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William J. Cahill, Jr.
Group Vice President

April 28, 1994

U. S. Nuclear Regulatory Commission
Attn: Document Control Room
Washington, DC 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
OPERATING LICENSES NPF-87 AND NPF-89
TRANSMITTAL OF THE ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT FOR 1993

Gentlemen:

Enclosed is one (1) copy of the Annual Radiological Environmental Operating Report for the CPSES Radiological Environmental Monitoring Program. This report is submitted pursuant to Section 6.9.1.3 of the CPSES Units 1 and 2 Technical Specifications. The report covers the period from January 1, 1993, through December 31, 1993, and summarizes the results of measurements and analysis of data obtained from samples collected during this interval.

If there are any questions regarding this report, contact Connie Wilkerson at (214) 812-8819 or Doug Kay at (817) 897-5204.

Sincerely,

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COMANCHE PEAK STEAM ELECTRIC STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

1993 ANNUAL REPORT

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INTRODUCTION

I. INTRODUCTION

The Radiological Environmental Monitoring Program for the Comanche Peak Steam Electric Station was conducted under contract with T U Electric. This report covers the period from January 1, 1993 through December 31, 1993 and summarizes the results of measurements and analyses of data obtained from samples collected during this interval.

A. Site and Station Description

Comanche Peak Steam Electric Station (CPSES) consists of two PWR units, each designed to operate at a power level of about 1150 megawatts (electrical). The station is located on Squaw Creek Reservoir in Somervell County about forty miles southwest of Fort Worth, Texas. Unit 1 received a low power operating license February 8, 1990 and achieved initial criticality on April 3, 1990. A full power license for Unit 1 was issued on April 17, 1990, and commercial operation was declared on August 13, 1990. Unit 2 achieved initial criticality on March 24, 1993 and synchronized to the electrical grid on April 9, 1993.

B. Objectives and Overview of the CPSES Monitoring Program

The United States Nuclear Regulatory Commission (USNRC) regulations require that nuclear power plants be designed, constructed, and operated to keep levels of radioactive material in effluents to unrestricted areas as low as reasonably achievable (ALARA) (10 CFR 50.34a). To assure that these criteria are met, each license authorizing reactor operation includes technical specifications (10 CFR 50.36a) governing the release of radioactive effluents.

In-plant monitoring is used to assure that these predetermined release limits are not exceeded. However, as a precaution against unexpected and undefined processes which might allow undue accumulation of radioactivity in any sector of the environment, a program for monitoring the plant environs is also included.

Sampling locations were selected on the basis of local ecology, meteorology, physical characteristics of the region, and demographic and land use features of the site vicinity. The radiological environmental monitoring program was designed on the basis of the USNRC Branch Technical Position on radiological environmental monitoring issued by the Radiological Assessment Branch, Revision 1 (November 1979)[1], the CPSES Technical Specifications[4] and the CPSES Offsite Dose Calculation Manual (ODCM)[5].

In 1993, the Radiological Environmental Monitoring Program included the measurement of ambient gamma radiation by thermoluminescent dosimetry; the determination of gamma emitters in sediment and fish; the determination of airborne gross beta, gamma emitters, and iodine-131; the measurement of tritium and gamma emitters in surface water; the measurement of tritium and gamma emitters in groundwater; the measurement of gross beta, tritium, iodine-131 and gamma emitters in drinking water; the determination of gamma emitters and iodine-131 in milk; and the measurement of gamma emitters in food products and gamma emitters and iodine-131 in broadleaf vegetation. Samples were collected by CPSES Environmental Personnel. Sample analyses were performed by Teledyne Isotopes.

The regulations governing the quantities of radioactivity in reactor effluents allow nuclear power plants to contribute, at most, only a few percent increase above normal background radioactivity. Background levels at any one location are not constant but vary with time as they are influenced by external events such as cosmic ray bombardment, weapons test fallout, and seasonal variations. These levels also can vary spatially within relatively short distances reflecting variations in geological composition. To differentiate between background radiation levels and increases resulting from operation of CPSES, the radiological surveys of the plant environs are divided into preoperational and operational phases. The preoperational phase of the program permits a general characterization of the radiation levels and concentrations prevailing prior to plant operation along with an indication of the degree of natural variation to be expected. The operational phase of the program obtains data which, when considered along with the data obtained in the preoperational phase, assist in the evaluation of the radiological impact of plant operation.

Preoperational measurements were conducted at CPSES from 1981 to 1989. These preoperational measurements were performed to:

1. Evaluate procedures, equipment and techniques.
2. Identify potentially important pathways to be monitored after the plant is in operation.
3. Measure background levels and their variations along potentially important pathways in the area surrounding the plant.
4. Provide baseline data for statistical comparison with future operational analytical results.

