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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  
Annual Radiological Environmental Operating Report - 1994

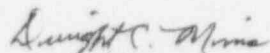
Gentlemen:

Arkansas Nuclear One (ANO), Units 1 and 2, Technical Specifications 6.12.2.5 and 6.9.4, respectively, require the submittal of an annual radiological environmental operating report for the previous calendar year prior to May 1 of each year.

Attached is the annual radiological environmental operating report for ANO for the year 1994. All radionuclides detected by the radiological environmental monitoring program during 1994 were significantly below regulatory limits. Therefore, plant operation during 1994 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 me.

Very truly yours,



Dwight C. Mims  
Director, Licensing

DCM/jjd

attachment

9505020226 941231  
PDR ADOCK 05000313  
R PDR

IF25  
11

cc: Mr. Leonard J. Callan  
Regional Administrator  
U. S. Nuclear Regulatory Commission  
Region IV  
611 Ryan Plaza Drive, Suite 400  
Arlington, TX 76011-8064

NRC Senior Resident Inspector  
Arkansas Nuclear One  
1448 S. R. 333  
Russellville, AR 72801

Mr. George Kalman  
NRR Project Manager Region IV/ANO-1 & 2  
U. S. Nuclear Regulatory Commission  
NRR Mail Stop 13-H-3  
One White Flint North  
11555 Rockville Pike  
Rockville, MD 20852

Ms. Greta Dicus  
Arkansas Department of Health  
Division of Radiation Control  
and Emergency Management  
4815 West Markham Street  
Little Rock, AR 72205



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**ARKANSAS NUCLEAR ONE - UNITS 1 AND 2**

**ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR 1994**

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ANNEXES TO THE ANNUAL REPORTS

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT FOR 1994



## 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, 1994 through December 31, 1994. This report fulfills the requirements of ANO Unit 1 Technical Specification 6.12.2.5 and Unit 2 Technical Specification 6.9.4.

During 1994, as in previous years, ANO detected radionuclides attributable to plant operations in the discharge surface water (Tritium), sediment (Manganese-54, Cobalt-58, Cobalt-60 and Cesium-137) and fish (Cesium-137). ANO personnel routinely monitor results from this area in order to note any trends. Their review of 1994 results from this area indicates the following:

- Tritium levels in the discharge basin surface water were representative of the historic average and were well below reporting requirements.
- Radionuclides in the discharge sediment are not demonstrating any increase in comparison to previous years. Review indicates that 1994 levels are less than those of previous years.
- Radionuclides in the discharge fish are not demonstrating any increase in comparison to previous years. In addition, all results were well below the required lower limit of detection as identified in the technical specification.

Section 2.0 of this report discusses these results in more detail.

### Radiological Environmental Monitoring Program

Radiation and radioactivity are monitored around ANO within a 22-mile radius. The environment around ANO has been monitored for radiation and radioactive contamination for approximately 22 years. The REMP was established about two years before the station became operational (1974). This program provides data on background radiation and radioactivity which is normally present in the area. ANO has continued to monitor the environment by sampling air, milk, water, food products, vegetation, sediment and fish, as well as measuring radiation directly.

Samples are collected from both indicator and control locations. Indicator locations are within approximately five miles of the site, and are expected to show any increases or buildup of radioactivity that might occur due to station operation. Control locations are further from the station and are expected to indicate the presence of only naturally occurring radioactivity. The results obtained from indicator locations are compared with control locations and with concentrations present in the environment before the station became operational. This allows for assessment of any impact the operation of ANO might have had on the surrounding environment.

In 1994, 958 radiological environmental samples were collected and analyzed for radioactivity. Radionuclide concentrations measured at indicator locations were compared to control locations, as well as concentrations, in previous years. ANO personnel assessed plant operations using this data and concluded that no significant impact occurred on the environs surrounding the plant. Radiation levels in the environment were undetectable in many cases and at or near previous levels in significant pathways associated with ANO. Therefore, plant operation has had no harmful effects nor resulted in any irreversible damage to the environment.

### **Attachments**

Attachment I contains results of air, milk, water, food products, vegetation, sediment and fish samples collected in 1994 and analyzed by Entergy Services, Inc. (ESI) System Chemistry. Results of ESI System Chemistry's participation in the Environmental Protection Agency (EPA) Interlaboratory Comparison Program are also contained in Attachment I. Attachment II contains results of thermoluminescent dosimeters (TLDs) collected in 1994 and analyzed by ANO Dosimetry. Attachment III contains statistical analyses performed on air and TLD results and the equations that were utilized. Attachment IV 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."

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## **SECTION 1.0**

### **INTRODUCTION**

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## Introduction

### **1.1 Radiation**

People are always subjected to natural radiation. This radiation exposure comes from the sun and naturally occurring radioactive materials present in the earth, structures we inhabit, and in the food and water we consume. There are radioactive gases in the air we breathe and our bodies are radioactive. The levels of natural or background radiation vary greatly from location to location. The average United States resident receives approximately 300 millirem a year from natural background as shown in Table 1-1.

In addition, man-made sources of radiation, such as X-rays, radiation for medical purposes, fallout from nuclear explosives testing and radioactive materials from nuclear power plants contribute additional exposure. However, as shown in Table 1-1, an individual receives the major portion of dose from natural background and other sources with nuclear power plants contributing <1.0 millirem. This would also be the case for individuals living around or next to ANO.

### **1.2 Benefits of Radiation**

Nuclear power plays an important part in meeting today's electricity needs and will continue to serve as an important source of energy well into the future. In addition, other uses of radiation have brought tremendous benefits to our everyday lives during the past 20 or 30 years. Radioisotopes and controlled radiation are used, for example, to sterilize medical supplies, to improve the keeping qualities of foods, in industrial processes, in medical science, and in the study of environmental pollution, agriculture and hydrology. Medical diagnosis and treatment are the main sources of public exposure to man-made radiation, but the benefit in terms of human lives and health is enormous.

### 1.3 Radiation Perspectives

Although it is not generally realized, radioactive materials from nuclear power plants are strictly regulated, while naturally occurring radiation is basically unregulated; however, as shown in Table 1-1, the public receives more exposure to naturally occurring radiation. For example, a person living near a 1000 MWe coal fired plant could receive 7.2 millirem in a year from naturally occurring radioactive materials contained in the coal that is burned. A person living adjacent to a similar sized nuclear plant is expected to receive less than 1.0 millirem in a year.

Radioactive elements lose their radioactivity, and resulting toxicity, with time. In comparison, potentially toxic non-radioactive materials, such as lead, silver and mercury, can present a danger to humans until properly treated, stabilized, and disposed.

### 1.4 Radiological Environmental Monitoring Program (REMP) Purpose and Design Criteria

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

- to measure radiation levels and their variations in environmental media in the area surrounding the plant,
- to determine average levels of radiation and radioactive material in various environmental media,
- to evaluate environmental sampling procedures, equipment and techniques, and
- to detect effects, if any, of ANO operation on the environmental radiation levels and concentrations.

The design criteria for the REMP are:

- to analyze important pathways for anticipated types and quantities of radionuclides released into the environment,

- to consider the possibility of a buildup of long-lived radionuclides in the environment and physical and biological accumulations that may contribute to human exposures,
- to consider the potential radiation exposure to plant and animal life in the environment surrounding ANO, and
- to correlate levels of radiation and radioactivity in the environment with radioactive releases from station operation.

#### 1.5 **Dose Pathways Associated with ANO**

Figure 1-1 shows potential exposure pathways that could occur as a result of a nuclear power plant. However, the most significant environmental dose pathways from a nuclear power station are direct dose from gaseous effluent and thyroid dose due to the ingestion of milk. ANO operations are expected to have little, if any, impact by these pathways due to the very low levels of radiation released.

#### 1.6 **Pathways Monitored**

The airborne, waterborne, ingestion and direct radiation pathways are monitored as required by ANO Technical Specifications. The REMP includes the sampling program required to meet the above intent. This program is supplemented with additional sampling in order to provide a comprehensive and well-balanced program. Sample locations to monitor exposure pathways are described in Table 1-2 and shown in Figure 1-2. Section 2.0 of this report provides a discussion of 1994 sampling results.

#### 1.7 **Previous Data Comparison**

A comparison of 1994 results to preoperational studies, operational controls and previous annual radiological environmental operating reports indicate no significant changes. Results remained at levels similar to those of previous years. Such results confirm that ANO effluent controls and equipment are performing satisfactorily and that plant operation has had no harmful effects nor resulted in any irreversible damage to the environment.

TABLE 1-1

Radiation Risks \***Radiation Risks in Perspective**

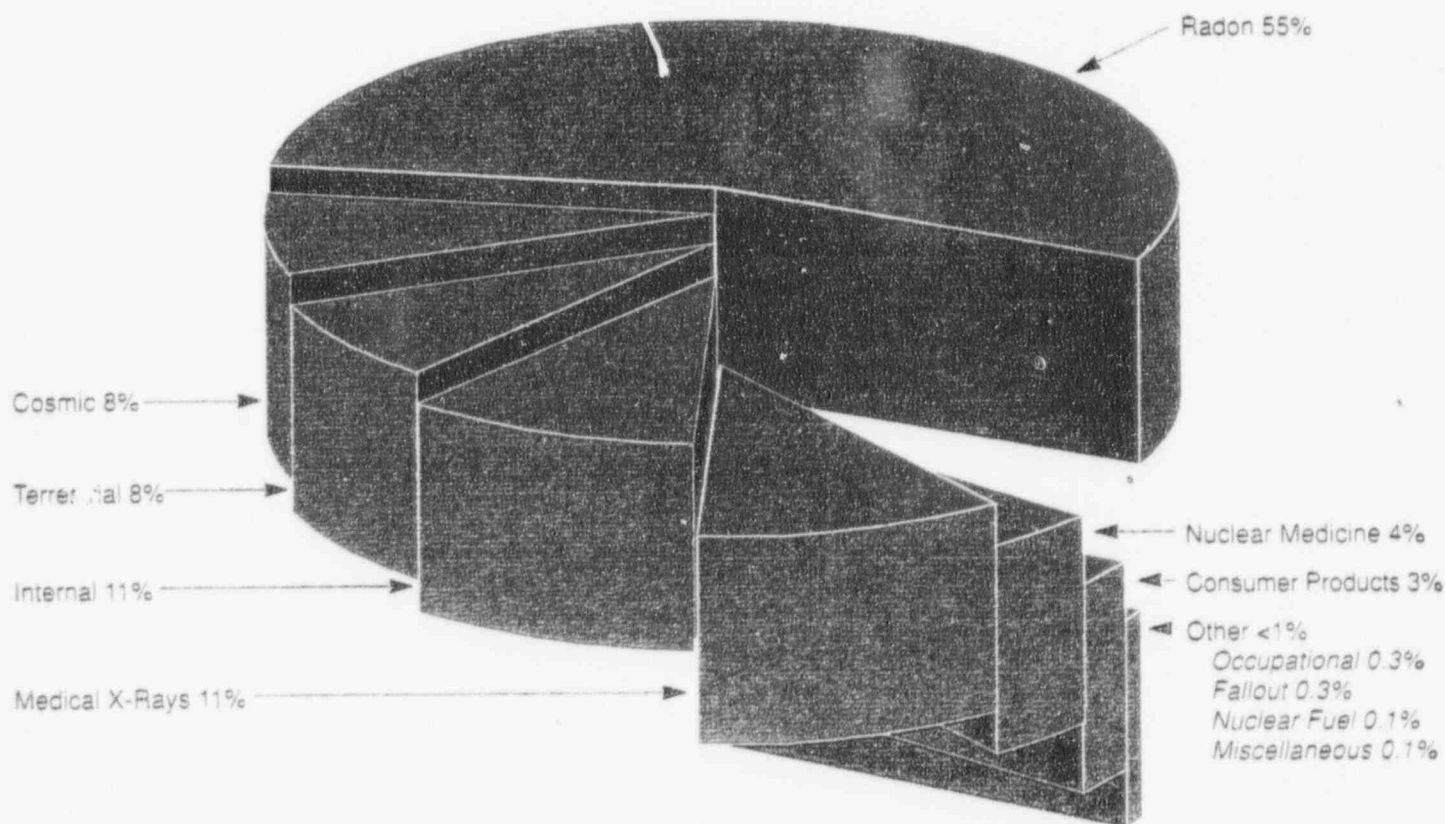
## Radiation Dose Comparisons

	Approximate MREM/Year
Natural Background	
Average U.S. Resident .....	300
Average Denver Resident .....	380
Radon in average households	
New York/New Jersey .....	360
Massachusetts .....	475
Medical Exposure	
Average U.S. Citizen .....	50
Typical Medical Examination	
Dental X-Rays (Full Mouth) .....	3,000 (Skin)
Chest X-Rays .....	10 (Bone)
Gastro-Intestinal Series (Upper & Lower) .....	1,400 (Bone)
Occupational Exposure	
Average Pilgrim Station	
Radiation Worker (since 1980) .....	600 MREM/Year

**Estimated Loss of Average Life**

## Expectancy From Various Health Risks

Health Risk	Estimated Days of Life Expectancy Lost (average)
Smoking 20 Cigarettes/Day .....	2370 (6.5 years)
Overweight (by 20%) .....	985 (2.7 Years)
All Accidents Combined .....	435 (1.2 Years)
Auto Accidents .....	200
Alcohol Consumption (U.S. Average) .....	130
Home Accidents .....	95
Drowning .....	41
Natural Background Radiation .....	8
Medical Diagnostic X-Rays (U.S. Average) .....	6
All Catastrophes (Earthquake, Etc.) .....	3.5
One REM Radiation .....	1

**Background Radiation Sources**

The percentage contribution of various radiation sources to the total average effective dose equivalent in the U.S. population.



TABLE 1-2

Sample Stations

---

Sample Station Number: 1

Approximate Direction and Distance from Plant: 88° - 0.6 miles

Sample Types: 1) Airborne radioiodines  
2) Airborne particulates  
3) Direct radiation

Sample Station Location:

The sample station is near the meteorology tower approximately 0.6 miles east of ANO.

---

Sample Station Number: 2

Approximate Direction and Distance from Plant: 235° - 0.4 miles

Sample Types: 1) Airborne radioiodines  
2) Airborne particulates  
3) Direct radiation

Sample Station Location:

IF traveling from ANO,

THEN go approximately 0.2 miles west toward Gate 4. Turn left and go approximately 0.1 miles. Turn right and go approximately 0.1 miles. The sample station is on the right at the former AP&L lodge location.

IF traveling south on Flatwood Road,

THEN go approximately 0.25 miles from sample station 109. Veer left at fork in road and go approximately 0.2 miles. Turn right and go approximately 0.1 miles. Turn right and go approximately 0.1 miles. The sample station is on the right at the former AP&L lodge location.

---

Sample Station Number: 3

Approximate Direction and Distance from Plant: 0° - 0.6 miles

Sample Types: 1) Airborne radioiodines  
2) Airborne particulates  
3) Direct radiation  
4) Groundwater (alternate)

Sample Station Location:

IF traveling west on Highway 333,

THEN go approximately 0.35 miles from Gate 2 at ANO. Turn left onto gravel road and go approximately 0.05 miles. The sample station is on the left.

IF traveling east on Highway 333,

THEN go approximately 0.9 miles from junction of Highway 333 and Flatwood Road. Turn right onto gravel road and go approximately 0.05 miles. The sample station is on the left.

---

TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 4

Approximate Direction and Distance from Plant: 180° - 0.7 miles

Sample Types: 1) Airborne radioiodines  
2) Airborne particulates  
3) Direct radiation

Sample Station Location:

Go approximately 0.25 miles south from bridge over intake canal. Turn right onto gravel road. Proceed approximately 0.1 miles west of May Cemetery entrance. The sample station is on the left approximately 50 feet south of the road.

---

Sample Station Number: 5

Approximate Direction and Distance from Plant: 298° - 8.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

While traveling on Highway 64, turn onto Cherry Street in Knoxville, AR and go approximately 0.7 miles. Turn left onto Highway 64 South and go approximately 0.2 miles. The sample station is on the right.

---

Sample Station Number: 6

Approximate Direction and Distance from Plant: 111° - 7.0 miles

Sample Types: 1) Airborne radioiodines  
2) Airborne particulates  
3) Direct radiation

Sample Station Location:

Go to the AP&L local office which is located off Highway 7T in Russellville, AR (305 South Knoxville Avenue). The sample station is in the southeast corner of the back lot.

---

Sample Station Number: 7

Approximate Direction and Distance from Plant: 209° - 19.3 miles

Sample Types: 1) Airborne radioiodines  
2) Airborne particulates  
3) Direct radiation

Sample Station Location:

Turn west at junction of Highway 7 and Highway 27 in Dardanelle, AR. Proceed to junction of Highway 27 and Highway 10 in Danville, AR. Turn right onto Highway 10 and proceed a short distance to the AP&L supply yard, which is on the right adjacent to an AP&L substation. The sample station is in the southwest corner of the supply yard.

---

Sample Station Number: 8

Approximate Direction and Distance from Plant: 180° - 0.1 miles

Sample Types: 1) Surface water (composite)  
2) Shoreline sediment  
3) Fish

Sample Station Location: Plant discharge canal

---



TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 10

Approximate Direction and Distance from Plant: 95° - 0.9 miles

Sample Types: 1) Surface water (composite)  
2) Shoreline sediment  
3) Fish

Sample Station Location:

Surface water (composite) is collected at plant intake structure. Shoreline sediment and fish are collected at plant inlet canal.

---

Sample Station Number: 13

Approximate Direction and Distance from Plant: 271° - 0.5 miles

Sample Types: 1) Broadleaf vegetation

Sample Station Location:

IF traveling south on Flatwood Road,

THEN go approximately 0.2 miles from sample station 109. The sample station is on the left.

IF traveling west from ANO toward Gate 4,

THEN go approximately 0.4 miles and turn right onto Flatwood Road. Go a short distance (approximately 30 yards). The sample station is on the right.

---

Sample Station Number: 14

Approximate Direction and Distance from Plant: 70° - 5.3 miles

Sample Types: 1) Drinking water

Sample Station Location:

From junction of Highway 7 and Water Works Road, go approximately 0.8 miles west on Water Works Road. The sample station is on the left at the intake to the Russellville city water system from the Illinois Bayou.

---

Sample Station Number: 16

Approximate Direction and Distance from Plant: 290° - 5.9 miles

Sample Types: 1) Shoreline sediment

Sample Station Location:

From junction of Highway 64 and Highway 359 (Flat Rock Piney Bay Recreational Area turnoff), go approximately 0.7 miles west on Highway 64. The sample station is at the Piney Creek area on Lake Dardanelle.

---

Sample Station Number: 19

Approximate Direction and Distance from Plant: 95° - 5.1 miles

Sample Types: 1) Milk

Sample Station Location:

Turn from Highway 7 onto Harrell Drive in Russellville, AR and go approximately 0.1 miles. Turn right and go approximately 0.25 miles. The sample station is on the left at the Arkansas Tech Dairy.

---

TABLE 1-2 (Con't)

Sample Stations

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Sample Station Number: 29

Approximate Direction and Distance from Plant: 24° - 6.9 miles

Sample Types: 1) Milk (alternate)

Sample Station Location:

Turn south from Highway 333 onto County Road 141 and go approximately 0.55 miles. Turn left and go approximately 0.6 miles. Turn left and go approximately 0.05 miles. The sample station is on the right at the Harold Steuber Dairy.

---

Sample Station Number: 32

Approximate Direction and Distance from Plant: 132° - 0.9 miles

Sample Types: 1) Groundwater

Sample Station Location:

From bridge over intake canal, go south approximately 0.25 miles. Turn left and go approximately 0.25 miles. Turn left on Bunker Hill Lane and go approximately 0.05 miles. The sample station is on the right at Clifton Stewart's Resident.

---

Sample Station Number: 33

Approximate Direction and Distance from Plant: 94° - 3.8 miles

Sample Types: 1) Groundwater

Sample Station Location:

From junction of Highway 64 and Highway 326 (Dike Road), go approximately 0.3 miles east on Dike Road. The sample station is on the left at the Quita Lake Recreation Area on the Illinois Bayou.

---

Sample Station Number: 36

Approximate Direction and Distance from Plant: 140° - 0.05 miles

Sample Types: 1) Pond water

2) Pond sediment

Sample Station Location:

The sample station is at the Wastewater Holding Pond on the ANO site east of the discharge canal.

---

Sample Station Number: 37

Approximate Direction and Distance from Plant: 0° - 7.5 miles

Sample Types: 1) Milk

Sample Station Location:

IF traveling north on Highway 333,

THEN go approximately 3.5 miles from junction of Highway 333 and Mill Creek Road on Highway 333. Turn left and go approximately 0.1 miles. The sample station is on the left at the Lawrence Steuber Dairy.

IF traveling from junction of Highway 7 and Highway 333,

THEN go approximately 6.0 miles west on Highway 333. Turn right and go approximately 0.1 mile. The sample station is on the left at the Lawrence Steuber Dairy.

---

TABLE 1-2 (Con't)

Sample Stations

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Sample Station Number: 38

Approximate Direction and Distance from Plant: 314° - 2.4 miles

Sample Types: 1) Food products (alternate)

Sample Station Location:

From west junction of Highway 64 and Highway 333 in London, AR, go approximately 0.4 miles west on Highway 64. Turn right at Hornet Estate and go approximately 0.1 miles. Turn left and go approximately 0.1 miles. The sample station is on the left at Ronnie Jones' residence.

---

Sample Station Number: 40

Approximate Direction and Distance from Plant: 119° - 2.2 miles

Sample Types: 1) Food products

Sample Station Location:

From junction on Highway 64 and Highway 326 (Marina Road), go approximately 2.0 miles on Marina Road. The sample station is on the left at Horace Hollis' residence just prior to curve.

---

Sample Station Number: 41

Approximate Direction and Distance from Plant: 358° - 3.8 miles

Sample Types: 1) Milk

Sample Station Location:

IF traveling from junction of Highway 333 and Mill Creek Road,  
THEN go approximately 1.8 miles on Mill Creek Road. Turn right onto Lowe Lane and go approximately 0.1 miles. Turn right and go approximately 0.05 miles. The sample station is on the right at the James Gibson Dairy.

IF traveling from junction of Highway 64 and Mill Creek Road,  
THEN go approximately 3.6 miles on Mill Creek Road. Turn left onto Lowe Lane and go approximately 0.1 miles. Turn right and go approximately 0.05 miles. The sample station is on the right at the James Gibson Dairy.

