

OPERATION OF A MOBILE
LOW-LEVEL RADIOACTIVE WASTE
VOLUME REDUCTION SYSTEM
AT
DRESDEN NUCLEAR POWER STATION

A SUBMITTAL TO THE
U.S. NUCLEAR REGULATORY COMMISSION
FROM
COMMONWEALTH EDISON COMPANY

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I. INTRODUCTION

A. Background

In a letter from B. Rybak to H. R. Denton, dated 10APR84, Commonwealth Edison Company (CECO) notified the U.S. Nuclear Regulatory Commission (NRC) that CECO desired to operate a mobile low-level radioactive waste volume reduction system (MVRS) at Dresden Nuclear Power Station (DNPS). Further information and a request for NRC approval to operate the MVRS was transmitted in a letter from B. Rybak to H. R. Denton, dated 07NOV84.

B. Purpose

The purpose of this document is to provide updated and clarified information relevant to obtaining NRC approval for operation of the MVRS at DNPS. This document reflects discussions of the previously submitted documents with the NRC staff.

C. Scope

The CECO Byron Station is equipped with a fluidized-bed incinerator-dryer system supplied by Aerojet Energy Conversion Company (AECC). The installed incinerator-drier represents employment by CECO of advanced technology for the volume reduction (VR) of low-level radioactive wastes. The Byron system will accept as input combustible dry active wastes (DAW), contaminated waste oils, and evaporator concentrates.

The Dresden Station utilization of the MVRS represents a further step by CECO towards volume reduction of low-level radioactive wastes. Although supplied by the same vendor, the MVRS to be placed in service at DNPS utilizes a different technology, namely, controlled-air incineration. The input waste streams are also different. The use of the MVRS at DNPS is being restricted by contractual agreement between CECO and AECC to accept as input only those containers of low-level radioactive wastes with a contact dose-rate reading less than or equal to 25 mRem per hour per 7.5 cubic feet.

This document has been prepared to allow an independent review of the DNPS application of the MVRS without reference to any materials related to the system at Byron Station.

II. DESCRIPTION OF SYSTEM AND GENERAL LAYOUT

Aerojet Energy Conversion Company (AECC) has submitted to the NRC a Topical Report which describes the MVRS. The NRC has found the topical report acceptable for referencing in license applications.

This transmittal is intended to be a supplement to the approved MVRS Topical Report No. AECC-4-NP-A (09NOV84). To expedite the review process, information which is contained within the Topical Report has not been duplicated within this transmittal.

A. System Description

The MVRS to be placed in service at DNPS is as described in Topical Report No. AECC-4-NP-A with only one exception -- the off-gas treatment system will utilize a high-efficiency particulate air (HEPA) filter only. Charcoal filters are not required in the DNPS application because MVRS use will be restricted to very low-level DAW and slightly contaminated waste oils. Extensive industry testing has shown that neither of these waste streams contains radioiodines. (Documentation for this statement is discussed in further detail later in this transmittal.)

A System Schematic for the equipment to be utilized at DNPS is presented in Figure 1. Again, the only difference between the schematic of Figure 1 and that presented in Topical Report No. AECC-4-NP-A is the absence of charcoal adsorbers and secondary HEPA filters in the filtered exhaust air for the DNPS application.

B. General Layout

The general arrangement of the MVRS will be as presented in Topical Report No. AECC-4-NP-A. The plant layout and location of the MVRS equipment at DNPS will be as shown in Figure 2 through Figure 5. (Those figures also show the MVRS pad discussed in the following section of this transmittal.)

III. DESCRIPTION OF PLANT INTERFACE

A. MVRS Site Pad

A concrete support pad for the MVRS will be constructed at the DNPS site. The site pad provides a structural foundation for the trailer-mounted MVRS. The pad has been designed using an acceptable concrete slab-on-grade method combined with conventional concrete pavement design practices. The pad will be approximately 60' x 60' in plan with an overall thickness of approximately 10". The pad will consist of a poured-in-place concrete pavement designed to bear a nominal concentrated loading of approximately 20,000 pounds per square foot to allow for the MVRS trailer support jacks. The pad will contain the necessary tie-down anchors, recessed below the top surface of the pad.

The area surrounding the concrete pad will be paved with compacted gravel to allow for normal site drainage patterns in the area. Sufficient area will be available for the truck tractors to enter from the east side, bring the trailers into position, and leave from the west side.

Foundation preparation will consist of overexcavation of all organic, soft, or fill soils and replacement with well graded sand and gravel fill. The existing plant drainage ditch in the area of the MVRS pad will be excavated for the installation of a concrete drainage pipe. One or more catch basins will be installed to maintain existing site drainage patterns.

