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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
2001 Annual Radiological Environmental Operating Report

Dear Sir or Madam:

Arkansas Nuclear One (ANO), Units 1 and 2, Technical Specifications 6.12.2.5 (Improved Technical Specification 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 2001. The radionuclides detected by the radiological environmental monitoring program during 2001 were significantly below regulatory limits; therefore, ANO plant operations during 2001 had no harmful effects nor resulted in any irreversible damage to the environment. This report fulfills the reporting requirements referenced above. This submittal contains no commitments. Should you have any questions regarding this submittal, please contact me.

Sincerely,

Sherrie R. Cotton

Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/nbm
Attachment

IE25

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ARKANSAS NUCLEAR ONE - UNITS 1 AND 2

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR 2001

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 23

2.8 Land Use Census Results 23

2.9 Interlaboratory Comparison Results 23

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY 27

3.1 2001 Program Results Summary 27

LIST OF TABLES

TABLE 1.1	RADIOLOGICAL ENVIRONMENTAL SAMPLING PROGRAM	12
TABLE 2.1	2001 LAND USE CENSUS	24
TABLE 3.1	RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY	28

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	25
FIGURE 2-2	DISCHARGE SEDIMENT	26

LIST OF ATTACHMENTS

ATTACHMENT 1	2001 RADIOLOGICAL MONITORING REPORT SUMMARY OF MONITORING RESULTS	32
ATTACHMENT 2	SEDIMENT DOSE CALCULATIONS	50

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, 2001 through December 31, 2001. This report fulfills the requirements of ANO Unit 1 Technical Specification 6.12.2.5 and Unit 2 Technical Specification 6.9.4. During 2001 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:

- Manganese-54, Cobalt-58, Cobalt-60 and Niobium-95 were detected in the surface water media during September and October while liquid radwaste discharges were occurring. However, the levels detected were well below regulatory reporting limits.

- Tritium levels in the surface water media continue to be below regulatory reporting limits.

- Cobalt-60 and Cesium-137 levels in the sediment media are not demonstrating any increase in comparison to previous years. Review indicates that 2001 levels are less than that of the historical average.

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

Cesium-137, attributable to fallout from previous atmospheric weapons testing, was detected once at the Station 16 sediment control location during 2001. However, the level detected is less than that of the historical average at this 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 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 2001, 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. Their review of 2001 data, in many cases, showed 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 2001. 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, 2001 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 collocated 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 2001 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 the technical specifications.

- **Air Samples**

Listed below are air sampler deviations that occurred during 2001 due to electrical failures (broken power lines and transformer fire). These deviations did not result in a missed sample and no LLD values were exceeded. As described in footnote (a) to ANO Units 1 and 2 ODCM Table 2.6-2, deviations are permitted from the required sampling schedule due to malfunction of sampling equipment and other legitimate reasons.

Station	Sampling Period	Run Time (Hours)
2	07/31/2001 – 08/14/2001	129.2
	08/14/2001 – 08/28/2001	119.8
7	06/19/2001 – 07/03/2001	328.5
	07/03/2001 – 07/17/2001	41.3
	07/17/2001 – 07/31/2001	286.6

- **Missed Samples**

One third quarter TLD (Station 127) was missed during 2001 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 2001 was 99% (95 of 96).

- **Surface Water**

  Tritium was initially detected in the first quarter composite for Station 8 (Discharge) at a concentration of 18,559 pCi/l and was documented in CR-ANO-C-2001-00199. ANO's review of liquid radwaste discharges did identify an increase in curies of tritium released, when comparing the fourth quarter of 2000 to the first quarter of 2001. However, it was determined that this was not the cause of the elevated tritium levels detected in the fourth quarter composite sample.

  Since monthly composite samples are collected for gamma analysis at this location, ANO requested the River Bend Station (RBS) Environmental Laboratory (central location for Entergy Operations' radiological environmental analysis) to perform a tritium analysis on the January, February and March samples. Results from these analyses showed a tritium range from 953 pCi/l to 1,898 pCi/l.

  Based on these results, ANO requested the RBS Environmental Laboratory to composite the January, February and March sample for gamma analysis, and perform a tritium analysis. The results of this composite showed a concentration of 1,761 pCi/l. Since it is apparent that the original tritium composite sample may have been contaminated, ANO personnel have elected to report the value of 1,761 pCi/l for the first quarter Station 8 tritium composite. This value is further validated by the Arkansas Department of Health (ADEH) who also obtained a result 1,675 pCi/l on the first quarter split tritium composite sample between ANO and the ADH.

- **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 2001.

Attachments

Attachment 1 contains results of air, TLD, water, sediment, fish, and food products samples collected in 2001. 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 2001. 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 2001 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 is 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 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	**Radioiodine and Particulates** 2 samples close to the Site Boundary, in (or near) different sectors with the highest calculated annual average groundlevel D/Q.	**Station 2 (240° - 0.5 miles)** - East of the sewage treatment plant. **Station 56 (273° - 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.
	Radioiodine and Particulates 1 sample from the vicinity of a community having the highest calculated annual average groundlevel D/Q.	**Station 6 (111° - 7.0 miles)** - Entergy local office in Russellville (305 South Knoxville Avenue).		
	Radioiodine and Particulates 1 sample from a control location 15-30 km (10 – 20 miles) distance.	**Station 7 (209° - 19.3 miles)** – Entergy Supply Yard on Highway 10 in Danville.		
	Radioiodine and Particulates One location sampled voluntarily by ANO.	**Station 1 (90° - 0.6 miles)** - On a pole near the meteorology tower.		
Direct Radiation	**TLDs** 16 inner ring stations with two or more dosimeters in each meteorological sector in the general area of the Site Boundary	**Station 1 (90° - 0.6 miles)** - On a pole near the meteorology tower. **Station 2 (240° - 0.5 miles)** - East of the sewage treatment plant. **Station 3 (6° - 0.7 miles)** – Junction of Highway 333 and Flatwood Road.	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	<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 4 (176° - 0.5 miles)** – West of May Cemetery entrance on south side of the road. **Station 56 (273° - 0.4 miles)** - West end of the sewage treatment plant. **Station 108 (313° - 0.9 miles)** - South on Flatwood Road on a utility pole. **Station 109 (290° - 0.6 miles)** - Utility pole across from the junction of Flatwood Road and Round Mountain Road. **Station 110 (140° - 0.7 miles)** - Bunker Hill Lane on the first utility pole on the left. **Station 145 (30° - 0.6 miles)** - Near west entrance to the RERTC on a utility pole. **Station 146 (50° - 0.6 miles)** - South end of east parking lot at RERTC on a utility pole. **Station 147 (63° - 0.6 miles)** - West side of Bunker Hill Road, approximately 100 yards from intersection with State Highway 333. **Station 148 (122° - 0.5 miles)** - Intersection of Bunker Hill Road with Scott Lane on county road sign post.	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	**TLDs** 16 inner ring stations with two or more dosimeters in each meteorological sector in the general area of the Site Boundary	**Station 149 (150° - 0.6 miles)** – On a utility pole on the south side of May Road. **Station 150 (201° - 0.6 miles)** – North side of May Road on a utility pole. **Station 151 (220° - 0.4 miles)** – West side of sewage treatment plant near the lake on a metal post. **Station 152 (338° - 0.8 miles)** – North side of State Highway 333 on a London City limit sign post.	Once per 92 days.	Gamma Dose – Once per 92 days.
	TLDs 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.	**Station 6 (111° - 7.0 miles)** - Entergy local office in Russellville (305 South Knoxville Avenue). **Station 7 (209° - 19.3 miles)** – Entergy Supply Yard on Highway 10 in Danville. **Station 111 (117° - 2.0 miles)** – Marina Road on a utility pole on the left just prior to curve. **Station 116 (320° - 1.9 miles)** - Highway 333 and Highway 64 in London on a utility pole north of the railroad tracks.		