---

Sample Station Number: 42

Approximate Direction and Distance from Plant: 73° - 12.4 miles

Sample Types: 1) Milk

Sample Station Location:

From junction of Highway 124 and Highway 326 in Gum Log, AR, go approximately 1.1 miles northeast on Highway 124. Turn left onto Gravel Hill Road and go approximately 0.6 miles. Turn right onto Hudson Loop and go approximately 0.3 miles. The sample station is on the left at the Hudson Dairy.

---

TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 45

Approximate Direction and Distance from Plant: 90° - 0.9 miles

Sample Types: 1) Broadleaf vegetation

Sample Station Location:

The sample station is located near mouth of intake canal.

---

Sample Station Number: 46

Approximate Direction and Distance from Plant: 295° - 4.1 miles

Sample Types: 1) Food products

Sample Station Location:

From west junction on Highway 64 and Highway 333 in London, AR, go west on Highway 64 approximately 2.4 miles. Turn right onto Scottie Lane and go approximately 0.1 miles. The sample station is on the right at Dewey Gregory's residence.

---

Sample Station Number: 48

Approximate Direction and Distance from Plant: 316° - 2.2 miles

Sample Types: 1) Food products

Sample Station Location:

R. J. Cochran residence, No. 26 Hwy 64 London West, directly North (across from) London Volunteer Fire Dept.

---

Sample Station Number: 108

Approximate Direction and Distance from Plant: 301° - 0.9 miles

Sample Types: 1) Direct radiation  
2) Food products

Sample Station Location:

IF traveling from Highway 333,

THEN turn south onto Flatwood Road and go approximately 0.4 miles. The sample station is on the right.

IF traveling north on Flatwood Road,

THEN go approximately 0.4 miles from sample station 109. The sample station is on the left.

---

Sample Station Number: 109

Approximate Direction and Distance from Plant: 285° - 0.5 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling south on Flatwood Road,

THEN go approximately 0.4 miles from sample station 108. Sample station 109 is on a utility pole on the left across from the junction of Flatwood Road and Round Mountain Road just before pavement ends.

IF traveling west from ANO toward Gate 4,

THEN go approximately 0.4 miles and turn right onto Flatwood Road. Go approximately 0.2 miles. The sample station is on a utility pole on the right across from the junction of Flatwood Road and Round Mountain Road just after pavement begins.

---

TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 110

Approximate Direction and Distance from Plant: 138° - 0.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

From bridge over intake canal, go south approximately 0.25 miles. Turn left and go approximately 0.25 miles. Turn right on Bunker Hill Lane. The sample station is on the first utility pole on the left.

---

Sample Station Number: 111

Approximate Direction and Distance from Plant: 121° - 2.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

From junction of Highway 64 and Highway 326 (Marina Road), go approximately 2.1 miles on Marina Road. The sample station is on a utility pole on the left just prior to curve.

---

Sample Station Number: 112

Approximate Direction and Distance from Plant: 74° - 2.6 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Go to the junction of Highway 64 and the I-40 exit which is approximately 1.3 miles east of sample station 113. Sample station 112 is on a utility pole on the northeast corner of the junction.

---

Sample Station Number: 113

Approximate Direction and Distance from Plant: 52° - 1.5 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Go to the east junction of Highway 333 and Highway 64. The sample station is on a utility pole on the southwest corner of the junction.

---

Sample Station Number: 114

Approximate Direction and Distance from Plant: 31° - 1.3 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on Highway 64,

THEN go approximately 0.6 miles west of the east junction of Highway 64 and Highway 333.

The sample station is on a utility pole on the right.

IF traveling east on Highway 64,

THEN go approximately 1.1 miles from sample station 115. Sample station 114 is on a utility pole on the left.

---



TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 115

Approximate Direction and Distance from Plant: 344° - 1.4 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on Highway 64,

THEN go approximately 1.1 miles west of sample station 114. Sample Station 115 is on a utility pole on the right.

IF traveling east on Highway 64,

THEN go approximately 0.8 miles from the west junction of Highway 64 and Highway 333 in London, AR. The sample station is on a utility pole on the left.

---

Sample Station Number: 116

Approximate Direction and Distance from Plant: 320° - 1.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Go one block south of the west junction of Highway 333 and Highway 64 in London, AR. The sample station is on a utility pole north of the railroad tracks.

---

Sample Station Number: 117

Approximate Direction and Distance from Plant: 305° - 17.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on I-40,

THEN take Exit 58 at Clarksville, AR. Turn right onto Rogers Street. At junction of Rogers Street and Highway 64, turn left and proceed west to first stop light. Turn left onto Cravens Street. The sample station is on a utility pole on the right between the county courthouse and the post office.

IF traveling west on Highway 64,

THEN go to first stop light past junction of Rogers Street and Highway 64. Turn left onto Cravens Street. The sample station is on a utility pole on the right between the county courthouse and the post office.

---

Sample Station Number: 118

Approximate Direction and Distance from Plant: 294° - 5.6 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling east on Highway 64,

THEN go approximately 0.3 miles from bridge which goes across Piney. The sample station is on a utility pole on the left.

IF traveling west on Highway 64,

THEN go approximately 0.4 miles past Flat Rock Piney Bay Recreational Area turnoff. The sample station is on a utility pole on the right.

---

TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 119

Approximate Direction and Distance from Plant: 309° - 4.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Turn west from Highway 333 onto Will Baker Road, which intersects Highway 333 approximately 1.4 miles north of the I-40 Overpass near London, AR. Go approximately 2.0 miles. The sample station is on a utility pole on the left just prior to pavement ending.

---

Sample Station Number: 120

Approximate Direction and Distance from Plant: 336° - 4.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling from I-40 Overpass in London, AR,

THEN go north on Highway 333 approximately 2.4 miles. The sample station is on a utility pole on the right near Martin Chapel.

IF traveling from junction of Mill Creek Road and Highway 333,

THEN go approximately 1.0 mile south on Highway 333. The sample station is on a utility pole on the left near Martin Chapel.

---

Sample Station Number: 121

Approximate Direction and Distance from Plant: 349° - 4.6 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling from I-40 Overpass in London, AR,

THEN go north on Highway 333 approximately 3.4 miles to Mill Creek Road. Turn right onto Mill Creek Road and go approximately 0.7 miles. The sample station is on a utility pole on the right.

IF traveling northwest on Mill Creek Road,

THEN go approximately 0.4 miles past East Point Baptist Church and Cemetery. The sample station is on a utility pole on the left.

---

Sample Station Number: 122

Approximate Direction and Distance from Plant: 18° - 3.3 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling north from junction of Highway 64 and Mill Creek Road,

THEN go approximately 2.5 miles. The sample station is on a utility pole on the right.

IF traveling southeast on Mill Creek Road,

THEN go approximately 1.9 miles from East Point Baptist Church. The sample station is on a utility pole on the left.

---

Sample Station Number: 123

Approximate Direction and Distance from Plant: 46° - 3.5 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Turn north from Pleasant View Road onto Ball Hill Road and go approximately 0.8 miles. The sample station is on a utility pole on the left.

---

TABLE 1-2 (Con't)

Sample Stations

---

**Sample Station Number: 124**

Approximate Direction and Distance from Plant: 60° - 3.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling from junction of Highway 64 and Mill Creek Road,

THEN go north on Mill Creek Road approximately 0.7 miles. Turn right onto Pleasant View Road and go approximately 1.3 miles. The sample station is on the right on a utility pole which is across from a siren and below a transmission line.

IF traveling west from junction of Highway 7 and Pleasant View Road,

THEN go approximately 3.1 miles. The sample station is on the left on a utility pole which is across from a siren and below a transmission line.

---

**Sample Station Number: 125**

Approximate Direction and Distance from Plant: 46° - 9.1 miles

Sample Types: 1) Direct radiation

Sample Station Location:

While traveling north on Highway 7, turn left onto Water Street in Dover, AR. Go one block and turn left onto South Elizabeth Street. Go one block and turn right onto College Street. The sample station is on a utility pole at the southeast corner of the red brick school building, which is located on top of hill.

---

**Sample Station Number: 126**

Approximate Direction and Distance from Plant: 81° - 5.5 miles

Sample Types: 1) Direct radiation

Sample Station Location:

The sample station is located on the west side of Highway 7 directly across from Shiloh Road, which is approximately 1.3 miles north of the junction of Highway 7 and Dike Road.

---

**Sample Station Number: 127**

Approximate Direction and Distance: 102° - 5.6 miles

Sample Types: 1) Direct radiation

Sample Station Location:

The sample station is located on the Arkansas Tech Campus on West O Street on a security light pole in front of Bryan Hall, which is the first building on the left when traveling from North Arkansas on West O Street.

---

**Sample Station Number: 128**

Approximate Direction and Distance from Plant: 113° - 8.6 miles

Sample Types: 1) Direct radiation

Sample Station Location:

The sample station is on a utility pole inside the security fence near the Russellville Airport Office. The airport is located off of East 16th Street and is well marked by airport signs.

---



TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 129

Approximate Direction and Distance from Plant: 118° - 7.3 miles

Sample Types: 1) Direct radiation

Sample Station Location:

The sample station is on a utility pole north of the Russellville High School sign, which is in front of the high school on east side of Highway 7T.

---

Sample Station Number: 130

Approximate Direction and Distance from Plant: 245° - 4.6 miles

Sample Types: 1) Direct radiation

Sample Station Location:

At junction of Highway 7 and Highway 22 in Dardanelle, AR, take Highway 22 toward Delaware, AR. Go approximately 0.4 miles west of Delaware Recreation Area turnoff. The sample station is on a utility pole on the right in Delaware, AR near Shirley's Beauty Salon.

---

Sample Station Number: 131

Approximate Direction and Distance from Plant: 244° - 2.4 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Turn north from Highway 22 onto Highway 393 at Delaware Recreation Area turnoff and go approximately 2.9 miles. The sample station is located past the boat ramp on an oak tree near crosstie steps in northeast quadrant of circle drive.

---

Sample Station Number: 132

Approximate Direction and Distance from Plant: 267° - 5.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Turn north from Highway 22 onto Highway 393 at Delaware Recreation Area turnoff and go approximately 0.9 miles. Turn left onto dirt road and go approximately 2.3 miles. The sample station is on a utility pole on the right.

---

Sample Station Number: 133

Approximate Direction and Distance from Plant: 233° - 3.7 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on Highway 22,

THEN go approximately 2.0 miles from sample station 134. Sample station 133 is on the south side of the Highway 22 causeway attached to the first NO PARKING ANY TIME sign west of the bridge.

IF traveling east on Highway 22 from Delaware, AR,

THEN go approximately 0.8 miles from Delaware Recreation Area turnoff. The sample station is on the south side of the Highway 22 causeway attached to the first NO PARKING ANY TIME sign west of the bridge.

---

TABLE 1-2 (Con't)

Sample Stations

---

**Sample Station Number: 134**

Approximate Direction and Distance from Plant: 200° - 2.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on Highway 22,

THEN go approximately 0.8 miles from sample station 135. Sample station 134 is on a utility pole on the right at Mockingbird Lane.

IF traveling east on Highway 22,

THEN go approximately 2.0 miles from sample station 133. Sample station 134 is on a utility pole on the left at Mockingbird Lane.

---

**Sample Station Number: 135**

Approximate Direction and Distance from Plant: 188° - 3.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on Highway 22,

THEN go approximately 1.7 miles from sample station 136. Sample station 135 is on a utility pole on the right.

IF traveling east on Highway 22,

THEN go approximately 0.8 miles from sample station 134. Sample station 135 is on a utility pole on the left.

---

**Sample Station Number: 136**

Approximate Direction and Distance from Plant: 168° - 4.3 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling west on Highway 22,

THEN go approximately 3.7 miles from junction of Highway 22 and Highway 7. The sample station is on the right on the first utility pole west of the Little Hays Creek Bridge.

IF traveling east on Highway 22,

THEN go approximately 1.7 miles from sample station 135. Sample station 136 is on the left on the first utility pole west of the Little Hays Creek Bridge.

---

**Sample Station Number: 137**

Approximate Direction and Distance from Plant: 150° - 8.4 miles

Sample Types: 1) Direct radiation

Sample Station Location:

At junction of Highway 7 and Highway 28 in Dardanelle, AR, go approximately 0.2 miles on Highway 28. The sample station is on a speed limit sign on the right in front of the Morris R. Moore Arkansas National Guard Armory.

---

TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 138

Approximate Direction and Distance from Plant: 193° - 5.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

At junction of Highway 22 and Highway 155 (Mt. Nebo Road) in Dardanelle, AR, turn west and go to top of mountain. Veer right at stop sign and proceed toward Sunset Point. The sample station is down a dirt road on the right which is approximately 0.1 miles southeast of Sunset Point. The sample station is on the left side of the dirt road on a utility pole near a TV tower.

---

Sample Station Number: 139

Approximate Direction and Distance from Plant: 178° - 19.2 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Take Highway 7 South through Dardanelle, AR to Ola, AR. Turn left at junction of Highway 7 and Highway 10 West in Ola, AR and go approximately 1/2 block. The sample station is on a utility pole on the left in front of the U. S. Post Office.

---

Sample Station Number: 140

Approximate Direction and Distance from Plant: 151° - 21.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

Proceed through Ola, AR and take Highway 10 East to Casa, AR, which is in Perry County. Turn right at the Perry-Casa High School. The sample station is on a utility pole at the southwest corner of the school.

---

Sample Station Number: 141

Approximate Direction and Distance from Plant: 125° - 3.8 miles

Sample Types: 1) Direct radiation

Sample Station Location:

While traveling southwest on Highway 326 (Marina Road), go approximately 2.4 miles from sample station 111. Sample station 141 is on the right on a utility pole, which is approximately 50 yards east of a transmission line. (The sample station is approximately 0.35 miles west of the junction of Hilltop Drive and Marina Road.)

---

Sample Station Number: 142

Approximate Direction and Distance from Plant: 129° - 5.1 miles

Sample Types: 1) Direct radiation

Sample Station Location:

The sample station is on a utility pole at the junction of Skyline Drive and Nordin Lane in Russellville, AR, near a peach orchard.

---

TABLE 1-2 (Con't)

Sample Stations

---

Sample Station Number: 143

Approximate Direction and Distance from Plant: 106° - 17.5 miles

Sample Types: 1) Direct radiation

Sample Station Location:

IF traveling east on Highway 64 to Atkins, AR,

THEN turn left at junction of Highway 64 and North Church Street. Proceed north. The sample station is on a utility pole on the left in front of Atkins High School near stop sign at corner of North Church Street and Northeast 3rd Street.

IF traveling east on Interstate 40,

THEN take Exit 94 at Atkins, AR. Turn left onto North Church Street and proceed south. The sample station is on a utility pole on the right in front of Atkins High School near stop sign at corner of North Church Street and Northeast 3rd Street.

---

Sample Station Number: 144

Approximate Direction and Distance from Plant: 313° - 12.7 miles

Sample Types: 1) Direct radiation

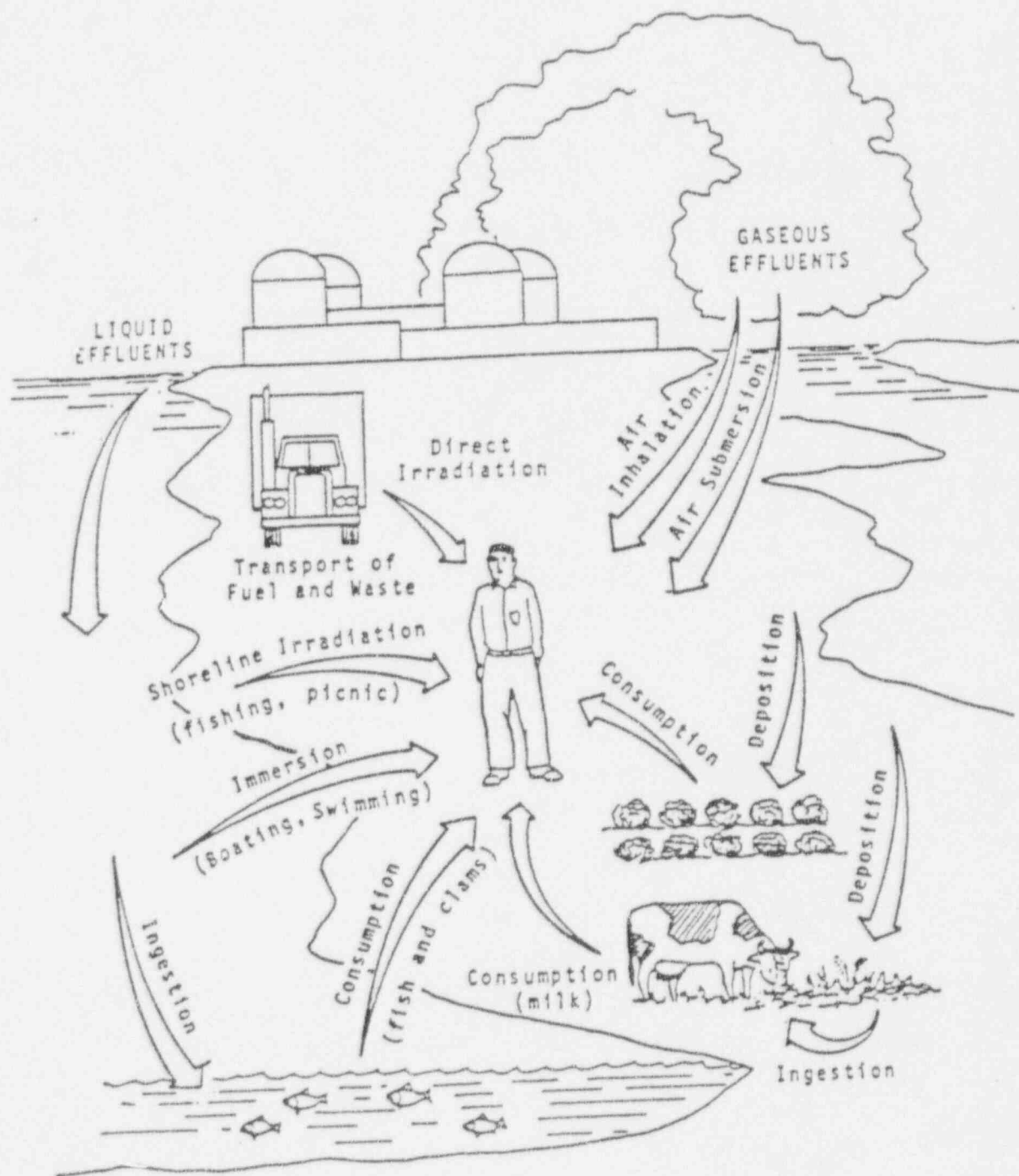
Sample Station Location:

While traveling on Highway 64, turn south onto Cumberland Street in Lamar, AR, and go approximately 0.7 miles. Veer left at stop sign. The sample station is on a utility pole across the one way fire lane in front of Lamar Elementary School.

---



FIGURE 1-1  
Exposure Pathways



**ANO 10 MILE EPZ MAP**

**ENVIRONMENTAL SAMPLING STATIONS**

LETTER DESIGNATION	MILES
A	0.1
B	0.2
C	0.3
D	0.4
E	0.5
F	0.6
G	0.7
H	0.8
I	0.9
J	1.0
K	1.1
L	1.2
M	1.3
N	1.4
O	1.5
P	1.6
Q	1.7
R	1.8
S	1.9
T	2.0
U	2.1
V	2.2
W	2.3
X	2.4
Y	2.5
Z	2.6
AA	2.7
AB	2.8
AC	2.9
AD	3.0
AE	3.1
AF	3.2
AG	3.3
AH	3.4
AI	3.5
AJ	3.6
AK	3.7
AL	3.8
AM	3.9
AN	4.0
AO	4.1
AP	4.2
AQ	4.3
AR	4.4
AS	4.5
AT	4.6
AU	4.7
AV	4.8
AW	4.9
AX	5.0
AY	5.1
AZ	5.2
BA	5.3
BB	5.4
BC	5.5
BD	5.6
BE	5.7
BF	5.8
BG	5.9
BH	6.0
BI	6.1
BJ	6.2
BK	6.3
BL	6.4
BM	6.5
BN	6.6
BO	6.7
BP	6.8
BQ	6.9
BR	7.0
BS	7.1
BT	7.2
BU	7.3
BV	7.4
BW	7.5
BX	7.6
BY	7.7
BZ	7.8
CA	7.9
CB	8.0
CC	8.1
CD	8.2
CE	8.3
CF	8.4
CG	8.5
CH	8.6
CI	8.7
CJ	8.8
CK	8.9
CL	9.0
CM	9.1
CN	9.2
CO	9.3
CP	9.4
CQ	9.5
CR	9.6
CS	9.7
CT	9.8
CU	9.9
CV	10.0
AW	10.1
AX	10.2
AY	10.3
AZ	10.4
BA	10.5
BB	10.6
BC	10.7
BD	10.8
BE	10.9
BF	11.0
BG	11.1
BH	11.2
BI	11.3
BJ	11.4
BK	11.5
BL	11.6
BM	11.7
BN	11.8
BO	11.9
BP	12.0
BQ	12.1
BR	12.2
BS	12.3
BT	12.4
BU	12.5
BV	12.6
BW	12.7
BX	12.8
BY	12.9
BZ	13.0
CA	13.1
CB	13.2
CC	13.3
CD	13.4
CE	13.5
CF	13.6
CG	13.7
CH	13.8
CI	13.9
CJ	14.0
CK	14.1
CL	14.2
CM	14.3
CN	14.4
CO	14.5
CP	14.6
CQ	14.7
CR	14.8
CS	14.9
CT	15.0
CU	15.1
CV	15.2
AW	15.3
AX	15.4
AY	15.5
AZ	15.6
BA	15.7
BB	15.8
BC	15.9
BD	16.0
BE	16.1
BF	16.2
BG	16.3
BH	16.4
BI	16.5
BJ	16.6
BK	16.7

---

## **SECTION 2.0**

### **RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

- INTERPRETATIONS AND TRENDS OF RESULTS**
  - PROGRAM DESCRIPTION**
-

### **2.1.1 Interpretations and Trends of Results**

Gross beta air particulate and Iodine-131 results for 1994 were similar to those obtained in previous years of the operational REMP. In addition, gross beta air particulate results were well below the preoperational average of 0.093 pCi/m<sup>3</sup> for indicator locations and 0.091 pCi/m<sup>3</sup> for control locations. However, fallout from atmospheric nuclear weapons testing was detected during the preoperational period. Therefore, preoperational results are not representative of actual conditions.

In 1994, gross beta results for indicator locations ranged from 0.004 - 0.032 pCi/m<sup>3</sup> with a mean of 0.015 pCi/m<sup>3</sup> as compared to control locations which ranged from 0.004 - 0.036 pCi/m<sup>3</sup> with a mean of 0.016 pCi/m<sup>3</sup>. All Iodine-131 results were less than the lower limit of detection (LLD). This indicates the airborne exposure pathway has not been affected by the operation of ANO and that airborne concentrations continue to be at, or near, background levels.

