X244 ALL
Document Control Desk
Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

May 9, 1996

Attached is a revision to the Offsite Dose Calculation Manual, Dresden Annex, Chapter 10. Please update your manual as follows:

Remove:

Dresden Chapter 10, Revision 1.5

Insert:

Dresden Chapter 10, Revision 1.7

Please sign below indicating your manual has been updated and that your controlled copy number is correct.

Name ______________________ Date ______________________

Return to:

ComEd
Central Files
1400 Opus Place
Downers Grove, IL 60515

-or-

Central Files
4th Floor
Downers Grove

200123

A009 0/1

DRESDEN ANNEX INDEX

CHAPTER 10

RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

TABLE OF CONTENTS

PAGE

CHAPTER 10

RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

TABLE OF CONTENTS (Cont'd)

PAGE

CHAPTER 10

LIST OF TABLES

NUMBER | PAGE

CHAPTER 10

LIST OF FIGURES

CHAPTER 10

RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

10.1 AIRBORNE RELEASES

10.1.1 System Description

A simplified gaseous radwaste and gaseous effluent flow diagram is provided for Dresden Unit 1 in Figure 10-1 and for Dresden Units 2 and 3 in Figure 10-2. Dresden 1 is no longer operational, but monitoring of potentially radioactive releases from the plant chimney continues.

Each airborne release point is classified as stack, vent, or ground level in accordance with the definitions in Section 4.1.4 and the results in Table A-1 of Appendix A. The principal release points for potentially radioactive airborne effluents and their classifications are as follows:

- For Dresden 1, the plant chimney (a stack release point).
- For Dresden 2/3:
  - The ventilation chimney (a stack release point).
  - The reactor building ventilation stack (a vent release point).

10.1.1.1 Condenser Offgas Treatment System

The condenser offgas treatment system is designed and installed to reduce radioactive gaseous effluents by collecting non-condensable off-gases from the condenser and providing for holdup to reduce the total radioactivity by radiodecay prior to release to the environment. The daughter products are retained by charcoal and HEPA filters. The system is described in Section 9.2 of the Dresden UFSAR.

10.1.1.2 Ventilation Exhaust Treatment System

Ventilation exhaust treatment systems are designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in selected effluent streams by passing ventilation or vent exhaust gases through charcoal absorbers and/or HEPA filters prior to release to the environment. Such a system is not considered to have any effect on noble gas effluents. The ventilation exhaust treatment systems are shown in Figures 10-1 and 10-2.

Engineered safety features atmospheric cleanup systems are not considered to be ventilation exhaust treatment system components.

10.1.2 Radiation Monitors

10.1.2.1 Unit 1 Chimney Monitor

Monitor 1-SPING-4A continuously monitors the final effluent from the Unit 1 chimney.

The monitor has isokinetic sampling, gaseous grab sampling, and particulate and iodine sampling capability. Tritium samples are obtained using a portable sampling system. A tap is available for obtaining a sample from the isokinetic probe.

In normal operation all three noble gas channels (low, mid-range, high) are on line and active.

No automatic isolation or control functions are performed by this monitor.

10.1.2.2 Units 2/3 Chimney Monitor

Monitor 2/3-SPING-4C continuously monitors the final effluent from the Units 2/3 chimney.

The monitor has isokinetic sampling, gaseous grab sampling, particulate and iodine sampling, and postaccident sampling capability. Tritium samples are obtained using a portable sampling system. A tap is available for obtaining a sample from the isokinetic probe.

In normal operation the two lower noble gas channels (low and mid-range) are on line and active. The high range noble gas channel flow is bypassed and this channel is in standby. On a high alarm the low and mid-range noble gas channels are bypassed and only the high range noble gas channel remains active.

No automatic isolation or control functions are performed by this monitor. Pertinent information on this monitor is provided in the Dresden 2/3 UFSAR Section 7.6.2.4.

In addition to the primary monitor described above, there is a backup system consisting of two additional detectors and sample taps in series in the primary sample stream.

10.1.2.3 Reactor Building Vent Stack Effluent Monitors

Monitor 2/3 SPING-4A continuously monitors the final effluent from the reactor building vent stack.

The vent stack monitor has isokinetic sampling, gaseous sampling, and iodine and particulate sampling capability. Tritium samples are obtained using a portable sampling system. A tap is available for obtaining a sample from the isokinetic probe.

All channels are continuously on line and active.

No automatic isolation or control functions are performed by this monitor.

10.1.2.4 Reactor Building Ventilation Monitors

Monitors 2(3)-1735A/B continuously monitor the effluent from the Unit 2(3) reactor building ventilation. On high alarm, the monitors automatically initiate closure of valves A02(3)A-5741, A02(3)B-5741, A02(3)A-5742, and A02(3)B-5742 thus isolating the Unit 2(3) reactor building ventilation, and initiate startup of the Unit 2/3 standby gas treatment system.