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	**TLDs** 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.	**Station 125 (46° - 9.0 miles)** - College Street on a utility pole at the southeast corner of the red brick school building. **Station 127 (102° - 5.3 miles)** - Arkansas Tech Campus on a utility pole across from Paine Hall. **Station 137 (150° - 8.1 miles)** – On a speed limit sign on the right in front of the Morris R. Moore Arkansas National Guard Armory. **Station 153 (305° - 9.2 miles)** - Knoxville Elementary School near the school entrance gate on a utility pole.	Once per 92 days.	Gamma Dose – Once per 92 days.
Waterborne	**Surface Water** 1 indicator location (influenced by plant discharge) 1 control location (uninfluenced by plant discharge)	**Station 8 (180° - 0.1 miles)** - Plant discharge canal. **Station 10 (90° - 0.5 miles)** – Plant intake canal.	Once per 92 days.	Gamma isotopic and tritium analyses once per 92 days.
	Drinking Water 1 indicator location (influenced by plant discharge) 1 control location (uninfluenced by plant discharge)	**Station 14 (70° - 5.3 miles)** - Russellville city water system from the Illinois Bayou. **Station 57 (208° - 19.5 miles)** - Danville public water supply treatment on Fifth Street.	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	**Sediment** 1 indicator location (influenced by plant discharge) 1 control location (uninfluenced by plant discharge)	**Station 8 (245° - 0.7 miles)** - Plant discharge canal. **Station 16 (290° - 5.5 miles)** - Panther Bay on south side of Arkansas River across from mouth of Piney Creek.	Once per 365 days.	Gamma isotopic analysis once per 365 days.
Ingestion	**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.	Currently, no available milking animals within 8 km of ANO.	Once per 92 days.	Gamma isotopic and I-131 analyses once per 92 days.
	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.	**Station 8 (230° - 0.6 miles)** – Plant discharge canal. **Station 16 (290° - 5.5 miles)** - Panther Bay on south side of Arkansas River across from mouth of Piney Creek.	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	**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. 1 sample location of broadleaf vegetation (edible or non-edible) from a control location 15 – 30 km distant, if milk sampling is not performed.	**Station 13 (278° - 0.5 miles)** - West from ANO toward Gate 4 onto Flatwood Road. **Station 55 (209° - 16.6 miles)** – Intersection of Highway 27 and 154.	Three per 365 days.	Gamma isotopic and I-131 analyses three times per 365 days.

FIGURE 1-1

SAMPLE COLLECTION SITES – NEAR FIELD

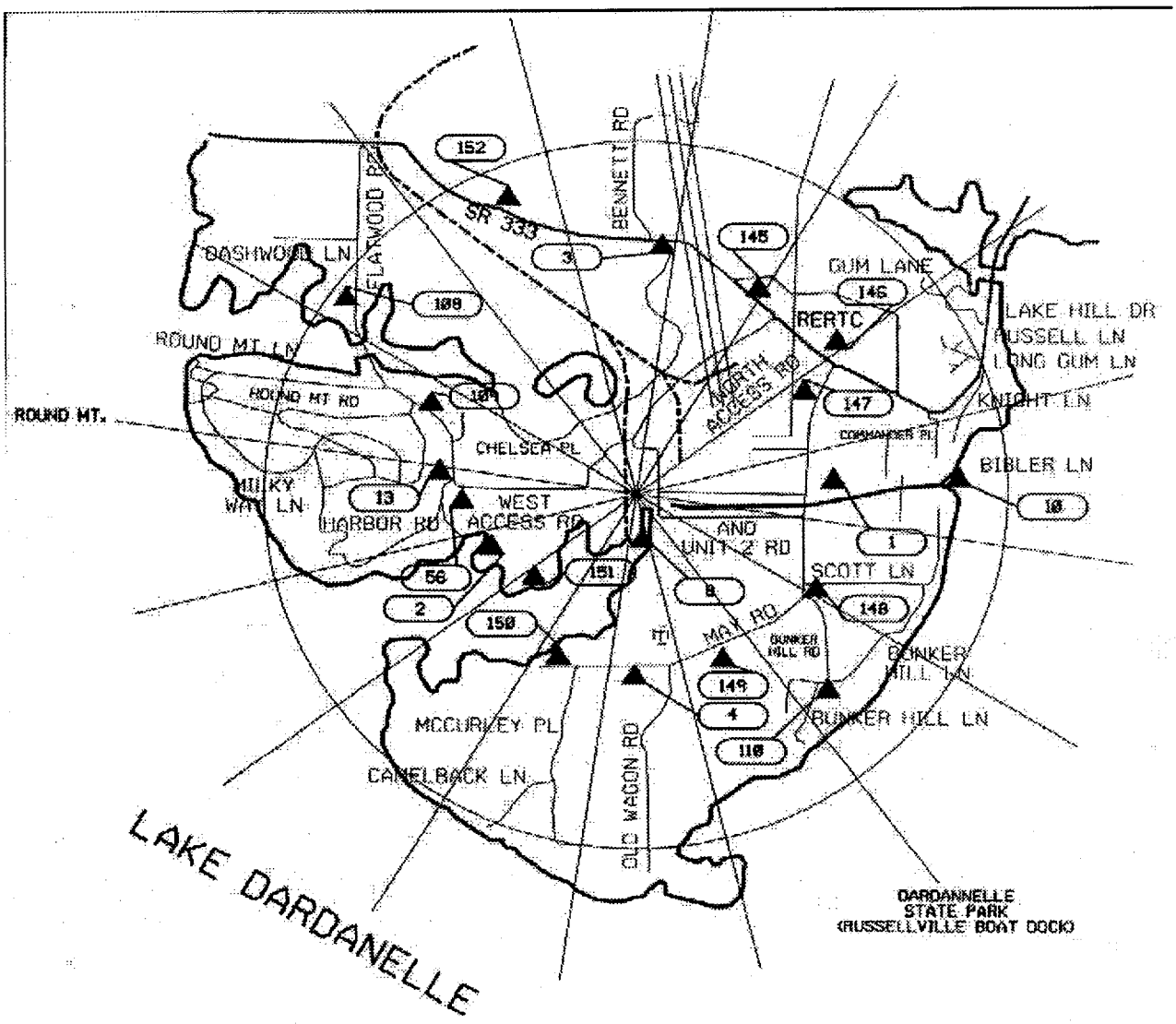
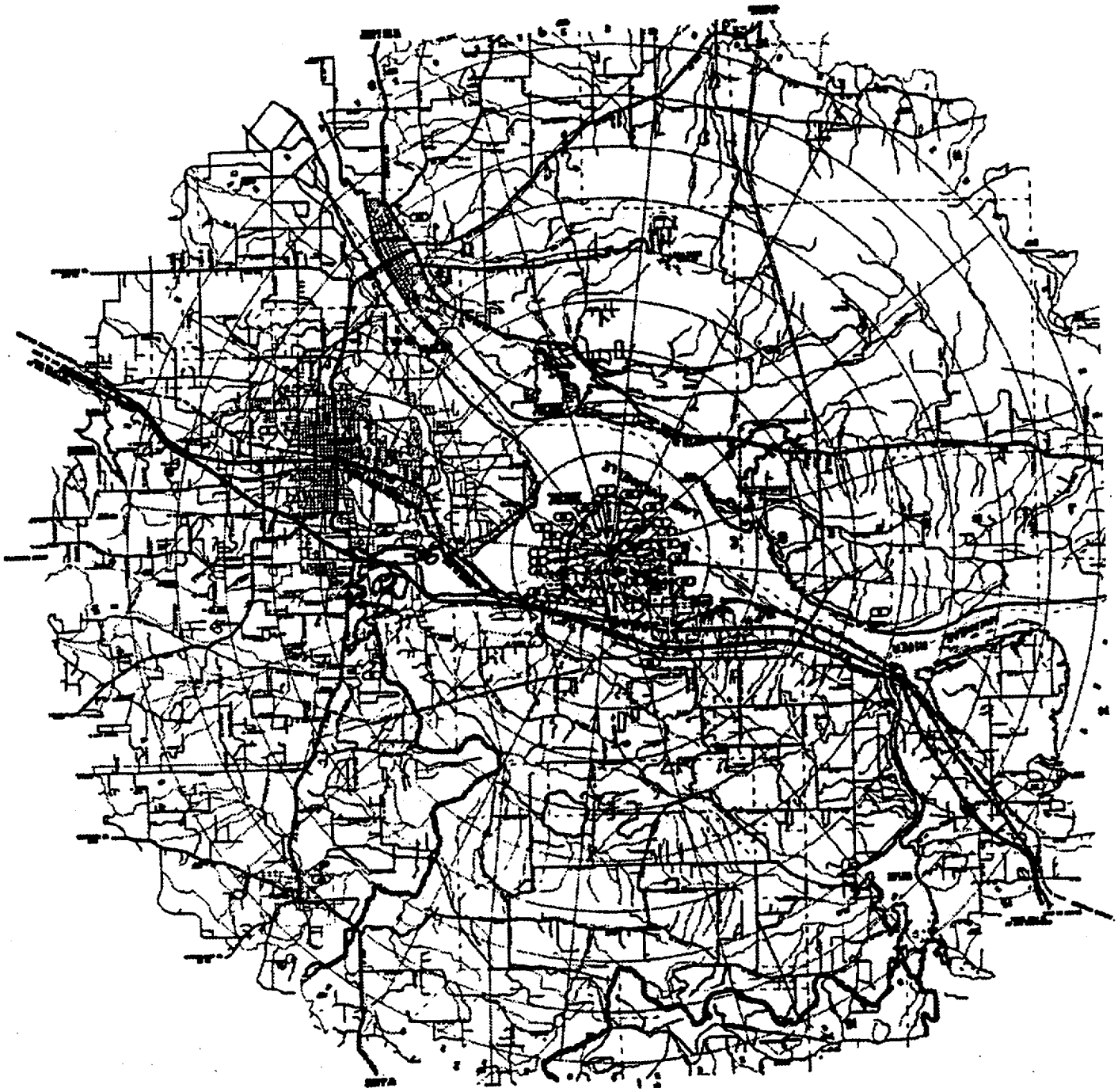


