QUAD-CITIES NUCLEAR POWER STATION

UNITS 1 AND 2

MONTHLY PERFORMANCE REPORT

JULY, 1986

COMMONWEALTH EDISON COMPANY

AND

IOWA-ILLINOIS GAS & ELECTRIC COMPANY

NRC DOCKET NOS. 50-254 AND 50-265

LICENSE NOS. DPR-29 AND DPR-30

0027H/0061Z

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I. INTRODUCTION

Quad-Cities Nuclear Power Station is composed of two Boiling Water Reactors, each with a Maximum Dependable Capacity of 769 MWe Net, located in Cordova, Illinois. The Station is jointly owned by Commonwealth Edison Company and Iowa-Illinois Gas & Electric Company. The Nuclear Steam Supply Systems are General Electric Company Boiling Water Reactors. The Architect/Engineer was Sargent & Lundy, Incorporated, and the primary construction contractor was United Engineers & Constructors. The Mississippi River is the condenser cooling water source. The plant is subject to license numbers DPR-29 and DPR-30, issued October 1, 1971, and March 21, 1972, respectively; pursuant to Docket Numbers 50-254 and 50-265. The date of initial Reactor criticalities for Units One and Two, respectively were October 18, 1971, and April 26, 1972. Commercial generation of power began on February 18, 1973 for Unit One and March 10, 1973 for Unit Two.

This report was compiled by Becky Brown and Carol Kronich, telephone number 309-654-2241, extensions 2240 and 2157.

II. SUMMARY OF OPERATING EXPERIENCE

A. Unit One

July 1-13

Unit One began the month of July holding load near full power. At 0920 hours, on July 1, the unit was placed on Economic Generation Control (EGC). The unit was taken out of EGC operation on July 4 at 0046 hours, and returned at 0215 hours. On July 5, at 0315 hours, the unit was taken off of EGC, and load was dropped to 700 MWe for Turbine surveillances. Load was increased to 750 MWe and the unit returned to EGC operation at 0410 hours. At 0953 hours the unit was taken off of EGC, and load was increased to full power. On July 6, at 0308 hours, the unit returned to EGC.

On July 7, at 0915 hours, the unit was taken off of EGC, and load was increased to full power. At 2030 hours load began a drop at 200 MWe/hour for a unit shutdown due to high conductivity -- condenser tube leak. The unit was taken off line on July 8, at 0045 hours, and at 0100 hours the unit was manually scrammed. On July 9, at 1538 hours, unit startup commenced. At 1844 hours the Reactor went critical. The unit was placed on line on July 10 at 0615 hours. Full power was reached on July 12 at 0100 hours after a normal load increase. Full load was held until July 13, at 0420 hours, when the unit was placed on EGC. The unit was taken off of EGC at 1715 hours and returned at 1755 hours.

July 14-31

On July 14, at 1020 hours, the unit was taken off of EGC for rod maneuvers. At 1522 hours load was increased to full power. Load was held near full power until July 19, at 2210 hours, when load was dropped to 705 MWe to reverse condenser flow. At 2330 hours load began an increase to full power. On July 20, at 1750 hours, the unit was placed on EGC. EGC was tripped on July 21, at 0757 hours, and load was increased to full power. The unit returned to EGC operation at 2353 hours. At 0659 hours, on July 22, the unit was taken off of EGC, and load was increased to full power. At 2205 hours the unit was returned to EGC operation until 2225 hours, when load was dropped to 700 MWe as per Load Dispatcher. At 2345 hours load was increased within EGC limits and the unit returned to EGC operation at 0030 hours, on July 23. At 0520 hours the unit was taken off of EGC, and load was increased to full power.

A. Unit One (cont.)

On July 25, at 0045 hours, load was dropped to 775 MWe to reverse condenser flow. At 0150 hours load was being held at full power. On July 26, at 0100 hours, load was dropped to 700 MWe for Turbine surveillances. At 0250 hours load began an increase to full power. At 1230 hours load was being held at 810 MWe. At 1700 hours the unit was returned to EGC operation. On July 28, at 0600 hours, the unit was taken off of EGC and load was increased to full power. On July 30, at 1615 hours, the unit was placed on EGC. At 1210 hours, on July 31, the unit was taken off of EGC, and load was increased to full power. The unit remained in EGC operation for the remainder of July.

B. Unit Two

July 1-17

Unit Two began the month of July on Economic Generation Control (EGC). On July 2, at 1455 hours, the unit was taken off of EGC, and later returned at 1545 hours. On July 4, at 2390 hours, the unit was taken off of EGC to perform surveillances. On July 5, at 0200 hours, the unit returned to EGC operation. At 0855 hours the unit was taken off of EGC and load was dropped to 740 MWe due to high 2A Condensate Demineralizer Post Strainer differential pressure. At 1035 hours the unit returned to EGC. At 1100 hours the unit was taken off of EGC, and load dropped to 765 MWe due to high 2G Condensate Demineralizer Post Strainer differential pressure. At 1240 hours load was dropped to 650 MWe to remove the 2G Condensate Demineralizer from service. At 2035 hours load began a normal increase to full power.

On July 6, at 1020 hours, the unit reached 801 MWe and held steady until 1630 hours when the unit was placed on EGC. On July 7, at 1000 hours, the unit was taken off of EGC and load was increased to full power. The unit returned to EGC operation at 0410 hours on July 8. At 0829 hours EGC was tripped and load was increased to full power. Load was held near full power until 0210 hours, on July 10, when the unit was placed on EGC. The unit was taken off of EGC at 0840 hours, on July 12, for surveillances. EGC operation was returned to at 1000 hours.

On July 13, at 0015 hours, the unit was taken off of EGC, and load was dropped to 650 MWe for control rod maneuvers. At 0405 hours load began an increase to full power. At 1230 hours, on July 14, load was dropped to approximately 420 MWe due to Recirculation Motor-Generator Set problems. At 1530 hours load began an increase towards full power. Full power was held until July 17, at 2045 hours, when load was dropped to 715 MWe to remove the 2A Circulation Water Pump from service.

B. Unit Two (cont.)

July 18-31

On July 18, at 0500 hours, load began an increase to full power. At 2320 hours, on July 19, load was dropped to 600 MWe to change over Reactor Feed Pumps. Load began an increase to full power at 2205 hours on July 20. On July 22, at 2215 hours, load began a drop to 700 MWe at the Load Dispatcher's request. On July 23, at 0045 hours, load began an increase to approximately full power. Load was held until 0135 hours, on July 21, when load was dropped to 715 MWe to remove the 2E Condensate Demineralizer from service. At 0505 hours load began an increase to 800 MWe.

On July 25, at 1020 hours, the unit was placed in EGC operation. EGC was tripped and load dropped to 735 MWe, on July 26, at 0055 hours, to perform Turbine surveillances. At 0253 hours the unit was returned to EGC. The unit continued in EGC operation until July 30, at 0030 hours, when EGC was tripped and the load was increased to near full load where it remained for the remainder of July.

III. PLANT OR PROCEDURE CHANGES, TESTS, EXPERIMENTS, AND SAFETY RELATED MAINTENANCE

A. Amendments to Facility License or Technical Specifications

On June 10, 1986, the NRC issued Amendments 94 and 90 to Facility Operating License Nos. DPR-29 and DPR-30, respectively. These Amendments add limiting conditions for operation and surveillance requirements to the Technical Specifications for certain plant modifications required by TMI Action Plan Items covered by Generic Letter 83-36. The Technical Specifications were approved for Post Accident Sampling, Sampling and Analysis of Plant Effluents, Containment High Range Radiation Monitor, Containment Pressure Monitor, Containment Water Level Monitor, and Containment Hydrogen Monitor.

B. Facility or Procedure Changes Requiring NRC Approval

In accordance with Technical Specification Section 6.7.B, changes to the Offsite Dose Calculation Manual (ODCM), Revision 11, information to support the change, and documentation that the change has been On-Site and Off-Site review approved are enclosed for submittal.

C. Tests and Experiments Requiring NRC Approval

There were no Tests or Experiments requiring NRC approval for the reporting period.

D. Corrective Maintenance of Safety Related Equipment

The following represents a tabular summary of the major safety related maintenance performed on Units 1 and 2 during the reporting period. This summary includes the following: Work Request Numbers, Licensee Event Report Numbers, Components, Cause of Malfunctions, Results and Effects on Safe Operation, and Action Taken to Prevent Repetition.

UNIT 1 MAINTENANCE SUMMARY

W.R. NUMBER	LER NUMBER	COMPONENT	CAUSE OF MALFUNCTION	RESULTS & EFFECTS ON SAFE OPERATION	ACTION TAKEN TO PREVENT REPETITION
Q43084		1-595-134 Standby Gas Treatment Initiation Relay	See Work Request Q42800 - Unit 2		

UNIT 2 MAINTENANCE SUMMARY

W.R. NUMBER	LER NUMBER	COMPONENT	CAUSE OF MALFUNCTION	RESULTS & EFFECTS ON SAFE OPERATION	ACTION TAKEN TO PREVENT REPETITION
Q42800		2-595-134 Standby Gas Treatment Initiation Relay	The relay armature hung-up when it de-energized, which prevented the relay contacts from closing when the relay was de-energized while testing the auto-start function of Standby Gas Treatment System.	The 'B' Standby Gas Treatment would not auto-start, but could be started manually. The 'A' Standby Gas Treatment System was fully operable.	The relay was replaced like-for-like, and was tested satisfactorily.
Q49865		2-756-48-41 LPRM	Incorrectly coded LPRM cables allowed the 'C' and 'D' cables to be reversed.	The 'C' and 'D' signals were bypassed when the signals were noticed to be reversed. A TIP was used on the affected LPRM to assure operability.	All other LPRM cables were checked, and the affected cables were corrected during the next shutdown of sufficient duration.

IV. LICENSEE EVENT REPORTS

The following is a tabular summary of all licensee event reports for Quad-Cities Units One and Two occurring during the reporting period, pursuant to the reportable occurrence reporting requirements as set forth in sections 6.6.B.1. and 6.6.B.2. of the Technical Specifications.

UNIT 1

Licensee Event Report Number	Date	Title of Occurrence

There were no Licensee Event Reports for Unit 1 for the reporting period.

UNIT 2

Licensee Event Report Number	Date	Title of Occurrence

There were no Licensee Event Reports for Unit 2 for the reporting period.

V. DATA TABULATIONS

The following data tabulations are presented in this report:

A. Operating Data Report

B. Average Daily Unit Power Level

C. Unit Shutdowns and Power Reductions

OPERATING DATA REPORT

DOCKET NO. 50-254

UNIT ONE

DATE AUGUST 4 1986

COMPLETED BY CAROL L KRONICH

TELEPHONE (309) 654-2241

OPERATING STATUS

1. Reporting period: 0000 070186 / 2400 073186 Gross hours in reporting period: 744

2. Currently authorized power level (MWt): 2511 Max.Depend capacity (MWe-Net): 769* Design electrical rating (MWe-Net): 789

3. Power level to which restricted(if any)(MWe-Net): NA

4. Reasons for restriction (if any):

	This Month	Yr.to Date	Cumulative
5. Number of hours reactor was critical	702.3	2858.6	99520.0
6. Reactor reserve shutdown hours	0.0	0.0	3421.9
7. Hours generator on line	690.5	2800.5	96080.0
8. Unit reserve shutdown hours.	0.0	0.0	909.2
9. Gross thermal energy generated(MWH)	1668413	6629226	201594383
10. Gross electrical energy generated(MWH)	539577	2151347	65270718
11. Net electrical energy generated(MWH)	515725	2048352	61074885
12. Reactor service factor	94.4	56.2	79.8
13. Reactor availability factor	94.4	56.2	82.6
14. Unit service factor	92.8	55.1	77.1
15. Unit availability factor	92.8	55.1	77.8
16. Unit capacity factor (Using MDC)	90.1	52.4	63.7
17. Unit capacity factor (Using Des.MWe)	87.9	51.0	62.1
18. Unit forced outage rate	7.2	2.0	5.8

19. Shutdowns scheduled over next 6 months (Type,Date,and Duration of each):

20. If shutdown at end of report period,estimated date of startup NA

*UNOFFICIAL COMPANY NUMBERS ARE USED IN THIS REPORT

OPERATING DATA REPORT

DOCKET NO. 50-265

UNIT TWO

DATE AUGUST 4 1986

COMPLETED BY CAROL L KRONICH

TELEPHONE (309) 654-2241

OPERATING STATUS

1. Reporting period: 0000 070186 2400 073186 Gross hours in reporting period: 744

2. Currently authorized power level (MWt): 2511 Max.Depend capacity (MWe-Net): 769* Design electrical rating (MWe-Net): 789

3. Power level to which restricted(if any)(MWe-Net): NA

4. Reasons for restriction (if any):

	This Month	Yr.to Date	Cumulative
5. Number of hours reactor was critical	744.0	4757.7	96025.4
6. Reactor reserve shutdown hours	0.0	0.0	2985.8
7. Hours generator on line	744.0	4715.3	93012.9
8. Unit reserve shutdown hours.	0.0	0.0	702.9
9. Gross thermal energy generated(MWH)	1805766	11234663	197343686
10. Gross electrical energy generated(MWH)	571627	3655476	63072258
11. Net electrical energy generated(MWH)	546418	3498990	59373249
12. Reactor service factor	100.0	93.5	77.6
13. Reactor availability factor	100.0	93.5	80.0
14. Unit service factor	100.0	92.7	75.2
15. Unit availability factor	100.0	92.7	75.7
16. Unit capacity factor (Using MDC)	95.5	89.4	62.4
17. Unit capacity factor (Using Des.MWe)	93.1	87.2	60.8
18. Unit forced outage rate	0.0	.5	7.8

19. Shutdowns scheduled over next 6 months (Type,Date,and Duration of each):

20. If shutdown at end of report period,estimated date of startup NA

*UNOFFICIAL COMPANY NUMBERS ARE USED IN THIS REPORT

APPENDIX B
AVERAGE DAILY UNIT POWER LEVEL

DOCKET NO. 50-254
UNIT ONE
DATE AUGUST 4 1986
COMPLETED BY CAROL L KRONICH
TELEPHONE (309) 654-2241

MONTH July 1986

DAY	AVERAGE DAILY POWER LEVEL (MWe-Net)	DAY	AVERAGE DAILY POWER LEVEL (MWe-Net)
1.	764.0	17.	770.7
2.	752.8	18.	761.0
3.	753.8	19.	775.9
4.	751.7	20.	753.7
5.	758.4	21.	752.7
6.	750.9	22.	781.3
7.	708.0	23.	731.4
8.	-8.3	24.	779.6
9.	-11.2	25.	763.3
10.	322.0	26.	757.0
11.	696.5	27.	740.2
12.	784.0	28.	775.3
13.	750.3	29.	769.8
14.	748.0	30.	770.6
15.	767.8	31.	745.0
16.	775.5		

INSTRUCTIONS

On this form, list the average daily unit power level in MWe-Net for each day in the reporting month. Compute to the nearest whole megawatt.

These figures will be used to plot a graph for each reporting month. Note that when maximum dependable capacity is used for the net electrical rating of the unit, there may be occasions when the daily average power level exceeds the 100% line (or the restricted power level line). In such cases, the average daily unit power output sheet should be footnoted to explain the apparent anomaly

APPENDIX B
AVERAGE DAILY UNIT POWER LEVEL

DOCKET NO. 50-265

UNIT TWO

DATE AUGUST 4 1986

COMPLETED BY CAROL L KRONICH

TELEPHONE (309) 654-2241

MONTH July 1986

DAY	AVERAGE DAILY POWER LEVEL (MWe-Net)	DAY	AVERAGE DAILY POWER LEVEL (MWe-Net)
1.	741.6	17	736.0
2.	741.8	18.	717.9
3.	741.0	19.	753.0
4.	740.0	20.	699.5
5.	685.5	21.	747.7
6.	741.4	22.	764.8
7.	746.6	23.	721.6
8.	754.3	24.	755.9
9.	771.7	25.	742.4
10.	742.8	26.	779.6
11.	737.1	27.	674.5
12.	753.1	28.	742.0
13.	697.0	29.	721.0
14.	631.3	30.	751.4
15.	731.7	31.	738.4
16.	754.6		

INSTRUCTIONS

On this form, list the average daily unit power level in MWe-Net for each day in the reporting month. Compute to the nearest whole megawatt.