B. Interface Services

The interface service requirements for the MVRS are electrical power and water, as described in Topical Report No. AECC-4-NP-A. CECO will provide

permanent connector receptacles for required services to be positioned at an appropriate location adjacent to the pad. (CECO will also provide some supplemental services.) The service connections will be housed in a weatherproof enclosure as shown in Figure 6 and further described in the following paragraphs.

1. Electrical Power. The normal power supply for the connected load of approximately 250 kW will be 300 amp, 480 VAC, 60 Hertz service from the DNPS non-1E electrical distribution system. The power will be supplied from the 34KV transformer system. The power supply (480V) will be brought via utility poles to a fusible disconnect switch located in the MVRS interface termination enclosure.

A 120 VAC service line will also be supplied to the interface area to provide power for outdoor convenience outlets, heat tracing of portions of the service water piping, and area lighting.

A connection will be made to a grounding lug connected to the DNPS grounding grid.

2. Service Water. A service water line will be provided to the MVRS interface enclosure. The water will be supplied from an existing non-safety related service water system. This water supply contains less than 1000 ppm dissolved solids, undetectable suspended solids greater than 25 microns, and has a pH of approximately 7. Nominal pressure is 110 psig (to within +5 psig and -10 psig) at the source which will be the DNPS Unit 2/3 Heating Boiler Building.

3. Fire Protection Water. Fire protection water will be available from a hydrant located approximately 100 feet south of the MVRS pad. Outside fire fighting ability will be available from a new fire station equipped with 300 feet of 2-1/2" fire hose and two adjustable fog nozles.

4. Propane Supply. CECO will provide a location for two 1000 gallon above-ground propane storage tanks. The tanks will be locally supplied, skid-mounted, and securely anchored in place during use.

5. Telephone Service. CECO will provide a telephone line to the interface enclosure.

C. Operational Interfaces

1. Waste Delivery. DAW will be delivered via truck, van, or other vehicle to the "Trash Loading Area" indicated in Topical Report No. AECC-4-NP-A.

Contaminated waste oils will be delivered in the same manner or via an oil storage truck. Waste oils will be pumped from the delivery vessel to the "Contaminated Oil Feed Tank" (T-12).

2. Ash Removal. Filled ash containers will be removed via truck, van, or other vehicle and taken to an existing low-level radioactive waste staging area.

3. Radiation Monitoring. Dose-rate monitoring in the area of the MVRS will be conducted according to existing practices. The MVRS will be added to existing schedules for such monitoring. Any required access control measures will be established according to the existing DNPS radiation control program.

The particulate filters and zeolite cartridges from the MVRS sampling systems will be periodically removed and analyzed using existing procedures for similar sampling media. Procedures will be established to define the frequency of such analyses.

IV. PLAN FOR SEGREGATION OF INPUT WASTES

A. Acceptable Waste Forms

1. DAW. The MVRS is designed for combustible low-level DAW only. Procedures will be prepared for separating DAW into combustible and non-combustible components. The combustible DAW will be placed into combustible containers to be used as feed to the MVRS (providing the activity level is acceptable as described section IV., B.).

2. Waste Oils. The only requirement for waste oils is that such oils be pumpable. Waste oils are presently collected in various containers for temporary storage prior to disposal. No new procedures are required for collection or segregation of waste oils.

B. Acceptable Activity Levels

1. DAW. Using existing procedures, the contact dose rate will be determined for each container. Containers with contact dose rates less than or equal to 25 mRem per hour per 7.5 cubic feet will be placed in a temporary holding area until an adequate supply is available to assure a meaningful run time for the MVRS.

2. Waste Oils. Using existing procedures, the contact dose rate will be determined for typical containers of waste oils. Those containers with contact dose rates less than or equal to 25 mRem per hour per 7.5 cubic feet will be placed in a temporary holding area until an adequate supply is available for transfer to the MVRS "Contaminated Oil Feed Tank" (T-12).

V. PROCESS CONTROL PROGRAM

A. AECC Process Control Program

As indicated in Topical Report No. AECC-4-NP-A, the service vendor will operate the equipment according to detailed procedures designed to provide the appropriate process control. Controlled copies of operating procedures will be provided by the service vendor to CECO.

B. CECO Administrative Controls

Prior to utilization of the MVRS, CECO will develop detailed procedures covering activities related to the MVRS. Such procedures will be developed,

reviewed, and implemented according to established practices and policies.

C. 10 CFR Part 61

CECO has in place a program for implementation of 10 CFR Part 61. The existing program includes broad corporate guidelines and site-specific procedures, practices, and policies. Site-specific procedures are under development for including the operation of the MVRS under this existing program. These procedures will be completed prior to operation of the MVRS.

1. Sampling. Present Dresden practices cover both DAW and waste oils. Nevertheless, CECO plans to collect samples of the MVRS ash for analysis. (The MVRS system has been designed to provide for collection of ash samples.) Such samples will be analyzed in accordance with the methodology specified in Section 61.55 of 10 CFR Part 61.

