Met-Ed / GPU

Metropolitan Edison Company
Post Office Box 480
Middletown, Pennsylvania 17057
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Writer's Direct Dial Number

July 2, 1980
TLL 316

TMI Program Office
Attn: Mr. J. T. Collins, Deputy Director
U. S. Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, Pennsylvania 17057

Dear Sir:

Three Mile Island Nuclear Station, U-*t II (TMI-2)
Operating License No. -73
Docket No. 50-320
Evaluation of EPICOR II Wastes

The EPICOR II Radwaste System continues to process TMI-II Auxiliary and Fuel Handling Buildings contaminated water. The System has performed extremely well decontaminating water well below cleanliness criteria. This performance has allowed using this processed water for decontamination purposes, and other transfer operations, with minimal ALARA concerns. As of July 1, 1980, 365,055 gallons have been processed with 109,492 gallons remaining. A summary report is included as Attachment No. 1. A detailed evaluation of System performance is the subject of another report being assembled. This letter is forwarded in response to NRC letter NRC/TMI-80-87, dated May 15, 1980.

Water cleanup has resulted in the generation of sixty-four (64) spent resin liners as of July 1, 1980. These wastes contain contaminants, including fission products and chemicals removed from the water. This letter forwards information related to, and a discussion of, evaluations conducted to determine the condition of these wastes.

Spent resin liners removed from the EPICOR II Radwaste System are placed in Waste Staging Facilities until final disposition. These facilities are massive concrete structures all but precluding access to the liners. A sealed fifteen (15) ton concrete cap over each liner staging cell provide liners protection from environmental conditions and essentially eliminates access by unauthorized personnel. The facility provides shielding allowing personnel to work alongside and on top of the cells containing liners without radiation problems. This facility has well demonstrated the ability to satisfy stringent ALARA requirements. Attachment No. 2 provides a layout of the protective barriers associated with liner retention at Three Mile Island (TMI). This is a general layout presentation: should details be necessary, they can be provided upon request.

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POOR QUALITY PAGES

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The retention of spent resin liners at TMI requires all necessary precautions to be taken to insure the fission products are contained until final disposition. The Commission's Memorandum and Order dated October 16, 1979, directed Metropolitan Edison to expeditiously solidify EPICOR II wastes. Extensive efforts are in progress to comply with this Order. This letter does not address the status of this solidification effort. Solidification will be the subject of separate correspondence as the results of conclusive studies and tests are obtained. This letter addresses the liners as they presently exist, in a dewatered state. Attachment No. 3 provides a tabulated summary of pertinent data for all liners.

Evaluating EPICOR II liners and resins for long term stability was conducted prior to placing the System in service. A more exhausive study is in progress to document the projected longevity of these containers without detrimentally altering the safe containment of fission products. Attachment No. 4 documents the background of this evaluation and provides a detailed discussion of items included. Preliminary analysis indicates, under postulated worst case conditions, the resin and liner package provides safe retention of fission products for several years. A more precise definition of this condition is in progress which includes radiolytical as well as chemical/metalurgical effects. When available, the details of this evaluation will be made available.

The NRC letter of May 15th requested information relative to the liners and resins in use. Attachment No. 4 contains much of this information. Attachments 5, 6, and 7 provide drawings of both the 4x4 and 6x6 liners, and the painting specification used on the liner interior. Please note the liners have recently undergone a minor modification to allow installation of an air bubbler for redundant level indication. The drawings are being updated to include these changes. These will be forwarded as available; however, this alteration has little to no impact on the long term integrity of the liners.

Should additional information not forwarded or highlighted in this letter be required, please contact me or my staff.

Sincerely,

G. K. Hovey
Director, TMI-II

GKH:RJM:dad

Attachments (7)
cc: T. Cintula
D. DiIanni
B. H. Grier
R. W. Reid
H. Silver
B. J. Snyder
V. Stello

List of Attachments

To GPU/MET-ED letter #TLL-316 of July 1st, 1980

Attach.#		Subject
1		Epicor II Radwaste System Summary Report dated June 18th, 1980
2		Epicor II Radwaste System Spent Resin Liner Protective Barriers
3		Epicor II Radwaste System Liner Usage Experience
4		Epicor II Radwaste System Liner Integrity and Resin Stability Evaluation
5		Epicor II Radwaste System 4 x 4 Liner Drawing (BL-62579)
6		Epicor II Radwaste System 6 x 6 Liner Drawing (T-66000)
7	a.	Epicor Liner Painting Specification (Placite #7155)
	b.	Epicor Liner Painting Specification (Phenoline 368 Primer + Finish)
	c.	Epicor Liner Surface Preparation Prior to Painting Specification (SSPC-SP5-63)
8		Summary of Epicor II Liner Gross Curie Loading
9		Summary of Epicor II Prefilters 1 - 11, Gross Curie Loading
10		Epicor II Radwaste System Geometry of Radiation Survey Meter (Sheets 1 & 2)
11		Epicor II Radwaste System Typical Prefilter Radiation Survey (With Survey Instrument 12.25 and 11.75 inches from liner)
12		Epicor II Radwaste System Typical Prefilter Radiation Survey (With Survey Instrument 9" from liner)
13		Epicor II Resin Irradiation Data

EPICOR II RADWASTE SYSTEM

Summary of Operation
as of June 4th, 1980

Date Commenced Processing Water----------------------October 22nd, 1979

WATER PROCESSING

Auxiliary Building Water Processed-------------- 330,930 Gals.
Aux. & F.H.B. Water to be Processed------------- 142,979 Gals.
Inleakage of Water to be Processed-------------- 408 GPD
Total Gals. through System Including Recycle----- 816,753 Gals.
Number of Batches-------------------------------- 50
Curies Removed by System------------------------- 47,269 Ci
Curies to be Removed----------------------------- 9,259 Ci
Processing Rate---------------------------------- 10 GPM
New Radwaste System Processing Rate------------- 1.01 GPM

Processed Water Disposition

In BWST-- 329,821 Gals.
In CC-T-1 & 2------------------------------------ 1,836 Gals.
In Unit II - COT-1A------------------------------ 81,607 Gals.

PERSONNEL EXPOSURE (As of June 8th, 1980)

Total Man Rem Exposure--------------------------- 11,434 Man Rem
* { Operation--
Liner Changeout----------------------------------
Maintenance-------------------------------------- }
Man Rem Exposure per Gal. Processed------------- 0.03 Man-Millirem
Total Man Rem Exposure per Curie Removed--------- 0.24 Man-Millirem
Projected Man Rem Exposure for Total
Curies to be Processed-------------------------- 13.6 Man Rem

SOLID WASTE PRODUCED

Spent Resin Liners------------------------------- 62
Micron Filters----------------------------------- 11
Resin Traps-------------------------------------- 4

Prefilters

Avg. Curie Loading------------------------------ 1,093.4 Curies
Avg. Liner throughput--------------------------- 7,696 Gals.

1st Demins.

Avg. Curie Loading------------------------------ 16.8 Curies
Avg. Liner Throughput--------------------------25,456 Gals.

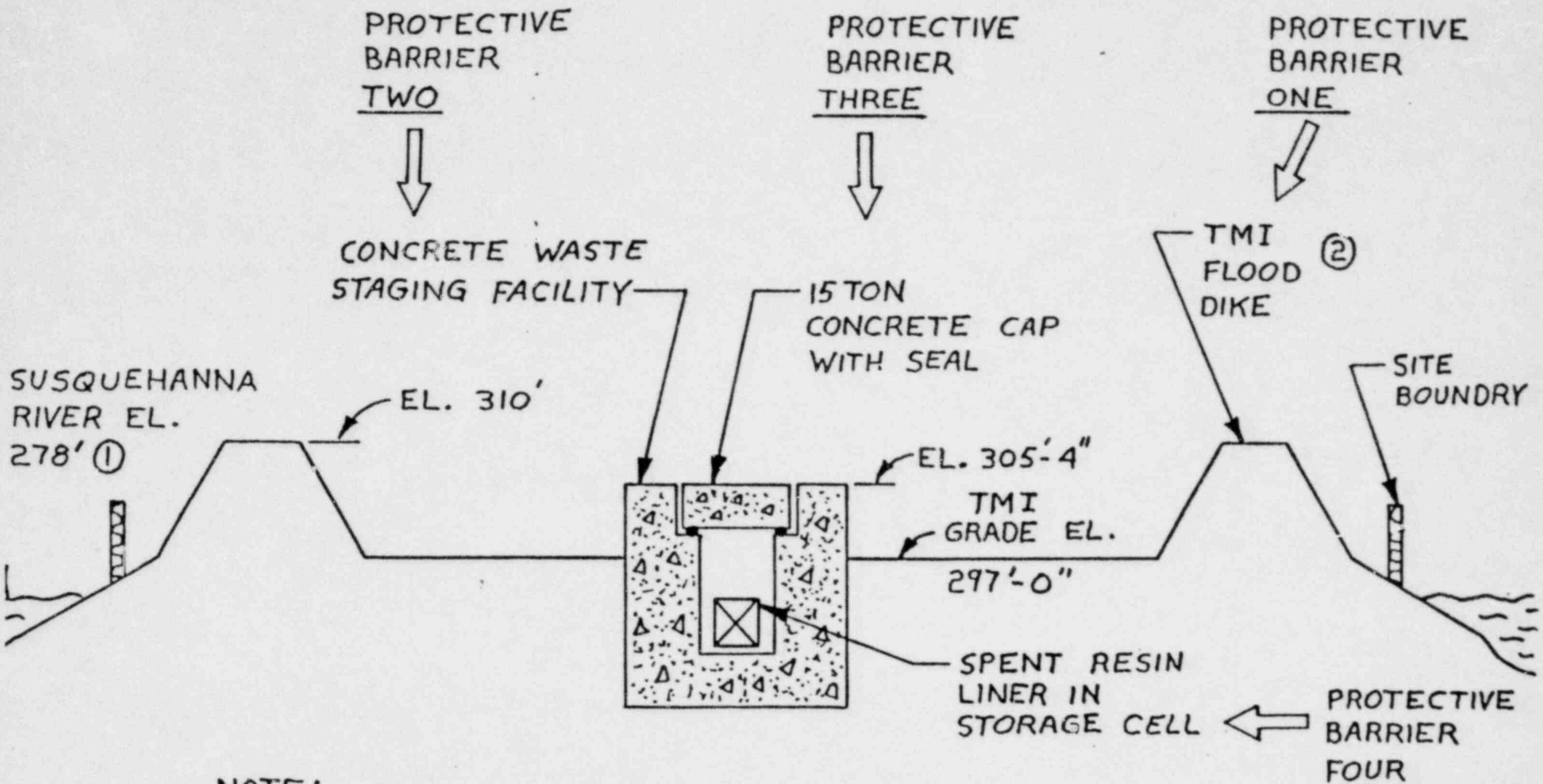
*Later

2nd Demins.

Avg. Curie Loading---------------------------- 3.7 Curies

Avg. Liner Throughput------------------------51,755 Gals.

THREE MILE ISLAND
EPICOR II RADWASTE SYSTEM
SPENT RESIN LINER PROTECTIVE BARRIERS



NOTE:

① NORMAL WATER ELEVATION

② THE FLOOD DIKE IS DESIGNED TO PREVENT TMI, FLOODING DURING THE WORST CASE CONDITION (RIVER AT 303', REF: FSAR)

EPICOR II LINER USAGE EXPERIENCE

Page: 1

BATCH#	GALLONS	FLOW RATE GPM	SOURCE	PREFILTER (PF) 1	PF 2	PF 3	PF 4	PF 5	PF 6	DEMIN 1 (DF) 1	DF 2	DF 3	DF 4	DEMIN 2 (DS) 1	DS 2
1	6132	12	Aux. Sump	203						0.78				0.11	
2	7132	10	Aux. Sump	240						0.79				0.22	
3	6116	8.3	Aux. Sump	484						0.80				2.07	
4	14110	12	Aux. Sump & Neut 8A		1239						4.40			0.14	
5	10700	10	Aux. Sump & Neut 8B			592					0.51			0.24	
-	3100	10	CCB Sump			-					-			-	
6	3900	10	Aux. Sump & RCBT 'A'			696					1.56			3.18	
7	10100	11	U-1 MWST, ABST & Aux. Sump				474					28			2.00
8	4280	8.5	U-1 MWST, ABST & Aux. Sump					153					0.40		0.02
-	2780	11	CCB Sump						-				-		-
9	4445	11	U-1 MWST, ABST & Aux. Sump						155				4.20		0.29
TOTALS	72785														
Liner Changeout Date:															
Gallons Thru Liner				19380	14100	17700	10100	4280	7225	19380	31800	10100	11505	51180	21605
Curies Deposited				927	1239	1288	474	153	155	2.37	6.47	28	4.6	5.96	2.31
Changeout Date				11/5	11/8	11/17	11/30	12/11	12/14	11/5	11/17	11/30	12/14	11/8	-
Reason for Changeout				3	1	1	2	2	2	3	2	2	2	2	-

1) Approaching Curie Limit 2) Chemical Concerns 3) Level Probe Problems 4) Outage

EPICOR II LINER USAGE EXPERIENCE

Page: 2

BATCH#	GALLONS	FLOW RATE GPM ✓	SOURCE	PREFILTER IPF)					DEMIN 1 (DF)			DEMIN 2 (DS)		
				7	8	9	10	11	5	6	7	2	3	4
From Page 1	72785											2.31		
10	3730	11.5	U-1 MWST, ABST & Aux. Sump	134					0.16			-		
11	8505	15	Aux. Sump	1071					38.6			0.36		
12	5475	15	RCBT 'A'		863				19.6			3.38		
13	5500	7	RCBT 'A'			889				-			1.56	
14	(161,763)	10	CC-T-2 (Recirc)				0.13			0.27			0.19	
15	1000	10	RCBT 'A'				131.2			0.34			0.01	
16	4000	10	RCBT 'A'					692.5			0.92			1.76
17	(206,000)	10	CC-T-2 (Recirc.)					0.10			0.10			0.30
TOTALS	100995													
Liner Changeout Date:														
Gallons Thru Liner				12235	5475	5500	1000	4000	17710	6500	4000	39315	6500	4000
Curies Deposited				1205	863	889	131.33	692.6	58.36	0.61	1.02	6.05	1.76	2.06
Changeout Date				12/17	12/19	12/21	1/11	2/5	12/19	1/11	2/5	12/19	1/11	-
Reason for Changeout				1	2	2	2	2	2	2	2	2	2	-

1) Approaching Curie Limit 2) Chemical Con rns 3) Level Probe Problems 4) Outage

EPICOR II LINER USAGE EXPERIENCE

BATCH#	GALLONS	FLOW RATE GPM	SOURCE	PREFILTER (PF)						DEMIN 1 (DF)			DEMIN 2 (DS)	
				12	13	14	15	16	17	8	9	10	4	5
From Page 2	100995												2.06	
18	(104,442)	30	CC-T-2 (Recirc.)										0.02	
19	7402	10	RCBT 'A'	1056.7						18.9				0.015
20	6820	10	RCBT 'A'		973.5					0.5				0.088
-	3380	10	CCB Sump			0.91					0.042			0.001
21	7940	10	RCBT 'A' & Aux. Sump			968.45					23.467			0.150
22	8000	10	RCBT 'A'				991.8				7.059			0.410
23	8250	10	RCBT 'A'					1250.6				1 559		0.008
24	7053	10	RCBT 'A'						1069.8			0.683		0.001
TOTALS	149858													
Liner Changeout Date:														
Gallons Thru Liner				7420	6820	11320	8000	8250	7053	14240	19320	15303	4000	48863
Curies Deposited				1056.7	973.5	968.96	991.8	1250.6	1069.8	19.4	30.568	2.242	2.08	0.673
Changeout Date				2/19	2/20	2/27	2/29	3/4	3/6	2/20	2/29	-	7/16	-
Reason for Changeout				1	2	2	2	1	1	2	2	-	[illegible]	-