These figures will be used to plot a graph for each reporting month. Note that when maximum dependable capacity is used for the net electrical rating of the unit, there may be occasions when the daily average power level exceeds the 100% line (or the restricted power level line). In such cases, the average daily unit power output sheet should be footnoted to explain the apparent anomaly

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APPENDIX D
UNIT SHUTDOWNS AND POWER REDUCTIONS

QTP 300-S13
Revision 6
August 1982

DOCKET NO. 050-254

UNIT NAME Quad-Cities Unit 1

COMPLETED BY C. Kronich

DATE August 13, 1986

REPORT MONTH JULY 1986

TELEPHONE 309-654-2241

NO.	DATE	TYPE F OR S	DURATION (HOURS)	REASON	METHOD OF SHUTTING DOWN REACTOR	LICENSEE EVENT REPORT NO.	SYSTEM CODE	COMPONENT CODE	CORRECTIVE ACTIONS/COMMENTS
86-20	860705	S	0.0	B	5		HA	TURBIN	Reduced load to 700 MWe for Turbine surveillances
86-21	860708	F	53.5	A	2		HC	HTEXCH	Unit outage due to high conductivity -- condenser tube leak
86-22	860719	S	0.0	H	5		HC	HTEXCH	Reduced load to 700 MWe to reverse condenser flow
86-23	860722	S	0.0	H	5		ZZ	ZZZZZZ	Reduced load to 700 MWe as per Load Dispatcher
86-24	860726	S	0.0	B	5		HA	TURBIN	Reduced load to 700 MWe for Turbine surveillances

APPROVED
AUG 1 6 1982
QCOSR

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APPENDIX D
UNIT SHUTDOWNS AND POWER REDUCTIONS

QTP 300-S13
Revision 6
August 1982

DOCKET NO. 050-265

UNIT NAME Quad-Cities Unit 1

COMPLETED BY C. Kronich

DATE August 13, 1986

REPORT MONTH JULY 1986

TELEPHONE 309-654-2241

NO.	DATE	TYPE F OR S	DURATION (HOURS)	REASON	METHOD OF SHUTTING DOWN REACTOR	LICENSEE EVENT REPORT NO.	SYSTEM CODE	COMPONENT CODE	CORRECTIVE ACTIONS/COMMENTS
86-22	860705	S	0.0	B	5		HH	DEMINX	Reduced load to 650 MWe -- Condensate Demineralizer maintenance
86-23	860713	S	0.0	H	5		RC	CONROD	Reduced load to 650 MWe for a control rod pattern adjustment
86-24	860714	F	0.0	H	5		CB	MOTORX	Reduced load to 420 MWe due to Recirculation Motor-Generator Set problems
86-25	860717	S	0.0	H	5		HF	PUMPXX	Reduced load to 715 MWe to take 2A Circulation Water Pump out of service
86-26	860719	S	0.0	B	5		CH	PUMPXX	Reduced load to 600 MWe to change over Reactor feed pumps
86-27	860722	S	0.0	H	5		ZZ	ZZZZZZ	Reduced load to 700 MWe as per Load Dispatcher
86-28	860724	S	0.0	B	5		HH	DEMINX	Reduced load to 715 MWe to remove 2E Condensate Demineralizer from service
86-29	860726	S	0.0	B	5		HA	TURBIN	Reduced load to 735 MWe for Turbine surveillances

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AUG 16 1982
QCOSR

VII. REFUELING INFORMATION

The following information about future reloads at Quad-Cities Station was requested in a January 26, 1978, licensing memorandum (78-24) from D. E. O'Brien to C. Reed, et al., titled "Dresden, Quad-Cities, and Zion Station--NRC Request for Refueling Information", dated January 18, 1978.

QTP 300-S32
Revision 1
March 1978

QUAD-CITIES REFUELING INFORMATION REQUEST

*

1. Unit: Q1 Reload: 8 Cycle: 9

2. Scheduled date for next refueling shutdown: 9-14-87

3. Scheduled date for restart following refueling: 12-21-87

4. Will refueling or resumption of operation thereafter require a technical specification change or other license amendment:

   NOT AS YET DETERMINED.

5. Scheduled date(s) for submitting proposed licensing action and supporting information:

   AUGUST 21, 1987

6. Important licensing considerations associated with refueling, e.g., new or different fuel design or supplier, unreviewed design or performance analysis methods, significant changes in fuel design, new operating procedures:

   NONE PLANNED AT PRESENT TIME.

7. The number of fuel assemblies.

   a. Number of assemblies in core: 724

   b. Number of assemblies in spent fuel pool: 1896

8. The present licensed spent fuel pool storage capacity and the size of any increase in licensed storage capacity that has been requested or is planned in number of fuel assemblies:

   a. Licensed storage capacity for spent fuel: 3657

   b. Planned increase in licensed storage: 0

9. The projected date of the last refueling that can be discharged to the spent fuel pool assuming the present licensed capacity: 2003

APPROVED

APR 20 1978

Q.C.O.S.R.

QTP 300-S32
Revision 1
March 1978

QUAD-CITIES REFUELING INFORMATION REQUEST

*

1. Unit: Q2 Reload: 7 Cycle: 8

2. Scheduled date for next refueling shutdown: 10-13-86

3. Scheduled date for restart following refueling: 1-19-87

4. Will refueling or resumption of operation thereafter require a technical specification change or other license amendment:

   TECHNICAL SPECIFICATION CHANGES WILL BE REQUIRED FOR NEW FUEL TYPES (MAPLHGR CURVES), MCPR OPERATING LIMIT, AND A LICENSE AMENDMENT TO MOVE SINGLE LOOP OPERATION INTO TECHNICAL SPECIFICATIONS.

5. Scheduled date(s) for submitting proposed licensing action and supporting information:

   SEPTEMBER 19, 1986, IF REQUIRED.

6. Important licensing considerations associated with refueling, e.g., new or different fuel design or supplier, unreviewed design or performance analysis methods, significant changes in fuel design, new operating procedures:

   NONE PLANNED AT PRESENT TIME.

7. The number of fuel assemblies.

   a. Number of assemblies in core: 724

   b. Number of assemblies in spent fuel pool: 836

8. The present licensed spent fuel pool storage capacity and the size of any increase in licensed storage capacity that has been requested or is planned in number of fuel assemblies:

   a. Licensed storage capacity for spent fuel: 3897

   b. Planned increase in licensed storage: 0

9. The projected date of the last refueling that can be discharged to the spent fuel pool assuming the present licensed capacity: 2003

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APR 20 1978

Q.C.O.S.R.

VIII. GLOSSARY

The follcwing abbreviations which may have been used in the Monthly Report, are defined below:

ACAD/CAM	-	Atmospheric Containment Atmospheric Dilution/Containment Atmospheric Monitoring
ANSI	-	American National Standards Institute
APRM	-	Average Power Range Monitor
ATWS	-	Anticipated Transient Without Scram
BWR	-	Boiling Water Reactor
CRD	-	Control Rod Drive
EHC	-	Electro-Hydraulic Control System
EOF	-	Emergency Operations Facility
GSEP	-	Generating Stations Emergency Plan
HEPA	-	High-Efficiency Particulate Filter
HPCI	-	High Pressure Coolant Injection System
HRSS	-	High Radiation Sampling System
IPCLRT	-	Integrated Primary Containment Leak Rate Test
IRM	-	Intermediate Range Monitor
ISI	-	Inservice Inspection
LER	-	Licensee Event Report
LLRT	-	Local Leak Rate Test
LPCI	-	Low Pressure Coolant Injection Mode of RHRS
LPRM	-	Local Power Range Monitor
MAPLHGR	-	Maximum Average Planar Linear Heat Generation Rate
MCPR	-	Minimum Critical Power Ratio
MFLCPR	-	Maximum Fraction Limiting Critical Power Ratio
MPC	-	Maximum Permissible Concentration
MSIV	-	Main Steam Isolation Valve
NIOSH	-	National Institute for Occupational Safety and Health
PCI	-	Primary Containment Isolation
PCIOMR	-	Preconditioning Interim Operating Management Recommendations
RBCCW	-	Reactor Building Closed Cooling Water System
RBM	-	Rod Block Monitor
RCIC	-	Reactor Core Isolation Cooling System
RHRS	-	Residual Heat Removal System
RPS	-	Reactor Protection System
RWM	-	Rod Worth Minimizer
SBGTS	-	Standby Gas Treatment System
SBLC	-	Standby Liquid Control
SDC	-	Shutdown Cooling Mode of RHRS
SDV	-	Scram Discharge Volume
SRM	-	Source Range Monitor
TBCCW	-	Turbine Building Closed Cooling Water System
TIP	-	Traversing Incore Probe
TSC	-	Technical Support Center

July 15, 1986

RECEIVED

JUL 21 '86

To: R. L. Bax
Station Manager
Quad Cities Station

ROUTE:

___	A (Asst. Supt.)
___	B (Operations)
___	C (Maintenance)
___	D Admin. & Tech.
___	E Personnel.
___	___
___	___
___	___
Initial	___

Subject: Inclusion of the Quad Cities Station Offsite Dose Calculation Manual, Site Specific Sections 7.2 & 8.0, Revision 11, in the July Operating Report

Per Technical Specifications, revisions to the Offsite Dose Calculation Manual (ODCM) are to be included in the Station's Monthly Operating Report for submittal to the NRC.

The enclosed Quad Cities ODCM, Site Specific Sections 7.2 & 8.0, Revision 11, has completed the necessary onsite and offsite reviews, and appropriate comments incorporated. Please include this ODCM in the July Operating Report.

If you have any questions regarding this request, please feel free to call D. M. Kenealy of my staff at G.O. Extension 3271.

Sincerely,

J. C. Golden
Supervisor of Emergency Planning
Nuclear Services Technical

Enclosure

cc: J. E. Sirovy
J. J. Kopacz
EPG-04-RE-ODCM11

DMK/lmk/6306E/48

86-334

ODCM LIST OF TABLES FOR QUAD-CITIES SECTION 7.2

ODCM LIST OF FIGURES FOR QUAD-CITIES SECTION 7.2

TABLE 7.2-1

AQUATIC ENVIRONMENT DOSE PARAMETERS

PARAMETER	QUAD CITIES
U^w, water usage, liters/hr	0.083
U^f, fish consumption, kg/hr	2.4×10^{-3}
$1/M^w$	1
$1/M^f$	1
F^w, ft^3/sec	4.7×10^4
F^f, ft^3/sec	4.7×10^3
t^f, hr*	24
t^w, hr**	7.5

B_i - Regulatory Guide 1.109, Revision 1, October 1977, Table A-1, Column 2 for freshwater fish. See Table 7.1-12.

F^t, ft^3/sec
F_o^w, ft^3/sec
$1/M_o^w$
T_o^w, hr
V^t, gal
t_o, hr

} Not applicable. No outdoor tanks without overflow pipes connected to other storage pipes.

*t^f (hr) = 24 hr (all stations) for the fish ingestion pathway

**t^w (hr) = 7.5 hr (Distance to Davenport is 15 miles; flow rate of 2 m.p.h.)

TABLE 7.2-2

ANNUAL DESIGN OBJECTIVES SET BY 10 CFR 50,
APPENDIX I FOR EACH REACTOR

TYPE OF DOSE	ANNUAL DESIGN OBJECTIVES
Airborne Releases	
Gamma Air Dose	10 mrad
Beta Air Dose	20 mrad
Whole Body Dose	5 mrem
Skin Dose	15 mrem
Infant Thyroid Dose	15 mrem
Liquid Releases	
Whole Body Dose	3 mrem
Thyroid Dose	10 mrem
Bone Dose	10 mrem
Skin Dose	10 mrem

TABLE 7.2-3

STATION: Quad-Cities Nuclear Power Station

LOCATION: Cordova, Illinois

CHARACTERISTICS OF ELEVATED RELEASE POINT

1) Release Height = 95 m 2) Diameter = 3.35 m

3) Exit Speed = 20.3 ms^{-1} 4) Heat Content= 4.1E3 KCal s^{-1}

CHARACTERISTICS OF VENT STACK RELEASE POINT

1) Release Height = 48 m 2) Diameter = 2.74 m

3) Exit Speed = 15.3 ms^{-1}

CHARACTERISTICS OF GROUND LEVEL RELEASE

1) Release Height = 0 m

2) Building Factor (D) = 36 m

METEOROLOGICAL DATA

A 296 ft. Tower is Located 1623 m SSE of Elevated Release Point

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Tower Data Used in Calculations

Release Point	Wind Speed And Direction	Differential Temperature
Elevated	296 ft.	296-33 ft.
Vent	196 ft.	196-33 ft.
Ground	33 ft.	196-33 ft.

TABLE 7.2-4

CRITICAL RANGES

DIRECTION	PRACTICAL SITE BOUNDARY* (m)	NEAREST RESIDENT** (m)	NEAREST DAIRY FARM RANGE*** (m)
N	864	966	
NNE	1029	1600	
NE	1212	2100	
ENE	1367	4600	
E	1170	3700	
ESE	1170	3219	
SE	1189	1600	
SSE	1422	1800	
S	1198	1300	
SSW	2140	4800	
SW	1372	4600	
WSW	823	3219	
W	713	4000	
WNW	713	4000	
NW	823	3219	
NNW	1481	3200	

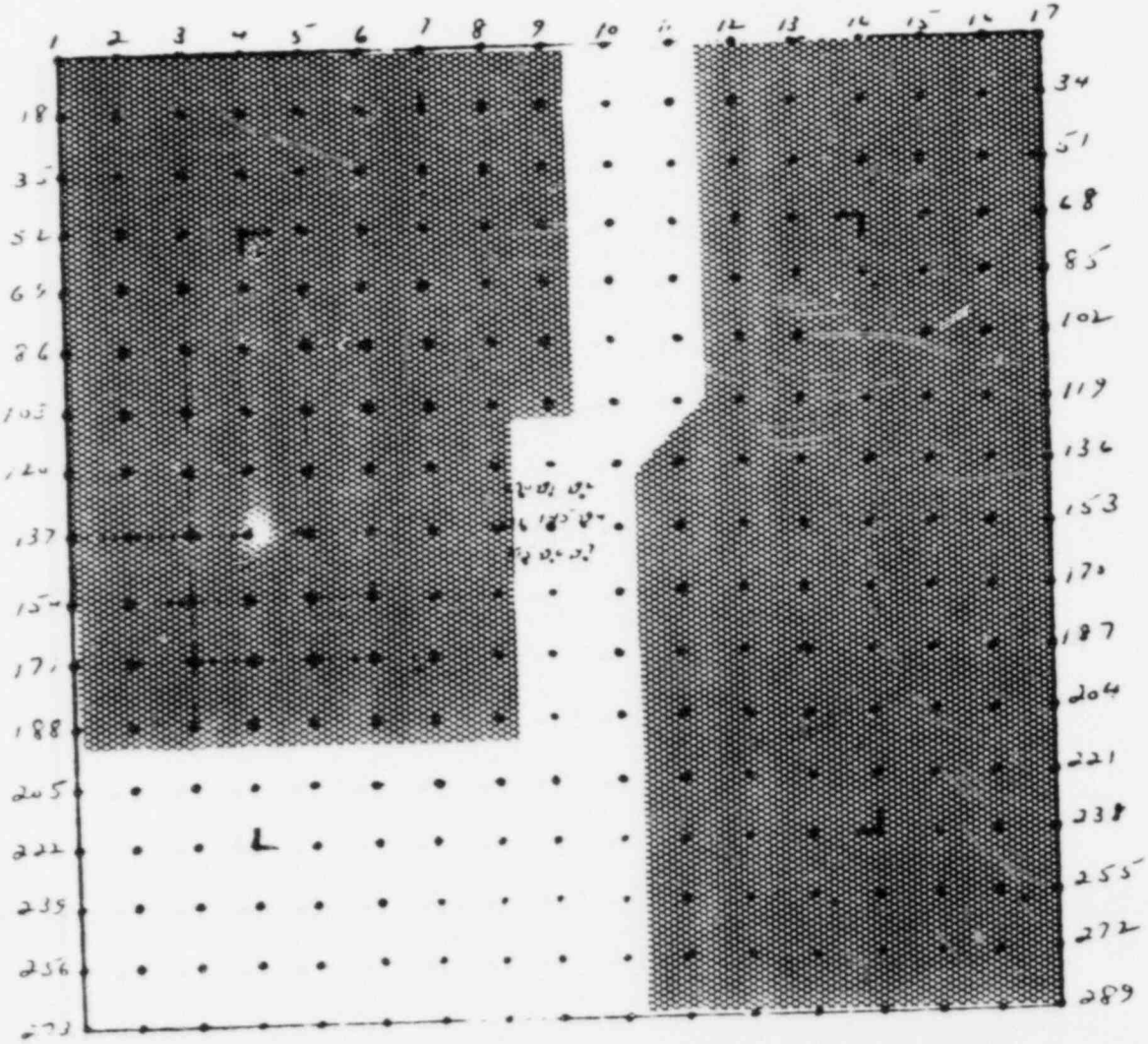
* Nearest land in unrestricted area

** Estimate range

*** Within 5 miles

TABLE 7.2-5

TERRAIN CORRECTION FACTORS (h_t) - QUAD-CITIES STATION



Shaded area has h_t=30m; unshaded area has h_t=0.

(Each increment is 4 mi)

Point 145 is the site.

TABLE 7.2-6

X/Q AND D/Q MAXIMA AT OR BEYOND THE UNRESTRICTED AREA BOUNDARY

DOWNWIND DIRECTION	ELEVATED(STACK) RELEASE				MIXED MODE(VENT) RELEASE			GROUND LEVEL RELEASE		
	RADIUS (METERS)	X/Q + (SEC/M**3)	RADIUS (METERS)	D/Q Δ (1/M**2)	RADIUS (METERS)	X/Q + (SEC/M**3)	D/Q Δ (1/M**2)	RADIUS (METERS)	X/Q + (SEC/M**3)	D/Q Δ (1/M**2)
N	864.	3.359-08	864.	1.627-09	864.	1.569-06	1.050-08	864.	3.785-06	2.085-08
NNE	1029.	4.304-08	1029.	1.869-09	1029.	5.723-07	4.333-09	1029.	1.151-06	6.452-09
NE	2800.	3.649-08	1212.	1.419-09	1212.	7.858-07	3.502-09	1212.	1.299-06	4.967-09
ENE	2800.	2.203-08	1367.	6.363-10	1367.	5.866-07	2.572-09	1367.	1.003-06	4.418-09
E	3219.	2.288-08	1170.	8.769-10	1170.	4.843-07	3.558-09	1170.	1.010-06	6.056-09
ESE	2800.	3.026-08	1170.	1.317-09	1170.	7.185-07	4.754-09	1170.	1.228-06	7.493-09
SE	2800.	3.906-08	1189.	1.428-09	1189.	9.715-07	5.298-09	1189.	1.681-06	9.041-09
SSE	2800.	3.067-08	1422.	8.104-10	1422.	5.276-07	2.488-09	1422.	1.108-06	4.828-09
S	3000.	2.526-08	1198.	7.757-10	1198.	3.412-07	2.253-09	1198.	1.261-06	5.022-09
SSW	3219.	2.194-08	1024.	7.054-10	1024.	2.913-07	2.639-09	1024.	1.002-06	5.535-09
SW	654.	3.439-08	654.	9.739-10	654.	6.155-07	4.495-09	654.	2.794-06	1.168-08
WSW	494.	7.298-08	500.	1.672-09	494.	1.039-06	6.518-09	494.	3.338-06	1.697-08
W	451.	6.637-08	500.	1.729-09	451.	2.657-06	1.238-08	451.	5.717-06	2.636-08
WNW	451.	7.002-08	500.	1.800-09	451.	5.104-06	1.824-08	451.	9.660-06	3.163-08
NW	485.	7.614-08	500.	1.698-09	485.	5.043-06	1.490-08	485.	1.218-05	2.980-08
NNW	640.	3.829-08	640.	1.335-09	640.	2.773-06	1.048-08	640.	5.197-06	1.810-08

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

+ Beta air, beta skin, and inhalation dose pathways.

