Met-Ed GPU

Metropolitan Edison Company
Post Office Box 480
Middletown, Pennsylvania 17057
717 944-4041 948-8401

November 30, 1979

Mr. John T. Collins
Nuclear Regulatory Commission
Trailer #1
Three Mile Island
Middletown, Pennsylvania 17057

TMI-2 Resin Liner Dewatering
Study Tests

Attached for your review is the report summarizing all of the work and studies directed toward dewatering of TMI-2 resin liners. Based upon the study we conclude that prior to shipment the capability exists to dewater the liner to between 0.2 and 0.3% free standing water. It can be expected that shipment of the liners may affect any remaining free water and that liner receipt at the burial ground site may show between 0.3 and 0.4% free standing water.

It is our understanding that this degree of free water meets historical shipping and burial site requirements. Upon your review of the attachment, we will finalize procedures to insure shipments are dewatered consistent with the developmental results.

Very truly yours,

Richard F. Wilson
Director TMI-2

RFW:rdg

Attachments

cc: R. C. Arnold
J. J. Barton
P. Deltete
J. C. DeVine
E. Fuller
J. G. Herbein
R. J. McGoey

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THREE MILE ISLAND UNIT II

RESIN LINER DEWATERING STUDY

R. J. McGoey
November 28, 1979

Approved by: J. J. Barton

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TMI UNIT II

RESIN LINER DEWATERING

TABLE OF CONTENTS

TMI UNIT II

SPENT RESIN LINER DEWATERING

I. Background

There is considerable concern in the Nuclear Industry for the shipment and disposal of radioactive waste. Of particular note is the existence of water in shipping containers. Licensed burial ground facilities such as in Richland, Washington and Barnwell, South Carolina require that no water be buried. Although the precise definition of this statement has not been specified in terms of chemical and physical properties of matter, it is critical that all efforts be made to minimize free standing water in shipping liners. Occurrences over the past few years has demonstrated that spent resin containers had free standing water upon arrival at burial grounds. This is detected by puncturing containers and observing liquid spillage. This results in a violation of burial ground requirements. It is with this concern that the dewatering of resins at TMI-II has been investigated.

A dewatering program was developed with two primary objectives:

1. To understand the mechanism by which water exists in a resin bed and confidently determine the amount of water.

1784 078

2. To perform various tests of removing water from the bed so as to remove free standing water from a container.

These objectives would develop a decision-making process by which we would understand the presence of water in resin containers to be shipped from TMI Unit II in a dewatered state.

II. Discussion

A. Mechanism of Water Retention

One of the main reasons that resin is used in the processing of radioactive water is its excellent capability to cleanse this water of ionic and non-ionic impurities. This process involves strong electro-chemical interaction between water impurities and resin. Therefore, the removal of water and/or impurities from a used resin bed involves energy and/or chemical interaction to return resin to a pure, dry state. Various tests were performed to evaluate how best to accomplish this process without detrimentally affecting the sorbtion of radioactivity on the resin.

When a resin liner is filled with water, water exists in two predominant states:

1. Free standing within the liner
2. Electro-chemically bound by resin.

Table 1 shows the breakdown of water in each of these two main states. Table 2 is the detailed calculations in support of Table 1. Table 3 is a graphic display of the existence of water in an EPICOR Resin Liner.

Free Standing Water

The 6'x6' liner used for the dewatering tests contained 518.4 gallons of free standing water. This is typical of the 6x6 EPICOR I and II Radwaste System Liners. This is water that exists in space above the resin and within resin interstitial void space. The amount of water within resin void space is highly dependent upon the compaction of the resin, resin type, and exhaustive level of the beads. This water is not bound to the resin and, therefore, can be removed from a liner relatively easily. A pump is typically used to draw or decant the water off the bottom of the liner through the normal liner effluent lateral arrangement. These laterals are located on the very bottom of the liner and allow water and not resin to pass through. The sand piper pumps used for dewatering have the capability of drawing a vacuum such that water is pulled into the laterals throughout the entire cross sectional area of the liner bottom. The laterals are specially designed and tested to verify this actually occurs.