The operational Radiological Environmental Monitoring Program is conducted to:

1. Verify that measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways.
2. Verify the effectiveness of in-plant measures used for controlling the release of radioactive materials.
3. Identify changes in the use of areas at and beyond the site boundary that may impact the principal pathways of exposure.

This report documents the fourth year of operational measurements and is submitted in accordance with the requirements of the CPSES Offsite Dose Calculation Manual, Part I, Administrative Control 6.9.1.3.

PROGRAM DESCRIPTIONS

II. PROGRAM DESCRIPTION

A. <u>Sample Locations</u>

Seventy-four locations within a radius of 20 miles from the CPSES site were included in the monitoring program for 1993. The number and location of monitoring points were determined by considering the locations where the highest off-site environmental concentrations have been predicted from plant effluent source terms, site hydrology, and site meteorological conditions. Other factors considered were applicable regulations, population distribution, ease of access to sampling stations, availability of samples at desired locations, security and future program integrity. Additionally an annual land use census is conducted to identify changes in the use of areas surrounding the plant. If changes are identified that impact the principal pathways of exposure, appropriate changes to the radiological environmental monitoring program are implemented. The results of the 1993 Land Use Census are provided in Appendix E.

The Radiological Environmental Monitoring Program for Comanche Peak is summarized in Table 1. Figure 1 shows the locations of the various sampling points.

B. Sampling Methods and Procedures

To derive meaningful and useful data from the Radiological Environmental Monitoring Program, sampling methods and procedures are required which will provide samples representative of potential pathways of the area. The methods and procedures used for each pathway monitored are described below.

1. Direct Radiation

Thermoluminescent dosimeters (TLDs) were used to determine the direct (ambient) radiation levels at monitoring points. Sampling locations were chosen according to the criteria given in the USNRC Branch Technical Position on Radiological Monitoring (Revision 1, November 1979)[1]. The area around the station was divided into 16 radial sectors of 22-1/2 degrees each. TLDs were placed in all sectors. Thermoluminescent dosimeters were located in two rings around the station. An inner ring was located at the site boundary and an outer ring was located at a distance of 4 to 6 miles from the station. Eleven additional TLDs were located at points of special interest, including two control locations. For routine TLD measurements, two dosimeters of $CaSO_4$:Dy in teflon cards were deployed at each selected location. One set of dosimeters was exchanged on a quarterly basis and the second set was exchanged on an annual basis. Additional sets of dosimeters were shipped with each exchange cycle to serve as in-transit controls.

Individual dosimeters were calibrated by exposure to an accurately known radiation field from a calibrated Cs-137 source.

2. Air Particulates and Air Iodine

Air particulate and air iodine samples were collected from the eight locations described in Table 1.

Each air particulate sample was collected by drawing air through a 47 millimeter diameter glass-fiber filter. Air iodine was collected by drawing air through a TEDA impregnated charcoal cartridge which was connected in series behind the filter. The filters and charcoal cartridges were collected weekly by CPSES staff. In the laboratory, air particulate filters were analyzed for gross beta activity and were composited quarterly for gamma spectrometry analysis. Charcoal cartridges were analyzed for iodine-131.

3. Milk

Milk samples were collected by CPSES staff monthly for the period January through April. May through October samples were collected semimonthly, except for June when three samples were collected. November and December samples were collected monthly. There was one milk sampling location (SW-13.5). Upon arrival at the laboratory, the milk samples were promptly analyzed for gamma emitters and for I-131 by utilizing radiochemistry techniques.

4. Water

The CPSES staff collected water at 11 locations. Surface water was collected at four locations (N-19.3, ESE-1.4, N-

1.5 and NE-7.4). Location N-1.5 provides samples representative of Squaw Creek Reservoir surface water at a location beyond significant influence of the plant discharge. Location ESE-1.4 provides samples representative of discharges from Squaw Creek Reservoir downstream to Squaw Creek and to Lake Granbury via the return line. Location NE-7.4 provides samples of Lake Granbury surface water down stream of the discharge from the return line from Squaw Creek Reservoir. A control sample is obtained from the Brazos River, upstream of Lake Granbury at location N-19.3.

Surface water samples from Squaw Creek Reservoir locations were collected weekly and composited for monthly gamma isotopic analysis. Samples from Lake Granbury locations were collected monthly and analyzed by gamma spectroscopy. All surface water samples were also composited quarterly by location for tritium analysis.

Surface-drinking water was collected at two locations (N-9.9 and NNW-0.1). Samples of Squaw Creek Reservoir water were collected at location NNW-0.1. Samples from this location were analyzed pursuant to the drinking water requirements even though Squaw Creek Reservior is not used as a potable water supply. Location N-9.9 was used to sample surface water from Lake Granbury near the intake of the City of Granbury potable water plant.

