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Subject: Annual Radiological Environmental Operating Report for 2004
Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6

Dear Sir or Madam:

Arkansas Nuclear One (ANO), Units 1 and 2, Technical Specifications 5.6.2 and 6.9.4, respectively, require the submittal of an annual radiological environmental operating report for the previous calendar year by May 15 of each year. Attached is the annual radiological environmental operating report for ANO for the year 2004. The radionuclides detected by the radiological environmental monitoring program during 2004 were significantly below regulatory limits; therefore, ANO plant operations during 2004 had no harmful effects nor resulted in any irreversible damage to the environment. This report fulfills the reporting requirements referenced above. Should you have any questions regarding this submittal, please contact Richard Scheide at (479) 858-4618.

This submittal contains no commitments.

Sincerely,

A handwritten signature in black ink, appearing to read "Dale E. James".

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DEJ/rhs
Attachments

IE25

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ARKANSAS NUCLEAR ONE - UNITS 1 AND 2

**ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT FOR 2004**

TABLE OF CONTENTS

SUMMARY	6
1.0 INTRODUCTION	10
1.1 Radiological Environmental Monitoring Program	10
1.2 Pathways Monitored	10
1.3 Land Use Census	10
2.0 INTERPRETATION AND TRENDS OF RESULTS	20
2.1 Air Particulate and Radioiodine Sample Results	20
2.2 Thermoluminescent Dosimetry Sample Results	20
2.3 Water Sample Results	20
2.4 Sediment Sample Results	22
2.5 Milk Sample Results	22
2.6 Fish Sample Results	22
2.7 Food Product Sample Results	22
2.8 Land Use Census Results	23
2.9 Interlaboratory Comparison Results	23
3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY	25
3.1 2004 Program Results Summary	25

LIST OF TABLES

TABLE 1.1	RADIOLOGICAL ENVIRONMENTAL SAMPLING PROGRAM	12
TABLE 3.1	RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY	26

LIST OF FIGURES

FIGURE 1-1	SAMPLE COLLECTION SITES – NEAR FIELD	18
FIGURE 1-2	SAMPLE COLLECTION SITES – FAR FIELD	19
FIGURE 2-1	TLD RADIATION DOSE	24

LIST OF ATTACHMENTS

ATTACHMENT 1	2004 RADIOLOGICAL MONITORING REPORT SUMMARY OF MONITORING RESULTS	33
ATTACHMENT 2	SEDIMENT DOSE CALCULATIONS	49

Summary

The Annual Radiological Environmental Operating Report presents data obtained through analyses of environmental samples collected for Arkansas Nuclear One's (ANO's) Radiological Environmental Monitoring Program (REMP) for the period January 1, 2004 through December 31, 2004. This report fulfills the requirements of ANO Unit 1 Technical Specification 5.6.2 and Unit 2 Technical Specification 6.9.4. During 2004, as in previous years, ANO detected radionuclides attributable to plant operations at the discharge location (Station 8). ANO personnel routinely monitor results from this area in order to note any trends. Their review of results from this area indicates the following:

- Tritium levels in the surface water media continue to be below regulatory reporting limits.
- Cesium-137 levels in the sediment media are not demonstrating any consistent increase in comparison to previous years. Review indicates that 2004 levels are less than that of the historical average (1999 – 2003).

Gross beta concentrations at the Station 14 (City of Russellville) indicator drinking water location continue to remain at previous operational background measurements and similar to the levels detected at the Station 57 (City of Danville) control drinking water location.

Radiological Environmental Monitoring Program

ANO established the REMP prior to the station becoming operational (1974) to provide data on background radiation and radioactivity normally present in the area. ANO has continued to monitor the environment by sampling air, water, sediment, fish, and food products, as well as measuring radiation directly. ANO also samples milk if milk-producing animals are present commercially within five miles of the plant.

The REMP includes sampling indicator and control locations within an approximately 20-mile radius of the plant. The REMP utilizes indicator locations near the site to show any increases or buildup of radioactivity that might occur due to station operation, and control locations farther away from the site to indicate the presence of only naturally occurring radioactivity. ANO personnel compare indicator results with control and preoperational results to assess any impact ANO operation might have had on the surrounding environment.

In 2004, ANO personnel collected environmental samples for radiological analysis. They compared results of indicator locations with control locations and previous studies, and concluded that overall no significant relationship exists between ANO operation and effect on the plant environs. Review of 2004 data, in many cases, revealed undetectable radiation levels in the environment and near background level in significant pathways associated with ANO.

Harmful Effects or Irreversible Damage

The REMP monitoring did not detect any harmful effects or evidence of irreversible damage in 2004. Therefore, no analysis or planned course of action to alleviate problems was necessary.

Reporting Levels

ANO's review indicates that no samples equaled or exceeded reporting levels for radioactivity concentration in environmental samples, as outlined in Units 1 and 2 Offsite Dose Calculation Manual (ODCM) Table 2.6-3, when averaged over any calendar quarter, due to ANO effluents. Therefore, 2004 results did not trigger any Radiological Monitoring Program Special Reports.

Radioactivity Not Attributable to ANO

The ANO REMP detected radioactivity attributable to other sources twice. These include the 25th Chinese nuclear test explosion in 1980, and the radioactivity plume release due to reactor core degradation at the Chernobyl Nuclear Power Plant in 1986. Prior to 1981, the ANO REMP detected radioactivity resulting from nuclear weapons testing, with Cesium-137 continuing to be periodically detected in certain pathways.

Comparison to Federal and State Programs

ANO personnel compared REMP data to federal and state monitoring programs as results became available. Historically, the programs used for comparison have included the U.S. Nuclear Regulatory Commission (NRC) TLD Direct Radiation Monitoring Network and the Arkansas Department of Health (ADH).

The NRC TLD Network Program was discontinued in 1998. Historically these results have compared to those from the ANO REMP. ANO TLD results continue to remain similar to the historical average and continue to verify that plant operation is not affecting the ambient radiation levels in the environment.

The ADH and the ANO REMP entail similar radiological environmental monitoring program requirements. These programs include collecting air samples and splitting or sharing sample media such as water, sediment and fish. Both programs have obtained similar results over previous years.

Sample Deviations

◆ Milk

The REMP did not include milk sampling within five miles (8 km) of ANO in 2004 due to unavailability. ANO Units 1 and 2 ODCM require collection of milk samples if available commercially within 8 km (5 miles) of the plant. ANO personnel collected vegetation samples to monitor the ingestion pathway, as specified in the ODCM, because of milk unavailability.

◆ Required Lower Limit of Detection (LLD) Values

All LLDs during this reporting period were within the acceptable limits required by Table 2.6-2 of the ANO Units 1 and 2 ODCM.

◆ Air Samples

Listed below are air sampler deviations that occurred during 2004 due to electrical power outages and equipment failure. These deviations did not result in the exceedance of the LLD values specified in the ODCM. As described in footnote (a) to ANO Units 1 and 2 ODCM Table 2.6-1, deviations are permitted from the required sampling schedule due to malfunction of sampling equipment and other legitimate reasons.

Station	Sampling Period	Comment
1	10/19/04 – 11/02/04	Air sample station power isolated due to construction. Sample resulted in reduced run time.
1	11/02/04 – 11/16/04	Air sample station power isolated due to construction. Sample resulted in reduced run time.
6	05/04/04 – 05/18/04	Air sample tubing broke. Sample flow reduced.

◆ Missed Samples

One fourth quarter TLD (Station 148) was missed during 2004 due to vandalism. This loss was an isolated instance that did not recur during the year and was replaced with a new TLD by ANO personnel once discovered. The recovery rate for TLDs during 2004 was 99% (95 of 96).

One air particulate and radioiodine cartridge sample, which is not required by the ODCM, was missed at Station 1 (indicator) during the sampling period of March 23 – April 6, 2004. This sample was missed due to personnel error and is documented in CR-ANO-C-2004-00600.

Although these were isolated instances that were corrected by ANO personnel once discovered, footnote (a) to ANO Units 1 and 2 ODCM Table 2.6-1 allows deviations from the required sampling schedule due to malfunction of sampling equipment and other legitimate reasons.