Water will naturally drain to the bottom of the liner and with pumping can be removed. Therefore, with relatively a small amount of energy input, free standing water is easily removed from a liner. It is the removal of the water that is the objective of dewatering programs.

Electro-Chemically Bound Water

This water is strongly bound electro-chemically by resin beads. The water is predominantly chemically held in the matrix of hydration. There are 433.8 gallons of water existing in this state in the resin. The liberation of this water is achieved by chemical or heat treatment of resins. Introduction of large amounts of energy will overcome the bond of hydration thereby releasing this water. However, this process will also upset the bond between resin beads and various impurities removed from processed water by the resin. It is, therefore, possible to liberate radio-isotopes held by resin beads. The amount of release would be dependent upon the extent of functional breakdown of the resin. Because it is undesirable to release radio-nuclides, there is no advantage to removing the chemically bound water. Therefore, the dewatering process should not introduce large amounts of energy or chemical adjustment which could alter the stability of radio-nuclides.

Dewatering Testing Objectives

Shipping and burial requirements state that free standing water is not allowed. Realizing this, it is the goal of any dewatering process to remove as much of the free water as possible. To remove any more of the water content is self-defeating for two (2) main reasons:

1. Removal of any electro-chemically bound water could result in the liberation of radio-nuclides from a resin bed.
2. Drying a resin bead makes the bead more mobile such that, should the integrity of a resin container be breached, a dry resin is more likely to migrate than a wet, dewatered resin bed.

Both reasons tend to defeat a basic premise of radioactive material handling, which is:

> Radioactive material should be fixed to an immobile medium so as to concentrate it and prevent its spread.

It is with this understanding that the various dewatering tests were conducted at TMI Unit II.

It was the objective to determine how efficient various dewatering techniques were in removing the approximate 518.4 gallons of free standing water existing in the resin liner.

III. Resin Liner Dewatering Tests

Several dewatering tests were conducted to determine the ability to remove free standing water in liners. Efficiency was measured in terms of percentage of free standing water removed and gallons of water remaining in the liner. These tests used various sources of energy input to accomplish liquid removal. These were:

- Hydraulic: Water pumping
- Pneumatic: Air drying
- Thermal: Hot air injection
- Mechanical: Vibration during road transit

Another aspect of energy testing was the length of application. Varied time frames were also utilized to determine effectiveness. Enclosure 1 provides the results of these tests.

These test results show that 1.63 gallons of free standing water still exists in a resin liner following completion of dewatering processes. This represents <u>0.3% of the total free standing water in the resin bed</u>. Some other points of interest are:

1. Road vibration liberated only 2 quarts of water more than the dewatering process employed for the test.
2. Although the use of heat reduced the relative humidity through the bed, it had an insignificant effect on overall drying effectiveness.
3. Altering the direction of the air flow through the bed reduced the liquid drainage. It could not

be verified whether this action just dispersed the water to different parts of the bed, thereby simply delaying when it might be liberated, or not.

4. The time the bed experienced air drying appeared to have little effect on total liquid removal.

IV. Theoretical Dewatering Verification

A. Establishing a Mathematical Model

Although the tests demonstrated how much water remained in the liners, additional studies and tests were conducted to verify the ability to predict free standing water removal. The precise resin mix was reviewed with respect to its state of exhaustion, electrolytical charge, compaction capability and resistence of interstitial void space. Laboratory tests were set up to prove the predictability and repeatability of the conditions to insure the mathematical model was accurate and reliable. From this thorough analysis a mathematical model was established which calculated that 312.7 gallons of water exists as free standing water within the resin bed used in the dewatering tests. This is the amount of liquid which has to be removed by the dewatering process.

B. Field Test Verification

In parallel with this effort the resin bed used for testing underwent several more tests. The parameters of this test are discussed in Enclosure 4. It was shown that 326.8 gallons of water were removed from the resin under conditions as assumed for the mathematical model. This included vibrating the resins, adjusting for temperature conditions, lancing the bed to liberate trapped air, and establishing proper resin compaction condition. It is extremely difficult to establish field conditions to exactly match laboratory assumed condition.

