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Duane Arnold Energy Center

1999

Annual Radioactive Materials Release Report

January 1, 1999 through December 31, 1999

Table Of Contents

INTRODUCTION 3

LIQUID EFFLUENT TABLE 4

LIQUID EFFLUENTS BY CALENDAR QUARTER

GASEOUS EFFLUENT TABLES 5

GASEOUS EFFLUENTS BY CALENDAR QUARTER
GASEOUS EFFLUENTS BY RELEASE POINT (CURIES)

SUMMARY OF RADIOACTIVE SOLID WASTE 7

SHIPMENTS MADE TO BURIAL FACILITIES:
SHIPMENTS MADE TO PROCESSING FACILITIES:
TOTAL SOLID WASTE DISPOSITION:
WASTE CLASSIFICATION PER 10 CFR 61
DRY ACTIVE WASTE
AQUEOUS MECHANICAL FILTERS
SPENT RESIN

SUMMARY OF METEOROLOGICAL DATA 11

STABILITY CLASS DATA 33'
WIND ROSE 33'
STABILITY CLASS DATA 156'
WIND ROSE 156'

ATTACHMENT 1: SUMMARY OF CHANGES TO THE ODAM REV. 12 19

ATTACHMENT 2: SUMMARY OF CHANGES TO THE ODAM REV. 13 20

ATTACHMENT 3: CURRENT REVISION OF THE ODAM 21

INTRODUCTION

This Annual Radioactive Material Release Report is for the period of January 1, 1999, through December 31, 1999.

There were no radioactive liquid effluent releases from the Duane Arnold Energy Center during this report period.

Gaseous effluent releases were continuous for the period and resulted in a small fraction of the 10 CFR 20 site boundary concentration limits and the 10 CFR 50, Appendix I dose requirements. There were no abnormal releases of radioactive material to the environment.

A total of eight solid radioactive waste shipments were made during 1999. Five shipments were of spent resin in high integrity containers (HICs). One Shipment was a mixture of resin and aqueous mechanical filters in a HIC. All six HIC shipments were sent directly for burial to Barnwell, South Carolina. One shipment of Dry Active Waste was sent to GTS Duratek for processing and volume reduction at Oak Ridge, Tennessee prior to burial. One shipment of Mixed Waste was sent to NSSI/Recovery Services, Inc. for treatment of hazardous constituents to meet land disposal restrictions. No irradiated hardware or component shipments were made during this reporting period.

There were two revisions to the Offsite Dose Assessment Manual (ODAM) in 1999

Revision 12 included the addition of notes to section 3 clarifying Midas software limitations. References to the Tech. Specs were removed from section 7.2.5. Sections 6.2.1/7.2.1 Bases were changed to reflect the implementation of plant modification #EMA-A28097. There were additional formatting changes.

Revision 13 removed the requirement for a Surveillance on Steam Jet Air Ejector Offgas Isolation. The Isolation feature of this system was removed by plant modification #EMA-A28097.

Details of these changes are described in Attachments 1 and 2.

LIQUID EFFLUENT TABLE

ANNUAL RADIOACTIVE MATERIAL RELEASE REPORT (1999) LIQUID EFFLUENTS BY CALENDAR QUARTER					
Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
strontium-89	Ci	<LLD	<LLD	<LLD	<LLD
strontium-90	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
cesium-137	Ci	<LLD	<LLD	<LLD	<LLD
iodine-131	Ci	<LLD	<LLD	<LLD	<LLD
cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD
iron-55	Ci	<LLD	<LLD	<LLD	<LLD
iron-59	Ci	<LLD	<LLD	<LLD	<LLD
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
chromium-51	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-niobium-95	Ci	<LLD	<LLD	<LLD	<LLD
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
technetium-99m	Ci	<LLD	<LLD	<LLD	<LLD
barium-lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
Other (specify)	Ci	<LLD	<LLD	<LLD	<LLD
		<LLD	<LLD	<LLD	<LLD
		<LLD	<LLD	<LLD	<LLD
Total for period (above)	Ci	<LLD	<LLD	<LLD	<LLD
xenon-133	Ci	<LLD	<LLD	<LLD	<LLD
xenon-135	Ci	<LLD	<LLD	<LLD	<LLD

<LLD means that the radionuclide was not identified in any samples and all measurement results were less than the lower limit of detection as required by the DAEC Offsite Dose Assessment Manual.

There were no radioactive liquid discharges from DAEC during this report period.