In addition, the standard "t" test was used to compare average gross beta concentrations from the indicator locations to the control. The test result indicates concentrations at indicator sample locations 1 and 4 to be statistically lower than that of the control location, and indicator sample locations 2 and 3 to be statistically the same as the control location. Although a minor difference exists in the results for sample stations 1 and 4, background fluctuations and geographical location are contributing factors to be considered. Results of this analysis is summarized in Attachment III.

Gross beta concentrations shown in Figure 2-1 further emphasize that ANO has had no influence on the airborne pathway. This figure shows 1994 monthly average results compared to a 1982 baseline average and 1987 through 1994 yearly average results for indicator locations compared to controls.

### **2.1.2 Program Description**

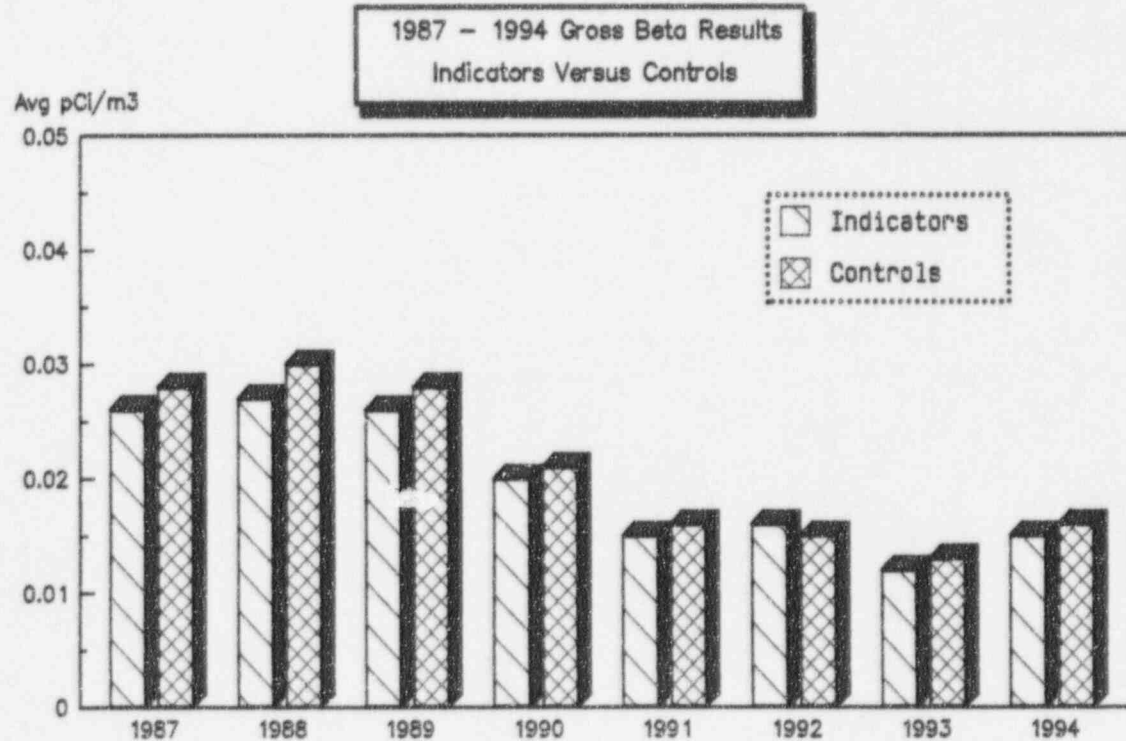
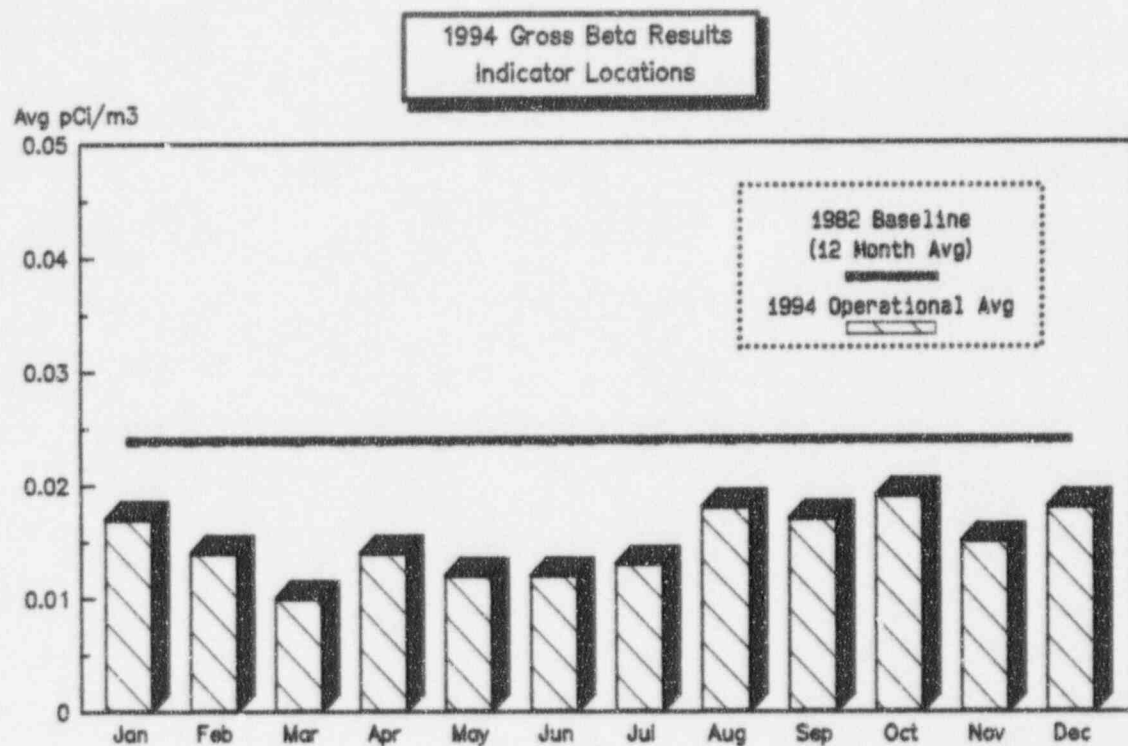
ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-1 and 3.12-1, respectively, require five air sampler locations for measurement of



radioactivity in the airborne exposure pathway. ANO used six continuous air samplers to provide gross beta, gamma and radioiodine activity measurements. Four of the air samplers were used as indicators (Stations 1, 2, 3 and 4) with the remaining two utilized as controls (Stations 6 and 7). These air samplers were placed at distances from 0.4 to 19.3 miles (Table 1-2 and Figure 1-2).

The air samplers were placed approximately one meter above the ground in weatherproof houses. A 47-millimeter glass fiber filter was installed in the intake line by the vacuum pump with a charcoal cartridge located directly downstream. Flows were adjusted to  $30 \pm 3$  liters per minute. Filters and cartridges were changed weekly and analyzed for gross beta radionuclides and radioiodine activity, respectively. In addition, the filters were composited quarterly and analyzed for gamma radionuclides.

FIGURE 2-1  
Air Sample Gross Beta Concentrations



## 2.2 THERMOLUMINESCENT DOSIMETRY

*Note: Analytical results are presented in Attachment II and summarized in Section 4.0.*

### 2.2.1 Interpretations and Trends of Results

Gamma radiation dose in 1994 was below that obtained in previous preoperational and operational years as illustrated in Table 2-1 due to a change in the calculation methodology as a result of the revisions to Title 10 of the Code of Federal Regulations, Part 20 (10CFR20). Previous calculated doses at ANO had been based on the lens of the eye ( $300 \text{ mg/cm}^2$ ) which yielded higher values. Calculated doses at ANO are now based on a deep working dose ( $1000 \text{ mg/cm}^2$ ) which yields lower values. Quarterly doses recorded by TLDs were as follows:

- 0 - 2 miles, mean of 16.4 mrem and range of 13.0 - 19.0 mrem
- 2 - 5 miles, mean of 15.0 mrem and range of 11.0 - 20.0 mrem
- >5 miles, mean of 15.7 mrem and range of 12.0 - 20.0 mrem

These results indicate that the ambient radiation levels remained at or near background in 1994 and have been unaffected by the operation of ANO. In addition, the standard "t" test was used to compare average radiation doses from the 0 - 2 and 2 - 5 mile area TLDs to the >5 mile area TLDs. The results from this test indicate radiation doses at the 0 - 2 mile range to be statistically higher than the >5 mile range and the 2 - 5 mile range to be statistically lower than that of the control. Background fluctuations and geographical location are contributing factors to be considered when evaluating minor differences of this magnitude. Attachment III summarizes the results of this analysis.

Radiation doses shown in Figure 2-2 further emphasize that ambient radiation levels have remained at or near background levels. This figure shows 1994 quarterly average results compared to preoperational levels and 1987 through 1994 annual quarterly average results for indicator locations compared to controls.

### 2.2.2 Program Description

ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-1 and 3.12-1, respectively, require forty TLD locations for measurement of direct radiation doses. ANO measured ambient radiation in the environment surrounding the plant with 44 TLDs (two lithium borate and calcium sulfate elements) to provide a quantitative measurement of the area radiation levels. ANO personnel placed these environmental TLDs at distances from 0.4 to 21.8 miles (Table 1-2 and Figure 1-2).

Each dosimeter was sealed in a plastic protective holder and suspended above the ground. The dosimeters were collected and analyzed quarterly. The TLD locations may be summarized as follows:

- 11 stations in the 0 - 2 mile range,
- 15 stations in the 2 - 5 mile range, and
- 18 stations in the >5 mile range.



**TABLE 2-1**  
**TLD Dose Rates \***

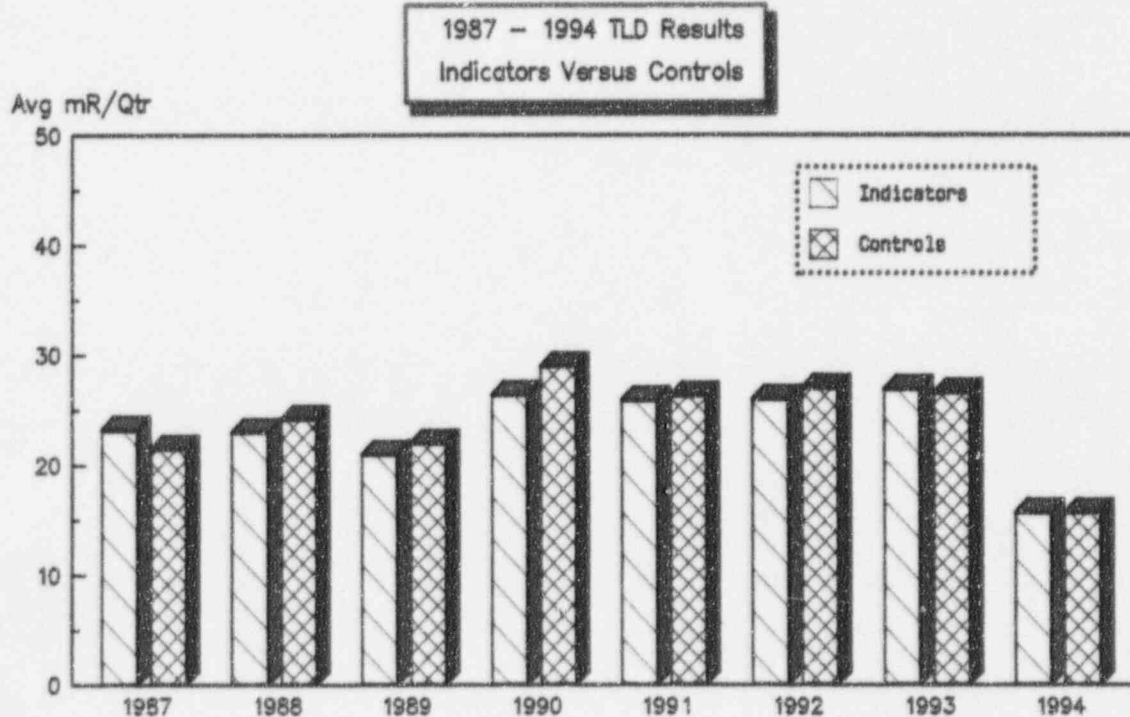
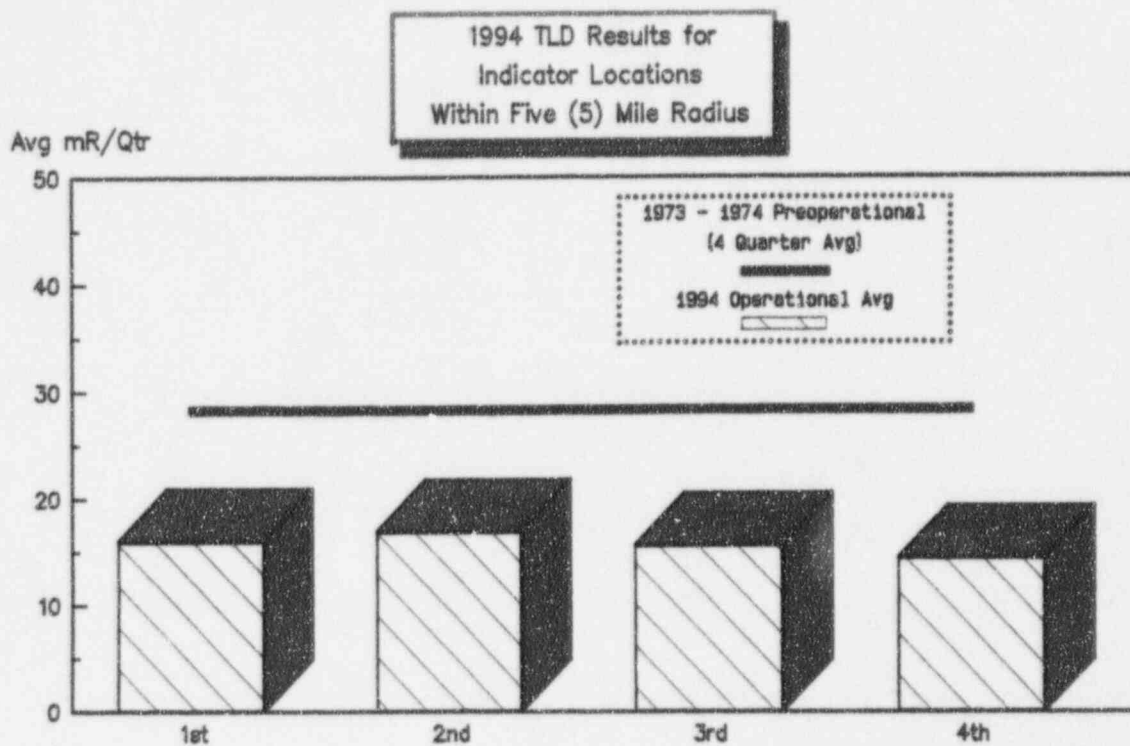
Year	Indicators	Controls
1973	20.8	24.3
1974	24.0	29.3
1987 **	23.2	21.5
1988	23.0	24.2
1989	21.0	22.0
1990	26.4	29.0
1991	25.9	26.3
1992	26.0	27.0
1993	26.9	26.6
1994 ***	15.7	15.7

\* *Values reported as annual average mR/quarter.*

\*\* *Began utilizing Panasonic TLDs.*

\*\*\* *Dose based on deep working dose (1000 mg/cm<sup>2</sup>). Previous doses based on lens of eye (300 mg/cm<sup>2</sup>).*

FIGURE 2-2  
TLD Radiation Dose



## 2.3 MILK

*Note: Analytical results are presented in Tables 2.1 through 2.4 of Attachment I and summarized in Section 4.0.*

### 2.3.1 Interpretations and Trends of Results

Milk samples were collected monthly from four locations in 1994 and analyzed for Iodine-131 and gamma radionuclides, except as described in Section 6.4. Gamma radionuclides and Iodine-131 were below detectable limits in indicator and control locations. Listed below is a comparison of 1994 results for indicator locations as compared to the preoperational and operational years. Results are reported in pCi/l units.

<u>Radionuclide</u>	<u>1994</u>	<u>1987 - 1993</u>	<u>Preoperational</u>
Iodine-131	<LLD	0.5	2.7
Cesium-137	<LLD	4.2	<LLD
Other Gammas	<LLD	<LLD	<LLD

Based on this comparison, the operation of ANO had no impact on this pathway in 1994, as has been the case in previous years.

### 2.3.2 Program Description

ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-1 and 3.12-1, respectively, require four milk locations for measurement of radioactivity by the ingestion exposure pathway. ANO and Arkansas Department of Health (ADH) personnel collected milk monthly from four locations at distances from 3.8 to 12.4 miles (Table 1-2 and Figure 1-2). Two locations were utilized as indicators (Arkansas Tech and Gibson) and two as controls (L. Steuber and Hudson).

Milk was collected from each location in two one-gallon labeled containers. Samples were preserved with formaldehyde and then analyzed for Iodine-131 and gamma radionuclides.

## 2.4 WATER

*Note: Analytical results are presented in Tables 3.1 through 5.2 of Attachment I and summarized in Section 4.0.*



#### 2.4.1 Interpretations and Trends of Results

Analytical results for 1994 drinking water, surface water and groundwater samples were similar to those reported in previous years.

Drinking water samples were collected monthly from one location and analyzed for gross beta radionuclides, Iodine-131, tritium and gamma radionuclides. Tritium and gamma radionuclides were below detectable limits, which is consistent with preoperational data. Iodine-131 was detected at a concentration of 0.3 pCi/l, which is below the technical specification required lower limit of detection value of 1.0 pCi/l. Therefore, there exists a degree of uncertainty on whether it is actually a true positive. Gross beta concentrations ranged from 2.9 - 7.8 pCi/l with a mean of 4.8 pCi/l, which are consistent with preoperational and operational levels. Listed below is a comparison of 1994 results to preoperational and operational years. Results are reported in pCi/l units.

<u>Radionuclide</u>	<u>1994</u>	<u>1987 - 1993</u>	<u>Preoperational</u>
Gross Beta	4.8	3.5	6.5
Iodine-131	0.3	0.3	<LLD
Gammas	<LLD	<LLD	<LLD
Tritium	<LLD	580.0	165.0

Based on this comparison, the operation of ANO had no impact on this pathway during 1994.

Surface water samples were collected monthly and analyzed for gamma radionuclides and a composite was analyzed quarterly for tritium. In addition, the ADH and ANO split monthly grab samples from the discharge canal and Piney Creek locations. These samples were analyzed monthly for gamma radionuclides and tritium. Listed below is a comparison of 1994 results from indicator locations as compared to the preoperational and operational years. Results are reported in pCi/l units and do not include ADH split samples.

<u>Isotope</u>	<u>1994</u>	<u>1987 - 1993</u>	<u>Preoperational</u>
Cobalt-58	<LLD	7.5	<LLD
Cesium-137	<LLD	<LLD	17.8
Other Gammas	<LLD	<LLD	<LLD
Tritium	610.0	691.3	200.0

Based on this comparison, 1994 levels are representative of the historic average; therefore, the operation of ANO had little or no impact on this pathway.

Figure 2-3, which presents 1994 tritium concentrations in comparison to previous years, further emphasizes the above conclusion.

Groundwater samples were collected quarterly from two locations and analyzed for gamma radionuclides and tritium. As in preoperational and previous operational years, gamma radionuclides remained undetectable. Although tritium has been detected in small concentrations during the preoperational and operational years, it was undetectable during 1994. Therefore, concentrations continue to be at, or near, background levels.

#### 2.4.2 Program Description

ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-1 and 3.12-1, respectively, require one drinking water, two surface water and two groundwater locations for the measurement of radioactivity by the waterborne exposure pathway.

Drinking water was sampled monthly from an indicator location (intake to Russellville City Water System from Illinois Bayou) at a distance of 5.3 miles (Table 1-2 and Figure 1-2), except as described in Section 6.4. Water was collected in two one-gallon labeled containers. Upon return from the field, the samples were acidified with hydrochloric acid and then analyzed for gross beta radionuclides, Iodine-131 and gamma radionuclides. In addition, a composite was analyzed quarterly for tritium.

Surface water samples were collected for two locations, an indicator location (discharge) and a control location (intake), at distances from 0.1 to 0.9 miles (Table 1-2 and Figure 1-2). The discharge and intake surface water samples were composited with an automatic sampler that collected a preset volume at set intervals (~ 2 gallons per week). Weekly, one-gallon of sample from each location was acidified with hydrochloric acid and placed in an appropriately labeled composite carboy. At the end of the month, a one-gallon sample from each composite carboy was placed in a labeled container. The samples were then analyzed for gamma radionuclides and a composite was analyzed quarterly for tritium.

