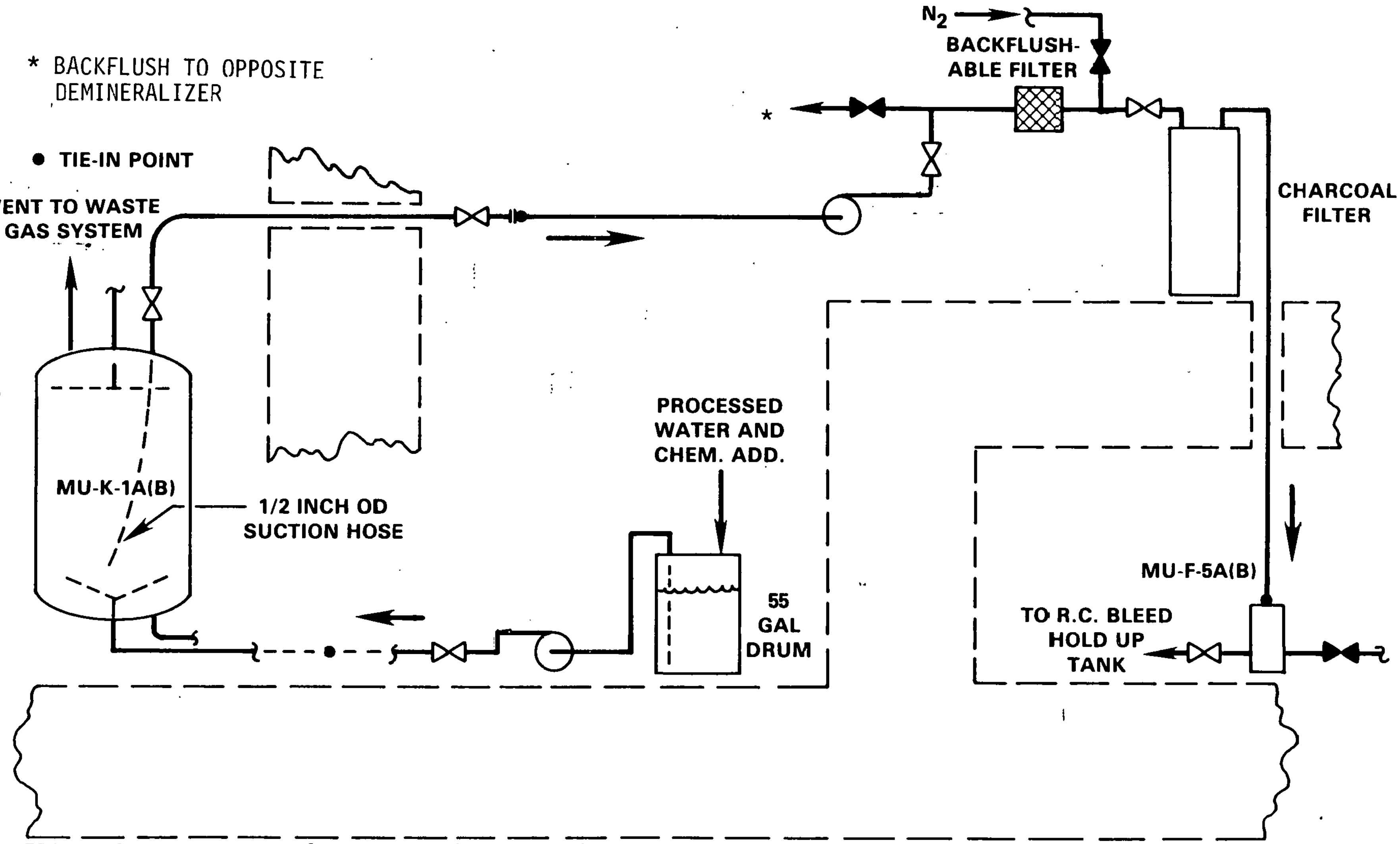


FIGURE 4. Remove Complex Compounds and Cesium.