1) Approaching Curie Limit 2) Chemical Concerns 3) Level Probe Problems 4) Outage

EPICOR II LINER USAGE EXPERIENCE

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BATCH#	GALLONS	FLOW RATE GPM ✓	SOURCE	PREFILTER (PF)						DEMIN 1 (DF)		DEMIN 2 (DS)		
				18	19	20	21	22	23	10	11	5	6	-
From Page 3	149858									2.242		0.673		
25	8100	10	RCBT 'A'	1286.04						1.616		0.001		
26	7952	10	RCBT 'A'		1263.31					0.848		0.004		
-	(13618)	10	CC-T-1 Training			-					-		-	
27	8100	10	RCBT 'B'			1284.1					0.466		0.001	
28	8100	10	RCBT 'B'				1283.2				1.337		0.011	
29	7103	10	RCBT 'B'					1126.02			0.443		0.016	
30	11300	10	CWST & Aux. Sump						1084.08		40.71		0.034	
TOTALS	200513													
Liner Changeout Date:														
Gallons Thru Liner				8100	7952	8100	8100	7103	11300	31355	34603	64915	34603	
Curies Deposited				1286.04	1263.31	1284.1	1283.2	1126.02	1084.08	4.706	43.442	0.678	0.062	
Changeout Date				3/10	3/14	4/8	4/10	4/15	4/17	3/14	4/17	3/14	-	
Reason for Changeout:				1	1	1	1	1	2	4	2	4	-	

1) Approaching Curie Limit 2) Chemical Concerns 3) Level Probe Problems 4) Outage

EPICOR II LINER USAGE EXPERIENCE

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BATCH#	GALLONS	FLOW RATE GPM	SOURCE	PREFILTER (PF) 24	25	26	27	28	29	30	31	32	Demin 1(DF) 12	Demin 1(DS) 6
From Page 4	200513													0.062
31	8100	10	RCBT 'B'	1283.5									1.06	0.002
32	8100	10	RCBT 'B'		1283.29								1.236	0.018
33	8100	10	RCBT 'B'			1283.07							1.16	0.363
34	8100	10	RCBT 'B'				1283.65						0.142	0.781
35	14212	10	MWHT					1174.4					6.339	0.007
36	8100	10	RCBT 'B'						1283.8				0.513	0.397
37	9405	10	RCBT 'B', Aux. Sump & CCB Sump							969.99			0.048	0.073
38	5100	10	RCBT 'C'								1292.2		0.547	0.575
39	5100	10	RCBT 'C'									1292.02	0.574	0.719
TOTALS	274830													

Liner Changeout Date:

	PF 24	PF 25	PF 26	PF 27	PF 28	PF 29	PF 30	PF 31	PF 32	DF 12	DS 6
Gallons Thru Liner	8100	8100	8100	8100	14212	8100	9405	5100	5100	74317	108920
Curies Deposited	1283.52	1283.29	1283.07	1283.65	1174.4	1283.8	969.99	1292.2	1292.02	11.619	2.997
Changeout Date	4/18	4/22	4/24	4/26	5/2	5/9	5/13	5/14	5/15	-	-
Reason for Changeout:	1	1	1	1	1	1	1	1	1	-	-

1) Approaching Curie Limit 2) Chemical Concerns 3) Level Probe Problems 4) Outage

EPICOR II LINER USAGE EXPERIENCE

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BATCH#	GALLONS	FLOW RATE GPM	SOURCE	PREFILTER (PF)								Demin 1 (DF)		Demin2 (DS)
				33	34	35	36	37	38	39		12	13	6
From Page 5	274830											11.619		2.997
40	5100	10	RCBT 'C'	1289.52								3.286		0.529
41	5100	10	RCBT 'C'		1292.28							0.337		0.717
42	5100	8	RCBT 'C'			1292.15							1.125	0.055
43	5100	10	RCBT 'C'				1292.27						0.681	0.389
44	5100	10	RCBT 'C'					1292.23					0.502	0.604
45	5100	10	RCBT 'C'						1292.91				0.214	0.211
46	5100	10	RCBT 'C'							1293.06			0.075	0.177
TOTALS	310,530													
Liner Changeout Date:														
Gallons Thru Liner				5100	5100	5100	5100	5100	5100	5100	—	84517	25,500	144620
Curies Deposited				1289.52	1292.28	1292.15	1292.27	1292.23	1292.91	1293.06		15.242	2.597	5.679
Changeout Date				5/16	5/19	5/20	5/22	5/23	5/27	5/28		5/19	-	5/28
Reason for Changeout:				1	1	1	1	1	1	1		2	-	2

1) Approaching Curie Limit 2) Chemical Concerns 3) Level Probe Problems 4) Outage

EPICOR II LINER USAGE EXPERIENCE

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BATCH#	GALLONS	FLOW RATE GPM	SOURCE	PREFILTER (PF) 40	41	42	43	44	45	46	DEMIN 1 (DF) 13	14	DEMIN 2 (DS) 7	8
From page 6	310530										2.597			
47	5100	10	RCBT 'C'	1292.73							0.448		0.152	
48	5100	[illegible]	RCBT 'C'		1292.78						0.003		0.521	
49	5100	10	RCBT 'C'			1292.78					0.168		0.382	
50	5100	[illegible]	RCBT 'C'				1292.62				0.185		0.529	
51	16225	10	RCBT/Tank Farm					1096.12				1.303	0.001	
52	17900	12	RCBT/Tank Farm						1203.52			7.104	0.084	
TOTALS														

Liner Changeout Date:

	40	41	42	43	44	45	46	13	14	7	8
Gallons Thru Liner	5100	5100	5100	5100	16225	17900		45.900			
Curies Deposited	1292.73	1292.78	1292.78	1292.62	1096.12	1203.52		3.401			
Changeout Date	5/31	6/2	6/4	6/6	6/26	6/30		6/5			
Reason for Changeout:	1	1	1	1	2	1		2			

1) Approaching Curie Limit 2) Chemical Concerns 3) Level Probe Problems 4) Outage

EPICOR II RADWASTE SYSTEM

LINER INTEGRITY

AND

RESIN STABILITY

PRELIMINARY EVALUATION

Process Support Group
July 1st, 1980

Table of Contents

I. Introduction

The Epicor II Radwaste System is designed and operated to remove fission products from a mobile medium, water, and transfer these products to a fixed medium, resin. In addition, this system concentrates radioactive material so that its overall management and final disposal is enhanced. Once contained in resin liners it is necessary to determine the long term stability of this package to properly contain fission products. To review this topic, both the integrity of the liner and the stability of the resin media over a period of time must be evaluated. This evaluation is divided into two parts in order to focus on the retention of fission products on the resin bead and secondly the retention of fission products by the liner itself.

II. General Assumptions

The assumptions governing this Epicor II liner and resin evaluation are:

- o The liners exist in a dewatered* state when they are removed from service.
- o The liners are retained in the Interim and/or Waste Staging Facility.
- o The resins are not solidified.

*Dewatered conditions are well documented and defined in the Dewatering Program Report (R. Wilson letter dtd. 11/30/80 to J. Collins, NRC).

- o The evaluation is to include the full range of time spans from immediate to infinite conditions. This would cover worst case parameters regardless whether they occur immediately upon removal from service or at infinite time.
- o Dispersal of fission products outside the container, should it ever occur, and its effects, are not included. It should be noted that resins in a dewatered state are relatively immobile by themselves.

III. Conclusion

The preliminary evaluation indicates under postulated worst case conditions, the resin and liner package provide safe retention of fission products for several years.

IV. Part I

EPICOR II RADWASTE SYSTEM
LINER CHEMICAL/METALLURGICAL EVALUATION

TMI-2 Process Support Group
GPU Laboratory Materials Technology Section
GPU Laboratory Chemistry Section
July 1st, 1980

A. Introduction

The integrity of Epicor II Spent Resin Liners must be analyzed in terms of the effects of the environment both external and internal to the liners. With the liners being retained in the Waste Staging Facilities, external environmental conditions are reasonably stable & are essentially of no consequence. The use of resins and associated contaminants deposited on the resins, require careful analysis with regard to internal conditions. The deposited contaminants result in both chemical and radiolytical factors which must be accounted for. The degree and time of metallurgical reaction dependence must be fully evaluated to determine the assurance of providing a proper container for containing fission products within the liner.

B. Background

The Epicor II Radwaste System was designed and constructed immediately following the TMI-II March 28th, 1979 accident. This system was required to clean radioactive waste water with activity ranging from 1.0 to 100 microcuries per cubic centimeter (μc/cc). The system was developed on an emergency basis by a large group of on site and off site personnel both company and consultants. The severely intense design stage included repeated meetings with vendors as well as presentations to Nuclear Regulatory Commission (NRC) personnel to insure that a highly reliable, well designed, safe system would be installed that would clean the contaminated water to satisfactory limits, producing a safe waste product, while accounting for ALARA requirements. Because of the criticality of having this system available in an expeditious manner, comprehensive reports, documents, evaluations and studies were not produced. However, correspondence is available to track the chronology of events and decisions pertinent to important issues.

The design of the Epicor II Liners was an item that was carefully scrutinized by both on and off site company personnel and consultants. This review included such items as long term integrity and provisions for handling. The main item of interest pertinent to this evaluation is liner integrity. This was the subject of several meetings and presentations during April, May and June 1979. The basic liner design is as shown in dwgs. BL-62579 for a 4 x 4 (four feet tall by four feet in diameter) (Attachment 5) and Epicor T-66000 for a 6 x 6 (Attachment 6). These carbon steel vessels are painted on both interior and exterior surfaces. Painting specifications, Plasite #7155 and Carboline (Phenoline 368 primer and finish) (Attachment 7) provide specifics of the type and method of interior paint application.

A metallurgical evaluation including experiences with this type of liner design concluded the liners would provide safe, reliable containment of fission products for at least five years following removal from service. It was envisioned five years would provide sufficient time from removal from service, to shipment and burial of these wastes. Since the burial facility provided the final long term containment, the integrity beyond five (5) years was not evaluated. There exists no regulations as to the design criteria of such liners so it was concluded the design would satisfy criteria both at TMI and for final disposition. Should the liner be required to act as containment for extended periods, it was judged that more resistant materials might be required, however since that was not the case, it was not selected. As discussed earlier, due to the urgency of this type of evaluation, formal documentation does not exist.

Once Epicor II became operational on October 22nd, 1979, it was determined that subsequent evaluation of the liner design would be conducted incorporating contaminant deposition and other performance data in the analysis. After several months of experience, a more formal, comprehensive evaluation was commenced to more precisely analyze conditions in the liner and how the liner would withstand this environment. The purpose of this review was to integrate chemical and metallurgical aspects with time so as to accurately define liner integrity. This evaluation is being performed by the Process Support Group and the GPU Laboratory Materials Technology and Chemistry Sections.

C. Assumptions

Some of the assumptions and/or variables included in this evaluation are:

1. Liner Internal Coating - The full range of liner paint conditions are considered.

   These include:

   The coating being fully intact; the coating partially failed; coating containing pin holes; or no coating.

   This range will include the worst case parameters.

2. Seal - Once a liner is removed from service it is dewatered and sealed with screwed cap fittings, and a 55 gallon drum ring seal.

3. Volume - A 4 x 4 liner contains an average of $30ft^3$ of resin while a 6 x 6 contains an average of $110ft^3$.

4. Moisture Content - The moisture content in a dewatered liner are as defined in the Dewatering Study. (R.Wilson

letter dtd. 11/30/80 to J. Collins, NRC)

5. Chemical Contaminants - Based upon sample results the minimum and maximum amount of chemicals deposited in each applicable liner type including items such as Sodium, Baron, Chlorides, Nitrates, Phosphates, Sulphates, etc. is included.

6. Curies - Based upon sample results, the minimum and maximum amount of curies deposited in each specific liner is included.

7. Exterior Environment - Epicor II liners are retained in on site Waste Staging Facilities. Moisture, temperature and other atmospheric conditions are included.

D. Conclusions

1. Preliminary analysis indicates that the resin liner under the postulated worst case conditions including an initial defect in the coating would not perforate for several years.

2. The coating vendors indicate that in the absence of defects in the coating, the normal life for the coating in the postulated environment would be similar to that for a coating subjected to demineralized water, which is in excess of ten years.

3. Tests conducted by the coating vendors indicate the coatings can withstand 1 x 10^9 rads dose with no apparent degradation.

4. The precise worst case internal environment as it relates to time must be more closely determined for a closer definition of the corrosion rate.

V. Part II

EPICOR II RADWASTE SYSTEM
RESIN IRRADIATION EVALUATION

TMI-2 Process Support Group
TMI-2 Radiological Engineering Group
July 1st, 1980

A. Introduction

The stability of the materials used in Epicor II liners for water cleanup purposes must be analyzed in terms of radiolytical effects. The fission products deposited on the organic and inorganic materials result in radiation exposure which accumulates with time. This integrated dose results in primary and secondary effects associated with the stability with which resins retain mixed fission products, and the integrity of the liner itself.

B. Background

The major radioisotope existing in the Auxiliary and Fuel Handling building waste waters immediately following the accident was iodine. The immediancy of cleaning this water dictated designing the Epicor II process to remove this contaminant, among others. The prefilter in the system was specifically tailored for this purpose with a design loading of up to 2,500 curies. The design was relatively fixed by the middle of May, 1979, with shielding based upon 2,500 curie deposition. Realizing the half life of Iodine (specifically ^{131}I) and the projected availability of placing the system in operation, an evaluation was recommenced for contaminant removal following the decay of iodine.

A meeting held on July 13th, 1979, focused on altering the system process design and reviewing the results of investigations completed by various organizations. It was during this meeting that the limitations associated with each liner was determined. In particular, personnel from Epicor Inc. presented a proposal to alter the prefilter from being a prime Iodine remover to being a prime Cesium and Strontium remover. The number of curies that could be safely deposited on the prefilter was reviewed in some detail. It was during this meeting, also attended by NRC personnel, that the radiation resistance of various types of resins was discussed. It was determined, based upon specific selection of resins, that 1300 curies would not present any significant detrimental effects. In addition, 1300 curies in a 4 x 4 liner would provide several choices for shipping casks when shipment was required. Other processing parameters would also be enhanced. This issue was investigated further with a second meeting held on July 24th, 1979. This second meeting, also attended by NRC personnel, confirmed that the curie volumes were satisfactory limits. (Prefilter 1,300 curies, Demineralizer K1, 500 curies and Demineralizer K-2, 20 curies.)

This initial review indicated no substantial concern over the near term radiolytical effects. As discussed in Part I "Liner Chemical/Metallurgical Evaluation," formal documentation of this evaluation was not made during the early development stages of the system.

After several months of operational experience, steps were taken to conduct a more exhaustive study. This study would formally document radiolytical effects and focus on primary and secondary actions in the liners integrated over time. This evaluation is being conducted by the Process Support and Radiological Engineering Groups.

C. Conclusions

1. Preliminary analysis based on postulated worst case conditions indicates that no significant areas of concern exist for several years following removal from service.