◆ **Unavailable Results**

ANO received analytical results in adequate time for inclusion in this report. In addition, ANO's review identified no missing results.

Program Modifications

ANO made no modifications to the REMP during 2004.

Attachments

Attachment 1 contains results of air, TLD, water, sediment, fish, and food products samples collected in 2004. TLDs were analyzed by Waterford-3 Dosimetry. All remaining samples were analyzed by River Bend Station's (RBS) Environmental Laboratory. Attachment 1 also contains RBS' participation in the interlaboratory comparison program during 2004. Attachment 2 contains dose calculations performed for sediment using a generalized equation from Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I."

1.0 Introduction

1.1 Radiological Environmental Monitoring Program

ANO established the REMP to ensure that plant operating controls properly function to minimize any associated radiation endangerment to human health or the environment. The REMP is designed for:

- Analyzing important pathways for anticipated types and quantities of radionuclides released into the environment.
- Considering the possibility of a buildup of long-lived radionuclides in the environment and identifying physical and biological accumulations that may contribute to human exposures.
- Considering the potential radiation exposure to plant and animal life in the environment surrounding ANO.
- Correlating levels of radiation and radioactivity in the environment with radioactive releases from station operation.

1.2 Pathways Monitored

The airborne, direct radiation, waterborne and ingestion pathways are monitored as required by the ANO ODCM. A description of the ANO REMP utilized to monitor the exposure pathways is described in Table 1.1 and shown in Figures 1-1 and 1-2.

Section 2.0 of this report provides a discussion of 2004 sampling results with Section 3.0 providing a summary of results for the monitored exposure pathways.

1.3 Land Use Census

ANO personnel conduct a land use census biannually, as required by ANO Units 1 and Unit 2 ODCM Section 2.6.2. The purpose of this census is to identify changes in uses of land within five miles of ANO that would require modifications to the REMP or ODCM. The most important criteria during this census are to determine location in each sector of the nearest:

- 1) Residence
- 2) Animal milked for human consumption
- 3) Garden of greater than 500 square feet producing broadleaf vegetation *

The method used by ANO personnel for conducting this land use census is as follows:

- ANO personnel conduct door-to-door field surveys and/or aerial surveys in each meteorological sector out to five miles in order to locate the nearest resident and milk animal.
- Consultation with local agricultural authorities is used in instances when personal contact cannot be made.
- As a result of these surveys, the following information is obtained in each meteorological sector:
 - 1) Nearest permanent residence
 - 2) Nearest milking animal
- ANO personnel identify locations on the map, measures distances to ANO (or use a GPS system) and records results.
- Locations, if any, are identified which yield a calculated dose or dose commitments greater than those currently calculated in the ODCM.
- ANO personnel compare results to previous census.

* ANO personnel do not perform a garden census since ODCM Section 2.6.2 allows the routine sampling of broadleaf vegetation in the highest D/Q sector near the site boundary in lieu of the garden census.

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Airborne	<u>Radioiodine and Particulates</u> 2 samples close to the Site Boundary, in (or near) different sectors with the highest calculated annual average groundlevel D/Q.	Station 2 (243° - 0.5 miles) - South of the sewage treatment plant. Station 56 (264° - 0.4 miles) – West end of the sewage treatment plant.	Continuous operation of sampler with sample collection as required by dust loading but at least once per 14 days.	Radioiodine Canister – Analyze at least once per 14 days for I-131. Particulate Sampler – Analyze for gross beta radioactivity following filter change.
	<u>Radioiodine and Particulates</u> 1 sample from the vicinity of a community having the highest calculated annual average groundlevel D/Q.	Station 6 (111° - 6.8 miles) - Entergy local office in Russellville (305 South Knoxville Avenue).		
	<u>Radioiodine and Particulates</u> 1 sample from a control location 15-30 km (10 – 20 miles) distance.	Station 7 (210° - 19.0 miles) – Entergy Supply Yard on Highway 10 in Danville.		
	<u>Radioiodine and Particulates</u> One location sampled voluntarily by ANO.	Station 1 (88° - 0.5 miles) - Near the meteorology tower.		
Direct Radiation	<u>TLDs</u> 16 inner ring stations with two or more dosimeters in each meteorological sector in the general area of the Site Boundary	Station 1 (88° - 0.5 miles) - On a pole near the meteorology tower. Station 2 (243° - 0.5 miles) - South of the sewage treatment plant. Station 3 (5° - 0.7 miles) – West of ANO Gate #2 on Highway 333 (approximately 0.35 miles)	Once per 92 days.	Gamma Dose – Once per 92 days.

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p><u>TLDs</u> 16 inner ring stations with two or more dosimeters in each meteorological sector in the general area of the Site Boundary</p>	<p>Station 4 (181° - 0.5 miles) – West of May Cemetery entrance on south side of the road.</p> <p>Station 56 (264° - 0.4 miles) - West end of the sewage treatment plant.</p> <p>Station 108 (306° - 0.9 miles) - South on Flatwood Road on a utility pole.</p> <p>Station 109 (291° - 0.6 miles) - Utility pole across from the junction of Flatwood Road and Round Mountain Road.</p> <p>Station 110 (138° - 0.8 miles) - Bunker Hill Lane on the first utility pole on the left.</p> <p>Station 145 (28° - 0.6 miles) - Near west entrance to the RERTC on a utility pole.</p> <p>Station 146 (45° - 0.6 miles) - South end of east parking lot at RERTC on a utility pole.</p> <p>Station 147 (61° - 0.6 miles) - West side of Bunker Hill Road, approximately 100 yards from intersection with State Highway 333.</p> <p>Station 148 (122° - 0.5 miles) - Intersection of Bunker Hill Road with Scott Lane on county road sign post.</p>	Once per 92 days.	Gamma Dose – Once per 92 days.

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p><u>TLDs</u> 16 inner ring stations with two or more dosimeters in each meteorological sector in the general area of the Site Boundary</p>	<p>Station 149 (156° - 0.5 miles) – On a utility pole on the south side of May Road.</p> <p>Station 150 (205° - 0.6 miles) – North side of May Road on a utility pole past the McCurley Place turn.</p> <p>Station 151 (225° - 0.4 miles) – West side of sewage treatment plant near the lake on a metal post.</p> <p>Station 152 (340° - 0.8 miles) – North side of State Highway 333 on a London City limit sign post.</p>	Once per 92 days.	Gamma Dose – Once per 92 days.
	<p><u>TLDs</u> 8 stations with two or more dosimeters in special interest areas such as population centers, nearby residences, schools, and in 1 – 2 areas to serve as control locations.</p>	<p>Station 6 (111° - 6.8 miles) - Entergy local office in Russellville (305 South Knoxville Avenue).</p> <p>Station 7 (210° - 19.0 miles) – Entergy Supply Yard on Highway 10 in Danville.</p> <p>Station 111 (120° - 2.0 miles) – Marina Road on a utility pole on the left just prior to curve.</p> <p>Station 116 (318° - 1.8 miles) - Highway 333 and Highway 64 in London on a utility pole north of the railroad tracks.</p>		

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p><u>TLDs</u> 8 stations with two or more dosimeters in special interest areas such as population centers, nearby residences, schools, and in 1 – 2 areas to serve as control locations.</p>	<p>Station 125 (46° - 8.7 miles) - College Street on a utility pole at the southeast corner of the red brick school building.</p> <p>Station 127 (100° - 5.2 miles) - Arkansas Tech Campus on a utility pole across from Paine Hall.</p> <p>Station 137 (151° - 8.2 miles) – On a speed limit sign on the right in front of the Morris R. Moore Arkansas National Guard Armory.</p> <p>Station 153 (304° - 9.2 miles) - Knoxville Elementary School near the school entrance gate on a utility pole.</p>	Once per 92 days.	Gamma Dose – Once per 92 days.
Waterborne	<p><u>Surface Water</u> 1 indicator location (influenced by plant discharge) 1 control location (uninfluenced by plant discharge)</p>	<p>Station 8 (166° - 0.2 miles) - Plant discharge canal.</p> <p>Station 10 (95° - 0.5 miles) – Plant intake canal.</p>	Once per 92 days.	Gamma isotopic and tritium analyses once per 92 days.
	<p><u>Drinking Water</u> 1 indicator location (influenced by plant discharge) 1 control location (uninfluenced by plant discharge)</p>	<p>Station 14 (70° - 5.1 miles) - Russellville city water system from the Illinois Bayou.</p> <p>Station 57 (208° - 19.5 miles) - Danville public water supply treatment on Fifth Street.</p>	Once per 92 days.	I-131, gross beta, gamma isotopic and tritium analyses once per 92 days.