HEDL 8306-067.1

FAST UPFLOW

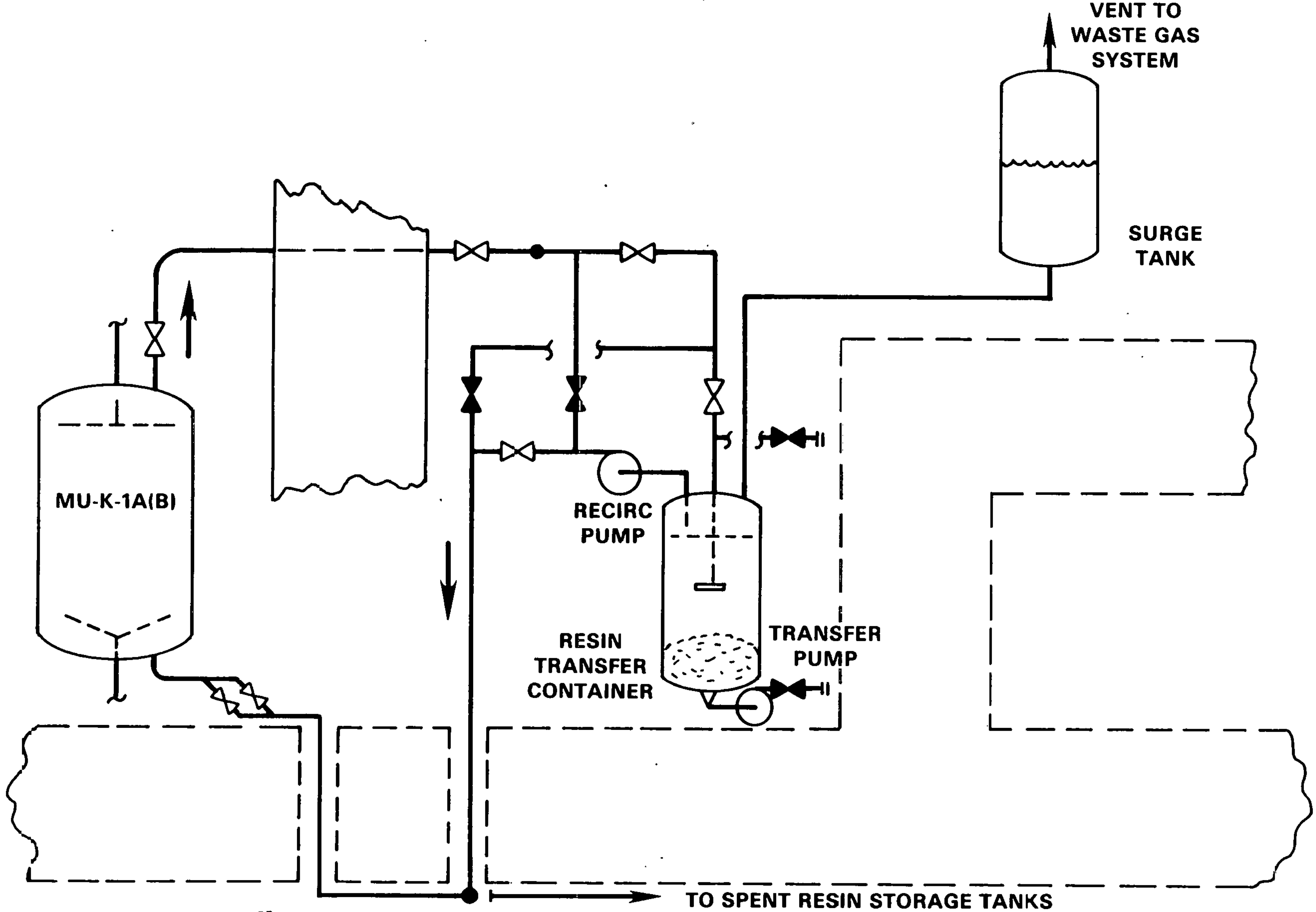


FIGURE 5. Fast Upflow.