2. Curies deposited in liners are not homogenously distributed throughout the liner.

D. Dose Calculation

The degree of radiation effect is almost directly related to the integrated dose received by resins. Since this is a critical parameter, this section details some of the assumptions and methodologies used in determining this value.

1. Assumptions:

Extremely conservative assumptions were used to calculate the integrated dose the resins are subjected to. Some of these are:

a. The maximum amount of curies are deposit d on the minimum amount of resins.

b. No self shielding of resins occurs within a liner.

c. Where applicable, the energy of gammas is completely absorbed by the section of resins which it is deposited on.

d. The dose received by a resin bead comes from a combination of radiation deposited on the bead itself as well as radiation from beads adjoining the particular bead being analyzed.

2. Curies Deposited:

The number of curies deposited per liner varies with each liner. Attachment 8 provides a presentation of the number of liners of each type versus the curies deposited. This display clearly shows the prefilters contain the vast majority of curies. The prefilters pose as the most severe situation and therefore the preliminary evaluation concentrates on these liners. The fission products removed by each liner are documented in Batch Data Sheets. These sheets are not included in this report due to their volume. These documents, previously provided to the NRC, allow calculating dose due to specific or group types of radionuclides. The data in these Batch Reports is summarized in Attachment 3.

3. Curie Distribution within a Liner:

The distribution of curie deposition throughout a liner is dependent upon liner design, types of resins used, direction of liquid flow, and how the resins are deposited within the bed. This single parameter provides a guidelines by which all associated variables can be accounted for.

Radiation surveys are taken as liners are lowered into Waste Staging Facilities. These surveys consist of radiation readings along side the length of a liner. Two circumferential points are taken 180° apart from each other. These two points allow for determining if preferential side loading is occurring due to channeling, bypasses, or other internal hydraulic actions. Attachment 10 shows the fixed geometry of the radiation surveys. The geometry of the instrument shows that approximately 6.6 inches of unshielded liner heighth is exposed to the meter's ion chamber at any one time. While the survey is being taken, the liner is stopped every six (6) inches of downward travel to obtain and record survey instrument readings. Although the chamber sees some radiation other than the unshielded portion, the amount of radiation is considered of limited significance.

Typical surveys for a liner containing 1292 curies are included in Attachments 11 and 12. These surveys show that as the meter window becomes more columnated (12.25 inches versus 9") the bell shaped curve becomes tighter and more pronounced. In addition these surveys show that curies are not homogenously deposited throughout a liner. From this information, the curies deposited versus cubic feet of resin was determined.

E. Resin Irradiation Data

The performance of resins when exposed to radiation is documented in many references readily available in the industry. No attempt will be made to list all pertinent documents. However, because the degree of resin resistance is dependent upon its type, the individual references for the type of materials used in Epicor II liners is important.

It is generally accepted that inorganic resins are more stable when exposed to radiation than organic resins. Also, as previously discussed, the prefilters contain the vast majority of radionuclides removed from the water. From this information it was determined that the first eleven (11) prefilters pose as the worst case condition for resin irradiation effects. Attachment 9 provides a tabulation of these first prefilters and the associated curies deposited. This attachment shows that only three (3) prefilters contain the greatest amount of curies. These liners pose as worst case conditions.

To evaluate the radiation effects of Epicor Inc. resins, data was accumulated that addressed the specific reaction experienced by the resins in use. This data is provided in Attachment 13.

Having established the worst case curie loading and obtaining resin irradiation references, the stability of the resins were evaluated.

F. Effects of Resin Irradiation

These are basically eight irradiation reactions which have been reviewed in this evaluation. These reactions were categorized according to effects on the resin matrix, physical alterations, and other safety concerns. They are:

- o Gas Generation
- o Safety of Nitrated Type Resins
- o Scission of Functional Groups
- o Scission of Polymeric Structure
- o Scission of Cross Linkage Bond
- o Agglomeration
- o Swelling/Shrinking
- o Discoloration

Each area will be explored to provide preliminary results of the analysis:

1. Gas Generation

Primary effect: Over the infinite life of a liner, under postulated worst case conditions, the maximum increase of liner pressure due to Gas Generation is 2 lbs. per square inch (psi). A hydrostatic test of a liner demonstrated that a liner can withstand up to 19 psi prior to breaching liner integrity. At that pressure a minor leakage point developes at the top of the liner. There is no indication that this will pose as a significant problem.

Secondary Effect: Possible generation of gases that would combine with residual moisture in the liner or the matrix of hydration of a resin bead could produce an acid. This acid might lower the pH of liner internals resulting in more aggressive chemical attack on the paint and/or liner surface. Since the liner and resin design contains a buffer to maintain the pH at 5.0 or higher, there is no indication that this will pose as a significant problem over the next several years.

2. Safety of Nitrated Type Resins

The Epicor II Radwaste System does not contain nitrated type resins nor is there sufficient amounts of nitrate contaminants in the waste water to shift resins to a nitrate form. This is not a concern.

3. Scission of Functional Groups

Primary Effect: The loss of exchange capacity is not a problem since once taken out of service, additional exchange capacity is not required. Even so, the resin in the liners is not exhausted chemically so a significant amount of capacity exists when removed from service.

Secondary Effect: Radioisotopes could be remobilized as a salt should functional groups complexed with radionuclides be broken from the main resin matrix. Since no liners are exhausted when removed from service, this extra capacity will refix any radionuclides back into solid resin matrix.

4. Scission of Polyneric Structure

Primary Effect: Physical breakup of resins results in fines which will not cause any problems in Epicor II liners.

Secondary Effect: The formation of reactive chemical species is based upon resin types, contaminants deposited, and radiolysis. There is no indication that this will pose as a significant problem over the next several years.

5. Scission of Cross Linkage Bond

The alteration of the porosity and/or ion exchange capacity of an Epicor II liner is not a problem since the liners will not be placed back in service for water cleanup purposes.

6. Agglomeration

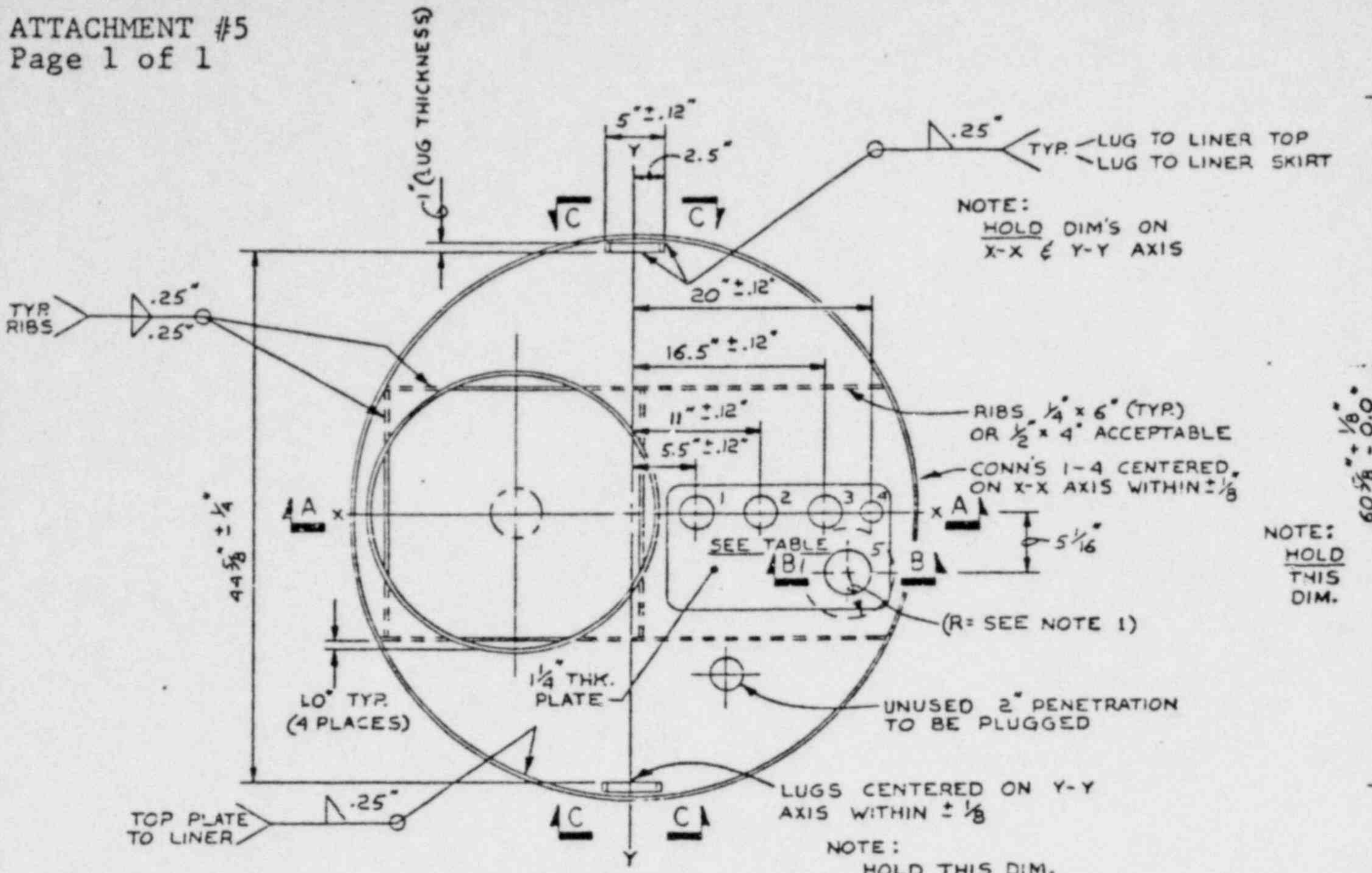
The agglomeration or joining of resin beads does not pose as a problem unless transfer of resin beads out of the liners is required. This effect is related to dose and over the next several years it is apparent that insufficient exposure to resins will occur to cause agglomeration.

7. Swelling/Shrinking

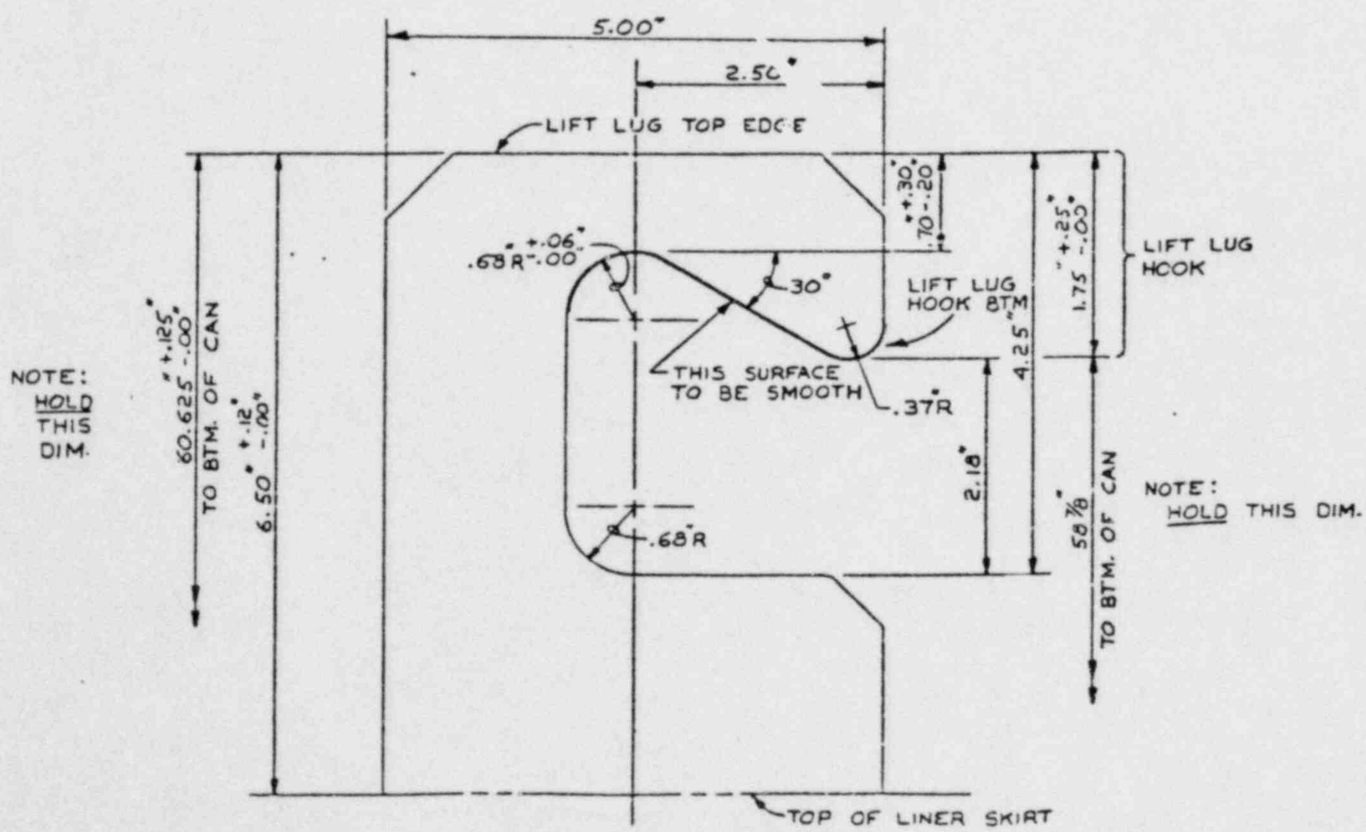
Sufficient void space exists in Epicor II liners to eliminate this as a concern. With solidification, this issue would have to be addressed carefully.

8. Discoloration

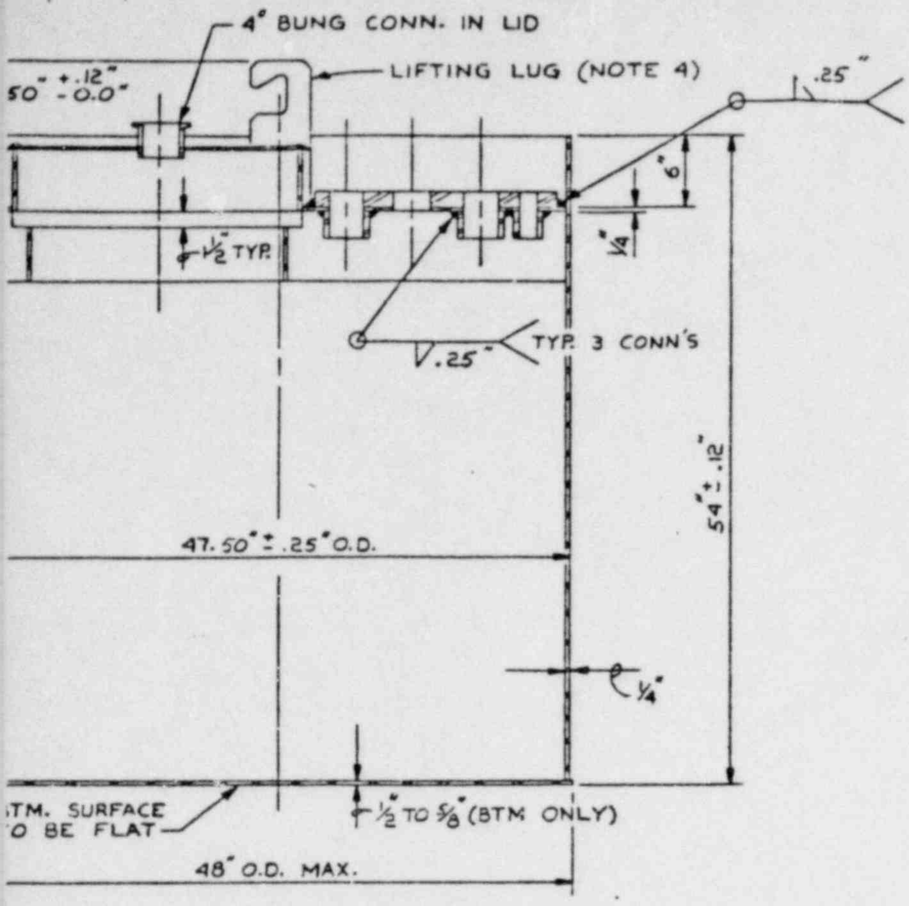
The change of the color of resins is of no consequence.