GASEOUS EFFLUENT TABLES

ANNUAL RADIOACTIVE MATERIAL RELEASE REPORT (1999)					
Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. Fission gases					
krypton-85	Ci	<LLD	<LLD	<LLD	<LLD
krypton-85m	Ci	3.41E+00	<LLD	<LLD	<LLD
krypton-87	Ci	<LLD	<LLD	<LLD	<LLD
krypton-88	Ci	2.08E+00	<LLD	<LLD	9.62E-02
xenon-133	Ci	6.23E+00	<LLD	1.75E+00	<LLD
xenon-135	Ci	5.33E-01	4.62E-01	1.30E+00	1.77E+00
xenon-135m	Ci	1.15E+00	1.97E+00	6.79E+00	5.80E-01
xenon-138	Ci	1.77E+00	1.41E+01	1.05E+01	5.31E+00
xenon-131m	Ci	<LLD	<LLD	<LLD	<LLD
argon-41	Ci	2.48E+00	<LLD	<LLD	<LLD
Tritium	Ci	5.58E+00	3.00E+00	4.10E+00	3.81E+00
Total Fission Gasses for period	Ci	2.32E+01	1.95E+01	2.44E+01	1.16E+01
2. Iodines	Ci				
iodine-131	Ci	5.75E-05	4.75E-05	5.79E-05	4.08E-05
iodine-133	Ci	5.36E-05	4.86E-05	5.87E-05	1.75E-05
iodine-135	Ci	<LLD	<LLD	<LLD	<LLD
Total Iodines for period	Ci	1.11E-04	9.61E-05	1.17E-04	5.83E-05
3. Particulates					
strontium-89	Ci	8.85E-06	7.81E-06	7.15E-06	8.43E-06
strontium-90	Ci	4.59E-08	1.24E-07	1.39E-07	3.97E-08
cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
cesium-137	Ci	<LLD	<LLD	<LLD	<LLD
barium-lanthanum-140	Ci	3.31E-07	7.49E-07	2.03E-06	3.24E-07
chromium-51	Ci	3.66E-07	2.50E-06	<LLD	1.16E-04
cobalt-58	Ci	<LLD	<LLD	<LLD	9.45E-06
cobalt-60	Ci	3.51E-05	1.89E-05	1.96E-05	1.34E-04
iron59	Ci	<LLD	<LLD	<LLD	1.74E-05
manganese-54	Ci	2.74E-06	2.49E-06	9.16E-07	6.32E-05
strontium-91	Ci	3.53E-07	2.92E-07	1.14E-06	6.44E-07
zinc-65	Ci	<LLD	6.51E-06	<LLD	1.36E-04
Total Particulates for Period	Ci	7.06E-05	6.08E-04	7.37E-05	6.03E-04
Total for Period	Ci	2.32E+01	1.95E+01	2.44E+01	1.16E+01

<LLD means that the radionuclide was not identified in any samples and all measurement results were less than the lower limit of detection as required by the DAEC Offsite Dose Assessment Manual.

ANNUAL RADIOACTIVE MATERIAL RELEASE REPORT (1999)
GASEOUS EFFLUENTS BY RELEASE POINT (Curies)

RELEASE POINT	OFFGAS STACK	REACTOR BUILDING	TURBINE BUILDING	LLRPSF
RELEASE HEIGHT	328 FEET	156 FEET	90 FEET	65 FEET
RELEASE MODE	ELEVATED	WAKE SPLIT	WAKE SPLIT	WAKE SPLIT
Ar-41	2.48E+00			
Kr-85m	3.41E+00			
Kr-85				
Kr-87				
Kr-88	2.08E+00			
Xe-131m				
Xe-133	7.98E+00			
Xe-135m	1.05E+01			
Xe-135	4.07E+00			
Xe-138	3.17E+01			
H-3	1.01E+00	7.68E+00	7.10E+00	7.02E-01
Cr-51	2.25E-06	1.17E-04		
Mn-54	4.34E-07	6.89E-05		
Co-58		9.45E-06		
Co-60	1.00E-06	2.06E-04	6.57E-07	
Fe-59		1.74E-05		
Sr-89	4.84E-06	1.64E-05	9.90E-06	1.09E-06
Sr-90	4.04E-08	1.37E-07	1.71E-07	
SR91	2.43E-06			
Cs-134				
Cs-137				
Ba-140	3.43E-06			
Zn-65	8.84E-07	1.43E-04		
I-131	4.48E-05	6.81E-05	8.91E-05	
I-133	3.10E-05	7.10E-05	7.61E-05	
I-135				
Totals	6.32E+01	7.68E+00	7.10E+00	7.02E-01

SUMMARY OF RADIOACTIVE SOLID WASTE

Listed below are tables summarizing the Duane Arnold Energy Center's generation of Radioactive Solid Waste for the period January 1, 1999 through December 31, 1999.

SHIPMENTS MADE TO BURIAL FACILITIES:

WASTE TYPE	NO. SHIPMENTS	VOLUME (M^3)	ACTIVITY (MBq)
Resin	6*	31.5	6.33E+7
Aqueous Mechanical Filters*		0.05	1.97E+5
DESTINATION	Chem-Nuclear Systems, Inc. (CNSI) Barnwell, South Carolina		

(*) One shipment contained both resin and aqueous mechanical filters.

