RTL #A9.621B

Beaver Valley Power Station

Unit 1/2

1/2-ODC-2.01

ODCM: LIQUID EFFLUENTS

Document Owner
Manager, Nuclear Environmental and Chemistry

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Safety Related Procedure	Yes
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1.0 PURPOSE

1.1 This procedure provides the calculational methodology to be used for determination of the following release parameters as denoted in Unit 1/2 Technical Specifications ITS 5.5.2.[3.2.1]

1.1.1 Liquid effluent monitor alarm setpoints (ITS 5.5.2.a)

1.1.2 Liquid effluent release concentration calculations (ITS. 5.5.2.b)

1.1.3 Liquid effluent dose projection and cumulative dose calculations (ITS 5.5.2.d and ITS 5.5.2.e)

1.2 This procedure also provides information related to the following:

1.2.1 Liquid Radwaste Treatment System ITS 5.5.2.f)

1.2.2 Site Boundary used for liquid effluents

1.3 Prior to issuance of this procedure, these items were contained in Section 1 of the old ODCM.

2.0 SCOPE

2.1 This procedure is applicable to all station personnel that are qualified to perform activities as described and referenced in this procedure.

3.0 REFERENCES AND COMMITMENTS

3.1 References

3.1.1 References For BV-1 Liquid Effluent Monitor Setpoints

3.1.1.1 Beaver Valley Power Station, Appendix I Analysis - Docket No. 50-334 and 50-412; Table 2.1-3

3.1.1.2 Beaver Valley Power Station, Appendix I Analysis - Docket No. 50-334 and 50-412; Table 2.1-2

3.1.1.3 10 CFR 20, Appendix B, (20.1001-20.2402) Table 2, Column 2 EC's

3.1.1.4 Calculation Package No. ERS-SFL-92-039, Isotopic Efficiencies For Unit 1 Liquid Process Monitors

3.1.1.5 Calculation Package No. ERS-ATL-93-021, Process Alarm Setpoints For Liquid Effluent Monitors

3.1.1.6 Stone and Webster Calculation Package No. UR(B)-160, BVPS Liquid Radwaste Releases and Concentrations - Expect and Design Cases (per Unit and Site).

3.1.2 References for BV-2 Liquid Effluent Monitor Setpoints

3.1.2.1 10 CFR 20, Appendix B, (20.1001-20.2402) Table 2, Column 2 EC's

3.1.2.2 Calculation Package No. ERS-SFL-86-026, Unit 2 DRMS Isotopic Efficiencies

3.1.2.3 Stone and Webster Computer Code LIQ1BB; "Normal Liquid Releases From A Pressurized Water Reactor"

3.1.2.4 Calculation Package No. ERS-JWW-87-015, Isotopic Efficiencies For 2SGC-RQ100

3.1.2.4.1 The Isotopic Efficiencies for 2SGC-RQ100 are superseded by the values presented in Calculation Package No. ERS-SFL-86-026.

3.1.2.5 Calculation Package No. ERS-WFW-87-021, Conversion Factor for 2SGC-RQ100

3.1.2.5.1 The Monitor Conversion Factor (CF_{11}) for 2SGC-RQ100 is superseded by the value presented in Calculation Package No. ERS-ATL-93-021.

3.1.2.6 Calculation Package No. ERS-ATL-93-021, Process Alarm Setpoints For Liquid Effluent Monitors

3.1.2.7 Stone and Webster Calculation Package No. UR(B)-160, BVPS Liquid Radwaste Releases and Concentrations - Expect and Design Cases (per Unit and Site)

3.1.3 References used for Other Portions of this procedure

3.1.3.1 NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants

3.1.3.2 NUREG-1301, Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors (Generic Letter 89-01, Supplement No. 1)

3.1.3.3 NUREG-0017; Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from PWRs, Revision 0

3.1.3.4 Regulatory Guide 1.113; Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, April 1977

3.1.3.5 Regulatory Guide 1.109; Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance to 10 CFR Part 50, Appendix I

3.1.3.6 Calculation Package No. ERS-ATL-83-027; Liquid Waste Dose Factor Calculation for HPM-RP 6.5, Issue 3 and Later

3.1.3.7 NUREG-0172; Age-Specific Radiation Dose Commitment Factors for a One-Year Chronic Intake

3.1.3.8 UCRL-50564; Concentration Factors of Chemical Elements in Edible Aquatic Organisms, Revision 1, 1972

3.1.3.9 1/2-ADM-1640, Control of the Offsite Dose Calculation Manual

3.1.3.10 1/2-ADM-0100, Procedure Writers Guide

3.1.3.11 NOP-SS-3001, Procedure Review and Approval

3.1.3.12 1/2-ODC-3.03, ODCM: Controls for RETS and REMP Programs

3.1.3.13 CR 02-06174, Tracking of Activities for Unit 1 RCS Zinc Addition Implementation. CA-014, Revise ODCM Procedure 1/2-ODC-2.01 (Tables 1.1-1a and 1b) to include the addition of Zn-65 to the ODCM liquid source term.

3.1.3.14 CR 03-02466, RFA-Radiation Protection Effluent Control Provide Recommendation on Processing when Performing Weekly Sample of [1LW-TK-7A/7B]. CA-02, Revise ODCM Procedure 1/2-ODC-2.01, (Attachment D) to show the liquid waste flow path cross-connect between Unit 1 and Unit 2.

3.1.3.15 CR 05-03306, Incorporated Improved Technical Specifications (ITS).

3.1.3.16 CR 05-03854, ODCM Figure for Liquid Effluent Release Points Need Updated. CA-01, revise ODCM procedure 1/2-ODC-2.01 (ODCM: Liquid Effluents) Attachment D, Figure 1.4-3 to incorporate a modified version of Plant Drawing No. 8700-RM-27F.

3.1.3.17 Unit 1 Technical Specification Amendment No. 275 (LAR 1A-302) to License No. DPR-66. This amendment to the Unit 1 license was approved by the NRC on July 19, 2006.

3.1.3.18 Vendor Calculation Package No. 8700-UR(B)-223, Impact of Atmospheric Containment Conversion, Power Uprate, and Alternative Source Terms on the Alarm Setpoints for the Radiation Monitors at Unit 1.

3.1.3.19 Engineering Change Package No. ECP-04-0440, Extended Power Uprate.

3.1.3.20 CR 06-04908, Radiation Monitor Alarm Setpoint Discrepancies. CA-03; revise ODCM procedure 1/2-ODC-2.01 to update the alarm setpoints of [RM-1RW-100] and [RM-1DA-100] for incorporation of the Extended Power Uprate per Unit 1 TS Amendment No. 275.

3.1.3.21 CR 06-6476, Procedure 1/2-ODC-2.01 needs revised for Plant Uprate. CA-01; revise ODCM procedure 1/2-ODC-2.01 to update the alarm setpoints of [2SWS-RQ101] for incorporation of the Extended Power Update at Unit 2 (ECP-04-0441) per Unit 2 TS Amendment No. 156.

3.1.3.22 CR 05-00004-15, CR05-00004-17 and SAP Order 200197646-0010 to revise 1/2-ODC-2.01. Add the Coolant Recovery Tanks [1BR-TK-4A/4B] as Liquid Waste Tanks to Section 8.4 description and Attachment D Figures 1.4-1 and 1.4-2. Add a default 2-tank volume recirculation time of 45.7 hrs for the Coolant Recovery Tanks [1BR-TK-4A/4B] to Attachment B Table 1.2-1a. Add the Cesium Removal Ion Exchangers [1BR-I-1A/1B and 2BRS-IOE21A/21B] to Section 8.4 description and Attachment B Figures 1.4-1 and 1.4-2. Revise the recirculation times in Attachment B Table 1.2-1a and 1.2-1b to indicate the times for nominal tank volume and maximum tank volume.

3.1.3.23 SAP Order 200197646-0660. Revise 1/2-ODC-2.01 Attachment D Figure 1.4-3 to remove STP Outfalls 113 and 203 due to retirement of the Sewage Treatment Plants and to remove U1 Steam Generator Blowdown Filter Backwash Outfall 501. Water is no longer discharged via these outfalls.

3.1.3.24 SAP Order 200197646-0810. Revise 1/2-ODC-2.01 to incorporate alarm setpoints for all possible detector combinations for [RM-1DA-100]. Specifically, due to obsolescence of the original Model 843-30 and 843-32 detectors that were previously installed in [RM-1DA-100], the vendor has upgraded them to Model 843-30R and 843-32R detectors, which include upgraded efficiency data as well.

3.1.3.25 CR 10-86844 revises 1/2-ODC-2.01 to remove description that batch releases of liquid waste are processed by recirculation through eductors. Deleted Attachment B which referenced minimum liquid waste batch release recirculation times and added description that liquid waste recirculation times to achieve two tank volumes are calculated based upon actual tank volume and pump capacity.

3.2 <u>Commitments</u>

3.2.1 Unit 1 and 2 Technical Specifications: ITS 5.5.2, Radioactive Effluent Controls Program

4.0 RECORDS AND FORMS

4.1 Records

4.1.1 Any calculation supporting ODCM changes shall be documented, as appropriate, by a retrievable document (e.g.; letter or calculation package) with an appropriate RTL number.

4.2 Forms

4.2.1 None

5.0 PRECAUTIONS AND LIMITATIONS

5.1 BV-1 and BV-2 utilize the concept of a shared liquid radioactive waste system according to NUREG-0133.(3.1.3.1) This permits the mixing of liquid radwaste for processing and allocating of dose due to release as defined in Section 8.4.

5.1.1 In Section 8.1 of this procedure, effluent monitor setpoints for a conservative mix are based on the individual Units' specific parameters, but effluent monitor setpoints for analysis prior to release permit use of the total dilution flow available at the site.

5.2 There is a difference in alarm setpoint terminology presentations for the radiation monitoring systems of BV-1 and BV-2.

5.2.1 Where HIGH and HIGH-HIGH terminology are used for BV-1 monitors, Alert and High terminology is used for BV-2 monitors.

5.2.2 BV-2 setpoints are presented in uCi/ml rather than cpm as in BV-1. This difference is due to BV-2 software which applies a conversion factor to the raw data (cpm). Note that the uCi/ml presentation is technically correct only for the specific isotopic mix used in the determination of the conversion factors. Therefore, BV-2 setpoints determined on analysis prior to release will be correct for properly controlling dose rate, but the indicated uCi/ml value may differ from the actual value.

5.3 This procedure also contains information that was previously contained in Section 5 of the previous BV-1 and 2 Offsite Dose Calculation Manual.

