EO #2860

ATCOR

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November 29, 1978

Mr. Robert L. Baer, Chief
Light Water Reactors
Branch No. 2
Division of Project Management
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Answers to Questions and Request for Additional Information for ATCOR Topical Report No. ATC-132-A

Reference: NRC Letter Dated September 19, 1978, Request for Additional Information

Dear Mr. Baer:

The enclosed information is provided in response to questions asked within the above referenced letter.

Please note that the response to Question number 1 is furnished on enclosed ATCOR PI&D Drawing 2344-D-01 (Sheet 1 and 2).

Should you have any further questions relating to the above noted subject, please do not hesitate to contact me.

Very truly yours,

Martin Brownstein

Martin Brownstein
Director
ATCOR Washington Inc.

MB:rk

Attachments: ATCOR PI&D Drawing 2344-D-01 (Sheet 1 & 2)
ATCOR Drawing SKD 2386-02 & SKD 2443-01
(3 copies each)
Response to Questions (30 copies each)

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NONE
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30/30
3 DRWGS

2. ATCOR Radwaste Solidification System Process Capacity

Drums Per Year Using Specific BWR Solid Waste Type Projections

a) Resin (Solid) Waste = 4,000 Cu.Ft./Yr. (1) ÷ 2* = 2,000 Cu.Ft./Yr.

b) Filter/Demin. Sludge = 19,500 Cu.Ft./Yr. (1) ÷ 2* = 9,750 Cu.Ft./Yr.

c) Liquid Waste prior to Volume Reduction (1) =
25550 Cu.Ft./Yr. ÷ 2* = 12,750 Cu.Ft./Yr.
*Used 1/2 of the solidified waste volume to obtain unsolidified annual volumes.

1a. Calculate annual drums containing ATCOR Resin/Cement mix and filling 55 gal. drum to 97%.
2,000 Cu.Ft./Yr. ÷ 5.348 Cu.Ft. Waste/Drum = 374 drums/yr.

1b. Calculate annual drums containing ATCOR Sludge/Cement mix and filling 55 gal. drum to 97%.
9,750 Cu.Ft./Yr. ÷ 5.348 Cu. Ft. Waste/Drum = 1,823 drums/yr.

1c. Calculate annual drums containing ATCOR Liquid Waste/Cement mix and filling drum to 97%.
25,500 Cu. Ft./Yr. x 75% volume reduction = 19,125 Cu. Ft./Yr. of 25% Wt. concentrated waste.
19,125 Cu.Ft./Yr. ÷ 5.348 Cu. Ft. Waste/Drum = 3,576 Drums/Yr.

Drums Per Year Using Specific PWR Solid Waste Type Projections

Resin (Solid) Waste = 1,350 Cu.Ft./Yr. (1) ÷ 2* = 675 Cu.Ft./Yr.
Liquid Waste prior to Volume Reduction (1) =
30,700 Cu.Ft./Yr. ÷ 2* = 15,350 Cu.Ft./Yr.
* Used 1/2 of the solidified waste volume to obtain unsolidified annual volumes.

2a. Calculate annual drums containing ATCOR Resin/Cement mix and filling 55 gal. drum to 97%.
675 Cu.Ft./Yr. ÷ 5.348 Cu.Ft. Waste/Drum = 126 Drums/Yr.

2b. Calculate annual drums containing ATCOR Liquid Waste/Cement mix and filling drum to 97%.
15,350 Cu.Ft./Yr. x 75% volume reduction = 11,513 Cu.Ft./Yr. of 25% Wt. concentrated waste.
11,513 Cu.Ft./Yr. ÷ 5.348 Cu.Ft. Waste/Drum = 2,153 Drums/Yr.

References

1. Assume Plant capacity of 1000 MWe.

2. From AIF/NESP-008-008ES, Oct. 1976, Page 17,

   Table 9

   a) Solidified Liquid 25.5 Cu.Ft./MWe x 1000 MWe = 25,500 Cu.Ft.

   b) Resin 4.0 Cu.Ft./MWe x 1000 MWe = 4000 Cu.Ft.

   c) Filter/Demin. Sludge 19.5 Cu.Ft/MWe x 1000 MWe = 19,500 Cu.Ft.

   Table 10

   a) Solidified Liquid 30.7 Cu.Ft./MWe x 1000 MWe = 30,700 Cu.Ft.

   b) Resin 2.7 Cu.Ft/MWe x 1000 MWe = 27,000 Cu.Ft.

3. AIF/NESP-008-008ES, Oct. 1976, per Table 3, Page 6 - generated waste is approximately 1/2 the value of solidified waste; therefore, to obtain unsolidified waste volume; for example: 30,700 ÷ 2 = 15,350 Cu.Ft./Yr. liquid waste, this waste quantity to be further concentrated through the plant evaporator to obtain final 25% wt. concentrations.

AIF/NESP-008
-008ES

National
Environmental
Studies
Project

NESP

A Survey and Evaluation of Handling and Disposing of Solid Low-Level Nuclear Fuel Cycle Wastes

Atomic Industrial Forum, Inc. AIF

given in the Appendix, and a summary of the radwaste volumes by type is given in Table 3. For comparison, PWRs were separatec into two categories: (1) those plants with a condensate polishing system (CPS), and (2) those without such a system. Future plants were selected to provide information on most combinations of NSSS vendors and architect-engineers.