Δ Produce and leafy vegetable pathways.

TABLE 7.2-6 (Cont'd)

QUAD-CITIES 1&2

AVERAGE WIND SPEEDS FOR EACH RELEASE MODE

DOWNWIND DIRECTION	AVERAGE WIND SPEED (m/sec) ELEVATED	MIXED MODE	GROUND LEVEL
N	6.5	4.4	4.0
NNE	5.7	3.9	3.4
NE	5.8	3.7	2.9
ENE	5.8	3.9	3.5
E	6.4	4.6	4.4
ESE	6.7	4.7	4.4
SE	6.2	4.1	3.8
SSE	5.2	3.7	3.2
S	5.2	3.7	3.3
SSW	5.3	4.2	4.1
SW	5.4	4.0	3.7
WSW	4.5	3.5	3.3
W	5.7	4.0	3.7
WNW	6.1	3.7	3.4
NW	5.9	3.4	2.8
NNW	6.2	3.8	3.5

TABLE 7.2-7

D/Q AT THE NEAREST MILK COW AND MEAT ANIMAL LOCATIONS WITHIN 5 MILES

DOWNWIND DIRECTION	NEAREST MILK COW D/Q(1/M**2) RADIUS (METERS)	ELEVATED RELEASE	MIXED RELEASE	GROUND RELEASE	NEAREST MEAT ANIMAL D/Q(1/M**2) RADIUS (METERS)	ELEVATED RELEASE	MIXED RELEASE	GROUND RELEASE
N	8047.	1.119-10	2.564-10	4.415-10	8047.	1.119-10	2.564-10	4.415-10
NNE	8047.	1.345-10	1.613-10	1.810-10	8047.	1.345-10	1.613-10	1.810-10
NE	8047.	1.286-10	1.659-10	1.842-10	4828.	2.817-10	3.938-10	4.552-10
ENE	8047.	7.134-11	1.362-10	2.011-10	8047.	7.134-11	1.362-10	2.011-10
E	3219.	3.212-10	7.066-10	1.055-09	3219.	3.212-10	7.066-10	1.055-09
ESE	8047.	1.346-10	1.977-10	2.616-10	8047.	1.346-10	1.977-10	2.616-10
SE	8047.	1.466-10	2.312-10	3.245-10	3219.	5.375-10	1.088-09	1.619-09
SSE	8047.	9.765-11	1.516-10	2.350-10	8047.	9.765-11	1.516-10	2.350-10
S	1694.	5.681-10	1.348-09	2.783-09	3219.	2.886-10	5.040-10	9.112-10
SSW	8047.	6.654-11	9.673-11	1.540-10	8047.	6.654-11	9.673-11	1.540-10
SW	8047.	6.086-11	8.692-11	1.586-10	8047.	6.086-11	8.692-11	1.586-10
WSW	8047.	7.959-11	1.008-10	1.478-10	8047.	7.959-11	1.008-10	1.478-10
W	8047.	8.643-11	1.384-10	1.999-10	8047.	8.643-11	1.384-10	1.999-10
WNW	8047.	8.184-11	1.738-10	2.400-10	8047.	8.184-11	1.738-10	2.400-10
NW	8047.	7.265-11	1.572-10	2.523-10	8047.	7.265-11	1.572-10	2.523-10
NNW	8047.	7.920-11	1.683-10	2.376-10	8047.	7.920-11	1.683-10	2.376-10

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 83M

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	4.436-06	4.006-07	864.	1.726-04	1.559-05	864.	4.081-04	3.685-05
NNE	1029.	1029.	5.563-06	5.024-07	1029.	6.291-05	5.681-06	1029.	1.210-04	1.092-05
NE	1212.	1212.	4.239-06	3.828-07	1212.	8.139-05	7.350-06	1212.	1.336-04	1.206-05
ENE	1367.	1367.	2.259-06	2.040-07	1367.	5.986-05	5.406-06	1367.	1.019-04	9.203-06
E	1170.	1170.	2.396-06	2.164-07	1170.	5.173-05	4.671-06	1170.	1.048-04	9.461-06
ESE	1170.	1170.	3.347-06	3.022-07	1170.	7.541-05	6.810-06	1170.	1.272-04	1.149-05
SE	1189.	1189.	4.093-06	3.696-07	1189.	1.019-04	9.200-06	1189.	1.737-04	1.568-05
SSE	1422.	1422.	3.156-06	2.850-07	1422.	5.367-05	4.847-06	1422.	1.114-04	1.006-05
S	1198.	1198.	2.567-06	2.318-07	1198.	3.656-05	3.301-06	1198.	1.298-04	1.172-05
SSW	1024.	1024.	2.294-06	2.071-07	1024.	3.283-05	2.965-06	1024.	1.050-04	9.481-06
SW	654.	654.	4.231-06	3.820-07	654.	7.185-05	6.488-06	654.	2.932-04	2.648-05
WSW	494.	494.	8.240-06	7.441-07	494.	1.164-04	1.051-05	494.	3.653-04	3.298-05
W	451.	451.	7.616-06	6.877-07	451.	2.770-04	2.501-05	451.	5.883-04	5.313-05
WNW	451.	451.	7.837-06	7.077-07	451.	5.155-04	4.655-05	451.	9.168-04	8.279-05
NW	485.	485.	8.367-06	7.556-07	485.	4.985-04	4.501-05	485.	1.109-03	1.002-04
NNW	640.	640.	4.750-06	4.289-07	640.	2.900-04	2.619-05	640.	5.238-04	4.730-05

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 85M

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	2.003-04	1.066-04	864.	1.192-03	6.175-04	864.	2.252-03	1.158-03
NNE	1029.	1029.	2.401-04	1.278-04	1029.	6.266-04	3.278-04	1029.	7.455-04	3.847-04
NE	1212.	1212.	1.692-04	9.001-05	1212.	6.397-04	3.325-04	1212.	8.024-04	4.134-04
ENE	1367.	1367.	9.329-05	4.965-05	1367.	4.656-04	2.419-04	1367.	6.447-04	3.327-04
E	1170.	1170.	1.134-04	6.037-05	1170.	4.396-04	2.291-04	1170.	6.585-04	3.400-04
ESE	1170.	1170.	1.416-04	7.539-05	1170.	5.858-04	3.045-04	1170.	7.905-04	4.080-04
SE	1189.	1189.	1.772-04	9.431-05	1189.	7.843-04	4.075-04	1189.	1.097-03	5.662-04
SSE	1422.	1422.	1.212-04	6.446-05	1422.	4.612-04	2.403-04	1422.	7.236-04	3.738-04
S	1198.	1198.	1.232-04	6.559-05	1198.	3.642-04	1.905-04	1198.	7.618-04	3.922-04
SSW	1024.	1024.	1.326-04	7.066-05	1024.	3.430-04	1.797-04	1024.	6.186-04	3.187-04
SW	654.	654.	1.973-04	1.051-04	654.	6.135-04	3.199-04	654.	1.439-03	7.360-04
WSW	494.	494.	3.307-04	1.760-04	494.	9.683-04	5.047-04	494.	1.800-03	9.210-04
W	451.	451.	3.395-04	1.808-04	451.	1.668-03	8.605-04	451.	2.739-03	1.398-03
WNW	451.	451.	3.176-04	1.690-04	451.	2.666-03	1.367-03	451.	3.988-03	2.028-03
NW	485.	485.	3.193-04	1.699-04	485.	2.597-03	1.332-03	485.	4.722-03	2.399-03
NNW	640.	640.	2.252-04	1.199-04	640.	1.659-03	8.538-04	640.	2.466-03	1.259-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 85

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	2.596-06	1.607-06	864.	1.350-05	8.354-06	864.	2.484-05	1.538-05
NNE	1029.	1029.	3.135-06	1.941-06	1029.	7.378-06	4.567-06	1029.	8.309-06	5.143-06
NE	1212.	1212.	2.208-06	1.367-06	1212.	7.455-06	4.614-06	1212.	9.040-06	5.596-06
ENE	1367.	1367.	1.224-06	7.576-07	1367.	5.424-06	3.357-06	1367.	7.313-06	4.526-06
E	1170.	1170.	1.475-06	9.133-07	1170.	5.086-06	3.148-06	1170.	7.362-06	4.557-06
ESE	1170.	1170.	1.839-06	1.138-06	1170.	6.750-06	4.178-06	1170.	8.840-06	5.472-06
SE	1189.	1189.	2.309-06	1.429-06	1189.	9.048-06	5.601-06	1189.	1.229-05	7.606-06
SSE	1422.	1422.	1.595-06	9.874-07	1422.	5.427-06	3.360-06	1422.	8.222-06	5.090-06
S	1198.	1198.	1.616-06	1.000-06	1198.	4.296-06	2.660-06	1198.	8.551-06	5.293-06
SSW	1024.	1024.	1.740-06	1.077-06	1024.	4.033-06	2.497-06	1024.	6.861-06	4.247-06
SW	654.	654.	2.564-06	1.587-06	654.	7.098-06	4.394-06	654.	1.575-05	9.750-06
WSW	494.	494.	4.303-06	2.664-06	494.	1.124-05	6.955-06	494.	1.960-05	1.213-05
W	451.	451.	4.446-06	2.752-06	451.	1.880-05	1.164-05	451.	2.973-05	1.841-05
WNW	451.	451.	4.163-06	2.577-06	451.	2.961-05	1.833-05	451.	4.328-05	2.679-05
NW	485.	485.	4.160-06	2.575-06	485.	2.891-05	1.790-05	485.	5.130-05	3.175-05
NNW	640.	640.	2.919-06	1.807-06	640.	1.860-05	1.151-05	640.	2.697-05	1.669-05

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 87

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	8.531-04	6.236-04	864.	3.746-03	2.710-03	864.	6.768-03	4.887-03
NNE	1029.	1029.	9.989-04	7.301-04	1029.	2.060-03	1.494-03	1029.	2.224-03	1.606-03
NE	1212.	1212.	6.913-04	5.051-04	1212.	1.967-03	1.424-03	1212.	2.324-03	1.678-03
ENE	1367.	1367.	3.785-04	2.765-04	1367.	1.397-03	1.011-03	1367.	1.863-03	1.346-03
E	1170.	1170.	4.711-04	3.443-04	1170.	1.388-03	1.005-03	1170.	1.957-03	1.413-03
ESE	1170.	1170.	5.879-04	4.296-04	1170.	1.823-03	1.320-03	1170.	2.349-03	1.696-03
SE	1189.	1189.	7.291-04	5.328-04	1189.	2.418-03	1.750-03	1189.	3.246-03	2.344-03
SSE	1422.	1422.	4.858-04	3.549-04	1422.	1.408-03	1.020-03	1422.	2.089-03	1.509-03
S	1198.	1198.	5.031-04	3.677-04	1198.	1.172-03	8.500-04	1198.	2.214-03	1.598-03
SSW	1024.	1024.	5.522-04	4.037-04	1024.	1.138-03	8.257-04	1024.	1.842-03	1.330-03
SW	654.	654.	8.411-04	6.148-04	654.	2.054-03	1.488-03	654.	4.334-03	3.129-03
WSW	494.	494.	1.428-03	1.044-03	494.	3.322-03	2.409-03	494.	5.520-03	3.985-03
W	451.	451.	1.487-03	1.087-03	451.	5.442-03	3.938-03	451.	8.387-03	6.054-03
WNW	451.	451.	1.390-03	1.016-03	451.	8.411-03	6.080-03	451.	1.212-02	8.749-03
NW	485.	485.	1.389-03	1.015-03	485.	8.166-03	5.903-03	485.	1.423-02	1.027-02
NNW	640.	640.	9.672-04	7.071-04	640.	5.180-03	3.745-03	640.	7.397-03	5.339-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 88

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	2.135-03	1.647-03	864.	9.137-03	6.971-03	864.	1.636-02	1.244-02
NNE	1029.	1029.	2.535-03	1.956-03	1029.	5.143-03	3.938-03	1029.	5.449-03	4.149-03
NE	1212.	1212.	1.764-03	1.361-03	1212.	4.977-03	3.802-03	1212.	5.803-03	4.416-03
ENE	1367.	1367.	9.697-04	7.478-04	1367.	3.550-03	2.710-03	1367.	4.669-03	3.555-03
E	1170.	1170.	1.193-03	9.200-04	1170.	3.454-03	2.640-03	1170.	4.797-03	3.652-03
ESE	1170.	1170.	1.484-03	1.145-03	1170.	4.541-03	3.468-03	1170.	5.762-03	4.387-03
SE	1189.	1189.	1.852-03	1.428-03	1189.	6.050-03	4.619-03	1189.	7.984-03	6.079-03
SSE	1422.	1422.	1.252-03	9.654-04	1422.	3.598-03	2.750-03	1422.	5.247-03	3.996-03
S	1198.	1198.	1.290-03	9.947-04	1198.	2.952-03	2.260-03	1198.	5.496-03	4.182-03
SSW	1024.	1024.	1.407-03	1.086-03	1024.	2.825-03	2.163-03	1024.	4.488-03	3.415-03
SW	654.	654.	2.103-03	1.622-03	654.	4.995-03	3.821-03	654.	1.040-02	7.900-03
WSW	494.	494.	3.549-03	2.738-03	494.	8.043-03	6.154-03	494.	1.311-02	9.965-03
W	451.	451.	3.672-03	2.833-03	451.	1.304-02	9.942-03	451.	1.986-02	1.508-02
WNW	451.	451.	3.433-03	2.648-03	451.	2.012-02	1.531-02	451.	2.878-02	2.184-02
NW	485.	485.	3.442-03	2.656-03	485.	1.963-02	1.494-02	485.	3.396-02	2.576-02
NNW	640.	640.	2.407-03	1.857-03	640.	1.256-02	9.568-03	640.	1.777-02	1.349-02

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 89

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	8.056-04	5.943-04	864.	2.160-03	1.576-03	864.	3.780-03	2.753-03
NNE	1029.	1029.	6.806-04	5.020-04	1029.	8.818-04	6.449-04	1029.	8.991-04	6.552-04
NE	1212.	1212.	4.236-04	3.124-04	1212.	5.550-04	4.057-04	1212.	5.668-04	4.130-04
ENE	1367.	1367.	2.140-04	1.578-04	1367.	3.773-04	2.755-04	1367.	4.751-04	3.462-04
E	1170.	1170.	3.486-04	2.571-04	1170.	6.405-04	4.677-04	1170.	8.439-04	6.148-04
ESE	1170.	1170.	4.631-04	3.415-04	1170.	8.035-04	5.882-04	1170.	1.025-03	7.469-04
SE	1189.	1189.	5.015-04	3.698-04	1189.	9.158-04	6.687-04	1189.	1.259-03	9.173-04
SSE	1422.	1422.	2.346-04	1.729-04	1422.	3.697-04	2.702-04	1422.	5.091-04	3.709-04
S	1198.	1198.	2.758-04	2.034-04	1198.	4.251-04	3.107-04	1198.	6.592-04	4.802-04
SSW	1024.	1024.	3.404-04	2.511-04	1024.	5.820-04	4.253-04	1024.	8.797-04	6.408-04
SW	654.	654.	7.494-04	5.528-04	654.	1.365-03	9.976-04	654.	2.595-03	1.890-03
WSW	494.	494.	1.414-03	1.043-03	494.	2.503-03	1.830-03	494.	4.276-03	3.114-03
W	451.	451.	1.745-03	1.287-03	451.	4.334-03	3.164-03	451.	6.959-03	5.067-03
WNW	451.	451.	1.630-03	1.202-03	451.	5.883-03	4.291-03	451.	8.959-03	6.523-03
NW	485.	485.	1.535-03	1.132-03	485.	4.917-03	3.588-03	485.	8.718-03	6.347-03
NNW	640.	640.	9.993-04	7.372-04	640.	2.760-03	2.014-03	640.	4.153-03	3.024-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR KR 90

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	1.015-04	7.277-05	864.	1.480-04	1.047-04	864.	1.835-04	1.295-04
NNE	1029.	1029.	5.079-05	3.641-05	1029.	3.336-05	2.365-05	1029.	2.365-05	1.669-05
NE	1212.	1212.	2.263-05	1.622-05	1212.	1.122-05	7.957-06	1212.	5.414-06	3.823-06
ENE	1367.	1367.	8.713-06	6.242-06	1367.	7.049-06	4.989-06	1367.	6.174-06	4.360-06
E	1170.	1170.	2.397-05	1.718-05	1170.	2.571-05	1.819-05	1170.	2.491-05	1.759-05
ESE	1170.	1170.	3.671-05	2.630-05	1170.	3.368-05	2.383-05	1170.	3.320-05	2.343-05
SE	1189.	1189.	3.286-05	2.354-05	1189.	2.564-05	1.815-05	1189.	2.389-05	1.687-05
SSE	1422.	1422.	6.624-06	4.744-06	1422.	4.173-06	2.957-06	1422.	3.379-06	2.387-06
S	1198.	1198.	1.289-05	9.233-06	1198.	9.167-06	6.494-06	1198.	8.062-06	5.692-06
SSW	1024.	1024.	2.230-05	1.598-05	1024.	2.678-05	1.895-05	1024.	3.068-05	2.166-05
SW	654.	654.	1.085-04	7.776-05	654.	1.430-04	1.012-04	654.	1.925-04	1.358-04
WSW	494.	494.	2.325-04	1.666-04	494.	3.155-04	2.237-04	494.	4.241-04	2.992-04
W	451.	451.	4.430-04	3.175-04	451.	7.115-04	5.036-04	451.	8.888-04	6.270-04
WNW	451.	451.	4.456-04	3.194-04	451.	7.985-04	5.648-04	451.	9.518-04	6.715-04
NW	485.	485.	3.687-04	2.644-04	485.	5.259-04	3.722-04	485.	6.338-04	4.470-04
NNW	640.	640.	1.869-04	1.340-04	640.	2.602-04	1.841-04	640.	2.887-04	2.036-04