5.3.1 In regards to this, the site boundary for liquid effluents was included in this procedure.

5.3.2 The Site Boundary for Liquid Effluents is shown in ATTACHMENT E Figure 5-1.

6.0 ACCEPTANCE CRITERIA

6.1 All changes to this procedure shall contain sufficient justification that the change will maintain the level of radioactive effluent control required by 10 CFR 20.1302, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR 50, and not adversely impact the accuracy or reliability of effluent dose or alarm setpoint calculation.(3.1.3.2)

6.1.1 All changes to this procedure shall be prepared in accordance with 1/2-ADM-0100(3.1.3.10) and 1/2-ADM-1640.(3.1.3.9)

6.1.2 All changes to this procedure shall be reviewed and approved in accordance with NOP-SS-3001(3.1.3.11) and 1/2-ADM-1640.(3.1.3.9)

7.0 PREREQUISITES

7.1 The user of this procedure shall be familiar with ODCM structure and format.

8.0 PROCEDURE

8.1 Alarm Setpoints

8.1.1 BV-1 Monitor Alarm Setpoint Determination

This procedure determines the monitor HIGH-HIGH Alarm Setpoint (HHSP) that indicates if the concentration of radionuclides in the liquid effluent released from the site to unrestricted areas exceeds 10 times the ECs specified in 10 CFR 20, Appendix B (20.1001-20.2402), Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases or exceeds a concentration of 2E-4 uCi/ml for dissolved or entrained noble gases.[3.1.1.5]

The methodology described in Section 8.1.1.2 is an alternative method to be used to determine the [RM-1LW-104] or [RM-1LW-116] monitor HHSP. The methodology in Section 8.1.1.2 may be used for any batch release and shall be used when the respective total gamma activity concentration of the liquid effluent prior to dilution exceeds 3.14E-3 uCi/ml and 7.33E-3 uCi/ml. This concentration is equivalent to the respective HHSPs derived in Section 8.1.1.1 and allows for respective tritium concentrations up to 4.26E+0 uCi/ml and 9.94E+0 uCi/ml.[3.1.1.5]

8.1.1.1 **BV-1 Setpoint Determination Based On A Conservative Mix**

The Alarm Setpoints shall be set at the values listed in the following table:

BV-1 LIQUID MONITOR SETPOINTS				
		cpm Above Background		
	Monitor	CR	HHSP	HSP
Liquid Waste Effluent Monitor	RM-1LW-104	3.53E+5	≤ 3.53E+5	≤ 2.47E+5
Laundry And Contaminated Shower Drains Monitor	RM-1LW-116	8.24E+5	≤ 8.24E+5	≤ 5.77E+5
Component Cooling/ Recirculation Spray Hx River Water Monitor	RM-1RW-100	2.57E+4	≤ 2.09E+4	≤ 1.46E+4
Component Cooling Hx River Water Monitor	RM-1RW-101	9.02E+3	≤ 9.02E+3	≤ 6.32E+3
Aux Feed Pump Bay Drain Monitor	RM-1DA-100 with Detector Model 843-30 or 843-32	(1) 1.22E+4 (2) 1.05E+4	(1) ≤ 1.20E+4 (2) ≤ 1.05E+4	(1) ≤ 8.43E+3 (2) ≤ 7.33E+3
	RM-1DA-100 with Detector Model 843-30R or 843-32R	(1) 1.22E+4 (2) 1.22E+4	(1) ≤ 1.20E+4 (2) ≤ 1.22E+4	(1) ≤ 8.43E+3 (2) ≤ 8.52E+3

(1) Use these values for a monitor with an analog drawer/meter face. These values are from Calculation No. 8700-UR(B)-223, and are justified for use in Attachment 6 of Calculation Package ERS-ATL-93-021. [3.1.1.5] [3.1.3.18]

(2) Use these values when the monitor is upgraded to a digital drawer/meter face. These values are justified for use in Attachment 6 of Calculation Package ERS-ATL-93-021[3.1.1.5]

The setpoint bases for all monitors can be found in Calculation Package ERS-ATL-93-021 and/or Calculation No. 8700-UR(B)-223.[3.1.3.18] The setpoints for RM-1LW-104 and RM-1LW-116 are based on the following conditions:

- Source terms given in ATTACHMENT A Table 1.1-1a. These source terms (without Zn-65) have been generated from the GALE Computer Code, as described in NUREG-0017.[3.1.3.3] The inputs to GALE are given in 1/2-ODC-3.01 Appendix B. The Zn-65 source term was generated via Calculation Package No. ERS-ATL-93-021.[3.1.1.5, 3.1.3.13]
- Dilution water flow rate of 22,800 gpm = (15,000 gpm BV-1 + 7,800 gpm BV-2).
- Discharge flow rate prior to dilution of 35 gpm for the Liquid Waste Effluent Monitor (RM-1LW-104).
- Discharge flow rate prior to dilution of 15 gpm for the Laundry and Contaminated Shower Drains Monitor [RM-1LW-116].

The above setpoints for [RM-1LW-104] and [RM-1LW-116] can be varied based on actual operating conditions resulting in changes in the discharge and dilution flow rates as follows:

$$HHSP = \frac{42F}{f} \qquad [1.1(1)\text{-}1]$$

where:

HHSP = Monitor HIGH-HIGH Alarm Setpoint above background (ncpm).

542 = Most restrictive proportionality constant based on nominal flow conditions:
542 = 3.53E+5 ncpm x 35 gpm ÷ 22,800 gpm [RM-1LW-104]
542 = 8.24E+5 ncpm x 15 gpm ÷ 22,800 gpm [RM-1LW-116]

F = Dilution water flow rate (gpm), BV-1 plus BV-2 Cooling Tower Blowdown Rate (not including release through the Emergency Outfall Structure).

f = Discharge flow rate prior to dilution (gpm).

8.1.1.1.1 BV-1 Mix Radionuclides

The "mix" (radionuclides and composition) of the liquid effluent was determined as follows:

- The liquid source terms that are representative of the "mix" of the liquid effluent were determined. Liquid source terms are the radioactivity levels of the radionuclides in the effluent from ATTACMENT A Table 1.1-1a.
- The fraction of the total radioactivity in the liquid effluent comprised by radionuclide "i" (S_i) for each individual radionuclide in the liquid effluent was determined as follows:

$$S_i = \frac{A_i}{\sum_i A_i} \qquad [1.1(1)\text{-}2]$$

where:

A_i = Annual release of radionuclide "i" (Ci/yr) in the liquid effluent from ATTACHMENT A Table 1.1-1a.

8.1.1.1.2 BV-1 Maximum Acceptable Concentration (All Radionuclides)

The maximum acceptable total radioactivity concentration (uCi/ml) of all radionuclides in the liquid effluent prior to dilution (C_t) was determined by:

$$C_t = \frac{F}{f \sum_i \frac{S_i}{OEC_i}} \qquad [1.1(1)\text{-}3]$$

where:

F = Dilution water flow rate (gpm), BV-1 plus BV-2 Cooling Tower Blowdown Rate (not including release through the Emergency Outfall Structure).

= 22,800 gpm = (15,000 gpm BV-1 + 7,800 gpm BV-2)

f = Maximum acceptable discharge flow rate prior to dilution (gpm).

= 35 gpm for Liquid Waste Effluent Monitor [RM-1LW-104].

= 15 gpm for Laundry and Contaminated Shower Drains Monitor [RM-1LW-116].

OEC_i = The ODCM liquid effluent concentration limit for radionuclide "i" (uCi/ml) from ATTACHMENT A Table 1.1-1a. The OEC is set at 10 times the 10 CFR 20, Appendix B (20.1001-20.2402) Table 2, Col. 2 EC values.

S_i = The fraction of total radioactivity attributed to radionuclide "i", from Equation [1.1(1)-2].

8.1.1.1.3 BV-1 Maximum Acceptable Concentration (Individual Radionuclide)

The maximum acceptable radioactivity concentration (uCi/ml) of radionuclide "i" in the liquid effluent prior to dilution (C_i) was determined by:

$$C_i = S_i \, C_t \qquad [1.1(1)\text{-}4]$$

8.1.1.1.4 BV-1 Monitor Count Rate

The calculated monitor count rate (ncpm) above background attributed to the radionuclides; (CR) was determined by:

$$CR = \sum_i C_i E_i \qquad [1.1(1)\text{-}5]$$

where:

E_i = Detection efficiency of the monitor for radionuclide "i" (cpm/uCi/ml) from ATTACHMENT A Table 1.1-1a. If not listed there, from Calculation Package ERS-SFL-92-039. (3.1.1.4)

8.1.1.1.5 BV-1 Monitor HHSP

The monitor HHSP above background (ncpm) should be set at the CR value. Since only one tank can be released at a time, adjustment of this value is not necessary to compensate for release from more than one source.

8.1.1.2 **<u>BV-1 Setpoint Determination Based On Analysis Prior To Release</u>**

The following method applies to liquid releases when determining the setpoint for the maximum acceptable discharge flow rate prior to dilution and the associated HHSP Alarm Setpoint based on this flow rate for the Liquid Waste Effluent Monitor [RM-1LW-104] and the Laundry and Contaminated Shower Drains Monitor [RM-1LW-116] during all operational conditions.

The monitor alarm setpoint is set slightly above (a factor of 1.25) the count rate that results from the concentration of gamma emitting radionuclides in order to avoid spurious alarms. To compensate for this increase in the monitor alarm setpoint, the allowable discharge flow rate is reduced by the same factor.

When the discharge flow rate is limited by the radwaste discharge pump rate capacity or by administrative selection rather than the allowable flow rate determined form activity concentration, the alarm setpoint will be proportionally adjusted based upon the excess dilution factor provided.

8.1.1.2.1 BV-1 Maximum Acceptable Discharge Flow Rate

The maximum acceptable discharge flow rate (f) prior to dilution (gpm) is determined by:

$$f = \frac{F}{1.25 \sum_i \frac{C_i}{OEC_i}} \quad [1.1(1)\text{-}6]$$

where:

F = Dilution water flow rate, BV-1 plus BV-2 Cooling Tower Blowdown (gpm).

The dilution water flow rate may include the combined cooling tower blowdown flow from both units exiting the discharge structure (but excluding emergency outfall structure flow) when simultaneous liquid discharges are administratively prohibited.

C_i = Radioactivity concentration of radionuclide "i" in the liquid effluent prior to dilution (uCi/ml) from analysis of the liquid effluent to be released.