TABLE 3. SUMMARY OF ANNUAL PWR RADWASTE VOLUMES BY TYPE

	PWR Solid Radwaste Type				
Parameters	Liquid	Resin	Filters	Contaminated Trash	Total Waste
Operating Plants					
1. Plants with CPS[a]					
a. Generated Waste, ft³/MWe/yr	12.8	0.4	0.2	7.4	20.8
b. Buried/Generated[c]	2.2	1.3	–	–	1.7
c. Solidified Waste, ft³/MWe/yr[b]	28.4	0.7	0.2	7.4	36.7
d. Percent of Total[d]	62%	2%	1%	36%	–
e. Sources of Waste[e]					
Waste/Boric Acid	50%/50%				
RCS		40%			
SFPCS		10%			
CPS		N/D			
Radwaste		50%			
2. Plants without CPS[f]					
a. Generated Waste, ft³/MWe/yr	8.3	1.1	0.5	6.0	15.9
b. Buried/Generated[c]	2.1	1.2	–	–	1.6
c. Solidified Waste, ft³/MWe/yr[b]	18.4	2.0	0.5	6.0	26.9
d. Percent of Total[d]	52%	7%	3%	38%	–
e. Sources of Waste[e]					
Waste/Boric Acid	65%/35%				
RCS		52%			
SFPCS		10%			
BRS		N/D			
Radwaste		38%			
Future Plants					
1. Plants with CPS[a] (PSARs)					
a. Generated Wastes, ft³/MWe/yr	2.5	0.8	0.7	1.8	5.8
b. Buried/Generated[c]	1.8-3.6	1.5-2.7	–	–	–
c. Solidified Waste, ft³/MWe/yr[b]	5.5	1.6	0.9	1.8	9.8
d. Percent of Total[d]	43%	14%	12%	31%	–
2. Plants without CPS[f] (PSARs)					
a. Generated Waste, ft³/MWe/yr	8.4	0.4	0.7	1.7	11.2
b. Buried/Generated[c]	N/D	N/D	N/D	N/D	N/D
c. Solidified Waste, ft³/MWe/yr[b]	18.4	0.8	0.7	1.7	21.0
d. Percent of Total[d]					
3. Plants with Deep Bed CPS[a] (ERDA 76-43)					
a. Generated Waste, ft³/MWe/yr	11.2	1.2	0.2	2.7	15.3
b. Buried/Generated[c]	N/D	N/D	N/D	N/D	N/D
c. Solidified Waste, ft³/MWe/yr[b]	24.5	2.4	0.2	2.7	29.8
d. Percent of Total[d]	73%	8%	1%	18%	–
4. Plants with Filter/Demin CPS[a] (ERDA 76-43)					
a. Generated Waste, ft³/MWe/yr	0.8	0.7	3.5[h]	2.7	7.7
b. Buried/Generated[c]	N/D	N/D	N/D	N/D	N/D
c. Solidified Waste, ft³/MWe/yr[b]	1.8	1.4	7.0	2.7	12.9
d. Percent of Total[d]	10%	9%	45%	35%	–

NOTES: (a) Plants with CPS are those having a Condensate Polishing System using either deep bed resin or filter/demineralizers.
(b) Solidified Waste is the estimated value based on average volume increase reported by operating plants (excluding shielding).
(c) Buried/Generated is the ratio of waste volume actually buried to that generated based on average volumes reported by operating plants.
(d) Percent of total waste is based on generated waste volumes before solidification.
(e) Sources of waste other than than from waste water or boric acid control are as follows: Reactor Cleanup System (RCS), Spent Fuel Pool Cleanup System (SFPCS), Condensated Polishing System (CPS), Boron Recycle System (BRS), and Radwaste Systems.
(f) Plants without CPS are those that do not have a Condensate Polishing System.
(g) Buried/Generated is waste volume buried divided by volume generated operating plants.
(h) Includes filter/demineralizer sludge.

TABLE 9. SUMMARY OF REFERENCE (DEEP BED RESIN) BWR RADWASTE PARAMETERS

Parameter	Specific BWR Solid Waste Type Projections					Basis
	Solidified Liquid	Resin	Filter/Demin. Sludge	Contaminated Trash	Total	
Design Waste Volume (ft^3/MWe/yr)	25.5	4.0	19.5	6.0	55.0	Table 7
Typical Plant Volume (ft^3/Yr)	25,500	4,000	19,500	6,000	55,000	Plant Size 1000 MWe
Personnel Radiation Exposure (man-rem/yr)	10.8	12.2	48.8	6.0	77.8	Appendix
Shipments Per Year						
6-drum shield	———	23	89	———	112	Average Values
14-drum shield	———	30	153	———	183	Based on Data
Shielded Van	51	———	———	———	51	in Appendix
Unshielded	27	———	———	13	40	
Total	78	53	242	13	386	
Annual Disposal Costs						
6-drum shield	———	$ 45,000	$175,000	———	$220,000	Appendix
14 drum shield	———	68,000	344,000	———	412,000	
Shielded Van	$135,000	———	———	———	135,000	
Unshielded	93,000	———	———	$38,000	131,000	
Total	$228,000	$113,000	$519,000	$38,000	$898,000	

Notes: (1) Volumes per shipment are as follows:
6-drum shield equivalent to $44 ft^3$
14-drum shield equivalent to $103 ft^3$
Shielded van equivalent to $243 ft^3$
Unshielded equivalent to $485 ft^3$
(2) Shipping Distance: 350 miles

TABLE 10. SUMMARY OF REFERENCE (WITH CONDENSATE POLISHING SYSTEM) PWR RADWASTE PARAMETERS

Parameter	Specific PWR Solid Waste Type Projections				
	Solidified Liquid	Resin	Filters	Contaminated Trash	Total
Design Waste Volume (ft^3/MWe/yr)	30.7	2.7	0.6	6.0	40.0
Typical Plant Volume (ft^3/yr)	30,700	2,700	600	6,000	40,000
Personnel Radiation Exposure (man-rem/yr)	15.1	10.0	27.0	6.6	58.7
Shipments Per Year					
6-drum shield	———	36	———	———	36
14-drum shield	———	11	6	———	17
Shield van	63	———	———	———	63
Unshielded	32	———	———	13	45
Total	95	47	6	13	161
Annual Disposal Costs					
6-drum shield	———	$71,000	———	———	$ 71,000
14-drum shield	———	25,000	$14,000	———	39,000
Shielded van	$167,000	———	———	———	167,000
Unshielded	110,000	———	———	$38,000	148,000
Total	$277,000	$96,000	$14,000	$38,000	$425,000

Notes: (1) Volumes per shipment are as follows:
6-drum shield equivalent to 44 ft^3
14-drum shield equivalent to 103 ft^3
Shielded van equivalent to 243 ft^3
Unshielded equivalent to 485 ft^3
(2) Shipping Distance: 350 miles

Response to Question 3.