Pertinent information on these monitors is provided in Dresden UFSAR Section 7.6.2.5.

10.1.2.5 Condenser Air Ejector Monitors

Monitors 2(3)-1733A/B and 2(3)-1738B continuously monitor gross gamma activity downstream of the Unit 2 and 3 steam jet air ejector and prior to release to the main chimney.

On high alarm monitors 2(3)-1733A/B automatically activate an interval timer which in turn initiates closure of air operated valve A02(3)-5406, thus terminating the release.

Pertinent information on these monitors is found in Dresden UFSAR Section 7.6.2.3.

10.1.2.6 Isolation Condenser Vent Monitor

Monitors 2(3)-1736 A/B continuously monitor radioactivity in the effluent from the isolation condenser vent. No control device is initiated by this monitor.

Pertinent information on this monitor is provided in Dresden UFSAR Section 7.6.2.10

10.1.3 Alarm and Trip Setpoints

10.1.3.1 Setpoint Calculations

10.1.3.1.1 Reactor Building Vent Monitors

The alarm setpoint for the reactor building vent monitor is established at 4 mr/hr.

10.1.3.1.2 Condenser Air Ejector Monitors

The high-high trip setpoint is established at ≤ 100 µCi/Sec per MWt (≐ 2.5E5µCi/sec) and the high alarm is established at ≤ 50µCi/sec per MWt (≐1.25E5µCi/sec).

10.1.3.1.3 Units 2/3 Plant Chimney Radiation Monitor

The setpoint is established at a count rate corresponding to 105,000 µCi/sec.

10.1.3.2 Release Limits

Alarm and trip setpoints of gaseous effluent monitors are established to ensure that the release rate limits of RETS are not exceeded. The release limits are found by solving Equations 10-1 and 10-2 for the total allowed release rate, Q_{tv}.

$$(1.11) \sum \{ f_i [Q_{ts} \bar{S_i} + Q_{tv} \bar{V_i}] \} < 500 \text{mrem/yr} \qquad (10\text{-}1)$$

$$\sum \{ (\bar{L_i} f_i [(X/Q)_s \, Q_{ts} \, \exp(-\lambda_i R/3600 u_s) + (X/Q)_v Q_{tv} \exp -\lambda_i R/3600 u_v)] + (1.11)(f_i)[Q_{ts} S_i + Q_{tv} V_i] \} < 3000 \text{mrem/yr} \qquad (10\text{-}2)$$

The summations are over noble gas radionuclides i.

f_i Fractional Radionuclide Composition
The release rate of noble gas radionuclide i divided by the total release rate of all noble gas radionuclides.

Q_{ts} Total allowed Release Rate, Stack Release [μCi/sec]
The total allowed release rate of all noble gas radionuclides released as stack releases.

Q_{tv} Total Allowed Release Rate, Vent Release [μCi/sec]
The total allowed release rate of all noble gas radionuclides released as vent releases.

The remaining parameters in Equation 10-1 have the same definitions as in Equation A-8 of Appendix A. The remaining parameters in Equation 10-2 have the same definition as in Equation A-9 of Appendix A.

Equation 10-1 is based on Equation A-8 of Appendix A and the RETS restriction on whole body dose rate (500 mrem/yr) due to noble gases released in gaseous effluents (see Section A.1.3.1 of Appendix A). Equation 10-2 is based on Equation A-9 of Appendix A and the RETS restriction on skin dose rate (3000 mrem/yr) due to noble gases released in gaseous effluents (see Section A.1.3.2 of Appendix A).

Calibration methods and surveillance frequency for the monitors will be conducted as specified in the RETS.

10.1.3.3 Release Mixture

In the determination of alarm and trip setpoints the radioactivity mixture in the exhaust air is assumed to have the following compositions.

- Reactor building vent effluent monitors.

  The mixture used for the GE monitors is taken from a representative isotopic analysis of the vent stack noble gas released during the calendar quarter in which the monitor is recalibrated. The "mixture" used for the SPING-4 is assumed to be a single pseudo-noble gas radionuclide.

- Condenser air ejector monitor.

  The mixture used for this monitor is taken from a representative isotopic analysis of noble gases collected at the recombiner outlet during the calendar quarter in which the monitor is recalibrated.

- Units 2/3 plant chimney monitors.

  The mixture used for the GE monitors is taken from the most recent isotopic analysis of noble gases collected from the chimney monitor during the calendar quarter in which the monitor is recalibrated. The "mixture" used for the SPING-4 is assumed to be a single pseudo-noble gas radionuclide.