1.25 = A factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

OEC_i = The ODCM liquid effluent concentration limit for radionuclide "i" (uCi/ml) from ATTACHMENT A Table 1.1-1a. The OEC is set at 10 times the 10 CFR 20, Appendix B (20.1001-20.2402) Table 2, Col. 2 EC values.

8.1.1.2.2 BV-1 Monitor Count Rate

The calculated monitor count rate (ncpm) above background attributed to the radionuclides, (CR) is determined by:

$$CR = 1.25 \sum_i C_i E_i \quad [1.1(1)\text{-}7]$$

where:

E_i = The detection efficiency of the monitor for radionuclide "i" (cpm/uCi/ml) from ATTACHMENT A Table 1.1-1a. If not listed there, from Calculation Package ERS-SFL-92-039.(3.1.1.4)

1.25 = A factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

8.1.1.2.3 BV-1 Monitor HHSP

The liquid effluent monitor HHSP above background (ncpm) should be set at the CR value adjusted by any excess dilution factor provided as defined in the following equation:

$$HHSP = CR \frac{f}{f'} \qquad [1.1(1)\text{-}8]$$

where:

HHSP = Monitor HHSP above background.

CR = Calculated monitor count rate (ncpm) from equation [1.1(1)-7].

f = Maximum acceptable discharge flow rate prior to dilution determined by equation [1.1(1)-6].

f' = Actual maximum discharge flow rate to be maintained for the discharge. The reduced value of f' may be due to pump limitations or administrative selection.

8.1.2 **BV-2 Monitor Alarm Setpoint Determination**

This procedure determines the monitor HIGH Alarm Setpoint (HSP) that indicates if the concentration of radionuclides in the liquid effluent released from the site to unrestricted areas exceeds 10 times the ECs specified in 10 CFR 20, Appendix B (20.1001-20.2402), Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases or exceeds a concentration of 2E-4 uCi/ml for dissolved or entrained noble gases.(3.1.2.6)

The methodology described in Section 8.1.2.2 is an alternative method to be used to determine the [2SGC-RQ100] monitor HSP. The methodology in Section 8.1.2.2 may be used for any batch release and shall be used when the total gamma radioactivity concentration of the liquid effluent prior to dilution exceeds 1.14E-3 uCi/ml. This concentration is equivalent to a monitor response and HSP derived in Section 8.1.2.1 and allows for a tritium concentration of up to 2.16E+0 uCi/ml. The setpoint was obtained by use of a conversion factor of 5.61E-9 uCi/ml/cpm determined for the nuclide mix.(3.1.2.6)

8.1.2.1 **BV-2 Setpoint Determination Based On A Conservative Mix**

The Alarm Setpoints shall be set at the values listed in the following Table:

BV-2 LIQUID MONITOR SETPOINTS				
		µCi/ml Above Background		
	Monitor	DV	HSP	ASP
Liquid Waste Effluent Monitor	2SGC-RQ100	1.14E-3	≤ 1.14E-3	≤ 7.99E-4
Service Water Monitor	2SWS-RQ101	4.30E-5	≤ 4.30E-5	≤ 3.01E-5
Service Water Monitor	2SWS-RQ102	4.30E-5	≤ 4.30E-5	≤ 3.01E-5

The setpoint for [2SGC-RQ100] is based on the following conditions, however, the setpoint bases for [2SWS-RQ101] and [2SWS-RQ102] can be found in Calculation Package ERS-ATL-93-021.[3.1.2.6]

- Source terms given in ATTACHMENT A Table 1.1-1b. These source terms (without Zn-65) have been generated by using models and input similar to NUREG-0017. The inputs are given in 1/2-ODC-3.01. The Zn-65 source term was generated via Calculation Package No. ERS-ATL-93-021.[3.1.2.6, 3.1.3.13]

- Dilution water flow rate of 22,800 gpm = (15,000 gpm BV-1 + 7,800 gpm BV-2).

- Discharge flow rate prior to dilution of 80 gpm for the Liquid Waste Effluent Monitor [2SGC-RQ100].

- A software conversion factor of 5.61E-9 uCi/ml/cpm associated with Liquid Waste Effluent Monitor [2SGC-RQ100].[3.1.2.6]

The above setpoint for [2SGC-RQ100] can be varied based on actual operating conditions resulting in the discharge and dilution flow rates as follows:

$$HSP = \frac{4.00E\text{-}6\ F}{f} \qquad [1.1(2)\text{-}1]$$

where:

HSP = HSP (uCi/ml) above background.

4.00E-6 = Proportionality constant based on nominal flow conditions:
4.00E-6 = 1.14E-3 net uCi/ml x 80 gpm ÷ 22,800 gpm

F = Dilution water flow rate, BV-1 plus BV-2 Cooling Tower Blowdown Rate (gpm).

f = Discharge flow rate prior to dilution (gpm).

8.1.2.1.1 BV-2 Mix Radionuclides

The "mix" (radionuclides and composition) of the liquid effluent was determined as follows:

- The liquid source terms that are representative of the "mix" of the liquid effluent were determined. Liquid source terms are the radioactivity levels of the radionuclides in the effluent from ATTACHMENT A Table 1.1-1b.
- The fraction of the total radioactivity in the liquid effluent comprised by radionuclide "i" (Si) for each individual radionuclide in the liquid effluent was determined as follows:

$$Si = \frac{Ai}{\sum_i A_i} \qquad [1.1(2)\text{-}2]$$

where:

Ai =Annual release of radionuclide "i" (Ci/yr) in the liquid effluent from ATTACHMENT A Table 1.1-1b.

8.1.2.1.2 BV-2 Maximum Acceptable Concentration (All Radionuclides)

The maximum acceptable total radioactivity concentration (uCi/ml) of all radionuclides in the liquid effluent prior to dilution (C_t) was determined by:

$$C_t = \frac{F}{f \sum_i \frac{S_i}{OEC_i}} \qquad [1.1(2)\text{-}3]$$

where:

F = Dilution water flow rate (gpm), BV-1 plus BV-2 Cooling Tower Blowdown Rate (not including release out through the Emergency Outfall Structure).

= 22,800 gpm = (15,000 gpm BV-1 + 7,800 gpm BV-2).

f = Maximum acceptable discharge flow rate prior to dilution (gpm).

= 80 gpm for Liquid Waste Process Effluent Monitor [2SGC-RQ100].

OECi = The ODCM liquid effluent concentration limit for radionuclide "i" (uCi/ml) from ATTACHMENT A Table 1.1-1b. The OEC is set at 10 times the 10 CFR 20, Appendix B (20.1001-20.2402) Table 2, Col. 2 EC values.

S_i = The fraction of total radioactivity attributed to radionuclide "i", from Equation [1.1(2)-2].

8.1.2.1.3 BV-2 Maximum Acceptable Concentration (Individual Radionuclide)

The maximum acceptable radioactivity concentration (uCi/ml) of radionuclide "i" in the liquid effluent prior to dilution (C_i) was determined by:

$$C_i = S_i \, C_t \qquad [1.1(2)\text{-}4]$$

8.1.2.1.4 BV-2 Monitor Display Value

The calculated monitor Display Value (uCi/ml) above background attributed to the radionuclides; (DV), was determined by:

$$DV = 5.61E\text{-}9 \, \Sigma_i \, C_i \, E_i \qquad [1.1(2)\text{-}5]$$

where:

5.61E-9 = Conversion factor (uCi/ml/cpm), an average determined for the source term mix.

E_i = Detection efficiency of the monitor for radionuclide "i" (cpm/uCi/ml) from ATTACHMENT A Table 1.1-1b. If not listed there, from Calculation Package ERS-SFL-86-026.[3.1.2.2]

8.1.2.1.5 BV-2 Monitor HSP

The monitor HIGH Alarm Setpoint above background (uCi/ml) should be set at the DV value.

8.1.2.2 **BV-2 Setpoint Determination Based On Analysis Prior To Release**

The following method applies to liquid releases when determining the setpoint for the maximum acceptable discharge flow rate prior to dilution and the associated HIGH Alarm Setpoint based on this flow rate for the Liquid Waste Effluent Monitor (2SGC-RQ100) during all operational conditions.

The monitor alarm setpoint is set slightly above (a factor of 1.25) the concentration reading that results from the concentration of gamma emitting radionuclides in order to avoid spurious alarms. To compensate for this increase in the monitor alarm setpoint, the allowable discharge flow rate is reduced by the same factor.

When the discharge flow rate is limited by the radwaste discharge pump rate capacity or by administrative selection rather than the allowable flow rate determined form activity concentration, the alarm setpoint will be proportionally adjusted based upon the excess dilution factor provided.

8.1.2.2.1 BV-2 Maximum Acceptable Discharge Flow Rate

The maximum acceptable discharge flow rate (f) prior to dilution (gpm) is determined by:

$$f = \frac{F}{1.25 \sum_i \frac{C_i}{OEC_i}}$$ [1.1(2)-6]

where:

F = Dilution water flow rate, BV-1 plus BV-2 Cooling Tower Blowdown (gpm).

The dilution water flow rate may include the combined cooling tower blowdown flow from both units exiting the discharge structure (but excluding emergency outfall structure flow) when simultaneous liquid discharges from both plants are administratively prohibited.

C_i = Radioactivity concentration of radionuclide "i" in the liquid effluent prior to dilution (uCi/ml) from analysis of the liquid effluent to be released.

1.25 = A factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

OEC_i = The ODCM liquid effluent concentration limit for radionuclide "i" (uCi/ml) from Table 1.1-1b. The OEC is set at 10 times the 10 CFR 20, Appendix B (20.1001-20.2402) ATTACHMENT A Table 2, Col. 2 EC values.

8.1.2.2.2 BV-2 Monitor Display Value

The calculated monitor Display Value (uCi/ml) above background attributed to the radionuclides; (DV) is determined by:

$$DV = (1.25)\ (5.61E\text{-}9)\ \Sigma_i\ C_i\ E_i \qquad [1.1(2)\text{-}7]$$

where:

E_i = The detection efficiency of the monitor for radionuclide "i" (cpm/uCi/ml) from ATTACHMENT A Table 1.1-1b. If not listed there, from Calculation Package ERS-SFL-86-026.(3.1.2.2)

1.25 = A factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

5.61E-9 = Conversion factor (uCi/ml/cpm), an average determined for the source term mix.

8.1.2.2.3 BV-2 Monitor HSP

The liquid effluent monitor HSP above background (uCi/ml) should be set at the DV value adjusted by any excess dilution factor provided as defined in the following equation:

$$HSP = DV \frac{f}{f'} \qquad [1.1(2)\text{-}8]$$

where:

HSP = HSP above background.