ATCOR's Quality Control Manual specification no. QCISM-100 which is used for nuclear power plant components and systems has been submitted to the USNRC for review and approval on October 14, 1977. The docket no. is 71-0002 and the control no. is 07953. ATCOR does comply with the USNRC Regulatory Guide 1.143 section 6. Attachment A entitled "Statement of Compliance to Applicable Standards" is furnished as a summary description of ATCOR's Quality Assurance Program and compliance to Section VI of Regulatory Guide 1.143.

ATTACHMENT A

STATEMENT OF COMPLIANCE WITH APPLICABLE STANDARDS

The ATCOR Quality Assurance Program is specifically designed to assure compliance with the U.S. Nuclear Regulatory Commission quality assurance requirements contained within the Code of Federal Regulation 10 CFR 50, Appendix B, USNRC Regulatory Guide 1.143 section 4, and the American National Standard document ANSI N45.2-1971. This program is applied throughout equipment design, fabrication, construction and test phases. It dictates planned and systematic action necessary to provide confidence that components or systems will perform satisfactorily in accordance with design criteria. ATCOR Inc. Sub-Vendor Quality Assurance Programs are reviewed prior to contract issuance to assure conformance with both ATCOR and customer specifications.

The principal elements of the ATCOR Quality Assurance Program, which will be used during the design, manufacture, and testing of ATCOR components and systems are as follows:

Organization - (In compliance with 10 CFR 50, Appendix B, Part 1, 10 USNRC Regulatory Guide 1.143 Section 6)

The Quality Assurance Manager reports directly to the Director of ATCOR and will be assigned autonomous control for the project. He will be responsible for checking, auditing, inspecting or otherwise verifying that an activity has been correctly performed as an independent, divorced from all activities concerned with design, planning, procurement, fabrication or testing of this contract.

Design and Configuration Control - (In compliance with 10 CFR 50, Appendix B, Parts II, III, V and VI, USNRC Regulatory Guide 1.143 section, Section 6 [4.2.3.1 (1), (2) and (3); 4.2.3.2 (1), (2) and (3)]

A system of checks and balances is used to assure design and configuration control. Each design is subjected to the following within the ATCOR system: review, approval, release and distribution prior to design acceptance. Once a design is completed and accepted, it is maintained current in both the central and engineering control files. Support drawings and specifications are similarly kept up to date. If, for any reason, a design change is required during construction, an approval by the Program Manager and the customer (if the change is initiated by ATCOR) is mandatory prior to implementation; thereby, design continuity is maintained. All customer specifications are converted by the Engineering Department into detailed drawings, purchase specifications, fabrication details and test procedures. After the preceding is completed, the Quality Assurance Manager will establish the initial quality control plan. This plan will detail which type of quality assurance program is to be followed, including all special requirements necessary to insure product conformance. Critical dimensions, manufacturing operations or other requirements, which must be independently verified by the ATCOR or subvendor quality control personnel, as well as the customer's inspector during fabrication or assembly, will be specifically identified on the ATCOR Inspection Point Program plan as well as the manufacturing operations control sheets.

Design and Configuration Control (Cont.)

Objective evidence of verification of these items will be provided by quality control personnel with initials by each item as well as on the Dimensional Check, Manufacturing Operations Control, Quality Control Inspector's Check and Inspection Point Program Sheets.

All of the above mentioned documentation is maintained to insure that both contractual and ATCOR quality requirements are fulfilled.

Procurement - (In compliance with 10CFR 50, Appendix B, Parts IV, VII, and VIII, USNRC Regulatory Guide 1.143 Section 6 (4.2.3.1(1), (2) and (3).

The Quality Control Manager will be responsible to review each purchase order for the procurement of equipment for this contract to assure the adequacy of quality requirements. All quality control requirements, including necessary receiving inspections, material certifications and tests, will be provided directly on individual purchase orders and identified by sign-off for compliance to contractual requisite quality requirements. During contracts, unpriced purchase orders (initiated by a sub-vendor) will be reviewed and maintained by both ATCOR and the customer for completeness, (if requested by customer). A sign-off on the ATCOR quality control record copy will be used to assure that the sub-vendor has indeed complied with both ATCOR and customer quality requirements.

Fabrication and Assembly Control - (In conformance with 10 CFR 50, Appendix B, Parts VIII, IX, XIII, XV and XVI, USNRC Regulatory Guide 1.143 Section 6 (4.2.3.1 (2), (3) and 4.2.3.2 (1), (2) and (3).

ATCOR will insure that the selected fabricator (sub-vendor) or ATCOR provide detailed fabrication and assembly documentation (drawings and procedures) and that the previously described quality control requirements are specifically identified and implemented. Each specific quality control requirement will be verified during the manufacturing phase by the sub-vendor's quality control personnel, and where required by ATCOR and customer's inspection personnel. A manufacturing control record and/or "As Built" drawings will be provided to ATCOR, and each item is initialled as it is verified during fabrication by the sub-vendor.

When a deviation from approved specifications, drawings and other documents concerning materials, equipment, etc. is found, approval in the form of a sign-off by ATCOR and the customer shall be required. This approval will not be given until the nonconformance is corrected.