Surface-drinking water samples were collected weekly and composited for iodine-131 analysis every two weeks and gamma isotopic and gross beta analyses monthly. Tritium analyses were performed quarterly.

There are five groundwater locations (SSE-4.6, W-1.2, WSW-0.1, N-1.45 and N-9.8). ODCM Table 3.1, Note (5) states that groundwater supplies in the site area are not affected by plant effluents and are sampled only to provide confirmation that groundwater is not affected by plant discharges.

Groundwater samples were collected quarterly. Gamma isotopic and tritium analyses were performed by location.

5. Fish

Fish samples were collected at two locations for the 1993 program. An area 2.0 miles east-northeast of the site in Squaw Creek Reservoir was chosen as the indicator location, and a location at Lake Granbury (NNE-8) was chosen as a control location. Fish sampling was conducted in June and November for Station ENE-2.0 and June and October for the control station..

Fish were collected by CPSES staff. Available edible species were gutted at the time of collection. Samples were then frozen and shipped to the laboratory for analysis. Fish were filleted in the laboratory and the edible portion analyzed by gamma spectrometry.

6. <u>Shoreline Sediment</u>

Shoreline sediment samples were collected in January and July from Squaw Creek Reservoir at location NNE-1.0. Samples were also collected from Lake Granbury at the control location N-9.9, and location NE-7.4, which is downstream of the discharge of the return line from Squaw Creek Reservior. CPSES staff collected the sediment samples and shipped them to the laboratory for analysis by gamma spectrometry.

7. <u>Food Products</u>

During the period of May through October, 12 samples were collected from two indicator sampling locations (E-4.2, ENE-9.0) and from the control station (SW-12.2) A total of 8 different types of food products were collected during this sampling period. Food product samples were collected by the CPSES staff and shipped to the laboratory where they were analyzed for gamma emitters.

8. <u>Broadleaf Vegetation</u>

Broadleaf vegetation was collected from the control location (SW-13.5) and two indicator stations (N-1.45 and SW-1.0) near the site boundary. Collection of broadleaf vegetation started in April 1993. Broadleaf samples consisted of available tree leaves; if tree leaves were unavailable, native grasses and weeds were substituted.

Gamma isotopic and iodine-131 analyses were performed for all broadleaf vegetation samples.

C. Interlaboratory Comparison Program

To demonstrate that the results of the environmental analyses are valid, the CPSES Radiological Environmental Monitoring Program requires that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices be performed. To fulfill this requirement, Teledyne Isotopes participates in the environmental sample cross-check program conducted by the U.S. Environmental Protection Agency (EPA).

The purpose of the interlaboratory comparison program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems. Participant laboratories measure the concentrations of specified radionuclides and report them to the issuing agency. The agency then furnishes the known values to the participant laboratory and specifies the control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

The results of Teledyne Isotopes' participation in the U.S. EPA Interlaboratory Comparison Program for 1993 are provided in Appendix A.

D. Deficiencies in the Sample Program

In accordance with section 6. 9.1.3 of the ODCM[5], any deviations from the sampling schedule of Table 3.12.1 of the ODCM shall be reported in the annual environmental monitoring report. During the year 1993, one deviation in sampling occurred in the air sampling requirements in that the air sample pump was not started by the field technician prior to leaving the sample station. Therefore, the air sample for the indicator location E-3.5 for the week of August 3 through August 10 was not collected. This deviation was due to personnel error and corrective actions have been taken to ensure that no further deviations of this type occur in the future. There were no other deficiencies during 1993.

SUMMARY AND DISCUSSION OF
1993 ANALYTICAL RESULTS

III. SUMMARY AND DISCUSSION OF 1993 ANALYTICAL RESULTS

Data from the radiological analyses of environmental media collected during the report period are tabulated and discussed below. The procedures and specifications followed in the laboratories for these analyses are as required in the Teledyne Isotopes Quality Assurance Manual IWL-0032-395 and are detailed in Teledyne Isotopes Analytical Procedures Manual. A synopsis of analytical procedures is contained in Appendix B of this report.

Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods as discussed in NCRP Report No. 50[2]. The use of "<" in the data tables symbolizes that the result is less than the lower limit of detection (LLD) as defined in Appendix B. Not Detected, "ND", is used periodically in the tables presenting gamma analysis results for various media. It primarily appears under the "Others" column, and indicates that no other detectable gamma emitting nuclides were identified. The Teledyne Isotopes analytical methods meet the LLD requirements addressed in the CPSES Offsite Dose Calculation Manual.

Tables 2 through 19 give the radioanalytical results for individual samples. A statistical summary of the results appears in Table 20. The reported averages are based only on concentrations above the limit of detection. In table 20, the fraction (f) of the total number of analyses with detectable activity follows in parentheses. Also given in parentheses are the minimum and maximum values of detectable activity during the report period.