DV = Calculated monitor concentration reading (uCi/ml) from equation [1.1(2)-7].

F = Maximum acceptable discharge flow rate prior to dilution determined by equation [1.1(2)-6].

f' = Actual maximum discharge flow rate to be maintained for the discharge. The reduced value of f' may be due to pump limitations or administrative selection.

8.2 Compliance With 10 CFR 20 EC Limits (ODCM CONTROL 3.11.1.1)

8.2.1 Batch Releases

8.2.1.1 Pre-Release

The radioactivity content of each batch release will be determined prior to release in accordance with 1/2-ODC-3.03, Table 4.11-1. In order to assure representative samples, at least two tank volumes of entrained fluid from each tank to be discharged shall be recirculated. To meet this requirement tank recirculation time is calculated using actual tank volumes and recirculation pump capacity. BV-1 and BV-2 will show compliance with ODCM Control 3.11.1.1 in the following manner:

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The activity of the various radionuclides in the batch release, determined in accordance with 1/2-ODC-3.03, Table 4.11-1, is divided by the minimum dilution flow to obtain the concentration at the unrestricted area. This calculation is shown in the following equation:

$$Conc_i = \frac{C_i R}{MDF} \quad [1.2\text{-}1]$$

where:

$Conc_i$ = Concentration of radionuclide "i" at the unrestricted area (uCi/ml).

C_i = Concentration of radionuclide "i" in the potential batch release (uCi/ml).

R = Release rate of the batch (gpm).

MDF = Minimum dilution flow (gpm). (May be combined BV-1/BV-2 flow when simultaneous liquid discharges are administratively prohibited).

The projected concentrations in the unrestricted area are compared to the OECs. Before a release is authorized, Equation [1.2-2] must be satisfied.

$$\Sigma_i (Conc_i/OEC_i) < 1 \quad [1.2\text{-}2]$$

where:

OEC_i = The ODCM effluent concentration limit of radionuclide "i" (uCi/ml) from ATTACHMENT A Table 1.1-1a and 1.1-1b. The OEC is set at 10 times the 10 CFR 20, Appendix B, (20.1001-20.2402) Table 2, Col. 2 EC values.[3.1.1.3, 3.1.2.1]

8.2.1.2 Post-Release

Following release from the batch tank, the Post Dose Correction Factor will be calculated in the following manner:

$$PDCF = \frac{(VA_t)/(DFA)}{(VI_t)/(DFI)} \quad [1.2\text{-}3]$$

where:

PCDF = Post Dose Correction Factor.

VA_t = Actual Volume of tank released (gal).

DFA = Actual Dilution Flow during release (gpm).

VI_t = Initial Volume authorized for release (gal).

DFI = Initial Dilution Flow authorized for release (gpm).

The concentration of each radionuclide following release from the batch tank will be calculated in the unrestricted area in the following manner when the Post Dose Correction Factor shown in equation [1.2-3] is >1:

The average activity of radionuclide "i" during the time period of release is divided by the actual dilution flow during the period of release to obtain the concentration in the unrestricted area. This calculation is shown in the following equation:

$$Conc_{ik} = \frac{C_{ik}\, V_{tk}}{ADF_k} \quad [1.2\text{-}4]$$

where:

$Conc_{ik}$ = The concentration of radionuclide "i" (uCi/ml) at the unrestricted area, during the release period of time k.

NOTE:	Since discharge is from an isolated well-mixed tank at essentially a uniform rate, the difference between average and peak concentration within any discharge period is minimal.

C_{ik} = Concentration of radionuclide "i" (uCi/ml) in batch release during time period k.

V_{tk} = Volume of Tank released during time period k (gal).

ADF_k = Actual volume of Dilution Flow during the time period of release k (gal).

To show compliance with ODCM CONTROL 3.11.1.1, the following relationship must be satisfied:

$$\Sigma_i(Conc_{ik}/OEC_i) \leq 1 \qquad [1.2\text{-}5]$$

8.2.2 **Continuous Releases**

Continuous releases of liquid effluents do not normally occur at BV-1 or BV-2. When they do occur, the concentration of various radionuclides in the unrestricted area would be calculated using Equation [1.2-1] with C_{ik}, the concentration of isotope i in the continuous release. To show compliance with ODCM CONTROL 3.11.1.1, Equation [1.2-5] must again be satisfied.

8.3 **Compliance With 10 CFR 50 Dose Limits (ODCM CONTROLS 3.11.1.2 And 3.11.1.3)**

BV-1 and 2 utilize the concept of a shared liquid radioactive waste system according to NUREG-0133.(3.1.3.1) This permits mixing of the liquid radwaste for processing. Since the resulting effluent release cannot accurately be ascribed to a specific reactor unit, the treated effluent releases are allocated as defined below.

8.3.1 **Cumulation Of Doses (ODCM CONTROL 3.11.1.2)**

The dose contribution from the release of liquid effluents will be calculated monthly for each batch release during the month and a cumulative summation of the total body and organ doses will be maintained for each calendar month, current calendar quarter, and the calendar year to date. The dose contribution will be calculated using the following equation:

$$D_\tau = UAF \sum_{i} A_{i\tau} \sum_{k=1}^{m} \Delta t_k C_{ik} F_k \qquad [1.3\text{-}1]$$

where:

D_τ = The cumulative dose commitment to the total body or any organ, τ, from the liquid effluents for the total time period $\sum_{k=1}^{m} \Delta t_k$ (mrem)

Δt_k = The length of the kth release over which C_{ik} and F_k are averaged for all liquid releases (hours).

C_{ik} = The average concentration of radionuclide, "i" (uCi/ml), in undiluted liquid effluent during time period Δt_k from any liquid release.

$A_{i\tau}$ = The site related ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter (mrem-ml per hr-uCi) from ATTACHMENT B Table 1.3-1.

m = Number of releases contributing to the cumulative dose, D_t.

UAF = Unit allocation factor. Provides apportionment of dose between BV-1 and BV-2. Normally set at 0.5 for each unit. (Must total to ≤ 1.0).

F_k = The near field average dilution factor for Cik during any liquid effluent release. Defined as the ratio of the average undiluted liquid waste flow to the product of the average flow from the site discharge structure during the report period to unrestricted receiving waters, times 3. (3 is the site specific applicable factor for the mixing effect of the BV-1 and BV-2 discharge structure).

$$= \frac{\text{Waste Flow}}{(3)(\text{Dilution Water Flow})}$$

The site specific applicable factor of 3 results in a conservative estimate of the near field dilution factor based upon Regulatory Guide 1.113[3.1.3.4] methodology and is a factor of 10 below the limit specified in NUREG-0133, Section 4.3.[3.1.3.1]

The dose factor $A_{i\tau}$ was calculated for an adult for each isotope using the following equation from NUREG-0133.[3.1.3.1]

$$A_{i\tau} = 1.14E5\,(730/D_w + 21BF_i)DF_{i\tau} \qquad [1.3\text{-}2]$$

where:

$$1.14E5 = \left[\frac{1E6\ \text{pCi}}{\text{uCi}}\right] \times \left[\frac{1E3\ \text{ml}}{\text{l}}\right] \times \left[\frac{1\text{yr}}{8760\ \text{hr}}\right]$$

730 = Adult water consumption rate (liters/yr).

D_w = Far field dilution factor from the near field area within 1/4 mile of the release point to the potable water intake for adult water consumption.

21 = Adult fish consumption (kg/yr).

BF_i = Bioaccumulation factor for radionuclide "i" in fish from Table A-1 of Regulatory Guide 1.109[3.1.3.5] (pCi/kg per pCi/l). However, if data was not available from that reference, it was obtained from Table 6 of UCRL-50564.[3.1.3.8]

The bioaccumulation factor for niobium (300 pCi/kg per pCi/l) was not obtained from either of the above references noted. It was obtained from IAEA Safety Series No. 57. Justification for use of this value is documented in Appendix A to Calculation Package No. ERS-ATL-83-027.[3.1.3.6]

$DF_{i\tau}$ = Dose conversion factor for radionuclide "i" for adults for a particular organ τ (mrem/pCi) from Table E-11 of Regulatory Guide 1.109,[3.1.3.5] or NUREG-0172.[3.1.3.7]

A table of $A_{i\tau}$ values for an adult at BV-1 and BV-2 are presented in ATTACHMENT B Table 1.3-1.

The far field dilution factor (Dw) for BV-1 and BV-2 is 200. This value is based on a total dilution factor of 600 applicable to the Midland water intake located 1.3 miles downstream and on the opposite bank from BV-1 and BV-2 (i.e., 200 = 600 ÷ 3). The total dilution factor of 600 represents a conservative fully mixed annual average condition. Since the Midland intake is located on the opposite bank and is below the water surface, essentially fully mixed conditions would have to exist for the radioactive effluent to be transported to the intake.

The cumulative doses (from each reactor unit) for a calendar quarter and a calendar year are compared to ODCM CONTROL 3.11.1.2 as follows:

For the calendar quarter,

$D_\tau < 1.5$ mrem total body [1.3-3]

$D_\tau < 5$ mrem any organ [1.3-4]

For the calendar year,

$D_\tau < 3$ mrem total body [1.3-5]

$D_\tau < 10$ mrem any organ [1.3-6]

If any of the limits in Equation [1.3-3] through [1.3-6] are exceeded, a Special Report pursuant to ODCM Control 3.11.1.2 of 1/2-ODC-3.03 is required.[3.1.3.12]

8.3.2 Projection Of Doses (ODCM CONTROL 3.11.1.3)

Doses due to liquid releases shall be projected at least once per 31 days in accordance with ODCM CONTROL 3.11.1.3 and this section. The Liquid Radwaste Treatment System shall be used to reduce the radioactive materials in each liquid waste batch prior to its discharge, when the projected doses due to liquid effluent releases from each reactor unit, when averaged over 31 days would exceed 0.06 mrem to the total body or 0.2 mrem to any organ. Doses used in the projection are obtained according to equation [1.3-1]. The 31-day dose projection shall be performed according to the following equations:

When including pre-release data,

$$D_{31} = \left[\frac{A+B}{T}\right] 31 + C \qquad [1.3\text{-}7]$$

When not including pre-release data,

$$D_{31} = \left[\frac{A}{T}\right] 31 + C \qquad [1.3\text{-}8]$$

where:

D_{31} = Projected 31 day dose (mrem).
A = Cumulative dose for quarter (mrem).
B = Projected dose from this release (mrem).
T = Current days into quarter.
C = Value which may be used to anticipate plant trends (mrem).