Testing and Inspection - (In conformance with a 10 CFR 50, Appendix B, Parts X, XI, XII, XIV and XV, USNRC Regulatory Guide 1.143 Section 6 (4.2.3.2 (1), (2) and (3).

All test and inspection requirements initiated by the Quality Control and Engineering Departments will be performed to insure adequacy of the manufacturing procedures and to demonstrate that the equivalent design and requisite quality is provided. All data will be checked in accordance with documented procedures. Completed copies of both procedures and results will be included as a part of the final fabrication record.

Records - (In compliance with 10 CFR 50, Appendix B, Parts XVII and XVIII, USNRC Regulatory Guide 1.143 Section 6(4.2.3.1 and 4.2.3.2).

Within three (3) weeks following the final acceptance inspection by ATCOR and the customer, ATCOR will provide a complete set of quality control records to the customer to establish objective evidence of compliance with contractual requirements. The records will be identified by an ATCOR project number and part no. so it can be easily retrieved. The record will include results of reviews and inspections and filed as a total job. This fabrication record will include, but will not be limited to, the following items:

a) If requested by the customer, a material record specifying (1) product form and heat number; (2) correlation of part and test report; and (3) component name or part number. At a minimum a certificate of compliance on materials is required. Marked drawings or annotated bills of material will be used if necessary to satisfy this requirement.

b) Material test reports or other evidence of acceptability (certificate of compliance) for each piece of material.

c) Welding procedure, procedure qualification, welder performance records, and special process procedures.

d) Reports of all inspections and tests, including liquid penetrant examinations, dimensional inspections, and leak tests. Radiographs will be included if radiographic inspection is performed.

e) Reports of any required check analyses, clearly identified with the material they represent.

f) Furnace temperature charts in cases where heat treatment is performed.

g) "As Built" drawings if, for any reason, the fabrication process deviates significantly from the design drawings and the latter drawings do not present a clear and correct description of the construction of the equipment or show proper sizes of materials and location and geometrics of welds.

The fabrication record will be assembled by the manufacturer and kept current at all times. ATCOR and the customer will have access to the record and at regular intervals, ascertain that it is complete and correct by Audit. Any deficiencies found shall promptly be rectified by the manufacturer.

On completion of fabrication and testing, the fabrication record shall be reviewed by the manufacturer and then by ATCOR and the customer. The manufacturer will certify to ATCOR, in writing, that the fabrication is (with noted exceptions) in complete conformity with the contract.

Response to Question 4.

Section 2.1 of NRC Topical Report, ATC-132A, For ATCOR RADIOACTIVE WASTE SOLIDIFICATION SYSTEM does contain some general information on waste conditioning phase of the system operation. It is important to prepare solid waste such as spent resin or filter media with the right quantity of liquid prior to mixing with cement.

We have determined the range (percentage of solid waste to liquid waste) that will produce acceptable solidified products and recommend to our customers that they should use as a guide the mid point of this range.

The liquid waste when solidified in our system using Masonary Cement may contain a wide variance in chemical content without inhibiting or interfering with the solidification process. Discussion of pretreatment of liquid follows:

1. pH - the waste will normally be in excess of 5 and in this event, no preconditioning need to be performed. The waste solidification process can neutralize strong acids with the use of Masonary Cement, but we recommend that any pH less than 5 be adjusted to at least 5.5, but less than 7. This can be accomplished by adding a liquid caustic to the waste. The responsibility of performing pH measurements and chemical additions are plant operating staff functions.

2. Oil - If oils are mixed with aqueous wastes with the oils either emulsified or less than 1% by volume, then solidification with the mixer-feeder in the ATCOR solidification system will produce at this time acceptable waste products for burial. The system can not handle very much free oil. If the oil content is high, it should be phase separated and filtered and released if not contaminated. If the oil cannot be successfully decontaminated by filtering, then it could be absorbed on vermiculite and blended with cement pastes in a separate operation. The presence of oil in the waste would be an abnormal occurrence and must be treated as such. The system could be used in the precondition phase to emulsify the oil if the plant operation staff desires.

3. Other Chemical Constituents - Concentrations of other chemicals can be handled within normal plant parameters without chemically shimming the waste. The liquid waste to cement ratios should be adjusted for the purpose of economics as the chemical concentration in the waste varies. The variance in chemical composition is generally known because of careful control of evaporators used to concentrate the liquid waste.

Response to Question 5.

Prior to waste solidification and radiation acknowledge, the operator visually observes the rad reading on the panel mounted indicator. An automatic alarm annunciates on the ATCOR panel and main control room panel upon exceeding the predetermined rad level. Part of the alarm function and circuitry is to signal an interlock which automatically prevents any waste processing by the operator.

ATCOR supplies a family of curves to allow the customer to determine the acceptable radiation limit for each shipping cask or shield prior to waste solidification. A typical curve is attached for your information.

Response to Question 6.