FIGURE 1-2

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 2001, as has been the case in previous years. Indicator gross beta air particulate results for 2001 were similar to those 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/m^3.

Monitoring Period	Result
Preoperational	0.05
1996 – 2000	0.02
2001	0.02

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 control location readings for previous years as shown in Figure 2-1.

ANO's comparison of the results to the control, as seen in Figure 2-1, indicates that the ambient radiation levels are unaffected by plant operations. Although four of the TLD stations shown in Figure 2-1 were slightly above the historical maximum control location value of 11.0 mrem/quarter, they were all within the upper (+) three standard deviation range of 12.0 mrem for the control. Therefore, levels continue to remain at or near background.

2.3 Water Sample Results

Analytical results for 2001 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. During 2001, gamma radionuclides and tritium was detected at the indicator location during liquid radwaste discharges from the plant.

Tritium was detected at concentrations ranging from 492.0 – 1,761.0 pCi/l with an average concentration of 869.8 pCi/l. However, from 1995 through 2000, tritium concentrations at this location have typically ranged from 430.0 - 5,588 pCi/l. Therefore, concentrations detected during 2001 are within the typical range of previous operational years and are not demonstrating any increase. Liquid effluent limitations imposed by 10CFR20 were met for all discharges and concentrations detected in the surface water samples were below reporting levels based on the reporting criteria outlined in Units 1 and 2 ODCM Table 2.6-3 when averaged over a calendar quarter.

In addition, the following gamma radionuclides were detected during the reporting period:

Radionuclide	Average Concentration	Range
Manganese-54	17.5	None
Cobalt-58	32.9	2.47 – 59.1
Cobalt-60	40.0	4.14 – 70.3
Niobium-95	18.4	16.8 – 20.0

As already stated above, liquid effluent limitations imposed by 10CFR20 were met for all discharges and concentrations detected in the surface water samples were below reporting levels based on the reporting criteria outlined in Units 1 and 2 ODCM Table 2.6-3 when averaged over a calendar quarter.

Based on the above, the operation of ANO had no impact on this pathway during 2001 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. In addition, gross beta concentrations at the indicator and control locations are similar as shown in Table 3.1. Listed below is a comparison of 2001 indicator results to preoperational and operational years. Results are reported as annual average pCi/l.

Radionuclide	2001	1996 – 2000	Preoperational
Gross Beta	2.15	3.44	2.0
Iodine-131	<LLD	<LLD	<LLD
Gammas	<LLD	<LLD	<LLD
Tritium	<LLD	335.0	200.0

Based on this comparison, the operation of ANO had no impact on this pathway during 2001 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 2001 and analyzed for gamma radionuclides. As in previous years, radionuclides attributable to ANO were detected in the discharge sediment. However, Figure 2-3 shows that 2001 levels are below those of previous operational years. 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 2001 had no significant impact on the environment or public.

2.5 Milk Sample Results

Milk samples were not collected during 2001 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 2001.

2.6 Fish Sample Results

Fish samples were collected from two locations and analyzed for gamma radionuclides. In 2001, 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 2001 and analyzed for Iodine-131 and gamma radionuclides. The 2001 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

The land use census did not identify any new locations during the September 2001 survey that yielded a calculated dose or dose commitment greater than those currently calculated, even though two new homes under construction were identified in Sectors "S" and "W" and minor adjustments were made to the nearest residence mileage distances (see Table 2.1).

Also, the land use census identified no milk-producing animals within a five-mile radius of the plant site. ANO personnel chose not to perform a garden census in 2001, which is allowed by ANO Units 1 and 2 ODCM Section 2.6.2, in lieu of broadleaf vegetation sampling in the meteorological sector (Sector 13) with the highest "D/Q".