2. Classification. Because of the contractually imposed restriction on the input to the MVRS, all product from the MVRS will be 10 CFR Part 61 Class A waste. Nevertheless, the ash product from operation of the MVRS will be classified in accordance with Section 61.55 of 10 CFR Part 61.

3. Disposal. The present plan calls for collection of the ash in strong tight containers which have been designed to mate with the ash delivery system of the MVRS. These containers will meet the minimum requirements of Section 61.56 of 10 CFR Part 61. Disposal will be conducted according to existing procedures for Class A wastes destined for shallow-land disposal.

VI. CALCULATION OF OFF-SITE DOSE CONTRIBUTION

A. Input Waste Characteristics

1. Activity. The expected radionuclide content of the wastes to be processed by the MVRS has been presented in Topical Report No. AECC-4-NP-A. Those data are based upon extensive studies published by the Electric Power Research Institute (EPRI), as indicated in the Topical Report. DNPS data were among the data base for the EPRI report.

Both the radionuclide content and the concentration of activity presented in Topical Report No. AECC-4-NP-A are appropriate bases for DNPS wastes.

2. Quantity. In Topical Report No. AECC-4-NP-A, calculations have been presented for an input rate of 5.2 Curies per year from a single-unit Boiling Water Reactor (BWR) site. Those calculations are appropriate bases for the DNPS application.

B. Release Rates

Expected release rates for specific radionuclides have been presented in Topical Report No. AECC-4-NP-A. Those release rates are appropriate for the expected release rates from operation at DNPS. (Because the Topical Report presents release rates per year per reactor, the expected release rates at DNPS will be double the values given in the Topical Report.)

C. Effluent Dose Assessment

1. Radionuclide Concentrations. Calculations presented in Topical Report No. AECC-4-NP-A show that the concentrations of radionuclides at a site boundary 1000 meters from the MVRs release point will be negligible. That is, such concentrations will be several orders of magnitude below the permissible concentrations listed in Table II, Column 1 of Appendix B to 10 CFR Part 20.

Calculations have been performed using the methods presented in the Dresden Off-Site Dose Calculations Manual (ODCM). Using DNPS site-specific parameters, which include a minimum site boundary range of 593 meters north-northwest of the MVRs, we have verified the validity of the conclusion in the Topical Report for the DNPS site-specific application.

2. Dose Impact. Calculations have been performed which provide an assessment of the site boundary dose rates resulting from both the effluents and the direct radiation emanating from the MVRs during operation. Those calculations, using DNPS site-specific parameters including dual-unit operations, show the maximum off-site annual dose to a hypothetical individual at the nearest site boundary resulting from MVRs operations will be less than one mRem. Addition of the MVRs dose contribution to the off-site dose resulting from normal operations of the plant shows the ability of the station to meet the requirements of 40 CFR Part 190 is unchanged. That is, MVRs operations at DNPS will have no impact on the overall off-site doses from the plant.

3. Supporting Calculations. Relevant information and the results of off-site dose calculations are included as an appendix to this document.

VII. SAFETY CONSIDERATIONS

A. Postulated Accident Scenarios

Various accident scenarios involving the MVRs have been postulated and analyzed. The scenarios are the following:

- (1) Loss of Scrub Solution Inventory,
- (2) Loss of Scrub Solution and HEPA Filter Fire,
- (3) Explosive Loss of Flue Gas and Ash,
- (4) Fire in Waste Feed Airlock,
- (5) Fire in Waste Feed Preparation Area, and
- (6) Spill of Incinerator Ash in Process Area.

In no case does a postulated accident scenario have any affect on plant safety systems.

B. Conclusion on Safety

Based on the considerations presented in this document, CECO has drawn the following conclusions:

(1) Operation of the MVRs at DNPS will not involve a significant increase in the probability or consequences of accidents previously considered

and does not involve a significant decrease in a safety margin, and, therefore, does not involve a significant hazards consideration;

(2) There is reasonable assurance that the health and safety of the public will not be endangered by operation of the MVRS at DNPS; and

(3) Operation of the MVRS at DNPS will be conducted in compliance with NRC regulations and NRC approval to operate the MVRS at DNPS will not be inimical to the common defense and security or to the health and safety of the public.

C. Negative Declaration for Environmental Impact Statement

On the basis of the foregoing, CECO has concluded that there would be no significant environmental impact attributable to the proposed operation of the MVRS at DNPS. As a result of this conclusion, CECO has further concluded that no environmental impact statement for the proposed operation of the MVRS at DNPS need be prepared, and that a negative declaration to this effect is appropriate.

VIII. CHANGES TO TECHNICAL DOCUMENTS

A. Technical Specifications

Proposed changes to the DNPS Technical Specifications related to operation of the MVRS are being submitted under separate cover and are not part of this document.

B. Final Safety Analysis Report (FSAR)

Because the postulated MVRS accident releases do not exceed the accident evaluations contained within the FSAR, no change to the FSAR is required.