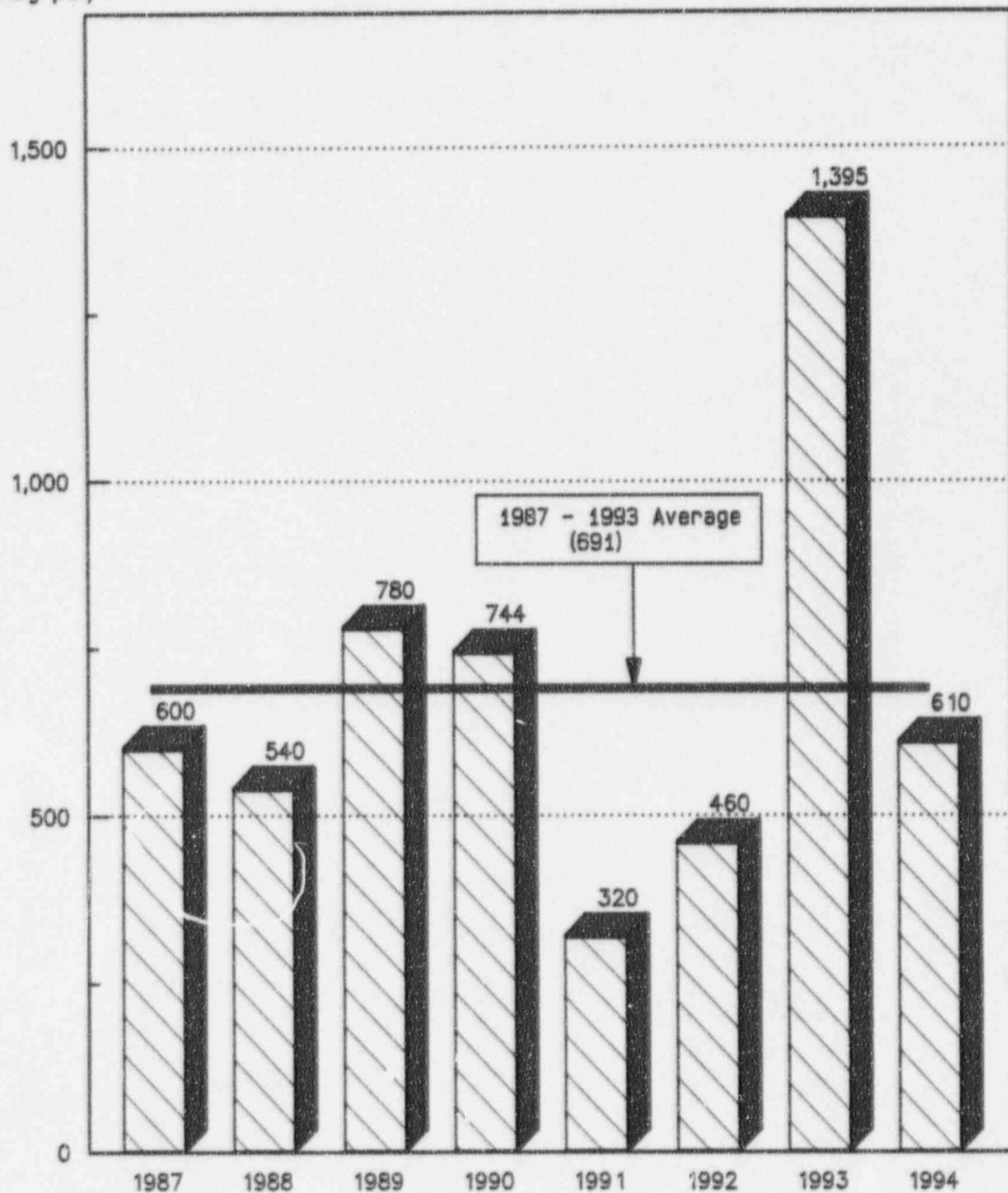
In addition, monthly grab surface water samples from the discharge and Piney Creek locations were collected by the ADH and split with ANO. These samples were analyzed monthly for gamma radionuclides and tritium.

Groundwater was sampled quarterly from two locations, the C. Stewart Residence (indicator) and Ouita Lake Recreation Area (control), at distances from 0.9 to 3.8 miles (Table 1-2 and Figure 1-2). Water was collected from each location in two one-gallon labeled containers. Upon return from the field, the samples were acidified with hydrochloric acid and then analyzed for gamma radionuclides and tritium.

FIGURE 2-3  
Discharge Tritium Concentrations

1987 - 1994 Tritium Results  
Discharge Surface Water

Avg pCi/l



## 2.5 VEGETATION AND FOOD PRODUCTS

*Note: Analytical results are presented in Tables 8.1 through 8.7 of Attachment I and summarized in Section 4.0.*



### **2.5.1 Interpretations and Trends of Results**

Vegetation and food product samples were collected when available from six locations in 1994 and analyzed for Iodine-131 and gamma radionuclides. The 1994 levels remained undetectable, as has been the case since 1989. Overall, concentrations continue to remain at, or near, background levels, and continue to be well below the preoperational Iodine-131 average levels of 60.0 pCi/kg, Cesium-134 average levels of 71.0 pCi/kg and Cesium-137 average levels of 350.0 pCi/kg, as measured from the indicator locations.

### **2.5.2 Program Description**

ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-1 and 3.12-1, respectively, require three food product locations and one vegetation location for measurement of radioactivity by the ingestion exposure pathway. ANO personnel collected, when available, from two vegetation indicator locations (Flatwood Road and Intake Canal) and four food product indicator locations (Cochran, Jones, Hollis and Shivers) at distances of 0.5 to 2.4 miles (Table 1-2 and Figure 1-2). In addition, the ADH collected and split samples with ANO at the Shivers location.

The preferred source of food products were fruits, flowering vegetables and tubular vegetables. The preferred source of non-food products were any vegetation with relatively broad leaves on which airborne radioactive particulate material might be deposited. Normally, when available, a minimum of 1000 grams of food products or vegetation was collected. The samples were then analyzed for gamma radionuclides and Iodine-131.

## 2.6 SEDIMENT

*Note: Analytical results are presented in Table 7.1 of Attachment I and summarized in Section 4.0.*

### **2.6.1 Interpretations and Trends of Results**

Sediment samples were collected semiannually from three locations in 1994 and analyzed for gamma radionuclides. As in previous years, radionuclides attributable to ANO were detected in the discharge sediment. Table 2-2 shows 1987 through 1994 average levels of radionuclides detected as compared to preoperational levels. Figure 2-4, which is derived from Table 2-2, shows that 1994 levels were actually lower than those of previous 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 IV. 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  $\leq 3$  millirem total body and  $\leq 10$  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 1994 had no significant impact on the environment or public.

### **2.6.2 Program Description**

ANO Unit 1 and Unit 2 Specification Tables 4.30-1 and 3.12-1, respectively, require two sediment locations for measurement of radioactivity by the waterborne exposure pathway. Contract personnel collected sediment semiannually from three locations, an indicator (Discharge) and two control locations (Intake and Piney Creek), at distances from 0.1 to 5.9 miles (Table 1-2 and Figure 1-2). A minimum of 1.5 liters of sample was collected with a dredge from the top layer of sediment from each location. After foreign objects were discarded, the samples were transferred to labeled containers and then analyzed for gamma radionuclides.

TABLE 2-2

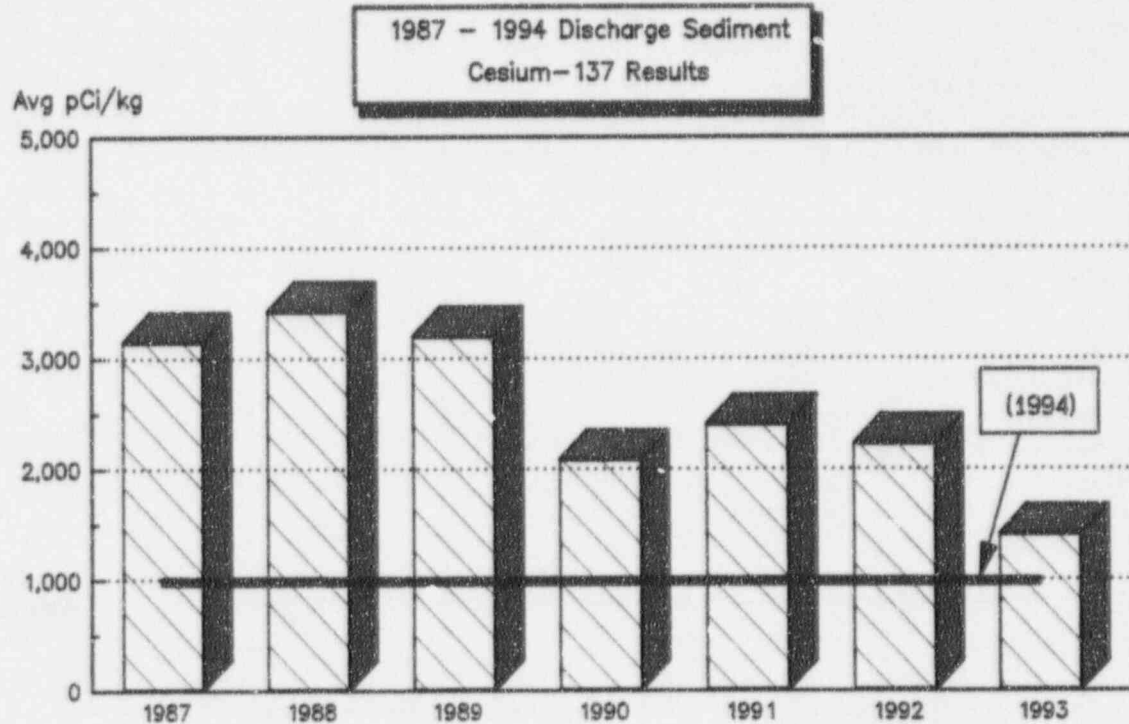
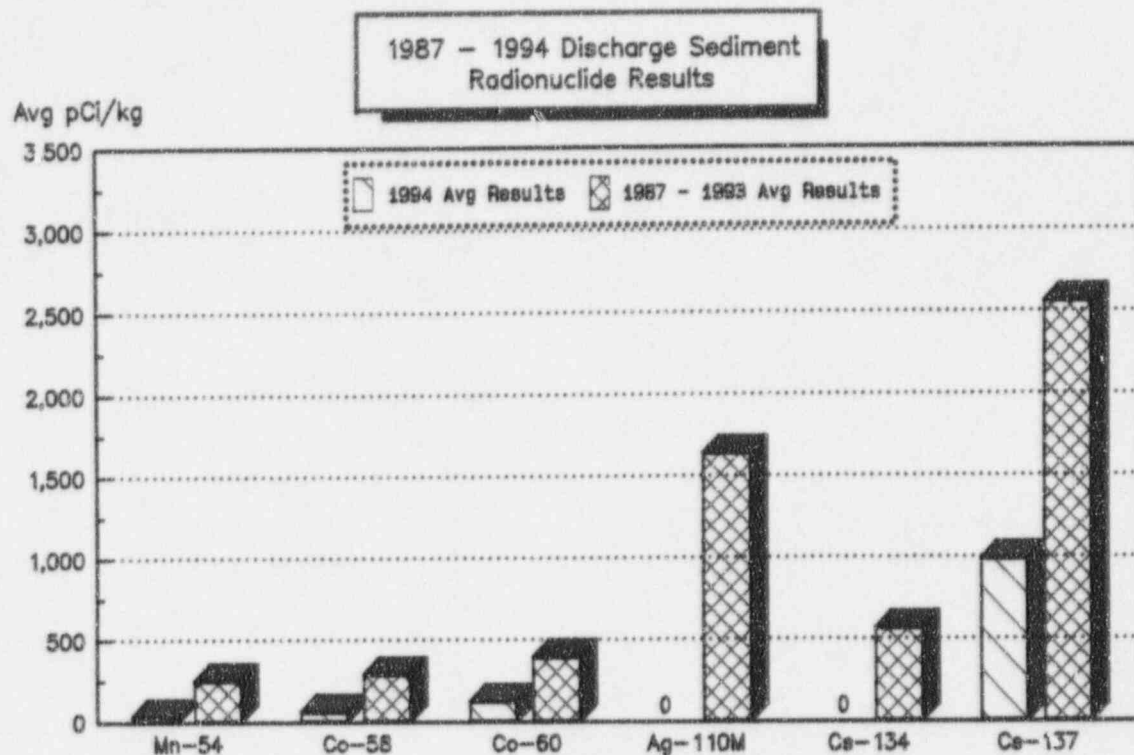
Discharge Sediment Analytical Summary \*

Year	Manganese-54	Cobalt-58	Cobalt-60	Silver-110m	Cesium-134	Cesium-137
1973	ND **	ND **	ND **	ND **	ND **	200.0
1974	18.0	ND **	ND **	ND **	ND **	170.0
1987	83.0	162.0	460.0	ND **	590.0	3147.0
1988	359.0	901.0	619.0	4130.0	785.0	3425.0
1989	606.0	246.0	508.0	1535.0	658.0	3200.0
1990	204.0	126.0	304.0	690.0	290.0	2087.0
1991	228.0	338.5	340.5	197.0	387.0	2404.5
1992	154.5	190.5	350.5	ND **	686.0	2228.0
1993	130.0	63.0	175.0	ND **	ND **	1412.5
1994	33.0	61.0	123.5	ND **	ND **	988.5

\* Units in pCi/kg

\*\* None detected

FIGURE 2-4  
Discharge Sediment





## 2.7 FISH

*Note: Analytical results are presented in Tables 6.1 through 6.4 of Attachment I and summarized in Section 4.0.*

### **2.7.1 Interpretations and Trends of Results**

Fish samples were collected semiannually from two locations and analyzed for gamma radionuclides. In 1994, Cesium-134 levels were undetectable in indicator and control locations. ANO's indicator sample location contained Cesium-137 which ranged from 8.0 - 16.0 pCi/kg with an annual mean of 12.3 pCi/kg. Cesium-137 was also detected in the ADH split sample at the indicator location at a concentration of 16.0 pCi/kg. During the preoperational monitoring period, gamma radionuclides were not detected.

No reporting levels as outlined in ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-3 and 3.12-3 respectively, were equaled or exceeded when averaged over any calendar quarter. Also, as shown in Figure 2-5, all detectable activities over previous years were well below the required LLD, and therefore results may not be true positives.

In addition, atmospheric fallout from nuclear weapons testing during the preoperational years and the most recent incident, Chernobyl Nuclear Power Plant in 1986, could be contributing to these levels since Cesium-137 has been detected in the control location over previous preoperational and operational years. However overall, the operation of ANO had no significant radiological impact upon the environment or public by this pathway.

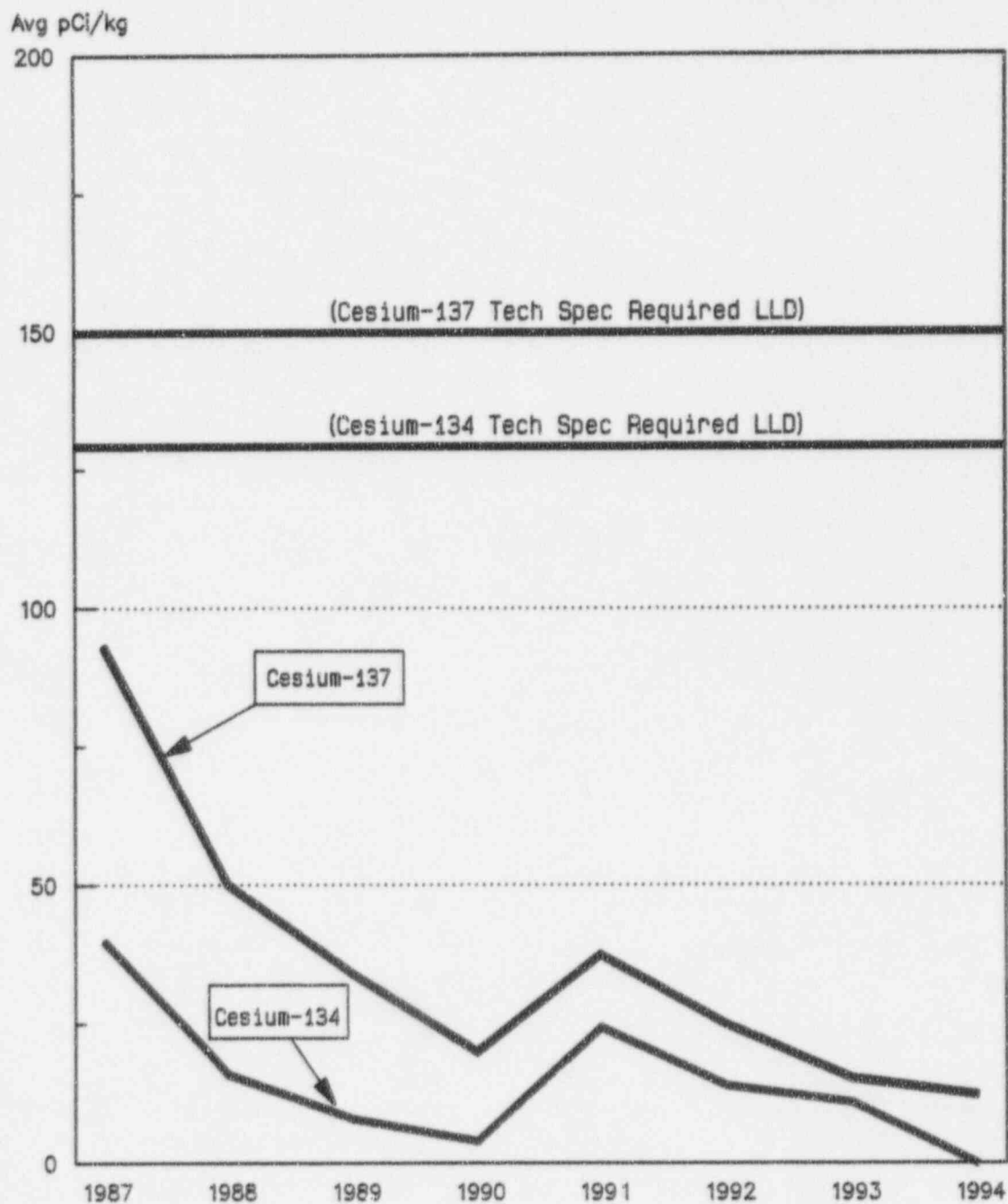
### **2.7.2 Program Description**

ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-1 and 3.12-1, respectively, require two fish locations for measurement of radioactivity by the ingestion exposure pathway. Fish were collected semiannually by a contractor from two locations, an indicator (Discharge) and a control (Intake), at distances from 0.1 to 0.9 miles (see Table 1-2 and Figure 1-2). In addition, the ADH collected and split samples with ANO at the discharge and intake location.

A sufficient amount was collected from each location to provide a minimum of 1000 grams (wet weight) of eviscerated fish sample. The samples were then analyzed for gamma radionuclides.

FIGURE 2-5  
Discharge Fish

1987 - 1994 Radionuclide Concentrations  
Discharge Fish



## **2.8 ANNUAL LAND USE CENSUS**



### **2.8.1 Interpretations and Trends of Results**

ANO did not modify the REMP, even though some changes occurred from 1993 to 1994. These changes involved replacing the White, Cravens and Shelton residences in Sectors 2, 6 and 12 with nearer residences (Snider, Lambert and Sides).

The land use census identified no location which yielded a calculated dose or dose commitment greater than those currently calculated. ANO personnel chose not to perform a garden census in 1994, which is allowed by ANO Unit One Technical Specification 4.30.2 and Unit Two Technical Specification 3/4.12.2, in lieu of broadleaf vegetation sampling in the meteorological sector (Sector 13) with the highest "D/Q". Results of the 1994 Land Use Census are presented in Table 2-3.

### **2.8.2 Program Description**

ANO personnel conducted an Annual Land Use Census, as required by ANO Unit 1 and Unit 2 Technical Specifications 4.30.2 and 3/4.12.2, respectively. The purpose of the census was to identify changes in uses of land within five miles of ANO which would require modifications to the REMP or Offsite Dose Calculation Manual (ODCM). The most important criteria during the census were to determine location in each sector of the nearest:

- Residence
- Animal milked for human consumption
- Garden of greater than 50 m<sup>2</sup> (500 ft<sup>2</sup>) producing broadleaf vegetation \*

The method used for conducting the 1994 Land Use Census was as follows:

- ANO personnel conducted door-to-door field surveys in each meteorological sector out to five miles in order to locate the nearest resident, milk animal and garden \*.
- Consultation with local agricultural authorities was used in instances when personal contact could not be made.
- As a result of these surveys, the following information was obtained in each meteorological sector:
  - Nearest permanent residence
  - Nearest garden and approximate size \*
  - Nearest milking animal.
- ANO personnel identified locations on the map, measured distances to ANO and recorded results.
- ANO personnel compared 1994 census results to 1993 census results.

\* ANO personnel chose not to perform a garden census in 1994, which is allowed by Unit 1 Technical Specification 4.30.2 and Unit 2 Technical Specification 3/4.12.2, in lieu of broadleaf vegetation sampling in the highest "D/Q" meteorological sector (Sector 13).

TABLE 2-3

1994 Land Use Census

(September 1994)

LAND USE CENSUS OF MILK-PRODUCING ANIMALS WITHIN FIVE (5) MILES

Milk - producing animals are divided into two categories defined as:

1. **Class A Dairies:** dairies in which milk is intended primarily for human consumption as Grade A milk.
2. **Individual Milk Animals:** family animals in which the milk is intended for home use.

Class A Dairies

<u>Dairy</u>	<u>Azimuth - Distance</u>
James Gibson	358 degrees - 3.8 miles

Individual Milk Animals

Bryan Irby	344 degrees - 2.8 miles
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MILK-PRODUCING ANIMALS OUTSIDE FIVE MILESClass A Dairies

<u>Dairy</u>	<u>Azimuth - Distance</u>
Arkansas Tech. Univ. Dairy	95 degrees - 5.1 miles
Harold Steuber (alternate)	24 degrees - 6.9 miles
Lawrence Steuber	0 degrees - 7.5 miles
Hudson Dairy (control)	73 degrees - 12.4 miles

INDIVIDUAL MILK -PRODUCING ANIMALS

None

TABLE 2-3

1994 Land Use Census

(September 1994)

Location of Nearest Residence

<u>Sector</u>	<u>Residence</u>	<u>Location</u>	<u>Distance (miles)</u>
1	S. Lynn	Hwy 333	0.7
2	Snider *	8893 Hwy 64	1.2
3	G. Murray	Gum Lane	0.9
4	Knight	Knight Lane	0.7
5	O. Bibler	Bibler Lane	0.9
6	R. Lambert *	Scott Lane	0.8
7	Douglas	237 Bunker Hill Lane	0.8
8	M. A. Wood	Wood Lane	0.8
9	J. Kelley	Rt. 3 Dardanelle	2.8
10	McClurley	May Road	0.8
11	Mhalderman	Hwy 22	3.2
12	G. Sides *	Flatwood Road	0.7
13	J. Nichols	Flatwood Road	1.0
14	Young	110 Round Mt. Lane	0.7
15	Stiles	Flatwood Road	0.9
16	C. Bohannon	2643 S.R. 333	1.2

\* *Changed since 1993 census.*

TABLE 2-3  
1994 Land Use Census  
 (September 1994)

Distance to Nearest Milk Animal, Residence and Garden (miles)

<u>Sector</u>	<u>Milk Animal</u>	<u>Residence</u>	<u>Garden</u>
1	3.8	0.7	*
2		1.2	*
3		0.9	*
4		0.7	*
5		0.9	*
6		0.8	*
7		0.8	*
8		0.8	*
9		2.8	*
10		0.8	*
11		3.2	*
12		0.7	*
13		1.0	*
14		0.7	*
15		0.9	*
16	2.8	1.2	*

\* Garden census not performed in lieu of broadleaf vegetation sampling in the meteorological sector (Sector 13) with the highest "D/Q".



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## **SECTION 3.0**

### **ANALYTICAL PROGRAM TECHNICAL DESCRIPTION**

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### **3.1 Sampling Handling and Treatment**

Once a representative sample is received by the analytical laboratory, the laboratory staff is responsible for properly treating and storing the sample. Environmental samples frequently require treatment prior to analysis. Treatment of the sample after it is received depends on the sample and analyses to be performed.