A. Direct Radiation

Environmental radiation dose rates determined by thermoluminescent dosimeters (TLDs) are given in Table 2. Thermoluminescent dosimetry badges with four readout areas each were deployed at each location on quarterly and annual cycles. The mean values of four readings (corrected individually for response to a known dose and for in-transit exposure) are reported.

A statistical summary of the 1993 data is included in Table 20. For the quarterly analyses the average dose rate of the control locations was 0.15 mR/day with a range of 0.12-0.21 mR/day. The average of the indicator locations for the quarterly samples was 0.14 mR/day with a range of 0.05 to 0.23 mR/day. For the annual samples, the average dose rate for the control samples was 0.17 mR/day. The indicator locations had an average of 0.16 mR/day with a range of 0.09-0.21 mR/day.

Oakley[3] calculates an ionizing background radiation dose equivalent of 82.2 mR/year for Fort Worth including a terrestrial component of 45.6 mR/year and an ionizing cosmic ray component of 36.6 mR/year (excludes neutron component). Since Oakley's values represent averages covering wide geographical areas, the measured ambient radiation average of 58 mR/year for the immediate locale of CPSES is consistent with Oakley's observations. Significant variations occur between geographical areas as a result of geological composition and altitude differences. Temporal variations result from changes in cosmic ray intensity, local human activities, and factors such as ground cover and soil moisture.

Anomalies in the 1993 measured doses relative to preoperational data were not noted. For 1989, the averages for the indicator locations were 0.16 mR/day (range of 0.11 to 0.22) and 0.13 mR/day (range of 0.11 to 0.17), for the quarterly and annual samples respectively. The 1988 averages for the quarterly and annual indicator locations were 0.16 mR/day (range of 0.10 to 0.20) and 0.15 mR/day (range of 0.12 to 0.18) respectively.

B. Air Particulates and Air Iodine

A total of 407 charcoal cartridges were analyzed for airborne iodine-131 by gamma spectrometry. No iodine-131 was detected at any of the sampling stations. Results of these measurements are presented in Table 3.

A total of 407 air particulate filters were collected and analyzed for gross beta activity. For 1993 the average gross beta activity for the control location was 0.020 pCi/m^3 with a range from 0.009 to 0.047 pCi/m^3. For the seven indicator locations the yearly average was 0.021 pCi/m^3 with a range from 0.0043 to 0.067 pCi/m^3. The gross beta analysis data are presented in Table 4. Anomalies in gross beta measurements relative to preoperational data were not noted.

Air filters were composited quarterly and then analyzed by gamma spectrometry. The gamma spectrometry data is presented in Table 5. Cosmogenic beryllium-7 was detected in all 32 samples; potassium-40, a naturally occurring nuclide, was measured in seven samples. The average beryllium-7 activity for the control location was 0.069 pCi/m^3 with a range of 0.057 to 0.085 pCi/m^3. For the indicator locations, the average beryllium-7 activity was 0.070 pCi/m^3 with a range of 0.0048 to 0.087 pCi/m^3. The average potassium-40 for the control location was 0.012 pCi/m^3. The average potassium-40 activity for the indicator locations was 0.011 pCi/m^3 with a range of 0.005-0.019 pCi/m^3.

C. Milk

A total of 19 milk samples were collected in 1993. All samples were analyzed for iodine-131 by radiochemistry and for other gamma emitting isotopes by gamma spectrometry. Results of these measurements are presented in Table 6 and 7.

No iodine-131 was found in any of the milk samples. The lower limits of detection can be found in Table 6.

Results of the gamma spectrometry measurements are presented in Table 7. Naturally occurring potassium-40 was detected in all of the milk samples. The average activity for the control location was 1365 pCi/l with a range of 1200 to 1580 pCi/l. Cesium-137 was not detected in any of the samples.

D. Water

Groundwater samples were collected from five locations during 1993. The samples were analyzed for gamma emitters and tritium on a quarterly basis, pursuant to the ODCM requirements for groundwater. Twenty-three samples were analyzed for gamma emitters by gamma spectrometry. Potassium-40 was detected in one indicator station with an average activity of 133 pCi/l. The control station samples were less than the lower limit of detection. Quarterly composites for each sampling location were analyzed for tritium; no tritium was detected. Results of these analyses are contained in Table 8 and 9 respectively.

Surface-drinking water was collected from two stations. All samples were analyzed for gamma emitters; results were below the lower limit of detection. Thirty samples were analyzed for gross beta activity. The indicator station had an average activity of 16 pCi/l with a range of 11 to 21 pCi/l. The control station had an average activity of 11 pCi/l with a range of 6.2 to 19 pCi/l. Eight quarterly composites were analyzed for tritium. The indicator station had an average activity of 4400 pCi/l with a range of 3800 to 4800 pCi/l. The control station showed no tritium activity above the lower limit of detection.