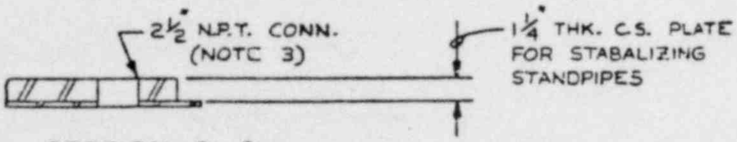
PLAN VIEW
SCALE: 1 1/2" = 1'-0"



SECTION C - C
SCALE: NONE



SECTION A-A
SCALE: 1 1/2" = 1'-0"



SECTION B-B
SCALE: NONE

TANK REQUIREMENTS:

MATERIALS

OPTION A - 304L WELDED WITH 308L (316L IS ALSO ACCEPTABLE)
OPTION B - CARBON STEEL SA36 WITH PHENOLINE 368 COATING INSIDE AND OUTSIDE

SPECIFICATIONS

1. THIS IS NOT A CODE TANK.
2. MATERIAL CERTIFICATIONS ARE NOT REQUIRED BUT CERTIFICATES OF COMPLIANCE FOR 304L OR 316L AND 308L MATERIALS ARE REQUIRED.
3. PAINTING OF ALL CARBON STEEL SURFACES TO BE A PRIME AND FINISH COAT OF PHENOLINE 368* APPLIED PER MFGR'S. INSTRUCTIONS. EACH COAT TO BE 3.5 MILS DRY THICKNESS.
4. PRESSURE BOUNDRY WELDS PER AWS D1.1 REQUIREMENTS AND WELDERS QUALIFIED TO D1.1 OR SECTION IX.
5. VISUAL AND LP INSPECTION OF PRESSURE BOUNDRY WELDS PER AWS D1.1, PRS 6.7 AND 10.17 OR SECT. VIII APP. VI.
6. FILL TANK WITH WATER AND VISUALY INSPECT FOR LEAK. USE STANDPIPE TO ACHIVE 14 FOOT HYDROSTATIC HEAD.
7. TOLERANCE ON ALL DIMENSIONS ± .12" UNLESS OTHERWISE NOTED.
8. SHIP LINERS DOWN W/CONNECTIONS PROTECTED. (i.e. W/PLUG OR EQUAL)

* PLASITE PRIMER 7155 NP WITH 9009 GRAY FINISH COAT, EACH 3.5 MILS THICK, IS ALSO ACCEPTABLE

NOTE:

1. FROM CENTER OF 2 1/2" PENETRATION (#5), A MINIMUM CLEARANCE RADIUS OF 3 7/8" IS REQUIRED FROM CLOSEST PEN. AND OR LINER RIM. ALSO ENSURE THAT THE 11" LONG PROBE WILL NOT INTERFER WITH INLET DISPERION BARS.
2. CONN'S 1,2,3,4 TO BE PERPENDICULAR TO LINER TOP IN X-X & Y-Y DIRECTIONS AT 25" ABOVE CONN.
3. ENSURE CONN. 5 IS PERPENDICULAR TO LINER TOP IN X-X & Y-Y DIRECTIONS 12" BELOW CONN.
4. ENSURE LIFT LUG OPENINGS ARE FACING OPPOSITE DIRECTIONS AS TO ALLOW LIFT BAR MECHANISM TO ENGAGE CLOCKWISE.

TABLE 1

TEM	DRILL & TAP	HALF COUPLING
LET	2" N.P.T.	ONE 2 CPLG. WELDED ON BTM. OF CONN.
ENT	2" N.P.T.	———
TLET	2" N.P.T.	ONE 2" CPLG. WELDED ON BTM. OF CONN.
BBLER	1" N.P.T.	ONE 1" CPLG. WELDED ON BTM. OF CONN.
ND OBE	2 1/2" N.P.T.	———

REVISIONS

REV	MADE	DESCRIPTION	DATE
3	JAS	UPDATED - REDRAW	10/31/80
2	JAS	ADDED PLATE & REV. 2" CONN'S ON TOP OF LINER	
1	JAS	REV. AS INDICATED	

REVISIONS

CONSTRUCTION
PRELIMINARY NOT FOR CONSTRUCTION
BIDDING PURPOSES

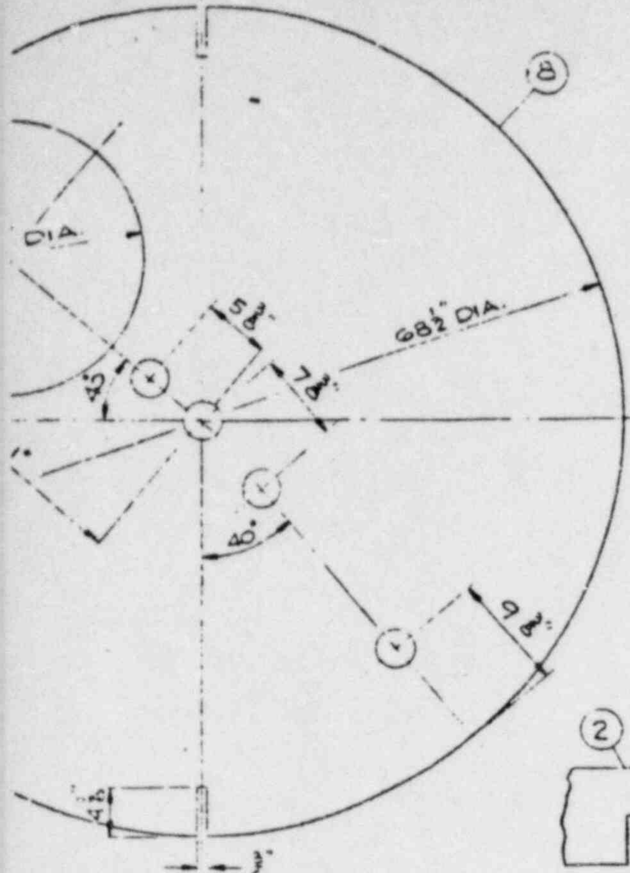
DATE | RELEASED FOR | ENGR.

TMI II
EPICOR II RADWASTE SYSTEM
4×4 LINER

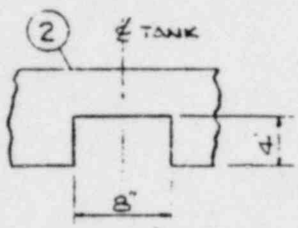
DRAFTING: JAS | CHECKED | ENGINEERING INTERFACES

7/01/80

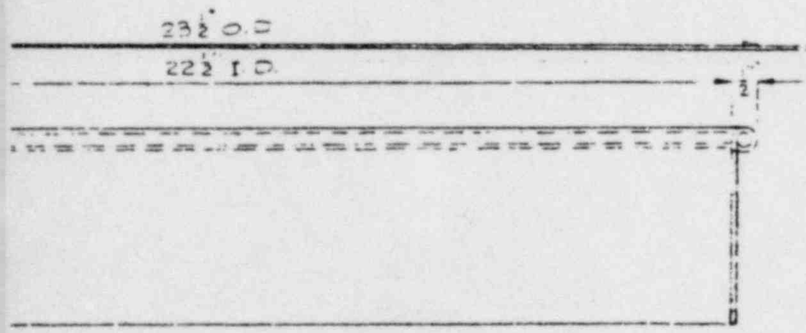
SCALE | DRAWING NUMBER: BL62579 | REV: 3



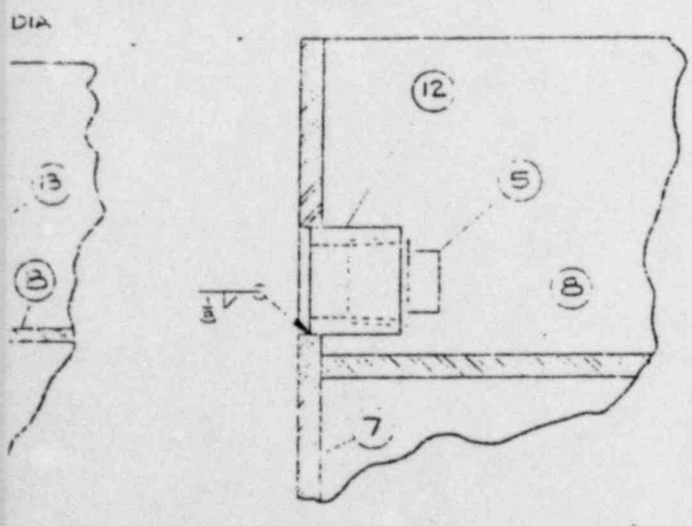
TOP PLATE



SECTION "CC"



DETAIL ITEM 10



DETAIL "A"

BILL OF MATERIAL

ITEM	QTY.	MAT'L	DESCRIPTION	SIZE
1	1	H.R.S.	TANK BOTTOM	¼ PL. × 70 DIA
2	2	H.R.S.	STIFFENER	¼ PL. × 6 × [illegible]
3	1	ALUM	NAME PLATE	16GA × 4 × 5
4	4	CRS	SHEET METAL SCR	0.200 × ¾ LG
5	1	H.R.S.	PIPE PLUG	½ - 3000 [illegible]
6	4	H.R.S.	COUPLING	2 - 3000#
7	1	H.R.S.	TANK SIDE	¼ PL × 74 × 2½
8	1	H.R.S.	TANK TOP	¼ PL × 68½ DIA
9	4	STEEL	PIPE PLUG	2 - 3000#
10	1	H.R.S.	FILLER CURB	14GA × 2 × 71⅛
11	1	PURCH	55GAL DRUM COVER	
12	1	H.R.S.	HALF COUPLING	½ - 3000#
13	2	H.R.S.	LIFTING LUG	⅝ PL × 4 × 7½
14	1	COMM.	SLING ASS'Y.	

NOTES:

1. ALL WELDS TO BE ZYGLO TESTED.
2. STENCIL TANK No. ON LONGITUDINAL SEAM AFTER METAL STAMPING HAS BEEN DONE; (AFTER FINAL TESTING)
3. PAINT (2) COATS OF PLASITE #7155 HHB IVORY PLUS (1) COAT #7155HHB LIGHT GREEN INSIDE. ALTERNATE COLORS TO 7½ MILS DRY. EXTERIOR PAINT (1) COAT RED OXIDE; (1) COAT [illegible] [illegible] OUTSIDE.
4. ITEM 14 - SLING ASS'Y ATTACHED.
5. CHECK (4) 2" NPT PIPE TAP BOLT [illegible] FOR ALIGNMENT

NO.	DATE	DESCRIPTION	BY	CHK.
△				
△				
△				
△				
△				

[illegible]

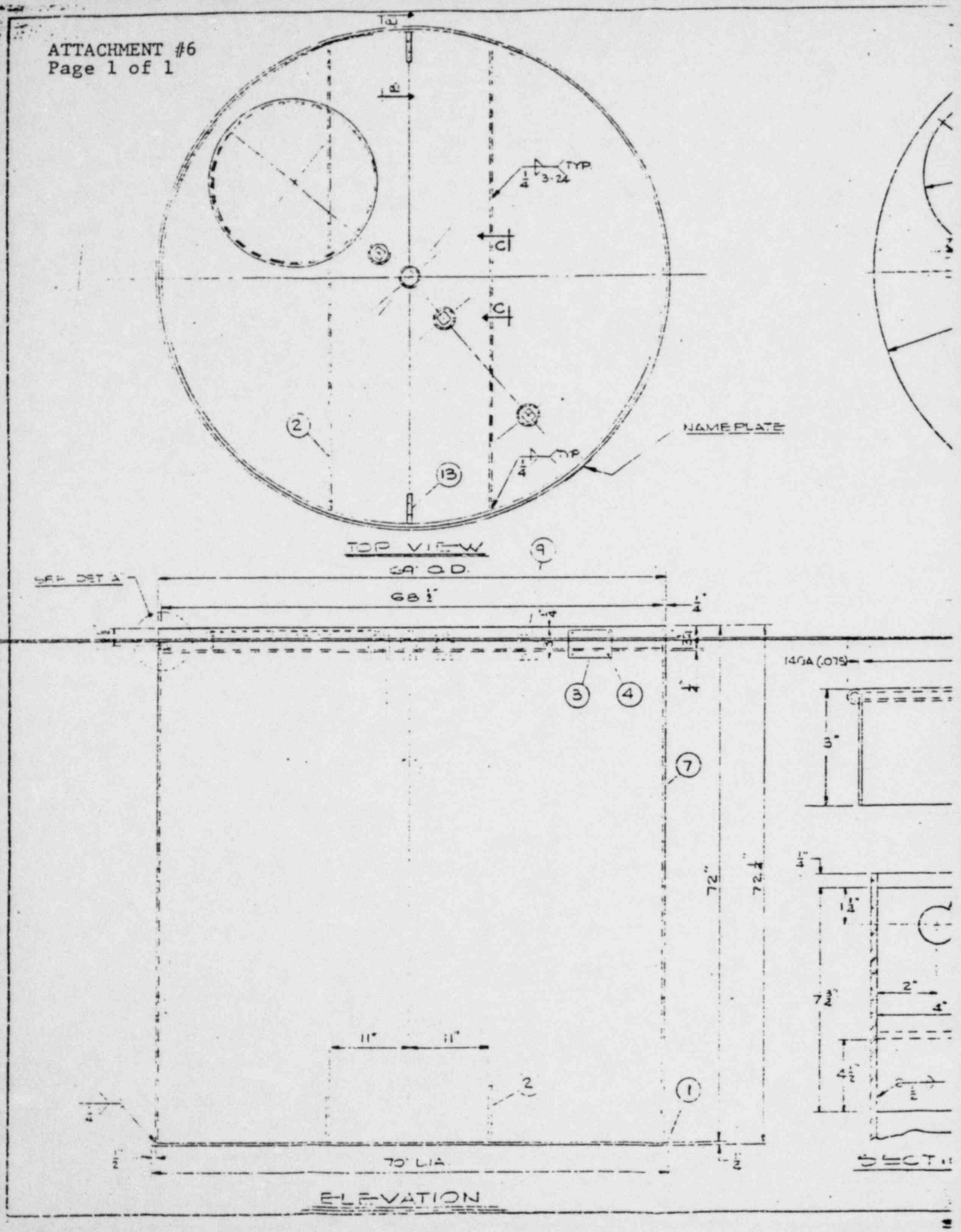
EPICOR INC.

LINDEN, N.J.

STORAGE TANK

6FT HIGH × 6FT [illegible] 1260 GAL CAPACITY

JOB NO.	DRAWING NO.	REV.
	T- 65600	


TYP.
$\frac{1}{4}$ 3-24
C
C
2
13
$\frac{1}{4}$ TYP.
NAMEPLATE
TOP VIEW
9
68 $\frac{1}{2}$
$\frac{1}{4}$
3
4
14GA (.075)
3"
7
72"
2"
4"
11"
11"
2
1
70" DIA
$\frac{1}{2}$
$\frac{1}{2}$
ELEVATION

meant to construe an express guarantee in actual service. The service is dependent upon proper application and actual operating conditions and it is generally recommended that users confirm adaptability of the product for a specific use by their own tests. Plasite No. 7155 is not suitable for service in corrosive acids or oxidizing service for continuous immersion.