C. Comparison of Results

It was hoped that the two independent analytical and empirical results would agree within 10% since many variables existed. However, the results show very close (within 4.3%) agreement, which shows not only a sound understanding of water retention in a resin bed, but also confidence in the ability to predict water removal efficiencies!

V. Moisture Absorbtion Program

With the realization that a very small finite amount of the free standing water is not removed by the dewatering procedure, a program was developed to investigate alternatives of insuring that absolutely no water would exist in a liner upon leaving TMI and upon arrival at the burial location.

This investigation involved testing various drying agents that could be readily pumped into and mixed within an exhausted resin bed following dewatering. The basic criteria used for calculating these substances were:

1. Non-reactive to resin beads and impurities fixed on resin.
2. Highly moisture absorbant.
3. Easily pumpable.
4. Able to mix within a resin bed.

Various laboratory tests were performed on a variety of substances. From these tests two materials were identified acceptable (one silicate and one cellulose). Additional tests were conducted and analysis performed to determine how much absorbant material would have to be pumped into a bed to absorb a given quantity of water that might be liberated. In this manner, knowing the amount of free standing water that might be retained in a liner following dewatering and shipping to the burial ground (1.63 gallons), a given amount of absorbant material could be added to eliminate the free standing state. Also, to be conservative, a greater than necessary amount of material could be added to absorb any water that could be produced from an upset condition. This provides added assurance and confidence of shipping no free standing water.

Should it be decided that 0.31% of free standing water is an excessive amount for shipping purposes, absorbant material could be added to a liner to reduce this to the point of elimination.

VI. EPICOR I Liner Experience

A. Additional Dewatering

EPICOR I liners produced during the early stages of Water Processing were not dewatered per the procedure found in Enclosure 2. Five liners were selected and dewatered for a second time per this updated (Rev.2) procedure. Enclosure 4 shows that no more than 0.75 gallons of water were removed by a more sophisticated procedure after the liners had been in storage for approximately five (5) months. This shows that the free standing water is, in fact, relatively easily removed even by earlier, less stringent dewatering procedures. This test also showed that all liners should be dewatered per the Rev.2 procedure prior to shipping.

B. Decanted Water

During the additional dewatering procedure employment, effluent from the liners were sampled to determine what the radionuclide and chemical characteristics of the free standing water in the liners were. In actuality, this decanted water is dependent upon the equilibrium of various water characteristics and the resin itself. It therefore could vary dependent upon the exhaustive stage of the bed. However, for information purposes, Enclosure 5 is provided for reference purposes. Of particular interest is the relatively low concentrations of the radionuclides. Most are less than 10 CFR-20 MPC concentrations. This information provides a measure by which it is understood what impact release of free standing water from the liner might have.

VII. Conclusions

The resin liner dewatering testing program shows that the various techniques can successfully dewater resins. Weepage and handling vibration would produce less than 0.3% free water in the liner following dewatering. This water when sampled on an EPICOR I demineralizer had very low levels of activity. Under existing shipping and burial guidelines, the Dewatering Procedure employed satisfies requirements. Should additional margin of safety be desired, additional moisture drying techniques can be employed.

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TABLE 1

WATER RETENTION IN A

TYPICAL EPICOR INC. 6'x6' RESIN LINER

I. TOTAL CONTAINER VOLUME - - - - - - 145 ft^3

II. VOLUME OF RESIN IN LINER ACCOUNTING FOR COMPACTION AND LINER INTERNALS- - - - -116.0ft^3

III. VOLUME OF FREE STANDING WATER ABOVE AND WITHIN RESIN - - - - - - - - - - - -68.8 ft^3

IV. TOTAL FREE STANDING WATER - - - - - -518.4 gallons

V. GALLONS OF WATER ELECTRO-CHEMICALLY BOUND BY RESIN- - - - - - - - - - - -433.8 gallons

NON PROPRIETARY

TABLE 2

DETAILED LINER CALCULATION DATA

1. Inside Volume of Container

   Diameter = 69" - o.5" wall thickness = 68.5"

   Height = 68.5" - 0.5" wall thickness = 68"

   Volume $= \pi r^2 h$

   $= 3.14 \times (68.5 \div 2)^2 \times 68$ $= 145\ ft^3$

2. Volume of Laterals . . . . $1.3\ ft^3$

3. Resins Loaded From Shipping Drums and into Liner: . $130\ ft^3$

4. Volume of Air Space Above Resins:

   Vessel diameter = 68.5"

   Height = 13"

   Volume $= \pi r^2 h$

   $= 3.14 \times (68.5 \div 2)^2 \times 13" = 27.7\ ft^3$

NOTE: This is space existing with resins filled with water, vibrated, and air lanced to achieve expected processing compaction.