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Waterborne	<p>Sediment 1 indicator location (influenced by plant discharge) 1 control location (uninfluenced by plant discharge)</p>	<p>Station 8 (243° - 0.9 miles) - Plant discharge canal. Station 16 (287° - 5.5 miles) - Panther Bay on south side of Arkansas River across from mouth of Piney Creek.</p>	Once per 365 days.	Gamma isotopic analysis once per 365 days.
Ingestion	<p>Milk 1 indicator sample location within 8 km distant if commercially available. 1 control sample location at a distant of >8 km, when an indicator exists.</p>	Currently, no available milking animals within 8 km of ANO.	Once per 92 days.	Gamma isotopic and I-131 analyses once per 92 days.
	<p>Fish 1 sample of commercially and/or recreationally important species in vicinity of plant discharge. 1 sample of same species in area not influenced by plant discharge.</p>	<p>Station 8 (212° - 0.5 miles) – Plant discharge canal. Station 16 (287° - 5.5 miles) - Panther Bay on south side of Arkansas River across from mouth of Piney Creek.</p>	Once per 365 days.	Gamma isotopic on edible portions once per 365 days.

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Ingestion	<p>Food Products 1 sample of broadleaf (edible or non-edible) near the Site Boundary from one of the highest anticipated annual average groundlevel D/Q sectors, if milk sampling is not performed.</p> <p>1 sample location of broadleaf vegetation (edible or non-edible) from a control location 15 – 30 km distant, if milk sampling is not performed.</p>	<p>Station 13 (273° - 0.5 miles) - West from ANO toward Gate 4 onto Flatwood Road.</p> <p>Station 55 (208° - 16.5 miles) – Intersection of Highway 27 and 154.</p>	Three per 365 days.	Gamma isotopic and I-131 analyses three times per 365 days.

FIGURE 1-1
SAMPLE COLLECTION SITES – NEAR FIELD

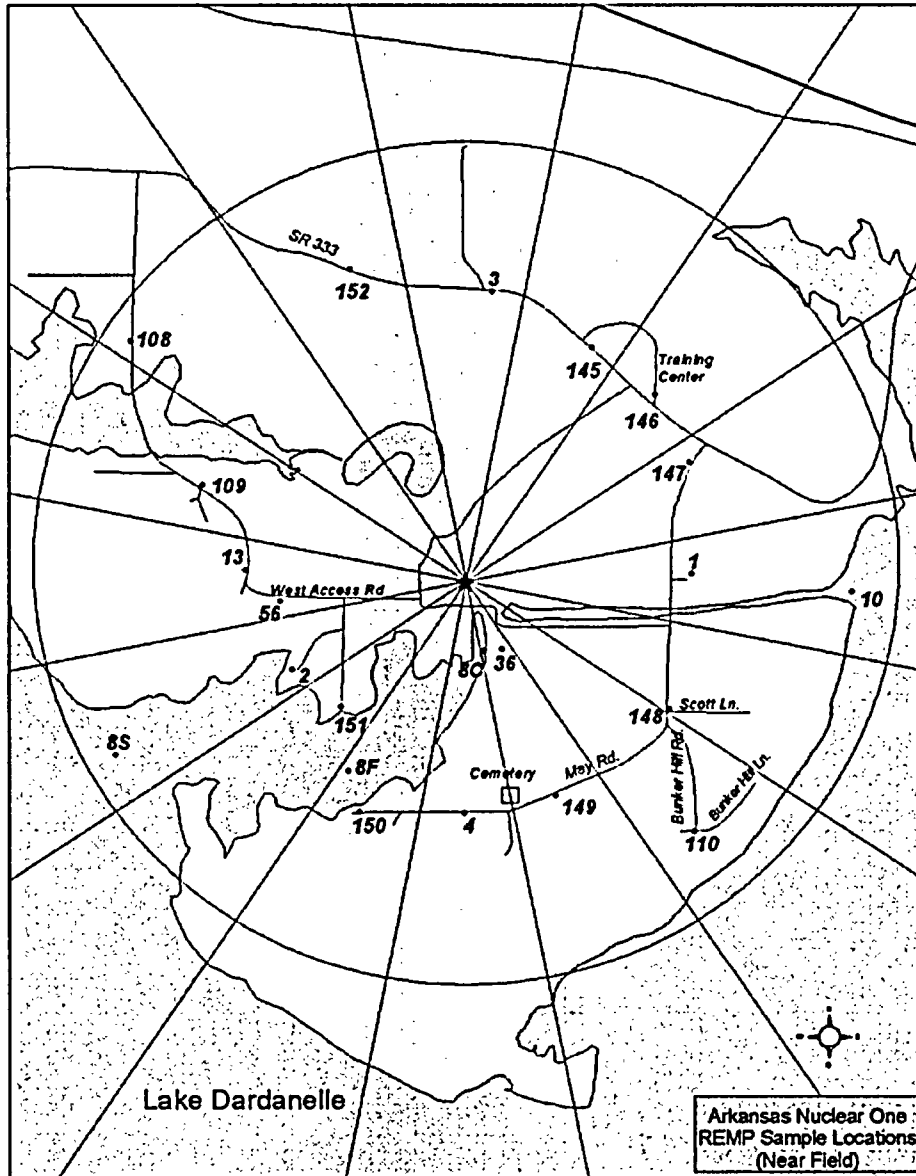
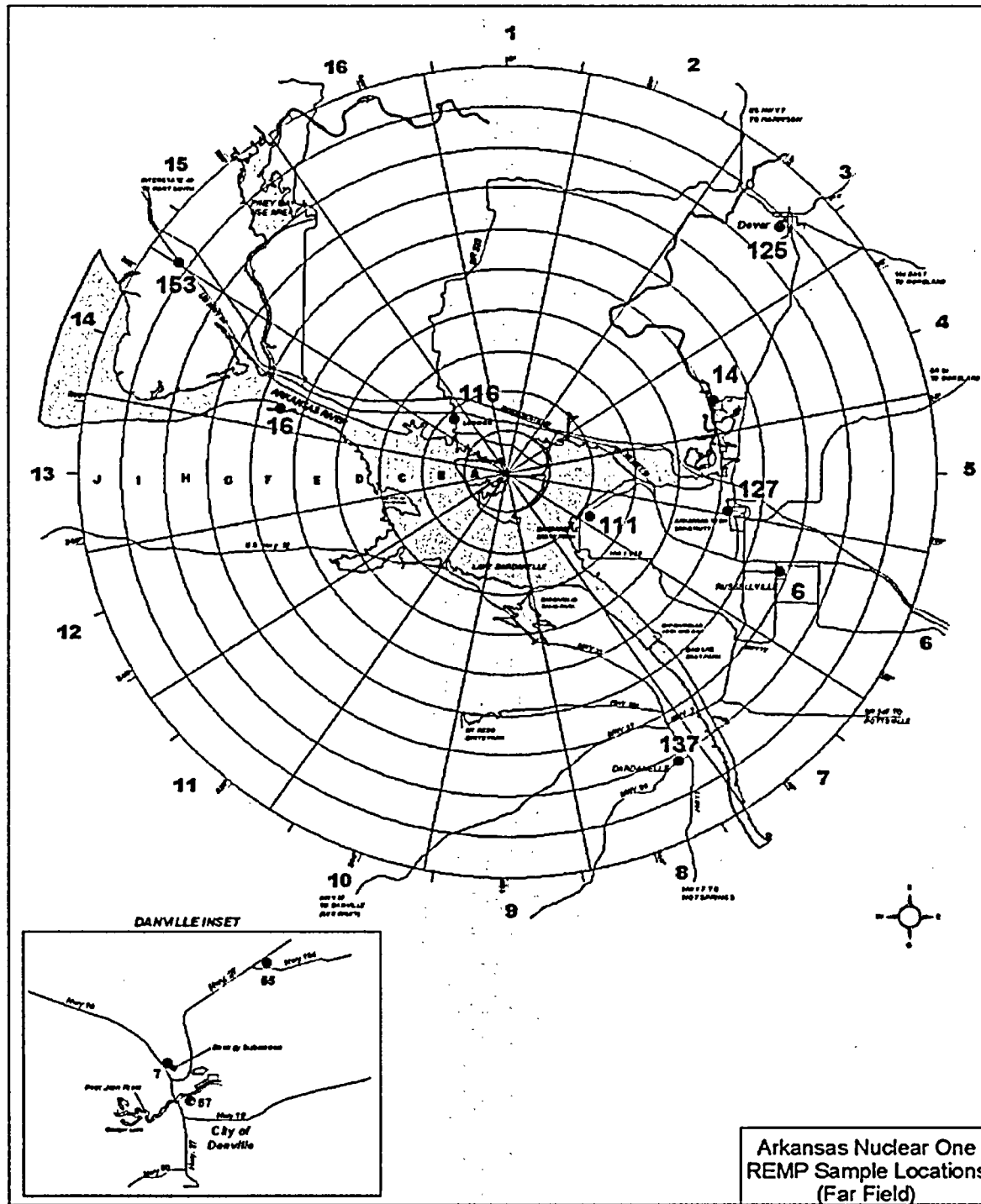