10.1.3.4 Conversion Factors

The conversion factors used to establish gaseous effluent monitor setpoints are obtained as follows.

- Reactor building vent effluent monitor.

  For the GE monitors, the isotopic analysis in Section 10.1.3.3 and the monitor reading (in mR/hr) at the time of the analysis are used to establish the conversion factor in mR/hr per µCi/cc. For the SPING-4 the conversion factor is based on the 0.8 MeV gamma of the pseudo-noble gas radionuclide.

- Condenser air ejector monitor.

  The isotopic analysis in Section 10.1.3.3 and the flow and monitor reading (in mR/hr) at the time of the analysis are used to establish the conversion factor in mR/hr per µCi/cc.

- Units 2/3 plant chimney monitors

  For the GE monitors, the isotopic analysis in Section 10.1.3.3 and flow and monitor reading (in CPS) at the time of the analysis are used to establish the conversion factor in CPS per µCi/cc. For the SPING-4 the conversion factor is based on the 0.8 MeV gamma of the pseudo-noble gas radionuclide.

10.1.3.5 HVAC Flow Rates

The HVAC exhaust flow rates are obtained from either the Units 2/3 process computers or the SPING-4 control station. If the actual flows are not available, the default values are:

Units 2/3 Chimney Air Flow	1.00E10 cc/min
Units 2/3 Combined Reactor Vent	6.23E9 cc/min
Unit 1 Chimney Air Flow	1.76E9 cc/min

10.1.4 Allocation of Effluents from Common Release Points

Radioactive gases, particulates, and iodines released from the Unit 1 chimney originate from Unit 1 only. However, radioactive gaseous effluents released from Units 2/3 are comprised of contributions from both units. Estimates of noble gas contributions from Units 2 and 3 are allocated considering appropriate operating conditions and measured SJAE off-gas activities. Allocation of radioiodine and radioactive particulate releases to Units 2 or 3 specifically is not as practical and is influenced greatly by in-plant leakage. Under normal operating conditions, allocation is made using reactor coolant iodine activities. During unit shutdowns or periods of known major in-plant leakage, the apportionment is adjusted accordingly. The allocation of effluents is estimated on a monthly basis.

10.1.5 Dose Projections

Because the gaseous releases are continuous, the doses are routinely calculated in accordance with the RETS.

10.2 LIQUID RELEASES

10.2.1 System Description

A simplified liquid radwaste and liquid effluent flow diagram is provided in Figure 10-3.

The liquid radwaste treatment system is designed and installed to reduce radioactive liquid effluents by collecting the liquids, providing for retention or holdup, and providing for treatment by evaporator, demineralizer and filter for the purpose of reducing the total radioactivity prior to reuse or release to the environment. The system is described in Section 9.3 of the Dresden Updated Final Safety Analysis Report.

10.2.1.1 Unit 1 Storage Tanks

Liquid radioactive effluents are not released from Unit 1 Storage tanks directly to the environment but are made through the Units 2/3 radwaste system.

10.2.1.2 Units 2/3 Waste Sample Tanks

There are three waste sample tanks (33,000 gallons each) which receive water from the liquid waste treatment system. These tanks are transferred to the waste surge tank for discharge to the Illinois River via the discharge canal.

10.2.1.3 Units 2/3 Floor Drain Sample Tanks

There are two floor drain sample tanks (22,000 gallons each) which receive liquid waste from the floor drain treatment system. These tanks are transferred to the waste surge tank for discharge to the Illinois River via the discharge canal.

10.2.1.4 Units 2/3 Waste Surge Tank

The waste surge tank receives processed water from the waste sample tanks and floor drain sample tanks. This tank discharges to the Illinois River via the discharge canal.

10.2.2 Radiation Monitors

10.2.2.1 Liquid Radwaste Effluent Monitor

Monitor 2/3-1721 is used to monitor all releases from the waste surge tank. On high alarm, a grab sample of the effluent is automatically taken from the discharge side of the sample chamber after a 0 to 60 second delay determined by a locally mounted timer. The release is terminated manually by initiating closure of the low flow (AO 2001-170) or high flow (AO-2001-195) discharge line valves.

Pertinent information on the monitor and associated control devices is provided in Dresden UFSAR Section 7.6.2.9.

10.2.2.2 Units 2/3 Service Water Effluent Monitors

Monitors 2(3)-1724 continuously monitor the service water effluent. On high alarm a grab sample is automatically taken.

Pertinent information on these monitors is provided in Dresden UFSAR Table Section 9.6.2.8.

10.2.2.3 Chemical Cleaning Facility Service Water Effluent Monitor

Monitor WASMC-06641-0700 continuously monitors service water effluent from the chemical cleaning facility. On high alarm the release is terminated by manually initiating closure of isolation valve AOS-06699-7904.