1784 090

5. Volume of Dispersion Header: . . . . $0.2\ ft^3$

6. Free Standing Water:

   a. For existing resin mix, electro-chemical charge, compaction, exhaustive stage, and overall compaction; the percentage of bed volume comprised of void space is - - - - - - - - - 36%

   b. Volume of resin in liner:

      Liner = $145\ ft^3$

      Space above resin = $-27.7\ ft^3$

      Lateral volume = $-1.3\ ft^3$

      $116.0\ ft^3$

   c. Volume of void space for free standing water:

      $36\% \times 116.0\ ft^3$ = - - - - - - - - - - - - - - - - $-41.8\ ft^3$

   d. Gallons of free standing water in resin:

      $41.8\ ft^3 \times 7.48\ gal/ft^3$ = - - - - - - - - - - - 312.7 gals.

   e. Gallons of water above resin

      $(27.7\ ft^3 - 0.2\ ft^3) \times 7.48\ gal/ft^3$ - - - - - 205.7 gals.

   f. Total free standing water in liner:

      In resin = 312.7

      Above resin = 205.7

      TOTAL - - - - - - - - - - - - - - 518.4 gals.

Table 2 (continued

7. Chemically Bound Water

a. Quantity of Water

The moisture content varies dependent upon resin type and exhaustive stage. For example:

CATION:	H :	50 to 55%
	Na:	45 to 49%
ANION :	OH:	45 to 60%

For the resins used, the chemically bound water makes up the following % of Total Volume --------------50%

This volume in gals. is:

$116.0\ ft^3 \times 50\% \times 748\ gal/ft^3$ ----------------433.8 gals.

b. Of the chemically bonded water there are two subdivision groupings of the precise bonding mechanism:

(1) Strong Chemical Matrix of Hydration:

(98% x 430.1) -------------------------- 425.2 gals.

(2) Chemical/Mechanical Matrix of Hydration:

(2% x 430.1) ---------------------------------8.6 gals.