THINNERS

The following thinners are recommended — the amounts required will vary depending on air and surface temperatures and application equipment.

It is recommended that the amount of thinner included on each order amount to approximately 20% of the coating order. This thinner may be used for cleaning equipment as well.

PLASITE NO. 71 THINNER is a medium fast thinner and is to be used under most conditions.

PLASITE NO. 72 THINNER is a relatively slow thinner and must be force cured when coating is used in Zone A applications. It is an aid to force curing and eliminating solvent popping and improves flow-out of coating.

PRIMERS

PLASITE NO. 7155 does not require a primer in Zone A service. If a shop primer or a primer to hold surface is required on large fabrications use No. 7155NP primer at 3 mils with topcoat of 6 mils No. 7155. Reference: Plasite Bulletin M-7NP.

CURING

1. Normally polymerization and curing will take place in 4 to 7 days at 70° F. If temperature is in the range of 50° to 65° F. Force Curing is recommended as curing rate is considerably lower at these temperatures.

2. Force Curing is recommended during cold weather, for enclosed tanks or when coated surface is to be immersed before 4 to 5 day room temperature curing will take place.

3. Force Curing at elevated temperature does increase resistance to certain exposures, therefore when exposure is severe, Force Curing is recommended to obtain maximum resistance.

4. Below are listed a few curing schedules that may be used for time and work planning. Prior to raising the metal to the force curing temperature it is necessary that an Air Dry time of 1½ to 3 hours at temperatures from 70° F. to 100° F. be allowed. After the air dry period has elapsed the temperature should be raised approximately 40° F. in increments of 30 minutes until the desired force curing temperatures are reached. DO NOT FORCE CURE Above 100° F. until final dry film is obtained.

METAL TEMPERATURE	CURING TIME	METAL TEMPERATURE	CURING TIME
130° F.	15 Hours	170° F.	3½ Hours
140° F.	9 Hours	180° F.	2½ Hours
150° F.	6 Hours	190° F.	2 Hours
160° F.	4½ Hours	200° F.	1¾ Hours

5. Final cure may be checked by exposi‹ g coated surface to MIBK for ten minutes. If the coating softens only after this exposure and no dissolving is obs ved the curing can be considered complete for all practical purposes.

SPRAY APPLICATION

1. All spray equipment should be thoroughly cleaned and the hose in particular should be free of old paint film and other contaminants.

2. Use standard production type spray guns:

GUN	FLUID	AIR
DeVilbiss P-MBC-510	FX	765
Binks #18	66-SS	63-PB
Binks #7	33	33-PE

Airless Spray is not recommended for Plasite No. 7155 application.

BRUSH APPLICATION

1. A high quality natural bristle brush set-in rubber should be used.

SAFETY & MISCELLANEOUS EQUIPMENT

1. For tank lining work it is recommended that the operator provide himself with clean coveralls and rubber soled shoes.

2. For tanks or enclosed spaces, use the necessary safety equipment such as air mask, explosion proof electrical equipment, non-sparking tools and ladders, safety belts. etc. The solvents in this coating are inflammable and care as demanded by good practice, OSHA, State & Local Safety Codes, etc. should be followed closely. For ventilation requirements refer to Plasite Bulletin PA-3 dated January 1963 or later.

APPLICATION PROCEDURE

SPRAY GUN

1. Air supply shall be uncontaminated. Adjust air pressure to approximately 50 lbs. at the gun and provide 5 to 10 lbs. of pot pressure. Adjust spray gun by first opening liquid valve and then adjusting air valve to give approximately 3" wide by 10" long oblong spray pattern with best possible atomization.
2. Apply a "mist" bonding pass.
3. Allow to dry approximately one minute but never long enough to allow film to completely dry.
4. Apply criss-cross multi-passes, moving gun at fairly rapid rate, maintaining a wet appearing film. Observe the coating surface and when it appears to be flowing together you will have an average of 3 mils wet film. By allowing the solvents to flash-off for a few minutes several more fast multi-passes may be applied until you have a film thickness of approximately 4 to 5 mils. (Approximately 7 wet mils)
5. Over coat time — This will vary both with temperature and ventilation. Probably will require from 8 to 12 hours at 70° F. for enclosed spaces. Less time required for exteriors.
6. By repeating Step No. 4 a homogenous film of 8 to 10 mils is obtained. Small areas or enclosed areas may require 3 coats as preferred by applicator.
7. Equipment must be thoroughly cleaned immediately after use with Plasite thinner to prevent the setting of the coating.

NOTE: All welds, pits and rough metal areas should be coated by brush prior to spray application.

BRUSH APPLICATION

1. Apply a very light criss-cross brush coat.
2. Allow to dry for approximately five minutes.
3. Apply a heavy coat using criss-cross brush pattern. "Flow" the coating on rather than try to "Brush out."
4. Allow to dry tack-free.
5. Repeat steps 3 and 4 until sufficient film thickness is obtained. Normally a film thickness of 2 mils can be obtained per coat by this method.

This Bulletin provides standard information on the coating and Application Procedure. Since conditions vary widely that may not be covered you may consult with your local Plasite Representative or Factory for further information.

... described under Zone of Usage.)

1. Remove weld splatter. Grind sharp edges to ⅛" radius, grind welds. Skip welds should be welded solid or caulked.

2. Degrease surface prior to sandblasting. Organic solvents alkaline solutions, steam, hot water with detergents or other systems that will completely remove dirt, oil, grease, etc., may be used. In some cases prebaking of old tanks is required.

3. The surface shall be blasted to a No. 1 white metal surface using a ⅛" or ⅜" blast nozzle supplied with 80 to 100 PSI. An anchor pattern or "TOOTH" in the metal shall correspond to approx. 20 to 25% of the film thickness of the coating.

4. Contaminated grit shall not be used for the finish work.

5. The grit used shall be a sharp silica sand, steel slag grit similar or equal to Black Beauty BB 25 or any other abrasive that has a sharp hard cutting surface, properly graded, dry and of best quality.

6. Further reference may be made to Steel Structures Painting Council Specification SSPC-SP 5 Blast Cleaning to White Metal. The anchor pattern shall be sharp and no evidence of a polished surface is allowed.

7. Remove all traces of grit and dust with a vacuum cleaner or by brushing. Care must be taken to avoid contaminating the surface with finger-prints or from detrimental material on the workers clothes.

8. The first application of coating shall be made the same day that the blasting is performed or precautions taken to allow no condensation or visible oxidation to take place.

CONCRETE

1. Normally a new concrete surface properly cured and floated with a wood trowel requires no surface preparation. It is required that it be clean and free of grease, oil or other contaminants.

2. Coating may be applied to old concrete surfaces provided it can be properly cleaned and neutralized.

3. If the concrete surface has a smooth glazed surface this should be removed by 10% Muriatic Acid solution thoroughly wetted, scrubbed and rinsed thoroughly, or blasting with a No. 50 grit will properly prepare the surface.

4. Pits, cavities and other imperfections may be filled with a proper epoxy grout. The grout should be cured and dry and then brushed or ground to remove rough spots and chalky material.

5. Plasite No. 7155 may be applied by brush, spray or roller. It is generally recommended that the first coat be diluted 1 part No. 71 solvent to two parts of clear coating material, brush applied to act as a sealer coat.

6. When surface is rough and porous, PLASITE Concrete Sealing System shall be used. Refer to Factory or area Representative.

ALUMINUM

The surface shall be clean and grease free and properly etched with one of the standard commercial surface preparation materials manufactured by Parker Rust Proofing Co., DuBois Chemicals "Shield II" system or by Amchem Products, Inc. Alodine 1200S System. Sandblasting with a sharp grit is another way of preparing the surface and in many cases it is also necessary to combine this with chemical surface treatment. Many aluminum alloys require different treatment, particularly those with high magnesium content.

PACKAGING & MIXING

A #7155 Kit will consist of 2 equal volume containers — Part I Pigmented (color) Resin and Part II Medium Viscosity Resin. In addition to equal volume containers Part I and Part II, there will be a small container of catalyst. Order coating in Kits stating total quantity needed and container size. The following Kits are available:

2-Pint Kit — 1 pint each Part I and Part II plus small container catalyst Part III — for a total of two pints.
2-Quart Kit — 1 quart each Part I and Part II plus small container catalyst Part III — for a total of two quarts.
2-Gallon Kit — 1 gal. each Part I and Part II plus small container catalyst Part III — for a total of two gallons.
10-Gal. Kit — 1 - 5 gallon each Part I and Part II plus small container catalyst Part III — for a total of ten gallons.

EXAMPLE: 24 Gallons equivalent would require:

2 - 10 gal. Kit	20 gal. total
2 - 2 gal. Kit	4 gal. total
	24 gallons

Mix Part I and II, then add Part III, Catalyst and mix thoroughly. Let stand approximately 30 minutes before using.

carboline

PHENOLINE® 368 PRIMER

350 HANLEY INDUSTRIAL COURT • ST. LOUIS, MO. 63144 • 31[illegible]-644-1000

SELECTION DATA

GENERIC TYPE: Modified phenolic. Part A and Part B mixed prior to application.

GENERAL PROPERTIES: A modified phenolic tank lining primer which provides good corrosion protection for steel, good adhesion to concrete and good resistance to water and moisture penetration.

RECOMMENDED USES: Phenoline 368 Primer is not recommended untopcoated. For water immersion service (fresh, demineralized and salt water and dilute caustic) Phenoline 368 WG Finish is the recommended topcoat. For concentrated caustic (50% maximum) service Phenoline 368 Finish is the recommended topcoat. For a general tank lining which resists a wide variety of chemicals and solvents, Phenoline 373 Finish is recommended.

NOT RECOMMENDED FOR: Immersion without a suitable topcoat.

CHEMICAL RESISTANCE GUIDE:

Exposure	Immersion
Acids	N.R.
Alkalies	Excellent
Solvents	Excellent
Salt	Excellent
Water	Excellent

TEMPERATURE RESISTANCE: (Dry)
Continuous: 200°F (93°C)

Immersion temperature depends on solution but should never exceed 180°F (81°C). All tanks must be insulated if the temperature exceeds 140°F (60°C).

FLEXIBILITY: Fair **WEATHERING:** Good (chalks)

ABRASION RESISTANCE: Good

SUBSTRATES: Apply to properly prepared steel, concrete or others as recommended.

TOPCOAT REQUIRED: May be topcoated with modified phenolics, catalyzed epoxies, or other generic types as recommended. Acceptable topcoats are Phenoline 372 Finish, Phenoline 368 Finish, Phenoline 368 WG and others.

COMPATIBILITY WITH OTHER COATINGS: Apply directly to substrate only.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
Phenoline 368 Primer	75 ± 1%

RECOMMENDED DRY FILM THICKNESS PER COAT: 5 mils (125 microns)

THEORETICAL COVERAGE PER MIXED KIT* (1.25 gals):
1504 mil sq. ft. (29.4 sq.m/l @ 25 microns)
301 sq. ft. at 5 mils (5.9 sq.m/l @ 125 microns)

*NOTE: Material losses during mixing and application will vary and must be taken into consideration when estimating job requirements.

SHELF LIFE: 1 year minimum.

COLORS: White only.

GLOSS: N/A

ORDERING INFORMATION

Prices may be obtained from Carboline Sales Representative or Main Office. Terms – Net 30 days.

SHIPPING WEIGHT:	1's	5's
Phenoline 368 Primer	19 lbs. (8.6 kgs)	86 lbs. (39.0 kgs)
Carboline Thinner #73	9 lbs. (4.1 kgs)	45 lbs. (20.4 kgs)

FLASH POINT: (Pensky-Martens Closed Cup)

Phenoline 368 Primer Part A	72°F (22°C)
Phenoline 368 Primer Part B	40°F (4°C)
Carboline Thinner #73	38°F (3°C)

Mar. 77-N

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions, and application procedure. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

SURFACE PREPARATIONS: Remove any oil or grease from surface to be coated with clean rags soaked in Carboline Thinner #2 or Toluol.

Steel: For immersion service, dry abrasive blast to a White Metal finish in accordance with SSPC-SP 5-63 to a degree of cleanliness in accordance with NACE #1 to obtain a 2 to 3 mil (50-75 microns) blast profile. For non-immersion service, dry abrasive blast to a Commercial finish in accordance with SSPC-SP 6-63 to a degree of cleanliness in accordance with NACE #3 to obtain a 2 to 3 mil (50-75 microns) blast profile.

Concrete: Do not coat concrete treated with hardening solutions unless test patch indicates satisfactory adhesion. Do not apply coating unless concrete has cured at least 28 days @ 70°F (21°C) and 50% RH or equivalent time. Apply to properly prepared concrete that was acid etched or swept sandblasted. (Vertical surfaces must be sandblasted.)

MIXING: Mix separately, then combine and mix in the following proportions:

	1 Gal. Kit	5 Gal. Kit
Phenoline 368 Primer Part A	1 Gal.	5 Gals.
Phenoline 368 Primer Part B	1 Qt.	1—5 Qt. Unit

Thin up to 30% by volume with Carboline Thinner #73.

POT LIFE: 2 hours at 75°F (24°C) and less at higher temperatures.

APPLICATION TEMPERATURES:

	Material	Surfaces
Normal	65-85°F (18-29°C)	65-85°F (18-29°C)
Minimum	60°F (16°C)	60°F (16°C)
Maximum	95°F (35°C)	120°F (49°C)

	Ambient	Humidity
Normal	65-90°F (18-32°C)	30-70%
Minimum	60°F (16°C)	0%
Maximum	120°F (49°C)	85%

Special thinning and application techniques may be required above or below normal conditions.

SPRAY: Use adequate air volume for correct operation. Hold gun 8-10 inches from the surface and at a right angle to the surface.

Use a 50% overlap with each pass of the gun. On irregular surfaces, coat the edges first, making an extra pass later.

NOTE: The following equipment has been found suitable, however, equivalent equipment may be substituted.

Conventional: Use 3/8" I.D. Mat'l. Hose.

Mfr. & Gun	Fluid Tip	Air Cap
Binks #18 or #62	66	66PB
DeVilbiss P-MGC or JGA	E	704
	approx. .070" I.D.	approx. 9-10 cfm @ 30 psi

Airless: Use 3/8" I.D. Mat'l. Hose.

Mfr. & Gun	Pump*
DeVilbiss JGB-507	QFA-514
Graco 205-591	President 30:1 or Bulldog 30:1
Binks Model 500	Mercury 5C

*Teflon packings are recommended and available from pump manufacturer.

Use a .021-.026" tip with 1800-2200 psi.

BRUSH: Use brush for small areas or touchup. Brush out well using full strokes and avoid rebrushing.

DRYING TIMES:

	Minimum	Temperature	Maximum*
Between coats:	72 hours @	60°F (16°C)	15 days
	36 hours @	75°F (24°C)	7 days
	24 hours @	90°F (32°C)	5 days

Final cure: *Depends on topcoat used, but must be at least maximum between coat dry time.

CLEAN UP: Use Carboline Thinner #2 or xylol.

STORAGE CONDITIONS:
Temperature: 40-110°F (4-43°C)   Humidity: 0-100%

For more detailed information please consult specific Carboline Application Guides.

CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

350 HANLEY INDUSTRIAL COURT • ST. LOUIS, MO. 63144 • 314-644-1000

SELECTION DATA

GENERIC TYPE: Modified phenolic. Part A and Part B mixed prior to application.

GENERAL PROPERTIES: A unique high solids tank lining system. Resists fresh and brine water and caustic solutions. A three coat system; 5 mils per coat (125 microns), of Phenoline 368 has good abrasion and excellent thermal shock and radiation resistance. Baking with special equipment to effect cure is not necessary. Application can be made at job site.

RECOMMENDED USES: A three coat Phenoline 368 system is recommended for lining tanks and vessels holding concentrated caustic (up to 50%). Also suitable for hot brine and salt water containment. Having outstanding radiation resistance, Phenoline 368 systems are used in the nuclear field for lining steel and concrete tanks for severe exposures. Used in many industries, including chemical processing, pulp and paper, utility and power, petroleum, marine. For high purity demineralized water, we recommend Phenoline 368 WG Finish.

NOT RECOMMENDED FOR: Immersion in acids or solutions with pH less than 6.

CHEMICAL RESISTANCE GUIDE:

Exposure	Immersion
Acids	N.R.
Alkalies	Excellent
Solvents	Excellent
Salt	Excellent
Water	Excellent

TEMPERATURE RESISTANCE: (Non-immersion)

Continuous:	200°F (93°C)
Non-continuous:	250°F (121°C)

Immersion temperature depends on solution, but should not exceed 180°F (82°C). All tanks must be insulated if the temperature exceeds 140°F (60°C).

SUBSTRATES: Apply over suitably primed metals, or properly primed or surfaced concrete. Others as recommended.

TOPCOAT REQUIRED: Normally none. Phenoline 372 Finish may be used over Phenoline 368 Finish to upgrade resistance and/or in contact with food products.

COMPATIBILITY WITH OTHER COATINGS: May be applied over catalyzed epoxies, phenolics or others as recommended. Acceptable primer is Phenoline 368 Primer.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
Phenoline 368 Finish	75% ± 1%

RECOMMENDED DRY FILM THICKNESS PER COAT: 5 mils (125 microns)

THEORETICAL COVERAGE PER MIXED KIT* (1.25 gals.):
1504 mil sq. ft. (29.4 sq.m/1 @ 25 microns)
301 sq. ft. at 5 mils (5.9 sq.m/1 @ 125 microns)

*NOTE: Material losses during mixing and application will vary and must be taken into consideration when estimating job requirements.

SHELF LIFE: Phenoline 368 Finish Part A — 12 mos.
Phenoline 368 Finish Part B — 24 mos.

COLORS: Gray 707 (Dark), or Gray 773 (Light) only.

GLOSS: Medium

ORDERING INFORMATION

Prices may be obtained from Carboline Sales Representative or Main Office. Terms — Net 30 days.

SHIPPING WEIGHT:

	1's	5's
Phenoline 368 Finish	19 lbs. (8.6 kgs)	86 lbs. (39.0 kgs)
Carboline Thinner #73	9 lbs. (4.1 kgs)	45 lbs. (20.4 kgs)

FLEXIBILITY: Poor WEATHERING: Good (chalks)

ABRASION RESISTANCE: Good

FLASH POINT: (Pensky-Martens Closed Cup)

Phenoline 368 Finish Part A	72°F (22°C)
Phenoline 368 Finish Part B	40°F (4°C)
Carboline Thinner #73	38°F (3°C)

...instructions should be followed closely to obtain the maximum service from the materials.

SURFACE PREPARATIONS: Remove any oil or grease from surface to be coated with clean rags soaked in Carboline Thinner #2 or Toluol.

Steel: Apply over clean, dry recommended primers.

Concrete: Do not coat concrete treated with hardening solutions unless test patch indicates satisfactory adhesion. Do not apply coating unless concrete has cured at least 28 days @ 70°F (21°C) and 50% RH or equivalent time.

Apply over clean, dry recommended surfacer or primer.

MIXING: Mix separately, then combine and mix in the following proportions.

	1-Gal. Kit	5-Gal. Kit
Phenoline 368 Finish Part A	1 Gal.	5 Gal.
Phenoline 368 Finish Part B	1 Qt.	1 - 5 Qt. Unit

Thin up to 30% by volume with Carboline Thinner #73.

POT LIFE: 2 hours at 75°F (24°C) and less at higher temperatures. Pot life ends when coating loses body and begins to sag.

APPLICATION TEMPERATURES:

	Material	Surfaces
Normal	65-85°F (18-29°C)	65-85°F (18-29°C)
Minimum	60°F (16°C)	60°F (16°C)
Maximum	95°F (35°C)	120°F (49°C)

	Ambient	Humidity
Normal	65-90°F (18-32°C)	30-70%
Minimum	60°F (16°C)	0%
Maximum	120°F (49°C)	85%

Special thinning and application techniques may be required above or below normal condition.

SPRAY: Use adequate air volume for correct operation. Hold gun 8-10 inches from the surface and at a right angle to the surface.

Use a 50% overlap with each pass of the gun. On irregular surfaces, coat the edges first, making an extra pass later.

NOTE: The following equipment has been found suitable, however, equivalent equipment may be substituted.

Conventional: Use 3/8" I.D. Mat'l. Hose.

Mfr. & Gun	Fluid Tip	Air Cap
Binks #18 or #62	66	66 PE
DeVilbiss P-MBC or JGA	E	704
	approx .070" I.D.	approx 9-10 cfm @ 30 psi

Airless: Use 3/8" I.D. Mat'l. Hose.

Mfr. & Gun	Pump*
DeVilbiss JGB-507	QFA-514
Graco 205-591	President 30:1 or Bulldog 30:1
Binks Model 500	Mercury 5C

*Teflon packings are recommended and available from pump manufacturer. Use a .021-.026" tip with 1800-2200 psi.

BRUSH OR ROLLER: Brush out well using full strokes and avoid rebrushing. Use brush for small areas or touchup only.

DRYING TIMES:

Between coats:	Minimum	Maximum*
	6 days @ 50°F (10°C)	30 days
	72 hours @ 60°F (16°C)	15 days
	36 hours @ 75°F (24°C)	7 days
	24 hours @ 90°F (32°C)	5 days

*If maximum cure time between coats is exceeded, special surface preparation may be required.

Final cure: (For immersion)
40 days @ 50°F (10°C)
20 days @ 60°F (16°C)
10 days @ 75°F (24°C)
7 days @ 90°F (32°C)

Force curing is suggested for tank linings.

Excessive film thickness or poor ventilating conditions require longer dry times and in extreme cases may cause premature failure.

Excessive humidity or condensation on the surface during curing may result in a surface haze or blush. This should be removed by water washing before recoating. In extreme conditons, this can interfere with the cure of the coating.

CLEAN UP: Use Carboline Thinner #2 or xylol.

STORAGE CONDITIONS:

Temperature: 40-110°F (4-43°C) Humidity: 0-100%

For more detailed information please consult specific Carboline Application Guides.

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CAUTION: CONTAINS FLAMMABLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS WORKMEN MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKMEN SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NONSPARKING SHOES.

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Steel Structures Painting Council
Surface Preparation Specifications

No. 5 White Metal Blast Cleaning

1. Scope

1.1 This specification covers the procedure required for the White Metal Blast Cleaning of structural steel surfaces prior to painting or coating.

2. Definition

2.1 White Metal Blast Cleaning is a method of preparing metal surfaces for painting or coating by removing all mill scale, rust, rust-scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels.

2.2 A White Metal Blast Cleaned Surface Finish is defined as a surface with a gray-white, uniform metallic color, slightly roughened to form a suitable anchor pattern for coatings. The surface, when viewed without magnification, shall be free of all oil, grease, dirt, visible mill scale, rust, corrosion products, oxides, paint, or any other foreign matter. The color of the clean surface may be affected by the particular abrasive medium used. Photographic or other visual standards of surface preparation may be used as provided in the Appendix to further define the surface if specified in the contract.

3. Procedures

3.1 White Metal Blast Cleaning shall consist of the following sequence of operations:

3.1.1 Heavy deposits of oil or grease shall be removed by the methods outlined in Spec. SSPC - SP 1-63, "Solvent Cleaning." Small quantities of oil or grease may be removed by the blast cleaning operation. If oil and grease are removed by blast cleaning, the abrasive shall not be reused if such reuse is detrimental to the surface.

3.1.2 Excessive rust-scale may be removed by impact tools, as outlined in Spec. SSPC-SP 2-63, "Hand Tool Cleaning," Spec. SSPC-SP 3-63, "Power Tool Cleaning" or by special blast cleaning equipment.

3.1.3 The surface shall be blast cleaned to a White Metal Finish by any of the following methods:

3.1.3.1 Dry sandblasting using compressed air blast nozzles and dry sand of a maximum particle size no larger than that passing through a 16 mesh screen, U. S. sieve series.

3.1.3.2 Wet or water-vapor sandblasting using compressed air blast nozzles, water and sand of a maximum particle size no larger than that passing through a 16 mesh screen, U. S. sieve series.

3.1.3.3 Grit blasting using compressed air blast nozzles and crushed grit made of cast iron, malleable iron, steel, or synthetic grits other than sand, of a maximum particle size no larger than that passing through a 16 mesh screen, U. S. sieve series. The largest commercial grade of metal grit permitted by this specification is SAE No. G-25 abrasive material.

3.1.3.4 Shot blasting using compressed air nozzles and cast iron, malleable iron, steel, or synthetic shot of a maximum size no larger than that passing through a 16 mesh screen, U. S. sieve series. The largest commercial grade permitted by this specification is SAE No. S-330.

3.1.3.5 Closed, recirculating nozzle blasting using compressed air, vacuum, and any of the preceding abrasives.

3.1.3.6 Grit blasting using centrifugal wheels and crushed grit made of cast iron, malleable iron, steel, or synthetic grits of a maximum particle size no larger than that passing through a 16 mesh screen, U. S. sieve series. The largest commercial grade of metal grit permitted by this specification is SAE No. G-25.

3.1.3.7 Shot blasting using centrifugal wheels and cast iron, malleable iron, steel, or synthetic shot of a maximum particle size no larger than that passing through a 16 mesh screen, U. S. sieve series. The largest commercial grade permitted by this specification is SAE No. S-330.

3.2 The surface, if dry blasted, shall be brushed with clean brushes made of hair, bristle or fiber, blown off with compressed air (from which detrimental oil and water have been removed), or cleaned by vacuum, for the purpose of removing any traces of blast products from the surface, and also for the removal of abrasive from pockets and corners.

3.3 The surface, if wet sandblasted, shall be cleaned by rinsing with fresh water to which sufficient corrosion inhibitor has been added to prevent rusting, or with fresh water followed by an inhibitive treatment. This cleaning shall be supplemented by brushing, if necessary, to remove any residue.

3.4 The compressed air used for nozzle blasting shall be free of detrimental amounts of condensed water or oil. Adequate separators and traps shall be provided.

3.5 Blast cleaning operations shall be done in such a manner that no damage is done to partially or entirely completed portions of the work.

3.6 Dry blast cleaning operations shall not be conducted on surfaces that will be wet after blast cleaning and before painting, or when ambient conditions are such that any visible rusting occurs before painting or coating.

If any rust forms after blast cleaning, the surface shall be reblast cleaned before painting.

3.7 The blast cleaned surface shall be examined for any traces of oil, grease, or smudges. If present, they shall be removed as outlined in Spec. SSPC - SP 1-63, "Solvent Cleaning."

3.8 The height of profile of the anchor pattern produced on the surface shall be limited to a maximum height that will not be detrimental to the life of the paint film. The maximum particle sizes specified in paragraphs 3.1.3.1 to 3.1.3.7 may produce an anchor pattern that is too high or too rough for the paint system to be used. In such cases the abrasive sizes should be reduced. If the application of the second coat of paint is deferred, an adequate reduction in anchor pattern height shall be made.

3.9 The height of the anchor pattern can be determined by grinding a flat spot on the blasted surface until the bottoms of the pits are almost reached. The height may then be measured with a micrometer depth gauge graduated to read 0.001" and with a base having a bearing length of two inches and a measuring rod of 3/32" diameter.

3.10 The blast cleaned surface should be further treated or primed, as specified in the agreement covering the work, preferably within 24 hours after blast cleaning when practicable, but in any event before any visible or detrimental rusting occurs. (See Section 3.6 and Appendix A. 7)

Where chemical contamination of the surface may occur, the steel should be painted as soon as possible after blast cleaning.

4. Safety Precautions

4.1 If fire or explosion hazards are present, proper precautions shall be taken before any work is done. If the structure previously contained flammable materials, it shall be purged of dangerous concentrations.

4.2 Nozzle blast operators exposed to blast dust shall wear a U. S. Bureau of Mines approved helmet connected to a source of clean, compressed air.

4.3 Filter type air respirators should be worn by all others who are exposed to blast dust environment. Adequate protection for personnel from flying particles shall also be provided in any blasting operation.

4.4 Safety goggles shall be worn by all persons near any blasting operation.

4.5 Blast hose shall be grounded to dissipate static charges.

5. Inspection

5.1 All work under this specification shall be subject to inspection by the owner or his representative. All parts of the work shall be accessible to the inspector. The contractor shall correct such work as is found defective under the specifications. If the contractor does not agree with the inspector, the arbitration or settlement procedure established in the contract, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

Appendix

A.1 SCOPE. The recommendations contained in this appendix are believed to represent current good practice, but are not to be considered as requirements of the specification.

A.2 White Metal Blast Cleaning should be employed when the protective coating or environment is such that no rust, mill scale, or other foreign matter can be tolerated on the surface of the steel. The cost of attaining such cleaning will be high as compared to the less critical Near-White Blast Cleaning or Commercial Blast Cleaning which may be adequate for most conditions.

In White Metal Blast Cleaning, the cleaning rate and subsequent costs are subject to wide variations due to the difficulty of removing all rust, mill scale, paint, etc. from the various surfaces that may be encountered. The final surfaces will be uniform in their degree of cleanliness, despite great differences in the original surfaces.

A.3. When this specification is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned in accordance with this specification and the amount of spot cleaning required. In maintenance painting it is not ordinarily intended that sound, adherent old paint be removed unless it is excessively thick or inflexible.

In preparing a previously painted surface, it is necessary to remove all corrosion and all paint which shows evidence of corrosion, peeling, excessive thickness, brittleness, blistering, checking, scaling or general disintegration. It is essential that the removal of the old paint be carried back around the edges of the spot or area until an area of completely intact and adhering paint film, with no rust or blisters underneath, is attained. Edges of tightly adherent paint remaining around the area to be recoated must be feathered, so that the repainted surface can have a smooth appearance. The remaining old paint should have sufficient adhesion so that it cannot be lifted as a layer by inserting a blade of a dull putty knife under it. The rate of blast cleaning may vary from one area to the next, in order to achieve the desired end condition.

A.4 The maximum permissible size of the abrasive particles will depend upon the allowable surface roughness or "maximum height of profile" of the surface; the allowable maximum height of profile is, in turn, dependent upon the thickness of paint to be applied.

The maximum height of profile is the height of the anchor pattern produced on the surface, measuring from the bottoms of the lowest pits to the tops of the highest peaks.