FIGURE 1-2
SAMPLE COLLECTION SITES – FAR FIELD



2.0 Interpretation and Trends of Results

2.1 Air Particulate and Radioiodine Sample Results

Iodine-131 was not detected in the radioiodine cartridges during 2004, as has been the case in previous years. Indicator gross beta air particulate results for 2004 were within the range of background levels obtained in previous years of the operational REMP and well below preoperational levels as seen below. Results are reported as annual average pCi/m³.

<u>Monitoring Period</u>	<u>Result</u>
1999 – 2003 (Minimum Value)	0.020
2004 Value	0.026
1999 – 2003 (Maximum Value)	0.030
Preoperational	0.050

Table 3.1, which includes gross beta concentrations, provides a comparison of the indicator and control means, and further emphasizes that the airborne pathway continues to remain at background levels.

2.2 Thermoluminescent Dosimetry Sample Results

ANO reports measured dose as net exposure (field reading less [transit + shield reading]) normalized to 92 days and relies on comparison of the indicator locations to the control as a measure of plant impact. Gamma radiation dose in the reporting period was compared to historical control location readings for previous years as shown in Figure 2-1.

ANO's comparison of the results to the control indicates that the ambient radiation levels are unaffected by plant operations. As shown in Figure 2-1, results from the indicator locations were within the upper (+) three standard deviation range of 10.2 mrem/quarter for the control. Therefore, levels continue to remain at or near background.

2.3 Water Sample Results

Analytical results for 2004 surface water and drinking water samples were similar to those reported in previous years.

Surface water samples were collected and analyzed for gamma radionuclides and tritium. Gamma radionuclides were below detectable limits which is typically consistent with that of previous operational years. Tritium continues to be detected at

the indicator location. However, the levels detected were within the range that has typically been seen at this location as shown below. Results are reported as annual average pCi/l.

<u>Monitoring Period</u>	<u>Concentration</u>
1999 – 2003 (Minimum Value)	272.0
2004 Value	544.3
1999 – 2003 (Maximum Value)	1847.5
Preoperational Value	200.0

ANO personnel have noted no definable trends associated with the tritium levels at the discharge location. Levels detected during 2004 and previous operational years have been well below regulatory reporting limits. Therefore, the operation of ANO had no impact on this pathway during 2004 and levels of radionuclides remain similar to those obtained in operational years.

Drinking water samples were collected from two locations (indicator and control). Although ANO personnel utilize Station 14 (City of Russellville) as an indicator location due to the potential for the pathway to exist, the City of Russellville has not withdrawn water from Lake Dardanelle in the past several years.

Drinking water samples were analyzed for gross beta radionuclides, Iodine-131, gamma radionuclides and tritium. Gamma radionuclides, Iodine-131 and tritium concentrations were below detectable limits at the indicator and control locations, which is consistent with preoperational and operational years. Gross beta concentrations at the indicator and control locations are similar as shown in Table 3.1. Listed below is a comparison of 2004 indicator results to preoperational and operational years. Results are reported as annual average pCi/l.

<u>Radionuclide</u>	<u>2004</u>	<u>1999 – 2003</u>	<u>Preoperational</u>
Gross Beta	2.53	3.60	2.0
Iodine-131	<LLD	<LLD	<LLD
Gammas	<LLD	<LLD	<LLD
Tritium	<LLD	<LLD	200.0

Therefore, the operation of ANO did not have any definable impact on this pathway during 2004 and radionuclides monitored for this pathway continue to remain at background levels.

2.4 Sediment Sample Results

Sediment samples were collected from two locations in 2004 and analyzed for gamma radionuclides. As in previous years, Cesium-137 attributable to ANO was detected in the discharge sediment. However, ANO personnel have noted no definable trends associated with this radionuclide at the discharge location. The concentration detected during 2004 was below that of historical averages (1999 – 2003) seen at this location. Since reporting levels for radionuclides in sediment have not been established, an evaluation of potential dose to the public from this media was performed as shown in Attachment 2. The annual maximum dose from all radionuclides to the skin and total body was <0.01 millirem.

Design objectives given in 10CFR50, Appendix I for liquid effluents are annual doses of ≤ 3 millirem total body and ≤ 10 millirem any organ. The values of <0.01 millirem for the skin and total body are well within the design objective criteria. Therefore, the level of radionuclides detected in 2004 had no significant impact on the environment or public.

2.5 Milk Sample Results

Milk samples were not collected during 2004 due to the unavailability of indicator locations within 8-km of ANO. Since there are no dairies within five miles of the ANO site, it is concluded ANO's operation had no impact on this pathway in 2004.

2.6 Fish Sample Results

Fish samples were collected from two locations and analyzed for gamma radionuclides. In 2004, gamma radionuclides were below detectable limits, which is consistent with the preoperational monitoring period and operational results since 1997. Therefore, based on these measurements, ANO operations had no significant radiological impact upon the environment or public by this pathway.

2.7 Food Product Sample Results

Food product samples were collected when available from two locations in 2004 and analyzed for Iodine-131 and gamma radionuclides. The 2004 levels remained undetectable, as has been the case in previous years. Therefore, since levels continue to remain at background, it can be concluded that plant operations is not impacting this pathway.