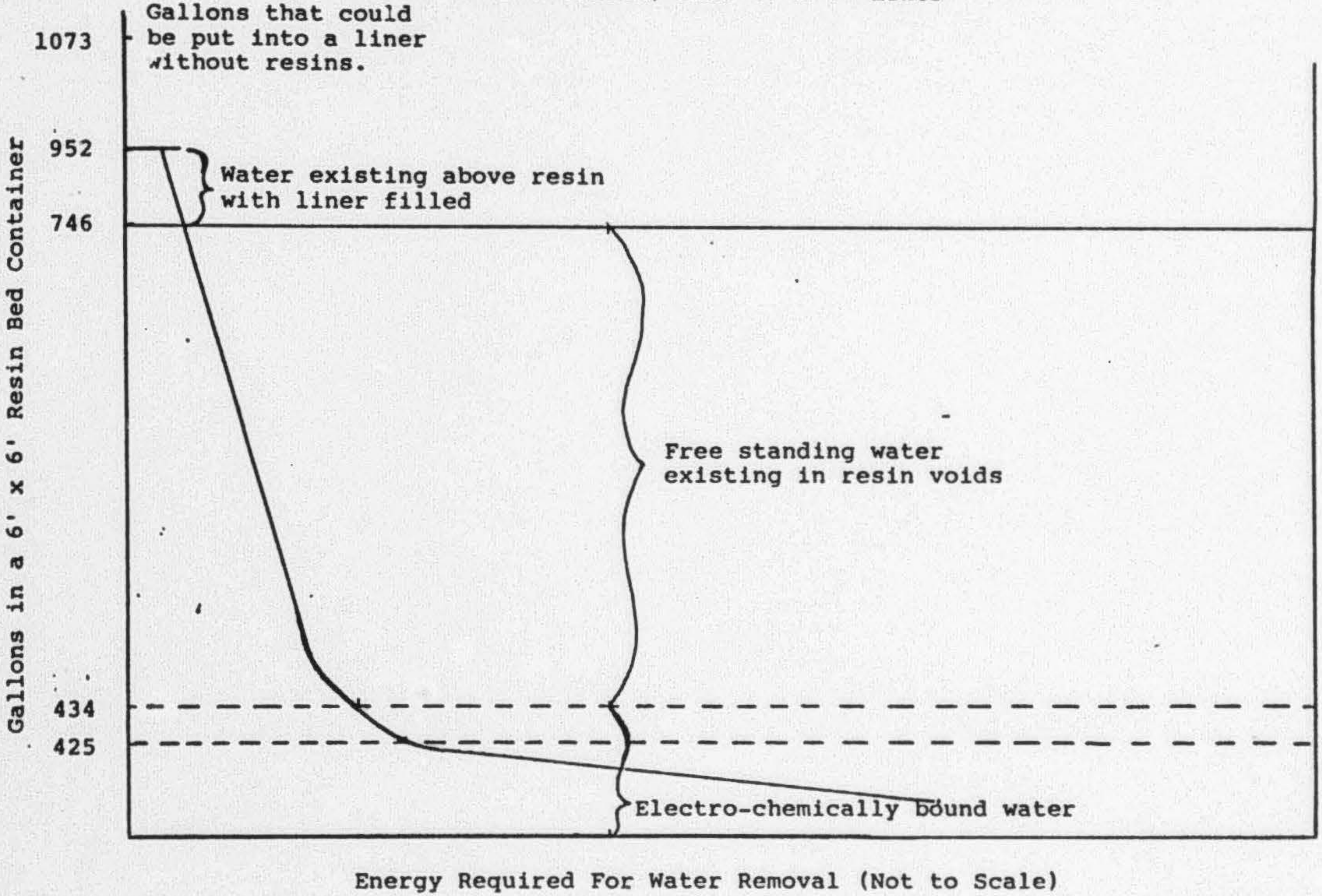
NOTE: It is this bonded water that would be released upon resin freezing.

1784 092

TABLE 3

The Existence of Water In A

Filled EPICOR, Inc. 6' x 6' Liner



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ENCLOSURE 1

SUMMARY OF
LINER DEWATERING
TEST RESULTS

	Test	Water Drained Following Dewatering Procedure	Percent (%) of Total Container Volume	Percent (%) of Free Standing Water
I.	Dewatering with Sandpiper Pump Air Drying with Sandpiper Pump			
IA.	Timing and Sequence Was Altered	1.3 Gallons	0.12%	0.25%
IB.	Timing and Sequence Was Altered	1.7 Gallons	0.15%	0.33%
IC.	Timing and Sequence Was Altered	1.2 Gallons	0.11%	0.23%
II.	Dewatering and Drying with Sandpiper Pump, Air Drying with Heated Air Exhauster	1.13 Gallons	0.10%	0.22%
III.	Dewatering with Sandpiper Pump Air Drying with Air Exhauster	1.13 Gallons	0.10%	0.22%
IV.	Test III coupled with Shipping 900 miles over the Road	1.63 Gallons	0.15%	0.31%
V.	Dewatering with Sandpiper Pump Air Drying with Sandpiper Pump (Reversing Airflow Direction)	0.25 Gallons	0.02%	0.05%

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TEST IA

Basic Method: Dewatering with Sandpiper Pump
Air Drying with Sandpiper Pump

Step	Date	Duration
1. Liner filled with demin water	9/26/79 (1130)	-
2. Liner decanted at 20 gpm until suction lost		
3. Liner air dried		
a. Air dried (≈150 scfm)		1 hr.
b. Allowed to settle		1 hr.
c. Air dried (≈150 scfm)		1 hr.
d. Allowed to settle		1 hr.
e. Air dried (≈150 scfm)		1 hr.
4. Bottom drain removed	9/26/79 (1830)	
5. Liner drained	9/27/79 (2030)	14 hrs.