A typical maximum height of profile produced by a number of different abrasives in actual blast cleaning operations has been measured as follows:

Abrasive	Maximum Particle Size	Maximum Height of Profile
Sand, very fine	through 80 mesh*	1.5 mils
Sand, fine	through 40 mesh	1.9
Sand, medium	through 18 mesh	2.5
Sand, large	through 12 mesh	2.8
**Steel grit #G-80	through 40 mesh	1.3–3.0
***Iron grit #G-50	through 25 mesh	3.3
Iron grit #G-40	through 18 mesh	3.6
Iron grit #G-25	through 16 mesh	4.0
Iron grit #G-16	through 12 mesh	8.0
**Steel shot #S-170	through 20 mesh	1.8–2.8
Iron shot #S-230	through 18 mesh	3.0
Iron shot #S-330	through 16 mesh	3.3
Iron shot #S-390	through 14 mesh	3.6

*U.S. Sieve Series. **Operating Mixtures.
***Crushed iron grit. A comparator available from SSPC is useful in estimating sand blast profile depth.

Maximum profile will vary somewhat with the angle and velocity of particle, with the hardness of surface, with the amount of recycling of working mixtures (of shot and grit) and with the thoroughness of blast cleaning.

A.5 The dry paint film thickness above the peaks of the profile should equal the thickness known to be needed over a smooth surface for the desired protection. If it is not possible to use an abrasive sized small enough to produce a desirable height of profile, the dry paint film thickness should be increased to provide adequate thickness above the peaks.

A.6 A suitable inhibitive treatment for blast cleaned surfaces is water containing 0.32 per cent of sodium nitrite and 1.28 per cent by weight of ammonium phosphate, secondary (dibasic), or as an alternate water containing about 0.2 per cent by weight of (a) chromic acid or (b) sodium chromate or (c) sodium dichromate or (d) potassium dichromate. Note: If solutions containing either chromates or dichromates are used, precautions should be taken to protect personnel from hazards resulting from breathing spray or contacting the solution.

A.7 The blast cleaned surface must be treated or primed before any rusting occurs, otherwise the benefit of the White Metal Blast Cleaning is lost. The freshly exposed bare metal will rust quickly under conditions of high humidity, when wet, or when in a corrosive atmosphere. Under normal mild atmospheric conditions it is best practice to prime or chemically treat within 24 hours after blast cleaning. Under no circumstances should the steel be permitted to rust before painting, regardless of the time elapsed.

Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is therefore recommended that dry blast cleaning should not be conducted when the steel surface is less than 5°F above the dew point.

The permissible time interval between blast cleaning and priming will vary greatly (from minutes to weeks) from one environment to another, in order that the surface remain free of corrosion, oil, etc. as required by Sections 3.6, 3.7, and 3.10. If a maximum interval is desired it shall be so specified in the contract covering the work.

A.8 Photographic standards of comparison may be used to define the final surface condition to be supplied under this specification. For intact mill scale, for partially rusted mill scale, for completely rusted mill scale, or for completely rusted and pitted surfaces, the appearance of the surface after White Metal Blast Cleaning should correspond with pictorial standards A Sa 3, B Sa 3, C Sa 3, or D Sa 3 of SSPC-Vis 1-67T.

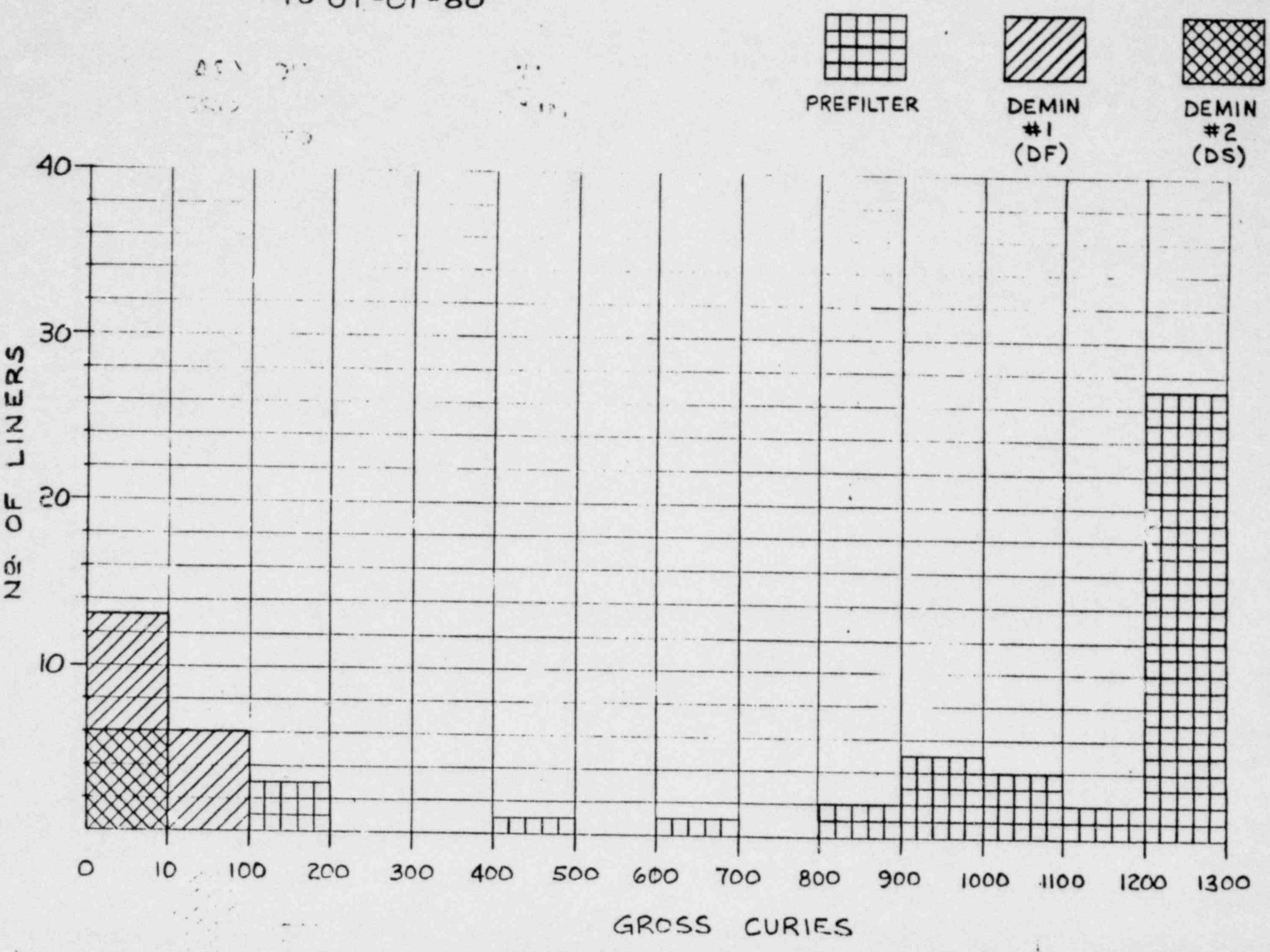
This correlation is cross-referenced in these visual standards, which were developed by the Swedish IVA, and have been mutually adopted by the Swedish Standards Association, the ASTM and the SSPC. As additional standards become available, particularly for initial surface conditions such as previously painted steel, these may be included by reference in the contract.

The color of the cleaned surface may be affected by the nature of the abrasive used.

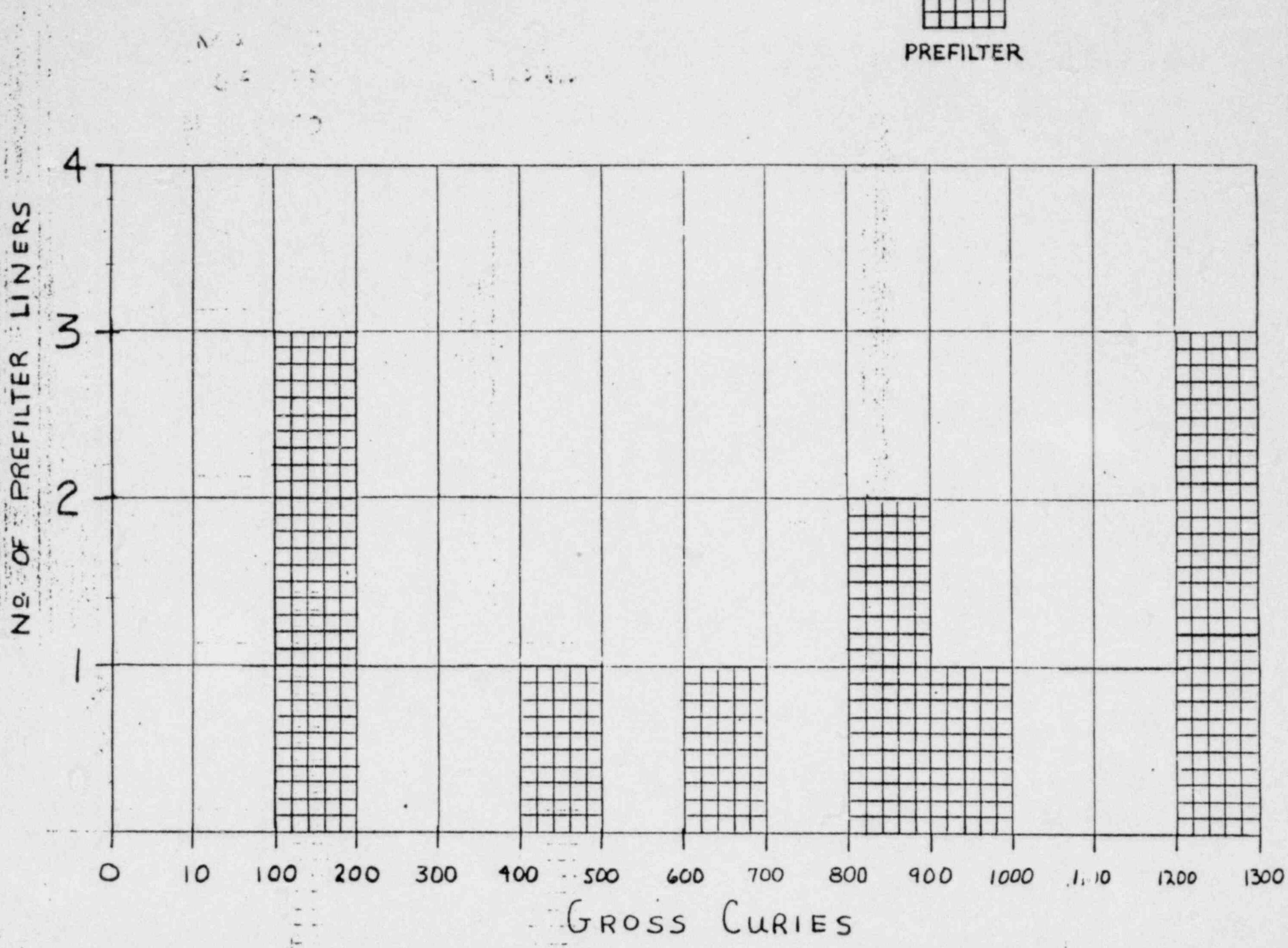
A.9 Other visual standards of surface preparation may be used as required by the owner when they are specified in the contract to illustrate the degree of metal cleanliness required. The owner will provide the specified samples or standards of such size and condition that they may be compared during the entire contract. If blast cleaned steel samples are used, they should be completely protected from corrosion during the period of the contract.

A.10 With the agreement of both contractual parties, examination under magnification or examination by chemical methods may be used in the evaluation of the cleanliness of the surface.

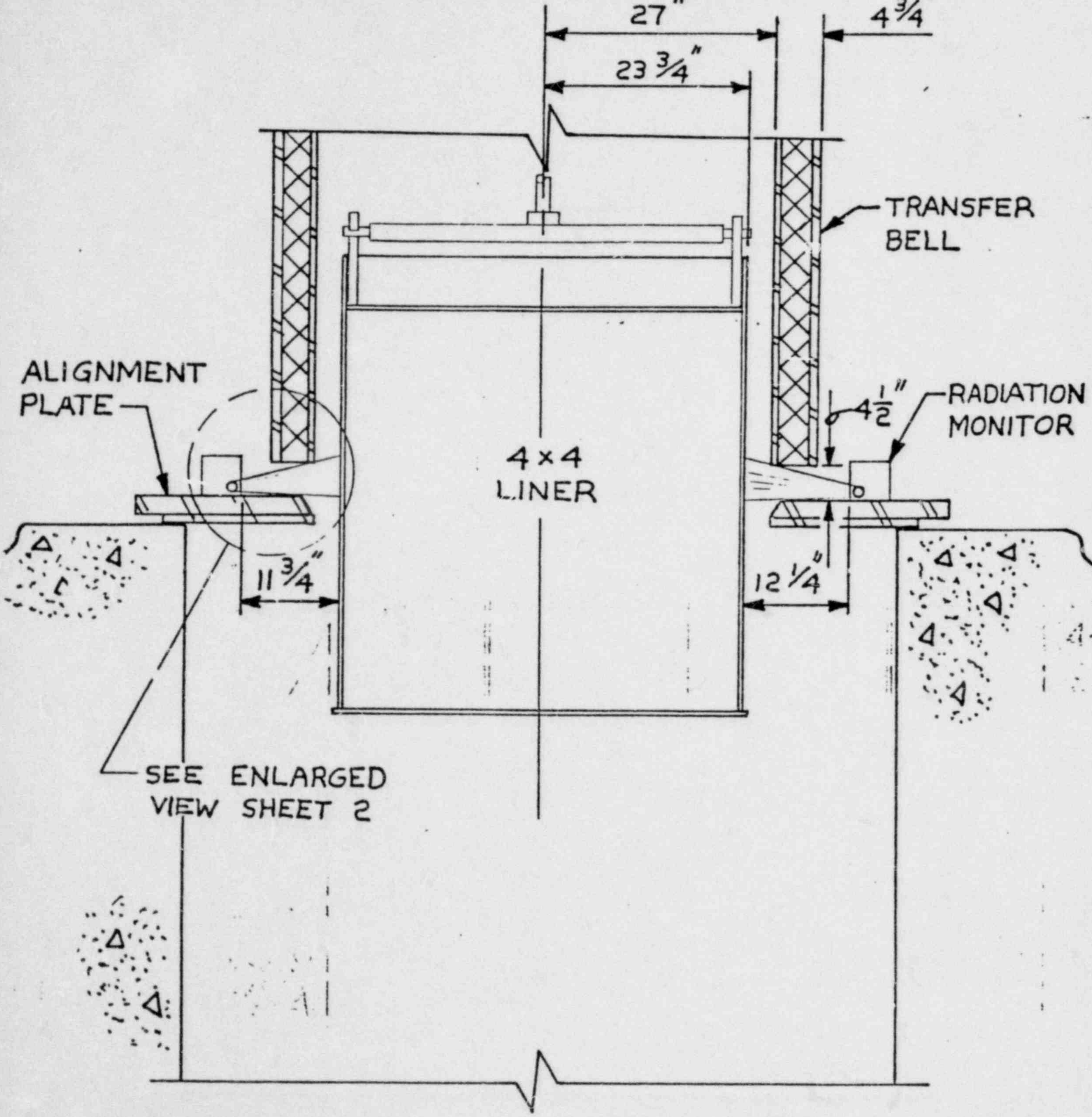
SUMMARY OF 64 EPICOR II LINERS
GROSS CURIE LOADING
TO 07-01-80