C. Off-Site Dose Calculations Manual (ODCM)

Because operation of the MVRS has no significant impact on off-site doses, no change to the ODCM is required.

D. Generating Stations Emergency Plan (GSEP)

For the sake of completeness, and if required by the Nuclear Regulatory Commission, postulated MVRS accidents could be added to the GSEP listing of unusual events.

System Schematic

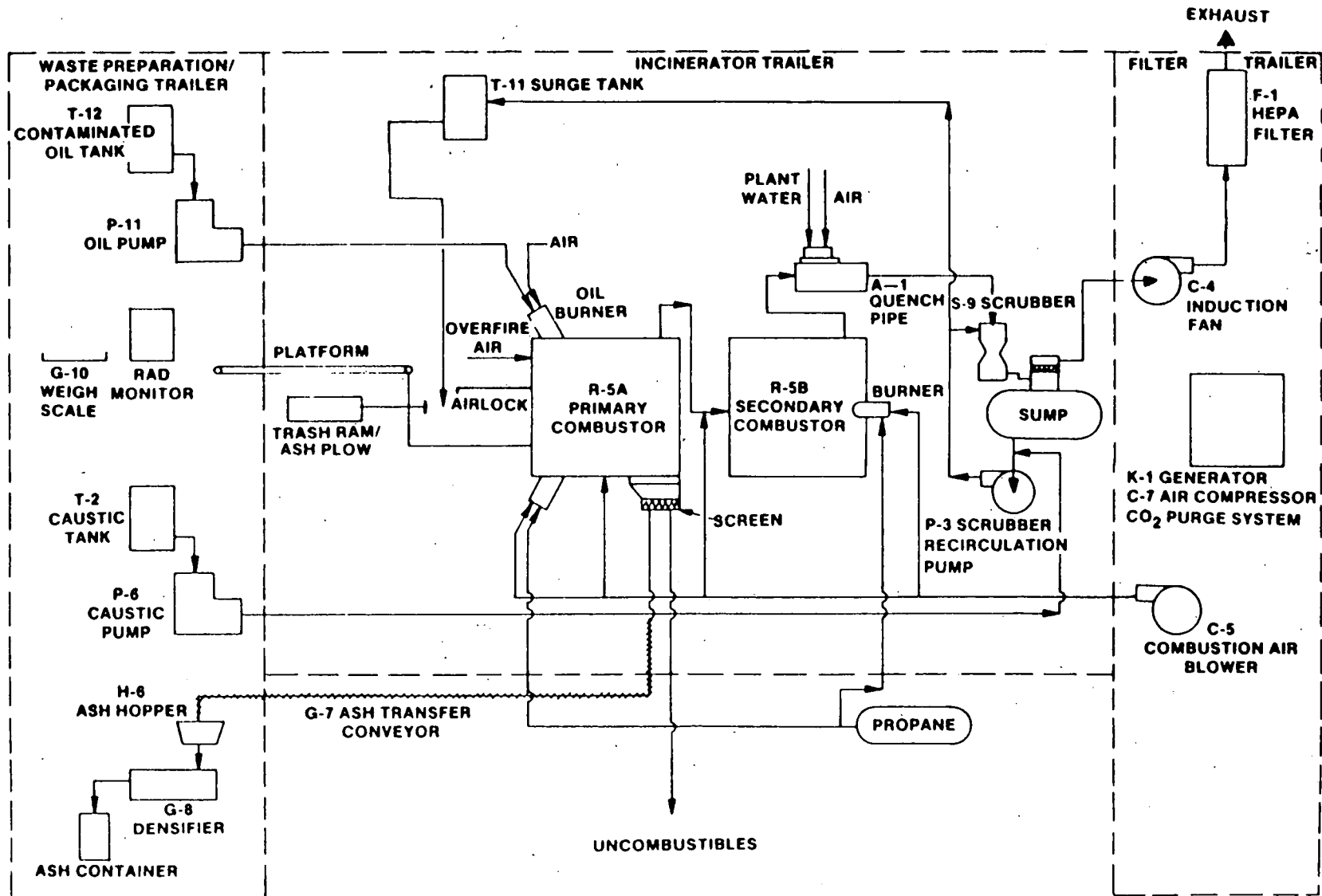


Figure 1.