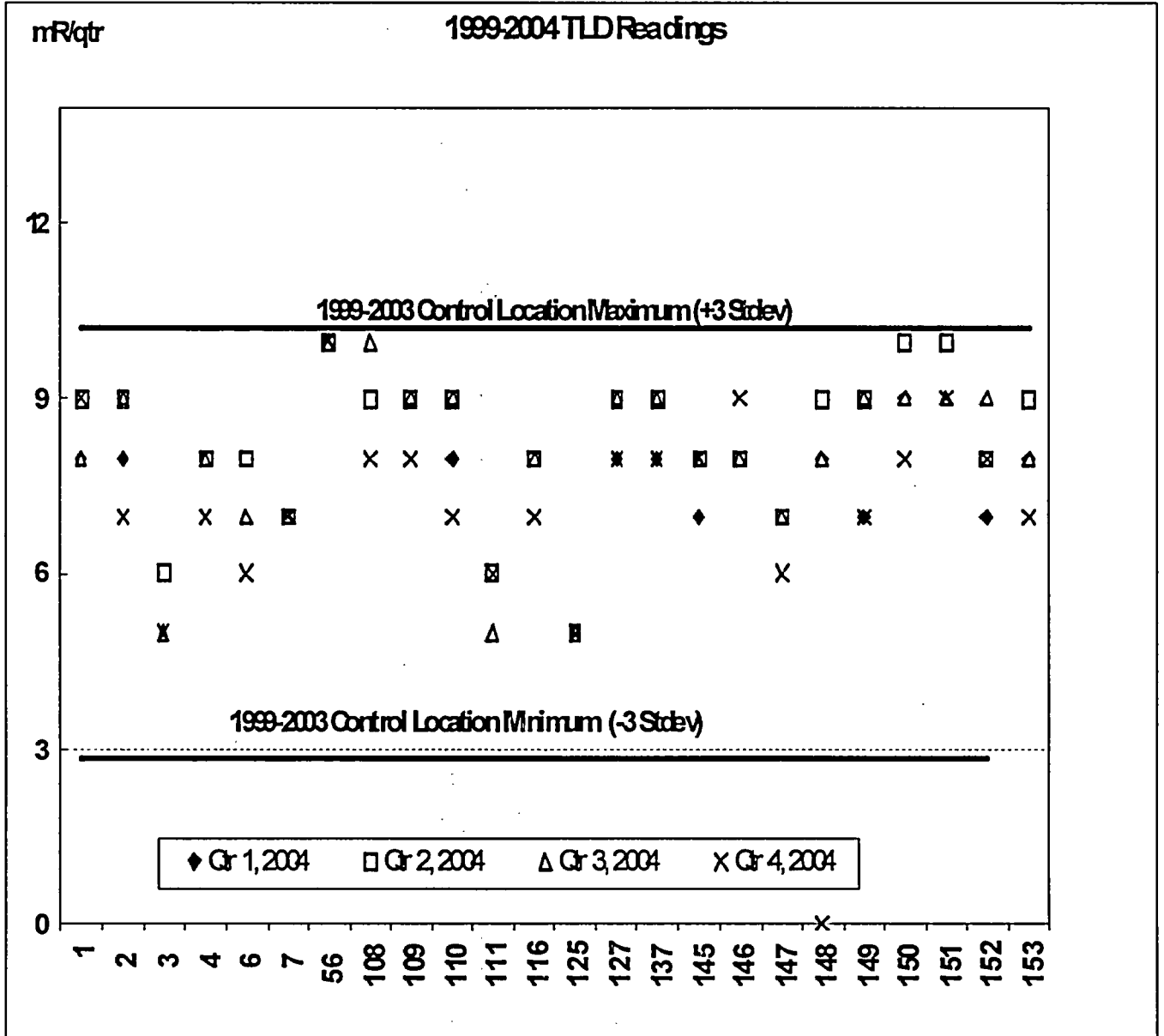
2.8 Land Use Census Results

ANO personnel conduct a land use census biannually. The most recent land use census was conducted in 2003. Therefore, a census was not required for this reporting year.

2.9 Interlaboratory Comparison Results

RBS' Environmental Laboratory analyzed interlaboratory comparison samples for ANO to fulfill the requirements of ANO Units 1 and 2 ODCM Section 2.6.3. Attachment 1, 2004 Radiological Environmental Monitoring Report, contains these results. ANO's review of RBS' interlaboratory comparison indicated that 100% of the sample results for accuracy and precision were within the acceptable control limits of the three normalized deviations.

Figure 2-1
 TLD Radiation Dose



3.0 Radiological Environmental Monitoring Program Summary

3.1 2004 Program Results Summary

Table 3.1 summarizes the 2004 REMP results. ANO personnel did not use values reported as less than the lower limit of detection (<LLD) when determining ranges and means for indicator and control locations.

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: ANO - Units 1 and 2 Docket No: 50-313 and 50-368
Location of Facility: Pope County, Arkansas Reporting Period: January - December 2004

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Air Particulates (pCi/m ³)	GB 129	0.01	0.026 (77 / 77) [0.014 - 0.298]	Station 2 (240°, 0.5 mi)	0.033 (26 / 26) [0.014 - 0.298]	0.023 (52 / 52) [0.012 - 0.039]	0
Airborne Iodine (pCi/m ³)	I-131 129	0.07	<LLD	N/A	N/A	<LLD	0

Inner Ring TLDs (mR/Qtr)	Gamma	63	(f)	8.2 (63 / 63) [5.0 – 10.0]	Station 56 (273°, 0.4 mi)	10.0 (4 / 4) [N/A]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma	28	(f)	7.3 (28 / 28) [5.0 – 9.0]	Station 127 (97°, 5.2 mi)	8.5 (4 / 4) [8.0 – 9.0]	N/A	0
				N/A	Station 137 (150°, 8.1 mi)	8.5 (4 / 4) [8.0 – 9.0]		
Control TLD (mR/Qtr)	Gamma	4	(f)	N/A	N/A	N/A	7.0 (4 / 4) [N/A]	0

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: ANO - Units 1 and 2 Docket No: 50-313 and 50-368
 Location of Facility: Pope County, Arkansas Reporting Period: January - December 2004

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Surface Water (pCi/l)	H-3 8	3000	544.3 (4/4) [386.0 - 872.0]	Station 8 (180°, 0.1 mi)	544.3 (4/4) [386.0 - 872.0]	282.0 (1/4) [N/A]	0
	GS 24						
	Mn-54	15	<LLD	N/A	N/A	<LLD	0
	Fe-59	30	<LLD	N/A	N/A	<LLD	0
	Co-58	15	<LLD	N/A	N/A	<LLD	0
	Co-60	15	<LLD	N/A	N/A	<LLD	0
	Zn-65	30	<LLD	N/A	N/A	<LLD	0
	Zr-95	30	<LLD	N/A	N/A	<LLD	0
	Nb-95	15	<LLD	N/A	N/A	<LLD	0
	I-131	15	<LLD	N/A	N/A	<LLD	0
	Cs-134	15	<LLD	N/A	N/A	<LLD	0
	Cs-137	18	<LLD	N/A	N/A	<LLD	0
	Ba-140	60	<LLD	N/A	N/A	<LLD	0
La-140	15	<LLD	N/A	N/A	<LLD	0	

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: ANO - Units 1 and 2 Docket No: 50-313 and 50-368
 Location of Facility: Pope County, Arkansas Reporting Period: January - December 2004

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Drinking Water (pCi/l)	GB 8	4	2.53 (3 / 4) [1.34 - 3.68]	Station 14 (70°, 5.3 mi)	2.53 (3 / 4) [1.34 - 3.68]	2.88 (3 / 4) [2.49 - 3.38]	0
	I-131 8	1.0	<LLD	N/A	N/A	<LLD	0
	H-3 8	2000	<LLD	N/A	N/A	<LLD	0
	GS 8		<LLD				
	Mn-54	15	<LLD	N/A	N/A	<LLD	0
	Fe-59	30	<LLD	N/A	N/A	<LLD	0
	Co-58	15	<LLD	N/A	N/A	<LLD	0
	Co-60	15	<LLD	N/A	N/A	<LLD	0
	Zn-65	30	<LLD	N/A	N/A	<LLD	0
	Zr-95	30	<LLD	N/A	N/A	<LLD	0
	Nb-95	15	<LLD	N/A	N/A	<LLD	0
	Cs-134	15	<LLD	N/A	N/A	<LLD	0
	Cs-137	18	<LLD	N/A	N/A	<LLD	0
	Ba-140	60	<LLD	N/A	N/A	<LLD	0
La-140	15	<LLD	N/A	N/A	<LLD	0	

Bottom Sediment (pCi/kg)	GS 2 Cs-134 Cs-137	150 180	<LLD 318.3 (1 / 1) [N/A]	N/A Station 8 (245°, 0.7 mi)	N/A 318.3 (1 / 1) [N/A]	<LLD <LLD	0 0
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TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: ANO - Units 1 and 2 Docket No: 50-313 and 50-368
 Location of Facility: Pope County, Arkansas Reporting Period: January - December 2004

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^c
				Location ^d	Mean (F) ^c [Range]		
Fish (pCi/kg)	GS 2						
	Mn-54	130	<LLD	N/A	N/A	<LLD	0
	Fe-59	260	<LLD	N/A	N/A	<LLD	0
	Co-58	130	<LLD	N/A	N/A	<LLD	0
	Co-60	130	<LLD	N/A	N/A	<LLD	0
	Zn-65	260	<LLD	N/A	N/A	<LLD	0
	Cs-134	130	<LLD	N/A	N/A	<LLD	0
	Cs-137	150	<LLD	N/A	N/A	<LLD	0
Food Products (pCi/kg)	I-131 6	60	<LLD	N/A	N/A	N/A	0
	GS 6						
	Cs-134	60	<LLD	N/A	N/A	N/A	0
	Cs-137	80	<LLD	N/A	N/A	N/A	0

^a GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.