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, 2001 Radiological Environmental Monitoring Report, contains these results. ANO's review of RBS' interlaboratory comparison indicated that 98% of the sample results for accuracy and precision were within the acceptable control limits of the three normalized deviations. For those sample results outside the acceptable control limits, ANO's and RBS's review indicated no impact on previously reported data. Attachment 1 also provides additional discussion regarding sample results outside the acceptable control limits.

TABLE 2.1

2001 Land Use Census

NEAREST RESIDENCE WITHIN FIVE MILES

Direction	Sector	Distance (miles)
N *	1	0.9
NNE	2	1.2
NE	3	0.9
ENE *	4	0.8
E	5	0.8
ESE	6	0.8
SE	7	0.8
SSE	8	0.8
S *	9	0.8
SSW *	10	0.7
SW	11	2.9
WSW	12	0.7
W *	13	0.9
WNW	14	0.8
NW *	15	1.0
NNW *	16	0.9

* Changed since previous census.

Figure 2-1

TLD Radiation Dose

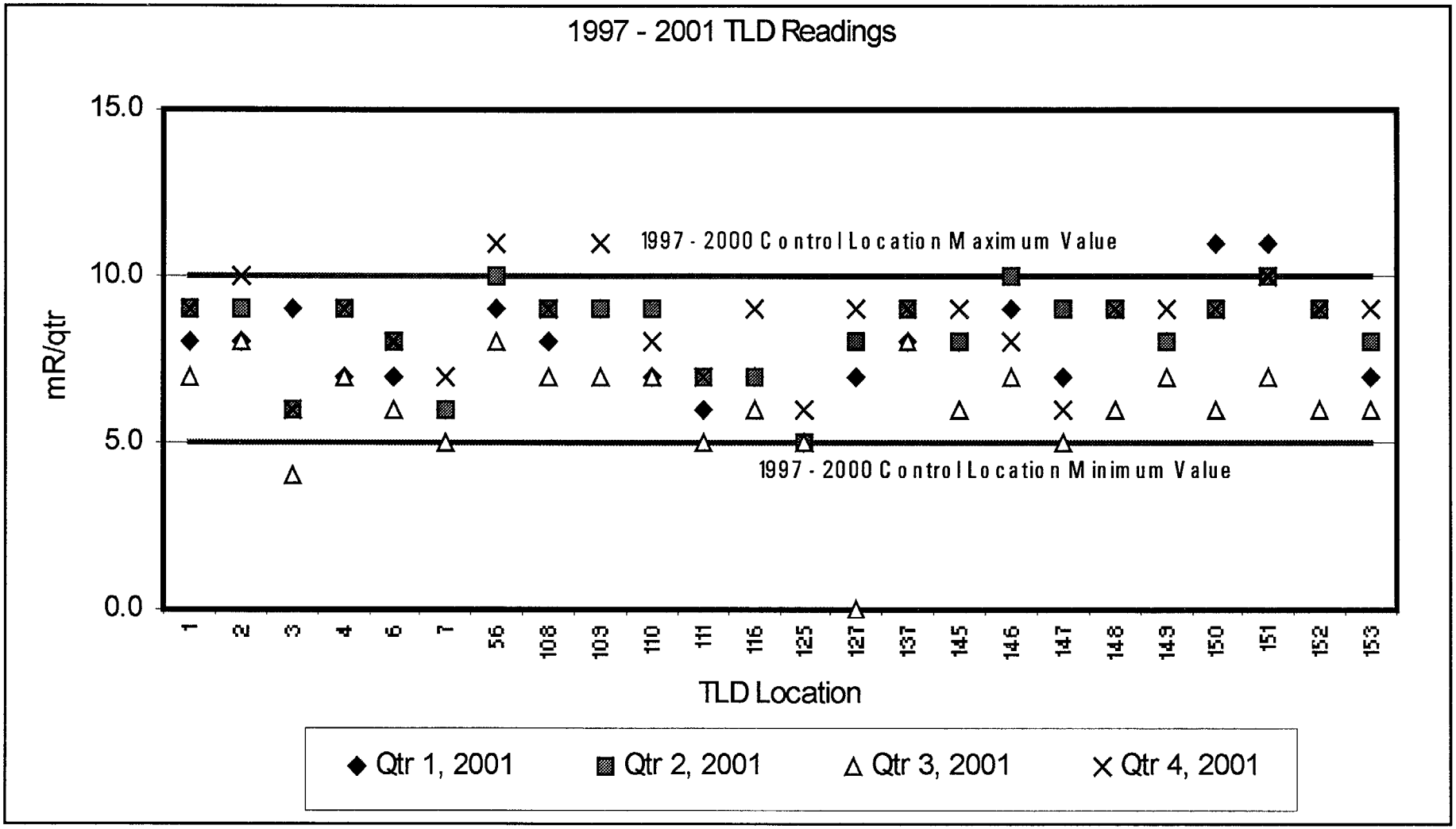
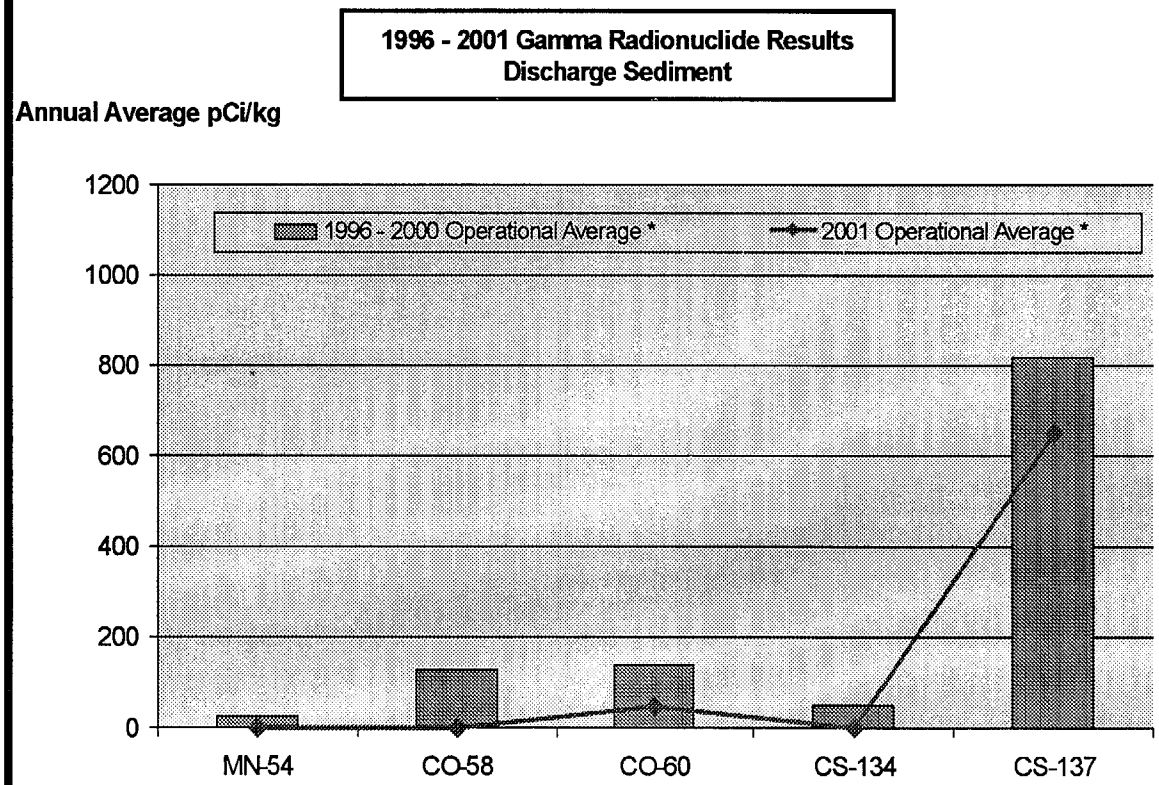