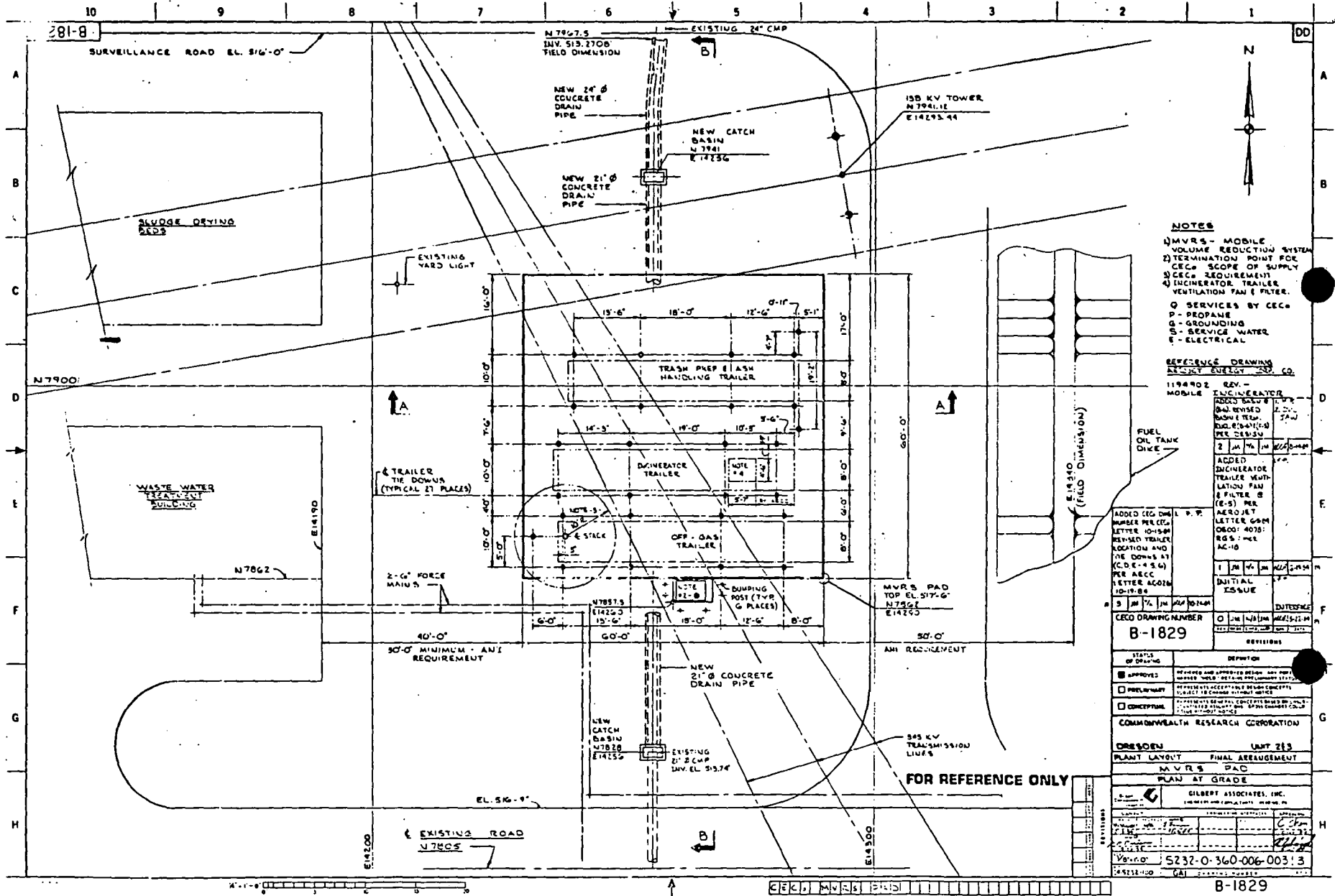


Figure 4.