HEDL 8306-067.2

FAST DOWNFLOW

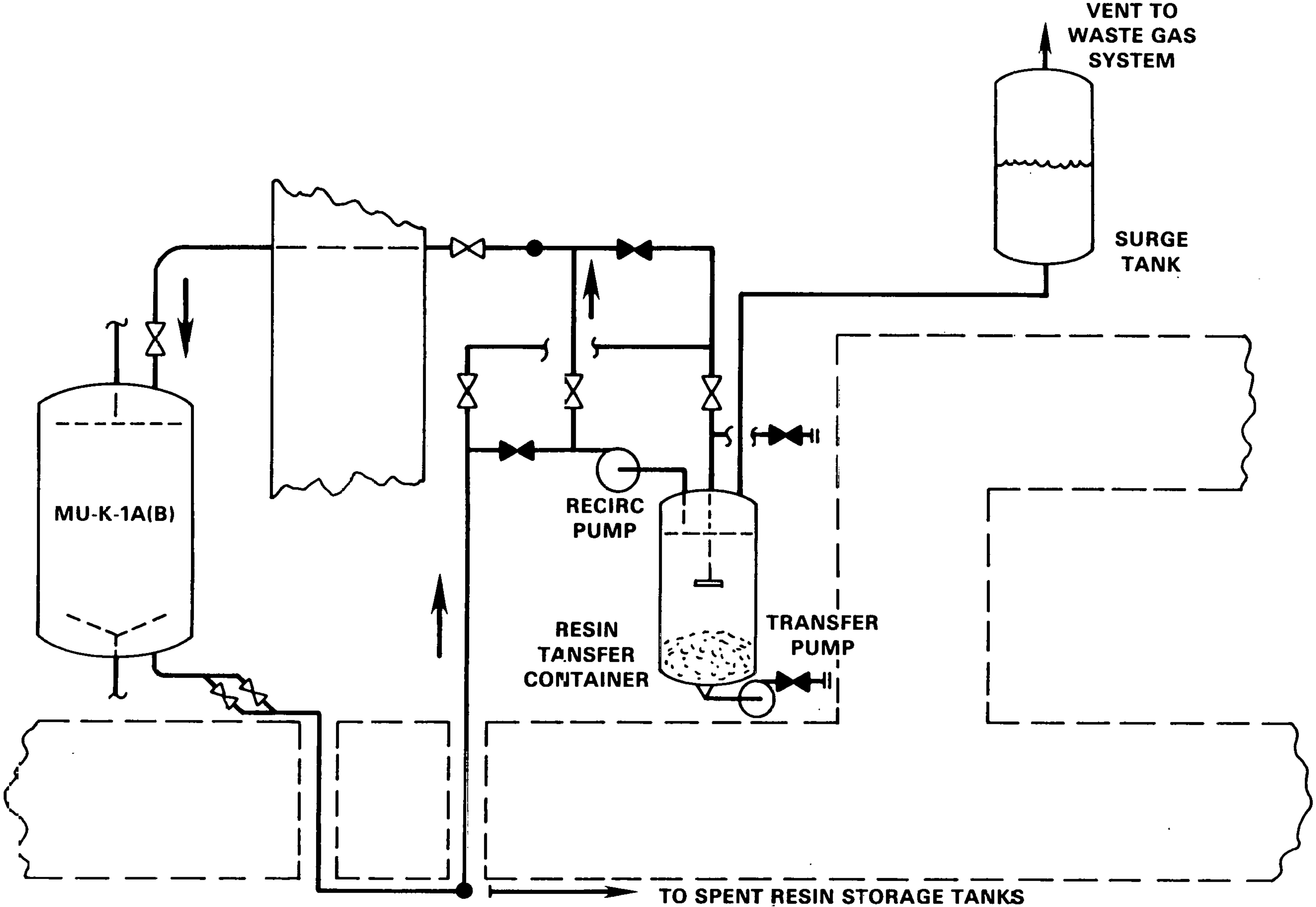


FIGURE 6. Fast Downflow.

step, fast upflow is initiated to clear the resin sluice line of resin and debris upstream of valves MU-V108 and MU-V-238. Upflow and injection of demineralized water is secured when the water level in the surge tank approaches the high level alarm point. Immediately thereafter fast downflow is initiated by changing valve positions and restarting the recirculation pump. Fast downflow recirculation is continued until all resin and debris have been sluiced from the demineralizer.