Figure 2-2

Discharge Sediment



*** Average based on positive results only.**

3.0 Radiological Environmental Monitoring Program Summary

3.1 2001 Program Results Summary

Table 3.1 summarizes the 2001 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 2001

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 130	0.01	0.02 (78 / 78) [0.01 – 0.05]	Station 1 (90° , 0.6 mi)	0.03 (26 / 26) [0.02 - 0.05]	0.03 (52 / 52) [0.02 - 0.10]	0
Airborne Iodine (pCi/m^3)	I-131 130	0.07	<LLD	N/A	N/A	<LLD	0
Inner Ring TLDs (mR/Qtr)	Gamma 64	(f)	8.2 (64 / 64) [4.0 – 11.0]	Station 151 (220°, 0.4 mi)	9.5 (4 / 4) [7.0 – 11.0]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma 27	(f)	7.1 (27 / 27) [5.0 – 9.0]	Station 137 (150°, 8.1 mi)	8.5 (4 / 4) [8.0 – 9.0]	N/A	0
Control TLD (mR/Qtr)	Gamma 4	(f)	N/A	N/A	N/A	6.0 (4 / 4) [5.0 – 7.0]	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 2001**

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	869.8 (4 / 4) [492.0 – 1761.0]	Station 8 (180°, 0.1 mi)	869.8 (4 / 4) [492.0 – 1761.0]	<LLD	0
	GS 25						
	Mn-54	15	17.5 (1 / 13) [NA]	Station 8 (180°, 0.1 mi)	17.5 (1 / 13) [NA]	<LLD	0
	Fe-59	30	<LLD	N/A	N/A	<LLD	0
	Co-58	15	32.9 (3 / 13) [2.47 – 59.1]	Station 8 (180°, 0.1 mi)	32.9 (3 / 13) [2.47 – 59.1]	<LLD	0
	Co-60	15	40.0 (3 / 13) [4.14 – 70.3]	Station 8 (180°, 0.1 mi)	40.0 (3 / 13) [4.14 – 70.3]	<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	18.4 (2 / 13) [16.8 – 20.0]	Station 8 (180°, 0.1 mi)	18.4 (2 / 13) [16.8 – 20.0]	<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 2001

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/1)	GB 8	4	2.15 (3 / 4) [1.69 – 2.44]	Station 14 (70°, 5.3 mi)	2.15 (3 / 4) [1.69 – 2.44]	2.33 (3 / 4) [2.03 – 2.70]	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						
	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

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 2001

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]		
Bottom Sediment	GS 3						
(pCi/kg)	Co-60	(f)	47.7 (1 / 1) [N/A]	Station 8 (245°, 0.7 mi)	47.7 (1 / 1) [N/A]	<LLD	0
	Cs-134	150	<LLD	N/A	N/A	<LLD	0
	Cs-137	180	650.0 (1 / 1) [N/A]	Station 8 (245°, 0.7 mi)	650.0 (1 / 1) [N/A]	36.2 (1 / 2) [N/A]	0
Fish	GS 4						
(pCi/kg)	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	I-131 6	60	<LLD	N/A	N/A	N/A	0
(pCi/kg)	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

2001 Radiological Monitoring Report

Summary of Monitoring Results

TABLE OF CONTENTS

TABLE 1.1	AIR PARTICULATE	34
TABLE 1.2	RADIOIODINE CARTRIDGE	35
TABLE 2.1	THERMOLUMINESCENT DOSIMETERS	36
TABLE 2.2	THERMOLUMINESCENT DOSIMETERS	37
TABLE 3.1	SURFACE WATER (GAMMA ISOTOPIC)	38
TABLE 3.2	SURFACE WATER (TRITIUM)	40
TABLE 4.1	DRINKING WATER (GAMMA ISOTOPIC & I-131)	41
TABLE 4.2	DRINKING WATER (TRITIUM)	42
TABLE 5.1	SEDIMENT	43
TABLE 6.1	FISH	44
TABLE 7.1	FOOD PRODUCTS	45
TABLE 8.1	INTERLABORATORY COMPARISON	46

Table 1.1
Sample Type: **Air Particulate**
Analysis: Gross Beta
Units: pCi/m^3

Start Date	End Date	Station 1 (Indicator)	Station 2 (Indicator)	Station 56 (Indicator)	Station 6 (Control)	Station 7 (Control)
Required LLD →		**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
12/19/2000	01/02/2001	0.04	0.04	0.03	0.04	0.04
01/02/2001	01/16/2001	0.03	0.03	0.03	0.03	0.03
01/16/2001	01/30/2001	0.04	0.03	0.03	0.03	0.03
01/30/2001	02/13/2001	0.02	0.02	0.02	0.02	0.02
02/13/2001	02/27/2001	0.02	0.02	0.02	0.02	0.02
02/27/2001	03/13/2001	0.03	0.03	0.03	0.02	0.03
03/13/2001	03/27/2001	0.02	0.02	0.02	0.02	0.02
03/27/2001	04/10/2001	0.02	0.02	0.02	0.02	0.02
04/10/2001	04/24/2001	0.02	0.02	0.02	0.02	0.02
04/24/2001	05/08/2001	0.03	0.02	0.02	0.03	0.02
05/08/2001	05/22/2001	0.02	0.02	0.02	0.02	0.02
05/22/2001	06/05/2001	0.02	0.02	0.01	0.02	0.02
06/05/2001	06/19/2001	0.02	0.02	0.02	0.10	0.02
06/19/2001	07/03/2001	0.02	0.02	0.02	0.02	0.02
07/03/2001	07/17/2001	0.02	0.02	0.02	0.02	0.02
07/17/2001	07/31/2001	0.03	0.03	0.03	0.02	0.02
07/31/2001	08/14/2001	0.02	0.03	0.02	0.02	0.02
08/14/2001	08/28/2001	0.03	0.03	0.03	0.03	0.03
08/28/2001	09/11/2001	0.02	0.01	0.02	0.02	0.02
09/11/2001	09/25/2001	0.04	0.03	0.03	0.03	0.03
09/25/2001	10/09/2001	0.02	0.03	0.02	0.03	0.03
10/09/2001	10/23/2001	0.02	0.02	0.02	0.02	0.03
10/23/2001	11/06/2001	0.02	0.02	0.02	0.02	0.02
11/06/2001	11/20/2001	0.05	0.05	0.04	0.05	0.04
11/20/2001	12/04/2001	0.02	0.02	0.02	0.03	0.02
12/04/2001	12/18/2001	0.02	0.02	0.02	0.02	0.02