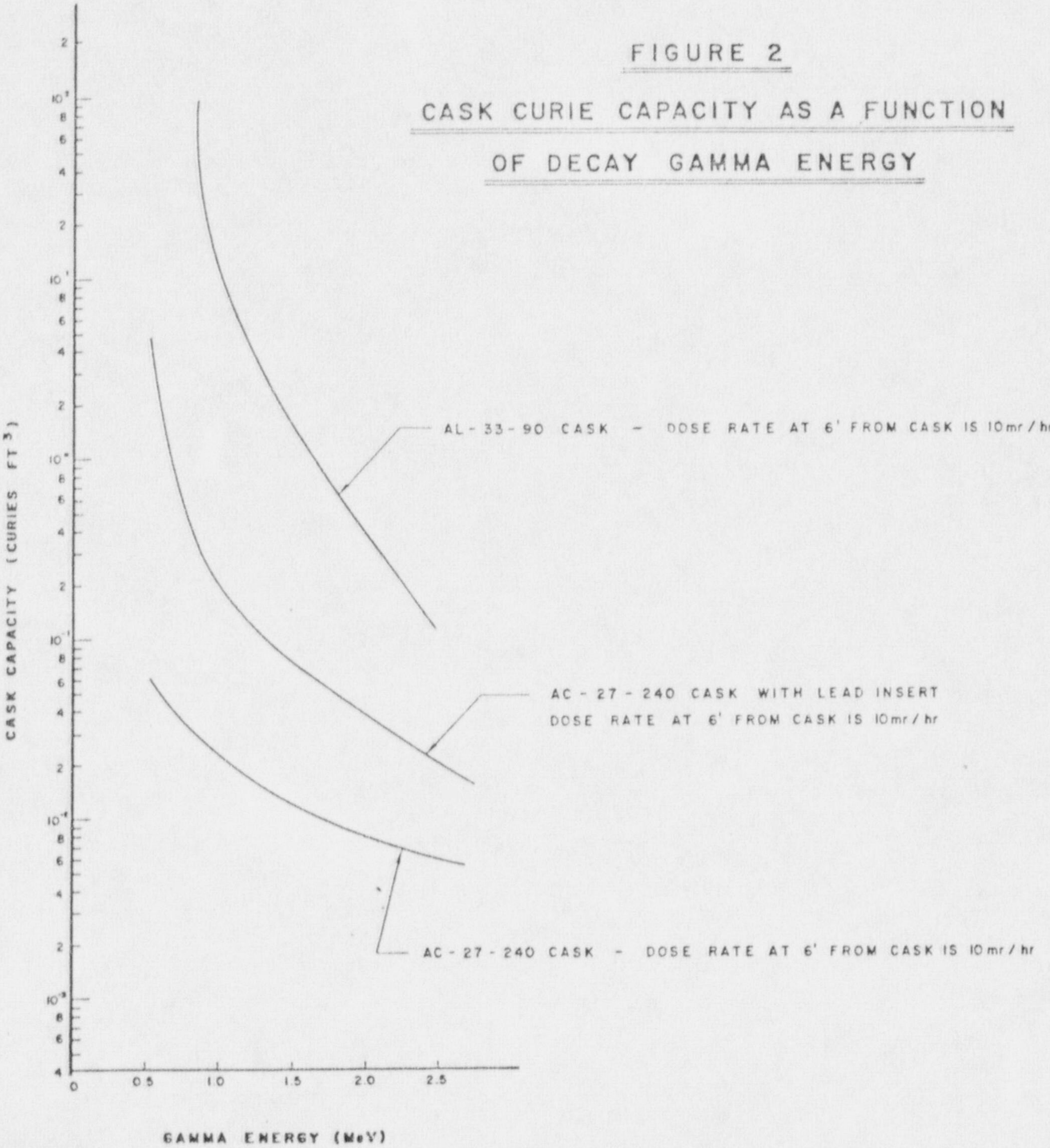
ATCOR's scope of supply is to provide electric strip heaters for the waste tank only. It is ATCOR's responsibility to advise the customer and recommend the heat tracing requirements needed for waste piping, pumps, inline instrumentation, etc. Upon ATCOR's recommendation, all heat tracing is provided by others. Waste concentrates are immediately and intimately mixed with dry cement insomuch as crystallized particles become a part of the cement matrix. Based on over four years of actual operating experience, crystallization within the mixer feeder is not a problem; therefore, we do not recommend heat tracing for this unit.

Response to Question 7.

The waste metering pump is calibrated, using each of the waste materials described in Section 2.4 on a quarterly basis. The pump calibrating procedure is identical to the procedure described in Section 9.0 Test Procedure, Section .3.4, page 9-5-35 thru 9-5-38. Similarly, the cement feeder is calibrated by following the procedure detailed on pages 9-5-50 thru 9-5-53. Acceptable setting times for the solidified product is a minimum of 72 hours after container filling. Consistency is determined after filling a container and leaving it uncapped. The uncapped container is visually examined, after 72 hours, with the aid of a remote TV monitoring system or mirrors. The same inspection procedure may be used to determine the lack of free water.

FIGURE 2

CASK CURIE CAPACITY AS A FUNCTION OF DECAY GAMMA ENERGY



Response to Question 8.

Both the mixer feeder flush alarm timer and mixer feeder flush timers are manually preset by ATCOR at time of preoperational testing. These timer settings, as well as all other timer settings are listed and become permanent parts of the operating procedure. For example, the flush alarm timer is set for 15 minutes while the mixer feeder flush timer is set for 30 seconds.

Response to Question 9.