3.4.3 Phase III

When sufficient resin and debris have been accumulated in the resin transfer container a recirculating slurry is established between the temporary concreting station in the model room (305' elev.) and the transfer container (see Figure 7). The resin and debris are then transferred into the concreting container until either 2200 Curies of activity are accumulated or sufficient ^{144}Ce to indicate that the 100 nCi TRU/g limit has been reached. The resin and debris are then dewatered and solidified in concrete. Based upon the non-TRU activity shown in Table 1, it is estimated that 6 liners of approximately 60 cu. ft. can accommodate the waste from both demineralizers. If rinsing or eluting the resin/debris bed is effective, the number of containers could decrease. If shipment must be made to U. S. Ecology, whose requirements are more stringent than 10CFR61, the number of containers may increase to as many as 48. As each liner is solidified, it can be placed in an interim storage area, thus decoupling the resin removal process from the two week shipping cycle.

A GPU proposed alternative concept (Figure 8) for concreting the resin and debris in 55 gallon drums and the loading station could be located at the north end of the 280' 6" level. The recirculating slurry would be established between the transfer container and the concreting station. A batch of slurry would be added to the conical shaped tank and allowed to settle. Liquid would then be decanted from the solids. This batching would be continued until the cone was filled with solids at which time the curie and TRU content would be measured. Assurances would be made that the end product would be within

RESIN AND DEBRIS TRANSFER TO SHIPPING CONTAINER

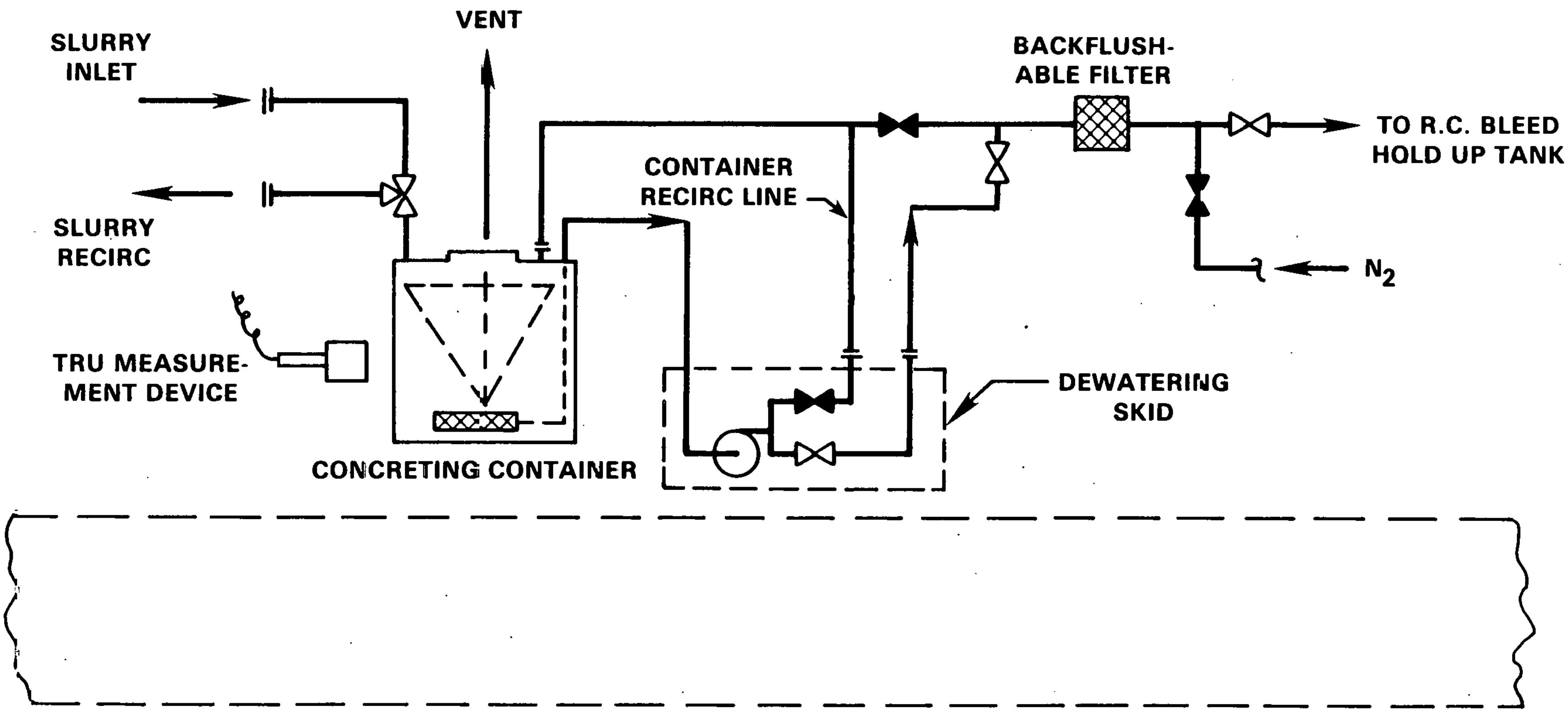


FIGURE 7. Resin and Debris Transfer to Shipping Container.