^b LLD = Required lower limit of detection based on ANO Units 1 and 2 ODCM Tables 2.6-2.

^c Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parenthesis (F).

- d** Locations are specified (1) by name and (2) degrees relative to reactor site.
- e** Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.
- f** LLD is not defined in ANO Units 1 and 2 ODCM Tables 2.6-2.

Attachment 1
2004 Radiological Monitoring Report
Summary of Monitoring Results

TABLE OF CONTENTS

TABLE 1.1	AIR PARTICULATE	32
TABLE 1.2	RADIOIODINE CARTRIDGE	33
TABLE 2.1	THERMOLUMINESCENT DOSIMETERS	34
TABLE 2.2	THERMOLUMINESCENT DOSIMETERS	35
TABLE 3.1	SURFACE WATER (GAMMA ISOTOPIC)	36
TABLE 3.2	SURFACE WATER (TRITIUM)	38
TABLE 4.1	DRINKING WATER (GAMMA ISOTOPIC & I-131)	39
TABLE 4.2	DRINKING WATER (TRITIUM)	40
TABLE 5.1	SEDIMENT	41
TABLE 6.1	FISH	42
TABLE 7.1	FOOD PRODUCTS	43
TABLE 8.1	INTERLABORATORY COMPARISON	44

Table 1.1
 Sample Type: Air Particulate
 Analysis: Gross Beta
 Units: pCi/m³

Start Date	End Date	Station 1 (Indicator)	Station 2 (Indicator)	Station 56 (Indicator)	Station 6 (Control)	Station 7 (Control)
<u>Required LLD</u> →		<u>0.01</u>	<u>0.01</u>	<u>0.01</u>	<u>0.01</u>	<u>0.01</u>
12/30/2003	01/13/2004	0.029	0.298	0.028	0.029	0.029
01/13/2004	01/27/2004	0.037	0.036	0.035	0.039	0.037
01/27/2004	02/10/2004	0.039	0.037	0.031	0.038	0.038
02/10/2004	02/24/2004	0.029	0.029	0.028	0.031	0.030
02/24/2004	03/09/2004	0.017	0.015	0.016	0.018	0.015
03/09/2004	03/23/2004	0.017	0.018	0.019	0.018	0.019
03/23/2004	04/06/2004	*	0.015	0.016	0.018	0.017
04/06/2004	04/20/2004	0.020	0.021	0.021	0.022	0.023
04/20/2004	05/04/2004	0.014	0.015	0.014	0.013	0.015
05/04/2004	05/18/2004	0.020	0.020	0.021	0.035	0.021
05/18/2004	06/01/2004	0.017	0.021	0.017	0.015	0.017
06/01/2004	06/15/2004	0.015	0.017	0.016	0.014	0.015
06/15/2004	06/29/2004	0.018	0.018	0.020	0.016	0.017
06/29/2004	07/13/2004	0.015	0.014	0.015	0.012	0.014
07/13/2004	07/27/2004	0.020	0.018	0.023	0.020	0.021
07/27/2004	08/10/2004	0.025	0.025	0.027	0.024	0.027
08/10/2004	08/24/2004	0.023	0.023	0.025	0.025	0.022
08/24/2004	09/07/2004	0.018	0.020	0.022	0.019	0.021
09/07/2004	09/21/2004	0.019	0.021	0.022	0.019	0.022
09/21/2004	10/05/2004	0.027	0.026	0.027	0.027	0.029
10/05/2004	10/19/2004	0.022	0.024	0.022	0.021	0.022
10/19/2004	11/02/2004	0.023	0.018	0.018	0.016	0.017
11/02/2004	11/16/2004	0.021	0.023	0.024	0.024	0.024
11/16/2004	11/30/2004	0.019	0.017	0.020	0.018	0.018
11/30/2004	12/14/2004	0.031	0.031	0.031	0.028	0.031
12/14/2004	12/28/2004	0.027	0.028	0.030	0.026	0.028

* Sample missed. See AREOR "Summary" for explanation.

Table 1.2
 Sample Type: Radioiodine Cartridge
 Analysis: Iodine-131
 Units: pCi/m³

Start Date	End Date	Station 1 (Indicator)	Station 2 (Indicator)	Station 56 (Indicator)	Station 6 (Control)	Station 7 (Control)
<u>Required LLD</u> →		<u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>
12/30/2003	01/13/2004	<0.019	<0.023	<0.015	<0.021	<0.018
01/13/2004	01/27/2004	<0.017	<0.016	<0.016	<0.018	<0.017
01/27/2004	02/10/2004	<0.010	<0.012	<0.016	<0.014	<0.011
02/10/2004	02/24/2004	<0.014	<0.018	<0.014	<0.011	<0.015
02/24/2004	03/09/2004	<0.019	<0.023	<0.021	<0.019	<0.016
03/09/2004	03/23/2004	<0.014	<0.013	<0.014	<0.014	<0.012
03/23/2004	04/06/2004	*	<0.019	<0.019	<0.025	<0.018
04/06/2004	04/20/2004	<0.018	<0.018	<0.015	<0.018	<0.015
04/20/2004	05/04/2004	<0.019	<0.019	<0.020	<0.018	<0.014
05/04/2004	05/18/2004	<0.018	<0.019	<0.017	<0.043	<0.015
05/18/2004	06/01/2004	<0.018	<0.027	<0.021	<0.021	<0.016
06/01/2004	06/15/2004	<0.011	<0.019	<0.016	<0.016	<0.017
06/15/2004	06/29/2004	<0.016	<0.020	<0.017	<0.018	<0.024
06/29/2004	07/13/2004	<0.013	<0.014	<0.011	<0.018	<0.012
07/13/2004	07/27/2004	<0.016	<0.022	<0.017	<0.019	<0.017
07/27/2004	08/10/2004	<0.021	<0.020	<0.017	<0.016	<0.016
08/10/2004	08/24/2004	<0.016	<0.019	<0.012	<0.020	<0.018
08/24/2004	09/07/2004	<0.014	<0.022	<0.016	<0.020	<0.020
09/07/2004	09/21/2004	<0.018	<0.021	<0.014	<0.020	<0.012
09/21/2004	10/05/2004	<0.014	<0.013	<0.016	<0.018	<0.019
10/05/2004	10/19/2004	<0.013	<0.013	<0.011	<0.015	<0.013
10/19/2004	11/02/2004	<0.031	<0.012	<0.014	<0.012	<0.012
11/02/2004	11/16/2004	<0.033	<0.014	<0.019	<0.017	<0.014
11/16/2004	11/30/2004	<0.014	<0.014	<0.013	<0.013	<0.012
11/30/2004	12/14/2004	<0.020	<0.020	<0.016	<0.018	<0.016
12/14/2004	12/28/2004	<0.023	<0.020	<0.023	<0.027	<0.018

* Sample missed. See AREOR "Summary" for explanation

Table 2.1
 Sample Type: Thermoluminescent Dosimeters
 Analysis: Gamma Dose
 Units: mrem/Qtr

Inner Ring (Indicators)					
Station	1st Qtr '03 (mrem)	2nd Qtr '03 (mrem)	3rd Qtr '03 (mrem)	4th Qtr '03 (mrem)	Annual Mean '03 (mrem)
3	6.0	6.0	5.0	5.0	5.5
145	7.0	8.0	8.0	8.0	7.8
146	8.0	8.0	8.0	9.0	8.3
147	7.0	7.0	7.0	6.0	6.8
1	8.0	9.0	8.0	9.0	8.5
148	8.0	9.0	8.0	**	8.3
110	8.0	9.0	9.0	7.0	8.3
149	7.0	9.0	9.0	7.0	8.0
4	8.0	8.0	8.0	7.0	7.8
150	9.0	10.0	9.0	8.0	9.0
151	10.0	10.0	9.0	9.0	9.5
2	8.0	9.0	9.0	7.0	8.3
56 *	10.0	10.0	10.0	10.0	10.0
109	9.0	9.0	9.0	8.0	8.8
108	9.0	9.0	10.0	8.0	9.0
152	7.0	8.0	9.0	8.0	8.0

* Station with highest annual mean.