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE131M

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	7.856-06	2.614-06	864.	1.679-04	2.624-05	864.	3.832-04	5.531-05
NNE	1029.	1029.	9.733-06	3.179-06	1029.	6.641-05	1.193-05	1029.	1.168-04	1.748-05
NE	1212.	1212.	7.163-06	2.273-06	1212.	8.439-05	1.369-05	1212.	1.318-04	1.943-05
ENE	1367.	1367.	3.903-06	1.252-06	1367.	6.241-05	1.007-05	1367.	1.018-04	1.527-05
E	1170.	1170.	4.399-06	1.483-06	1170.	5.307-05	8.942-06	1170.	1.018-04	1.533-05
ESE	1170.	1170.	5.762-06	1.874-06	1170.	7.659-05	1.244-05	1170.	1.236-04	1.852-05
SE	1189.	1189.	7.180-06	2.348-06	1189.	1.039-04	1.679-05	1189.	1.695-04	2.554-05
SSE	1422.	1422.	5.280-06	1.649-06	1422.	5.711-05	9.571-06	1422.	1.120-04	1.695-05
S	1198.	1198.	4.792-06	1.620-06	1198.	3.897-05	6.984-06	1198.	1.270-04	1.859-05
SSW	1024.	1024.	4.744-06	1.703-06	1024.	3.457-05	6.363-06	1024.	1.004-04	1.480-05
SW	654.	654.	7.621-06	2.564-06	654.	7.147-05	1.217-05	654.	2.691-04	3.740-05
WSW	494.	494.	1.360-05	4.359-06	494.	1.144-04	1.930-05	494.	3.309-04	4.619-05
W	451.	451.	1.325-05	4.404-06	451.	2.578-04	3.854-05	451.	5.281-04	7.239-05
WNW	451.	451.	1.295-05	4.169-06	451.	4.716-04	6.683-05	451.	8.198-04	1.099-04
NW	485.	485.	1.344-05	4.232-06	485.	4.588-04	6.511-05	485.	9.954-04	1.324-04
NNW	640.	640.	8.598-06	2.912-06	640.	2.731-04	3.992-05	640.	4.793-04	6.570-05

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE133M

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	3.220-05	1.557-05	864.	3.141-04	1.020-04	864.	6.591-04	1.972-04
NNE	1029.	1029.	3.913-05	1.883-05	1029.	1.437-04	5.239-05	1029.	2.087-04	6.491-05
NE	1212.	1212.	2.794-05	1.333-05	1212.	1.640-04	5.514-05	1212.	2.315-04	7.088-05
ENE	1367.	1367.	1.539-05	7.367-06	1367.	1.206-04	4.034-05	1367.	1.821-04	5.677-05
E	1170.	1170.	1.826-05	8.866-06	1170.	1.074-04	3.726-05	1170.	1.831-04	5.730-05
ESE	1170.	1170.	2.307-05	1.109-05	1170.	1.490-04	5.013-05	1170.	2.211-04	6.889-05
SE	1189.	1189.	2.889-05	1.390-05	1189.	2.011-04	6.735-05	1189.	3.049-04	9.554-05
SSE	1422.	1422.	2.025-05	9.614-06	1422.	1.148-04	3.966-05	1422.	2.022-04	6.362-05
S	1198.	1198.	1.995-05	9.692-06	1198.	8.410-05	3.061-05	1198.	2.214-04	6.729-05
SSW	1024.	1024.	2.100-05	1.037-05	1024.	7.677-05	2.847-05	1024.	1.765-04	5.402-05
SW	654.	654.	3.160-05	1.533-05	654.	1.463-04	5.121-05	654.	4.449-04	1.273-04
WSW	494.	494.	5.367-05	2.568-05	494.	2.321-04	8.067-05	494.	5.497-04	1.581-04
W	451.	451.	5.428-05	2.625-05	451.	4.605-04	1.431-04	451.	8.607-04	2.421-04
WNW	451.	451.	5.134-05	2.460-05	451.	7.960-04	2.332-04	451.	1.305-03	3.564-04
NW	485.	485.	5.208-05	2.479-05	485.	7.754-04	2.275-04	485.	1.571-03	4.246-04
NNW	640.	640.	3.590-05	1.745-05	640.	4.761-04	1.444-04	640.	7.807-04	2.196-04

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE133

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	3.323-05	1.268-05	864.	3.515-04	1.056-04	864.	7.318-04	2.092-04
NNE	1029.	1029.	4.043-05	1.538-05	1029.	1.619-04	5.209-05	1029.	2.347-04	6.892-05
NE	1212.	1212.	2.908-05	1.100-05	1212.	1.840-04	5.641-05	1212.	2.597-04	7.550-05
ENE	1367.	1367.	1.609-05	6.101-06	1367.	1.361-04	4.167-05	1367.	2.053-04	6.041-05
E	1170.	1170.	1.882-05	7.204-06	1170.	1.214-04	3.800-05	1170.	2.069-04	6.110-05
ESE	1170.	1170.	2.390-05	9.085-06	1170.	1.677-04	5.149-05	1170.	2.494-04	7.343-05
SE	1189.	1189.	2.995-05	1.140-05	1189.	2.263-04	6.928-05	1189.	3.447-04	1.018-04
SSE	1422.	1422.	2.128-05	8.026-06	1422.	1.294-04	4.035-05	1422.	2.285-04	6.766-05
S	1198.	1198.	2.059-05	7.887-06	1198.	9.490-05	3.053-05	1198.	2.481-04	7.179-05
SSW	1024.	1024.	2.148-05	8.319-06	1024.	8.670-05	2.821-05	1024.	1.977-04	5.746-05
SW	654.	654.	3.238-05	1.238-05	654.	1.635-04	5.127-05	654.	4.873-04	1.351-04
WSW	494.	494.	5.596-05	2.121-05	494.	2.566-04	7.985-05	494.	6.018-04	1.673-04
W	451.	451.	5.613-05	2.143-05	451.	5.031-04	1.460-04	451.	9.354-04	2.559-04
WNW	451.	451.	5.329-05	2.022-05	451.	8.636-04	2.415-04	451.	1.403-03	3.755-04
NW	485.	485.	5.444-05	2.056-05	485.	8.414-04	2.355-04	485.	1.683-03	4.469-04
NNW	640.	640.	3.675-05	1.407-05	640.	5.222-04	1.497-04	640.	8.494-04	2.325-04

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE135M

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	3.872-04	2.393-04	864.	1.720-03	1.052-03	864.	3.220-03	1.964-03
NNE	1029.	1029.	4.150-04	2.564-04	1029.	8.409-04	5.166-04	1029.	9.696-04	5.923-04
NE	1212.	1212.	2.783-04	1.720-04	1212.	7.184-04	4.404-04	1212.	8.897-04	5.432-04
ENE	1367.	1367.	1.488-04	9.193-05	1367.	4.963-04	3.041-04	1367.	7.041-04	4.302-04
E	1170.	1170.	2.000-04	1.236-04	1170.	5.748-04	3.525-04	1170.	8.513-04	5.202-04
ESE	1170.	1170.	2.540-04	1.570-04	1170.	7.447-04	4.564-04	1170.	1.021-03	6.237-04
SE	1189.	1189.	3.027-04	1.871-04	1189.	9.546-04	5.850-04	1189.	1.382-03	8.442-04
SSE	1422.	1422.	1.838-04	1.136-04	1422.	4.911-04	3.013-04	1422.	7.799-04	4.767-04
S	1198.	1198.	1.966-04	1.215-04	1198.	4.539-04	2.788-04	1198.	8.818-04	5.383-04
SSW	1024.	1024.	2.234-04	1.381-04	1024.	4.870-04	2.992-04	1024.	8.318-04	5.078-04
SW	654.	654.	3.810-04	2.355-04	654.	9.794-04	6.008-04	654.	2.151-03	1.310-03
WSW	494.	494.	6.701-04	4.141-04	494.	1.647-03	1.010-03	494.	2.933-03	1.786-03
W	451.	451.	7.248-04	4.480-04	451.	2.815-03	1.721-03	451.	4.546-03	2.766-03
WNW	451.	451.	6.778-04	4.188-04	451.	4.326-03	2.638-03	451.	6.456-03	3.923-03
NW	485.	485.	6.649-04	4.109-04	485.	4.068-03	2.481-03	485.	7.321-03	4.448-03
NNW	640.	640.	4.526-04	2.797-04	640.	2.440-03	1.490-03	640.	3.837-03	2.213-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE135

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RADIUS (METERS)	V (MRAD/YR)/	LEASE VBAR UCI/SEC)	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	7.814-04	1.522-04	864.	1.627-03	8.738-04	864.	3.046-03	1.633-03
NNE	1029.	1029.	8.387-04	1.831-04	1029.	8.676-04	4.670-04	1029.	1.015-03	5.448-04
NE	1212.	1212.	2.389-04	1.291-04	1212.	8.843-04	4.753-04	1212.	1.097-03	5.886-04
ENE	1367.	1367.	1.320-04	7.135-05	1367.	6.446-04	3.464-04	1367.	8.844-04	4.746-04
E	1170.	1170.	1.598-04	8.643-05	1170.	6.063-04	3.260-04	1170.	8.982-04	4.820-04
ESE	1170.	1170.	1.995-04	1.078-04	1170.	8.064-04	4.334-04	1170.	1.078-03	5.784-04
SE	1189.	1189.	2.499-04	1.351-04	1189.	1.081-03	5.807-04	1189.	1.497-03	8.034-04
SSE	1422.	1422.	1.717-04	9.281-05	1422.	6.407-04	3.445-04	1422.	9.941-04	5.335-04
S	1198.	1198.	1.743-04	9.424-05	1198.	5.054-04	2.720-04	1198.	1.040-03	5.576-04
SSW	1024.	1024.	1.874-04	1.014-04	1024.	4.747-04	2.556-04	1024.	8.404-04	4.507-04
SW	654.	654.	2.773-04	1.499-04	654.	8.413-04	4.525-04	654.	1.934-03	1.036-03
WSW	494.	494.	4.638-04	2.508-04	494.	1.325-03	7.127-04	494.	2.413-03	1.292-03
W	451.	451.	4.760-04	2.575-04	451.	2.257-03	1.211-03	451.	3.660-03	1.959-03
WNW	451.	451.	4.452-04	2.408-04	451.	3.587-03	1.922-03	451.	5.316-03	2.844-03
NW	485.	485.	4.475-04	2.420-04	485.	3.499-03	1.875-03	485.	6.298-03	3.367-03
NNW	640.	640.	3.161-04	1.709-04	640.	2.247-03	1.205-03	640.	3.309-03	1.771-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE137

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	1.103-04	7.148-05	864.	3.458-04	2.226-04	864.	6.269-04	4.031-04
NNE	1029.	1029.	9.706-05	6.286-05	1029.	1.429-04	9.211-05	1029.	1.551-04	9.976-05
NE	1212.	1212.	6.142-05	3.977-05	1212.	9.384-05	6.046-05	1212.	1.041-04	6.693-05
ENE	1367.	1367.	3.146-05	2.037-05	1367.	6.455-05	4.156-05	1367.	8.642-05	5.557-05
E	1170.	1170.	4.952-05	3.206-05	1170.	1.038-04	6.686-05	1170.	1.438-04	9.247-05
ESE	1170.	1170.	6.538-05	4.233-05	1170.	1.306-04	8.411-05	1170.	1.739-04	1.119-04
SE	1189.	1189.	7.175-05	4.646-05	1189.	1.515-04	9.758-05	1189.	2.184-04	1.404-04
SSE	1422.	1422.	3.533-05	2.287-05	1422.	6.340-05	4.084-05	1422.	9.355-05	6.016-05
S	1198.	1198.	4.051-05	2.623-05	1198.	7.053-05	4.545-05	1198.	1.176-04	7.561-05
SSW	1024.	1024.	4.912-05	3.181-05	1024.	9.325-05	6.007-05	1024.	1.483-04	9.534-05
SW	654.	654.	1.038-04	6.723-05	654.	2.145-04	1.382-04	654.	4.306-04	2.768-04
WSW	494.	494.	1.944-04	1.259-04	494.	3.884-04	2.503-04	494.	6.907-04	4.441-04
W	451.	451.	2.344-04	1.518-04	451.	6.798-04	4.377-04	451.	1.116-03	7.175-04
WNW	451.	451.	2.191-04	1.419-04	451.	9.533-04	6.133-04	451.	1.467-03	9.426-04
NW	485.	485.	2.071-04	1.341-04	485.	8.128-04	5.230-04	485.	1.471-03	9.457-04
NNW	640.	640.	1.355-04	8.779-05	640.	4.535-04	2.918-04	640.	6.963-04	4.476-04

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR XE138

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	9.518-04	6.932-04	864.	3.639-03	2.610-03	864.	6.657-03	4.761-03
NNE	1029.	1029.	1.008-03	7.337-04	1029.	1.823-03	1.312-03	1029.	2.003-03	1.434-03
NE	1212.	1212.	6.713-04	4.886-04	1212.	1.515-03	1.088-03	1212.	1.812-03	1.296-03
ENE	1367.	1367.	3.575-04	2.602-04	1367.	1.034-03	7.422-04	1367.	1.433-03	1.025-03
E	1170.	1170.	4.860-04	3.538-04	1170.	1.225-03	8.801-04	1170.	1.755-03	1.256-03
ESE	1170.	1170.	6.158-04	4.482-04	1170.	1.578-03	1.133-03	1170.	2.106-03	1.507-03
SE	1189.	1189.	7.318-04	5.326-04	1189.	2.013-03	1.445-03	1189.	2.842-03	2.034-03
SSE	1422.	1422.	4.384-04	3.190-04	1422.	1.034-03	7.430-04	1422.	1.588-03	1.137-03
S	1198.	1198.	4.737-04	3.448-04	1198.	9.751-04	7.017-04	1198.	1.798-03	1.286-03
SSW	1024.	1024.	5.428-04	3.953-04	1024.	1.057-03	7.607-04	1024.	1.716-03	1.227-03
SW	654.	654.	9.326-04	6.792-04	654.	2.127-03	1.530-03	654.	4.441-03	3.174-03
WSW	494.	494.	1.643-03	1.196-03	494.	3.619-03	2.605-03	494.	6.111-03	4.369-03
W	451.	451.	1.778-03	1.295-03	451.	6.032-03	4.329-03	451.	9.453-03	6.756-03
WNW	451.	451.	1.660-03	1.209-03	451.	9.114-03	6.529-03	451.	1.336-02	9.542-03
NW	485.	485.	1.633-03	1.190-03	485.	8.565-03	6.137-03	485.	1.508-02	1.077-02
NNW	640.	640.	1.113-03	8.103-04	640.	5.133-03	3.679-03	640.	7.487-03	5.350-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

TABLE 7.2-8 (Cont'd)