SUMMARY OF EPICOR II PREFILTERS 1 THRU 11
GROSS CURIE LOADING
TO 07-01-80



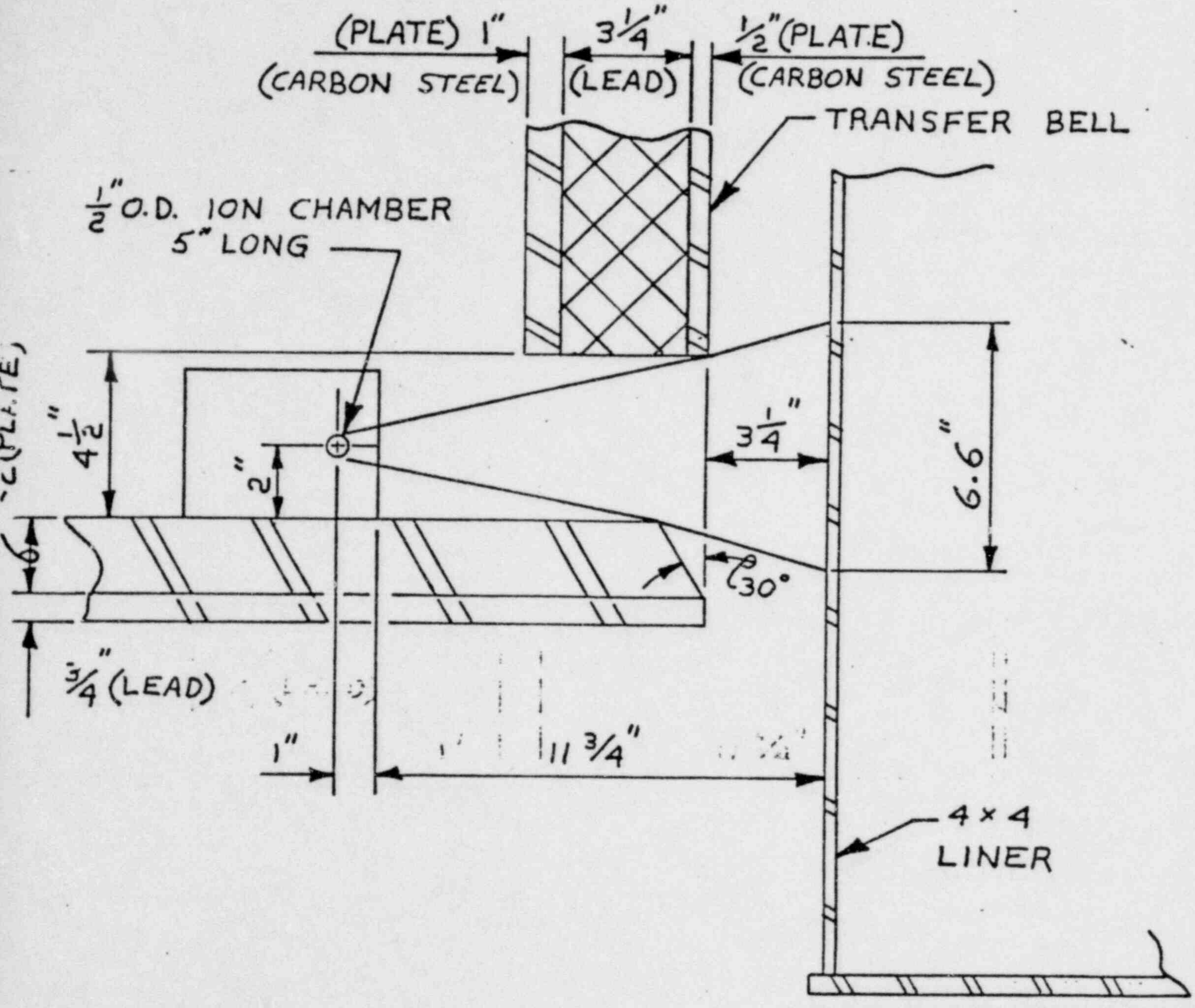
EPICOR II RADWASTE SYSTEM GEOMETRY OF RADIATION SURVEY METER



SCALE: 3/4" = 1'-0"
JAS

SHEET 1 OF 2

EPICOR II RADWASTE SYSTEM GEOMETRY OF RADIATION SURVEY METER

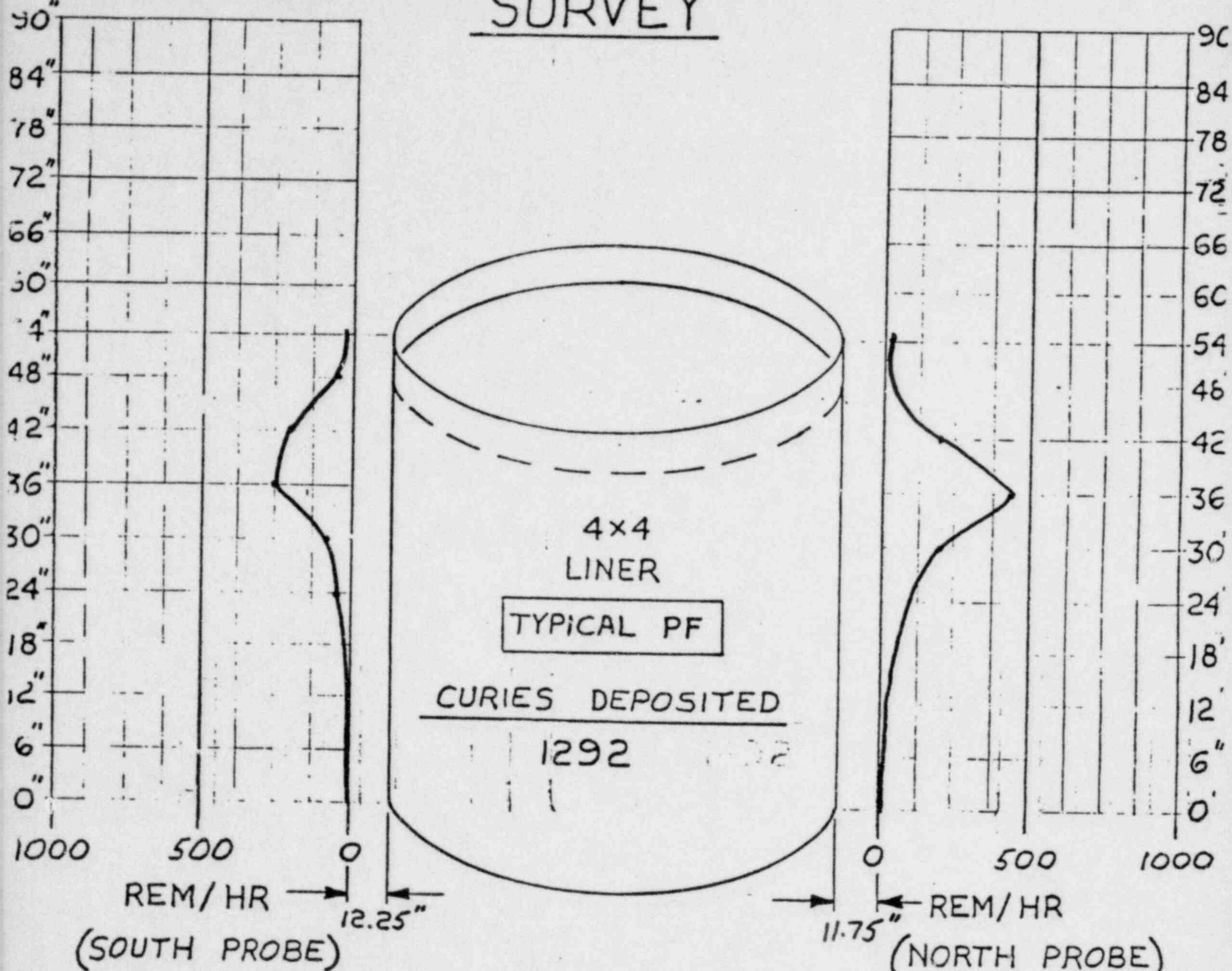


SCALE: 3" = 1'-0"

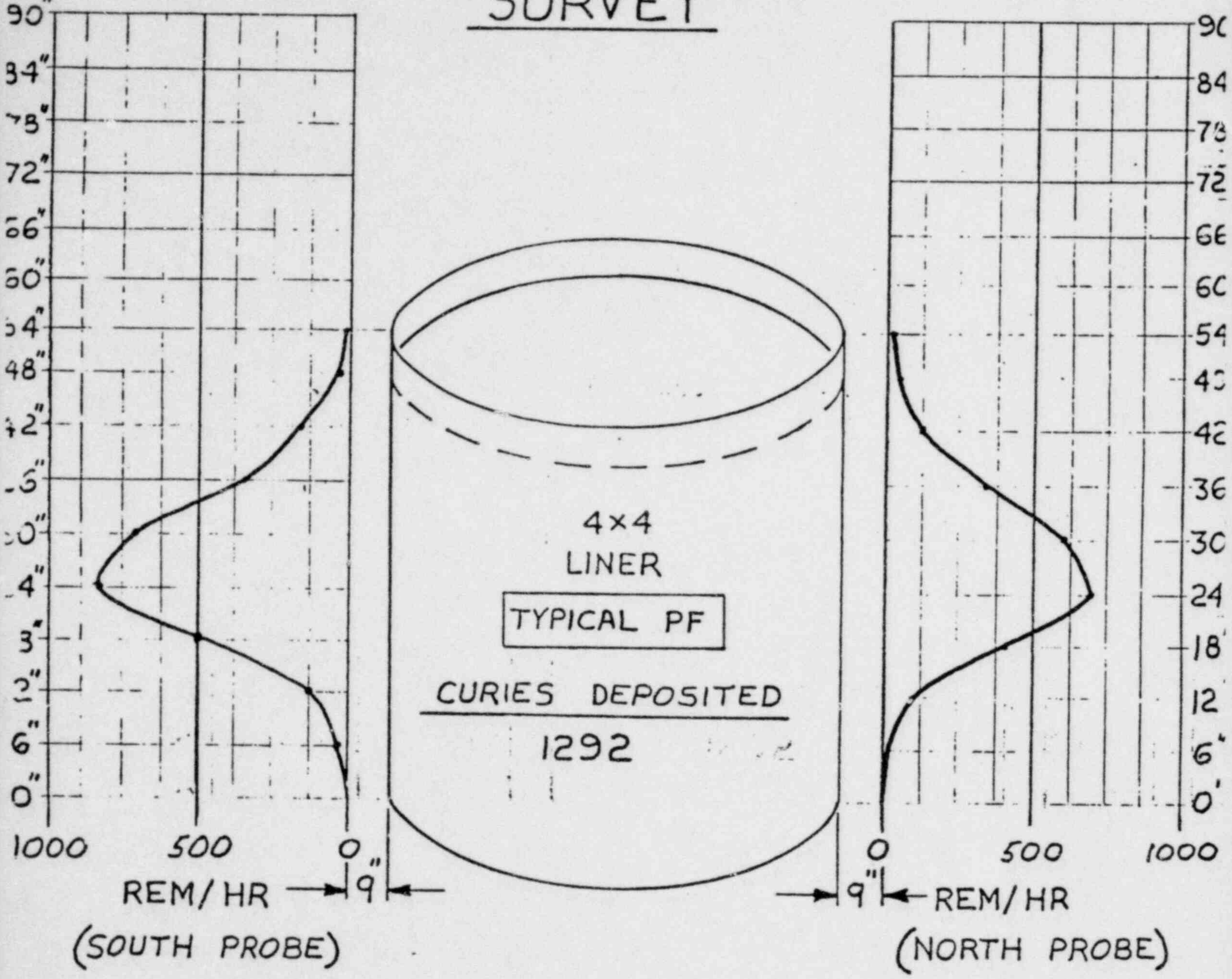
JAS

SHEET 2 OF 2

EPICOR II RADWASTE SYSTEM TYPICAL PREFILTER RADIATION SURVEY



EPICOR II RADWASTE SYSTEM TYPICAL PREFILTER RADIATION SURVEY



EPICOR II RESIN IRRADIATION DATA

This data is proprietary to Epicor Inc. and is forwarded to the NRC under separate cover.

PLASITE
REG. U.S. PAT. OFF.
No.
7155

Technical Bulletin **M-7**

5-1-73 (Replaces M-7, 2-1-68)

HI-RESISTANT HEAVY BUILD PROTECTIVE COATING

TYPE — A water resistant phenolic coating cross linked with epoxy resin and polymerized with an alkaline type curing agent.

INTENDED USE — This material is primarily a tank lining for water, including low conductivity deionized or distilled water at elevated temperatures as well as use with brines and other aqueous solutions. This material has excellent solvent resistance. This coating has 18 years excellent field history as a lining for tanks holding 180° to 190° F. deionized water.

TEMPERATURE RESISTANCE — Dry Film basis is 400° F. for short periods. Continuous immersion temperatures depend on particular reagent and temperatures.

SURFACE PREPARATION — Steel surfaces should be prepared by blasting to white metal since this coating is intended for use in immersion service.

APPLICATION — Plasite No. 7155 is formulated for use as a Spray or Brush applied coating.

COLORS — Standard colors ivory - black - light gray - clear - light green.

FILM THICKNESS PER COAT — A 3 to 5 mil film produced in one multi-pass continuous spray coat. (Approximately a 1 to 2 mil film may be produced in one "flow on" brush coat.)

COVERAGE — For estimating purposes — 100 sq. ft. per gal. will produce a 3 to 4 mil film. Three multi-pass spray coats will produce an 8 to 10 mil film for immersion service. Under ideal conditions and when large areas are being sprayed this film can normally be produced in two multi-pass spray operations.

DRYING TIME — Surface will normally be tack free in two to three hours at 70° F.

CURING TIME — 4 to 7 days at 70° F. to 90° F. Refer to Page 2 for force curing.

PHYSICAL SPECIFICATIONS

PIGMENTS — Titanium dioxide, carbon black and inerts.

SOLIDS — 38% by Wt. 28% by Vol.

POT LIFE — Approx. 8 to 12 hrs. at 70° F.

SHELF LIFE — 12 Months.

SPRAY VISCOSITY — 14 seconds (±) 3, Ford Cup #4 depending on color.

SHIPPING WT. — Approximately 11 lbs. per gallon.

ELECTRICAL RESISTANCE — 30.5×10^{10} OHMS/CM²/CM Volume Resistivity ASTM D257-58.

ABRASIVE RESISTANCE — Tabor, 156 Miligrams per 1000 cycles, 1000 Gram Weight. CS-17 Wheel Ivory color.

HARDNESS — SWARD — 30.

THERMAL SHOCK — Unaffected 5 cycles — 70° F. to 200° F.

NOTE: Above tests were conducted on films applied to cold rolled steel, cured at 150° F. for six hours.

ZONE OF USAGE

A ZONE — This would include immersion service for process and storage vessels. A film thickness of 8 to 10 mils required.

CHEMICAL RESISTANCE

The following list of laboratory tests is an indication of the range of chemical resistance. These tests consist of 1" x 5" mild steel test panels coated to a film thickness of 8 to 10 mils. The panels are one-half immersed in the solution at temperatures of 70° to 80° F. for a period of six months with no effect on the coating, unless otherwise stated.

ACIDS	ALKALIES	SOLVENTS	MISCELLANEOUS
50% CITRIC	10% Potassium Hydroxide	Perchlorethylene	Distilled Water - 212° F.
25% Boric	Sat. Sodium Carbonate	Chlorethene	Conc. Brine - Boiling
*20% Sulphuric Acid		Toluol	Ammonium Nitrate
*Conc. Hydrochloric		Xylol	Magnesium Chloride
*24 Hour Exposure		Alcohol - Ethyl, Decyl, Isobutyl	Ferric Chloride
		Aliphatic & Aromatic Hydrocarbons	Sodium Chlorate

*See Note on Page 2

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