Iodine-131 analyses by radiochemistry were performed on 56 samples of surface-drinking water; there was no measurable activity. Results of these analyses are contained in Tables 10-13.

Surface water was sampled from four locations during 1993. Samples were analyzed for gamma isotopic on a monthly basis and tritium composites on a quarterly basis, per the ODCM requirements for surface water. Fifty-six samples were analyzed by gamma spectrometry. Potassium-40 was not detected in any of the samples. Sixteen composited surface water samples were analyzed for tritium. The indicator stations had an average activity of 4313 pCi/l with a range of 3400-5700 pCi/l. The tritium detected in Squaw Creek Reservoir samples is attributed to liquid effluent discharges from CPSES. The results of these analyses can be found in Table 14 and 15 respectively. The level of tritium in the Squaw Creek Reservoir is well within the expected value predicted in the CPSES Final Safety Analysis Report.

E. Fish

The results of gamma isotopic analyses of fish samples collected during 1993 are presented in Table 16. A total of ten samples were analyzed, seven from the indicator location (ENE-2) and three from the control location (NNE-8). Sampling efforts concentrated on the larger edible species of commercial and/or recreational importance.

Cesium-137 was detected in three of the samples from Squaw Creek Reservoir with an average activity of 38 pCi/kg wet and a range of 28 to 49 pCi/kg wet. Preoperational levels have ranged from 3 to 39 pCi/kg wet on thirteen different occasions. Naturally occurring potassium-40 was detected in all samples. The average potassium-40 concentration for the two indicator samples is 2506 pCi/kg wet with a range of 1590 to 3600 pCi/kg wet. The average concentration for the control location is 2883 pCi/kg wet with a range of 2680 to 3160 pCi/kg wet.

F. Shoreline Sediments

The processes by which radionuclides and stable elements are concentrated in bottom sediments are complex, involving physiochemical interaction in the environment between the various organic and inorganic materials from the watershed. These interactions can proceed by a myriad of steps in which the elements are absorbed in or displaced from the surfaces of colloidal particles enriched with chelating organic materials. Biological action of bacteria and other benthic organisms also contribute to the concentration of certain elements and in the acceleration of the sedimentation process.

Results of the gamma isotopic analyses of the sediments sampled from the CPSES environment are given in Table 17. For 1993 three locations, one control and two indicators, were sampled semiannually. The average, fraction of detectables, and range of radionuclide concentrations are summarized in Table 20.

Naturally occurring gamma emitters found in detectable concentrations were K-40, Pb-212, Bi-214, Pb-214, Ra-226 and Th-228. Cesium-137 was measured in one sample from an indicator location with an activity of 47 pCi/kg. Preoperational levels of cesium-137 have ranged from 9.2 to 150 pCi/kg on four different occasions.

G. Food Products

Results of gamma isotopic analyses of food samples are contained in Table 18. A total of 12 samples were analyzed from three locations. Potassium-40, a naturally occurring isotope, was found in all 12 samples. For the indicator locations the average potassium-40 activity was 2906 pCi/kg wet with a range of 1120 to 5080 pCi/kg wet. Naturally occurring beryllium-7 was detected in two samples, one from indicator station E-4.2 with an activity of 194 pCi/kg wet and from control station SW-12.2 with an activity of 873. No I-131, Cs-134 or Cs-137 were detected in food products during 1993.

H. Broadleaf Vegetation

Results of gamma isotopic analyses of broadleaf vegetation samples are contained in Table 19. A total of 25 samples were analyzed from three locations. Potassium-40, a naturally occurring isotope, was found in all samples. The average potassium-40 activity for the control location was 5501 pCi/kg wet with a range of 1310 to 9240 pCi/kg wet. For the indicator locations the average potassium-40 activity was 3813 pCi/kg wet with a range of 2010 to 5840 pCi/kg wet. Naturally occurring beryllium-7 was detected in sixteen indicator samples with an average activity of 2087 pCi/kg wet; the range was 1010 to 6030 pCi/kg wet. The nine samples from control station SW-13.5 were found to have beryllium-7 with an average activity of 1895 pCi/kg wet and a range of 646-3940 pCi/kg wet.

Iodine-131, Cs-134 and Cs-137 were below the lower limit of detection in all samples.