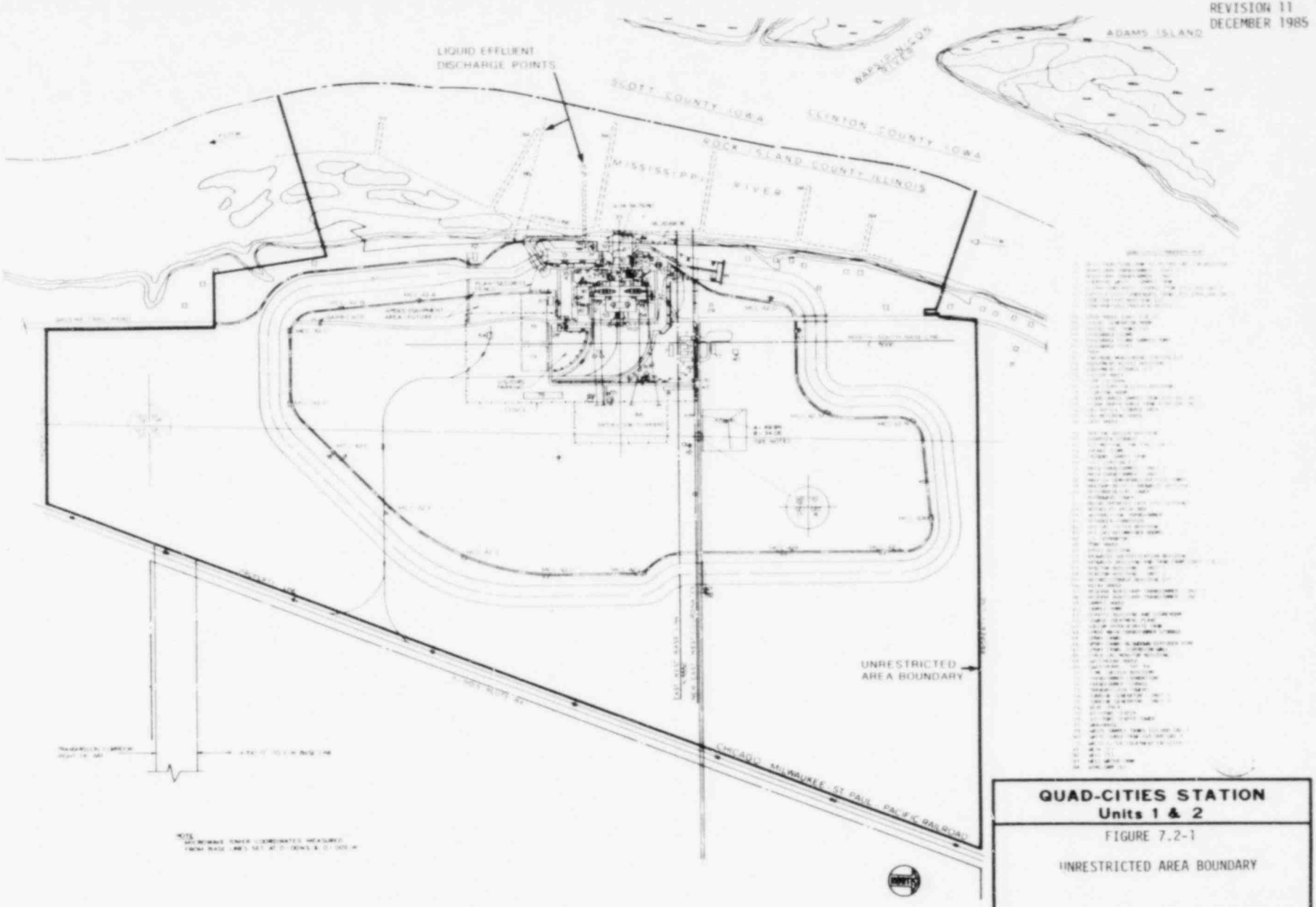
QUAD-CITIES 1&2

MAXIMUM OFFSITE FINITE PLUME GAMMA DOSE FACTORS FOR AR 41

DOWNWIND DIRECTION	RESTRICTED AREA BOUND (METERS)	ELEVATED(STACK) RELEASE RADIUS (METERS)	S (MRAD/YR)/(UCI/SEC)	SBAR	MIXED MODE(VENT) RELEASE RADIUS (METERS)	V (MRAD/YR)/(UCI/SEC)	VBAR	GROUND LEVEL RELEASE RADIUS (METERS)	G (MRAD/YR)/(UCI/SEC)	GBAR
N	864.	864.	1.279-03	9.016-04	864.	5.818-03	4.102-03	864.	1.057-02	7.449-03
NNE	1029.	1029.	1.507-03	1.062-03	1029.	3.201-03	2.256-03	1029.	3.492-03	2.462-03
NE	1212.	1212.	1.044-03	7.361-04	1212.	3.109-03	2.192-03	1212.	3.698-03	2.607-03
ENE	1367.	1367.	5.741-04	4.048-04	1367.	2.218-03	1.564-03	1367.	2.965-03	2.090-03
E	1170.	1170.	7.079-04	4.991-04	1170.	2.172-03	1.531-03	1170.	3.084-03	2.175-03
ESE	1170.	1170.	8.827-04	6.223-04	1170.	2.862-03	2.018-03	1170.	3.703-03	2.611-03
SE	1189.	1189.	1.098-03	7.742-04	1189.	3.808-03	2.685-03	1189.	5.128-03	3.615-03
SSE	1422.	1422.	7.391-04	5.211-04	1422.	2.233-03	1.574-03	1422.	3.329-03	2.347-03
S	1198.	1198.	7.619-04	5.371-04	1198.	1.836-03	1.294-03	1198.	3.517-03	2.480-03
SSW	1024.	1024.	8.349-04	5.886-04	1024.	1.764-03	1.244-03	1024.	2.891-03	2.038-03
SW	654.	654.	1.258-03	8.872-04	654.	3.150-03	2.221-03	654.	6.756-03	4.763-03
WSW	494.	494.	2.140-03	1.509-03	494.	5.085-03	3.585-03	494.	8.554-03	6.031-03
W	451.	451.	2.219-03	1.564-03	451.	8.373-03	5.903-03	451.	1.300-02	9.168-03
WNW	451.	451.	2.074-03	1.462-03	451.	1.302-02	9.179-03	451.	1.885-02	1.329-02
NW	485.	485.	2.076-03	1.463-03	485.	1.266-02	8.926-03	485.	2.219-02	1.565-02
NNW	640.	640.	1.443-03	1.017-03	640.	8.046-03	5.673-03	640.	1.155-02	8.142-03

QUAD-CITIES 1&2 SITE METEOROLOGICAL DATA 1/74 - 12/75

REVISION 11
DECEMBER 1985



QUAD-CITIES STATION
Units 1 & 2

FIGURE 7.2-1

UNRESTRICTED AREA BOUNDARY

8.0 RADIOACTIVE EFFLUENT TREATMENT SYSTEMS, MODELS FOR SETTING GASEOUS AND LIQUID EFFLUENT MONITOR ALARM AND TRIP SETPOINTS, AND ENVIRONMENTAL RADIOLOGICAL MONITORING

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ODCM LIST OF TABLES FOR QUAD-CITIES SECTION 8.0

ODCM LIST OF FIGURES FOR QUAD-CITIES SECTION 8.0

8.0 RADIOACTIVE EFFLUENT TREATMENT SYSTEMS, MODELS FOR SETTING GASEOUS AND LIQUID EFFLUENT MONITOR ALARM AND TRIP SETPOINTS, AND ENVIRONMENTAL RADIOLOGICAL MONITORING

8.1 GASEOUS RELEASES

8.1.1 System Design

A simplified gaseous radwaste and gaseous effluent flow diagram is provided in Figure 8.1-1.

8.1.1.1 Gaseous Radwaste Treatment System

A gaseous radwaste treatment system shall be any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system off-gases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

8.1.2 Alarm and Trip Setpoints

Alarm and trip setpoints of gaseous effluent monitors at the principal points of release of ventilation exhaust air containing radioactivity are established to ensure that the release limits of 10 CFR 20 are not exceeded. The setpoints are found by solving Equations 2.6 and 2.7 for each class of release.

For this evaluation the radioactivity mixture in the exhaust air is assumed to have the composition of gases listed in Table 3-3 from "Technical Derivation of BWR 1971 Design Basis Radioactive Material Source Terms", NEDO-10871, March 1973, General Electric Company. This mixture of radioactive gases is representative of the activity found at the point of release from the fuel with no radioactive decay accounted for.

Equation 2.6 is rewritten using the fractional composition of each nuclide, f_i, and a total release rate, Q_t, for each class:

$$1.11 \sum_i \left[Q_{ts}(\bar{S}_i \times f_i) + Q_{tv}(\bar{V}_i \times f_i) \right] < 500 \frac{\text{mrem}}{\text{yr}} \qquad (8.1)$$

f_i **Fractional Radionuclide Composition**

The release rate of radionuclide i divided by the total release of all radionuclides.

Q_{ts} Total Release Rate, Stack Release (μCi/sec)

The release rate for all radionuclides due to a stack release.

Q_{tv} Total Release Rate, Vent Release (μCi/sec)

The release rate for all radionuclides due to a vent release.

Equation 8.1 can be solved for Q_t for each class of release for release limit determinations.

Similarly, Equation 2.7 can be rewritten:

$$\sum_i \left\{ \bar{L}_i \left[(\chi/Q)_s Q_{ts} f_i \exp(-\lambda_i R/3600u_s) + (\chi/Q)_v Q_{tv} f_i \exp(-\lambda_i R/3600u_v) \right] + 1.11 \left[S_i Q_{ts} f_i + V_i Q_{tv} f_i \right] \right\} < 3000 \frac{\text{mrem}}{\text{yr}} \qquad (8.2)$$

Equation 8.2 can be solved for Q_t for each class of release and a corresponding release limit be determined. The most conservative release limit determined from Equations 8.1 and 8.2 will be used in selecting the appropriate alarm and trip setpoints for each class of release.

The exact settings will be selected to ensure that 10 CFR 20 limits are not exceeded.

Surveillance frequencies for gaseous effluent monitors will be as stated in Table 4.2-4 of the Technical Specifications. Calibration methods will be consistent with the definitions found in Section 1.0 of the Technical Specifications.

8.1.3 Main Chimney Releases

8.1.3.1 Chimney Noble Gas Monitors

Releases of radioactive noble gases from the main chimney release point are continuously monitored by a General Electric (GE) off-line monitoring system consisting of two instrument channels, each of which uses a scintillation detector as its sensing element. Samples of the effluent stream are taken high in the chimney, where good mixing is ensured, and drawn through a constant flow-and-pump network, past the detectors. The detector equipment part numbers are RE 1/2-1731A and RE 1/2-1731B.

Each monitoring channel consists of a 2-inch by 2-inch sodium iodide thallium activated scintillation detector, shielded sample chamber, pulse preamplifier, and process radiation (log count) monitor with integral power supply for providing high voltage to the detector. The channels share a common recorder and common trip auxiliaries unit whose output initiate high radiation alarm annunciations. The recorder, alarms, and remote control switches for the chimney gas monitoring system are located in the main control room.

The monitor display has a logarithmic scale with a range of 10^{-1} to 10^{6} counts per second.

In addition to the GE noble gas monitors, the gas sample is routed through a filter paper on which particulates are deposited, through a charcoal cartridge which traps the iodines, and through Eberline low and medium range noble gas detectors.

Under accident conditions, the above pathway can be bypassed and the sample routed through an Eberline/Victoreen system which has an Eberline high range noble gas monitor and a Victoreen postaccident particulate and iodine sampler.

The Eberline low and medium range noble gas detectors view the same volume, while the Eberline high range noble gas detector views externally a section of one inch stainless steel tubing as its sample volume. The low range is monitored by a beta scintillation detector (Eberline Model RDA-3A), while both the medium and high range measurements are performed by an energy-compensated GM detector. Background subtraction is provided for all three ranges. Sample flow is provided by a stainless steel diaphragm vacuum pump and an air flow regulator. Sample flow is set to insure isokinetic sampling monitored by a solid-state flow sensor.

The three Eberline noble gas detectors are part of a microprocessor-controlled gaseous effluent monitoring system (Eberline SPING-4). The monitoring system's control terminal, strip chart recorder panel 912-1 and annunciating panel 912-4 are located in the control room on Panel 912-1. The control terminal provides immediate access to current detector activity, operating parameters, and history files for any detector. Changes in detector operational status are automatically printed and audibly acknowledged. The SPING-4 microprocessor's memory has battery backup to maintain all operating parameters and history files for any detector in the event of a system power loss.

For all of the above monitors, the sample pumps and detectors, with local controls, are located in the chimney sample house at the base of the chimney. Power is supplied to the process radiation monitors from the station 48/24-Vdc battery systems.

The main chimney noble gas monitor alarm setpoints will be selected to ensure that the combined release rate of the main chimney and the reactor building vent stack does not exceed the most conservative release limit determined from Equations 8.1 and 8.2.

8.1.3.2 SJAE Off-Gas Monitors

The major source of radioactive noble gases is from each unit's off-gas system. Each unit's off-gas system has its own radiation detection instrumentation capable of isolating the off-gas release pathway.

Off-gas from the main condenser is monitored for gross gamma activity downstream of the steam jet air ejectors (SJAE) and prior to release to the main chimney. Continuous radiation monitoring is maintained on the off-gas hold-up pipe. The off-gas monitoring system for each unit is performed in two channels, each of which includes a gamma sensitive ion-chamber detector, and a logarithmic radiation monitor with integral power supply. The two channels share a common two-pen recorder and a trip auxiliaries unit whose output feeds an interval timer. System controls, alarm annunciators, recorder, and displays are located on panels in the main control room. The ion-chamber detectors are mounted adjacent to and at the beginning of the off-gas hold-up pipe, a 36-inch diameter header whose function is to contain the off-gas for a period of time dependent on off-gas flow and allow for radioactive decay prior to release to the chimney.

A high radiation condition in the hold-up pipe will initiate an interval timer with a variable setting of 0 to 15 minutes. When the preselected time interval has elapsed, an isolation valve at the inlet to the chimney from the off-gas system will automatically close, preventing release of radioactive gases from the affected off-gas system.

Power is supplied to the off-gas process radiation monitors from the station's 48/24-Vdc battery systems. Power to the interval timer is from the 120-Vac essential service bus. The timer provides the signal to the solenoid-operated valves which control the air supply to the air-operated isolation valve (equipment part number AO 1(2)-5406). The monitor display is a logarithmic scale and has a range of 1 to 10^6 units (mR/hr). The detectors equipment part numbers are RE 1(2)-1733A and RE 1(2)-1733B.

The SJAE monitor alarm setpoints will be selected to ensure that the combined release rate of the main chimney and station vent stack does not exceed the most conservative release limit determined from Equations 8.1 and 8.2.

8.1.3.3 Allocation of Effluents from Common Release Points

Radioactive gaseous effluents released from the main chimney are comprised of contributions from both units. Under normal operating conditions, it is difficult to allocate the radioactivity between units due to fuel performance, in-plant leakage, power history, and other variables. Consequently, allocation will normally be made evenly between the units. During extended unit shutdowns or periods of known differences, the apportionment will be adjusted accordingly. The allocation of the effluents will be made on a monthly basis.

8.1.4 Reactor Building Ventilation Stack Releases

8.1.4.1 Ventilation Stack Monitors

Releases of radioactive noble gases from each reactor building's ventilation system are monitored prior to introduction to the ventilation stack. Two sensor and converter (detector) units are located in each unit's reactor building exhaust duct, and provide continuous gamma radiation monitoring.

The sensor is a Geiger-Mueller tube, polarized by high voltage from the power supply. The output signal from each sensor converter is applied to an indicator and trip unit, where it is amplified and used to drive a meter. This unit also provides trip functions for upscale and downscale alarms through auxiliary units. A downscale trip in either channel annunciates a low radiation (malfunction) alarm. An upscale trip in either channel initiates a reactor building ventilation system high-high radiation alarm. Control logic is such that one channel high level trip or two channel low level trips will shut down and isolate the reactor building ventilation system for both units and initiate the standby gas treatment system.

The exhaust duct monitors provide a signal to a two-pen recorder which will annunciate a high radiation condition in the exhaust duct. This is an alarm only, and does not initiate corrective action. The recorder, controls, indicator and trip units, alarms, and annunciators are located on panels in the main control room.

The power supply to each sensor channel is supplied from a different power source. The A channel is fed from the 120-Vac.

A reactor protection system and the B channel are fed from the 120-Vac B reactor protection system.

The indicating meters have a logarithmic scale with a range of 0.01 to 100 mR/hr. The sensor and converter units have equipment part numbers RE 1(2)-1735A and RE 1(2)-1735B.

Each reactor building's ventilation system is isolated by closure of two air-operated butterfly valves (AO 1(2)A-5741 and AO 1(2)B-5741) located in series downstream of the reactor building ventilation supply fans, and by closure of two air-operated butterfly valves (AO 1(2)A-5742 and AO 1(2)B-5742) located in series downstream of the radiation sensors and upstream of the exhaust fans. Air supplies to these valves are controlled by solenoid valves powered from the 125-Vdc station battery systems. The control logic relays which operate these solenoids are powered by the 120-Vac essential service bus.

The reactor building ventilation stack monitor alarm setpoint will be 2 mR/hr above background. Using an empirical relationship of mR/hr and μ/Ci/sec at design flowrates, the calculated reactor building ventilation stack release rate will be employed in Equation 8.1 and 8.2 to select the most conservative main chimney monitor alarm setpoints.

8.1.4.2 Allocation of Effluents from Common Release Points

Radioactive gaseous effluents released from the reactor building vent stack are comprised of contributions from both units. Estimates of noble gas contributions from each unit will be made by analyzing grab samples from the individual units. Allocations of radioiodine and radioactive particulate releases will be made by analyzing samples taken from continuous samples on each unit. The allocation of the effluents will be made on a monthly basis.