SHIPMENTS MADE TO PROCESSING FACILITIES:

WASTE TYPE	NO. SHIPMENTS	VOLUME (M^3)	ACTIVITY (MBq)
Dry Active Waste	1	24.6	2.10E+4
DESTINATION	GTS Duratek Oak Ridge, Tennessee		
Mixed Waste	1	5.4	2.15E+2
DESTINATION	NSSI/Recovery Services, Inc. Houston, Texas		

SOLIDIFICATION AGENT: None MODE OF TRANSPORTATION: Exclusive-Use Vehicle (Trucks)

TOTAL SOLID WASTE DISPOSITION:

WASTE	VOLUME (M^3)	ACTIVITY (MBq)
Shipped	6.16E+1	6.35E+7
Buried **	3.86E+1	6.35E+7

(**) Includes waste buried directly by DAEC and waste buried by processing facilities.
Waste buried by the processing facility includes waste shipped from the DAEC in years prior to 1999.

No irradiated hardware or component shipments were made during this reporting period.

WASTE CLASSIFICATION PER 10 CFR 61	NUMBER OF SHIPMENTS
A-Unstable	2
A-Stable	5
B	0
C	1

SUMMARY OF RADIOACTIVE SOLID WASTE

(January 1, 1999 - December 31, 1999)

MAJOR NUCLIDE COMPOSITION

DRY ACTIVE WASTE

Principle Nuclide	1st QTR (MBq)	2nd QTR (MBq)	3rd QTR (MBq)	4th QTR (MBq)	Total (MBq)	Percent Abundance
Cr-51	0.00E+00	4.77E+00	0.00E+00	5.34E+02	5.38E+02	2.53%
Mn-54	0.00E+00	3.87E+00	0.00E+00	9.78E+02	9.82E+02	4.63%
Fe-55	0.00E+00	1.36E+02	0.00E+00	1.68E+04	1.69E+04	79.54%
Co-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Co-60	0.00E+00	6.27E+01	0.00E+00	2.38E+03	2.45E+03	11.51%
Fe-59	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Ni-59	0.00E+00	2.23E-02	0.00E+00	0.00E+00	2.23E-02	0.00%
Ni-63	0.00E+00	6.02E+00	0.00E+00	1.31E+02	1.37E+02	0.65%
Zn-65	0.00E+00	0.00E+00	0.00E+00	1.69E+02	1.69E+02	0.79%
H-3	0.00E+00	1.36E+00	0.00E+00	2.55E+00	3.91E+00	0.02%
C-14	0.00E+00	9.81E-02	0.00E+00	8.16E+00	8.25E+00	0.04%
Cs-134	0.00E+00	3.98E-04	0.00E+00	0.00E+00	3.98E-04	0.00%
Cs-137	0.00E+00	0.00E+00	0.00E+00	1.21E+01	1.21E+01	0.06%
Ce-144	0.00E+00	5.04E-01	0.00E+00	0.00E+00	5.04E-01	0.00%
Sr-90	0.00E+00	0.00E+00	0.00E+00	1.84E-02	1.84E-02	0.00%
Tc-99	0.00E+00	6.37E-06	0.00E+00	1.70E-05	2.34E-05	MDA
Nb-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
I-129	0.00E+00	6.07E-05	0.00E+00	1.85E-05	7.92E-05	MDA
Pu-238	0.00E+00	9.40E-04	0.00E+00	0.00E+00	9.40E-04	0.00%
Pu-239/240	0.00E+00	4.51E-04	0.00E+00	0.00E+00	4.51E-04	0.00%
Pu-241	0.00E+00	1.63E-01	0.00E+00	0.00E+00	1.63E-01	0.00%
Am-241	0.00E+00	2.44E-03	0.00E+00	2.70E-02	2.95E-02	0.00%
Cm-242	0.00E+00	8.21E-04	0.00E+00	5.11E-03	5.93E-03	0.00%
Cm-243/244	0.00E+00	2.92E-03	0.00E+00	0.00E+00	2.92E-03	0.00%
U-233/234	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Hf-181	0.00E+00	0.00E+00	0.00E+00	4.84E+01	4.84E+01	0.23%
Ru-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Sr-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Zr-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Totals	0.00E+00	2.15E+02	0.00E+00	2.10E+04	2.12E+04	100.00%

No DAW Shipments were made during the first and third quarters of 1999.

Tc-99 and I-129 represent Minimum Detectable Activity (MDA) values.
These two nuclides are in units of uCi/swipe from Rad Calc # 97-17-R and 99-006-R.

Note: H-3, C-14, Tc-99, and I-129 were required to be manifested per 10 CFR 20, Appendix G.