CONCLUSIONS

IV. CONCLUSIONS

It is concluded from the levels obtained in environmental samples during 1993 and comparison of these levels to preoperational measurements, operational measurements of 1991 and 1992, and operational controls that the operation of CPSES in 1993 resulted in no changes in measurable levels of radiation or radioactive materials in the environment except the tritium detected in Squaw Creek Reservoir has increased from averages of approximately 2400 pCi/l in 1991 and 3400 pCi/l in 1992, to 4400 pCi/l in 1993. This increase has been expected; CPSES Unit 2 began operations in 1993. The atmospheric environment was sampled for airborne particulate matter, radioiodine, and direct radiation. The terrestrial environment was sampled for milk, groundwater, surface-drinking water, food products and broadleaf vegetation. The aquatic environment was sampled for surface water, fish and shoreline sediment. The analyses of these samples provided results which were either below the measurement detection limits or were indicative of natural terrestrial and cosmic ray radiation levels, except for the tritium in the surface water of Squaw Creek Reservoir which was far below the reporting levels for radioactivity concentrations in environmental samples.

REFERENCES

V. REFERENCES

1. U.S. Nuclear Regulatory Commission, "An Acceptable Radiological Environmental Monitoring Program", Radiological Assessment Branch Technical Position, November 1979, Rev. 1

2. National Council on Radiation Protection and Measurements, "Environmental Radiation Measurements", NCRP Report No. 50, Washington, D.C., December 27, 1976

3. Oakley, D.C., "Natural Radiation Exposure in the United States", ORP/SID 72-1 Office of Radiation Programs, U.S. Environmental Protection Agency, Washington, D.C., June 1972

4. Comanche Peak Steam Electric Station Units 1 and 2 Technical Specifications

5. Offsite Dose Calculation Manual For TU Electric Comanche Peak Steam Electric Station Units 1 and 2.

DATA TABLES

TABLE 1

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T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM -- 1993

Media	Number of Locations	Identification by Sector and Distance (Miles)	Sampling Frequency (a)	Analyses	Analytical Frequency (a)
Gamma Exposure	43	N-1.45; N-4.4; N-6.5; N-9.4; NNE-1.1 NNE-5.65; NE-1.7; NE-4.8; ENE-2.5; ENE-5.0; E-0.5; E-1.9; E-3.5; E-4.2; ESE-1.4; ESE-4.7; SE-1.3; SE-3.85; SE-4.6; SSE-1.3; SSE-4.4; SSE-4.5; S-1.5; S-4.2; SSW-1.1; SSW-4.4; SW-0.9; SW-4.8; SW-12.3; WSW-1.0; WSW-5.35; WSW-7.0; W-1; W-2; W-5.5 WNW-1; WNW-5.0; WNW-6.7; NW-1; NW-5.7; NW-9.9; NNW-1.35; NNW-4.6	Q,A	Thermoluminescent Dosimetry	Q,A
Air Particulate Air Iodine	8	N-9.4 E-3.5; SSE-4.5 SW-12.3; NW-1.0; N-1.45; SW/WSW-0.95 S/SSW-1.2	W	Gross Beta	W
				Gamma Spectrometry Filter	QC
				Gamma Spectrometry Charcoal Cartridge	W
Surface Water	4	N-19.3; ESE-1.4; N-1.5 NE-7.4	M (b)	Gamma Spectrometry	M
				Tritium	QC
Groundwater	5	SSE-4.6 W-1.2; WSW-0.1 N-9.8; N-1.45	Q	Gamma Spectrometry	Q
				Tritium	Q
Water-Surface Drinking	2	NNW-0.1; N-9.9	SM (c)	Gross Beta	M
				Gamma Spectrometry	M
				Iodine-131	SM
				Tritium	QC

TABLE 1
(PAGE 2 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM -- 1993

Media	Number of Locations	Identification by Sector and Distance (Miles)	Sampling Frequency (a)	Analyses	Analytical Frequency (a)
Sediment	3	N-9.9; NNE-1; NE-7.4	SA	Gamma Spectrometry	SA
Fish	2	NNE-8; ENE-2	SA	Gamma Spectrometry	SA
Milk	1	SW-13.5	SM, (d)	Iodine-131	SM (d)
				Gamma Spectrometry	SM (d)
Food Products	3	E-4.2; ENE-9.0 SW-12.2	MH	Gamma Spectrometry	MH
				Iodine-131	MH
Broadleaf Vegetation	3	N-1.45; SW-1.0; SW-13.5	M	Gamma Spectrometry	M
				Iodine-131	M

(a) Frequency Codes Are:
W = Weekly
M = Monthly
Q = Quarterly
QC = Quarterly Composite
SM = Semimonthly (i.e., once per 2-week period)
MH = Monthly during availability for harvest
SA = Semiannual
A = Annual

(b) Surface water samples from Squaw Creek Reservoir are monthly composites of weekly grab samples. Samples from Lake Gra[illegible] are monthly composites of weekly grab samples when Lake Granbury is receiving letdown from Squaw Creek Reservoir; otherwise they are monthly grab samples.

(c) Drinking water samples are a composite of weekly grab samples over a 2-week period when I-131 analysis is performed; otherwise they are monthly composites of weekly grab samples.

(d) Milk sample collection and analysis frequency is semimonthly when animals are on pasture. Otherwise samples are collected and analyzed monthly.