8.4 Liquid Radwaste System

The liquid radwaste system has the capability to control, collect, process, store, recycle, and dispose of liquid radioactive waste generated as a result of plant operations, including anticipated operational occurrences. This system also uses some of the components of the steam generator blowdown system for processing.

Simplified flow diagrams of the liquid radwaste systems for BV-1 and BV-2 are provided as ATTACHMENT D Figures 1.4-1 and 1.4-2 respectively. A diagram showing the liquid effluent release points is provided as ATTACHMENT D Figure 1.4-3. A diagram of the site boundary for liquid effluents is provided as ATTACHMENT E Figure 5-1.

Since the concept of a shared liquid radwaste system is used, then any liquid waste generated can be stored, processed and discharged from either BV-1 or BV-2.

8.4.1 **BV-1 Liquid Radwaste System Components**

8.4.1.1 [1BR-I-1A/1B]: Cesium Removal Ion Exchangers

There are two of these ion exchangers, each has a capacity of 35 cubic feet. They are located on the east side of the Auxiliary Building (elevation 735'). They receive process fluid (liquid waste) from the reactor coolant system when letdown flow is diverted from the volume control tank.

8.4.1.2 [1BR-TK-4A/4B]: Coolant Recovery Tanks

There are two of these tanks, each tank has a nominal capacity of 195,000 gallons (maximum capacity = 205,578 gallons). They are located in the Solid Waste Building. They receive diverted letdown flow from the volume control tank and various reactor plant non-aerated drains that were processed through the cesium removal ion exchangers. These tanks can also receive liquid wastes that were processed through the cesium removal ion exchangers from Unit 2.

8.4.1.3 [1LW-TK-2A/2B]: High Level Waste Drain Tanks

There are two of these tanks, each tank has a nominal capacity of 5,000 gallons (maximum capacity = 4,899 gallons). They are located on the northwest wall of the Auxiliary Building (elevation 735'). They receive liquid wastes from the vent and drain system.

8.4.1.4 [1LW-TK-3A/3B]: Low Level Waste Drain Tanks

There are two of these tanks, each tank has a nominal capacity of 2,000 gallons (maximum capacity = 1,998 gallons). They are located in the northwest corner of the Auxiliary Building (elevation 735'). They also receive liquid wastes from the vent and drain system.

8.4.1.5 [1LW-FL-6]: Liquid Waste Pre-Conditioning Filter

There is a pre-conditioning filter with a 50 cubic feet capacity. The main purpose of the pre-conditioning filter is to clean liquid waste water of particulate and dissolved radioactive contaminants that is stored in [1LW-TK-2A/2B], [1LW-TK-3A/3B] and [1BR-TK-4A/4B]. The pre-conditioning filter can be customized with varying grades of activated charcoal (carbon) intended for removal of radionuclides in a colloidal state. The charcoal may consist of Course Mesh High Activated Coco Carbon, Medium Mesh High Activated Coco Carbon, Fine Mesh High Activated Coco Carbon and Cobalt Selective Media. This filter is located in the Decontamination Building (elevation 735').

8.4.1.6 [1LW-I-2]: Liquid Waste Demineralizer

There are four (4) demineralizer vessels each with a capacity of 30 cubic feet. The main purpose of the demineralizer is to clean liquid waste water of particulate and dissolved radioactive contaminants that was stored in [1LW-TK-2A/2B], [1LW-TK-3A/3B] and [1BR-TK-4A/4B] and pre-conditioned by [1LW-FL-6]. Each of the demineralizer vessels can be customized with different resins for effective removal of chemical contaminants along with radioactive contaminants. Generally, vessels 1 and 2 may contain Cation Resin, vessel 3 may be left empty to accept special resin (e.g., Mixed Bed Resin, Macro-porous Resin, Anion Resin, etc.) and vessel 4 may contain an Antimony Removal Resin. This demineralizer is located in the Decontamination Building (elevation 735').

8.4.1.7 Liquid Waste Evaporator

An evaporator was originally designed to process liquid waste at Unit 1 with a capacity of 6 gpm. However, this evaporator was retired prior to initial issue of the ODCM, because of concerns for creating a mixed-waste. SINCE the evaporator is no longer in-use, THEN it is not shown on Figure 1.4-1.

8.4.1.8 [1LW-TK-7A/7B]: Steam Generator Drain Tanks

There are two of these tanks, each tank has a nominal capacity of 34,500 gallons (maximum capacity = 35,800 gallons). They are located in the Fuel Pool Leakage Monitoring Room (elevation 735'). They normally receive liquid waste that has been processed through the liquid waste demineralizer. These tanks can also receive liquid waste from Unit 2. Upon completion of filling operation, the tank is placed on recirculation through the demineralizer until the radioactivity concentration is acceptable for discharge. A minimum of two tank volumes must be recirculated prior to sampling for discharge permit preparation.

8.4.1.9 [RM-1LW-104]: Liquid Waste Discharge Radiation Monitor

This off-line gamma scintillator radiation monitor continuously analyzes liquid waste as it is being discharged. The normal rate of discharge through this radiation monitor from [1LW-TK-7A/7B] is <35 gpm. The normal rate of discharge through this radiation monitor from [1BR-TK-4A/4B] is <150 gpm. The upper activity alarm on this radiation monitor has a setpoint that would indicate we are approaching OEC limits for radioactive water leaving the site. If an upper activity alarm on this radiation monitor is received, it automatically terminates the discharge by closing the discharge line isolation valve.

8.4.2 **BV-1 Laundry and Contaminated Shower Drain System Components**

8.4.2.1 [1LW-TK-6A/6B]: Laundry and Contaminated Shower Drain Tanks

There are two of these tanks, each has a nominal capacity of 1,200 gallons (maximum capacity = 1,303 gallons). They are located in the northwest corner of the Auxiliary Building (elevation 722'). They receive laundry and contaminated shower drains waste from the Service Building. These tanks can also receive mop water waste from Unit 2. The waste in these tanks is not sent to the liquid waste demineralizer for cleanup because this waste may contain organic compounds that will deplete a resin bed. Upon completion of filling operation, the tank must be recirculated a minimum of two tank volumes prior to sampling for discharge permit preparation.

8.4.2.2 [RM-1LW-116]: Laundry and Contaminated Shower Drains Tank Discharge Radiation Monitor

This off-line gamma scintillator radiation monitor continuously analyzes laundry and contaminated shower drains waste as it is being discharged. The normal rate of discharge through this radiation monitor from [1LW-TK-6A/6B] is <15 gpm. The upper activity alarm on this radiation monitor has a setpoint that would indicate we are approaching OEC limits for radioactive water leaving the site. If an upper activity alarm on this radiation monitor is received, it automatically terminates the discharge by closing the discharge line isolation valve.

8.4.3 **BV-2 Liquid Radwaste System Components**

8.4.3.1 [2BRS-IOE21A/21B]: Cesium Removal Ion Exchangers.

There are two of these ion exchangers, each has a capacity of 35 cubic feet. They are located on the east side of the Auxiliary Building (elevation 718'). They receive and process liquid wastes from the reactor coolant system during dilution or letdown operations.

8.4.3.2 [2LWS-TK21A/21B]: Waste Drain Tanks

There are two of these tanks, each tank has a nominal capacity of 10,000 gallons (maximum capacity = 10,184 gallons). They are located in the northeast corner of the Auxiliary Building (elevation 710'). They receive liquid wastes from the vent and drain system. These tanks can also receive liquid wastes from Unit 1. IF further processing is not necessary, THEN it may be placed on recirculation. A minimum of two tank volumes must be recirculated prior to sampling for discharge permit preparation.

8.4.3.3 [2SGC-IOE21A/21B]: Steam Generator Blowdown Cleanup Ion Exchangers

The main purpose of the ion exchangers is to clean liquid waste water of particulate and dissolved radioactive contaminants through an ion exchange process. There is a resin bed, outlets strainer, and cleanup filter associated with each of these ion exchangers. They are located in the Waste Handling Building (elevation 722').

8.4.3.4 Liquid Waste Evaporator

Two evaporators were originally designed to process liquid waste at Unit 2 with a capacity of 20 gpm each. However, these evaporators were retired prior to initial issue of the ODCM, because of concerns for creating a mixed-waste. SINCE the evaporators are no longer in-use, THEN they are not shown on Figure 1.4-2.

8.4.3.5 [2SGC-TK23A/23B]: Steam Generator Blowdown Test Tanks

There are two of these tanks, each has a nominal capacity of 18,000 gallons (maximum capacity = 17,955 gallons). They are located in the Auxiliary Building (elevation 755'). They receive liquid waste that has been processed through the cleanup ion exchangers. Upon completion of filling operation, the tank is placed on recirculation through the demineralizer until the radioactivity concentration is acceptable for discharge. A minimum of two tank volumes must be recirculated prior to sampling for discharge permit preparation.

8.4.3.6 [2SGC-TK21A/21B]: Steam Generator Blowdown Hold Tanks

There are two of these tanks, each has a nominal capacity of 50,000 gallons (maximum capacity = 51,460 gallons). They are located in the Waste Handling Building (elevation 722'). These tanks are used to store liquid waste when the radioactive concentration of the steam generator blowdown test tank is not acceptable for discharge. . These tanks can also receive liquid wastes from Unit 1. The contents of this tank may be drained or processed through the Unit 1 or Unit 2 Liquid Radwaste Treatment System until the radioactivity concentration is acceptable for discharge. A minimum of two tank volumes must be recirculated prior to sampling for discharge permit preparation.

8.4.3.7 [2SGC-RQ100]: Liquid Waste Effluent Monitor

This off-line gamma scintillator radiation monitor continuously analyzes liquid waste as it is being discharged. The normal rate of discharge through this radiation monitor is <85 gpm. The upper activity alarm on this radiation monitor has a setpoint that would indicate we are approaching OEC limits for radioactive water leaving the site. If an upper activity alarm is received, it automatically terminates the discharge by closing the discharge line isolation valves.