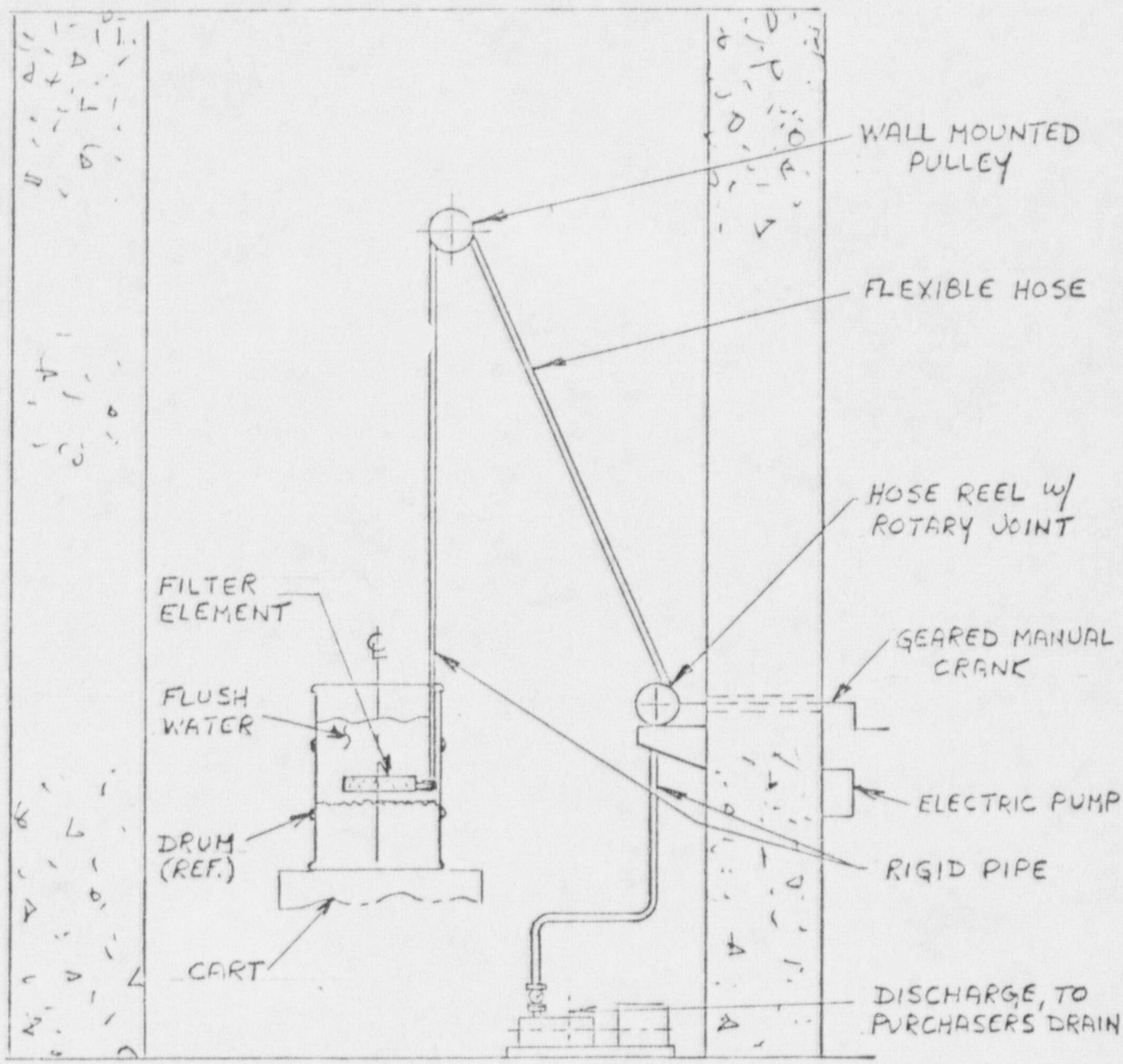
Basically, flushing the mixer feeder is performed directly into an empty 55 gallon drum*. This drum is then set aside to allow the cement contents to settle and harden. A siphon, which can be remotely inserted into the drum, is provided to decant the excess water for return to the waste tank or for processing. This drum is then filled with cemented waste at the start of the next solidification batch. The flush water siphon system consists of a packaged assembly. Included is one pump and motor, valves, pressure switch all mounted on a common baseplate. Additional items include a flexible hose, filter, winch and pully system plus all necessary controls. A typical layout is illustrated on the attached sketch.

Removal and replacement of the filter is a manual operation. The operation consists of merely threading the filter into a mating fitting which takes only minutes. The filter itself is capable of being backwashed; however, we recommend replacing the filter entirely. The decant system procedure is to remove excess water several days after flushing into a drum. This duration is more than ample, since it takes only a few hours for the cement to actually settle and take an initial set in the drum. Once the cement forms a hard layer in the drum, the filter will only see plain water. It is not anticipated that the filter will become contaminated as expected with precoat filters for example. Degree of filtration for the filter used is 50 micron particle size.

*or larger volume container

Response to Question 10.

The mixer flush operation and cycle is controlled by a timer (see item 8). Should the timer fail, automatic shut-off and overfilling would be prevented by the identical instruments which detect and signal maximum cemented waste levels in a container. Typical flush water quantities are approximately 35 gallons.



TYPICAL FLUSH WATER SIPHON SYSTEM

Response to Question 11.

Design of the decontamination spray booth is strictly a function of the physical container size eg: 55 gallon drums or large volume containers. The decontamination spray station is usually a custom designed unit to suit the customer's specific design requirements and building layout. Equal decontamination capability is afforded by either of ATCOR's design approach. In all cases, decontamination cleaning and air drying is performed in a completely enclosed barrier to restrict further spread of contamination and separated from the process aisle and storage area.

Response to Question 12.

a) Yes. Anytime the cement feed valve is closed, the cement feeder cannot be started. If the feed valve closes during normal operation, the cement feeder will stop and terminate the entire mixing phase of operation.

b) Yes. Closing the mixer feeder discharge valve will automatically stop the mixer.

c) Yes. The entire mixing phase is automatically terminated.

d) Yes. High waste level signal terminates all filling operations or prevents further adding of material into the tank.

e) There is no mechanism which interlocks drum capping with the decontamination wash cycle. This is an operation that requires the operator to visually observe the capping sequence through either a shield window, TV system or mirrors. Upon visual verification that the drum is capped, only then is the drum transferred to the decontamination station for washdown.

Response to Question 13.

Section 3 of NRC Topical Report, ATC-132A, For ATCOR Radioactive Waste Solidification System, presents tables of operating flow-rates of waste and cement along with operating tolerances needed to form acceptable waste products. Although there is no published and approved acceptance criteria for radioactive waste, we use the following criteria to describe acceptable solidified liquid wastes:

a) There should be no free standing liquids after 24 hours of mixing the waste with the cement.

b) The product should be free standing, non friable after 24 hours of mixing the waste with the cement.

c) The product without support of sample container, should be able to survive a four (4) foot drop test onto an unyielding flat structure with only localized failure noted.

d) The product should be able (without support of its container) to support a compressive load of not less than three (3) times its own containerized weight.

e) The product when exposed in free standing water for 168 hours should show no visable signs of failure.