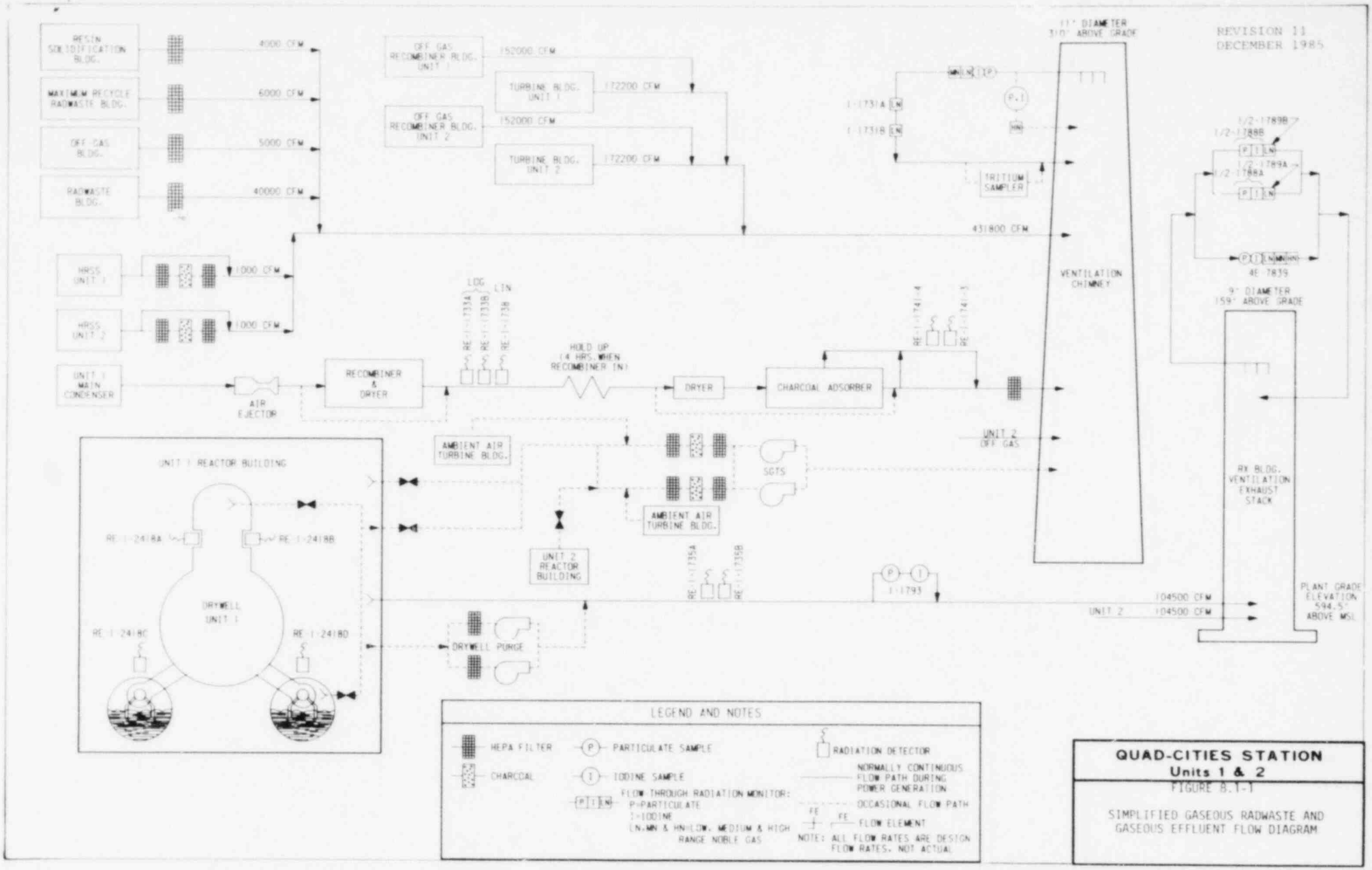
8.1.5 Symbols Used in Section 8.1

SYMBOL	NAME	UNIT
Q_{ts}	Total Release Rate, Stack Release	(μCi/sec)
$\bar{S}_i$	Gamma Whole Body Dose Constant, Stack Release	(mrad/yr per μCi/sec)
f_i	Fractional Radionuclide Composition	
Q_{tv}	Total Release Rate, Vent Release	(μCi/sec)
$\bar{V}$	Gamma Whole Body Dose Constant, Vent Release	(mrad/yr per μCi/sec))
Q_{is}	Release Rate of Nuclide i, Stack Release	(μCi/sec)
Q_{iv}	Release Rate of Nuclide i, Vent Release	(μCi/sec)
$\bar{L}_i$	Beta Skin Dose Constant	(mrem/yr per $\mu Ci/m^3$)
$(\chi/Q)_s$	Relative Effluent Concentration, Vent Stack Release	(sec/m^3)
λ_i	Radiological Decay Constant	(hr^{-1})
R	Downwind Range	(m)
u_s	Average Wind Speed, Stack Release	(m/sec)

SYMBOL	NAME	UNIT
$(\chi/Q)_v$	Relative Effluent Concentration, Vent Release	(sec/m^3)
u_v	Average Wind Speed, Vent Release	(m/sec)
S_i	Gamma Dose Constant, Stack Release	(mrad/yr per µCi/sec)
V_i	Gamma Dose Constant, Stack Release	(mrad/yr per µCi/sec)

8.1.6 Constants Used In Section 8.1

NUMERICAL VALUE	NAME	UNIT
1.11	Conversion Constant	(mrem/mrad)
3600	Conversion Constant	(sec/hr)


REVISION 11
DECEMBER 1985
RESIN SOLIDIFICATION BLDG.
MAXIMUM RECYCLE RADWASTE BLDG.
OFF GAS BLDG.
RADWASTE BLDG.
4000 CFM
6000 CFM
5000 CFM
40000 CFM
OFF GAS RECOMBINER BLDG. UNIT 1
OFF GAS RECOMBINER BLDG. UNIT 2
152000 CFM
152000 CFM
TURBINE BLDG. UNIT 1
TURBINE BLDG. UNIT 2
172200 CFM
172200 CFM
11' DIAMETER
310' ABOVE GRADE
1-1731A LN
1-1731B LN
TRITIUM SAMPLER
431800 CFM
VENTILATION CHIMNEY
1/2-1788B
1/2-1788
1/2-1789A
1/2-1788A
4E 7839
9' DIAMETER
159' ABOVE GRADE
HRSS UNIT 1
HRSS UNIT 2
1000 CFM
1000 CFM
UNIT 1 MAIN CONDENSER
AIR EJECTOR
RECOMBINER & DRYER
LOG
LIN
HOLD UP (4 HRS. WHEN RECOMBINER IN)
DRYER
CHARCOAL ADSORBER
UNIT 2 OFF GAS
AMBIENT AIR TURBINE BLDG.
AMBIENT AIR TURBINE BLDG.
SGTS
UNIT 1 REACTOR BUILDING
DRYWELL UNIT 1
UNIT 2 REACTOR BUILDING
DRYWELL PURGE
1-1793
104500 CFM
UNIT 2 104500 CFM
RX BLDG. VENTILATION EXHAUST STACK
PLANT GRADE ELEVATION 594.5' ABOVE MSL
LEGEND AND NOTES
HEPA FILTER
CHARCOAL
PARTICULATE SAMPLE
IODINE SAMPLE
FLOW THROUGH RADIATION MONITOR:
P=PARTICULATE
I=IODINE
LN, MN & HN=LOW, MEDIUM & HIGH RANGE NOBLE GAS
RADIATION DETECTOR
NORMALLY CONTINUOUS FLOW PATH DURING POWER GENERATION
OCCASIONAL FLOW PATH
FLOW ELEMENT
NOTE: ALL FLOW RATES ARE DESIGN FLOW RATES, NOT ACTUAL
QUAD-CITIES STATION
Units 1 & 2
FIGURE 8.1-1
SIMPLIFIED GASEOUS RADWASTE AND GASEOUS EFFLUENT FLOW DIAGRAM

8.2 LIQUID RELEASES

8.2.1 System Design

Simplified liquid radwaste and liquid effluent flow diagrams are provided in Figures 8.2-1 and 8.2-2.

A liquid radwaste treatment system shall be a system designed and installed to treat radioactive liquid effluents by collecting the liquids, providing for retention or holdup, and providing for treatment by demineralization to reduce the total radioactivity prior to the release of liquids to the environment.

8.2.2 Alarm Setpoints

Alarm setpoints of liquid effluent monitors at the principal release points are established to ensure that the limits of 10 CFR 20 are not exceeded in the unrestricted area. The concentration limit (C_{lim}) in the discharge line prior to dilution in the initial dilution stream is:

$$C_{lim} = MPC \left[\frac{F^d_{ave} + F^r_{max}}{F^r_{max}} \right] \qquad (8.3)$$

C_{lim} — Limiting Concentration in Discharge Line (μCi/ml)

The maximum concentration in the discharge line permitted to be discharged to the initial dilution stream.

MPC — Weighted Maximum Permissible Concentration (μCi/ml)

$$MPC = \frac{\sum_{i=1}^{n} C_i}{\sum_{i=1}^{n} \frac{C_i}{MPC_i}} \quad \text{or} \quad \frac{\sum_{i=1}^{n} A_i}{\sum_{i=1}^{n} \frac{A_i}{MPC_i}} \qquad (8.4)$$

where:

C_i = μCi/ml of nuclide i;

MPC_i = maximum permissible concentration μCi/ml of nuclide i; and

A_i = μCi of nuclide i released in time t.

F^r_{max} Maximum Flow Rate, Radwaste Discharge (ft^3/sec)

The maximum flow rate of radwaste from the discharge tank to the initial dilution stream.

F^d_{ave} Average Flow Rate, Initial Dilution Stream (ft^3/sec)

The average flow rate of the initial dilution stream which carries the radionuclides to the unrestricted area boundary.

Surveillance frequencies for liquid effluent monitors will be as stated in Table 4.2-3 of the Technical Specifications.

Calibration methods will be consistent with the definitions found in Section 1.0 of the Technical Specifications.

8.2.3 Radwaste Discharge Line Releases

8.2.3.1 Radwaste Discharge Monitor

The radwaste releases are currently monitored for radioactivity using two grab samples and a composite sample. These samples are analyzed for alpha, beta, and gamma radiation. MPC calculations are done to determine discharge rate and dilution volume.

Installation of a new continuous monitor for the radwaste discharge line is in progress. It is an offline monitoring system which uses a 2-inch by 2-inch sodium iodine thallium actuated scintillation detector in a lead-shielded housing. The sample container is bowl shaped to minimize crud buildup. A GM tube is used to determine the background radiation level.

The radwaste discharge monitor provides a signal to a recorder and an Eberline CT-2 control terminal. A high radiation alarm will be activated by the control terminal. The process radiation monitor, control terminal, alarm, and annunciator are located on panels in the main control room.

The process liquid monitor has a logarithmic scale with a range of 10^{-1} to 10^{6} counts/sec. The monitor is powered by 120-Vac.

The radwaste discharge line detector (RE 1/2-1799-01) is mounted adjacent to the radwaste control room. The flow is routed there after the flow control valves and prior to the selection of several alternate discharge routes.

The alarm setpoint for the radwaste discharge monitor is established at or below the maximum concentration determined by Equation 8.3. The concentration is converted to an alarm setpoint using an efficiency curve developed for the monitor through use of a Cs-137/Ba-137m liquid calibration sources.

8.2.3.2 Allocation of Effluents From Common Release Points

Radioactive liquid effluents released from the radwaste treatment system are comprised of contributions from both units. Determination of the allocation of waste is achieved by comparing

the pump timer totals for each unit's floor drain and equipment drain pumps to the amount of waste sent to the river discharge tank from the floor drain and waste collector storage tanks. Liquid effluents from laundry and chemical waste are allocated evenly between units. During extended unit shutdown or periods of significant plant input differences, the apportionment will be adjusted accordingly. The allocation of the effluents will be made on a monthly basis.

8.2.3.3 Administrative and Procedural Controls for Radwaste Discharges

Administrative and procedural controls have been implemented to ensure proper control of radioactive liquid radwaste discharges, to preclude a release in excess of 10 CFR 20 limits. The discharge rate for each batch is calculated by a technician and then independently verified by two operating staff personnel.

A single river discharge tank has been designated and modified from which all radwaste discharges will normally be released. This tank has manual inlet and discharge valves which can be locked.

The inlet valve is locked closed during recirculation of the tank prior to sampling and during the discharge to preclude an accidental addition to the tank which could change its activity.

The discharge valve is locked closed at all times except during the discharge. All other lines, which tie-in with the discharge line, are locked closed. The high and low flow control valves are selected by a key-lock switch which allows the use of only one of the two flow control valves at any one time. The key to this switch and the locked valves is under the administrative control of the radwaste foreman.

A documented valve checklist is prepared for each batch discharge. The proper valve lineup is checked by the operator and the radwaste foreman, prior to release. If any sudden significant increase of the radiation monitor occurs during the discharge, the release is terminated. These controls are documented in Station Operating and Administrative Procedures.

8.2.4 Service Water Header Releases

8.2.4.1 Service Water Effluent Monitors

Each unit's main service water effluent header is monitored for radioactivity by taking grab samples every twelve hours and analyzing for gross beta activity.

Installation of a new continuous monitor for both service water headers is in progress. It is an offline continuous monitoring system. The process liquid monitor uses a 2-inch by 2-inch sodium iodine thallium-activated scintillation detector in a lead shielded housing. The sample container is bowl shaped to minimize crud buildup. A GM tube is used to determine background radiation levels.

The service water effluent monitor on each unit provides a signal to a recorder and to an Eberline CT-2 control terminal, which initiates a high radiation alarm. The process radiation monitor, recorder, alarm and annuciator are located on the panels in the main control room.

The process liquid monitors have logarithmic scales with a range of 10^{-1} to 10^{6} counts per second. The monitors are powered from 120 Vac.

The service water system detectors (RE 1(2)-1799-01) are located adjacent to the main service water effluent header on each unit prior to release to the discharge bay.

The alarm setpoints for the service water effluent monitors are established at or below the maximum concentration determined by Equation 8.3.

8.2.5 Determination of Initial Dilution Stream Flow Rates

For those release paths which have installed flow monitoring instrumentation, that instrumentation will be used to determine the flow rate of the initial dilution stream. This instrumentation will be operated and maintained as prescribed by the Technical Specifications. For those release paths which do not have installed flow monitoring instrumentation, flow rates will be determined by use of appropriate engineering data such as pump curves, differential pressures, or valve position indication.

8.2.6 Symbols Used In Section 8.2

SYMBOL	NAME	UNIT
C_{lim}	Liquid Release Limit	(μCi/ml)
MPC	Weighted Maximum Permissible Concentration	(μCi/ml)
C_i	Nuclide Concentration	(μCi/ml)
MPC_i	Maximum Permissible Concentration	(μCi/ml)
A_i	Nuclide Quantity Released	(μCi)
F^r_{max}	Maximum Flow Rate, Radwaste Discharge	(ft^3/sec)
F^d_{ave}	Average Flow Rate, Initial Dilution Stream	(ft^3/sec)

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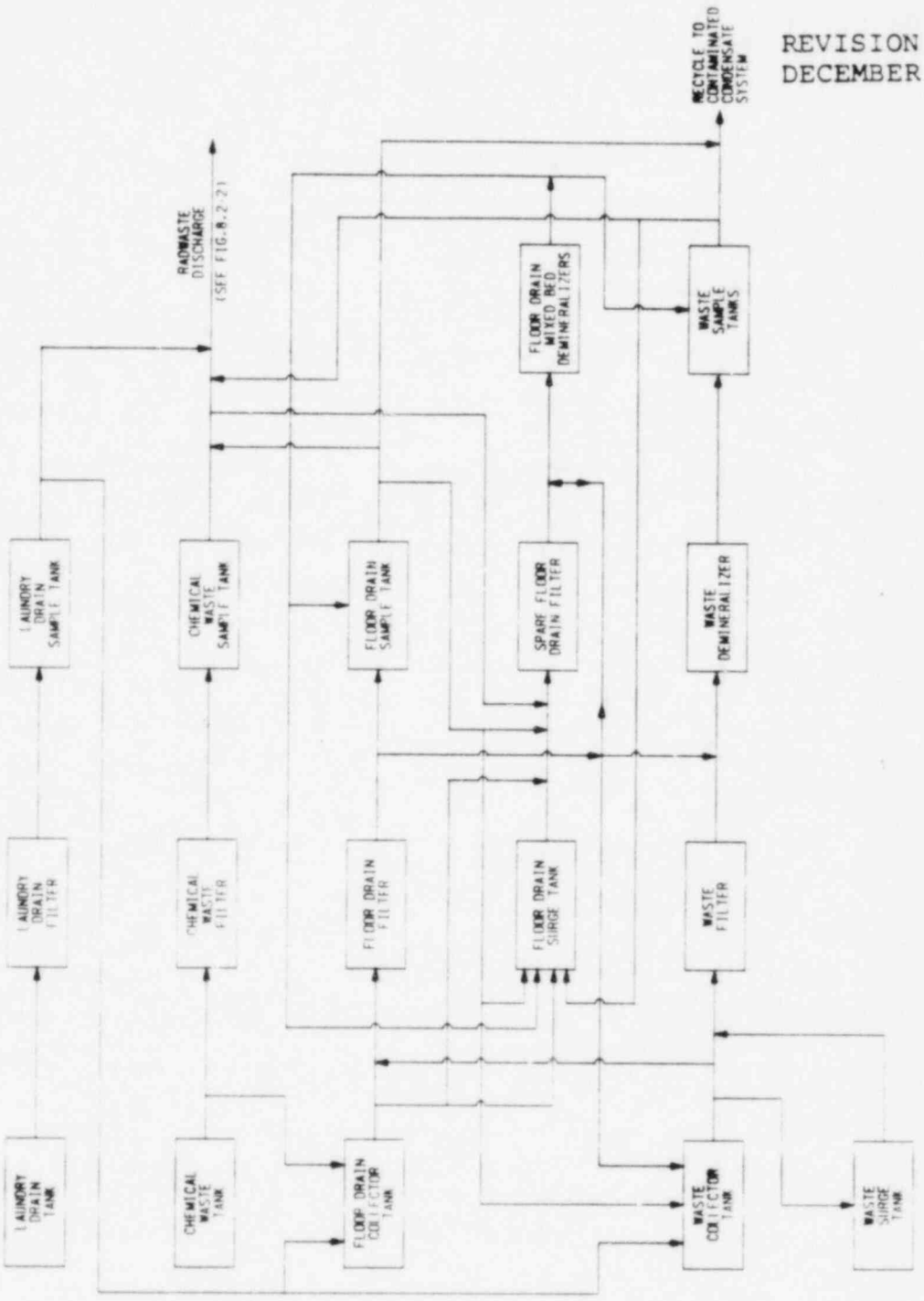
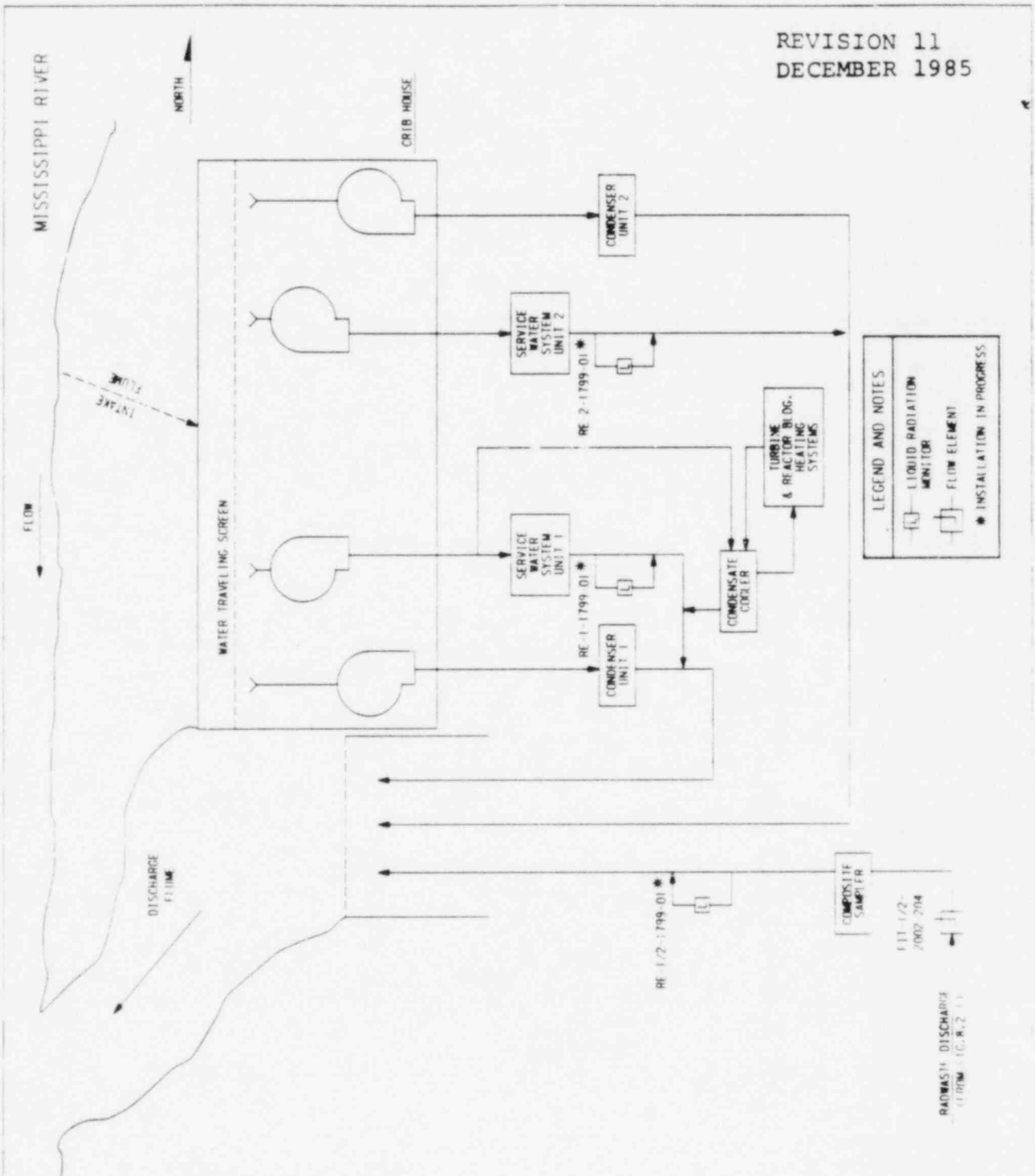