No control device is initiated by this monitor.

10.2.3 Alarm and Trip Setpoints

10.2.3.1 Setpoint Calculations

Alarm and trip setpoints of liquid effluent monitors at the principal release points are established to ensure that the limits of 10CFR20 are not exceeded in the unrestricted area.

10.2.3.1.1 Liquid Radwaste Effluent Monitor

The monitor setpoint is found by solving equation 10-3 for the total isotopic activity.

$$P \leq K \times \left(\sum C_i^T / \sum C_i^T / DWC_i\right) \times \left((40{,}000 + F_{max}^r) / F_{max}^r\right) \qquad (10\text{-}3)$$

P Release Setpoint (cpm)

C_i^T Concentration of radionuclide i in the release tank (µCi/ml)

F_{max}^r Maximum Release Tank Discharge Flow Rate (gpm)

The flow rate from the radwaste discharge tank. The maximum pump discharge rate of 250 gpm is used for calculating the setpoint.

K Calibration constant (cpm/µCi/ml)

DWC_i Derived Water Concentration of Radionuclide i (µCi/ml)

The concentration of radionuclide i given in Appendix B, Table 2, Column 2 to 10CFR20.1001-2402. When technical specifications allow, ten[1] (10) times the DWC_i may be used.

40,000 Dilution Flow (gpm)

Releases are not permitted if the calculated dilution flow is less than 40,000 gpm. Once it has been determined that the dilution flow is ≥ 40,000 gpm, this value (40,000 gpm) is used even if the actual dilution flow is much greater.

---

1 Dresden Station may use ten (10) upon Technical Specification approval. Until then, one (1) times the DWC must be used.

10.2.3.1.2 Units 2/3 Service Water Effluent Monitor

The monitor setpoint is established at two times the background radiation value.

10.2.3.1.3 Chemical Cleaning Facility Service Water Effluent Monitor

The monitor setpoint is established at two times the background radiation value.

10.2.3.2 Discharge Flow Rates

10.2.3.2.1 Release Tank Discharge Flow Rate

Prior to each batch release, a grab sample is obtained.

The results of the analysis of the sample determine the discharge rate of each batch as follows:

$$F^r_{max} = 0.1(40{,}000/\sum (C_i\ /DWC_i)) \qquad (10\text{-}4)$$

The summation is over radionuclides i.

0.1 Reduction factor for conservatism.

F^r_{max} Maximum Permitted Discharge Flow Rate (gpm)

The maximum permitted flow rate from the radwaste discharge tank. Releases are not permitted if the calculated discharge rate, F^r_{max}, is less than 250 gpm. (gpm)

40,000 Dilution Flow (gpm)

C_i Concentration of Radionuclide i in the Release Tank (µCi/mL)

The concentration of radioactivity in the radwaste discharge tank based on measurements of a sample drawn from the tank.

DWC_i Derived Water Concentration of Radionuclide i (µCi/ml)

The concentration of radionuclide i given in Appendix B, Table 2, Column 2 to 10CFR20.1001-2402. When technical specifications allow, ten (10)[2] times the DWC_i may be used.

[2] Dresden Station may use ten (10) upon Technical Specification approval. Until then, one (1) times the DWC must be used.

10.2.3.3 Release Limits

Release limits are determined from 10CFR20. Calculated maximum permissible discharge rates are divided by 10 to ensure that applicable derived water concentrations (DWC) are not exceeded.

10.2.3.4 Release Mixture

For the liquid radwaste effluent monitor, the release mixture used for the setpoint determination is the radionuclide mix identified in the grab sample isotopic analysis.

For all other liquid effluent monitors, no release mixture is used because the setpoint is established at "two times background."

10.2.3.5 Conversion Factors

The readout for the liquid radwaste effluent monitor is in CPM. The calibration constant is based on the detector sensitivity to Co-60.

The readouts for the Units 2/3 service water effluent monitors are in μCi/mℓ. The calibration constants are based on the detector sensitivity to Co-60.

10.2.3.6 Liquid Dilution Flow Rates

The dilution flow is determined using the information in Table 10-1. However, by procedure the maximum dilution flow used for determining liquid radwaste release rates and setpoints is 40,000 gpm. Thus, even if the dilution flow exceeds 40,000 gpm, for conservatism, the calculations are based on 40,000 gpm.

10.2.4 Allocation of Effluents from Common Release Points

Radioactive liquid effluents released from the release tanks are comprised of contributions from all three units. Under normal operating conditions, it is difficult to apportion the radioactivity between the units. Consequently, allocation is normally made evenly between units 2 and 3.