#### **3.1.1 Water Samples**

Depending on sample type, one-gallon water samples were acidified with five to twenty milliliters (ml) of concentrated hydrochloric (HCl) acid when collected. Samples for tritium analyses should not be stored in polyethylene bottles for more than 3 or 4 months because water can evaporate through polyethylene.

#### **3.1.2 Air Filters**

Air filters were handled with care when heavy dust loadings were observed because particulate matter is easily removed from the filter. Air filters were normally received by the laboratory in plastic containers; some extremely low-level analyses required analysis of the container as well as the sample.

#### **3.1.3 Milk**

Milk samples were usually refrigerated until analyses could be performed. Milk samples analyzed for Iodine-131 had 100 ml of formaldehyde added to avoid binding of the iodine that may occur with smaller levels of formaldehyde.

#### **3.1.4 Soil and Bottom Sediment**

Soil and sediment samples were dried, pulverized and sieved before analysis. To ensure a homogeneous sample, thorough mixing was required.

#### **3.1.5 Other Samples**

Perishable samples were preserved by refrigeration or freezing. Vegetation and other samples may need to be dried, pulverized or ashed before or after analysis for long-term storage.

### **3.2 Gross Beta Air Sample Analysis**

Air filters were counted for 100 minutes, or until required LLDs shown in ANO's Unit 1 Technical Specification Table 4.30-2 and Unit 2 Technical Specification Table 3.12-2 were achieved, in a low-background alpha-beta counter at least 24-hours after collection in order to allow for decay of short-lived materials such as radon and thoron.

### **3.3 Gross Beta Water Sample Analysis**

This section describes the process used to measure overall beta radionuclides of water samples without identifying specific radioactive isotopes present. No chemical separation techniques were involved. Two hundred ml of sample were evaporated in a beaker on a hot plate. The residue was transferred and dried in a 2-inch stainless steel planchet. The planchets were counted for 100 minutes, or until required LLDs referenced in Section 3.2 were achieved, in a low-background alpha-beta counting system. Calculation of activity includes a self-absorption correction factor for counter efficiency based on weight of residue on each planchet.

### **3.4 Tritium Water Sample Analysis**

Five ml of water was added to 15 ml of liquid scintillation solution in a 25 ml vial. The sample was inserted into a liquid scintillation spectrometer and counted for 300 - 500 minutes, or until required LLDs referenced in Section 3.2 were achieved.

### **3.5 Iodine-131 Sample Analysis**

Four liters or more of the sample were thoroughly mixed with a stable iodine carrier solution, and passed through an anion exchange resin column to remove iodine from the sample.

Next, the iodine was stripped from the resin with a sodium hypochlorite solution, reduced with hydroxylamine hydrochloride and extracted into carbon tetrachloride as free iodine. It was then back-extracted into sodium bisulfite solution and was precipitated as silver iodide. The precipitate was mounted on a stainless steel planchet and counted for 240 minutes, or until required LLDs referenced in Section 3.2 were achieved, in a low-background alpha-beta counting system.

### **3.6 Gamma Isotopic Sample Analysis**

#### **3.6.1 Milk and Water**

A 3.5-liter Marinelli beaker was filled with a representative aliquot of the sample. The sample was then counted for a minimum of 240 minutes, or until required LLDs referenced in Section 3.2 were achieved, in a shielded GeLi detector.

A computer software program defined peaks by certain changes in slope of the spectrum. The program also compared the energy of each peak with a library of peaks for radionuclide identification and then performed a calculation using appropriate fractional gamma ray abundance, half-life, detector efficiency and net counts in the peak region.

#### **3.6.2 Vegetation, Food and Garden Crops and Fish**

A maximum quantity of undried vegetation, food or garden crop sample was loaded into a tared 3.5-liter Marinelli and weighed. The sample was then counted for 60 minutes, or until required LLDs referenced in Section 3.2 were achieved, in a shielded GeLi detector as described in Section 3.6.1.

As much as possible (up to the total sample) of the edible portion of a fish was loaded into a tared Marinelli beaker and weighed. The sample was diluted with deionized water to weigh 3.5 kilograms and counted for a minimum of 240 minutes, or until required LLDs referenced in Section 3.2 were achieved, in a shielded GeLi detector as described in Section 3.6.1.

#### **3.6.3 Soils and Sediments**

Soils and sediments were dried at a low temperature (less than 100° C), loaded into a tared 1.0-liter Marinelli beaker and weighed. The sample was then counted for 240 minutes, or until required LLDs referenced in Section 3.2 were achieved, in a shielded GeLi detector as described in Section 3.6.1.

#### **3.6.4 Charcoal Cartridges**

Charcoal cartridges were counted in a Marinelli beaker, with one to four cartridges positioned on the face of a GeLi detector and up to seven cartridges on its side. Each detector was calibrated for both top and side positions and a counting efficiency determined. The Iodine-131 detection limit was determined for each charcoal cartridge, assuming no positive results for Iodine-131, by utilizing smallest volume of air recorded for a cartridge within the Marinelli beaker. If Iodine-131 was observed in the screening count of a set of cartridges, each charcoal cartridge was positioned on the face of the detector and then counted separately.

#### **3.6.5 Air Particulate**

The 12 to 14 (depending on the calendar quarter) air particulate filters for a quarterly composite for each field station were stacked one on top of another and counted for at least one hour in a shielded GeLi detector, as described in Section 3.6.1, or until required LLDs referenced in Section 3.2 were achieved.

#### **3.7 Thermoluminescent Dosimetry**

Environmental radiation doses were measured using TLDs that contained two lithium borate and calcium sulfate elements. Approximately forty-eight hours prior to installation, the TLDs were annealed. After cooling, the TLDs were mounted in appropriate labeled blue clamshell type hangers and double-sealed in a whirl-pak, or similar protective covering. Upon return from the field, TLDs were read in a Panasonic UD-710A TLD Reader.

#### **3.8 Data Reporting Conventions**

The mean of the analytical results is calculated as follows:

$$\bar{X} = \sum Xi / n$$

where:  $\bar{X}$  = Mean

$Xi$  = Individual sample results

$n$  = Number of sample results



Rounding of calculated values is accomplished by inspection of digits to the right of the last reported digit with values less than 5 rounded down and values greater than 5 rounded up. When values equals 5, reported value is rounded to an even number.

Analytical results, which are less than the two sigma counting error, are reported as less than the lower limit of detection calculated for that sample. Analytical results greater than the two sigma counting error are reported along with the associated two sigma counting error as a plus or minus ( $\pm$ ) term.

Calendar quarters are considered to be the following time periods:

- 1st Quarter = January - March
- 2nd Quarter = April - June
- 3rd Quarter = July - September
- 4th Quarter = October - December

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## SECTION 4.0

### RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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#### 4.1 1994 Program Results Summary

Table 4-1, which includes all sampling locations and samples split with the ADH, summarizes the 1994 REMP results. Table 4-2 lists indicator and control locations used to develop Table 4-1. 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 4-1

Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type ( Units )	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean ( F ) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean ( F ) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean ( F ) <sup>c</sup> [ Range ]		
Air Particulates ( pCi/m <sup>3</sup> )	GB 312	0.01	0.015 ( 207 / 208 ) [ 0.004 - 0.032 ]	Station 2 ( 235°, 0.4 mi )	0.016 ( 51 / 52 ) [ 0.007 - 0.032 ]	0.016 ( 104 / 104 ) [ 0.004 - 0.036 ]	0
	GS 24						
	Cs-134	0.01	<LLD	N/A	N/A	<LLD	0
	Cs-137	0.01	<LLD	N/A	N/A	<LLD	0
Airborne Iodine ( pCi/m <sup>3</sup> )	I-131 312	0.07	<LLD	N/A	N/A	<LLD	0
0 - 2 Mile TLDs ( mR/Qtr )	Gamma 43	(f)	16.4 ( 43 / 43 ) [ 13.0 - 19.0 ]	Station 109 ( 285°, 0.5 mi )	18.0 ( 3 / 3 ) [ 17.0 - 19.0 ]	N/A	0
2 - 5 Mile TLDs ( mR/Qtr )	Gamma 59	(f)	15.0 ( 59 / 59 ) [ 11.0 - 20.0 ]	Station 112 ( 74°, 2.6 mi )	17.3 ( 4 / 4 ) [ 15.0 - 20.0 ]	N/A	0
>5 Mile TLDs ( mR/Qtr )	Gamma 70	(f)	N/A	N/A	N/A	15.7 ( 70 / 70 ) [ 12.0 - 20.0 ]	0



TABLE 4-1

Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type (Units)	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> [ Range ]		
Drinking Water (pCi/l)	GB 12	4	4.8 ( 4 / 12 ) [ 2.9 - 7.8 ]	Station 14 ( 70°, 5.3 mi )	4.8 ( 4 / 12 ) [ 2.9 - 7.8 ]	N/A	0
	I-131 12	1.0	0.3 ( 1 / 12 ) [ N/A ]	Station 14 ( 70°, 5.3 mi )	0.3 ( 1 / 12 ) [ N/A ]	N/A	0
	H-3 4	1000	<LLD	N/A	N/A	N/A	0
	GS 12						
	Mn-54	15	<LLD	N/A	N/A	N/A	0
	Fe-59	30	<LLD	N/A	N/A	N/A	0
	Co-58	15	<LLD	N/A	N/A	N/A	0
	Co-60	15	<LLD	N/A	N/A	N/A	0
	Zn-65	30	<LLD	N/A	N/A	N/A	0
	Zr-95	15	<LLD	N/A	N/A	N/A	0
	Nb-95	15	<LLD	N/A	N/A	N/A	0
	Cs-134	10	<LLD	N/A	N/A	N/A	0
	Cs-137	18	<LLD	N/A	N/A	N/A	0
	Ba-140	15	<LLD	N/A	N/A	N/A	0
	La-140	15	<LLD	N/A	N/A	N/A	0

TABLE 4-1

Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type (Units)	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Location Mean (F) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> [ Range ]		
Surface Water (pCi/l)	H-3 8	(g)	610.0 ( 3 / 4 ) [ 430.0 - 950.0 ]	Station 8 ( 180°, 0.1 mi )	610.0 ( 3 / 4 ) [ 430.0 - 950.0 ]	420.0 ( 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	15	<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	15	<LLD	N/A	N/A	<LLD	0
	La-140	15	<LLD	N/A	N/A	<LLD	0
ADH Split Surface Water (pCi/l)	H-3 24	(g)	715.0 ( 2 / 12 ) [ 430.0 - 1000.0 ]	Station 8 ( 180°, 0.1 mi )	715.0 ( 2 / 12 ) [ 430.0 - 1000.0 ]	<LLD	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	15	<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	15	<LLD	N/A	N/A	<LLD	0
	La-140	15	<LLD	N/A	N/A	<LLD	0

TABLE 4-1

Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type (Units)	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> [ Range ]		
Groundwater (pCi/l)	H-3 8	1000	<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	15	<LLD	N/A	N/A	<LLD	0
	Nb-95	15	<LLD	N/A	N/A	<LLD	0
	Cs-134	10	<LLD	N/A	N/A	<LLD	0
	Cs-137	18	<LLD	N/A	N/A	<LLD	0
	Ba-140	15	<LLD	N/A	N/A	<LLD	0
	La-140	15	<LLD	N/A	N/A	<LLD	0
Milk (pCi/l)	I-131 48	1.0	<LLD	N/A	N/A	<LLD	0
	GS 48						
	Cs-134	15	<LLD	N/A	N/A	<LLD	0
	Cs-137	18	<LLD	N/A	N/A	<LLD	0
	Ba-140	15	<LLD	N/A	N/A	<LLD	0
	La-140	15	<LLD	N/A	N/A	<LLD	0

TABLE 4-1

## Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type (Units)	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> [ Range ]		
Vegetation (pCi/kg wet)	I-131	60	<LLD	N/A	N/A	N/A	0
	GS	60	<LLD	N/A	N/A	N/A	0
	Cs-134 Cs-137	80	<LLD	N/A	N/A	N/A	0
Food Product (pCi/kg wet)	I-131	60	<LLD	N/A	N/A	N/A	0
	GS	60	<LLD	N/A	N/A	N/A	0
	Cs-134 Cs-137	80	<LLD	N/A	N/A	N/A	0
ADH Split Food Product (pCi/kg wet)	I-131	60	<LLD	N/A	N/A	N/A	0
	GS	60	<LLD	N/A	N/A	N/A	0
	Cs-134 Cs-137	80	<LLD	N/A	N/A	N/A	0

TABLE 4-1

Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type (Units)	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean ( F ) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean ( F ) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean ( F ) [ Range ]		
Fish ( pCi/kg wet )	GS 8						
	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	12.3 ( 4 / 4 ) [ 8.0 - 16.0 ]	Station 8 ( 180°, 0.1 mi )	12.3 ( 4 / 4 ) [ 8.0 - 16.0 ]	<LLD	0
ADH Split Fish ( pCi/kg wet )	GS 3						
	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	16.0 ( 1 / 2 ) [ N/A ]	Station 8 ( 180°, 0.1 mi )	16.0 ( 1 / 2 ) [ N/A ]	<LLD	0



TABLE 4-1

Radiological Environmental Monitoring Program Summary

Name of Facility ANO - Units 1 and 2 Docket No. 50-313 and 50-368  
 Location of Facility Pope, Arkansas Reporting Period January - December 1994  
 (County, State)

Sample Type (Units)	Type & Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> [ Range ]	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> [ Range ]	Number of Nonroutine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> [ Range ]		
Bottom Sediment (pCi/kg dry)	GS <sup>6</sup>						
	Mn-54	(f)	33.0 (2 / 2) [ 33.0 - 33.0 ]	Station 8 ( 180°, 0.1 mi )	33.0 (2 / 2) [ 33.0 - 33.0 ]	17.0 (2 / 4) [ 12.0 - 22.0 ]	0
	Co-58	(f)	61.0 (1 / 2) [ N/A ]	Station 8 ( 180°, 0.1 mi )	61.0 (1 / 2) [ N/A ]	<LLD	0
	Co-60	(f)	123.5 (2 / 2) [ 113.0 - 134.0 ]	Station 8 ( 180°, 0.1 mi )	123.5 (2 / 2) [ 113.0 - 134.0 ]	<LLD	0
	Ag-110m	(f)	<LLD	N/A	<LLD	<LLD	0
	Cs-134	150	<LLD	N/A	<LLD	<LLD	0
	Cs-137	180	988.5 (2 / 2) [ 919.0 - 1058.0 ]	Station 8 ( 180°, 0.1 mi )	988.5 (2 / 2) [ 919.0 - 1058.0 ]	91.8 (4 / 4) [ 48.0-124.0 ]	0

<sup>a</sup> GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.

<sup>b</sup> LLD = Required lower limit of detection based on Arkansas Nuclear One Unit 1 and Unit 2 Technical Specification Tables 4.30-2 and 3.12-2, respectively.

<sup>c</sup> Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

<sup>d</sup> Locations are specified (1) by name and (2) degrees relative to reactor site.

<sup>e</sup> 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.

<sup>f</sup> LLD is not defined in ANO Unit 1 and Unit 2 Technical Specification Tables.

<sup>g</sup> LLD not defined in ANO Technical Specification Tables, therefore, assumed 2000 based on Regulatory Guide 4.8.

TABLE 4-2

Indicator & Control Locations

Sample Type	Locations	Total Samples	Total & Type of Analyses
Air	• Indicators - Station 1 (Met Tower)	52	52 ea. - Gross Beta, I-131; 4-Gamma
	Station 2 (AP&L Lodge)	52	52 ea. - Gross Beta, I-131; 4-Gamma
	Station 3 (Bennett Farm)	52	52 ea. - Gross Beta, I-131; 4-Gamma
	Station 4 (May Cemetery)	52	52 ea. - Gross Beta, I-131; 4-Gamma
	• Controls - Station 6 (Russellville)	52	52 ea. - Gross Beta, I-131; 4-Gamma
	Station 7 (AP&L Substation)	52	52 ea. - Gross Beta, I-131; 4-Gamma
TLDs	• Indicators		
	- 0 - 2 Miles - Stations 1, 2, 3, 4, 108, 109, 110, 113, 114, 115, 116	43	43-Gamma
	- 2 - 5 Miles - Stations 111, 112, 119, 120, 121, 122, 123, 124, 130, 131, 133, 134, 135, 136, 141	59	59-Gamma
	• Controls		
	- > 5 Miles - Stations 5, 6, 7, 117, 118, 125, 126, 127, 128, 129, 132, 137, 138, 139, 140, 142, 143, 144	70	70-Gamma
Water	<u>Drinking</u>		
	• Indicator - Station 14 (Russellville)	12	12 ea. - Gross Beta, I-131, Gamma; 4-Tritium
	• Control - None	N/A	N/A

TABLE 4-2

Indicator & Control Locations

Sample Type	Locations	Total Samples	Total & Type of Analyses
Water	<u>Surface</u>		
	• Indicators - Station 8 (Discharge)	12	12 Gamma; 4-Tritium
	Station 8 (Discharge) *	12	12 ea. - Tritium, Gamma
	• Controls - Station 10 (Intake)	12	12-Gamma; 4-Tritium
	Station 16 (Piney Creek) *	12	12 ea. - Tritium, Gamma
	<u>Groundwater</u>		
	• Indicator - Station 32 (Stewarts)	4	4 ea. - Tritium, Gamma
	• Control - Station 33 (Ouita Lake Recreation Area)	4	4 ea. - Tritium, Gamma
Milk	• Indicators - Station 19 (Arkansas Tech)	12	12 ea. - I-131, Gamma
	Station 41 (Gibson)	11	11 ea. - I-131, Gamma
	• Controls - Station 37 (Steuber)	13	13 ea. - I-131, Gamma
	Station 42 (Hudson)	12	12 ea. - I-131, Gamma
Vegetation	• Indicators - Station 13 (Flatwood Road)	3	3 ea. - I-131, Gamma
	Station 45 (Intake Canal)	3	3 ea. - I-131, Gamma
	• Control - None	N/A	N/A
Food Products	• Indicators - Station 32 (Cochran Residence)	2	2 ea. - I-131, Gamma
	Station 38 (Jones Residence)	3	3 ea. - I-131, Gamma
	Station 40 (Hollis Residence)	3	3 ea. - I-131, Gamma
	Station 108 (Shivers Residence)	7	7 ea. - I-131, Gamma
	Station 108 (Shivers Residence) *	5	5 ea. - I-131, Gamma
	• Control - None	N/A	N/A

\* ADH split sample

TABLE 4-2

Indicator & Control Locations

Sample Type	Locations	Total Samples	Total & Type of Analyses
Fish	• Indicators - Station 8 (Discharge)	4	4-Gamma
	Station 8 (Discharge) *	2	2-Gamma
	• Controls - Station 10 (Intake)	4	4-Gamma
	Station 10 (Intake) *	1	1-Gamma
Sediment	• Indicator - Station 8 (Discharge)	2	2-Gamma
	• Controls - Station 10 (Intake)	2	2-Gamma
	Station 16 (Piney Creek)	2	2-Gamma

\* ADH split sample

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**SECTION 5.0**  
**QUALITY CONTROL DATA**

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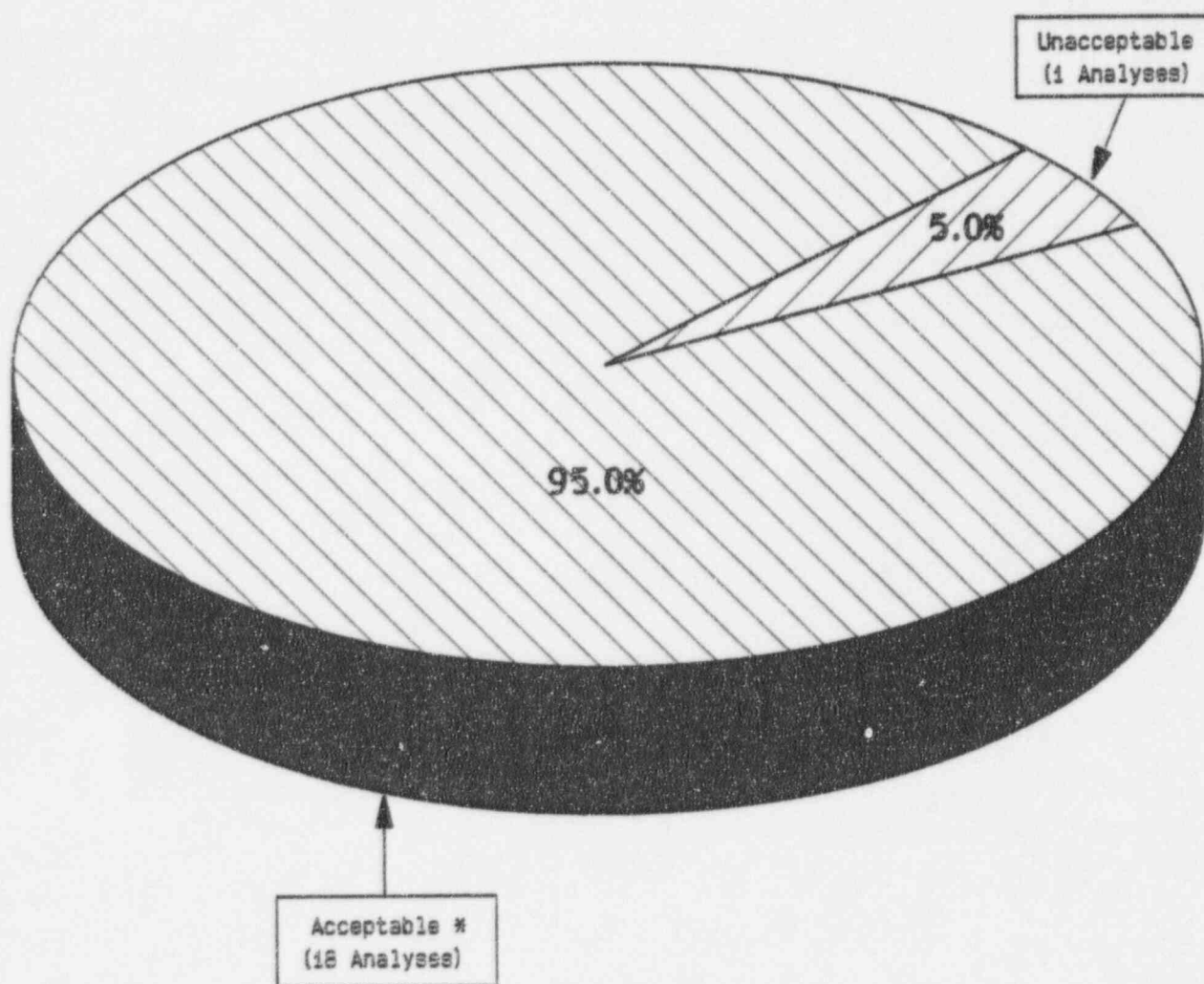
## 5.1 Crosscheck Program Results

ESI System Chemistry analyzed EPA crosscheck samples for ANO to fulfill the requirements of ANO Unit 1 and Unit 2 Technical Specifications 4.30.3 and 3/4.12.3, respectively. Attachment 2, the 1994 Radiological Environmental Monitoring Report, contains these results. ESI System Chemistry's analysis participation, shown in Figure 5-1, indicates consistent, valid data based on achieving a 95% analyses acceptance.