QUAD-CITIES STATION
Units 1 & 2

FIGURE 8.2-1

SIMPLIFIED LIQUID RADWASTE
PROCESSING DIAGRAM

REVISION 11
DECEMBER 1985



QUAD-CITIES STATION
Units 1 & 2

FIGURE 8.2-2

SIMPLIFIED LIQUID EFFLUENT
FLOW DIAGRAM

8.3 SOLIDIFICATION OF WASTE/PROCESS CONTROL PROGRAM

The process control program (PCP) shall contain the sampling, analysis, and formulation determination by which solidification of radioactive wastes from liquid systems is ensured. Figure 8.3-1 is a simplified diagram of solid radwaste processing.

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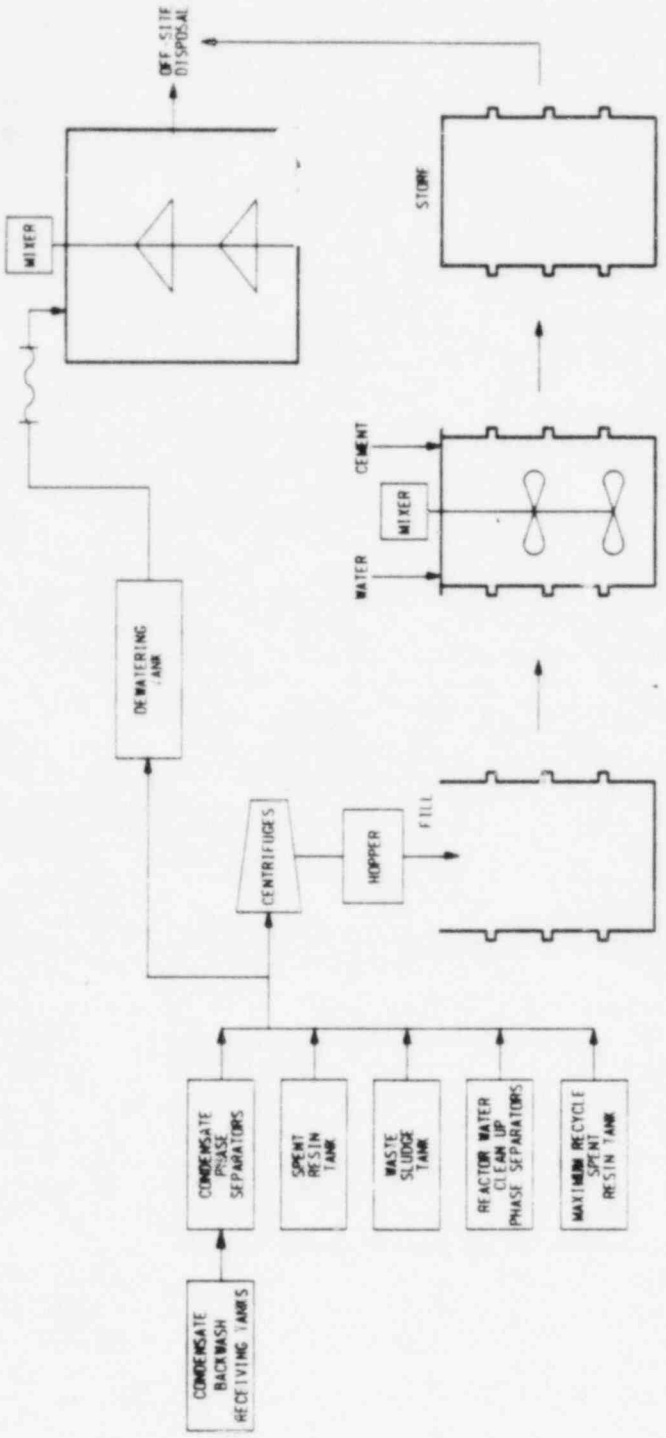

QUAD-CITIES STATION
Units 1 & 2

FIGURE 8.3-1

SIMPLIFIED SOLID RADWASTE
PROCESSING DIAGRAM

8.4 ENVIRONMENTAL RADIOLOGICAL MONITORING

The environmental radiological monitoring program to be performed in the environs around Quad-Cities Station is given in Table 8.4-1.

Figure 8.4-1 shows the 16 fixed air sampling sites and TLD locations; also shown are the "outer ring" (approximately 5 miles distant) TLD locations. Figure 8.4-2 shows the "inner ring" TLD locations. The TLD's are code numbered as follows: XYY-N,

where:

X = 1 means inner ring,

X = 2 means outer ring, and

YY-N is an identification code.

Figure 8.4-3 shows the milk, fish, water, and sediment sample locations.

The reporting levels for radioactivity concentrations in environmental samples are given in Table 8.4-2. The practical lower limits of detection for this program are given in Table 8.4-3.

TABLE 8.4-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE		SAMPLING OR MONITORING LOCATIONS			SAMPLING OR COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. Airborne	a.	Onsite or Near Field[a]				Particulate Sampler:
		Q-01 Onsite Station 1	0.5 mi	N	Continuous sampler operation with particulate filter collection weekly and radioiodine canister collection bi-weekly	Gross beta analysis following filter change[b]
		Q-02 Onsite Station 2	0.5 mi	ENE		Radioiodine Canister:
		Q-03 Onsite Station 3	0.6 mi	S		I-131 analysis bi-weekly
		Q-04 Nitrin	1.5 mi	NE		Sampling Train:
		Q-05 Saddle Club Dairy Farm	1.8 mi	SSE		Test and maintenance weekly
		Q-06 Hanson's Boat Landing	1.8 mi	NNW		
	b.	Far Field[a]				
		Q-07 Clinton	9.0 mi	NE	Continuous sampler operation with particulate filter exchange weekly and radioiodine canister exchange bi-weekly	Particulate Sampler:
		Q-08 Sikkema Farm	7.0 mi	ENE		Gross beta when analyses are made[b,c]
		Q-09 Erie	13.0 mi	ESE		Radioiodine Canister:
		Q-10 Hillsdale	10.0 mi	SE		I-131 when analyses are made[c]
		Q-11 Port Byron	8.0 mi	S		Sampling Train:
		Q-12 Bettendorf	13.0 mi	SW		Test and maintenance weekly
		Q-13 Princeton	4.8 mi	SW		
		Q-14 Utica Ridge Road	11.0 mi	ESE		
		Q-15 DeWitt	13.0 mi	WNW		
		Q-16 Low Moor	6.0 mi	NNW		

TABLE 8.4-1 (Cont'd)

EXPOSURE PATHWAY AND/OR SAMPLE	SAMPLING OR MONITORING LOCATIONS	SAMPLING OR COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. Direct Radiation	a. At Air Sampling Sites[a]	Quarterly	Gamma dose quarterly
	Same locations as fixed air sampling locations in Item 1.		
	b. Inner Ring[d]	Quarterly	Gamma dose quarterly

101-1	0.7 mi	N
101-2	0.8 mi	N
102-1	1.7 mi	NNE
102-2	1.7 mi	NNE
103-1	1.2 mi	NE
104-1	1.1 mi	ENE
104-2	0.95 mi	ENE
104-3	0.63 mi	ENE
105-1	0.75 mi	E
106-1	0.71 mi	ESE
106-2	0.71 mi	ESE
107-1	0.73 mi	SE
107-2	0.78 mi	SE
107-3	0.86 mi	SE
108-1	0.96 mi	SSE
108-2	0.89 mi	SSE
109-1	0.87 mi	S
109-2	0.98 mi	S
111-1	2.6 mi	SW
111-2	2.6 mi	SW
112-1	2.5 mi	WSW
112-2	2.2 mi	WSW
113-1	2.6 mi	W
113-2	2.5 mi	W
114-1	2.6 mi	WNW
114-2	2.5 mi	WNW
115-1	2.6 mi	NW
115-2	2.0 mi	NW
116-1	2.2 mi	NNW
116-2	2.4 mi	NNW

TABLE 8.4-1 (Cont'd)

EXPOSURE PATHWAY AND/OR SAMPLE	SAMPLING OR MONITORING LOCATIONS			SAMPLING OR COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. Direct Radiation (Cont'd)	c. Outer Ring[a]			Quarterly	Gamma dose quarterly
	201-1	4.6 mi	N		
	201-2	4.0 mi	N		
	202-1	4.4 mi	NNE		
	202-2	5.0 mi	NNE		
	203-1	5.0 mi	NE		
	203-2	4.5 mi	NE		
	204-1	4.5 mi	ENE		
	204-2	3.9 mi	ENE		
	205-1	5.6 mi	E		
	205-2	4.7 mi	E		
	206-1	5.0 mi	ESE		
	206-2	4.8 mi	ESE		
	207-1	4.3 mi	SE		
	207-2	4.6 mi	SE		
	208-1	4.4 mi	SSE		
	208-2	4.7 mi	SSE		
	209-1	4.4 mi	S		
	209-2	4.5 mi	S		
	210-1	4.4 mi	SSW		
	210-2	4.4 mi	SSW		
	211-1	3.5 mi	SW		
	212-1	5.4 mi	WSW		
	212-2	4.7 mi	WSW		
	213-1	4.7 mi	W		
	213-2	5.5 mi	W		
	214-1	4.4 mi	WNW		
	214-2	4.4 mi	WNW		
	215-1	4.8 mi	NW		
	215-2	4.5 mi	NW		
	216-1	4.5 mi	NNW		
	216-2	4.2 mi	NNW		

TABLE 8.4-1 (Cont'd)

EXPOSURE PATHWAY AND/OR SAMPLE		SAMPLING OR MONITORING LOCATIONS				SAMPLING OR COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. Waterborne[e]							
	a. Public Water Supply	Q-19	East Moline Water Works	16.0 mi	SSW	Weekly collection composited monthly	Gamma isotopic analysis monthly
		Q-20	Davenport Water Works	18.0 mi	SSW		
	b. Cooling Water Sample	Q-21	Inlet	at station		Weekly	Gross beta analysis weekly
		Q-22	Discharge	at station			
	c. Sediment	Q-23	Lock and Dam No. 14	15.0 mi	SSW	Annually	Gamma isotopic analysis annually
4. Ingestion[e]							
	a. Milk	Q-17	Hansen Dairy Farm	6.0 mi	ENE	Weekly collection when animals in pasture (May to Oct.); monthly, Nov. to March	I-131 analysis on each sample
		Q-18	Musal Farm	5.5 mi	SW		
	b. Fish	Q-24	Davenport Farm Market (Pool #14 of Miss. River)	15.0 mi	SSW	Semi-annually	Gamma isotopic on edible portions of each sample

[a] See Figure 8.4-1.

[b] A gamma isotopic analysis shall be performed wherever the gross beta concentration in a sample exceeds by five times (5X) the average concentration of the preceding calendar quarter for the sample location.

[c] Far field samples are analyzed when near field results are inconsistent with previous measurements and radioactivity is confirmed as having its origin in airborne effluents released from the station, or at the discretion of the Emergency Planning Supervisor.

[d] See Figure 8.4-2.

[e] See Figure 8.4-3.

TABLE 8.4-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS

IN ENVIRONMENTAL SAMPLES

ANALYSIS	REPORTING LEVELS				
	WATER (pCi/ℓ)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/Kg, wet)	MILK (pCi/ℓ)	FOOD PRODUCTS (pCi/Kg, wet)
H-3	20,000*				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400**				
I-131	2	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	1,000	70	2,000
Ba-La-140	200**			300**	

* For drinking water samples. This is 40 CFR Part 141 value.

**Total for parent and daughter.

TABLE 8.4-3

MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD)[a,b]

ANALYSIS	WATER (pCi/ℓ)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/Kg, wet)	MILK (pCi/ℓ)	SEDIMENT (pCi/Kg, dry)
Gross Beta[c]	5	0.01	1,000	5	2,000
Gamma Isotopic	20	0.01	200	20	200
I-131	5	0.1	100[d]	5(0.5)[e]	
Cs-134	10		100	10	
Cs-137	10		100	5	
H-3	200				

TABLE 8.4-3 (Cont'd)

NOTES:

a. Other radionuclides which are measurable and identifiable by gamma-ray spectrometry, together with the nuclides indicated in Table 8.4-3, shall also be identified and reported when an actual analysis is performed on a sample. Nuclides which are below the LLD for the analyses shall not be reported as being present at the LLD level for that nuclide.

b. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95 percent probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radio-chemical separation)

$$LLD = \frac{4.66 \cdot (S_b)}{(A) \cdot (E) \cdot (V) \cdot (2.22) \cdot (Y) \cdot (\exp(-\lambda \Delta t)) \cdot (t)}$$

Where:

LLD is the "a priori" lower limit of detection for a blank sample or background analysis as defined above (as pCi per unit mass or volume).

S_b is the square root of the background count or of a blank sample count; it is the estimated standard error of a background count or a blank sample count as appropriate (in units of counts).

E is the counting efficiency (as counts per disintegration).

A is the number of gamma-rays emitted per disintegration for gamma-ray radionuclide analysis (A = 1.0 for gross alpha and tritium measurements).

V is the sample size (in units of mass or volume).

2.22 is the number of disintegrations per minute per picocurie.

Y is the fractional radio-chemical yield when applicable (otherwise Y = 1.0).

TABLE 8.4-3 (Cont'd)

Lambda is the radioactive decay constant for the particular radionuclide (in units of reciprocal minutes).

Delta t is the elapsed time between the midpoint of sample collection and the start time of counting. ($\Delta t = 0.0$ for enviromental samples and for gross alpha measurements.)

t is the duration of the count (in units of minutes).

The value of "S_b" used in the calculation of the LLD for a detection system shall be based on an actual observed background count or a blank sample count (as appropriate) rather than on an unverified theoretically predicted value. Typical values of "E", "V", "Y", "t", and "delta t" shall be used in the calculation.

For gamma-ray radionuclide analyses the background counts are determined from the total counts in the channels which are within plus or minus one FWHM (Full Width at Half Maximum) of the gamma-ray photopeak energy normally used for the quantitative analysis for that radionuclide. Typical values of the FWHM shall be used in the calculation.

The LLD for all measurements is defined as an "a priori" (before the fact) limit representing the capability of a measurement system and not as an "a posteriori" (after the fact) limit for a particular measurement.

c. Referenced to Cs-137.

d. For thyroid.

e. 0.5 pCi/ℓ on samples collected during the pasture season.