A
B
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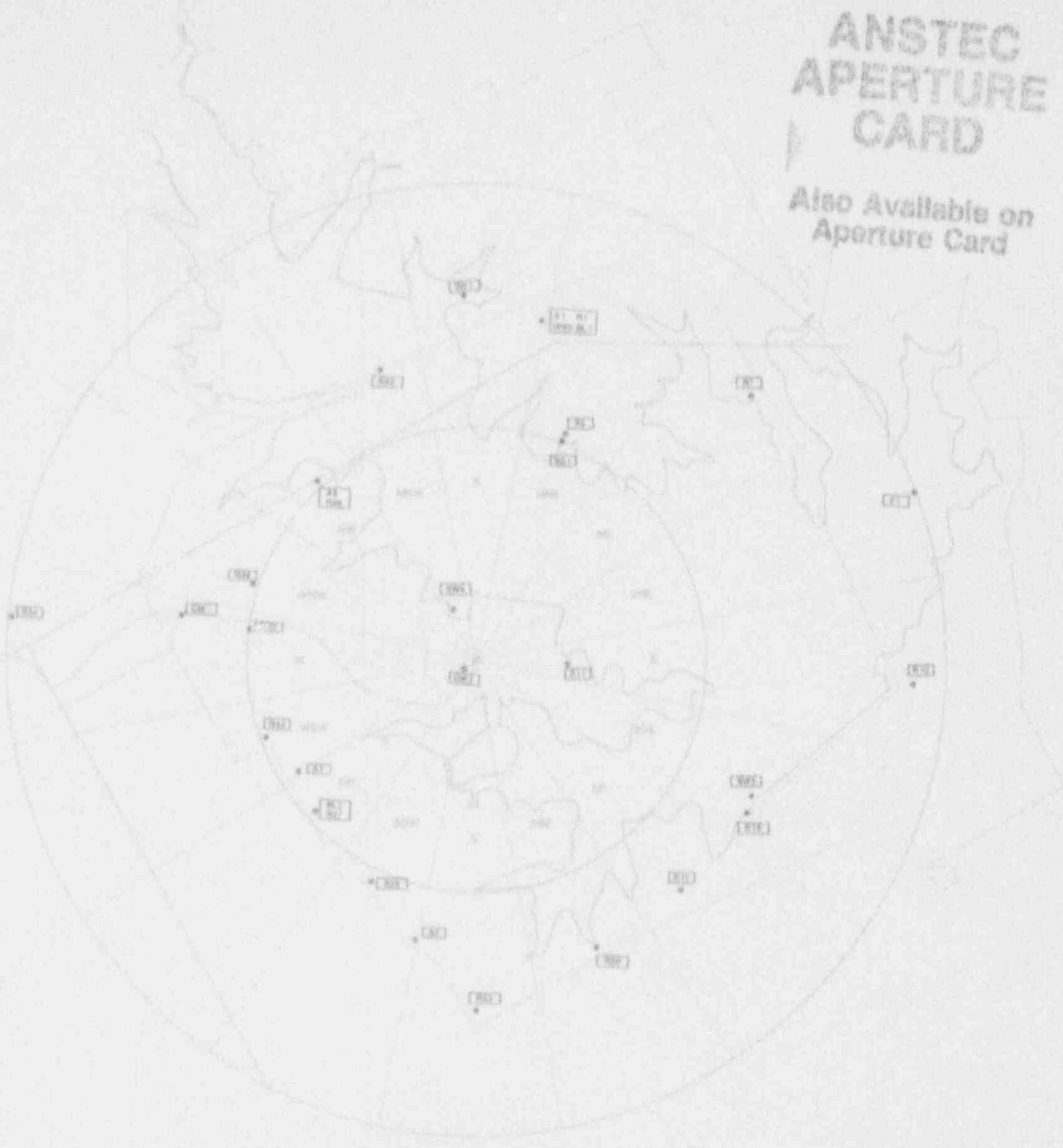
H



Locations within 2 miles of the Station

FIGURE 1

RADIOLOGICAL ENVIRONMENTAL

MONITORING LOCATIONS

(Page 1 of 2)

9405030187-01

FIGURE 1

(Page 2 OF 2)