The one unacceptable analysis result, which involved the radionuclide Ruthenium-106, was determined by the laboratory to be associated with the gamma detectors calibration efficiency curve. This conclusion was based on the detectors being recalibrated and obtaining a new Ruthenium-106 calibration efficiency curve. Once the data from the new efficiency curve was incorporated into the equation that calculates activity, results fell within the acceptable three standard deviation range. Due to the small amount of Ruthenium-106 concentration in crosscheck samples of this type, other laboratories also experience similar problems due to the statistical probabilities involved with counting materials with low activity. However, since the efficiency curve was only related to Ruthenium-106, the validity of ANO's 1994 data was not affected in any way.

FIGURE 5-1  
EPA Intercomparison Study

EPA Interlaboratory Comparison  
Results for 1994



\* Within the Three Standard Deviation Range

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## **SECTION 6.0**

### **1994 SAMPLING AND ANALYTICAL RESULTS**

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### **6.1 1994 Data**

Attachments I and II present analytical data obtained by ESI System Chemistry and ANO's Dosimetry Section on samples collected from January through December 1994. ESI System Chemistry provided data in monthly progress reports with exception of TLDs. ANO's Dosimetry Section provided TLD data in quarterly reports. Data presented in Attachments I and II compare to that encountered in previous years.

### **6.2 Lower Limit of Detection**

ESI System Chemistry routinely counted below the maximum required LLDs specified in ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-2 and 3.12-2, respectively. Factors such as unavoidable small sample size, background fluctuations, presence of interfering radionuclides or other uncontrollable circumstances may cause Technical Specification LLDs to be unachievable. However, ANO personnel's review of 1994 results indicates acceptable LLDs within the required Technical Specifications limits.

### **6.3 Reporting Levels**

ANO found radioactivity attributable to plant operations in surface water, sediment and fish from the discharge. However, no reporting levels for radioactivity concentration in environmental samples, as outlined in ANO Unit 1 and Unit 2 Technical Specification Tables 4.30-3 and 3.12-3, respectively, when averaged over any calendar quarter, were equaled or exceeded due to ANO effluents. Therefore, no Radiological Monitoring Special Reports were required.

### **6.4 Sampling Deviations**

Four TLDs were lost or damaged in the field during 1994 due to vandalism or water moisture. Lost or damaged TLDs were replaced by ANO personnel once discovered. These losses were isolated instances which did not recur during the year.

However, TLD losses of this type are characteristic of other TLD programs. The 1994 recovery rate for TLDs was 98% (172 of 176) which is also comparable with other TLD programs.

In December of 1994, a sample was not collected from the Gibson Dairy, due to the owner discontinuing his milking operations. This reduced ANO's active sampling locations from four to three. Due to a misinterpretation of the technical specifications, an additional location was not added to the program until March 1995. This condition and corrective actions taken are discussed in Licensee Event Report 50-313/95-003-00, submitted on April 14, 1995 (OCAN049511).

The Russellville drinking water sample collected on May 5, 1994 was lost in-transit to the analytical laboratory. Efforts by ANO and laboratory personnel to locate the sample proved unsuccessful. Although this incident did not recur during 1994, ANO personnel are now collecting duplicate samples as a backup to offset a recurrence of this type again. In addition, a chain-of-custody form is now being utilized to track sample movement.

The Stewart food product sample location was discontinued in 1994 and replaced by the Cochran residence. This activity was not a deviation since ANO's active sampling locations remained at four, as compared to the technical specifications requirement of three.

All other samples were within program parameters.

**6.5 Radioactivity Not Attributable to ANO**

Radioactivity attributable to other sources was detected by the ANO REMP in 1977, 1978 and 1981 following nuclear weapons testing. The most recent incident occurred in May 1986 when the radioactive plume release due to reactor core degradation at the Chernobyl Nuclear Power Plant was detected.

**6.6 Sampling Relocation**

The Stewart food product garden location was discontinued and replaced by Cochran. This change was incorporated in the ODCM.

**6.7 Comparison to Federal and State Programs**

Data from the ANO REMP was compared to federal and state monitoring programs as results became available. The federal monitoring program used for comparison was the U.S. Nuclear Regulatory Commission (NRC) TLD Direct



Radiation Monitoring Network. The state program is conducted by the ADH.

The latest available results from the NRC TLD Network have been compared to those from ANO's program. Through 1994, no change in TLD results has been attributed to ANO operation.

Radiological monitoring by the ADH entails similar sampling requirements to the ANO REMP. In many cases air samples and TLDs are collocated, while sample media such as food products, water, milk and fish are shared or split. Throughout 1994, both programs have obtained results that are within similar ranges. The only common location where radioactivity attributable to ANO has been detected is the ANO discharge. Discharge water, sediment and fish results were above background levels due to ANO effluents.

**6.8 Unavailable Results**

Analytical contractor results were received in adequate time for inclusion in this report. No missing results were identified during ANO personnel's review.

**6.9 Harmful Effects or Irreversible Damage**

No harmful effects or evidence of irreversible damage were detected by ANO monitoring. Therefore, no analysis or planned course of action to alleviate problems was necessary.



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**ATTACHMENT I**

**1994 Radiological Environmental Monitoring Report**

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ARKANSAS NUCLEAR ONE  
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT  
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### Summary of Monitoring Results

In 1994, plant-related isotopes were detected in the intake sediment and surface water samples. Plant-related isotopes were also detected in the discharge fish, sediment and surface water during the 1994 reporting period.

### Sample Deviations

The following sampling deviations occurred during 1994:

- The Russellville city water sample collected for May 1994 was lost in-transit to the System Chemistry lab. For a more detailed discussion regarding this deviation, refer to Section 6.4 of the Annual Radiological Environmental Operating Report.
- The December 1994 milk sample was not collected from the Gibson Dairy (sample location MK-41) due to closure. For a more detailed discussion regarding this deviation, refer to Section 6.4 of the Annual Radiological Environmental Operating Report.

All other samples were within program parameters.

### Required Lower Limit of Detection (LLD) Values

All LLD values reported in 1994 were within the acceptable limits required by the technical specifications.



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 11

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS:  $\mu\text{Ci}/\text{m}^3$

LOCATION: 01, MET TOWER

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
940057	12/28/93	01/04/94	0.022 +/-0.002	< 0.050
940106	01/04/94	01/11/94	0.023 +/-0.002	< 0.019
940135	01/11/94	01/18/94	0.010 +/-0.002	< 0.024
940165	01/18/94	01/25/94	0.018 +/-0.002	< 0.019
940198	01/25/94	02/01/94	0.014 +/-0.002	< 0.025
940244	02/01/94	02/08/94	0.018 +/-0.002	< 0.032
940284	02/08/94	02/15/94	0.009 +/-0.002	< 0.026
940303	02/15/94	02/22/94	0.015 +/-0.002	< 0.021
940383	02/22/94	03/01/94	0.011 +/-0.002	< 0.038
940415	03/01/94	03/08/94	0.013 +/-0.002	< 0.028
940430	03/08/94	03/15/94	0.008 +/-0.002	< 0.018
940468	03/15/94	03/22/94	0.008 +/-0.002	< 0.020
940501	03/22/94	03/29/94	0.010 +/-0.002	< 0.022
940601	03/29/94	04/05/94	0.016 +/-0.002	< 0.020
940685	04/05/94	04/12/94	0.012 +/-0.002	< 0.030
940701	04/12/94	04/19/94	0.015 +/-0.002	< 0.023
940732	04/19/94	04/26/94	0.010 +/-0.002	< 0.022
940773	04/26/94	05/03/94	0.012 +/-0.002	< 0.024
940809	05/03/94	05/10/94	0.007 +/-0.003	< 0.027
940844	05/10/94	05/17/94	0.016 +/-0.002	< 0.016
940902	05/17/94	05/24/94	0.013 +/-0.002	< 0.040
940909	05/24/94	05/31/94	0.012 +/-0.002	< 0.023
940953	05/31/94	06/07/94	0.010 +/-0.002	< 0.021
941001	06/07/94	06/14/94	0.009 +/-0.002	< 0.053
941029	06/14/94	06/21/94	0.008 +/-0.002	< 0.015
941063	06/21/94	06/28/94	0.018 +/-0.002	< 0.018

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 1.1a

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 01, MET TOWER

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
941152	06/28/94	07/05/94	0.015 +/-0.002	< 0.021
941201	07/05/94	07/12/94	0.011 +/-0.002	< 0.015
941233	07/12/94	07/19/94	0.009 +/-0.002	< 0.017
941291	07/19/94	07/26/94	0.015 +/-0.002	< 0.028
941315	07/26/94	08/02/94	0.015 +/-0.002	< 0.017
941368	08/02/94	08/09/94	0.015 +/-0.002	< 0.026
941421	08/09/94	08/16/94	0.019 +/-0.002	< 0.035
941441	08/16/94	08/23/94	0.017 +/-0.002	< 0.027
941469	08/23/94	08/30/94	0.017 +/-0.002	< 0.012
941517	08/30/94	09/06/94	0.011 +/-0.002	< 0.035
941579	09/06/94	09/13/94	0.023 +/-0.002	< 0.032
941616	09/13/94	09/20/94	0.019 +/-0.002	< 0.031
941720	09/20/94	09/27/94	0.012 +/-0.002	< 0.047
941767	09/27/94	10/04/94	0.031 +/-0.003	< 0.030
941778	10/04/94	10/11/94	0.023 +/-0.002	< 0.027
941831	10/11/94	10/18/94	0.010 +/-0.002	< 0.025
941867	10/18/94	10/25/94	0.017 +/-0.002	< 0.033
941911	10/25/94	11/01/94	0.018 +/-0.002	< 0.029
941984	11/01/94	11/08/94	0.021 +/-0.002	< 0.030
941994	11/08/94	11/15/94	0.008 +/-0.002	< 0.018
942045	11/15/94	11/22/94	0.011 +/-0.002	< 0.027
942052	11/22/94	11/29/94	0.014 +/-0.002	< 0.021
942111	11/29/94	12/06/94	0.016 +/-0.002	< 0.035
942135	12/06/94	12/13/94	0.020 +/-0.002	< 0.019
942152	12/13/94	12/20/94	0.020 +/-0.002	< 0.021
942231	12/20/94	12/27/94	0.019 +/-0.002	< 0.047

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 1.2

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 02, SW OF SITE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
940058	12/28/93	01/04/94	0.020 +/-0.002	< 0.050
940107	01/04/94	01/11/94	0.011 +/-0.002	< 0.019
940136	01/11/94	01/18/94	0.021 +/-0.002	< 0.024
940166	01/18/94	01/25/94	0.015 +/-0.002	< 0.019
940199	01/25/94	02/01/94	0.014 +/-0.002	< 0.025
940245	02/01/94	02/08/94	0.016 +/-0.002	< 0.032
940285	02/08/94	02/15/94	0.018 +/-0.002	< 0.026
940304	02/15/94	02/22/94	0.015 +/-0.002	< 0.021
940384	02/22/94	03/01/94	0.011 +/-0.002	< 0.038
940415	03/01/94	03/08/94	0.013 +/-0.002	< 0.028
940431	03/08/94	03/15/94	0.012 +/-0.002	< 0.018
940469	03/15/94	03/22/94	0.009 +/-0.002	< 0.020
940502	03/22/94	03/29/94	0.012 +/-0.002	< 0.022
940602	03/29/94	04/05/94	0.016 +/-0.002	< 0.020
940686	04/05/94	04/12/94	0.011 +/-0.002	< 0.030
940702	04/12/94	04/19/94	0.021 +/-0.002	< 0.023
940733	04/19/94	04/26/94	0.018 +/-0.002	< 0.022
940774	04/26/94	05/03/94	0.007 +/-0.002	< 0.024
940810	05/03/94	05/10/94	0.015 +/-0.003	< 0.027
940845	05/10/94	05/17/94	0.016 +/-0.002	< 0.016
940903	05/17/94	05/24/94	0.015 +/-0.002	< 0.040
940910	05/24/94	05/31/94	0.009 +/-0.002	< 0.023
940954	05/31/94	06/07/94	0.015 +/-0.002	< 0.021
941002	06/07/94	06/14/94	< 0.008	< 0.053
941030	06/14/94	06/21/94	0.016 +/-0.002	< 0.015
941064	06/21/94	06/28/94	0.020 +/-0.002	< 0.018

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO.: 1.2a

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 02, SW OF SITE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
			0.01	0.07
941153	06/28/94	07/05/94	0.019 +/-0.002	< 0.021
941202	07/05/94	07/12/94	0.013 +/-0.002	< 0.015
941234	07/12/94	07/19/94	0.012 +/-0.002	< 0.017
941292	07/19/94	07/26/94	0.016 +/-0.002	< 0.028
941316	07/26/94	08/02/94	0.017 +/-0.002	< 0.017
941369	08/02/94	08/09/94	0.019 +/-0.002	< 0.026
941422	08/09/94	08/16/94	0.023 +/-0.002	< 0.035
941442	08/16/94	08/23/94	0.020 +/-0.002	< 0.027
941470	08/23/94	08/30/94	0.025 +/-0.002	< 0.012
941518	08/30/94	09/06/94	0.009 +/-0.002	< 0.035
941580	09/06/94	09/13/94	0.022 +/-0.002	< 0.032
941617	09/13/94	09/20/94	0.020 +/-0.002	< 0.031
941721	09/20/94	09/27/94	0.018 +/-0.002	< 0.047
941768	09/27/94	10/04/94	0.032 +/-0.003	< 0.030
941779	10/04/94	10/11/94	0.023 +/-0.002	< 0.027
941832	10/11/94	10/18/94	0.010 +/-0.002	< 0.025
941868	10/18/94	10/25/94	0.018 +/-0.002	< 0.033
941912	10/25/94	11/01/94	0.019 +/-0.002	< 0.029
941985	11/01/94	11/08/94	0.019 +/-0.002	< 0.030
941995	11/08/94	11/15/94	0.010 +/-0.002	< 0.018
942046	11/15/94	11/22/94	0.015 +/-0.002	< 0.027
942053	11/22/94	11/29/94	0.017 +/-0.002	< 0.021
942112	11/29/94	12/06/94	0.017 +/-0.002	< 0.035
942136	12/06/94	12/13/94	0.020 +/-0.002	< 0.019
942153	12/13/94	12/20/94	0.027 +/-0.002	< 0.021
942232	12/20/94	12/27/94	0.015 +/-0.002	< 0.047

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 1.3

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 03, N OF SITE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
940059	12/28/93	01/04/94	0.015 +/-0.002	< 0.050
940108	01/04/94	01/11/94	0.017 +/-0.002	< 0.019
940137	01/11/94	01/18/94	0.015 +/-0.002	< 0.024
940167	01/18/94	01/25/94	0.015 +/-0.002	< 0.019
940200	01/25/94	02/01/94	0.011 +/-0.002	< 0.025
940246	02/01/94	02/08/94	0.017 +/-0.002	< 0.032
940286	02/08/94	02/15/94	0.015 +/-0.002	< 0.026
940325	02/15/94	02/22/94	0.014 +/-0.002	< 0.021
940385	02/22/94	03/01/94	0.012 +/-0.002	< 0.038
940417	03/01/94	03/08/94	0.014 +/-0.002	< 0.028
940432	03/08/94	03/15/94	0.011 +/-0.002	< 0.018
940470	03/15/94	03/22/94	0.007 +/-0.002	< 0.020
940503	03/22/94	03/29/94	0.013 +/-0.002	< 0.022
940603	03/29/94	04/05/94	0.016 +/-0.002	< 0.020
940687	04/05/94	04/12/94	0.012 +/-0.002	< 0.030
940703	04/12/94	04/19/94	0.013 +/-0.002	< 0.023
940734	04/19/94	04/26/94	0.017 +/-0.002	< 0.022
940775	04/26/94	05/03/94	0.007 +/-0.002	< 0.024
940811	05/03/94	05/10/94	0.022 +/-0.003	< 0.027
940846	05/10/94	05/17/94	0.015 +/-0.002	< 0.016
940904	05/17/94	05/24/94	0.012 +/-0.002	< 0.040
940911	05/24/94	05/31/94	0.014 +/-0.002	< 0.023
940955	05/31/94	06/07/94	0.010 +/-0.002	< 0.021
941003	06/07/94	06/14/94	0.005 +/-0.002	< 0.053
941031	06/14/94	06/21/94	0.011 +/-0.002	< 0.015
941065	06/21/94	06/28/94	0.016 +/-0.002	< 0.018



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 1.3a

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 03, N OF SITE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
941154	06/28/94	07/05/94	0.020 +/-0.002	< 0.021
941203	07/05/94	07/12/94	0.011 +/-0.002	15
941235	07/12/94	07/19/94	0.011 +/-0.002	17
941293	07/19/94	07/26/94	0.016 +/-0.002	< 0.028
941317	07/26/94	08/02/94	0.015 +/-0.002	< 0.017
941370	08/02/94	08/09/94	0.017 +/-0.002	< 0.026
941423	08/09/94	08/16/94	0.020 +/-0.002	< 0.035
941443	08/16/94	08/23/94	0.018 +/-0.002	< 0.027
941471	08/23/94	08/30/94	0.023 +/-0.002	< 0.012
941519	08/30/94	09/06/94	0.014 +/-0.002	< 0.035
941581	09/06/94	09/13/94	0.029 +/-0.002	< 0.032
941618	09/13/94	09/20/94	0.026 +/-0.002	< 0.031
941722	09/20/94	09/27/94	0.014 +/-0.002	< 0.047
941769	09/27/94	10/04/94	0.031 +/-0.003	< 0.030
941780	10/04/94	10/11/94	0.017 +/-0.002	< 0.027
941833	10/11/94	10/18/94	0.009 +/-0.002	< 0.025
941869	10/18/94	10/25/94	0.016 +/-0.002	< 0.033
941913	10/25/94	11/01/94	0.018 +/-0.002	< 0.029
941986	11/01/94	11/08/94	0.016 +/-0.002	< 0.030
941996	11/08/94	11/15/94	0.008 +/-0.002	< 0.018
942047	11/15/94	11/22/94	0.016 +/-0.002	< 0.027
942054	11/22/94	11/29/94	0.017 +/-0.002	< 0.021
942113	11/29/94	12/06/94	0.016 +/-0.002	< 0.035
942137	12/06/94	12/13/94	0.018 +/-0.002	< 0.019
942154	12/13/94	12/20/94	0.022 +/-0.002	< 0.021
942733	12/20/94	12/27/94	0.019 +/-0.002	< 0.047

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 14

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 04, MAY CEMETERY

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
			0.01	0.07
940060	12/28/93	01/04/94	0.011 +/-0.002	< 0.050
940109	01/04/94	01/11/94	0.015 +/-0.002	< 0.019
940138	01/11/94	01/18/94	0.014 +/-0.002	< 0.024
940168	01/18/94	01/25/94	0.018 +/-0.002	< 0.019
940201	01/25/94	02/01/94	0.008 +/-0.002	< 0.025
940247	02/01/94	02/08/94	0.015 +/-0.002	< 0.032
940287	02/08/94	02/15/94	0.010 +/-0.002	< 0.026
940306	02/15/94	02/22/94	0.012 +/-0.002	< 0.021
940386	02/22/94	03/01/94	0.008 +/-0.002	< 0.038
940418	03/01/94	03/08/94	0.012 +/-0.002	< 0.028
940433	03/08/94	03/15/94	0.007 +/-0.002	< 0.018
940471	03/15/94	03/22/94	0.004 +/-0.002	< 0.020
940504	03/22/94	03/29/94	0.006 +/-0.002	< 0.022
940604	03/29/94	04/05/94	0.013 +/-0.002	< 0.020
940688	04/05/94	04/12/94	0.005 +/-0.002	< 0.030
940704	04/12/94	04/19/94	0.016 +/-0.002	< 0.023
940735	04/19/94	04/26/94	0.009 +/-0.002	< 0.022
940776	04/26/94	05/03/94	0.009 +/-0.002	< 0.024
940812	05/03/94	05/10/94	0.012 +/-0.003	< 0.027
940847	05/10/94	05/17/94	0.014 +/-0.002	< 0.016
940905	05/17/94	05/24/94	0.011 +/-0.002	< 0.040
940912	05/24/94	05/31/94	0.010 +/-0.002	< 0.023
940956	05/31/94	06/07/94	0.010 +/-0.002	< 0.021
941004	06/07/94	06/14/94	0.005 +/-0.002	< 0.003
941032	06/14/94	06/21/94	0.006 +/-0.002	< 0.015
941066	06/21/94	06/28/94	0.015 +/-0.002	< 0.018

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 1.4a

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 04 MAY CEMETERY

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
			0.01	0.07
941155	06/28/94	07/05/94	0.009 +/-0.002	< 0.021
941204	07/05/94	07/12/94	0.010 +/-0.002	< 0.015
941236	07/12/94	07/19/94	0.005 +/-0.002	< 0.017
941294	07/19/94	07/26/94	0.013 +/-0.002	< 0.028
941318	07/26/94	08/02/94	0.010 +/-0.002	< 0.017
941371	08/02/94	08/09/94	0.009 +/-0.002	< 0.026
941424	08/09/94	08/16/94	0.020 +/-0.002	< 0.035
941444	08/16/94	08/23/94	0.019 +/-0.002	< 0.027
941472	08/23/94	08/30/94	0.012 +/-0.002	< 0.012
941520	08/30/94	09/06/94	0.015 +/-0.002	< 0.035
941582	09/06/94	09/13/94	0.009 +/-0.002	< 0.032
941619	09/13/94	09/20/94	0.022 +/-0.002	< 0.031
941723	09/20/94	09/27/94	0.006 +/-0.002	< 0.047
941770	09/27/94	10/04/94	0.028 +/-0.002	< 0.030
941781	10/04/94	10/11/94	0.019 +/-0.002	< 0.027
941834	10/11/94	10/18/94	0.009 +/-0.002	< 0.025
941870	10/18/94	10/25/94	0.012 +/-0.002	< 0.033
941914	10/25/94	11/01/94	0.021 +/-0.002	< 0.029
941987	11/01/94	11/08/94	0.018 +/-0.002	< 0.030
941997	11/08/94	11/15/94	0.010 +/-0.002	< 0.018
942048	11/15/94	11/22/94	0.016 +/-0.002	< 0.027
942055	11/22/94	11/29/94	0.014 +/-0.002	< 0.021
942114	11/29/94	12/06/94	0.012 +/-0.002	< 0.035
942138	12/06/94	12/13/94	0.015 +/-0.002	< 0.019
942155	12/13/94	12/20/94	0.018 +/-0.002	< 0.021
942234	12/20/94	12/27/94	0.016 +/-0.002	< 0.047