The variances in our operating tolerences indicate with conservatism compliance with the above, self imposed criteria.

Response to Question 14.

The only instrumentation in the system which may be overridden is the Waste Tank ultrasonic level (with an exception) and the Container Filling ultrasonic level control units. This type of level control comes equipped with an external ON-OFF switch. Only when processing liquid waste, such as evaporator bottoms, chemical drains, it is not critical if the waste tank ultrasonic unit is operational or off. It is important, however, that the unit is functional and indicating during the waste conditioning phase, that is adding the correct amount of liquid to dewatered resin. As discussed, the amount of liquid being added must be visually monitored. Switching the container fill ultrasonic unit to off will not discontinue the filling operation. Redundancy is provided by the fixed level conductance probes and the electric fill timer. Basically, the remainder of instruments described in Section 3.1 cannot be overridden. All of these instruments interlock the system and must be operational to continue normal system operation.

Response to Question 15.

The skid drain lip is designed to contain or collect small amounts of leakage, such as pump seal leakage or abnormal spillage. At the end of the lip is a piped connection, which extends to a local floor drain. A collection tank with varying capacities, receives the floor drains which are temporarily stored prior to waste solidification. The intent of the skid drain lip is to confine any leakage to a small area and to permit drainage to a collection tank.

Response to Question 16.

The answer to this question coincides with the reply to item 11. In other words, the design of the decontamination station or smear station is dependent specifically on the container size being used.

Regardless of the container opening size, the splatter shield is always gasketed to seal the fill opening thus preventing splatter. This design and concept is not restricted to containers with 55 gallon drum openings.

Response to Question 17.

Filtration of dry cement is accomplished using a standard vent filter directly mounted to the cement silo. The automatic and self cleaning vent filter has a dust retaining efficiency of 99.9% of particles 2 micron or larger. Further protection is assured by using an additional secondary panel type filter directly attached to the vent discharge. This filter has the identical dust retaining efficiency of the primary vent filter that is 99.9% of particles 2 microns and over.

Equal filtration is provided for venting the displaced air during radwaste container filling. The vent filter is a part of the mixer feeder cover design. It is manually replaced after every 50 hours of system operation. The filter is secured by a standard hose clamp and is clearly accessable for removal and replacement. In general, the radwaste system is virtually a closed and sealed system by design and construction. Only normal or standard ventillation requirements typical for ventillating the plant radwaste area is needed.

Response to Question 18.

The probe referred to in Section 9 is used for the detection of flow or no flow of dry materials such as cement. It is a capacitance probe that senses a change in capacity. For example, air alone (no cement flow) emits a specific capacity value, while cement flow (air and cement) has a different strength capacity. The probe described in Section 4.9 is a conductance probe that sends a signal upon material contact. It is tuned specifically for the application that is detection of waste level. In application, the two probes are not interchangeable in any way.

Response to Question 19.

A painted arrow over the handwheel showing the proper direction of rotation is the only mechanism provided. ATCOR has not experienced any problems or have received reports from the field that this method is unsatisfactory. Improper rotation would prevent material discharge, in addition to loading up the mixer internals such that the operator could not physically turn the handwheel.

Response to Question 20.

There has been no formal testing program to determine the characteristics of the final waste product other than to establish that the products made with sham wastes having the chemical constituents of plant waste do meet our own criteria (see question 13).

Response to Question 21.

Based on design features of the ATCOR Radioactive Waste Solidification System and in plant shielding in the form of concrete walls is such that personnel exposure to radiation during normal operation is minimal and is estimated to be less than 2 rem per year. This exposure has been calculated as follows:

Drums/year X no. of operators X radiation level ÷ drums/year

a) from answer no. 2, BWR Waste Projections equals a total of 5773 drums/year.

b) Number of operators equals 1½ men

c) Radiation level is 0.002R/Hr

d) ATCOR Radwaste System can process 9 drums/hour

5773 drums/year X 1.5M X 0.002 R/Hr ÷ 9 drums/Hr = 1.92 rem

The system has been designed to provide emergency process functions in cases of a loss of electric power or other similar emergencies. The design features remote mechanical operation from behind the shielding. The exposure in the event of such an emergency would be the same for the time spent in normal system operation.

Exposure during system maintenance has been kept to as low as practical by separation of process equipment which does not contain radioactive residues from those which have processed waste and cement paste. Those portions of the system which are required to contain and process radioactive waste have been designed to minimize radioactive material buildup and each component has been designed to remove residues by high pressure low volume spray devices. The radiation exposure during maintenance periods is estimated to be less than 1.2 rem per year. This exposure has been calculated below:

D.R.$^{(1)}$ X time$^{(2)}$ = total maintenance exposure

(10) mrem/hr X (120) hours = 1.2 rem where:

(1) maximum dose rate expected after flush. Experience has shown that the radiation levels have been less by a factor of 3.

(2) the time allotted for these maintenance functions should not exceed this value and it is also necessary to point out that most of the maintenance time will not be in the area of highest dose rate.

Response to Question 22.

ATCOR's compliance with ALARA and design philosophy is addressed on pages 5-6 and 5-7 in the Topical Report. Specifically, the length of pipe runs are minimized to the shortest possible and practical distance between two points. All waste piping bends, no exceptions, are 5 times the pipe diameter with all waste inlet and return lines properly sized. For example, liquid waste lines are 1½ inch diameter minimum, resin slurry lines are 2 inch diameter minimum.

On all applicable construction drawings, general notes are included to alert the field what specific piping requirements must be adhered to eg. no low points, pockets where material can accummulate, etc. ATCOR's piping drawings take all of these key points into consideration and during skid fabrication and design.