SUMMARY OF RADIOACTIVE SOLID WASTE

(January 1, 1999 - December 31, 1999)

MAJOR NUCLIDE COMPOSITION

AQUEOUS MECHANICAL FILTERS

Principle Nuclide	1st QTR (MBq)	2nd QTR (MBq)	3rd QTR (MBq)	4th QTR (MBq)	Total (MBq)	Percent Abundance
H-3	8.88E-01	0.00E+00	0.00E+00	0.00E+00	8.88E-01	0.00%
C-14	1.51E-05	0.00E+00	0.00E+00	0.00E+00	1.51E-05	0.00%
Cr-51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Mn-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Fe-55	8.29E+04	0.00E+00	0.00E+00	0.00E+00	8.29E+04	42.07%
Fe-59	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Co-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Co-60	7.47E+04	0.00E+00	0.00E+00	0.00E+00	7.47E+04	37.91%
Zn-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Ni-59	2.55E+02	0.00E+00	0.00E+00	0.00E+00	2.55E+02	0.13%
Ni-63	3.77E+04	0.00E+00	0.00E+00	0.00E+00	3.77E+04	19.13%
Sr-90	8.95E+00	0.00E+00	0.00E+00	0.00E+00	8.95E+00	0.00%
Nb-94	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Tc-99	4.42E-04	0.00E+00	0.00E+00	0.00E+00	4.42E-04	MDA
Ru-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
I-129	1.60E-03	0.00E+00	0.00E+00	0.00E+00	1.60E-03	MDA
Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Cs-137	7.22E+02	0.00E+00	0.00E+00	0.00E+00	7.22E+02	0.37%
Pu-238	6.77E+00	0.00E+00	0.00E+00	0.00E+00	6.77E+00	0.00%
Pu-239/40	8.69E+00	0.00E+00	0.00E+00	0.00E+00	8.69E+00	0.00%
Pu-241	7.22E+02	0.00E+00	0.00E+00	0.00E+00	7.22E+02	0.37%
Am-241	5.81E+00	0.00E+00	0.00E+00	0.00E+00	5.81E+00	0.00%
Cm-242	7.81E-02	0.00E+00	0.00E+00	0.00E+00	7.81E-02	0.00%
Cm-243/44	1.15E+01	0.00E+00	0.00E+00	0.00E+00	1.15E+01	0.01%
U-233/34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Totals	1.97E+05	0.00E+00	0.00E+00	0.00E+00	1.97E+05	100.00%

No Mechanical Filter Shipments were made during the second, third and fourth quarters of 1999.

Tc-99 and I-129 represent Minimum Detectable Activity (MDA) values.
These two nuclides are in units of uCi/gram from Rad Calc #99-001-R.

Note: H-3, C-14, Tc-99, and I-129 were required to be manifested per 10 CFR 20, Appendix G.

SUMMARY OF RADIOACTIVE SOLID WASTE

(January 1, 1999 - December 31, 1999)

MAJOR NUCLIDE COMPOSITION

SPENT RESIN

Principle Nuclide	1st QTR (MBq)	2nd QTR (MBq)	3rd QTR (MBq)	4th QTR (MBq)	Total (MBq)	Percent Abundance
H-3	3.61E+03	1.02E+03	4.49E+02	2.70E+03	7.78E+03	0.01%
C-14	1.96E+03	1.20E+03	9.83E+02	2.84E+03	6.98E+03	0.01%
Cr-51	0.00E+00	0.00E+00	0.00E+00	6.77E+04	6.77E+04	0.11%
Mn-54	1.77E+06	6.30E+04	3.80E+04	1.06E+05	1.97E+06	3.11%
Fe-55	4.77E+07	1.16E+06	6.20E+05	1.78E+06	5.12E+07	80.90%
Fe-59	0.00E+00	0.00E+00	0.00E+00	6.59E+03	6.59E+03	0.01%
Co-58	0.00E+00	0.00E+00	0.00E+00	1.11E+04	1.11E+04	0.02%
Co-60	7.72E+06	2.27E+05	9.98E+04	2.86E+05	8.33E+06	13.16%
Zn-65	6.32E+05	2.22E+05	1.02E+05	3.26E+05	1.28E+06	2.02%
Ni-59	1.79E+03	1.18E+02	4.73E+01	1.36E+02	2.09E+03	0.00%
Ni-63	2.96E+05	1.41E+04	6.09E+03	1.76E+04	3.34E+05	0.53%
Sr-90	1.67E+02	1.59E+01	6.07E+00	5.24E+01	2.42E+02	0.00%
Tc-99	1.79E-06	1.79E-06	5.43E-06	5.43E-06	MDA	MDA
Ru-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
I-129	6.52E-06	6.52E-06	2.45E-05	2.45E-05	MDA	MDA
Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Cs-137	1.45E+04	2.13E+04	3.77E+03	3.25E+04	7.21E+04	0.11%
Pu-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Pu-239/40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Pu-241	5.05E+00	1.13E+01	4.10E+00	3.53E+01	5.58E+01	0.00%
Am-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
Cm-242	3.94E-01	1.10E-01	1.07E-01	8.89E-01	1.50E+00	0.00%
Cm-243/44	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
U-233/34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00%
						0.00%
Totals	5.81E+07	1.71E+06	8.71E+05	2.64E+06	6.33E+07	100.00%

Tc-99 and I-129 represent Minimum Detectable Activity (MDA) values.
These two nuclides are in units of uCi/gram from Rad Calc #98-001-R and 99-003-R.