Table 1.2
Sample Type: **Radioiodine Cartridge**
Analysis: Iodine-131
Units: pCi/m^3

Start Date	End Date	Station 1 (Indicator)	Station 2 (Indicator)	Station 56 (Indicator)	Station 6 (Control)	Station 7 (Control)
Required LLD →		**0.07**	**0.07**	**0.07**	**0.07**	**0.07**
12/19/2000	01/02/2001	<0.01	<0.01	<0.01	<0.01	<0.01
01/02/2001	01/16/2001	<0.01	<0.01	<0.01	<0.01	<0.01
01/16/2001	01/30/2001	<0.02	<0.02	<0.02	<0.02	<0.02
01/30/2001	02/13/2001	<0.02	<0.01	<0.02	<0.02	<0.02
02/13/2001	02/27/2001	<0.02	<0.02	<0.02	<0.02	<0.02
02/27/2001	03/13/2001	<0.01	<0.01	<0.01	<0.01	<0.01
03/13/2001	03/27/2001	<0.01	<0.01	<0.01	<0.01	<0.01
03/27/2001	04/10/2001	<0.02	<0.01	<0.01	<0.01	<0.01
04/10/2001	04/24/2001	<0.01	<0.01	<0.01	<0.01	<0.01
04/24/2001	05/08/2001	<0.02	<0.02	<0.02	<0.02	<0.02
05/08/2001	05/22/2001	<0.01	<0.01	<0.02	<0.01	<0.01
05/22/2001	06/05/2001	<0.01	<0.01	<0.01	<0.01	<0.01
06/05/2001	06/19/2001	<0.01	<0.01	<0.01	<0.05	<0.01
06/19/2001	07/03/2001	<0.02	<0.02	<0.02	<0.02	<0.02
07/03/2001	07/17/2001	<0.02	<0.02	<0.01	<0.02	<0.07
07/17/2001	07/31/2001	<0.01	<0.01	<0.02	<0.01	<0.01
07/31/2001	08/14/2001	<0.02	<0.05	<0.02	<0.02	<0.02
08/14/2001	08/28/2001	<0.02	<0.03	<0.02	<0.02	<0.02
08/28/2001	09/11/2001	<0.02	<0.03	<0.03	<0.02	<0.03
09/11/2001	09/25/2001	<0.02	<0.01	<0.02	<0.02	<0.01
09/25/2001	10/09/2001	<0.01	<0.02	<0.01	<0.01	<0.01
10/09/2001	10/23/2001	<0.02	<0.02	<0.02	<0.02	<0.02
10/23/2001	11/06/2001	<0.02	<0.02	<0.02	<0.02	<0.02
11/06/2001	11/20/2001	<0.02	<0.01	<0.02	<0.02	<0.02
11/20/2001	12/04/2001	<0.01	<0.01	<0.01	<0.02	<0.01
12/04/2001	12/18/2001	<0.01	<0.01	<0.01	<0.01	<0.01

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

Inner Ring (Indicators)					
Station	**1st Qtr '01 (mrem)**	**2nd Qtr '01 (mrem)**	**3rd Qtr '01 (mrem)**	**4th Qtr '01 (mrem)**	**Annual Mean '01 (mrem)**
3	9.0	6.0	4.0	6.0	**6.3**
145	8.0	8.0	6.0	9.0	**7.8**
146	9.0	10.0	7.0	8.0	**8.5**
147	7.0	9.0	5.0	6.0	**6.8**
1	8.0	9.0	7.0	9.0	**8.3**
148	9.0	9.0	6.0	9.0	**8.3**
110	7.0	9.0	7.0	8.0	**7.8**
149	8.0	8.0	7.0	9.0	**8.0**
4	7.0	9.0	7.0	9.0	**8.0**
150	11.0	9.0	6.0	9.0	**8.8**
151 *	11.0	10.0	7.0	10.0	**9.5**
2	8.0	9.0	8.0	10.0	**8.8**
56	9.0	10.0	8.0	11.0	**9.3**
109	9.0	9.0	7.0	11.0	**9.0**
108	8.0	9.0	7.0	9.0	**8.3**
152	9.0	9.0	6.0	9.0	**8.3**

*** Location with highest annual mean.**

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

Special Interest Areas - (Population Centers & Schools)					
Station	**1st Qtr '01 (mrem)**	**2nd Qtr '01 (mrem)**	**3rd Qtr '01 (mrem)**	**4th Qtr '01 (mrem)**	**Annual Mean '01 (mrem)**
6	7.0	8.0	6.0	8.0	**7.3**
111	6.0	7.0	5.0	7.0	**6.3**
116	7.0	7.0	6.0	9.0	**7.3**
125	5.0	5.0	5.0	6.0	**5.3**
127	7.0	8.0	Missing	9.0	**8.0**
137 *	8.0	9.0	8.0	9.0	**8.5**
153	7.0	8.0	6.0	9.0	**7.5**

*** Location with highest annual mean.**

Special Interest Areas – (Control)					
Station	**1st Qtr '01 (mrem)**	**2nd Qtr '01 (mrem)**	**3rd Qtr '01 (mrem)**	**4th Qtr '01 (mrem)**	**Annual Mean '01 (mrem)**
7	6.0	6.0	5.0	7.0	**6.0**

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
	Required LLD →		**15**	**30**	**15**	**15**	**30**	**30**	**15**	**15**	**15**	**18**	**60**	**15**
Station 8 (Indicator)	12/31/2000	01/31/2001	<3.46	<8.93	<3.56	<2.69	<10.70	<6.46	<4.81	<7.77	<3.94	<4.13	<19.80	<7.24
Station 10 (Control)	12/31/2000	01/31/2001	<4.20	<7.45	<3.68	<3.64	<8.50	<6.59	<4.75	<6.06	<3.27	<3.82	<16.10	<8.08
Station 8 (Indicator)	01/31/2001	02/28/2001	<2.72	<6.25	<3.36	<2.49	<6.84	<5.22	<3.43	<5.19	<3.90	<3.76	<13.60	<4.12
Station 10 (Control)	01/31/2001	02/28/2001	<3.48	<6.89	<3.70	<3.32	<6.44	<5.39	<4.52	<5.57	<3.41	<4.39	<18.10	<5.37
Station 8 (Indicator)	02/28/2001	03/31/2001	<2.78	<5.95	<2.50	<3.42	<4.55	<6.04	<2.75	<5.36	<3.49	<4.56	<13.00	<5.95
Station 10 (Control)	02/28/2001	03/31/2001	<3.96	<7.77	<6.08	<3.07	<12.80	<5.69	<6.50	<8.50	<4.71	<4.96	<23.90	<9.19
Station 8 (Indicator)	03/31/2001	04/30/2001	<2.92	<5.86	<4.08	<3.63	<7.26	<6.73	<3.73	<8.10	<4.14	<3.06	<19.50	<8.20
Station 10 (Control)	03/31/2001	04/30/2001	<3.10	<6.71	<3.44	<3.27	<6.32	<6.36	<3.73	<8.76	<2.78	<3.59	<24.70	<8.14
Station 8 (Indicator)	04/30/2001	05/31/2001	<3.73	<7.25	<3.82	<2.67	<10.10	<6.82	<3.81	<8.21	<4.06	<3.95	<16.30	<7.73
Station 10 (Control)	04/30/2001	05/31/2001	<4.38	<6.96	<3.50	<3.87	<4.38	<6.08	<4.04	<7.02	<4.10	<4.10	<19.20	<5.90
Station 8 (Indicator)	05/31/2001	06/30/2001	<6.29	<9.59	<6.35	<5.00	<11.40	<7.57	<5.89	<7.70	<4.07	<5.64	<19.30	<6.53
Station 10 (Control)	05/31/2001	06/30/2001	<5.60	<9.85	<5.94	<4.24	<11.30	<8.70	<5.02	<7.43	<5.02	<5.48	<22.80	<8.22