ATCOR's normal scope of supply is to include valving and piping to permit flushing of all waste lines. Further, ATCOR provides standard pump designs that are specially modified to include additional flush connections such that the entire pump housing can be completely flushed along with any return line. Flush provisions for waste piping beyond ATCOR's interface is provided by the customer upon ATCOR's recommendation. All waste lines and valves have butt weld end connections. The only exception in using butt weld connections is where it becomes necessary to remove and replace component parts. To permit ease of maintenance, flanged connections will be used.

As previously discussed in our Topical Report, all drives, motors, handcranks, valves where possible, instrumentation calibration points and reach rods are located in low radiation controlled areas to minimize exposure to operating personnel.

Response to Question 23.

The answer to this question is more clearly illustrated by referring to ATCOR drawing SKD-2443-01. This drawing illustrates a typical drumming system. Empty drums are stored in the truck bay area. The operator manually carries the drum through the control area and places it on the drum input conveyor. From the input conveyor, a motorized drum conveying system remotely moves the drum to each station shown on the drawing. At the drum pick up point, the crane lifts the drum and places it into the drum storage area.

ATCOR drawing SKD-2386-02 shows an example of liner system. Empty liners are picked up at the truck bay and placed into the liner storage area using a fork lift truck. The next operation consists of lifting an empty liner, using the overhead crane, and lowering the liner onto the liner transfer cart. With the liner placed on the cart, the motorized vehicle remotely positions the liner at the designated fill, closure and pick-up stations. When full, once more the overhead crane is used to remotely place the filled liner into the storage area.

Response to Question 24.

RADIATION ZONE DESIGNATIONS FOR FIGURE 14

Area	Clean Shutdown	During Operation	During Maintenance
High Level Storage	1	5	3
Low Level Storage	1	5	3
Process Aisle	3	5	2
Waste Tank Cubicle	3	5	2
Cement Bin Area	1	2	1
Operator Control Area	1	2	1
Baler Area	2	5	1
Truck Bay Area	1	5	1

Legend:

Radiation Zone 1 $\leq$ 1 mrem/hour

2 $\leq$ 2.5 mrem/hour

3 $\leq$ 15 mrem/hour

4 $\leq$ 100 mrem/hour

5 $>$ 100 mrem/hour

Response to Question 25.

Potential for release to the atmosphere of significant quantities of radioactivity resulting from a failure of the radioactive waste solidification system is quite small for the following reasons:

a. The solidification agent (masonry cement) in the dry form is inert and when mixed with liquids reacts very slowly.

b. The waste is processed in small batches so that the quantity which can be released at any one time is limited.

The following are two (2) scenarios which describe situations where radioactivity could be released from the system:

1. <u>Transfer of the radioactive waste to the waste conditioning tank</u>

   a. Operator lines up plant waste tank transfer system to radwaste system waste conditioning tank.

   b. Waste conditioning tank level indication system has failed without operator knowledge.

   c. Waste conditioning tank redundant level alarm and valve isolation of waste conditioning tank has failed without operator knowledge.

   d. The operator transfers waste without level indication or alarm protection and over-fills waste conditioning tank.

   e. Excess waste is vented to waste conditioning tank cubicle and liquid waste spills onto floor and drains from the cubicle into a radioactive waste floor drain.

   f. After some time period in excess of normal fill time, operator terminates fill and investigates why the excessive fill time.

   Assumption:

   1. Operator terminates fill operation after twice the normal time period to fill the waste condition tank.

   2. Waste is hot concentrates (approximately 180°F) with 12% H_3BO_3 or 25% Na_2SO_4 by weight solution containing 10 curies per cubic foot of by product waste with about equal concentrations of ^{60}CO and ^{137}Cs.

   Note: Although resin waste slurries contain higher concentrations of radioactivity per gram of waste, the likelyhood of an airborne release would be significantly lower.

2. Filling of waste container from mixer feeder without having a waste receptical in place

   a. Operat)r of system sets up for batch processing and does not visually check that receptical is in place. Visual indication is provided to the operator by T.V., by lead glass view windows and/or by mirrors.

   b. Interlock system 'as failed without operator knowledge.

   c. Operator processe, system dumping paste of liquid waste and masonry cement on floor of process cubicle.

   Note: Although this condition is very unlikely, it will generate less airborne activity than the previous scenario, because the waste blended with cement is less likely to become airborne as a paste. This type of failure will require more remedial action, but should generate less airborne activity.

In the first scenario, airborne activity can be estimated:

$A = v \times \text{specific activity} \times P/100 \times F \times V^{-1}$

v; Volume of waste released = 2X normal fill volume minus tank internal volume approx. $(2 \times 100\ ft^3)-(120\ ft^3) = 80\ ft^3$

P; Percentage of liquid which initially becomes airborne = 0.1% of activity in liquid which is a conservative estimate based on carry over for steam.

F; Fraction of activity that remains suspended in room air - 10^{-2} conservative estimate.

V; floodable volume of waste condition tank cubicle = approximately 20' X 20' X 20') (0.70)*

*30% of volume of cubicle is estimated to be equipment.

Specific activity in waste is estimated to be 10 curies/ft^3

$$A = 80\ ft^3 \times \frac{10\ \text{curies}}{ft^3} \times \frac{10^{-1}}{100} \times \frac{1}{10^2} \times \frac{1}{0.7 \times 8 \times 10^3\ ft^3}$$

$$A = 1.4 \times 10^{-6}\ \frac{\text{curies}}{ft^3} \text{ or } 1.4\ \frac{uci}{ft^3}$$

$A = 5 \times 10^{-4}\ \frac{uci}{ml}$ during highest transient condition at time of failure

The reduction due to dilution as air is exhausted from room would be in excess of 100, and with filtration with in plant HEPA filters, the concentration would be further reduced by another factor of 1000.

Conclusion:

1. The local airborne concentration would be high.

2. The concentration in the plant exhaust would be reduced to allowable discharge limits during transient condition.