Results: Relative humidity of inlet air = 55
Relative humidity of effluent air = 56
Water drained . . . . 1.3 Gallons

TEST 1B

Basic Method: Dewatering with Sandpiper pump
Air Drying with Sandpiper pump

Step	Time	Duration
1. Liner filled with demin water	9/27/79(2200)	
2. Liner decanted at 20 gpm until pump lost suction		
3. Air Dried (≈150 scfm)		5 hr.
4. Bottom Drain Removed	9/28/79(0500)	5 hr.
5. Liner Drained	9/29/79(1900)	14 hrs.

Results: Water Drained . . . . 1.7 Gallons

TEST 1C

Basic Method: Dewatering with Sandpiper pump
Air drying with Sandpiper pump

	Step	Time	Duration
1.	Liner filled with demin water	9/29/79(2100)	
2.	Liner decanted at 20 gpm until pump lost suction.		
3.	Air dried (≈150 scfm)		2 hrs.
4.	Allowed to Settle		2 hrs.
5.	Air Dried (≈150 scfm)		2 hrs.
6.	Allowed to Settle		2 hrs.
7.	Air Dried (≈150 scfm)		2 hrs.
8.	Bottom Drain Opened	9/30/79(0930)	
9.	Liner Drained	9/30/79(2130)	12 hrs.

Results: Water Drained . . . . 1.2 Gallons

TEST II

Basic Method: Dewatering with Sandpiper Pump
Air Drying with Sandpiper Pump
Air Drying with Air Exhauster

	Step	Date	Duration
1.	Liner filled with demin water	10/1/79(0800)	
2.	Liner decanted at 20 gpm		
3.	Air dried (≈150 scfm)		1 hr.
4.	Allowed to settle		1 hr.
5.	Air dried (≈150 scfm)		1 hr.
6.	Allowed to settle		1 hr.
7.	Air dried (≈150 scfm)		1 hr.
8.	Allowed to settle		1 hr.
9.	Air dried with exhauster at 18,211 scfm		1 hr.
10.	Bottom drain removed	10/1/79(1700)	
11.	Liner drained	10/2/79(1900)	14 hrs.

Results: Relative humidity - inlet air . . . 95
- outlet air. . . 95
Water Drained . . . . 1.13 Gallons

TEST III

Basic Method: Dewatering with Sandpiper Pump
Air Drying with Sandpiper Pump
Hot Air Injected
Exhausted with Air Blower

	Step	Date	Duration
1.	Liner filled with demin water	10/2/79(2000)	
2.	Liner decanted at 20 gpm		
3.	Air dried (≈150 scfm)		1 hr.
4.	Allowed to settle		1 hr.
5.	Air dried		1 hr.
6.	Allowed to settle		1 hr.
7.	Air dried		1 hr.
8.	Allowed to settle	10/3/79(0400)	1 hr.
9.	How air injected		
10.	Exhausted at≈18,211 scfm	10/3/79(0500)	1 hr.
11.	Bottom drain removed	10/3/79(0600)	
12.	Liner drained	10/5/79(0900)	39 hrs.*

* No change after 12 hours of draining

Results: Relative humidity: Inlet air . . . 68
Outlet air. . . 66
Water Drained . . . . 1.13 Gallons

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TEST IV

Basic Method: Ship Dewatered Liner Following Test III Over the Road Approximately 900 Miles

	Test	Date	Duration
1.	Complete Test III	10/5/79(0900)	
2.	Shipped liner on a flatbed truck to Massachusetts	10/5/79(1230)	
3.	Liner returned to TMI	10/6/79(2300)	36 hrs.
4.	Bottom drain removed	10/6/79(2400)	
5.	Liner drained	10/6/79(0900)	9 hrs.
6.	Liner drained*	10/10/79(1300)	100 hrs.

Results: Water Drained Test III . . . . 1.13 Gallons

Water Drained after Road Transit . . . .5 Gallons
(and drained for 9 hours)

Total 1.63 Gallons

* No water drained after the initial 9 hour period.