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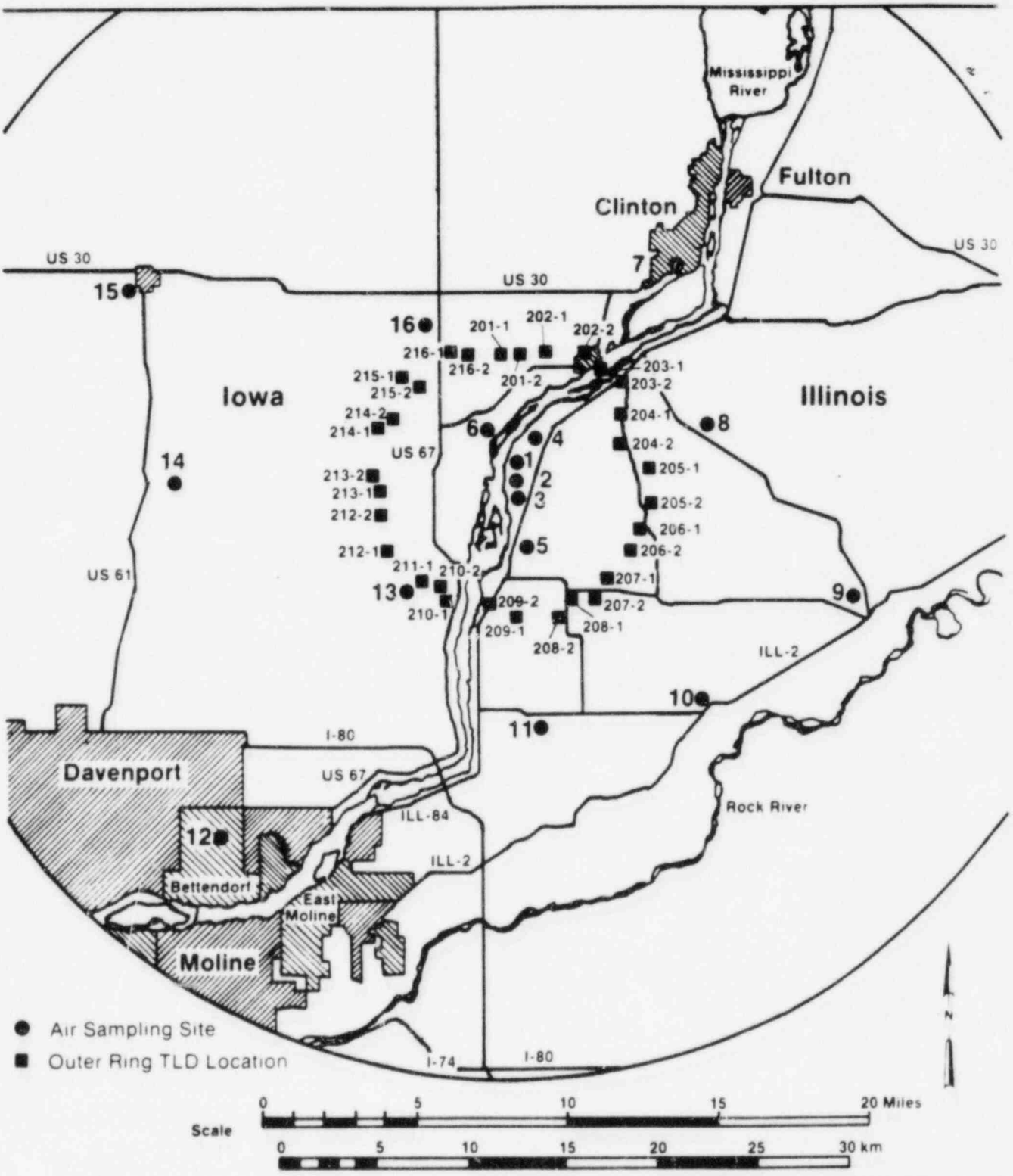
DECEMBER 1985



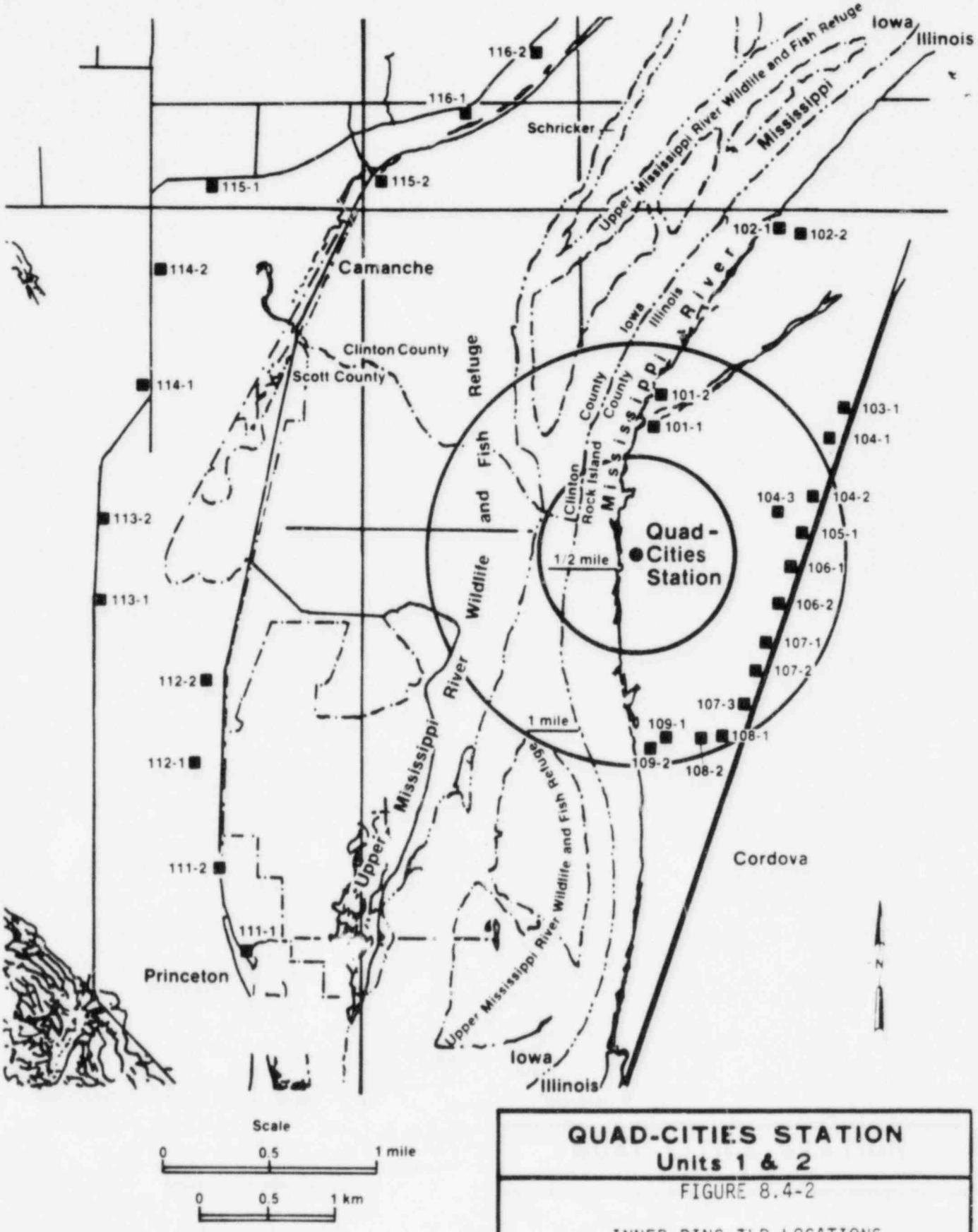
QUAD-CITIES STATION
Units 1 & 2

FIGURE 8.4-1

FIXED AIR SAMPLING SITES
AND OUTER RING TLD LOCATIONS

6415-1
10-85—372

REVISION 11
DECEMBER 1985



Scale

0 0.5 1 mile

0 0.5 1 km

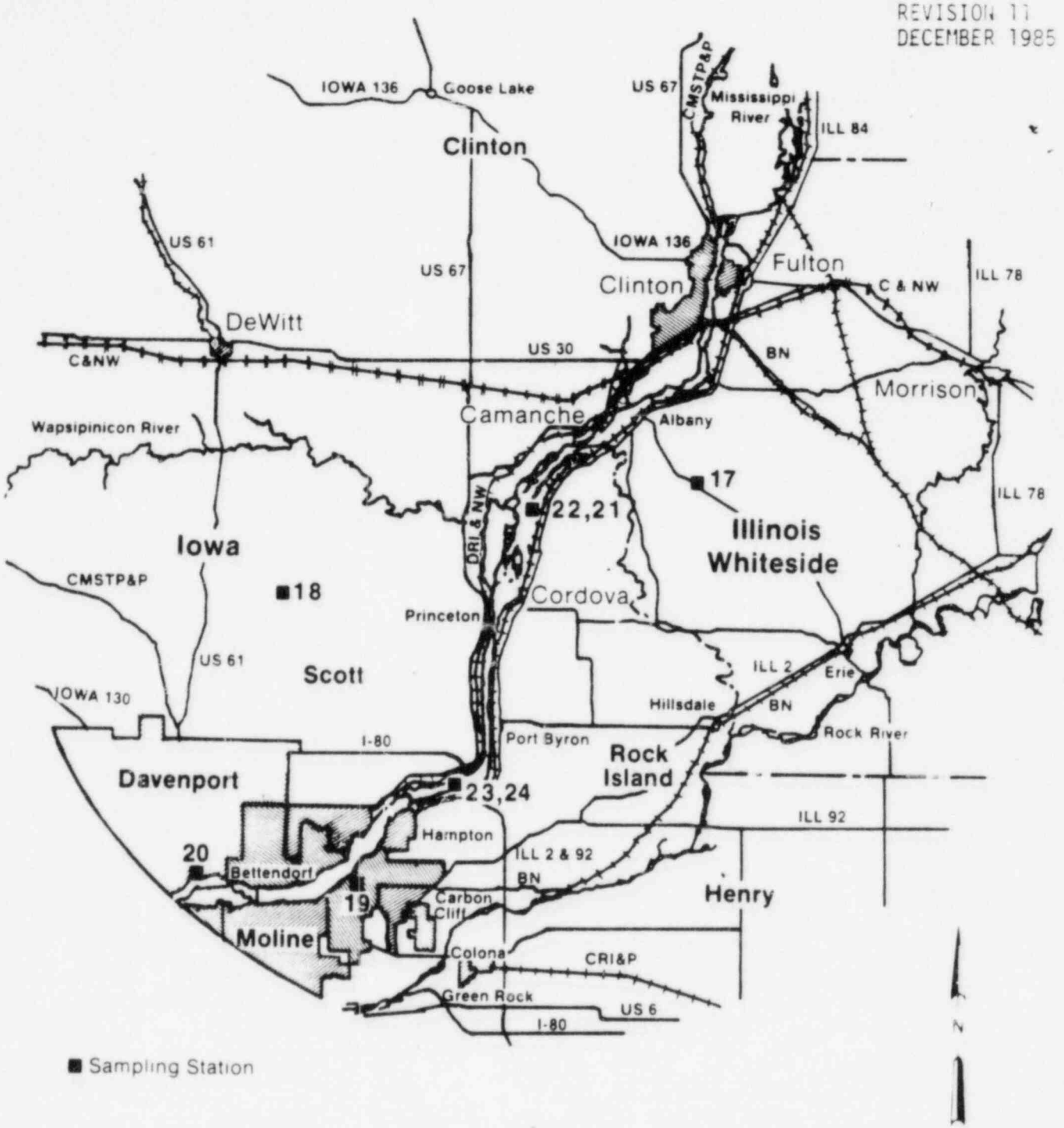
QUAD-CITIES STATION
Units 1 & 2

FIGURE 8.4-2

INNER RING TLD LOCATIONS

6415-3
10-85—372

REVISION 11
DECEMBER 1985



QUAD-CITIES STATION
Units 1 & 2

FIGURE 8.4-3

MILK, FISH, WATER, AND
SEDIMENT SAMPLE LOCATIONS

6415.2
10-85—372

QAP 1400-T1
Revision 2
September 1985

QUAD CITIES STATION ONSITE
REVIEW ASSIGNMENT

DATE 12/13/85

REVIEW NO. 85-33

REVIEW PARTICIPANTS:

H. Lihou
~~G. Spedl~~ ~~NRR~~
P. Behrens
~~J. Swales NRR~~
R. Lezon
R. Wiebenga
G. Powell

ASSIGNMENT:

Review revision 11 to Quad-Cities Station Offsite Dose Calculation Manual (ODCM).

Richard L Burson
STATION MANAGER

APPROVED
OCT 10 1985
O.C.O.S.R.

9/0321a

(final)
-1-

Commonwealth Edison
72 West Adams Street, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690 - 0767

November 7, 1985

To: T. Lihou

Subject: Onsite Review of the Offsite Dose Calculation Manual, Revision 11
Quad Cities Station Site Specific Sections 7.2 and 8.0

Enclosed please find a copy of the revised site specific sections 7.2 and 8.0 of Quad Cities Station's Offsite Dose Calculation Manual. This revision must go through an onsite review prior to submittal to the NRC and general distribution.

The Quad Cities ODCM is scheduled to be included with the December Operating Report for submittal to the NRC in January 1986. Since the ODCM must also be offsite reviewed, I would appreciate the onsite review be completed by December 1, 1985.

Your cooperation in expediting the review process is greatly appreciated.

Rick L. Thacker

Rick L. Thacker
Environmental Health Physicist

Carol J. Bennett

Carol J. Bennett
Lead Environmental Health Physicist

cc: EPG-04-RE-ODCM-Rev11
W. Brenner
J. Golden

JCG/DMK/lmk/6451E/70

Rev. 7
3-1-82

OSR FORM - 1
RECORD OF REQUEST FOR OFFSITE REVIEW

Station Quad Cities Onsite Review No. 85-33

Submitted by H. Lihou Date 12/12/85

____ Test or experiment not involving an unreviewed safety question.
____ Proposed test or experiment involving an unreviewed safety question
____ Proposed change to procedure, equipment or system involving an unreviewed safety question.
____ Proposed change to Tech. Spec. or license.
____ Unanticipated deficiency of design or operation of safety related structures, systems, or components.
____ Proposed change to GSEP.
__✓__ Referral by T. S. Supervisor, Station Superintendent, Division Vice President Nuclear Stations, or Manager of Quality Assurance

Additional subject description: ODCM Sections 7.2 and 8.0

Supporting documents attached: ODCM, Letter from C Bennett to T. Lihou 11/7/85

Date required for Offsite Review completion: 1/24/85

Reason for specified date: Must be complete by End of Year Commitment Level (1985)

****

Received by _____ Date _____
Senior Participant

Offsite Review No. _____

QUAD-CITIES STATION
ON-SITE REVIEW REPORT

QAP 1400-T2
Revision 3
September 1985

Reference Information:

OSR No: 85-33

Review Date: 12/13/85

Request Date: 12/13/85

OSR Request Originator:

Station _____ Off-Stie Review _____

NLA _____ Other' X

NFS _____ Was Request Complete:

SNED _____ Yes X NO ___
(Attach material submitted)

Subject:

Reason for Review:

Tech. Spec. 6.1.G.2.a ✓ (On-Site)

Tech. Spec. 6.1.G.1.a _____ (Off-Site)

Other: NRC Bulletin _____ Deviation _____

AIR Request _____ Station _____

On-Site Reference Materials (attach):

Safety Evaluation _____ Procedures Affected _____

Tech Spec Pages _____ MRD Number _____

FSAR Pages _____ AIR Number _____

QA Manual Pages _____ Other ODCM, List of Changes (OSR), List of Changes suggested by Environ Health Phys.

Off-Stie Completion Info:

Check List Complete _____ Advance Notification _____

Forward to Off-Site ✓ Date _____

Off-Site Review Number _____ Person _____

Disposition:

Routine Report	✓
Off-Site Review for Concurrence (T.S. 6.1.G.2.a.(5))	
AIR Issued (#)	
NRC Submittal Needed	
Technical Specification Change	
Unreviewed Safety Question	
Other	
No Further Action	✓
Other	

APPROVED
OCT 10 1985
QCOSR

QUAD-CITIES STATION

ON-SITE REVIEW REPORT

OSR NO 85-33

ON-SITE REVIEW SUMMARY: The OSR members reviewed the revision to the ODCM seperately and noted the following items. On page 8.1-4 paragraph #3 it is mentioned that background substraction is provided for all three ranges of the main chimney eberline equipment. Due to the equipment not being used as built the built in background substraction is not used. On page 8.4-2 there is a misspelling of the city, Erie. Recommended changes are on the attached sheets. This revision reflects the current practices for monitoring effluents and will need to be revised when the new service water and radwaste monitors are operable.

ON-SITE REVIEW RECOMMENDATION:

The OSR committee recommends that the revision be approved as revised and that it be submitted for an offsite review for approval.

PARTICIPANTS: Greg R Powell, H D Gibson, _____
Paul Behnen, [illegible], Robert Lyon

Approved: Richard Lang for
Station Manager

ATTACHMENTS:

Date: 12-13-85

- Bennett to L. Hoar Letter 11/85
- ODCM sec 7.2 & 8.0 Changes
- Recommended changes (OSR Final)

9/0322a

APPROVED
OCT 10 1985
O.C.O.S.R.

Rev. 1
1-25-85

RECEIVED

FEB 26 '86

ROUTE:
A (Asst. Supt.)
B (Operations)
C (Maintenance)
D Admin. & Tech.
E Personnel.
Initial

OSR FORM - 5
OFFSITE REVIEW REPORT

Facility: Quad Cities Onsite Review No. 85-33 (T3) I

Offsite Review No. 86-05

Description
of Subject: ODCM Section 7.2 and 8

X The above listed onsite review does not constitute an unreviewed safety question.

Onsite Review summary should be incorporated into ODCM.

X Remarks noted above warrant additional Emergency Planning consideration.

E. Budzichowski — 2/13/86
Senior Participant — Date

M. M. Servoss — 2/18/86
Other Participant — Date

J. P. Leider — 2/19/86
Superintendent of Offsite Review — Date

Copies to:
_ Mgr. Dresden
x Mgr. Quad Cities
_ Mgr. Zion
_ Mgr. LaSalle
_ Mgr. Byron
_ Mgr. Braidwood
_ With Attachment (s)
x B. Thomas/C. Reed
x D. P. Galle
x D. L. Farrar/J. Wojnarowski

0034n

86-080

Commonwealth Edison
Quad Cities Nuclear Power Station
22710 206 Avenue North
Cordova, Illinois 61242
Telephone 309/654-2241

RAR-86-23

August 1, 1986

Director, Office of Inspection & Enforcement
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Document Control Desk

Enclosed for your information is the Monthly Performance Report covering the operation of Quad-Cities Nuclear Power Station, Units One and Two, during the month of July, 1986.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD-CITIES NUCLEAR POWER STATION

Gary Apedl for
R. A. Robey
Services Superintendent

bb

Enclosure

0027H/0061Z

IE24
1/1