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
	Required LLD →		**15**	**30**	**15**	**15**	**30**	**30**	**15**	**15**	**15**	**18**	**60**	**15**
Station 8 (Indicator)	06/30/2001	07/31/2001	<3.99	<5.91	<3.19	<3.20	<7.31	<5.53	<3.67	<5.24	<4.03	<3.52	<13.80	<6.74
Station 10 (Control)	06/30/2001	07/31/2001	<1.77	<5.83	<3.13	<3.19	<7.14	<6.64	<3.37	<5.01	<3.26	<3.18	<12.10	<4.70
Station 8 (Indicator)	07/31/2001	08/31/2001	<4.59	<6.50	<2.95	<4.81	<7.66	<6.73	<4.74	<6.25	<4.12	<3.65	<16.90	<5.97
Station 10 (Control)	07/31/2001	08/31/2001	<4.05	<5.96	<3.83	<3.12	<8.87	<5.52	<4.09	<6.06	<3.25	<3.84	<18.50	<5.28
Station 8 (Indicator)	08/31/2001	09/30/2001	<12.10	<14.50	**37.20**	**45.50**	<18.20	<14.20	**16.80**	<13.6	<7.23	<6.93	<39.60	<7.88
Station 8 (Indicator) *	08/31/2001	09/30/2001	**17.50**	<11.00	**59.10**	**70.30**	<9.78	<12.90	**20.00**	<14.0	<5.85	<5.78	<38.60	<8.51
Station 10 (Control)	08/31/2001	09/30/2001	<4.80	<12.10	<4.77	<6.37	<13.40	<8.42	<8.04	<11.4	<5.69	<6.32	<29.80	<9.47
Station 8 (Indicator)	09/30/2001	10/31/2001	<4.48	<7.16	**2.47**	**4.14**	<8.14	<6.53	<5.25	<6.12	<4.19	<3.27	<20.80	<6.88
Station 10 (Control)	09/30/2001	10/31/2001	<2.92	<9.20	<4.09	<3.28	<7.54	<5.86	<3.40	<6.90	<3.73	<2.89	<19.80	<6.72
Station 8 (Indicator)	10/31/2001	11/30/2001	<3.18	<9.94	<4.01	<2.70	<6.15	<5.98	<5.58	<13.0	<3.85	<4.51	<29.40	<9.78
Station 10 (Control)	10/31/2001	11/30/2001	<2.54	<7.90	<3.74	<2.39	<5.47	<7.95	<4.84	<11.6	<3.92	<3.66	<22.50	<9.73
Station 8 (Indicator)	11/30/2001	12/31/2001	<3.20	<7.37	<2.71	<3.86	<7.07	<5.75	<4.13	<7.91	<3.16	<3.28	<19.10	<7.16
Station 10 (Control)	11/30/2001	12/31/2001	<4.43	<8.78	<3.85	<4.68	<8.37	<5.33	<4.41	<6.88	<3.62	<3.68	<20.30	<5.70

*** Duplicate sample.**

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

Location	Begin Date	End Date	H-3
		Required LLD →	**3000**
Station 8 (Indicator)	12/31/2000	03/31/2001	1,761.00
Station 10 (Control)	12/31/2000	03/31/2001	<565.00
Station 8 (Indicator)	03/31/2001	06/30/2001	537.00
Station 10 (Control)	03/31/2001	06/30/2001	<527.00
Station 8 (Indicator)	06/30/2001	09/30/2001	492.00
Station 10 (Control)	06/30/2001	09/30/2001	<541.00
Station 8 (Indicator)	09/30/2001	12/31/2001	689.00
Station 10 (Control)	09/30/2001	12/31/2001	<537.00

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)	03/07/2001	2.44	<0.89	<1.19	<2.31	<1.18	<1.18	<2.38	<2.23	<1.37	<1.30	<1.38	<6.25	<1.92
Station 57 (Control)	03/07/2001	2.03	<0.83	<0.99	<2.11	<1.04	<1.02	<2.02	<1.90	<1.11	<1.16	<1.03	<5.02	<1.74
Station 14 (Indicator)	06/12/2001	<1.59	<0.88	<4.87	<5.60	<4.77	<4.86	<11.80	<5.87	<5.48	<5.11	<4.03	<22.10	<10.70
Station 57 (Control)	06/12/2001	<1.65	<0.89	<3.71	<6.75	<4.82	<4.80	<5.81	<4.58	<5.42	<5.51	<4.31	<18.00	<7.40
Station 14 (Indicator)	09/19/2001	1.69	<0.90	<3.33	<9.40	<4.14	<3.67	<9.33	<8.65	<6.25	<5.26	<5.62	<12.30	<6.93
Station 57 (Control)	09/19/2001	2.70	<0.90	<6.35	<7.09	<5.54	<5.75	<8.56	<11.60	<4.42	<5.17	<6.12	<24.60	<4.03
Station 14 (Indicator)	12/07/2001	2.33	<0.98	<3.17	<8.37	<2.97	<3.34	<8.77	<6.63	<4.51	<3.80	<3.42	<14.70	<5.10
Station 57 (Control)	12/07/2001	2.25	<0.90	<2.91	<5.63	<2.41	<2.61	<5.32	<4.61	<2.95	<3.26	<3.04	<11.40	<3.81

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

Location	Collection Date	H-3
	Required LLD ➔	**2000**
Station 14 (Indicator)	03/07/2001	<561.00
Station 57 (Control)	03/07/2001	<560.00
Station 14 (Indicator)	06/12/2001	<524.00
Station 57 (Control)	06/12/2001	<520.00
Station 14 (Indicator)	09/19/2001	<560.00
Station 57 (Control)	09/19/2001	<558.00
Station 14 (Indicator)	12/07/2001	<549.00
Station 57 (Control)	12/07/2001	<544.00

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

Location	Collection Date	Co-60	Cs-134	Cs-137
	Required LLD →	**NA**	**150**	**180**
Station 8 (Indicator)	09/21/2001	47.70	<150.00	650.00
Station 16 (Control)	09/25/2001	<99.9	<122.00	<98.70
Station 16 (Control)	09/25/2001	<78.3	<102.00	36.20

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
	Required LLD →	**130**	**260**	**130**	**130**	**260**	**130**	**150**
Station 8 (Indicator)	09/11/2001	<8.73	<26.00	<10.30	<8.90	<19.20	<6.55	<8.00
Station 16 (Control)	09/11/2001	<15.70	<64.60	<21.90	<9.48	<43.70	<10.60	<12.90
Station 8 (Indicator)	09/20/2001	<15.40	<48.50	<14.10	<17.40	<34.70	<13.30	<11.70
Station 16 (Control)	09/20/2001	<7.53	<22.90	<7.82	<6.79	<24.10	<7.36	<7.40