Note: H-3, C-14, Tc-99, and I-129 were required to be manifested per 10 CFR 20, Appendix G.

SUMMARY OF METEOROLOGICAL DATA

The following pages are a summation of meteorological data accumulated during the calendar year 1999 by the MIDAS (Meteorological Information and Dose Assessment System) at the Duane Arnold Energy Center.

Stability Class tables include wind speed, wind direction, and stability class at the specified sensor height (33 feet or 156 feet). A summary table of all stability classes at each height is also included.

Data recovery for atmospheric stability, wind speed, and wind direction was greater than 92% at both 33 feet and 156 feet.

Stability Class Data 33'

TEMPERATURE DIFFERENCE DEG.F/100 FT

TABLE	GREATER THAN	LESS THAN OR EQUAL TO
1(A)	------	-1.045
2(B)	-1.045	-0.935
3(C)	-0.935	-0.825
4(D)	-0.825	-0.275
5(E)	-0.275	0.825
6(F)	0.825	2.200
7(G)	2.200	------
8	ALL LAPSE GROUPS IN ONE TABLE	

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	5	4	6	0	0	16
NNE	0	5	9	0	0	0	14
NE	4	11	21	5	0	0	41
ENE	0	8	12	4	0	0	24
E	1	24	6	1	0	0	32
ESE	3	27	11	4	0	0	45
SE	7	35	25	2	0	0	69
SSE	13	83	50	1	0	0	147
S	16	107	87	9	1	0	220
SSW	3	25	55	20	8	0	111
SW	1	15	16	7	1	0	40
WSW	0	13	20	6	2	0	41
W	0	5	16	20	1	0	42
WNW	0	3	12	19	0	3	37
NW	0	9	13	19	8	1	50
NNW	1	6	19	29	3	0	58
TOTAL	50	381	376	152	24	4	987

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	2	2	0	0	4

NNE	0	3	6	1	0	0	10
NE	0	8	8	5	0	0	21
ENE	1	4	7	2	0	0	14
E	0	6	5	0	0	0	11
ESE	0	5	2	1	0	0	8
SE	1	3	9	1	0	0	14
SSE	2	7	7	1	0	0	17
S	1	11	8	5	0	0	25
SSW	4	7	6	9	0	0	26
SW	2	7	9	4	0	0	22
WSW	0	1	2	3	0	0	6
W	0	3	5	1	0	0	9
WNW	0	1	2	3	1	0	7
NW	1	3	2	4	5	1	16
NNW	0	5	8	18	2	0	33
TOTAL	12	74	88	60	8	1	243

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: C DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	2	4	7	0	0	15
NNE	1	3	4	0	0	0	8
NE	0	5	11	3	0	0	19
ENE	0	5	3	1	0	0	9
E	1	6	3	0	0	0	10
ESE	2	4	4	0	0	0	10
SE	3	8	9	0	0	0	20
SSE	3	8	10	1	0	0	22
S	5	8	11	3	0	0	27
SSW	1	8	7	10	1	0	27
SW	0	8	5	1	0	0	14
WSW	0	1	5	1	0	0	7
W	0	5	3	3	0	0	11
WNW	0	3	6	8	5	0	22
NW	1	1	6	2	4	1	15
NNW	0	2	18	9	1	0	30
TOTAL	19	77	109	49	11	1	266

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5	25	47	27	1	0	105
NNE	8	18	34	13	1	0	74
NE	12	67	83	43	4	0	209
ENE	16	75	75	37	2	0	205
E	32	71	58	9	0	0	170
ESE	11	71	55	9	1	0	147
SE	23	81	69	9	0	0	182
SSE	20	81	44	2	0	0	147
S	11	93	72	18	0	0	194
SSW	15	45	45	31	3	0	139
SW	14	42	40	14	1	0	111
WSW	5	52	35	10	0	1	103
W	7	37	47	21	10	1	123
WNW	6	28	61	47	20	8	170
NW	7	59	86	103	30	3	291
NNW	7	56	215	126	19	0	423
TOTAL	199	901	1066	519	92	13	2793