HEDL 8306-067.4

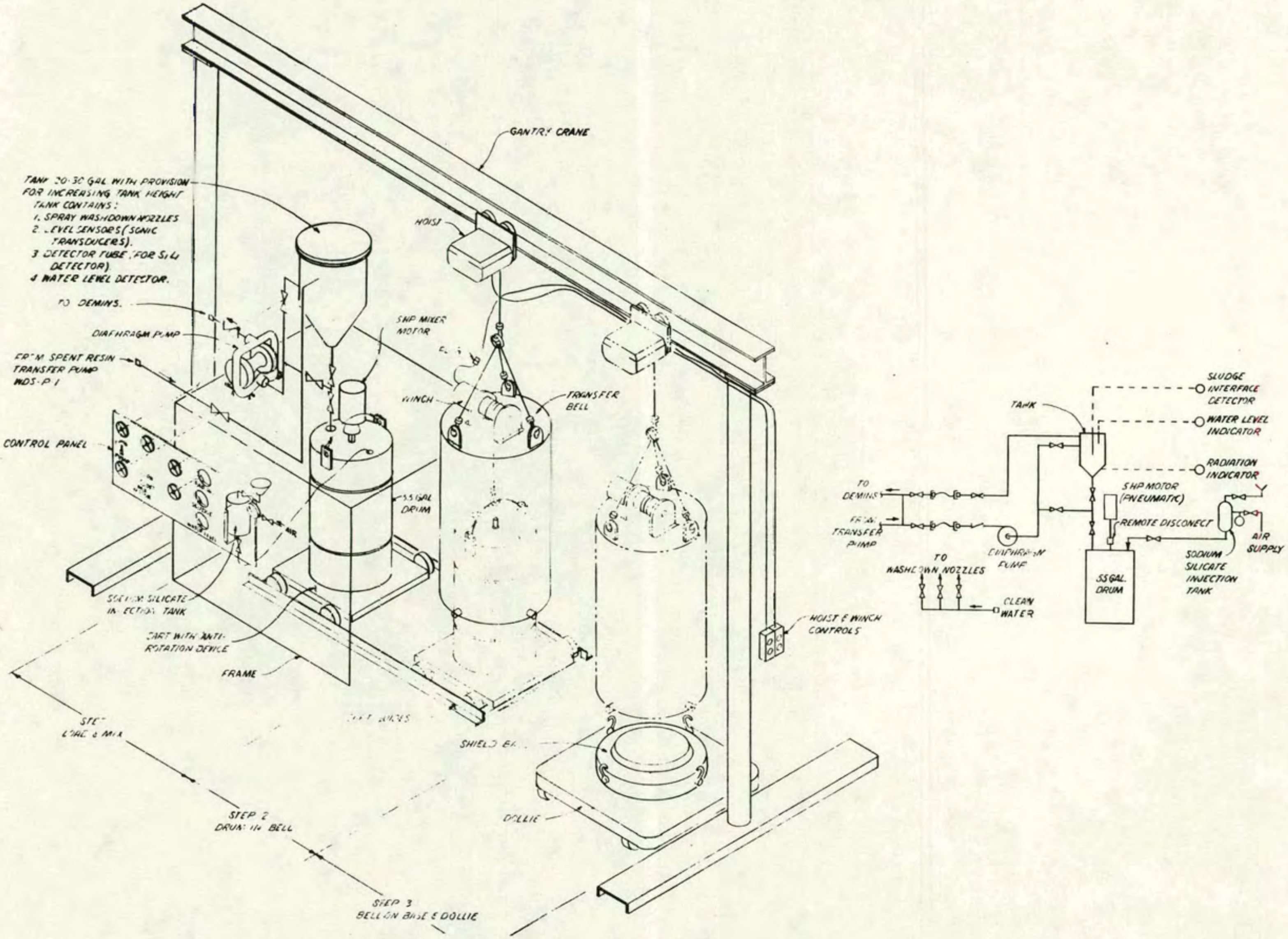


FIGURE 8. GPU Alternate Concreting Station.