10.2.5 Projected Doses for Releases

Doses due to liquid effluents are calculated in accordance with the RETS.

10.3 SOLIDIFICATION OF WASTE/PROCESS CONTROL PROGRAM

The process control program (PCP) contains the sampling, analysis, and formulation determination by which solidification of radioactive wastes from liquid systems is ensured.

Figure 10-4 is a simplified diagram of solid radwaste processing.

TABLE 10-1
Data for Determination of Dilution Flow Rates

Closed Cycle Dilution Flow Determination
(Gate 4451 out of water, Gate 4452 full closed)

6"	50,000
15"	100,000
21"	150,000
30"	200,000
36"	250,000
40"	300,000
0.0.W	350,000

Open Cycle Dilution Flow Determination
(Gate 4450 full open, Gates 4451 and 4452 full closed)

6"	168,000
12"	335,000
19"	404,000*
26"	580,000*
35"	740,000*
0.0.W	900,000*

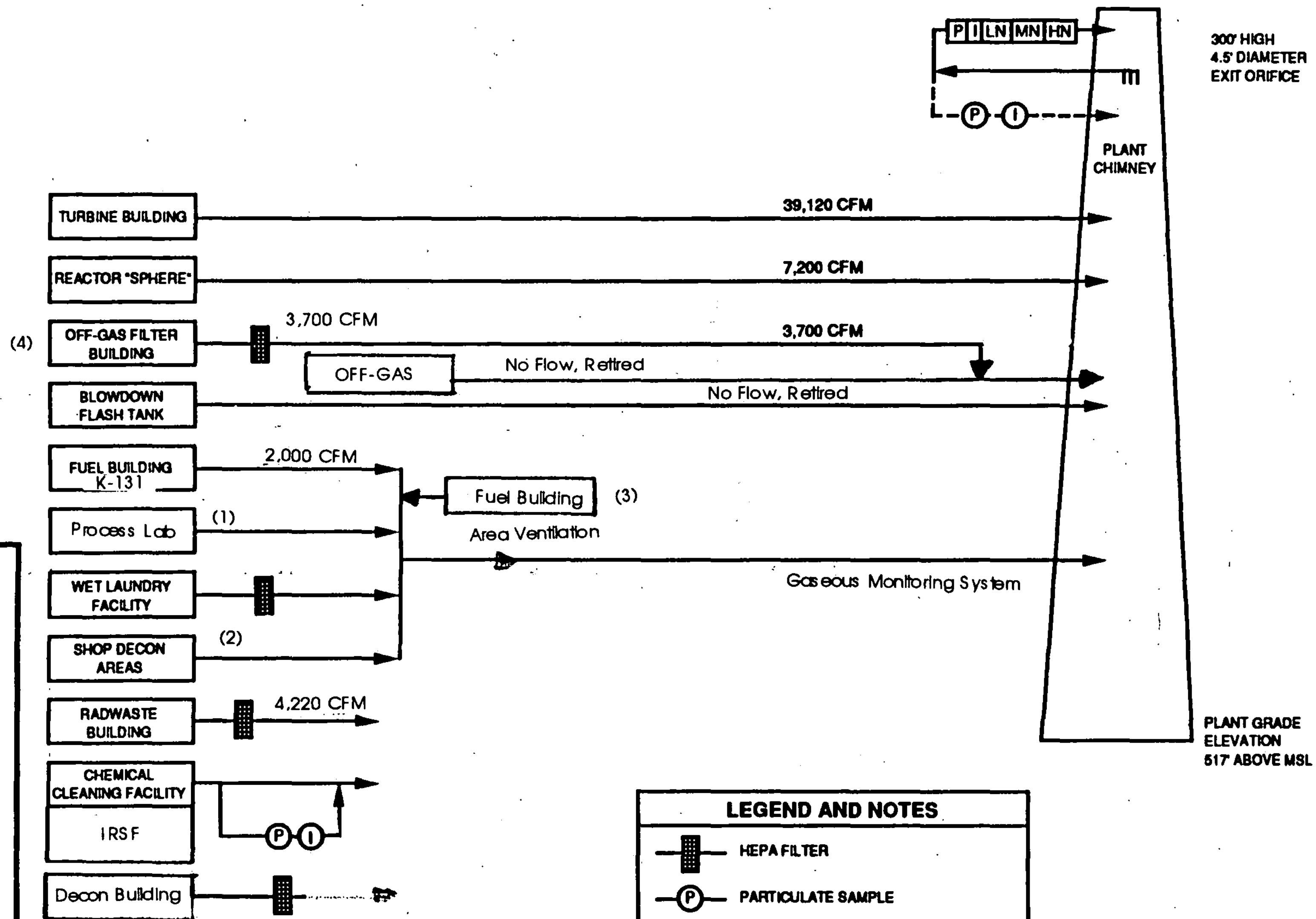
*These dilution flows have 100,000 gpm subtracted from them for conservatism.