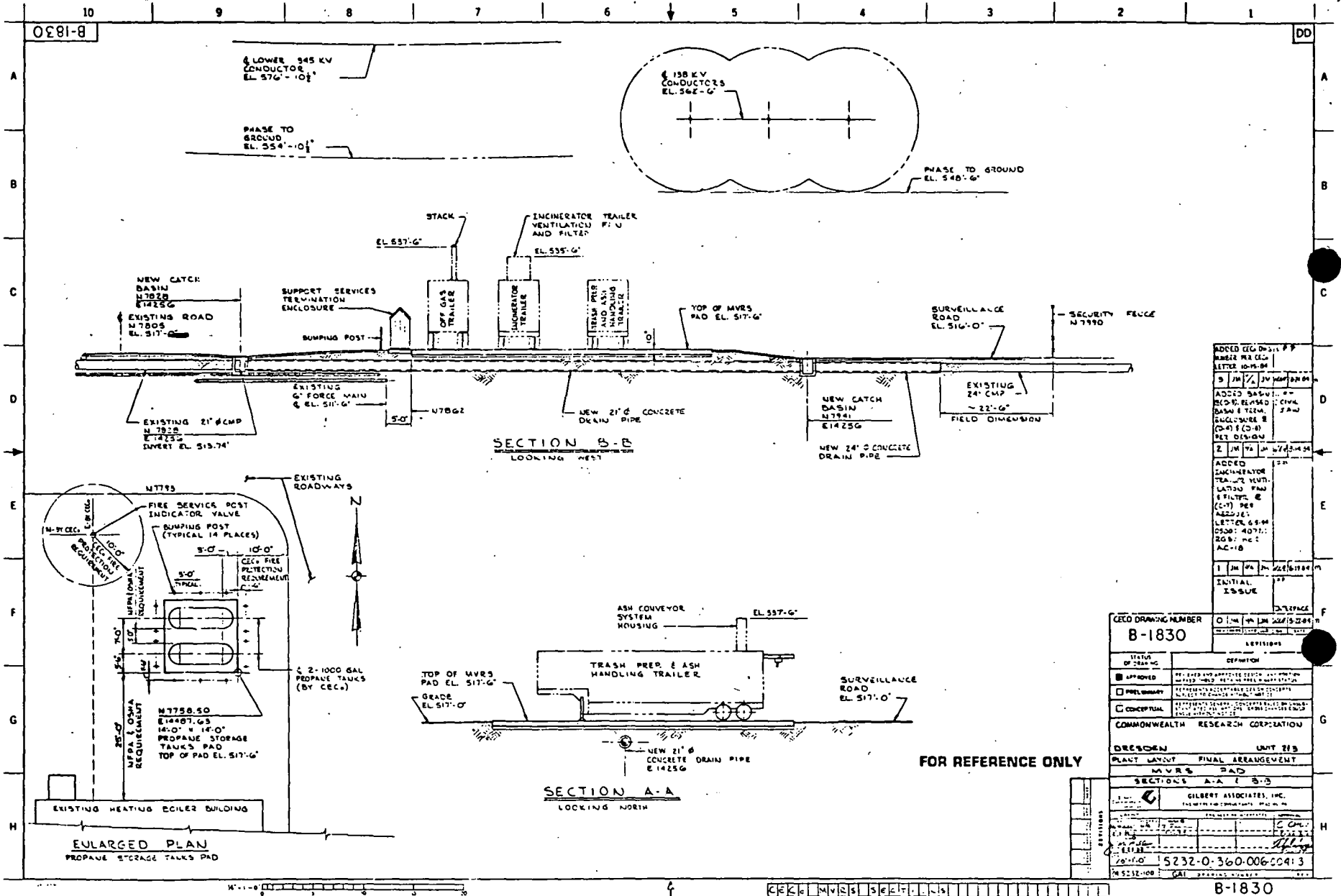


Figure 5.

A

COMMONWEALTH RESEARCH CORP.

MADE CHKD
NIA

DRAWING NUMBER

5232-0-360-010-005

REV

B

PLANT LAYOUT ENGRG STUDY

PDS

ENG INTERF

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA

MVRS INTERFACE

SCALE NONE

TERMINATION ENCLOSURE

W.C. 045232100

ENGINEER APPROVAL DEPT DATE

REV	MADE	CH	PDS	APP	DATE	REV	MADE	CH	PDS	APP	DATE
	B	NIA	NA	JM	NIA						1/7/84

TYR MVRS TERMINATION ENCLOSURE

REDRAWN

CONCEPTUAL

REPRESENTS GENERAL CONCEPTS BASED ON UNSUBSTANTIATED ASSUMPTIONS. GROSS CHANGES COULD ENSUE WITHOUT NOTICE.