10CFR61 limits prior to releasing the contents to the 55 gallon drum. Solidification would take place in the 55 gallon drum and the solidified waste would be placed in an interim storage area. Approximately 50 drums are required to accommodate the non-TRU activity shown in Table 1. This could increase to about 390 drums if U. S. Ecology license limits for TRU are applied.

3.4.4 Advantages and Disadvantages

The temporary upflow/downflow system has the following advantages and disadvantages:

Advantages

1. Allows controlled transfer of resin and debris during fast upflow.

2. Minimizes risk of plugging the resin sluice line during fast downflow.

3. Does not contaminate the Waste Disposal System and assures the cleanest plant condition of demineralizers and associated piping.

Disadvantages

1. New piping, tanks and associated equipment require design, fabrication, and testing which results in an extended schedule.

2. Relatively high costs.

3. Removal of temporary piping and equipment has some Man-Rem exposure risk.

4. The resin and debris are assumed to be sluicable.

5. A TRU measurement system must be designed, fabricated, and tested.

3.5 USE OF EXISTING SYSTEMS

The demineralizer resin and debris can be removed utilizing the existing systems for resin sluicing and solidification. This process again consists of three phases with Phase I and III being as described previously in Section 3.4. Once cesium and complex organics have been removed, the resin and debris are sluiced to the spent resin storage tank. The resin and debris can then be transferred in a slurry to a temporary concreting station in the model room at the 305' elev.

3.5.1 Removal Procedure (See Figure 9)

When the cesium and complex organics have been removed from the resin and debris, they can be sluiced to the spent resin storage tank as follows:

Add nitrogen and demineralized water to demineralizer through the normal outlet line to generate a resin slurry. Then add demineralized water to the demineralizer through the sluice line using the existing connection to the sluice line header. This will unpack resin in the resin sluice line upstream of valves MU-V108 and MU-V238. Monitor the pressure increase in the demineralizer until it reaches approximately 75 psig. Then secure the water to the sluice line and open the inlet valve to the spent resin storage tank WDS-T-1B. Attempt to maintain 75 psig in the demineralizer by throttling nitrogen and demineralizer water valves. If the pressure goes to zero, the contents have been transferred to the spent resin storage tank. If the pressure remains constant with MU-V114 and MU-V-292 shut and the sluice line valves open, the sluice line is plugged. The estimated quantity of demineralized water required to sluice resin and debris from each demineralizer is 1200 gallons.

Once the resin and debris are in the spent resin storage tank they can be transferred to the concreting station. Generate a slurry by adding demineralized water and adding nitrogen. Vent gas from spent resin storage tank to waste gas system. Add water at a rate of 50 gpm for 20 minutes (1000 gallons). The spent resin storage tank will now contain approximately 2200 gallons of