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 15

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 06, LOCAL OFFICE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
940061	12/28/93	01/04/94	0.019 +/-0.002	< 0.050
940110	01/04/94	01/11/94	0.018 +/-0.002	< 0.019
940139	01/11/94	01/18/94	0.019 +/-0.002	< 0.024
940169	01/18/94	01/25/94	0.022 +/-0.002	< 0.019
940202	01/25/94	02/01/94	0.007 +/-0.002	< 0.025
940248	02/01/94	02/08/94	0.013 +/-0.002	< 0.032
940288	02/08/94	02/15/94	0.014 +/-0.002	< 0.026
940307	02/15/94	02/22/94	0.012 +/-0.002	< 0.021
940387	02/22/94	03/01/94	0.013 +/-0.002	< 0.038
940419	03/01/94	03/08/94	0.012 +/-0.002	< 0.028
940434	03/08/94	03/15/94	0.011 +/-0.002	< 0.018
940472	03/15/94	03/22/94	0.004 +/-0.002	< 0.020
940505	03/22/94	03/29/94	0.014 +/-0.002	< 0.022
940605	03/29/94	04/05/94	0.017 +/-0.002	< 0.020
940689	04/05/94	04/12/94	0.011 +/-0.002	< 0.030
940705	04/12/94	04/19/94	0.022 +/-0.002	< 0.023
940736	04/19/94	04/26/94	0.014 +/-0.002	< 0.022
940777	04/26/94	05/03/94	0.010 +/-0.002	< 0.024
940813	05/03/94	05/10/94	0.018 +/-0.003	< 0.027
940848	05/10/94	05/17/94	0.015 +/-0.002	< 0.016
940906	05/17/94	05/24/94	0.019 +/-0.002	< 0.040
940913	05/24/94	05/31/94	0.013 +/-0.002	< 0.023
940957	05/31/94	06/07/94	0.016 +/-0.002	< 0.021
941005	06/07/94	06/14/94	0.011 +/-0.002	< 0.053
941033	06/14/94	06/21/94	0.015 +/-0.002	< 0.015
941067	06/21/94	06/28/94	0.020 +/-0.002	< 0.018

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO.: 1.5a

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 06, LOCAL OFFICE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
941156	06/28/94	07/05/94	0.019 +/-0.002	< 0.021
941205	07/05/94	07/12/94	0.012 +/-0.002	< 0.015
941237	07/12/94	07/19/94	0.006 +/-0.002	< 0.017
941295	07/19/94	07/26/94	0.016 +/-0.002	< 0.028
941319	07/26/94	08/02/94	0.016 +/-0.002	< 0.017
941372	08/02/94	08/09/94	0.017 +/-0.002	< 0.026
941425	08/09/94	08/16/94	0.020 +/-0.002	< 0.035
941445	08/16/94	08/23/94	0.020 +/-0.002	< 0.027
941473	08/23/94	08/30/94	0.022 +/-0.002	< 0.012
941521	08/30/94	09/06/94	0.017 +/-0.002	< 0.035
941583	09/06/94	09/13/94	0.023 +/-0.002	< 0.032
941620	09/13/94	09/20/94	0.018 +/-0.002	0.031
941724	09/20/94	09/27/94	0.005 +/-0.002	< 0.047
941771	09/27/94	10/04/94	0.031 +/-0.003	< 0.030
941782	10/04/94	10/11/94	0.015 +/-0.002	< 0.027
941835	10/11/94	10/18/94	0.007 +/-0.002	< 0.025
941871	10/18/94	10/25/94	0.013 +/-0.002	< 0.033
941915	10/25/94	11/01/94	0.014 +/-0.002	< 0.029
941988	11/01/94	11/08/94	0.013 +/-0.002	< 0.030
941998	11/08/94	11/15/94	0.009 +/-0.002	< 0.018
942049	11/15/94	11/22/94	0.014 +/-0.002	< 0.027
942056	11/22/94	11/29/94	0.013 +/-0.002	< 0.021
942115	11/29/94	12/06/94	0.012 +/-0.002	< 0.035
942139	12/06/94	12/13/94	0.015 +/-0.002	< 0.019
942156	12/13/94	12/20/94	0.015 +/-0.002	< 0.021
942235	12/20/94	12/27/94	0.015 +/-0.002	< 0.047



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 16

SAMPLE: AIR SAMPLES, (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 07, DANVILLE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
940062	12/28/93	01/04/94	0.019 +/-0.002	< 0.050
940111	01/04/94	01/11/94	0.023 +/-0.002	< 0.019
940140	01/11/94	01/18/94	0.020 +/-0.002	< 0.024
940170	01/18/94	01/25/94	0.018 +/-0.002	< 0.019
940203	01/25/94	02/01/94	0.009 +/-0.002	< 0.025
940249	02/01/94	02/08/94	0.018 +/-0.002	< 0.032
940289	02/08/94	02/15/94	0.015 +/-0.002	< 0.026
940308	02/15/94	02/22/94	0.016 +/-0.002	< 0.021
940388	02/22/94	03/01/94	0.013 +/-0.002	< 0.038
940420	03/01/94	03/08/94	0.016 +/-0.002	< 0.028
940435	03/08/94	03/15/94	0.011 +/-0.002	< 0.018
940473	03/15/94	03/22/94	0.006 +/-0.002	< 0.020
940506	03/22/94	03/29/94	0.014 +/-0.002	< 0.022
940606	03/29/94	04/05/94	0.017 +/-0.002	< 0.020
940690	04/05/94	04/12/94	0.012 +/-0.002	< 0.030
940706	04/12/94	04/19/94	0.023 +/-0.002	< 0.023
940737	04/19/94	04/26/94	0.018 +/-0.002	< 0.022
940778	04/26/94	05/03/94	0.009 +/-0.002	< 0.024
940814	05/03/94	05/10/94	0.022 +/-0.003	< 0.027
940849	05/10/94	05/17/94	0.015 +/-0.002	< 0.016
940907	05/17/94	05/24/94	0.011 +/-0.002	< 0.040
940914	05/24/94	05/31/94	0.013 +/-0.002	< 0.023
940958	05/31/94	06/07/94	0.015 +/-0.002	< 0.021
941006	06/07/94	06/14/94	0.009 +/-0.002	< 0.053
941034	06/14/94	06/21/94	0.012 +/-0.002	< 0.015
941068	06/21/94	06/28/94	0.017 +/-0.002	< 0.018

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO.: 16a

SAMPLE: AIR SAMPLES (BETA, I-131)

COLLECTION: CONTINUOUS WITH WEEKLY EXCHANGE

UNITS: pCi/m<sup>3</sup>

LOCATION: 07, DANVILLE

LAB NO.	BEGIN DATE	END DATE	GROSS BETA	I-131
REQ'D LLD			0.01	0.07
941157	06/28/94	07/05/94	0.024 +/-0.002	< 0.021
941206	07/05/94	07/12/94	0.011 +/-0.002	< 0.015
941238	07/12/94	07/19/94	0.013 +/-0.002	< 0.017
941296	07/19/94	07/26/94	0.015 +/-0.002	< 0.028
941320	07/26/94	08/02/94	0.017 +/-0.002	< 0.017
941373	08/02/94	08/09/94	0.019 +/-0.002	< 0.026
941426	08/09/94	08/16/94	0.022 +/-0.002	< 0.035
941446	08/16/94	08/23/94	0.023 +/-0.002	< 0.027
941474	08/23/94	08/30/94	0.028 +/-0.002	< 0.012
941522	08/30/94	09/06/94	0.020 +/-0.002	< 0.035
941584	09/06/94	09/13/94	0.028 +/-0.002	< 0.032
941621	09/13/94	09/20/94	0.021 +/-0.002	< 0.031
941725	09/20/94	09/27/94	0.020 +/-0.002	< 0.047
941772	09/27/94	10/04/94	0.036 +/-0.003	< 0.030
941783	10/04/94	10/11/94	0.020 +/-0.002	< 0.027
941836	10/11/94	10/18/94	0.009 +/-0.002	< 0.025
941872	10/18/94	10/25/94	0.021 +/-0.002	< 0.033
941916	10/25/94	11/01/94	0.022 +/-0.002	< 0.029
941989	11/01/94	11/08/94	0.018 +/-0.002	< 0.030
941999	11/08/94	11/15/94	0.012 +/-0.002	< 0.018
942050	11/15/94	11/22/94	0.017 +/-0.002	< 0.027
942057	11/22/94	11/29/94	0.018 +/-0.002	< 0.021
942116	11/29/94	12/06/94	0.019 +/-0.002	< 0.035
942140	12/06/94	12/13/94	0.021 +/-0.002	< 0.019
942157	12/13/94	12/20/94	0.022 +/-0.002	< 0.021
942236	12/20/94	12/27/94	0.021 +/-0.002	< 0.047

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 17

SAMPLE: AIR SAMPLES, (GAMMA)

COLLECTION: QUARTERLY COMPOSITE OF WEEKLY SAMPLES

UNITS: pCi/m<sup>3</sup>

LOCATION	LAB NO	BEGIN DATE	END DATE	Cs-134	Cs-137
	REQ'D LLD			0.01	0.01
01, MET TOWER	940584	12/28/93	03/29/94	< 0.0009	< 0.0006
01, MET TOWER	941103	03/29/94	06/28/94	< 0.0008	< 0.0007
01, MET TOWER	941666	06/28/94	09/27/94	< 0.0009	< 0.0009
01, MET TOWER	942222	09/27/94	12/27/94	< 0.0011	< 0.0010
02, SW OF SITE	940585	12/28/93	03/29/94	< 0.0009	< 0.0007
02, SW OF SITE	941104	03/29/94	06/28/94	< 0.0009	< 0.0009
02, SW OF SITE	941667	06/28/94	09/27/94	< 0.0009	< 0.0008
02, SW OF SITE	942223	09/27/94	12/27/94	< 0.0012	< 0.0010
03, N OF SITE	940586	12/28/93	03/29/94	< 0.0007	< 0.0006
03, N OF SITE	941105	03/29/94	06/28/94	< 0.0008	< 0.0005
03, N OF SITE	941668	06/28/94	09/27/94	< 0.0011	< 0.0010
03, N OF SITE	942224	09/27/94	12/27/94	< 0.0011	< 0.0010
04, MAY CEMETERY	940587	12/28/93	03/29/94	< 0.0009	< 0.0008
04, MAY CEMETERY	941106	03/29/94	06/28/94	< 0.0009	< 0.0007
04, MAY CEMETERY	941669	06/28/94	09/27/94	< 0.0008	< 0.0007
04, MAY CEMETERY	942225	09/27/94	12/27/94	< 0.0011	< 0.0008
06, LOCAL OFFICE	940588	12/28/93	03/29/94	< 0.0008	< 0.0006
06, LOCAL OFFICE	941107	03/29/94	06/28/94	< 0.0007	< 0.0006
06, LOCAL OFFICE	941670	06/28/94	09/27/94	< 0.0007	< 0.0006
06, LOCAL OFFICE	942226	09/27/94	12/27/94	< 0.0009	< 0.0007
07#, DANVILLE	940589	12/28/93	03/29/94	< 0.0009	< 0.0007
07#, DANVILLE	941108	03/29/94	06/28/94	< 0.0009	< 0.0007
07#, DANVILLE	941671	06/28/94	09/27/94	< 0.0010	< 0.0011
07#, DANVILLE	942227	09/27/94	12/27/94	< 0.0015	< 0.0010

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 2.1

SAMPLE: MILK SAMPLES, (I-131, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 19, ARK. TECH.

LAB NO.	COLLECTION DATE	I-131	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		1.0	15	18	15	15
940122	01/18/94	< 0.3	< 3	< 3	< 11	< 3
940185	02/02/94	< 0.3	< 2	< 2	< 7	< 2
940330	03/02/94	< 0.3	< 3	< 3	< 10	< 3
940614	04/07/94	< 0.3	< 2	< 2	< 7	< 2
940750	05/03/94	< 0.3	< 3	< 2	< 8	< 2
940994	06/14/94	< 0.2	< 3	< 2	< 11	< 4
941187	07/12/94	< 0.2	< 2	< 2	< 8	< 2
941299	08/03/94	< 0.5	< 3	< 2	< 8	< 2
941477	09/06/94	< 0.9	< 2	< 2	< 8	< 2
941717	10/04/94	< 0.5	< 3	< 2	< 12	< 3
941937	11/09/94	< 0.6	< 3	< 3	< 11	< 3
942118	12/13/94	< 0.7	< 3	< 2	< 11	< 2

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 2.2

SAMPLE: MILK SAMPLES, (I-131, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 37, STEUBER DAIRY

LAB NO.	COLLECTION DATE	I-131	Cs-134	Cs-137	Ba-140	La-140
REQ'D LID		10	15	18	15	15
940050	01/06/94	< 0.3	< 3	< 3	< 10	< 3
940195	02/02/94	< 0.3	< 3	< 2	< 8	< 3
940333	03/02/94	< 0.2	< 3	< 2	< 13	< 2
940500	03/30/94	< 0.3	< 2	< 2	< 11	< 2
940730	04/27/94	< 0.3	< 2	< 2	< 8	< 2
940869	05/25/94	< 0.3	< 4	< 3	< 11	< 4
941047	06/22/94	< 0.2	< 2	< 2	< 10	< 3
941227	07/20/94	< 0.4	< 2	< 2	< 8	< 2
941397	08/18/94	< 0.7	< 3	< 2	< 11	< 3
941553	09/14/94	< 0.7	< 2	< 2	< 8	< 2
941805	10/14/94	< 0.6	< 3	< 3	< 11	< 3
941940	11/09/94	< 0.9	< 3	< 3	< 11	< 3
942073	12/07/94	< 0.7	< 3	< 3	< 12	< 2

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 2.3

SAMPLE: MILK SAMPLES, (I-131, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 41, GIBSON DAIRY

LAB NO.	COLLECTION DATE	I-131	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		1.0	15	18	15	15
940123	01/18/94	< 0.2	< 4	< 2	< 9	< 2
940186	02/01/94	< 0.4	< 3	< 3	< 8	< 3
940331	03/01/94	< 0.3	< 3	< 3	< 9	< 3
940615	04/07/94	< 0.3	< 3	< 2	< 9	< 2
940751	05/03/94	< 0.3	< 4	< 3	< 12	< 4
940995	06/14/94	< 0.3	< 3	< 2	< 11	< 2
941188	07/12/94	< 0.2	< 3	< 3	< 12	< 2
941300	08/02/94	< 0.9	< 3	< 3	< 10	< 3
941478	09/06/94	< 0.6	< 3	< 3	< 14	< 4
941718	10/04/94	< 0.5	< 2	< 2	< 10	< 3
941938	11/08/94	< 0.7	< 3	< 2	< 11	< 2

NO SAMPLE \*

\* Gibson Dairy discontinued milking operations after November 1994. Section 6.4 of the Annual Radiological Environmental Operating Report provides further discussion.



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 2.4

SAMPLE: MILK SAMPLES, (I-131, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 42, HUDSON DAIRY

LAB NO.	COLLECTION DATE	I-131	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		1.0	15	18	15	15
940124	01/18/94	< 0.2	< 3	< 2	< 9	< 2
940187	02/01/94	< 0.4	< 3	< 3	< 11	< 3
940322	03/01/94	< 0.2	< 3	< 3	< 11	< 3
940616	04/07/94	< 0.3	< 3	< 3	< 15	< 3
940752	05/03/94	< 0.2	< 2	< 2	< 8	< 3
940996	06/14/94	< 0.4	< 3	< 3	< 13	< 3
941189	07/12/94	< 0.2	< 3	< 3	< 12	< 3
941301	08/02/94	< 0.5	< 3	< 3	< 12	< 3
941479	09/06/94	< 0.7	< 3	< 3	< 12	< 3
941719	10/04/94	< 0.5	< 3	< 3	< 14	< 4
941939	11/08/94	< 0.8	< 4	< 3	< 13	< 3
942119	12/13/94	< 0.5	< 3	< 3	< 10	< 3

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO.: 3.1

SAMPLE: DRINKING WATER, (BETA, I-131, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 14, CITY WATER

LAB NO.	COLLECTION DATE *	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
REQ'D LLD		4.0	1.0	15	30	15	15	30	15	15	10	18	15	15
940073	01/12/94	< 3.3	< 0.2	< 2	< 3	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 7	< 2
940256	02/08/94	< 1.9	0.3 +/- 0.2	< 1	< 2	< 1	< 1	< 3	< 3	< 2	< 2	< 1	< 8	< 3
940345	03/08/94	< 1.9	< 0.2	< 2	< 3	< 2	< 2	< 5	< 4	< 2	< 2	< 2	< 8	< 2
940618	04/07/94	< 2.1	< 0.3	< 2	< 3	< 2	< 2	< 5	< 5	< 3	< 3	< 3	< 13	< 3
940918	06/01/94	4.8 +/- 1.4	< 0.4	< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 3	< 3	< 12	< 4
941143	07/01/94	< 2.2	< 0.3	< 3	< 3	< 3	< 3	< 5	< 6	< 3	< 3	< 3	< 11	< 3
941278	07/28/94	7.8 +/- 1.5	< 0.5	< 2	< 4	< 3	< 2	< 6	< 6	< 3	< 3	< 3	< 11	< 3
941408	08/23/94	3.6 +/- 1.4	< 0.8	< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 3	< 3	< 11	< 3
941511	09/20/94	2.9 +/- 1.3	< 0.5	< 2	< 3	< 2	< 2	< 5	< 6	< 3	< 3	< 2	< 13	< 4
941824	10/18/94	< 1.8	< 0.8	< 3	< 3	< 3	< 3	< 6	< 6	< 3	< 3	< 3	< 12	< 3
941990	11/18/94	< 1.7	< 0.6	< 2	< 3	< 2	< 2	< 5		< 2	< 2	< 2	< 12	< 2
942125	12/13/94	< 1.9	< 0.5	< 2	< 4	< 2	< 2	< 6	< 6	< 3	< 3	< 2	< 11	< 4

\* May sample was lost in-transit to the ESI laboratory. Section 6.4 of the Annual Radiological Environmental Operating Report provides further discussion.

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 3.2

SAMPLE: DRINKING WATER, (H-3)

COLLECTION: QUARTERLY COMPOSITE

UNITS: pCi/L

LOCATION: 14, CITY WATER

LAB NO	BEGIN DATE	END DATE	H-3
	REQ'D LLD		
940346	01/12/94	03/08/94	< 400
940919	04/07/94	06/01/94	< 380
941578	07/01/94	09/20/94	< 480
942126	10/18/94	12/13/94	< 310

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 41

SAMPLE: SURFACE WATER, ( GAMMA)

COLLECTION: MONTHLY COMPOSITE

UNITS: pCi/L

LOCATION: 08, DISCHARGE BAY

LAB NO.	BEGIN DATE	END DATE	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD			15	30	15	15	30	15	15	15	18	15	15
940188	12/31/93	01/31/94	< 2	< 4	< 2	< 2	< 6	< 4	< 2	< 2	< 2	< 9	< 3
940310	01/31/94	02/28/94	< 2	< 3	< 2	< 3	< 5	< 5	< 2	< 3	< 2	< 8	< 3
940541	02/28/94	03/31/94	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 3	< 2	< 12	< 3
940739	03/31/94	04/30/94	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 2	< 2	< 11	< 2
940916	04/30/94	05/31/94	< 2	< 3	< 3	< 2	< 5	< 6	< 3	< 3	< 3	< 14	< 3
941139	05/31/94	06/30/94	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 9	< 3
941297	06/30/94	07/31/94	< 2	< 3	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 10	< 2
941466	07/31/94	08/31/94	< 1	< 2	< 1	< 2	< 3	< 3	< 1	< 2	< 2	< 6	< 2
941700	08/31/94	09/30/94	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 2	< 2	< 14	< 3
941888	09/30/94	10/31/94	< 2	< 3	< 2	< 3	< 5	< 5	< 3	< 3	< 2	< 10	< 3
942043	10/31/94	11/30/94	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 9	< 2
942203	11/30/94	12/31/94	< 2	< 3	< 2	< 2	< 5	< 5	< 3	< 3	< 3	< 13	< 4

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO : 4.2

SAMPLE: SURFACE WATER, (H-3)

COLLECTION: QUARTERLY COMPOSITE

UNITS: pCi/L

LOCATION: 08, DISCHARGE BAY

LAB NO.	BEGIN DATE	END DATE	H-3
			2000
940579	12/31/93	03/31/94	< 390
941141	03/31/94	06/30/94	430 +/-230
941702	06/30/94	09/30/94	950 +/-290
942205	09/30/94	12/31/94	450 +/-190

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 43

SAMPLE: SURFACE WATER, (CAMMA)

COLLECTION: MONTHLY COMPOSITE

UNITS: pCi/L

LOCATION: 10, INTAKE CANAL

LAB NO.	BEGIN DATE	END DATE	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Ni	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD			15	30	15	15	30	15	15	15	18	15	15
940189	12/31/93	01/31/94	< 2	< 3	< 2	< 3	< 5	< 5	< 2	< 2	< 2	< 9	< 3
940311	01/31/94	02/28/94	< 2	< 3	< 2	< 2	< 5	< 4	< 2	< 2	< 2	< 7	< 2
940542	02/28/94	03/31/94	< 2	< 4	< 3	< 3	< 5	< 6	< 3	< 3	< 3	< 10	< 3
940740	03/31/94	04/30/94	< 2	< 3	< 2	< 3	< 5	< 5	< 2	< 2	< 2	< 9	< 3
940917	04/30/94	05/31/94	< 2	< 2	< 2	< 2	< 3	< 4	< 2	< 2	< 2	< 9	< 3
941140	05/31/94	06/30/94	< 2	< 3	< 2	< 2	< 5	< 5	< 3	< 3	< 2	< 14	< 3
941298	06/30/94	07/31/94	< 3	< 4	< 3	< 3	< 7	< 7	< 3	< 3	< 4	< 13	< 4
941467	07/31/94	08/31/94	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 2	< 2	< 8	< 3
941701	08/31/94	09/30/94	< 2	< 3	< 3	< 3	< 5	< 6	< 2	< 3	< 3	< 13	< 4
941889	09/30/94	10/31/94	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 2	< 2	< 11	< 2
942044	10/31/94	11/30/94	< 2	< 3	< 3	< 3	< 6	< 6	< 3	< 3	< 3	< 12	< 4
942202	11/30/94	12/31/94	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 2	< 2	< 12	< 2