- END -

ATTACHMENT A
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LIQUID SOURCE TERMS

TABLE 1.1-1a
BV-1 LIQUID SOURCE TERM

NUCLIDE	(2) A_i ANNUAL RELEASE (Ci)	(3) OEC_i (uCi/ml)	(4) E_i DETECTION EFFICIENCY (cpm/uCi/ml)
Cr-51	1.3E-3	5E-3	1.18E+7
Mn-54	3.1E-4	3E-4	8.59E+7
Fe-55	1.6E-3	1E-3	(5)
Fe-59	8.3E-4	1E-4	9.17E+7
Co-58	1.4E-2	2E-4	1.16E+8
Co-60	2.0E-3	3E-5	1.73E+8
Zn-65 (3.1.3.13)	2.69E-2	5E-5	4.67E+7
Np-239	1.4E-4	2E-4	8.49E+7
Br-83	2.5E-5	9E-3	1.36E+6
Br-84	2.5E-5	4E-3	9.75E+7
Br-85	2.7E-6	(5)	6.19E+6
Rb-86	7.5E-5	7E-5	(5)
Sr-89	2.9E-4	8E-5	(5)
Sr-90	1.1E-5	5E-6	(5)
Y-90	9.4E-6	7E-5	(5)
Y-91m	8.7E-6	2E-2	8.98E+7
Y-91	5.7E-5	8E-5	2.60E+5
Y-93	7.4E-7	2E-4	(5)
Zr-95	5.1E-5	2E-4	8.60E+7
Nb-95	5.2E-5	3E-4	8.64E+7
Sr-91	1.3E-5	2E-4	6.97E+7
Mo-99	1.1E-2	2E-4	2.84E+7
Tc-99m	1.1E-2	1E-2	8.96E+7
Ru-103	3.4E-5	3E-4	9.5E+7
Ru-106	1.0E-5	3E-5	(5)
Rh-103m	3.4E-5	6E-2	(5)
Rh-106	1.0E-5	(5)	(5)
Te-125m	2.5E-5	2E-4	1.83E+5
Te-127m	2.6E-4	9E-5	4.09E+4
Te-127	2.7E-4	1E-3	1.38E+6
Te-129m	1.1E-3	7E-5	4.02E+6
Te-129	6.7E-4	4E-3	1.12E+7
I-130	1.2E-4	2E-4	3.08E+8
Te-131m	1.6E-4	8E-5	1.82E+8
Te-131	3E-5	8E-4	1.20E+8
I-131	1.6E-1	1E-5	1.11E+8
Te-132	4.3E-3	9E-5	1.17E+8
I-132	4.9E-3	1E-3	2.66E+8
I-133	4.0E-2	7E-5	9.90E+7
I-134	8.0E-5	4E-3	2.70E+8
Cs-134	4.6E-2	9E-6	1.99E+8

ATTACHMENT A

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LIQUID SOURCE TERMS

I-135	4.3E-3	3E-4	1.19E+8
Cs-136	8.9E-3	6E-5	2.80E+8
Cs-137	3.3E-2	1E-5	8.01E+7
Ba-137m	3.1E-2	1E-5	8.01E+7
Ba-140	1.1E-4	8E-5	4.37E+7
La-140	1.1E-4	9E-5	2.00E+8
Ce-141	5.1E-5	3E-4	5.07E+7
Ce-143	2.8E-6	2E-4	7.27E+7
Ce-144	3.2E-5	3E-5	1.06E+7
Pr-143	2.7E-5	2E-4	1.04E+0
Pr-144	3.2E-5	6E-3	2.25E+6
H-3	5.50E+2	1E-2	(5)
TOTAL[(1)]	4.05E-1		

(1) Excluding Tritium and Entrained Noble Gases

(2) Source Term for (RM-1LW-104 and RM-1LW-116) from Stone and Webster Calculation Package UR(B)-160 [(3.1.1.6)]

(3) ODCM Effluent Concentration Limit = 10 times the EC values of 10 CFR 20 [(3.1.1.3)]

(4) Detection Efficiency for (RM-1LW-104 and RM-1LW-116) from Calculation Package ERS-SFL-92-039 [(3.1.1.4)]

(5) Insignificant

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LIQUID SOURCE TERMS

TABLE 1.1-1b
BV-2 LIQUID SOURCE TERM

NUCLIDE	(2) A_i ANNUAL RELEASE (Ci)	(3) OEC_i (uCi/ml)	(4) DETECTION EFFICIENCY (cpm/uCi/ml)
Cr-51	1.00E-4	5E-3	2.01E+7
Mn-54	2.50E-5	3E-4	1.27E+8
Fe-55	1.30E-4	1E-3	(5)
Fe-59	6.50E-5	1E-4	1.26E+8
Co-58	1.10E-3	2E-4	1.82E+8
Co-60	1.60E-4	3E-5	2.38E+8
Zn-65 (3.1.3.13)	5.10E-2	5E-5	6.50E+7
Np-239	3.20E-5	2E-4	1.65E+8
Br-83	2.90E-5	9E-3	2.42E+6
Br-84	5.90E-9	4E-3	1.38E+8
Rb-86	3.70E-5	7E-5	1.04E+7
Sr-89	2.20E-5	8E-5	1.83E+4
Sr-90	8.50E-7	5E-6	(5)
Sr-91	5.30E-6	2E-4	1.04E+8
Mo-99	2.30E-3	2E-4	4.47E+7
Tc-99m	2.10E-3	1E-2	1.40E+8
Te-125m	1.90E-6	2E-4	3.94E+5
Te-127m	2.10E-5	9E-5	1.26E+5
Te-127	2.50E-5	1E-3	2.43E+6
Te-129m	8.20E-5	7E-5	6.53E+6
Te-129	5.30E-5	4E-3	1.96E+7
I-130	2.30E-4	2E-4	5.18E+8
Te-131m	5.20E-5	8E-5	2.85E+8
Te-131	9.40E-6	8E-4	1.88E+8
I-131	1.00E-1	1E-5	1.96E+8
Te-132	7.80E-4	9E-5	1.76E+8
I-132	2.30E-3	1E-3	4.22E+8
I-133	6.50E-2	7E-5	1.73E+8
I-134	4.60E-6	4E-3	4.06E+8
Cs-134	3.00E-2	9E-6	3.25E+8
I-135	9.20E-3	3E-4	1.71E+8
Cs-136	3.90E-3	6E-5	4.28E+8
Cs-137	2.20E-2	1E-5	1.28E+8
Ba-137m	2.10E-2	1E-5	1.33E+8
Ba-140	9.30E-6	8E-5	7.50E+7
La-140	8.40E-6	9E-5	3.08E+8

ATTACHMENT A
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LIQUID SOURCE TERMS

TABLE 1.1-1b (continued)
BV-2 LIQUID SOURCE TERM

NUCLIDE	(2) A_i ANNUAL RELEASE (Ci)	(3) OEC_i (uCi/ml)	(4) E_i DETECTION EFFICIENCY (cpm/uCi/ml)
Y-90	6.00E-7	7E-5	
Y-91m	3.60E-6	2E-2	1.59E+8
Y-91	4.40E-6	8E-5	3.55E+5
Y-93	3.00E-7	2E-4	2.03E+7
Zr-95	4.00E-6	2E-4	1.35E+8
Nb-95	4.00E-6	3E-4	1.33E+8
Ru-103	2.70E-6	3E-4	1.71E+8
Ru-106	8.20E-7	3E-5	(5)
Rh-103m	2.70E-6	6E-2	(5)
Rh-106	8.20E-7	--	5.65E+7
Ce-141	4.00E-6	3E-4	7.75E+7
Ce-143	8.60E-7	2E-4	1.20E+8
Ce-144	2.60E-6	3E-5	1.87E+7
Pr-143	2.30E-6	2E-4	1.63E+0
Pr-144	2.60E-6	6E-3	3.40E+6
H-3	5.50E+2	1E-2	(5)
TOTAL(1)	2.40E-1		

(1) Excluding Tritium and Entrained Noble Gases
(2) Source Term for (2SGC-RQ100) from Computer Code LIQ1BB (3.1.2.3)
(3) ODCM Effluent Concentration Limit = 10 times the EC values of 10 CFR 20 (3.1.2.1)
(4) Detection Efficiency for (2SGC-RQ100) from Calculation Package ERS-SFL-86-026 (3.1.2.2)
(5) Insignificant

ATTACHMENT B
Page 1 of 3
INGESTION DOSE COMMITMENT FACTORS

TABLE 1.3-1

A_{it} VALUES FOR THE ADULT FOR THE BEAVER VALLEY SITE
(mrem/hr per uCi/ml)

NUCLIDE	BONE	LIVER	T-BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E-01	2.70E-01	2.70E-01	2.70E-01	2.70E-01	2.70E-01	2.70E-01
C-14	3.13E 04	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03
Na-24	4.08E 02	4.08E 02	4.08E 02	4.08E 02	4.08E 02	4.08E 02	4.08E 02
P-32	4.62E 07	2.87E 06	1.79E 06	0.00E-01	0.00E-01	0.00E-01	5.19E 06
Cr-51	0.00E-01	0.00E-01	1.27E 00	7.62E-01	2.81E-01	1.69E 00	3.21E 02
Mn-54	0.00E-01	4.38E 03	8.35E 02	0.00E-01	1.30E 03	0.00E-01	1.34E 04
Mn-56	0.00E-01	1.10E 02	1.95E 01	0.00E-01	1.40E 02	0.00E-01	3.52E 03
Fe-55	6.59E 02	4.56E 02	1.06E 02	0.00E-01	0.00E-01	2.54E 02	2.61E 02
Fe-59	1.04E 03	2.45E 03	9.38E 02	0.00E-01	0.00E-01	6.83E 02	8.15E 03
Co-57	0.00E-01	2.10E 01	3.50E 01	0.00E-01	0.00E-01	0.00E-01	5.33E 02
Co-58	0.00E-01	8.95E 01	2.01E 02	0.00E-01	0.00E-01	0.00E-01	1.81E 03
Co-60	0.00E-01	2.57E 02	5.67E 02	0.00E-01	0.00E-01	0.00E-01	4.83E 03
Ni-63	3.12E 04	2.16E 03	1.05E 03	0.00E-01	0.00E-01	0.00E-01	4.51E 02
Ni-65	1.27E 02	1.65E 01	7.51E 00	0.00E-01	0.00E-01	0.00E-01	4.17E 02
Cu-64	0.00E-01	1.00E 01	4.70E 00	0.00E-01	2.52E 01	0.00E-01	8.53E 02
Zn-65	2.32E 04	7.37E 04	3.33E 04	0.00E-01	4.93E 04	0.00E-01	4.64E 04
Zn-69	4.93E 01	9.43E 01	6.56E 00	0.00E-01	6.13E 01	0.00E-01	1.42E 01
Br-83	0.00E-01	0.00E-01	4.04E 01	0.00E-01	0.00E-01	0.00E-01	5.82E 01
Br-84	0.00E-01	0.00E-01	5.24E 01	0.00E-01	0.00E-01	0.00E-01	4.11E-04
Br-85	0.00E-01	0.00E-01	2.15E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Rb-86	0.00E-01	1.01E 05	4.71E 04	0.00E-01	0.00E-01	0.00E-01	1.99E 04
Rb-88	0.00E-01	2.90E 02	1.54E 02	0.00E-01	0.00E-01	0.00E-01	4.00E-09
Rb-89	0.00E-01	1.92E 02	1.35E 02	0.00E-01	0.00E-01	0.00E-01	1.12E-11
Sr-89	2.22E 04	0.00E-01	6.39E 02	0.00E-01	0.00E-01	0.00E-01	3.57E 03
Sr-90	5.48E 05	0.00E-01	1.34E 05	0.00E-01	0.00E-01	0.00E-01	1.58E 04
Sr-91	4.10E 02	0.00E-01	1.65E 01	0.00E-01	0.00E-01	0.00E-01	1.95E 03
Sr-92	1.55E 02	0.00E-01	6.72E 00	0.00E-01	0.00E-01	0.00E-01	3.08E 03
Y-90	5.80E-01	0.00E-01	1.55E-02	0.00E-01	0.00E-01	0.00E-01	6.15E 03
Y-91m	5.48E-03	0.00E-01	2.12E-04	0.00E-01	0.00E-01	0.00E-01	1.61E-02
Y-91	8.50E 00	0.00E-01	2.27E-01	0.00E-01	0.00E-01	0.00E-01	4.68E 03
Y-92	5.09E-02	0.00E-01	1.49E-03	0.00E-01	0.00E-01	0.00E-01	8.92E 02
Y-93	1.62E-01	0.00E-01	4.46E-03	0.00E-01	0.00E-01	0.00E-01	5.12E 03
Zr-95	2.53E-01	8.11E-02	5.49E-02	0.00E-01	1.27E-01	0.00E-01	2.57E 02
Zr-97	1.40E-02	2.82E-03	1.29E-03	0.00E-01	4.26E-03	0.00E-01	8.73E 02
Nb-95	4.47E 00	2.49E 00	1.34E 00	0.00E-01	2.46E 00	0.00E-01	1.51E 04
Nb-97	3.75E 02	9.49E-03	3.46E-03	0.00E-01	1.11E-02	0.00E-01	3.50E 01