PRELIMINARY

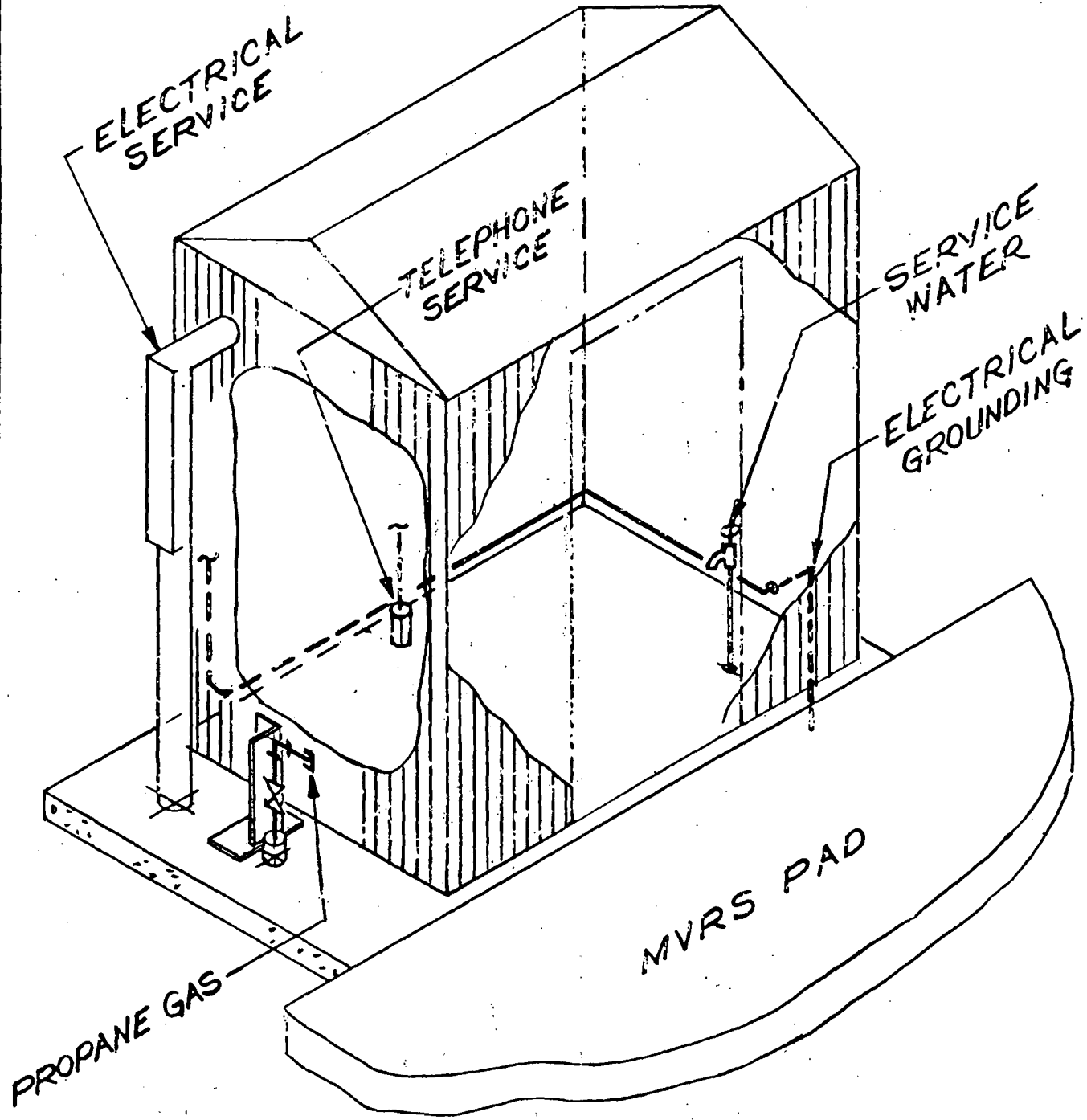
REPRESENTS ACCEPTABLE DESIGN CONCEPTS. SUBJECT TO CHANGE WITHOUT NOTICE.

APPROVED

REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

STATUS OF DRAWING

DEFINITION



GAI 4001

Figure 6.

APPENDIX

Table 1. Relative Effluent and Deposition Factors for Off-Site Locations

Table 2. Inhalation and Ingestion Dose Commitments at Off-Site Locations

Table 3. Sources for Off-Site Direct Radiation

Table 4. Basic Source Terms for Various Process Materials

Table 5. MVRS Gamma Source Terms & Exposure Rates

Table 1.

RELATIVE EFFLUENT AND DEPOSITION FACTORS
FOR OFFSITE LOCATIONS

<u>Description</u>	<u>Radius</u> <u>(meters)</u>	<u>Direction</u>	<u>X/Q</u> <u>(sec/m³)</u>	<u>D/Q</u> <u>(m⁻²)</u>
Maximum Annual Average X/Q	610	NE	6.695E-6	2.30E-8
Maximum Annual Average D/Q	658	NNE	6.14E-6	2.32E-8
Maximum D/Q at Meat Animal	1609	NE	1.36E-6	4.656E-9
Maximum D/Q at Milk Animal	8047	N	7.07E-8	3.51E-10
Maximum X/Q at Site Boundary - ODCM Model, 1 m/sec	593	NNW	1.53E-4	N/A
Maximum X/Q at Site Boundary - Gaussian Model, 1 m/sec	593	NNW	4.68E-4	N/A
Maximum X/Q at Site Boundary - ODCM Model, 4.4 m/sec	593	NNW	4.54E-5	N/A
Maximum X/Q at Site Boundary - Gaussian Model, 4.4 m/sec	593	NNW	1.18E-4	N/A

Table 2.