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
	Required LLD →	**60**	**60**	**80**
Station 13 (Indicator)	06/12/2001	<28.90	<21.30	<16.80
Station 55 (Control)	06/13/2001	<55.00	<28.00	<26.00
Station 13 (Indicator)	07/11/2001	<59.50	<42.00	<34.40
Station 55 (Control)	07/11/2001	<43.50	<39.70	<56.00
Station 13 (Indicator)	08/08/2001	<59.70	<25.10	<33.40
Station 55 (Control)	08/08/2001	<45.00	<16.50	<25.90

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

Sample Type (units)	Study	Date	Analysis	Known Value [a]	RBS Value	RBS N-Dev [b]	RBS N-Range [c]
Air Filter (pCi/filter)	E2818-125	09/20/01	BETA	90.0 ± 17.3	93.0	0.60	0.065
Charcoal Cartridge (pCi/cartridge)	E2673A-125	06/14/01	I-131	80.0 ± 13.9	79.8	-0.04	0.148
	E2908-125	12/06/01	I-131	91.0 ± 15.8	90.8	-0.03	0.467
Water (pCi/liter)	E2576-125	03/22/01	BETA	168 ± 43.7	162	-0.44	0.211
	E2574-125	03/22/01	CR-51	242 ± 21.0	240	-0.29	0.391
			MN-54	101 ± 8.75	104	1.03	0.234
			CO-58	48.0 ± 8.66	47.2	-0.28	0.189
			FE-59	84.0 ± 8.66	89.5	1.91	0.992
			CO-60	147 ± 12.7	144	-0.63	0.643
			ZN-65	186 ± 32.2	180	-0.59	0.064
			I-131	90.0 ±15.6	89.6	-0.08	0.965
			CS-134	129 ± 11.2	132	0.90	0.733
			CS-137	102 ± 8.83	101	-0.37	0.845
			CE-141	94.0 ± 8.66	93.4	-0.21	0.697
	E2575-125 (Duplicate)	03/22/01	CR-51	242 ± 21.0	251	1.24	2.734
			MN-54	101 ± 8.75	103	0.57	0.234
			CO-58	48.0 ± 8.66	52.3	1.48	0.295
			FE-59	84.0 ± 8.66	91.6	2.63	0.697
			CO-60	147 ± 12.7	140	-1.57	0.321
			ZN-65	186 ± 32.2	187	0.09	0.349
			I-131	90.0 ±15.6	93.7	0.72	1.523
			CS-134	129 ± 11.2	128.7	-0.09	0.733
			CS-137	102 ± 8.83	99.8	-0.76	0.220
			CE-141	94.0 ± 8.66	94.9	0.32	0.591

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]
Water	E2674-125	06/14/01	H-3	7494 ± 1298	7635	0.33	0.130
(pCi/liter)	E2816-125	09/20/01	CR-51	265 ± 23.0	269	0.48	1.382
			MN-54	149 ± 12.9	155	1.39	0.000
			CO-58	128 ± 11.1	127	-0.27	0.369
			FE-59	62.0 ± 8.66	70.0	2.84	0.473
			CO-60	193 ± 16.7	197	0.78	0.551
			ZN-65	184 31.9	185	0.06	0.032
			I-131	60.0 ± 10.4	59.0	-0.19	0.276
			CS-134	116 ± 10.1	109	-2.09	0.204
			CS-137	232 ± 20.1	233	0.15	0.815
			CE-141	88.0 ± 8.66	91.0	1.17	1.004
	E2817-125	9/20/01	CR-51	265 ± 23.0	269	0.57	0.401
	(Duplicate)		MN-54	149 ± 12.9	155	1.47	0.159
			CO-58	128 ± 11.1	128	0.09	0.646
			FE-59	62.0 ± 8.66	71	**3.24** [d]	0.366
			CO-60	193 ± 16.7	195	0.30	0.796
			ZN-65	184 ± 31.9	189	0.44	0.225
			I-131	60.0 ± 10.4	59.7	-0.09	0.226
			CS-134	116 ± 10.1	111	-1.39	0.306
			CS-137	232 ± 20.1	230	-0.35	0.153
			CE-141	88.0 ± 8.66	94	2.24	0.236

Table 8.1
Sample Type: **Interlaboratory Comparison**
Analysis: Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	Known Value [a]	RBS Value	RBS N-Dev [b]	RBS N-Range [c]
Sediment	E2909-125	12/6/01	CR-51	0.631 ± 0.055	0.613	-0.97	0.600
(pCi/gram)			MN-54	0.189 ± 0.033	0.207	1.69	0.241
			Co-58	0.115 ± 0.010	0.117	0.68	0.267
			FE-59	0.129 ± 0.022	0.145	2.10	0.545
			CO-60	0.449 ± 0.039	0.465	1.21	0.465
			ZN-65	0.262 ± 0.045	0.288	1.70	0.187
			CS-134	0.252 ± 0.022	0.250	-0.29	0.319
			CS-137	0.531± 0.046	0.537	0.39	0.707
			CE-141	0.481 ± 0.042	0.498	1.20	0.069

NOTES:

(a) The "known" values are listed with a range reflecting control (3 sigma) limits.

(b) The normalized deviation from the "known" value is computed from the deviation and the standard error of the mean; ±2.000 is the warning limit and ±3.000 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; +2.000 is the warning limit and +3.000 is the control limit. This is a measure of precision of the analytical methods.

(d) The results reported were out of the control limits.

Interlaboratory Comparison Program Exceptions

There was one result outside the control limits for accuracy in the 2001 cross check program participation studies. This result was in a gamma isotopic analysis of water sample.

The study result outside the control limits for accuracy was in the analysis of the September 20, 2001 Fe-59 nuclide sample study, which is a duplicate sample for that study. The Fe-59 result was within control limits for the other water sample in this quarterly study. RBS normalized-deviation for the analysis was +3.24 with control limits of ±3.00. This high bias result is considered conservative and is considered as having no impact on past results of the program. The bias high result for Fe-59 is contributed to coincidence summing effects. A coincidence summing correction was employed in the past, but was discontinued due to the production of non-conservative low-bias results. Fe-59 results were all within control limits in other crosscheck samples for the year 2001. The normalized-deviations for Fe-59 in other samples during year 2001 were 1.91, 2.63, 2.84, and 2.10.

There is no impact accessed on previously reported data due to these results. Environmental samples are analyzed and reported with a ninety-five percent confidence level that the analytical result with its associated error encompasses the "true" value. Ninety-six percent of RBS environmental crosscheck results were within control limits for accuracy and precision during 2001.

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) × (C) × (U) × (D) × (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/m^2;

C = 2001 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/m^2, and

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

(Dose from Sediment in Millirem/Year)

Radionuclide	2001 Maximum Concentration	Conversion Factor For Skin	Total Skin Dose	Conversion Factor For Total Body	Total Body Dose
Co-60	47.7	2.00 E-08	2.56 E-04	1.70 E-08	2.17 E-04
Cs-137	650.0	4.90 E-09	8.54 E-04	4.20 E-09	7.32 E-04
TOTAL			**1.11 E-03**		**9.49 E-04**