ATTACHMENT B
Page 2 of 3
INGESTION DOSE COMMITMENT FACTORS

TABLE 1.3-1

A_{it} VALUES FOR THE ADULT FOR THE BEAVER VALLEY SITE
(mrem/hr per uCi/ml)

NUCLIDE	BONE	LIVER	T-BODY	THYROID	KIDNEY	LUNG	GI-LLI
Mo-99	0.00E-01	1.05E 02	2.00E 01	0.00E-01	2.38E 02	0.00E-01	2.43E 02
Tc-99m	8.97E-03	2.54E-02	3.23E-01	0.00E-01	3.85E-01	1.24E-02	1.50E 01
Tc-101	9.23E-03	1.33E-02	1.30E-01	0.00E-01	2.39E-01	6.79E-03	4.00E-14
Ru-103	4.51E 00	0.00E-01	1.94E 00	0.00E-01	1.72E 01	0.00E-01	5.26E 02
Ru-105	3.75E-01	0.00E-01	1.48E-01	0.00E-01	4.85E 00	0.00E-01	2.29E 02
Ru-106	6.70E 01	0.00E-01	8.48E 00	0.00E-01	1.29E 02	0.00E-01	4.34E 03
Ag-110m	9.48E-01	8.77E-01	5.21E-01	0.00E-01	1.72E 00	0.00E-01	3.58E 02
Sb-124	7.87E 00	1.49E-01	3.12E 00	1.91E-02	0.00E-01	6.13E 00	2.23E 02
Sb-125	5.03E 00	5.62E-02	1.20E 00	5.11E-03	0.00E-01	3.88E 00	5.54E 01
Te-125m	2.57E 03	9.30E 02	3.44E 02	7.72E 02	1.04E 04	0.00E-01	1.03E 04
Te-127m	6.49E 03	2.32E 03	7.90E 02	1.66E 03	2.63E 04	0.00E-01	2.17E 04
Te-127	1.05E 02	3.78E 01	2.28E 01	7.81E 01	4.29E 02	0.00E-01	8.32E 03
Te-129m	1.10E 04	4.11E 03	1.74E 03	3.78E 03	4.60E 04	0.00E-01	5.55E 04
Te-129	3.01E 01	1.13E 01	7.33E 00	2.31E 01	1.26E 02	0.00E-01	2.27E 01
Te-131m	1.66E 03	8.10E 02	6.75E 02	1.28E 03	8.21E 03	0.00E-01	8.05E 04
Te-131	1.89E 01	7.88E 00	5.96E 00	1.55E 01	8.27E 01	0.00E-01	2.67E 00
Te-132	2.41E 03	1.56E 03	1.47E 03	1.72E 03	1.50E 04	0.00E-01	7.39E 04
Te-134	3.10E 01	2.03E 01	1.25E 01	2.71E 01	1.96E 02	0.00E-01	3.44E-02
I-129	1.19E 02	1.02E 02	3.35E 02	2.63E 05	2.19E 02	0.00E-01	1.61E 01
I-130	2.75E 01	8.10E 01	3.20E 01	6.87E 03	1.26E 02	0.00E-01	6.97E 01
I-131	1.51E 02	2.16E 02	1.24E 02	7.08E 04	3.71E 02	0.00E-01	5.70E 01
I-132	7.37E 00	1.97E 01	6.90E 00	6.90E 02	3.14E 01	0.00E-01	3.71E 00
I-133	5.16E 01	8.97E 01	2.74E 01	1.32E 04	1.57E 02	0.00E-01	8.06E 01
I-134	3.85E 00	1.05E 01	3.74E 00	1.81E 02	1.66E 01	0.00E-01	9.12E-03
I-135	1.61E 01	4.21E 01	1.55E 01	2.78E 03	6.76E 01	0.00E-01	4.76E 01
Cs-134	2.98E 05	7.09E 05	5.79E 05	0.00E-01	2.29E 05	7.61E 04	1.24E 04
Cs-136	3.12E 04	1.23E 05	8.86E 04	0.00E-01	6.85E 04	9.39E 03	1.40E 04
Cs-137	3.82E 05	5.22E 05	3.42E 05	0.00E-01	1.77E 05	5.89E 04	1.01E 04
Cs-138	2.64E 02	5.22E 02	2.59E 02	0.00E-01	3.84E 02	3.79E 01	2.23E-03
Ba-139	9.69E-01	6.90E-04	2.84E-02	0.00E-01	6.45E-04	3.92E-04	1.72E 00
Ba-140	2.03E 02	2.55E-01	1.33E 01	0.00E-01	8.66E-02	1.46E-01	4.18E 02
Ba-141	4.71E-01	3.56E-04	1.59E-02	0.00E-01	3.31E-04	2.02E-04	2.22E-10
Ba-142	2.13E-01	2.19E-04	1.34E-02	0.00E-01	1.85E-04	1.24E-04	3.00E-19
La-140	1.51E-01	7.59E-02	2.01E-02	0.00E-01	0.00E-01	0.00E-01	5.57E 03
La-142	7.71E-03	3.51E-03	8.74E-04	0.00E-01	0.00E-01	0.00E-01	2.56E 01
Ce-141	2.63E-02	1.78E-02	2.02E-03	0.00E-01	8.26E-03	0.00E-01	6.80E 01

ATTACHMENT B
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INGESTION DOSE COMMITMENT FACTORS

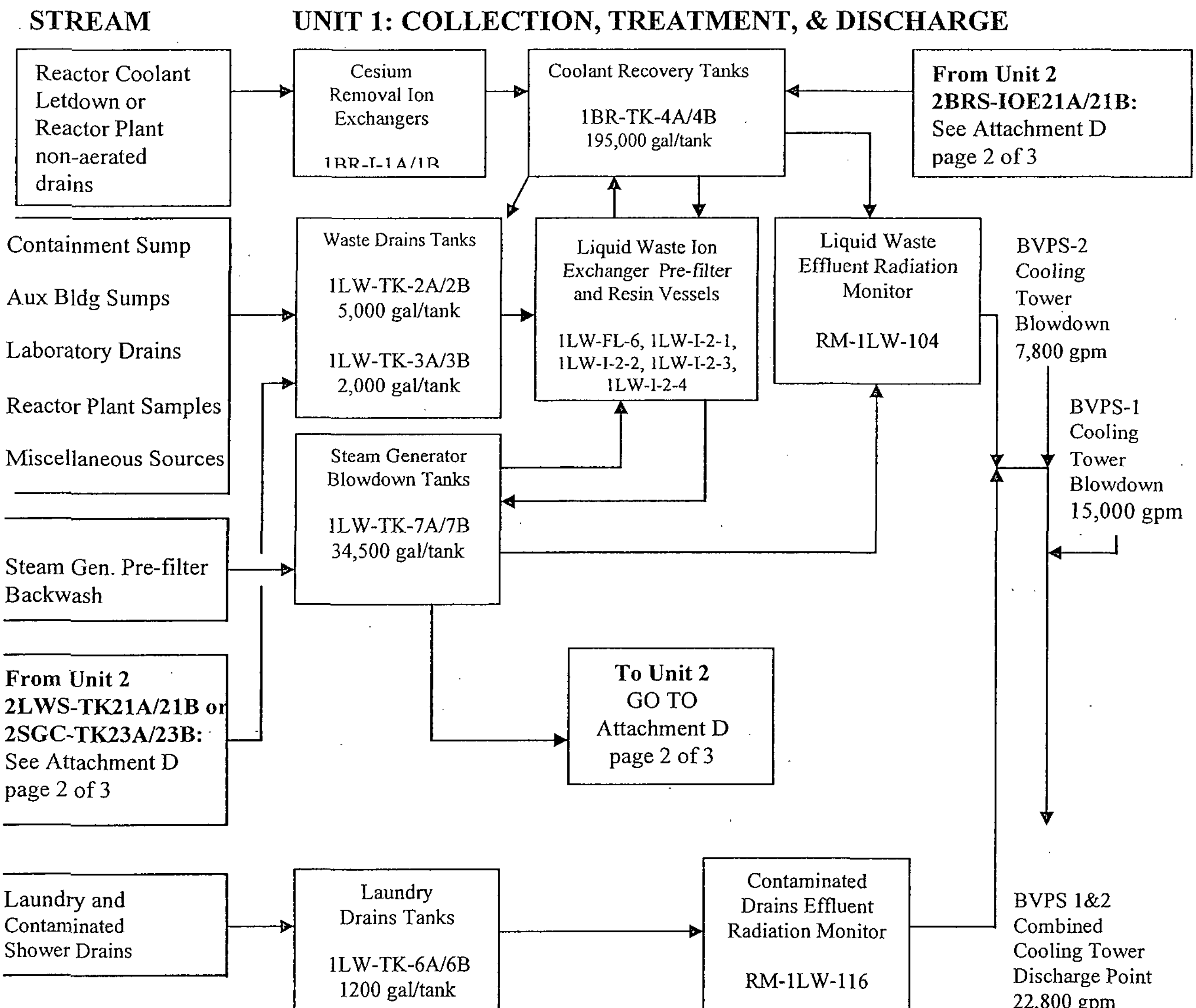
TABLE 1.3-1

A_{it} VALUES FOR THE ADULT FOR THE BEAVER VALLEY SITE
(mrem/hr per uCi/ml)