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 4.4

SAMPLE: SURFACE WATER, (H-3)

COLLECTION: QUARTERLY COMPOSITE

UNITS: pCi/L

LOCATION: 10, INTAKE

LAB NO.	BEGIN DATE	END DATE	H-3
			<u>2000</u>
940580	12/31/93	03/31/94	< 390
941142	03/31/94	06/30/94	< 380
941703	06/30/94	09/30/94	420 +/-290
942204	09/30/94	12/31/94	< 310

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 45

SAMPLE: SURFACE WATER SPLIT W/ADH, ( H-3, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 08, DISCHARGE BAY

LAB NO.	COLLECTION DATE	H-3	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		2000	15	30	15	15	30	15	15	15	18	15	15
940027	01/04/94	< 400	< 2	< 3	< 2	< 3	< 6	< 6	< 2	< 3	< 3	< 10	< 3
940250	02/15/94	< 400	< 3	< 5	< 3	< 2	< 6	< 6	< 3	< 3	< 2	< 14	< 4
940421	03/15/94	< 400	< 2	< 3	< 2	< 2	< 5	< 4	< 2	< 2	< 2	< 7	< 2
940648	04/12/94	< 390	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 3	< 2	< 11	< 2
940790	05/10/94	< 390	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 7	< 3
940941	06/07/94	< 380	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 7	< 2
941246	07/22/94	< 380	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 8	< 2
941386	08/16/94	< 490	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 8	< 2
941533	09/13/94	< 490	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 2	< 2	< 11	< 2
941787	10/13/94	430 +/- 290	< 2	< 2	< 2	< 2	< 3	< 4	< 2	< 2	< 2	< 7	< 2
941971	11/15/94	1000 +/- 310	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 2	< 2	< 9	< 3
942173	12/27/94	< 310	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 8	< 3

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 4.6

SAMPLE: SURFACE WATER SPLIT W/ADH (H-3, GAMMA)

COLLECTION: MONTHLY

UNITS: pCi/L

LOCATION: 16, PINEY CREEK

LAB NO.	COLLECTION DATE	H-3	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		2000	15	30	15	15	30	15	15	15	18	15	15
940028	01/04/94	< 400	< 2	< 3	< 2	< 3	< 4	< 5	< 2	< 2	< 2	< 12	< 6
940251	02/15/94	< 400	< 3	< 5	< 3	< 4	< 7	< 6	< 3	< 3	< 3	< 12	< 4
940422	03/15/94	< 400	< 2	< 3	< 2	< 3	< 5	< 6	< 3	< 3	< 2	< 9	< 3
940649	04/12/94	< 390	< 2	< 3	< 2	< 2	< 5	< 4	< 2	< 2	< 2	< 9	< 3
940791	05/10/94	< 390	< 3	< 3	< 2	< 3	< 5	< 6	< 3	< 3	< 3	< 9	< 3
940942	06/07/94	< 380	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 3	< 2	< 10	< 2
941247	07/22/94	< 380	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 2	< 2	< 12	< 2
941387	08/11/94	< 490	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 3	< 3	< 9	< 3
941534	09/13/94	< 490	< 3	< 4	< 2	< 2	< 5	< 6	< 3	< 3	< 3	< 10	< 3
941788	10/13/94	< 480	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 3	< 2	< 11	< 4
941972	11/15/94	< 500	< 2	< 3	< 2	< 2	< 5	< 4	< 2	< 2	< 2	< 10	< 2
942174	12/27/94	< 310	< 2	< 3	< 2	< 2	< 5	< 5	< 2	< 2	< 2	< 10	< 2

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 51

SAMPLE: GROUND WATER, (H-3, GAMMA)

COLLECTION: QUARTERLY

UNITS: pCi/L

LOCATION: 32, STEWART RESIDENCE

LAB NO.	COLLECTION DATE	H-3	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		2000	15	30	15	15	30	15	15	15	18	15	15
940257	02/08/94	< 430	< 2	< 5	< 2	< 2	< 7	< 4	< 2	< 2	< 2	< 15	< 4
940767	05/03/94	< 390	< 2	< 3	< 2	< 3	< 5	< 6	< 2	< 3	< 2	< 10	< 3
941276	07/28/94	< 380	< 2	< 3	< 2	< 2	< 4	< 5	< 2	< 3	< 2	< 12	< 3
941830	10/20/94	< 500	< 2	< 4	< 3	< 3	< 6	< 6	< 3	< 3	< 3	< 10	< 4

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 5.2

SAMPLE: GROUND WATER, (H-3, GAMMA)

COLLECTION: QUARTERLY

UNITS: pCi/L

LOCATION: 33, QUITA RECREATION AREA

LAB NO.	COLLECTION DATE	H-3	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
REQ'D LLD		2000	15	30	15	15	30	15	15	15	18	15	15
940258	02/08/94	< 400	< 2	< 4	< 3	< 3	< 5	< 5	< 3	< 3	< 2	< 14	< 5
940768	05/03/94	< 390	< 3	< 5	< 3	< 4	< 8	< 9	< 4	< 4	< 3	< 15	< 5
941277	07/28/94	< 380	< 2	< 2	< 2	< 2	< 4	< 4	< 2	< 2	< 2	< 9	< 3
941825	10/18/94	< 500	< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 3	< 3	< 11	< 4

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 6.1

SAMPLE: FISH SAMPLES, ( GAMMA)

COLLECTION: SEMIANNUALLY

UNITS: pCi/kg

LOCATION : 08, DISCHARGE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
REQ'D LLD			130	260	130	130	260	130	150
940486	03/16/94	BASS & CRAPPIE	< 6	< 11	< 7	< 7	< 16	< 7	11 +/- 6
940487	03/16/94	CATFISH	< 6	< 12	< 7	< 7	< 16	< 8	8 +/- 7
941853	09/29/94	CATFISH	< 4	< 11	< 5	< 5	< 13	< 5	14 +/- 6
941865	09/29/94	BASS & CRAPPIE	< 5	< 13	< 7	< 6	< 15	< 7	16 +/- 5



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 62

SAMPLE: FISH SAMPLES, ( GAMMA)

COLLECTION: SEMIANNUALLY

UNITS: pCi/kg

LOCATION: 10, INTAKE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
REQ'D LLD			130	260	130	130	260	130	150
940488	03/16/94	BASS & CRAPPIE	< 6	< 11	< 6	< 6	< 16	< 7	< 6
940489	03/16/94	CATFISH	< 5	< 9	< 6	< 6	< 14	< 6	< 6
941864	09/29/94	CATFISH	< 5	< 11	< 6	< 5	< 13	< 5	< 5
941866	09/29/94	BASS & CRAPPIE	< 6	< 14	< 7	< 6	< 16	< 7	< 7

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 6.3

SAMPLE: FISH SAMPLES SPLIT W/ ADH (GAMMA)

COLLECTION: AS REQUESTED

UNITS: pCi/kg

LOCATION: 08, DISCHARGE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
<u>REQ'D LLD</u>			130	260	130	130	260	130	150
	04/20/94	FISH FILLETS	< 7	< 12	< 8	< 8	< 17	< 8	< 7
941/89	10/06/94	FISH FILLETS	< 5	< 9	< 6	< 5	< 13	< 7	16 +/- 6

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 6.4  
SAMPLE: FISH SAMPLES SPLIT W/ ADH ( GAMMA)  
COLLECTION: AS REQUESTED  
UNITS: pCi/kg

LOCATION : 10, INTAKE

LAB NO	COLLECTION DATE	SAMPLE TYPE	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
REQ'D LLD			130	260	130	130	260	130	150
940699	04/20/94	FISH FILLETS	< 8	< 13	< 8	< 8	< 19	< 9	< 9

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 7.1

SAMPLE: SEDIMENT, ( GAMMA)

COLLECTION: SEMIANNUALLY

UNITS: pCi/kg

LOCATION	LAB NO.	COLLECTION DATE	Mn-54	Co-58	Co-60	Ag-110m	Cs-134	Cs-137
	REQ'D LLD		N/A	N/A	N/A	N/A	150	180
08, DISCHARGE	940443	03/22/94	33 +/-10	61 +/-14	113 +/-14	< 42	< 20	919 +/-22
08, DISCHARGE	941523	09/10/94	33 +/- 13	< 18	134 +/- 21	< 58	< 29	1058 +/- 32
10, INTAKE	940444	03/22/94	12 +/- 8	< 9	< 10	< 37	< 13	85 +/-15
10, INTAKE	941524	09/10/94	22 +/- 8	< 9	< 10	< 36	< 14	124 +/- 16
16, PINEY CREEK	940445	03/22/94	< 9	< 9	< 10	< 34	< 12	48 +/- 9
16, PINEY CREEK	941525	09/10/94	< 13	< 12	< 14	< 41	< 17	110 +/- 13

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 8.1

SAMPLE: VEGETATION: BROADLEAF, (I-131, GAMMA)

COLLECTION: MONTHLY WHEN AVAILABLE

UNITS: pCi/kg

LOCATION: 13, W OF SITE

LAB NO.	COLLECTION DATE	I-131	Cs-134	Cs-137
<u>REQ'D LLD</u>		<u>60</u>	<u>60</u>	<u>80</u>
940948	06/07/94	< 36	< 36	< 38
941165	07/07/94	< 27	< 24	< 19
941374	08/12/94	< 23	< 14	< 12

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 8.2

SAMPLE: VEGETATION: BROADLEAF, (I-131, GAMMA)

COLLECTION: MONTHLY WHEN AVAILABLE

UNITS: pCi/kg

LOCATION: 45, E OF SITE

LAB NO.	COLLECTION DATE	I-131	Cs-134	Cs-137
<u>REQ'D LLD</u>		60	60	80
940943	06/07/94	< 28	< 27	< 26
941166	07/07/94	< 31	< 30	< 27
941375	08/12/94	< 23	< 19	< 15



# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 8.3

SAMPLE: VEGETATION: FOOD PRODUCTS SP, IT W/ADH (GAMMA)

COLLECTION: AS REQUESTED.

UNITS: pCi/kg

LOCATION: 108, J.T. SHIVERS RESIDENCE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	I-131	Cs-134	Cs-137
REQ'D LLD			60	60	80
941248	07/21/94	SQUASH	< 10	< 7	< 6
941249	07/21/94	CUCUMBERS	< 13	< 10	< 9
941250	07/21/94	POTATOES	< 10	< 9	< 9
941853	10/26/94	TURNIP GREENS	< 9	< 10	< 9
941854	10/26/94	TURNIPS	< 14	< 16	< 14

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 8.4

SAMPLE: VEGETATION: FOOD PRODUCTS (GAMMA)

COLLECTION: AT TIME OF HARVEST

UNITS: pCi/kg

LOCATION: 108, J.T. SHIVERS RESIDENCE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	I-131	Cs-134	Cs-137
REQ'D LLD			60	60	30
940975	06/13/94	POTATOES & ONIONS	< 7	< 7	< 7
940976	06/13/94	CABBAGE	< 17	< 17	< 15
940977	06/13/94	SQUASH	< 11	< 10	< 9
940978	06/13/94	GREEN BEANS	< 12	< 12	< 10
941311	08/02/94	SQUASH	< 22	< 19	< 17
941312	08/02/94	OKRA	< 16	< 16	< 13
941313	08/02/94	TOMATOES	< 7	< 7	< 6

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 85

SAMPLE: VEGETATION: FOOD PRODUCTS (GAMMA)

COLLECTION: AT TIME OF HARVEST.

UNITS: pCi/kg

LOCATION: 40, HOLLIS RESIDENCE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	I-131	Cs-134	Cs-137
<u>REQ'D LLD</u>			<u>60</u>	<u>60</u>	<u>80</u>
941434	08/25/94	POTATOES	< 7	< 6	< 6
941435	08/25/94	OKRA	< 13	< 12	< 10
941728	10/06/94	TOMATCES	< 7	< 6	< 5

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. : 8.6

SAMPLE: VEGETATION: FOOD PRODUCTS (GAMMA)

COLLECTION: AT TIME OF HARVEST.

UNITS: pCi/kg

LOCATION: 38, JONES RESIDENCE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	I-131	I-134	Cs-137
REQ'D LLD			60	60	80
941432	08/19/94	TOMATOES	< 20	< 9	< 8
941433	08/19/94	OKRA & GREEN BEANS	< 13	< 7	< 8
941729	10/06/94	CABBAGE	< 18	< 12	< 11

# ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

TABLE NO. 8.7  
 SAMPLE: VEGETATION: FOOD PRODUCTS (GAMMA)  
 COLLECTION: AT TIME OF HARVEST.  
 UNITS: pCi/kg

LOCATION: 48, COCHRAN RESIDENCE

LAB NO.	COLLECTION DATE	SAMPLE TYPE	I-131	Cs-134	Cs-137
REQ'D LLD			60	60	80
941851	10/20/94	TURNIPS	< 11	< 9	< 8
941852	10/20/94	YAMS	< 16	< 12	< 11

# EPA CROSS CHECK RESULTS

EPA PREP DATE	DATE RESULTS ISSUED	MEDIA	NUCLIDE	EPA RESULTS	ESI, SYSTEM CHEMISTRY RESULTS	NORM DEV. KNOWN
10/19/93	02/11/94	WATER BLIND B (pCi/L)	Beta Co-60 Cs-134 Cs-137	58.00 10.00 12.00 10.00	57.00 10.00 10.00 12.00	-0.17 0.00 -0.69 0.69
11/12/93	02/15/94	WATER GAMMA (pCi/L)	Co-60 Zn-65 Ru-106 Cs-134 Cs-137 Ba-133	30.00 150.00 201.00 59.00 40.00 79.00	31.33 155.00 162.33 58.67 41.00 81.67	0.46 0.58 -3.35* -0.12 0.35 0.58
01/28/94	04/15/94	WATER (pCi/L)	Gross Beta	62.00	54.00	-1.39
02/04/94	04/20/94	WATER (pCi/L)	I-131	119.00	119.67	0.10
03/04/94	07/25/94	WATER (pCi/L)	H-3	4936.0	4766.67	-0.59
04/19/94	08/11/94	WATER BLIND B (pCi/L)	Beta Co-60 Cs-134 Cs-137	117.00 20.00 34.00 29.00	103.33 21.00 33.33 32.33	-1.32 0.35 -0.23 1.15
07/22/94	10/21/94	WATER (pCi/L)	Gross Beta	10.0	12.67	0.92
08/05/94	10/25/94	WATER (pCi/L)	H-3	9951.0	10003.33	0.09
10/07/94	01/12/95	WATER (pCi/L)	I-131	79.0	76.67	-0.51

\* A new efficiency curve was determined for this radionuclide. Once the data from this new counting efficiency curve was incorporated into the equation that calculates activity, results fell within the acceptable three standard deviation range. Section 5.1 of the Annual Radiological Environmental Operating Report provides further discussion.



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**ATTACHMENT II**

**1994 Environmental Thermoluminescent Dosimetry Report**

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TABLE 1

0 - 2 MILE TLD RESULTS FOR 1994

<i>Station</i>	<i>1st Qtr (mrem)</i>	<i>2nd Qtr (mrem)</i>	<i>3rd Qtr (mrem)</i>	<i>4th Qtr (mrem)</i>	<i>Annual Mean (mrem)</i>
1	18.0	19.0	16.0	15.0	17.0
2	16.0	19.0	18.0	17.0	17.5
3	15.0	17.0	15.0	13.0	15.0
4	16.0	15.0	14.0	15.0	15.0
108	18.0	18.0	18.0	16.0	17.5
109 *	(1)	19.0	18.0	17.0	18.0
110	17.0	17.0	17.0	15.0	16.5
113	14.0	17.0	16.0	14.0	15.3
114	17.0	17.0	16.0	15.0	16.3
115	17.0	18.0	16.0	15.0	16.5
116	18.0	17.0	15.0	15.0	16.3
MEAN	16.6	17.5	16.3	15.2	

\* Location with highest annual mean.

(1) TLD missing in field.

TABLE 2

2 - 5 MILE TLD RESULTS FOR 1994

<i>Station</i>	<i>1st Qtr (mrem)</i>	<i>2nd Qtr (mrem)</i>	<i>3rd Qtr (mrem)</i>	<i>4th Qtr (mrem)</i>	<i>Annual Mean (mrem)</i>
111	14.0	17.0	14.0	13.0	14.5
112 *	18.0	20.0	16.0	15.0	17.3
119	17.0	17.0	15.0	14.0	15.8
120	15.0	15.0	14.0	13.0	14.3
121	16.0	17.0	15.0	14.0	15.5
122	15.0	15.0	14.0	14.0	14.5
123	14.0	15.0	15.0	13.0	14.3
124	19.0	17.0	16.0	16.0	17.0
130	15.0	15.0	15.0	13.0	14.5
131	15.0	16.0	14.0	13.0	14.5
133	14.0	14.0	(1)	11.0	13.0
134	15.0	16.0	15.0	13.0	14.8
135	13.0	16.0	15.0	14.0	14.5
136	16.0	19.0	16.0	15.0	16.5
141	13.0	16.0	13.0	12.0	13.5
MEAN	15.3	16.3	14.8	13.5	

\* Location with highest annual mean.

(1) TLD missing in field.

TABLE 3

>5 MILE TLD RESULTS FOR 1994

<i>Station</i>	<i>1st Qtr (mrem)</i>	<i>2nd Qtr (mrem)</i>	<i>3rd Qtr (mrem)</i>	<i>4th Qtr (mrem)</i>	<i>Annual Mean (mrem)</i>
5	17.0	19.0	16.0	15.0	16.8
6	17.0	19.0	17.0	15.0	17.0
7	15.0	16.0	15.0	14.0	15.0
117	15.0	16.0	14.0	13.0	14.5
118	16.0	15.0	15.0	14.0	15.0
125	14.0	15.0	14.0	13.0	14.0
126	16.0	18.0	16.0	15.0	16.3
127	18.0	18.0	17.0	15.0	17.0
128 *	17.0	20.0	16.0	17.0	17.5
129	16.0	18.0	17.0	15.0	16.5
132	(1)	18.0	15.0	14.0	15.7
137	17.0	16.0	15.0	15.0	15.8
138	13.0	16.0	13.0	12.0	13.5
139	15.0	16.0	14.0	(1)	15.0
140	16.0	19.0	16.0	15.0	16.5
142	14.0	15.0	14.0	14.0	14.3
143	16.0	17.0	16.0	15.0	16.0
144	17.0	19.0	16.0	15.0	16.8
MEAN	15.8	17.2	15.3	14.5	

\* Location with highest annual mean.

(1) TLD missing in field.

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## **ATTACHMENT III**

### **Statistical Analyses**

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### Statistical Analyses

Calculation of the mean, standard deviation and "t" values are as follows:

**Mean:**  $\bar{X} = \sum Xi / n$

where:  $\bar{X}$  = Mean of sample results  
 $\sum Xi$  = Sum of individual results  
 $n$  = Number of samples

**Standard Deviation** =  $\sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$

where:  $Sd$  = Standard deviation  
 $X$  = Individual sample result  
 $\bar{X}$  = Mean of sample results  
 $n$  = Number of samples

**"t" Value** = 
$$\frac{(\bar{x} - \bar{y})}{\sqrt{\frac{(n_x - 1)s_x^2 + (n_y - 1)s_y^2}{n_x + n_y - 2}} \sqrt{\frac{1}{n_x} + \frac{1}{n_y}}}$$

where:  $t$  = Calculated "t" value  
 $\bar{x}$  = Mean of first data set  
 $\bar{y}$  = Mean of second data set  
 $n_x$  = Number of variables in first data set  
 $s_x$  = Standard deviation of first data set  
 $n_y$  = Number of variables in second data set  
 $s_y$  = Standard deviation of second data set



### Statistical Analyses

- Calculated "t" values were compared to tabular "t" values obtained from the CRC Standard Mathematical Tables, 26th Edition (1981) to test the hypothesis that the true mean of the first population is equal to the true mean of the second population. For purposes of this report, the "t" test was only performed for air samples and TLDs, due to the large number of positive results involved.
- Samples types other than those presented below were not statistically analyzed due to small sample sizes.

### *Air Samples*

Parameter	Station 1	Station 2	Station 3	Station 4	Station 7
Gross Beta Mean ( $10\text{E-3 pCi/m}^3$ )	14.7 (15)	16.4 (16)	15.4 (15)	12.4 (12)	17.4 (17)
Gross Beta Standard Deviation ( $10\text{E-3 pCi/m}^3$ )	5.0	4.9	5.1	4.9	5.6
Number in Sample	52	51	52	52	52
Calculated "t" Value to Comparison with Control Station ( 7 )	-2.596	- 0.964	- 1.905	- 4.850	N/A
Tabular "t" Value at 95% Confidence ( t, 0.025, n )	1.986	1.986	1.986	1.986	N/A

### Statistical Analyses

#### *TLDs*

Parameter	0 - 2 Miles	2 - 5 Miles	> 5 Miles
Mean ( mrem/Qtr )	16.4	15.0	15.7
Standard Deviation ( mrem/Qtr )	1.5	1.7	1.6
Number in Sample	43	59	70
Calculated "t" Value to Comparison with Stations Located >5 Miles	2.310	- 2.405	N/A
Tabular "t" Value at 95% Confidence ( t, 0.025, n )	1.983	1.978	N/A

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## **ATTACHMENT IV**

### **Sediment Dose Calculations**

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### Sediment Dose Calculations

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

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

where:

**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  $\text{Kg/m}^2$ ;

**C** = 1994 maximum radionuclide concentration in  $\text{pCi/kg}$ ;

**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  $\text{mrem/hr per pCi/m}^2$ , and

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

Dose from Sediment in Millirem/Year

Radionuclide	1994 Maximum Concentration	Conversion Factor For Skin	Total Skin Dose	Conversion Factor For Total Body	Total Body Dose
Mn-54	33	6.80 E-09	6.01 E-05	5.80 E-09	5.13 E-05
Co-58	61	8.20 E-09	1.34 E-04	7.00 E-09	1.14 E-04
Co-60	134	2.00 E-08	7.18 E-04	1.70 E-08	6.11 E-04
Cs-137	1058	4.90 E-09	1.39 E-03	4.20 E-09	1.19 E-03
<i>TOTAL</i>			<i>2.30 E-03</i>		<i>1.97 E-03</i>