Lake Bypassed Dilution Flow
(Gates 4450 and 4452 full open, Gate 4451 Full Closed)

Circ. Water Pump Running	De-Icing Valves Closed Flow in gpm	De-Icing Valves Open Flow in gpm
2	380,000	300,000
3	480,000	380,000
4	760,000	600,000
5	860,000	780,000
6	960,000	890,000

OFFSITE DOSE CALCULATION MANUAL
DRESDEN STATION UNIT 1

FIGURE 10-1
SIMPLIFIED GASEOUS RADWASTE AND GASEOUS EFFLUENT FLOW DIAGRAM



(1) Not running, lab no longer in use

(2) Areas no longer exist, suction ducts capped

(3) New installation, when completed
8,000 CFM summer
4,000 CFM winter

(4) Not normally Run

LEGEND AND NOTES

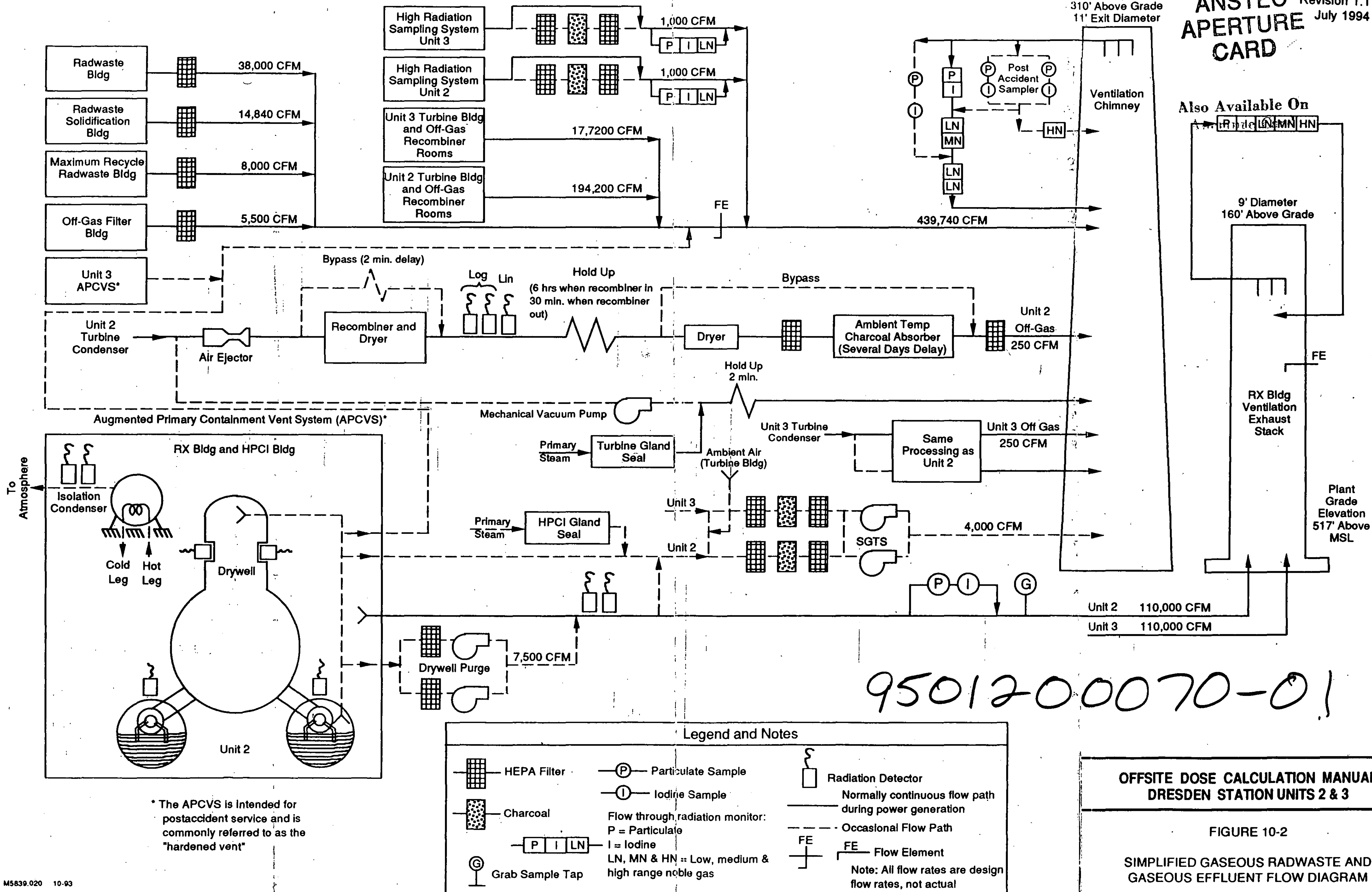
- HEPA FILTER
- (P) PARTICULATE SAMPLE
- (I) IODINE SAMPLE
- [P I LN] FLOW THROUGH RADIATION MONITOR:
  P = PARTICULATE
  I = IODINE
  LN, MN & HN = LOW, MEDIUM & HIGH RANGE NOBLE GAS