TEST V

Basic Method: Dewatering with Sandpiper Pump
Air Drying with Sandpiper Pump
Backflushing Air through Effluent Line

	Step	Date	Duration
1.	Liner filled with demin water	10/20/79(1000)	
2.	Liner decanted at 20 gpm from bottom lateral		
3.	Liner air dried (≈150 scfm)		1 hr.
4.	Allowed to settle		1 hr.
5.	Liner air dried (≈150 scfm)		1 hr.
6.	Allowed to settle		1 hr.
7.	Liner air dried (≈150 scfm)		1 hr.
8.	Allowed to settle		1 hr.
9.	Air dried air from bottom lateral (effluent line) out the dispersion header (inlet line)		1 hr.
10.	Bottom drain removed	10/20/79(2000)	
11.	Liner drained	10/21/79(0800)	12 hrs.

Results: Water Drained . . . . 0.5 Gallons

SOURCES OF ENERGY INPUT

1. Hydraulic Pumping and Pneumatic Air

Sandpiper Pump

$$20 \frac{\text{gals.}}{\text{min.}} \times \frac{7.43 \text{ ft}^3}{\text{gal.}} = 150 \frac{\text{ft}^3}{\text{min.}}$$

$\approx$ 150 scfm of equivalent air

2. Pheumatic Air Drying

$$3{,}710 \frac{\text{Linear Feet}}{\text{Minute}} \times \text{Area of Opening} = \text{cfm of Air}$$

$$3{,}710 \frac{\text{ft}^3}{\text{min}} \times \left[\pi \left(\frac{30''}{2} \times \frac{1}{12}\right)^2\right] = 18{,}211 \text{ cfm}$$

3. Thermal - Hot Air Supply

1320 Watt Heater

ENCLOSURE 2

LINER DEWATERING PROCEDURE

The attached procedure was the basic procedure employed. The results of this procedure are reflected in Test IA.

CAPOLUPO & GUNDAL, INC. LINER DEWATERING PROCEDURE

10/08/79 CG-1079-0086/REV. 2

1.0 REFERENCES

1.1 Blueprint of typical pre-filter or deminvessel to be dewatered.

1.2 Applicable Epicor/Cap-Gun flow diagram.

1.3 Applicable S.O.P./O.P.

1.4 Blueprint of typical Cap-Gun pump.

2.0 LIMITS AND PRECAUTIONS

2.1 Continuous on scene Health Physics coverage is required per shift Health Physics Supervisor.

2.2 Personnel performing work in accordance with this procedure shall utilize every means available to maintain their radiation exposure as low as reasonably achievable. (ALARA)

2.3 All applicable limits and precautions shall be adhered to per existing system operations procedure.

3.0 PRE-REQUISITES

3.1 Ensure there is adequate room in tank to receive liquid from vessel being dewatered.

3.2 The vessel to be dewatered must be vented.

3.3 The dewatering pump must be working properly as determined by Capolupo & Gundal, Inc. Foreman.

3.4 Vessel influent line to be blown out and detached from vessel per existing procedure. To ensure no new liquid will enter vessel.

4.0 PROCEDURE

4.1 Start up vessel decant pump and continue to pump until loss of suction, as determined by Cap-Gun Foreman. Continue to pump for one (1) hour.

4.2 Stop pump and let vessel settle for one (1) hour minimum.

4.3 Restart vessel decant pump and pump for one (1) hour.

4.4 Stop vessel decant pump.

4.5 Let vessel settle for a minimum of one (1) hour.

4.6 Restart vessel decant pump for a minimum of one (1) hour.

4.7. Vessel is now dewatered, continue to prepare for shipment per existing applicable procedure.

ENCLOSURE 3

LINER DEWATERING PROCEDURE

Attached is the summary of the procedure used to verify the mathematical model used to calculate free standing water amounts and the efficiency of its removal.

SUPPLEMENTAL LINER DEWATERING TESTS

Date: November 21, 1979

Liner: Epicor I Demineralizer No. 14
(Same Demineralizer that was used for previous tests)

Basic Purpose: To determine empirically in the field the amount of freestanding water that can be removed from the liner.