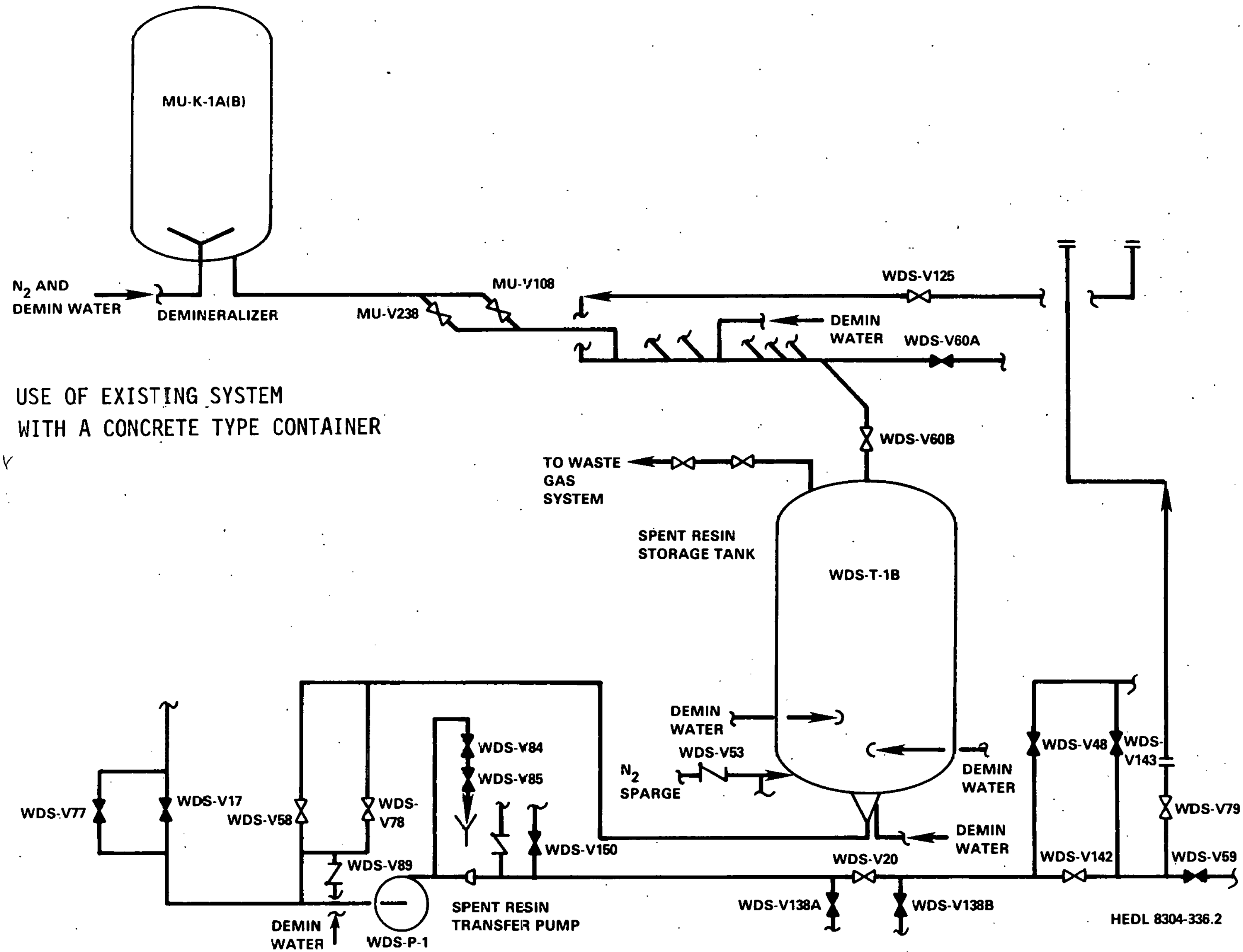


FIGURE 9. Use of Existing System

water (capacity is 3861 gallons). Continue to sparge with nitrogen to maintain slurry and then pump the slurry to the temporary concreting system located in the model room through the existing piping intended for this purpose. The solidification process is as described in Section 3.4.

3.5.2 Advantages and Disadvantages

Utilization of the existing systems has the following advantages and disadvantages:

Advantages

1. Has the shortest schedule for resin removal.

2. Utilizes many normal TMI-2 procedures for resin removal.

3. Relatively low cost.

Disadvantages

1. Contaminates existing clean piping, tanks and equipment.

2. Assumes resin and debris are sluicable.

3. Greater risk of plugging sluice line since all contents are removed at once.

4. A TRU measurement system must be designed, fabricated, and tested.

4.0 REFERENCES

1. M. K. Mahaffey, et al, Resin and Debris Removal System Conceptual Design, HEDL-7335, Hanford Engineering Development Laboratory, Richland, WA, May 1983.

DISTRIBUTION - HEDL-7377

DOE-RL	-	KR Absher PFX Dunigan, Jr. (3) JJ Schreiber FR Standerfer
EG&G/TIO	-	GJ Quinn (10)
PNL	-	DE Knowlton
RHO	-	RE Smith
WHC	-	EA Evans W/C-23 WM Gajewski W/B-82 RD Hensyel W/A-5 WW Jenkins W/B-84 MK Mahaffey W/B-12 IF Marshall W/C-123(2) LM Northey W/B-84 EJ Renkey W/B-17 WJ McShane W/B-12 DL Swannack W/B-84 HH Yoshikawa W/C-44 Central Files W/C-123 (2)
ORNL	-	A Malinouskas
LASL	-	J Halbig