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	16	30	14	3	3	0	66
NNE	18	23	13	2	0	0	56
NE	22	81	25	2	0	0	130
ENE	24	49	22	1	0	0	96
E	36	59	10	2	0	0	107
ESE	34	72	13	1	0	0	120
SE	35	129	22	3	0	0	189
SSE	37	126	56	3	0	0	222
S	36	170	173	19	1	0	399
SSW	34	63	55	4	0	0	156
SW	30	32	28	3	0	0	93
WSW	23	23	8	5	0	0	59
W	12	45	19	6	0	0	82
WNW	15	22	21	7	1	0	66
NW	16	50	36	14	3	0	119
NNW	4	79	106	12	5	1	207
TOTAL	392	1053	621	87	13	1	2167

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	9	6	0	0	0	0	15
NNE	10	11	1	0	0	0	22
NE	13	31	3	0	0	0	47
ENE	20	6	0	0	0	0	26
E	20	9	1	0	0	0	30
ESE	26	6	0	0	0	0	33
SE	34	15	0	0	0	0	49
SSE	45	30	0	0	0	0	75
S	72	38	1	0	0	0	111
SSW	49	27	1	0	0	0	77
SW	39	19	1	1	0	0	60
WSW	32	20	1	0	0	0	53
W	16	15	0	0	0	0	31
WNW	22	6	0	0	0	0	28
NW	10	19	2	0	0	0	31
NNW	3	11	2	0	0	0	16
TOTAL	420	269	13	1	0	0	704

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	7	0	0	1	0	2	10
NNE	14	8	2	0	0	0	24
NE	33	23	8	0	0	0	64

ENE	69	6	0	0	0	0	79
E	47	0	1	0	0	0	51
ESE	41	2	0	0	0	0	46
SE	43	3	0	0	0	0	49
SSE	65	1	0	0	0	0	68
S	87	7	0	0	0	0	96
SSW	89	7	1	0	0	0	99
SW	113	7	0	0	0	0	122
WSW	81	4	0	0	0	0	87
W	57	1	1	0	0	0	62
WNW	17	0	0	0	0	0	18
NW	7	1	0	0	0	0	10
NNW	4	0	0	2	0	0	6
TOTAL	774	70	13	3	0	2	891

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:WS33 DIRECTION:WD33 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	40	68	71	46	4	2	231
NNE	51	71	69	16	1	0	208
NE	84	226	159	58	4	0	531
ENE	130	153	119	45	2	0	453
E	137	175	84	12	0	0	411
ESE	117	187	85	15	1	0	409
SE	146	274	134	15	0	0	572
SSE	185	336	167	8	0	0	698
S	228	434	352	54	2	0	1072
SSW	195	182	170	74	12	0	635
SW	199	130	99	30	2	0	462
WSW	141	114	71	25	2	1	356
W	92	111	91	51	11	1	360
WNW	60	63	102	84	27	11	348
NW	42	142	145	142	50	6	532
NNW	19	159	368	196	30	1	773
TOTAL	1866	2825	2286	871	148	22	8051

PERIODS OF CALM(HOURS): 33
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

Wind Rose 33'

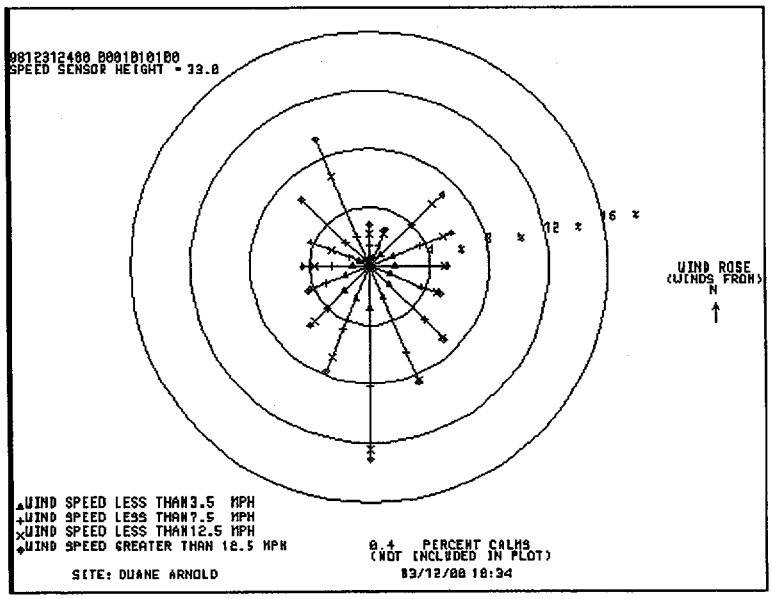

Figure 1 33' Wind Rose (Direction From)

Stability Class Data 156'

TEMPERATURE DIFFERENCE DEG.F/100 FT

TABLE	GREATER THAN	LESS THAN OR EQUAL TO
1(A)	------	-1.045
2(B)	-1.045	-0.935
3(C)	-0.935	-0.825
4(D)	-0.825	-0.275
5(E)	-0.275	0.825
6(F)	0.825	2.200
7(G)	2.200	------
8	ALL LAPSE GROUPS IN ONE TABLE	