** Sample missed. See AREOR "Summary" for explanation

Table 2.2
 Sample Type: Thermoluminescent Dosimeters
 Analysis: Gamma Dose
 Units: mrem/Qtr

Special Interest Areas - (Population Centers & Schools)					
Station	1st Qtr '03 (mrem)	2nd Qtr '03 (mrem)	3rd Qtr '03 (mrem)	4th Qtr '03 (mrem)	Annual Mean '03 (mrem)
6	8.0	8.0	7.0	6.0	7.3
111	6.0	6.0	5.0	6.0	5.8
116	8.0	8.0	8.0	7.0	7.8
125	5.0	5.0	5.0	5.0	5.0
127 *	8.0	9.0	9.0	8.0	8.5
137 *	8.0	9.0	9.0	8.0	8.5
153	8.0	9.0	8.0	7.0	8.0

* Stations with highest annual mean.

Special Interest Areas - (Control)					
Station	1st Qtr '03 (mrem)	2nd Qtr '03 (mrem)	3rd Qtr '03 (mrem)	4th Qtr '03 (mrem)	Annual Mean '03 (mrem)
7	7.0	7.0	7.0	7.0	7.0

Table 3.1
 Sample Type: Surface Water
 Analysis: Gamma Isotopic
 Units: pCi/l

Location	Start Date	End Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	<u>Required LLD</u> →		<u>15</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>30</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
Station 8 (Indicator)	12/31/2003	01/31/2004	<4.00	<8.32	<3.98	<3.57	<7.39	<5.93	<4.26	<8.56	<3.58	<3.36	<20.35	<8.39
Station 10 (Control)	12/31/2003	01/31/2004	<4.15	<9.58	<3.75	<4.22	<7.33	<7.58	<3.79	<9.75	<4.31	<3.47	<21.48	<5.57
Station 8 (Indicator)	01/31/2004	02/29/2004	<4.46	<10.67	<3.09	<4.32	<9.67	<7.86	<4.54	<8.30	<4.56	<4.64	<24.60	<3.54
Station 10 (Control)	01/31/2004	02/29/2004	<5.37	<9.73	<5.34	<3.80	<12.73	<9.36	<6.10	<6.76	<3.00	<5.24	<21.63	<4.41
Station 8 (Indicator)	02/29/2004	03/31/2004	<3.75	<4.79	<2.87	<2.29	<7.11	<5.46	<2.79	<4.18	<3.16	<2.98	<15.49	<3.68
Station 10 (Control)	02/29/2004	03/31/2004	<2.70	<7.44	<3.02	<3.49	<5.97	<5.49	<3.91	<6.53	<3.79	<3.79	<17.96	<4.69
Station 8 (Indicator)	03/31/2004	04/30/2004	<3.73	<10.84	<5.95	<8.29	<10.49	<8.50	<6.51	<8.05	<5.85	<5.54	<27.24	<9.87
Station 10 (Control)	03/31/2004	04/30/2004	<5.62	<9.01	<5.15	<6.23	<12.13	<10.97	<4.97	<10.37	<6.00	<5.98	<28.82	<11.14
Station 8 (Indicator)	04/30/2004	05/31/2004	<4.05	<6.63	<3.42	<3.38	<7.90	<6.39	<4.19	<6.86	<3.78	<4.22	<20.10	<6.02
Station 10 (Control)	04/30/2004	05/31/2004	<3.61	<6.07	<2.78	<3.87	<7.21	<5.70	<2.87	<7.42	<3.18	<3.71	<16.27	<6.99
Station 8 (Indicator)	05/31/2004	06/30/2004	<3.78	<8.40	<3.12	<2.56	<6.71	<5.94	<3.73	<6.28	<4.14	<3.36	<15.48	<5.12
Station 10 (Control)	05/31/2004	06/30/2004	<3.48	<7.52	<3.69	<4.06	<8.70	<7.04	<4.56	<5.91	<4.37	<3.35	<17.36	<5.43

Table 3.1
 Sample Type: Surface Water
 Analysis: Gamma Isotopic
 Units: pCi/l

Location	Start Date	End Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	<u>Required LLD</u> →		<u>15</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>30</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
Station 8 (Indicator)	06/30/2004	07/31/2004	<5.32	<11.26	<5.29	<5.10	<9.18	<9.52	<6.25	<11.84	<5.26	<4.07	<25.46	<8.92
Station 10 (Control)	06/30/2004	07/31/2004	<4.19	<10.55	<3.92	<4.40	<13.27	<6.65	<4.84	<11.20	<5.33	<1.64	<33.36	<3.72
Station 8 (Indicator)	07/31/2004	08/31/2004	<4.26	<3.28	<3.00	<3.86	<8.46	<5.54	<4.17	<8.38	<4.09	<3.33	<19.50	<6.41
Station 10 (Control)	07/31/2004	08/31/2004	<3.17	<7.33	<3.92	<2.33	<8.39	<6.29	<3.90	<7.88	<4.01	<2.73	<20.41	<5.76
Station 8 (Indicator)	08/31/2004	09/30/2004	<5.42	<10.19	<6.67	<4.76	<10.72	<8.12	<4.03	<9.50	<5.68	<4.99	<23.79	<6.57
Station 10 (Control)	08/31/2004	09/30/2004	<3.97	<9.81	<4.28	<3.70	<9.43	<7.89	<4.14	<6.78	<4.56	<4.25	<16.25	<4.29
Station 8 (Indicator)	09/30/2004	10/31/2004	<5.79	<9.76	<4.81	<4.88	<10.44	<10.14	<5.37	<7.97	<5.70	<5.70	<19.07	<10.13
Station 10 (Control)	09/30/2004	10/31/2004	<4.49	<6.47	<4.50	<4.42	<4.45	<8.32	<4.74	<6.51	<5.62	<5.68	<21.10	<7.98
Station 8 (Indicator)	10/31/2004	11/30/2004	<3.62	<6.21	<3.45	<3.09	<7.87	<5.59	<3.51	<3.42	<3.89	<3.66	<15.16	<4.14
Station 10 (Control)	10/31/2004	11/30/2004	<2.78	<5.93	<2.86	<3.32	<5.83	<5.41	<3.35	<4.37	<3.63	<3.14	<10.93	<4.42
Station 8 (Indicator)	11/30/2004	12/31/2004	<5.06	<11.74	<4.48	<3.46	<6.62	<7.55	<5.75	<13.17	<5.22	<5.79	<35.08	<7.88
Station 10 (Control)	11/30/2004	12/31/2004	<3.67	<9.13	<5.47	<4.03	<10.12	<7.90	<7.22	<10.79	<5.12	<5.72	<17.44	<11.74

Table 3.2
 Sample Type: Surface Water
 Analysis: Tritium
 Units: pCi/l

Location	Begin Date	End Date	H-3
		<u>Required LLD</u> →	<u>3000</u>
Station 8 (Indicator)	12/31/03	03/31/04	430
Station 10 (Control)	12/31/03	03/31/04	<611
Station 8 (Indicator)	03/31/04	06/30/04	386
Station 10 (Control)	03/31/04	06/30/04	<569
Station 8 (Indicator)	06/30/04	09/30/04	489
Station 10 (Control)	06/30/04	09/30/04	<578
Station 8 (Indicator)	09/30/04	12/31/04	872
Station 10 (Control)	09/30/04	12/31/04	282

Table 4.1
 Sample Type: Drinking Water
 Analysis: Gross Beta, Iodine-131 and Gamma Isotopic
 Units: pCi/l