INHALATION AND INGESTION DOSE COMMITMENTS
AT OFFSITE LOCATIONS

1. Location: Maximum Annual Average X/Q (mrem/yr)

<u>Organ</u>	<u>Age Group</u>			
	<u>Infant</u>	<u>Child</u>	<u>Teen</u>	<u>Adult</u>
Bone	0.60	0.80	0.68	0.64
Liver	0.59	0.84	0.74	0.68
Total Body	0.58	0.65	0.66	0.66
Thyroid	0.58	0.58	0.58	0.58
Kidney	0.58	0.67	0.64	0.62
Lung	0.62	0.66	0.66	0.64
GI-LLI	0.58	0.64	0.66	0.66
Skin	0.69	0.69	0.69	0.69

2. Location: Maximum Annual Average D/Q (mrem/yr)

Bone	0.59	0.77	0.68	0.65
Liver	0.591	0.85	0.75	0.69
Total Body	0.59	0.66	0.66	0.67
Thyroid	0.59	0.59	0.59	0.59
Kidney	0.59	0.67	0.64	0.62
Lung	0.62	0.66	0.66	0.64
GI-LLI	0.59	0.64	0.67	0.66
Skin	0.69	0.69	0.69	0.69

3. Location: Nearest Meat Animal (mrem/yr)

Bone	0.12	0.16	0.14	0.13
Liver	0.12	0.17	0.15	0.14
Total Body	0.12	0.13	0.13	0.14
Thyroid	0.12	0.12	0.12	0.12
Kidney	0.12	0.14	0.13	0.13
Lung	0.12	0.13	0.13	0.13
GI-LLI	0.12	0.13	0.14	0.14
Skin	0.14	0.14	0.14	0.14

Table 2. (continued)

4. Location: Nearest Milk Animal (mrem/yr)

<u>Organ</u>	<u>Age Group</u>			
	<u>Infant</u>	<u>Child</u>	<u>Teen</u>	<u>Adult</u>
Bone	0.012	0.014	0.011	0.0097
Liver	0.013	0.015	0.012	0.011
Total Body	0.0088	0.0099	0.01	0.01
Thyroid	0.0083	0.0083	0.0083	0.0083
Kidney	0.0096	0.010	0.0096	0.0091
Lung	0.0091	0.0095	0.0094	0.009
GI-LLI	0.0086	0.0092	0.0097	0.0097
Skin	0.011	0.011	0.011	0.011

5. Location: Nearest Site Boundary at $X/Q = 4.68E-4$ (mrem/hr)

Bone	6.1E-5	1E-4	7.6E-5	5.5E-5
Liver	8.3E-5	1.2E-4	1.2E-4	9.2E-5
Total Body	1.1E-5	2.8E-5	5.5E-5	7E-5
Thyroid	1.5E-9	2.3E-9	2E-9	1.6E-9
Kidney	2.3E-5	3.9E-5	4.3E-5	3.2E-5
Lung	0.0013	0.0021	0.0025	0.0017
GI-LLI	1E-5	2.8E-5	7.7E-5	8.5E-5

Table 3.

SOURCES FOR OFFSITE DIRECT RADIATION

<u>Location</u>	<u>Source</u>	<u>Shielding Credit</u>
Waste Preparation	3 drums DAW (21 ft ³)	Self-absorption, air
Incinerator Feed	1 drum DAW (7 ft ³)	Self-absorption, air
Incinerator	1 drum DAW + 513 lbs ash	Incinerator liner - 4" firebrick, air
Scrubbers 400 lbs ash	Self-absorption, air	
Surge Tank	100 lbs ash	Self-absorption, air
HEPA Filters	12 lbs ash	Air
HIC Loadout	2 HICs (680 lbs ash)	Self-absorption, 2" lead air

Table 4.

BASIC SOURCE TERMS
FOR VARIOUS PROCESS MATERIALS

<u>Nuclide</u>	<u>mCi/Drum DAW Feed</u>	<u>mCi/lb Ash</u>	<u>mCi/HIC</u>	<u>mCi in Scrubber w/400 lbs ash</u>	<u>mCi in Surge Tank w/100 lbs ash</u>
Cr-51	0.378	0.05	17.0	20.	5.0
Mn-54	0.567	0.075	25.48	30.	7.5
Co-58	0.077	0.01	3.46	4.	1.0
Co-60	3.906	0.516	175.55	206.4	51.6
Zn-65	0.322	0.043	14.47	17.2	4.3
Cs-134	0.588	0.078	26.43	31.2	7.8
Cs-137	1.148	0.152	51.6	60.8	15.2

Table 5.

MVRS GAMMA SOURCE TERMS & EXPOSURE RATES

<u>Location</u>	<u>Gamma/sec. @ 0.7 MeV</u>	<u>Gamma/sec. @ 1.25 MeV</u>	<u>Dose Rate at 593 m mrem/hr</u>	<u>Annual Dose at 593 m mrem</u>
Waste Preparation	3.3E8	8.88E8	2.55E-6	0.0068
Incineration Feed	1.1E8	2.96E8	8.5E-7	0.0023
Incinerator	7.5E9	2.01E10	3.07E-5	0.082
Scrubber	5.8E9	1.57E10	1.94E-5	0.0539
Surge Tank	1.5E9	3.9E9	6.03E-6	0.0161
HEPA Filters	1.75E8	4.7E8	2.39E-6	0.0064
HIC Loadout	9.9E9	2.66E10	1.74E-6	0.0047
TOTAL			6.37E-5	0.17