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	5	4	7	0	0	17
NNE	0	7	19	12	1	0	39
NE	2	10	9	4	1	0	26
ENE	1	9	10	5	1	0	26
E	2	12	12	3	0	0	29
ESE	2	7	23	8	1	0	41
SE	2	21	48	21	3	0	95
SSE	7	36	73	42	5	0	163
S	4	42	75	66	20	3	210
SSW	2	14	25	29	15	6	91
SW	1	12	11	12	5	2	43
WSW	0	1	14	14	2	1	32
W	0	5	7	19	10	2	43
WNW	0	1	10	14	13	4	42
NW	0	5	8	20	12	2	47
NNW	2	4	6	24	6	1	43
TOTAL	26	191	354	300	95	21	987

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	4	4	1	0	9
NNE	0	3	5	4	2	0	14
NE	1	8	5	6	0	0	20
ENE	0	1	7	1	1	0	10
E	0	6	2	2	0	0	10
ESE	1	2	4	2	1	0	10
SE	0	1	6	6	1	0	14
SSE	3	2	8	5	2	0	20
S	2	6	6	7	8	0	29
SSW	1	5	6	3	8	0	23
SW	1	4	5	6	3	1	20
WSW	0	0	2	1	0	0	3
W	1	2	4	5	0	0	12
WNW	0	2	1	2	2	2	9
NW	0	2	7	5	1	4	19
NNW	0	2	3	12	4	0	21
TOTAL	10	46	75	71	34	7	243

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101

STABILITY CLASS: C DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	0	4	4	1	0	10
NNE	2	3	9	3	1	0	18
NE	1	5	3	1	0	0	10
ENE	0	3	4	3	0	0	10
E	1	5	5	0	0	0	11
ESE	0	2	3	1	0	0	6
SE	1	4	11	5	1	0	22
SSE	0	5	13	6	2	0	26
S	3	4	10	9	4	2	32
SSW	0	5	9	8	5	0	27
SW	1	1	0	0	1	0	3
WSW	0	2	4	4	0	0	10
W	1	1	7	3	1	0	13
WNW	0	2	5	7	6	3	23
NW	0	0	6	1	3	4	14
NNW	0	2	12	13	4	0	31
TOTAL	11	44	105	68	29	9	266

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	7	13	28	25	6	0	79
NNE	4	22	52	52	15	0	145
NE	11	33	67	49	19	3	182
ENE	10	41	59	53	4	0	167
E	10	65	52	39	7	0	173
ESE	2	51	52	57	10	1	173
SE	8	32	77	47	8	0	172
SSE	4	35	81	53	10	0	183
S	5	30	57	53	19	3	167
SSW	10	23	24	33	26	2	118
SW	7	34	43	28	8	5	125
WSW	1	27	33	20	9	1	91
W	6	23	47	23	16	11	126
WNW	7	23	45	71	41	36	223
NW	7	35	74	107	84	14	321
NNW	3	21	125	143	45	11	348
TOTAL	102	508	916	853	327	87	2793

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	16	23	27	7	5	1	79
NNE	8	32	41	21	2	0	104
NE	9	26	45	10	0	0	90
ENE	9	25	35	17	1	0	87
E	7	36	34	6	4	0	89
ESE	4	26	79	26	2	0	137
SE	8	29	144	44	4	0	229
SSE	3	27	95	131	10	2	268
S	7	25	115	168	19	2	336
SSW	6	26	37	49	8	0	126

SW	4	23	21	20	7	0	75
WSW	9	20	17	5	5	0	56
W	7	18	27	18	6	0	76
WNW	5	14	41	21	7	1	89
NW	3	20	54	30	12	4	123
NNW	8	29	85	73	4	4	203
TOTAL	113	399	897	646	96	14	2167

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	11	9	5	0	0	0	25
NNE	7	14	14	5	0	0	40
NE	4	13	14	0	0	0	31
ENE	5	6	0	0	0	0	12
E	6	8	6	2	0	0	22
ESE	1	8	18	0	0	0	28
SE	4	20	53	2	0	0	79
SSE	9	14	34	5	0	0	62
S	5	16	34	4	0	0	59
SSW	6	27	21	5	0	0	59
SW	7	26	16	1	1	0	51
WSW	2	30	11	3	0	0	46
W	10	12	29	0	0	0	51
WNW	5	18	17	1	0	0	41
NW	12	21	22	4	0	0	59
NNW	6	14	17	2	0	0	39
TOTAL	100	256	311	34	1	0	704