NOTES:
1. UNIT 1 IS NOT OPERATIONAL
2. ALL FLOW RATES ARE DESIGN FLOW RATES, NOT ACTUAL

ANSTEC APERTURE CARD

Revision 1.1
July 1994

Also Available On Aperture Card

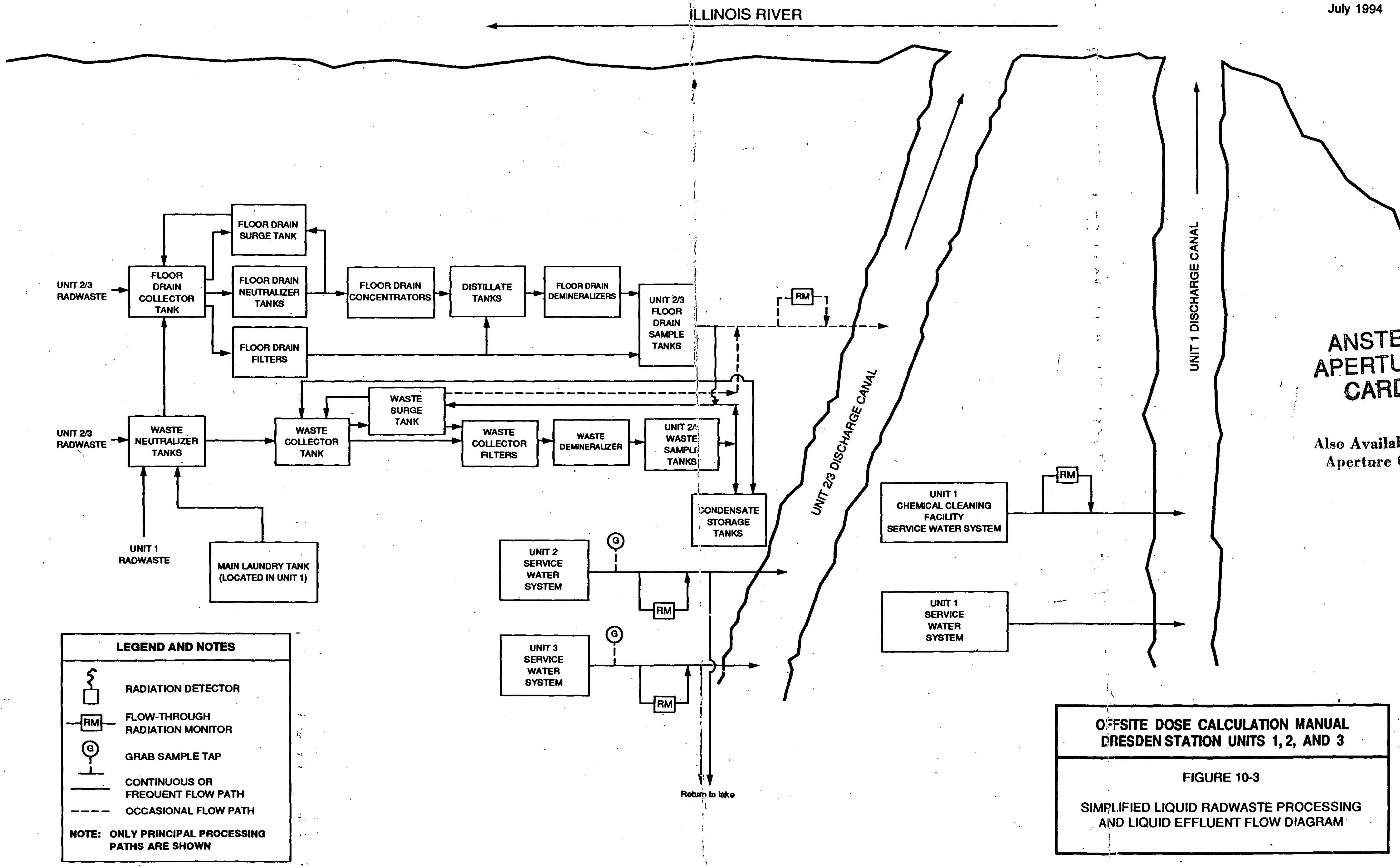


OFFSITE DOSE CALCULATION MANUAL
DRESDEN STATION UNITS 2 & 3

FIGURE 10-2

SIMPLIFIED GASEOUS RADWASTE AND GASEOUS EFFLUENT FLOW DIAGRAM

9501200070-01



ANSTEC APERTURE CARD