Location	Collection Date	Gross Beta	I-131	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
Required LLD →		4.0	1.0	15	30	15	15	30	30	15	15	18	60	15
Station 14 (Indicator)	03/09/04	2.56	<0.90	<4.96	<8.36	<4.18	<5.09	<14.15	<8.61	<5.89	<5.41	<5.64	<25.86	<6.94
Station 57 (Control)	03/09/04	3.38	<0.84	<7.24	<10.28	<5.41	<5.89	<9.43	<10.65	<5.55	<5.82	<6.75	<25.36	<7.88
Station 14 (Indicator)	06/15/04	1.34	<0.90	<4.32	<8.68	<3.50	<3.26	<6.40	<6.43	<3.16	<3.61	<3.13	<17.77	<6.39
Station 57 (Control)	06/15/04	2.76	<0.89	<3.53	<5.62	<3.49	<3.49	<6.87	<5.96	<3.59	<3.81	<3.61	<18.79	<4.94
Station 14 (Indicator)	09/14/04	3.68	<0.83	<3.58	<9.89	<4.46	<4.39	<7.88	<9.81	<6.88	<5.35	<4.99	<13.32	<6.88
Station 57 (Control)	09/14/04	2.49	<0.88	<3.22	<4.41	<2.81	<3.03	<7.27	<5.37	<3.10	<2.84	<3.16	<12.35	<4.78
Station 14 (Indicator)	12/15/04	<1.53	<0.90	<4.01	<9.16	<3.74	<4.21	<6.92	<6.69	<4.37	<4.21	<3.66	<16.90	<5.16
Station 57 (Control)	12/15/04	<1.53	<0.90	<3.31	<8.18	<3.33	<3.58	<7.00	<6.93	<3.61	<3.34	<3.64	<16.01	<6.19

Table 4.2
Sample Type: Drinking Water
Analysis: Tritium
Units: pCi/l

Location	Collection Date	H-3
	<u>Required LLD</u> →	<u>2000</u>
Station 14 (Indicator)	03/09/04	<576
Station 57 (Control)	03/09/04	<575
Station 14 (Indicator)	06/15/04	<547
Station 57 (Control)	06/15/04	<557
Station 14 (Indicator)	09/14/04	<561
Station 57 (Control)	09/14/04	<555
Station 14 (Indicator)	12/15/04	<570
Station 57 (Control)	12/15/04	<579

Table 5.1
Sample Type: Sediment
Analysis: Gamma Isotopic
Units: pCi/kg

Location	Collection Date	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>150</u>	<u>180</u>
Station 8 (Indicator)	10/25/04	<96.52	318.30
Station 16 (Control)	10/25/04	<52.49	<42.60

Table 6.1
 Sample Type: Fish
 Analysis: Gamma Isotopic
 Units: pCi/kg

Location	Collection Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>130</u>	<u>260</u>	<u>130</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>150</u>
Station 8 (Indicator)	10/17/2004	<10.74	<46.44	<13.02	<17.48	<33.37	<10.06	<13.23
Station 16 (Control)	09/09/2004	<21.12	<9.04	<26.22	<11.87	<53.77	<18.88	<9.81

Table 7.1
 Sample Type: Food Products
 Analysis: Iodine-131 and Gamma Isotopic
 Units: pCi/kg

Location	Collection Date	I-131	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>60</u>	<u>60</u>	<u>80</u>
Station 13 (Indicator)	06/17/2004	<57.69	<44.42	<42.26
Station 55 (Control)	06/17/2004	<53.22	<41.53	<39.35
Station 13 (Indicator)	07/13/2004	<42.79	<47.74	<36.20
Station 55 (Control)	07/13/2004	<32.45	<19.86	<18.11
Station 13 (Indicator)	08/10/2004	<59.05	<48.41	<51.41
Station 55 (Control)	08/10/2004	<57.51	<39.22	<33.06

Table 8.1
 Sample Type: Interlaboratory Comparison
 Analysis: Gross Beta, Iodine-131 and Gamma Isotopic

Sample Type (units)	Study	Date	Analyses	Known Value ^a	RBS Value ^e	RBS N-Dev ^b	RBS N-Range ^c
Charcoal Cartridge (pCi/cartridge)	E4171-125	06/17/2004	I-131	81.9	84	0.44	0.361
Water (pCi/liter)	E4170-125	06/17/2004	Beta	286	251	-1.43	0.028
			Cr-51	250	234	-1.09	0.142
	E4169-125	06/17/2004	Mn-54	77.4	84.3	1.55	0.916
			Co-58	50.8	46.3	-1.52	0.465
			Fe-59	48.9	55.3	2.28	0.725
			Co-60	189	198	0.86	0.188
			Zn-65	109	107	-0.26	0.108
			I-131	84.3	87.0	0.55	0.841
			Cs-134	111	109	-0.36	0.319
			Cs-137	171	176	0.51	0.069
			Ce-141	172	181	0.94	0.618
	E4242-125	09/16/2004	H-3	12000	11685	-0.45	0.224
Air Filter (pCi/filter)	E4240-125	09/16/2004	Beta	67.7	66.7	-0.26	0.174
			Cr-51	129	115	-1.83	0.458
	E4243-125	09/16/2004	Mn-54	105	104.7	-0.05	0.338
			Co-58	54.8	55.5	0.23	0.614
			Fe-59	53.0	56.4	1.12	0.256
			Co-60	72.5	72.3	-0.05	0.807
			Zn-65	103	97.1	-0.99	0.241
			Cs-134	55.8	50.6	-1.60	0.191
			Cs-137	124	117	-1.02	0.143
			Ce-141	145	143	-0.20	0.244

Table 8.1
 Sample Type: Interlaboratory Comparison
 Analysis: Tritium and Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	Known Value ^a	RBS Value	RBS N-Dev ^b	RBS N-Range ^c
Sediment (pCi/gram)	E4241-125	09/16/2004	Cr-51	0.348	0.293	-2.72	0.424
			Mn-54	0.252	0.264	0.82	0.141
			Co-58	0.132	0.128	-0.52	0.492
			Fe-59	0.127	0.140	1.77	0.558
			Co-60	0.174	0.174	0.03	0.339
			Zn-65	0.248	0.264	1.09	0.333
			Cs-134	0.134	0.130	-0.52	0.485
			Cs-137	0.403	0.426	1.00	0.132
			Ce-141	0.348	0.352	0.20	0.424
Milk (pCi/liter)	E4172-125	06/17/2004	Cr-51	228	251	1.72	0.181
			Mn-54	70.5	74.0	0.86	0.335
			Co-58	46.2	46.0	-0.07	0.384
			Fe-59	44.5	44.4	-0.04	1.818
			Co-60	172	173	0.13	0.206
			Zn-65	99.3	91.7	-1.33	0.535
			I-131	58.2	53.7	-1.35	0.710
			Cs-134	101	93.3	-1.31	0.234
			Cs-137	156	147	-1.04	0.265
Ce-141	157	145	-1.29	0.263			

NOTES:

- (a) The "known" value as determined by Analytics.
- (b) The normalized deviation from the "known" value is computed from the deviation and the standard error of the mean; ± 2.00 is the warning limit and ± 3.00 is the control limit. This is a measure of accuracy of the analytical methods.
- (c) The normalized range is computed from the mean range, the control limit and the standard error of the range; $+2.00$ is the warning limit and $+3.00$ is the control limit. This is a measure of precision of the analytical methods.

Interlaboratory Comparison Program Exceptions

There were no results outside the control limits for accuracy in the 2004 cross check program participation studies.

ATTACHMENT 2

Sediment Dose Calculations

Sediment Dose Calculations

Dose calculation for the discharge sediment was performed using generalized equation found in Regulatory Guide 1.109, Appendix A as follows:

$$R = (40) \times (C) \times (U) \times (D) \times (W)$$

R = Annual dose to skin or total body in mrem/year;

40 = Area-mass conversion factor given in Appendix A of Regulatory Guide 1.109 in Kg/m²;

C = 2004 maximum radionuclide concentration in pCi/kg;

U = Maximum exposure time given in Table E-5 of Regulatory Guide 1.109 (67 hours for teenager);

D = External dose conversion factor for standing on contaminated ground given in Table E-6 of Regulatory Guide 1.109 in mrem/hr per pCi/m², and

W = Shore-width factor (0.1) given in Table A-2 of Regulatory Guide 1.109.

(Dose from Sediment in Millirem/Year)

Radionuclide	2004 Maximum Concentration	Conversion Factor For Skin	Total Skin Dose	Conversion Factor For Total Body	Total Body Dose
Cs-137	318.3	4.90 E-09	4.18 E-04	4.20 E-09	3.58 E-04
TOTAL			4.18 E-04		3.58 E-04