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	25	19	2	1	1	1	49
NNE	10	12	12	12	0	0	46
NE	12	17	10	1	0	0	40
ENE	10	11	6	1	0	0	29
E	12	12	4	0	0	0	30
ESE	12	13	23	0	0	0	48
SE	8	52	35	0	0	0	95
SSE	12	56	46	0	0	0	115
S	17	49	28	1	0	0	97
SSW	16	44	12	0	0	0	72
SW	17	42	2	0	0	0	61
WSW	12	23	3	0	0	0	38
W	14	15	5	1	0	0	36
WNW	14	19	4	1	0	0	38
NW	14	20	10	0	0	0	44
NNW	22	23	6	2	0	0	53
TOTAL	227	427	208	20	1	1	891

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 98123124-00010101
STABILITY CLASS: ALL DT/DZ

ELEVATION: SPEED:WS156 DIRECTION:WD156 LAPSE:DEL T

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	61	69	74	48	14	2	268
NNE	31	93	152	109	21	0	406
NE	40	112	153	71	20	3	399
ENE	35	96	121	80	7	0	341
E	38	144	115	52	11	0	364
ESE	22	109	202	94	14	1	443
SE	31	159	374	125	17	0	706
SSE	38	175	350	242	29	2	837
S	43	172	325	308	70	10	930
SSW	41	144	134	127	62	8	516
SW	38	142	98	67	25	8	378
WSW	24	103	84	47	16	2	276
W	39	76	126	69	33	13	357
WNW	31	79	123	117	69	46	465
NW	36	103	181	167	112	28	627
NNW	41	95	254	269	63	16	738
TOTAL	589	1871	2866	1992	583	139	8051

PERIODS OF CALM(HOURS): 11
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 711

Wind Rose 156'

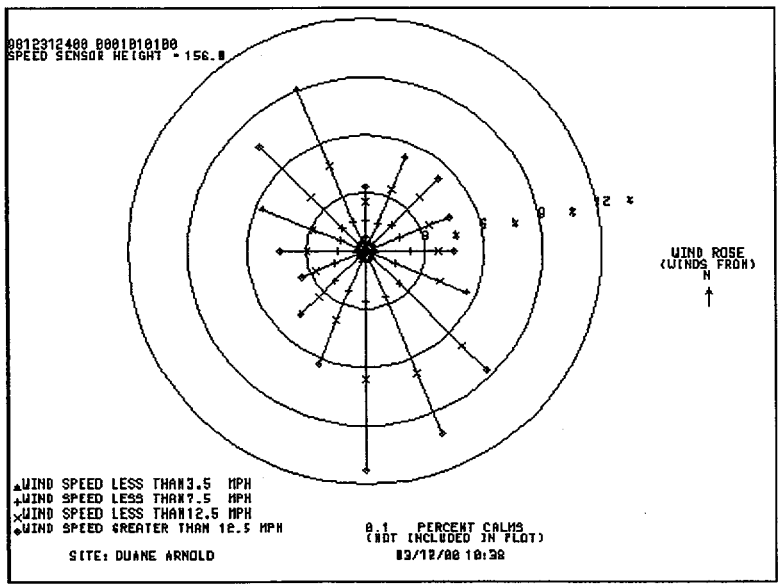

Figure 2 156' Wind Rose (Direction From)

ATTACHMENT 1: SUMMARY OF CHANGES TO THE ODAM REV. 12

Revision 12 to the ODAM was implemented on July 1st, 1999.
The following summarizes the changes implemented in this revision.

Section 3.1.1 The terminology "75 mrem to his thyroid or 25 mrem to his total body" was changed to "75 mrem to the thyroid or 25 mrem to the total body"

Section 3.5 Notes were added in section 3 to describe the limitations in the use of Midas© Software when performing calculations with annualized averaged meteorological data. The affected changes are in sections 3.5.1.1, 3.5.1.2, 3.5.2.1, 3.6, 3.7.

Section 6.01 Definitions of surveillance terminology as used in the ODAM were changed to match definitions in the Technical Specifications.
A reference to Iowa Electric Light and Power was removed.

Section 6.1.5.1 Reference to a Semi-annual report was changed to Annual Report.

Table 6.2-1&
Table 7.2-1 The term "Normal Range" was added to the title of the tables to clarify the purpose of the tables:
Normal Range Radioactive Gaseous Effluent Monitoring Instrumentation
Normal Range Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Table 6.2-2 Was changed to reflect the implementation of plant modification #EMA-A28097.

Section 7.2.5 References to the Tech. Specs were removed. The section of the Tech. Spec. that was listed was an "old" tech spec section number. The specification was moved to the ODAM.

Section 6/7.2.1 Bases were changed to reflect the implementation of plant modification #EMA-A28097.

ATTACHMENT 2: SUMMARY OF CHANGES TO THE ODAM REV. 13

ODAM Revision 13 was implemented on November 12th, 1999.
The following summarizes the changes implemented in this revision.

Section 7.2.1.3 The requirement for a Surveillance on the Steam Jet Air Ejector Offgas Isolation system was removed. The Isolation feature of this system was removed by plant modification #EMA-A28097

ATTACHMENT 3: CURRENT REVISION OF THE ODAM