Basic Procedure:

STEP	TIME DURATION
1. Fully Decant Liner	
2. Measure temperature of water entering Resin	
3. Pump 55 gallons of water into Liner	
4. Lance and vibrate Resin while filling continuously	
5. Allow Resin to settle	10 Minutes
6. Pump another 55 gallons of water into Liner	
7. Lance and vibrate Resin	
8. Allow Resin to settle	10 Minutes
9. Repeat steps until water is just at the heighth of the Resin	
10. Allow to settle	30 Minutes
11. Measure the distance from the top of the Liner	
12. Measure temperature of water in Resin	
13. Conduct dewatering procedure per enclosure 1 test 1A	6 Hours
14. Measure the amount of water removed	
15. Measure the temperature of the water removed	
16. Allow bed to settle and remove Liner Bottom Drain	

Results:

Temperature: Water Entering Liner........... 58 Degrees Fahr.

Water In Liner.................. 64 Degrees Fahr.

Water Decanted from Liner...... 58 Degrees Fahr.

Distance from Resin Level to top of Liner... 13"

Free Standing Water......................... 330 Gallons
(Includes 1,5" Above Resin)

Free Standing Water in Resin................ 326.8 Gallons
(Minus Extra 1.5" of Water)

Water drained from Liner after removing
bottom drain plug........................... NONE

ENCLOSURE 4

Attached is a Summary Report of the results of Dewatering Epicor I Liners that had been Dewatered five (5) months earlier by a less effective Dewatering Procedure

1784 108

CAPOLUPO & GUNDAL, INC.
142 ELM STREET • SALISBURY, MA 01950 • (617) 462-2997; 462-6543

September 19, 1979

To: Mr. Rick McGoey
From: James R. Hensch
Subject: Liner Dewatering Tests

On this date, September 19, 1979, a liner dewatering test was performed on the following liners as per your request. Our results were as follows:

Liner	Results
D-1	.75 Gallons
D-2	.33 Gallons
D-9	.33 Gallons
P-4	.75 Gallons
P-1	750 Milliliters

Should there be any questions regarding these tests, please feel free to contact me at 948-8000, ext. 8322.

Sincerely,

James R Hensch

James R. Hensch
Supervisor
Capolupo & Gundal, Inc.

JRH/mmh

cc: Shift Rad Waste Engineer
Richard E. Capolupo
File

1784 109

ENCLOSURE 5

The attached sample results show the Analysis of Water removed from Epicor I Demineralizer # 10 during Dewatering process after Liner had been in storage.

1784 110

19148
9/13
0630

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ____ No. 2 ____ B&W ✓ SAI ____ RMC ____ NBC ____ Other ____

Title Cond Gun – Demin To Effluent Sample No. 19148

Time/Date Sample 0001 9-13-79 Time/Date Analysis 0530 9-13-79

Geometry Planchette / Bottle Counting Time 1 min

Volume 10 ml BD Analyst [illegible]

Air ____ (1) Liquid ✓ (2) Other ____

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

Isotope	Concentration	LLD	Uncertainty
Cond	8.1 umhos/cm		
pH	4.90		
Boron	6.79×10^{2} ppm		
BG	1.3×10^{-4} µCi/ml		

1784 111

TMI-119 7 79

19147
9/13
0350

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ____ No. 2 ____ B&W ✓ SAI ____ RMC ____ NRC ____ Other ____

Title U-1 Drain #10 Eff Sample No. 19147

Time/Date Sample 0001 9/13 Time/Date Analysis 0317 9/13

Geometry — Counting Time 600 sec

Volume 250 Analyst D'Benedetto

Air ________ (1) Liquid ✓ (2) Other ________

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

Isotope	Concentration	LLD	Uncertainty
Cs-137	2.531E-05		4.220E-06
Co-60		1.178E-05	
Co-58		1.235E-05	
Cs-134		2.545E-05	
I-131		2.595E-06	
La-140		1.123E-05	
Ba-140		9.712E-06	

TMI-113 7-79