NUCLIDE	BONE	LIVER	T-BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ce-143	4.64E-03	3.43E 00	3.79E-04	0.00E-01	1.51E-03	0.00E-01	1.28E 02
Ce-144	1.37E 00	5.73E-01	7.36E-02	0.00E-01	3.40E-01	0.00E-01	4.64E 02
Pr-143	5.54E-01	2.22E-01	2.75E-02	0.00E-01	1.28E-01	0.00E-01	2.43E 03
Pr-144	1.81E-03	7.53E-04	9.22E-05	0.00E-01	4.25E-04	0.00E-01	2.61E-10
Nd-147	3.79E-01	4.38E-01	2.62E-02	0.00E-01	2.56E-01	0.00E-01	2.10E 03
W-187	2.96E 02	2.47E 02	8.65E 01	0.00E-01	0.00E-01	0.00E-01	8.10E 04
Np-239	2.90E-02	2.85E-03	1.57E-03	0.00E-01	8.89E-03	0.00E-01	5.85E 02

ATTACHMENT C
Page 1 of 3
LIQUID RADWASTE SYSTEM

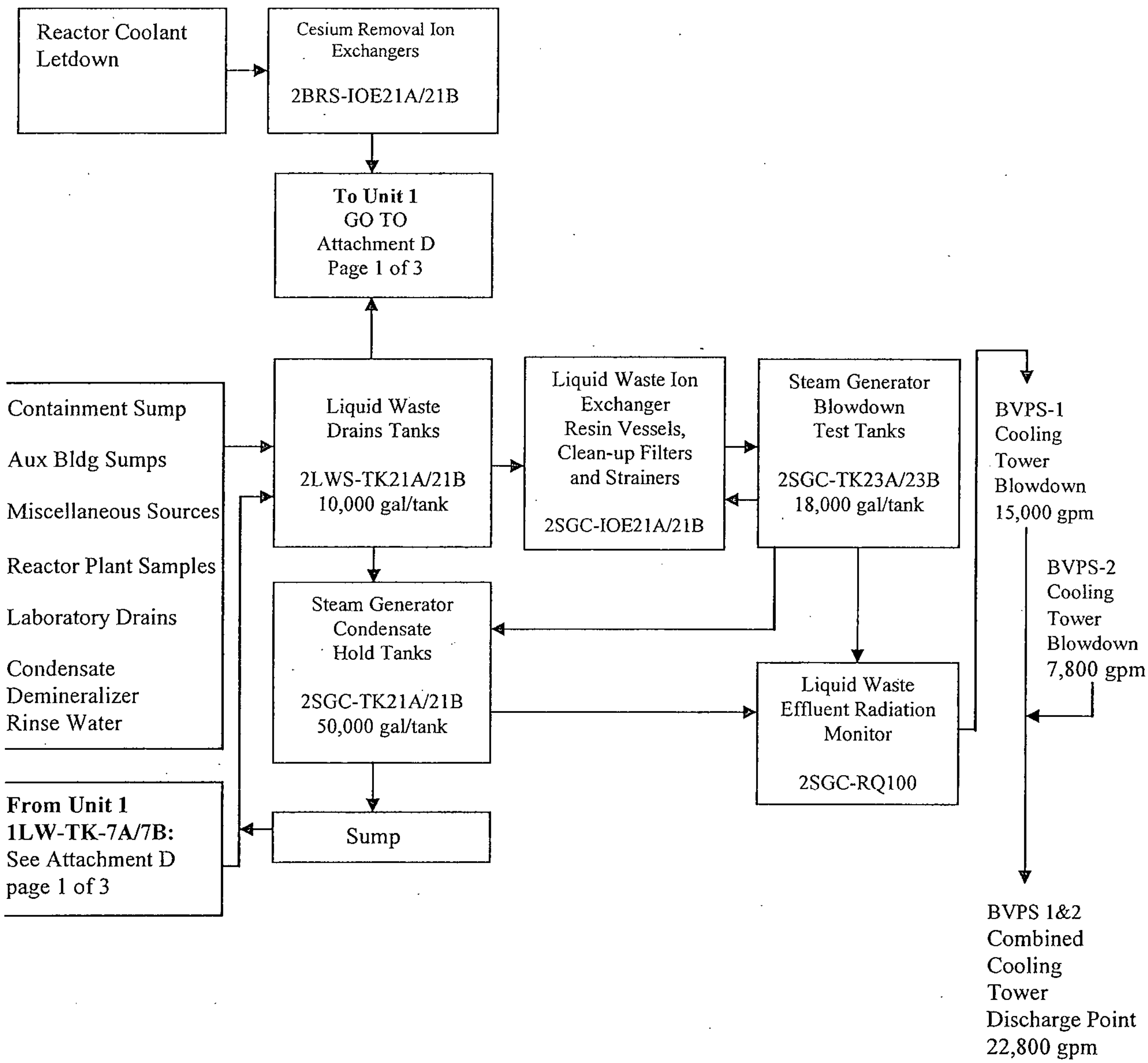
FIGURE 1.4-1
BV-1 LIQUID RADWASTE SYSTEM



ATTACHMENT C
Page 2 of 3
LIQUID RADWASTE SYSTEM

FIGURE 1.4-2
BV-2 LIQUID RADWASTE SYSTEM

STREAM **UNIT 2: COLLECTION, TREATMENT, & DISCHARGE**



ATTACHMENT C
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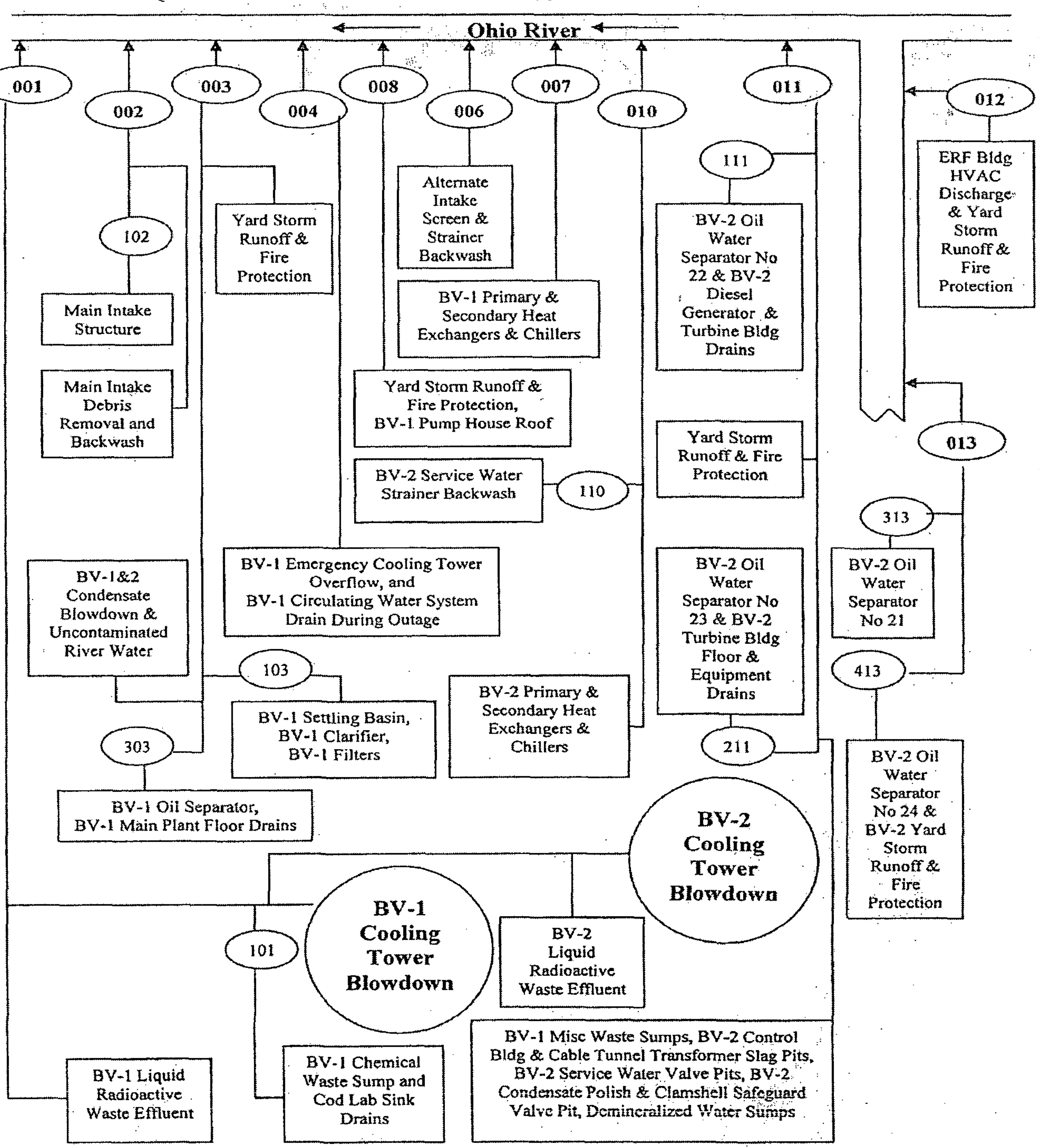
LIQUID RADWASTE SYSTEM

FIGURE 1.4-3
BV-1 AND 2 LIQUID EFFLUENT RELEASE POINTS



ATTACHMENT D
Page 1 of 1
SITE BOUNDARY FOR LIQUID EFFLUENTS

FIGURE 5-1
SITE BOUNDARY FOR LIQUID EFFLUENTS