Also Available On Aperture Card

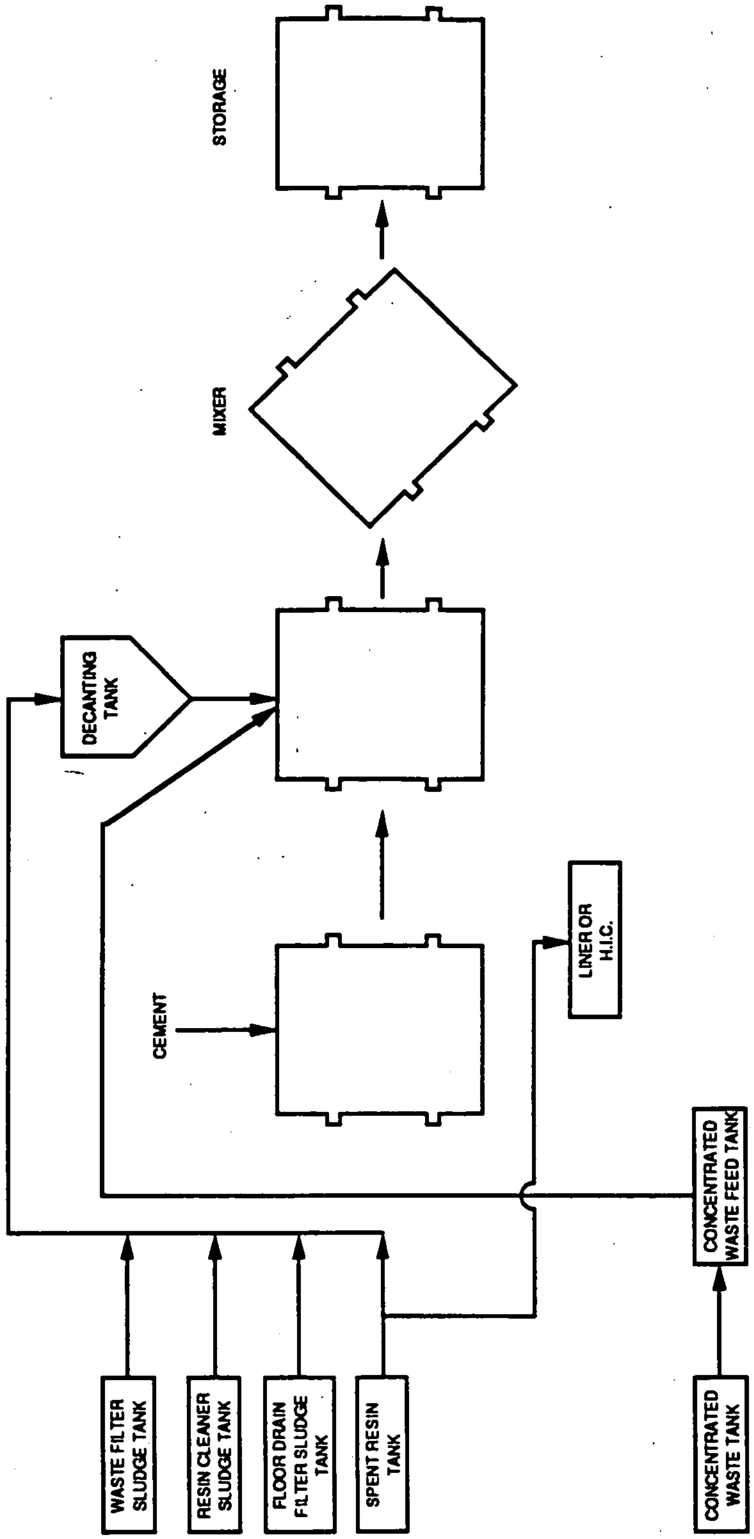
OFFSITE DOSE CALCULATION MANUAL
DRESDEN STATION UNITS 1, 2, AND 3

FIGURE 10-3

SIMPLIFIED LIQUID RADWASTE PROCESSING AND LIQUID EFFLUENT FLOW DIAGRAM

M5839.009 06-93

9501200070-02



OFFSITE DOSE CALCULATION MANUAL
DRESDEN STATION UNITS 2 AND 3

FIGURE 10-4

SIMPLIFIED SOLID RADWASTE PROCESSING DIAGRAM

M5839.011 06-93