KEY OF ENVIRONMENTAL SAMPLING LOCATIONS

SAMPLING POINT	LOCATION (SECTOR-MILES)	SAMPLE TYPE*	SAMPLING POINT	LOCATION (SECTOR MILES)	SAMPLE TYPE*
A 1	N-1.45	A	R28	SW-4.8	R
A 2	N-9.4	A	R29	SW-12.3	R
A 3	E-3.5	A	R30	WSW-1.0	R
A 4	SSE-4.5	A	R31	WSW-5.35	R
A 5	S/SSW-1.2	A	R32	WSW-7.0	R
A 6	SW-12.3	A	R33	W-1.0	R
A 7	SW/WSW-0.95	A	R34	W-2.0	R
A 8	NW-1.0	A	R35	W-5.5	R
			R36	WNW-1.0	R
			R37	WNW-5.0	R
			R38	WNW-6.7	R
			R39	NW-1.0	R
			R40	NW-5.7	R
R 1	N-1.45	R	R41	NW-9.9	R
R 2	N-4.4	R	R42	NNW-1.35	R
R 3	N-6.5	R	R43	NNW-4.6	R
R 4	N-9.4	R	SW1	N-1.5	SW
R 5	NNE-1.1	R	SW2	N-9.9	SW/DW
R 6	NNE-5.65	R	SW3	N-19.3	SW
R 7	NE-1.7	R	SW4	NE-7.4	SW
R 8	NE-4.8	R	SW5	ESE-1.4	SW
R 9	ENE-2.5	R	SW6	NNW-0.1	SW/DW
R10	ENE-5.0	R	GW1	W-1.2	GW/DW
R11	E-0.5	R	GW2	WSW-0.1	GW/DW
R12	E-1.9	R	GW3	SSE-4.6	GW/DW
R13	E-3.5	R	GW4	N-9.8	GW/DW
R14	E-4.2	R	GW5	N-1.45	GW/DW
R15	ESE-1.4	R	SS1	NNE-1.0	SS
R16	ESE-4.7	R	SS2	N-9.9	SS
R17	SE-1.3	R	SS3	NE-7.4	SS
R18	SE-3.85	R			
R19	SE-4.6	R	M4	SW-13.5	M
R20	SSE-1.3	R	F1	ENE-2.0	F
R21	SSE-4.4	R	F2	NNE-8.0	F
R22	SSE-4.5	R	FP1	ENE-9.0	FP
R23	S-1.5	R	FP2	E-4.2	FP
R24	S-4.2	R			
R25	SSW-1.1	R	FP4	SW-12.2	FP
R26	SSW-4.4	R	BL1	N-1.45	BL
R27	SW-0.9	R	BL2	SW-1.0	BL
			BL3	SW-13.5	BL

*TYPES:
A - Air Sample
R - Direct Radiation
SW - Surface Water
DW - Drinking Water
GW - Groundwater
SS - Shoreline Sediment
M - Milk
F - Fish
FP - Food Product
BL - Broadleaf Vegetation

TABLE 2
(PAGE 1 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
Direct Radiation - Thermoluminescent Dosimetry
Results in mR/day ± 2 s. d.

Station	FIRST QUARTER 01/13-04/15/93	SECOND QUARTER 04/15-07/14/93	THIRD QUARTER 07/14-10/13/93	FOURTH QUARTER 10/13/93-01/05/94	AVERAGE ± 2 S.D.	ANNUAL 01/13/93-01/05/94
N-1.45	0.14±0.02	0.09±0.01	0.12±0.01	0.15±0.007	0.13±0.01	0.16±0.05
N-4.4	0.15±0.02	0.11±0.02	0.14±0.01	0.19±0.01	0.15±0.02	0.17±0.03
N-6.5	0.15±0.01	0.10±0.01	0.12±0.009	0.17±0.06	0.13±0.02	0.15±0.05
N-9.4	0.14±0.01	0.10±0.02	0.12±0.01	0.20±0.03	0.14±0.02	0.16±0.01
NNE-1.1	0.15±0.009	0.11±0.02	0.14±0.02	0.18±0.04	0.14±0.02	0.18±0.02
NNE-5.65	0.15±0.02	0.12±0.05	0.13±0.01	0.16±0.05	0.14±0.03	0.16±0.02
NE-1.7	0.13±0.01	0.09±0.005	0.11±0.003	0.14±0.01	0.12±0.009	0.16±0.04
NE-4.8	*	0.11±0.01	0.12±0.01	0.18±0.04	0.14±0.02	0.11±0.02**
ENE-2.5	0.16±0.007	0.12±0.03	0.14±0.01	0.19±0.05	0.15±0.02	0.17±0.007
ENE-5	0.18±0.03	0.15±0.009	0.17±0.01	0.22±0.11	0.18±0.04	0.16±0.02
E-0.5	0.14±0.02	0.10±0.01	0.12±0.01	0.19±0.05	0.14±0.02	0.17±0.06
E-1.9	0.12±0.07	0.07±0.009	0.11±0.01	0.16±0.08	0.12±0.04	0.14±0.04
E-3.5	0.18±0.02	0.12±0.02	0.16±0.01	0.21±0.07	0.17±0.03	0.22±0.02
E-4.2	0.17±0.01	0.12±0.01	0.15±0.01	0.21±0.07	0.16±0.03	0.20±0.05
ESE-1.4	0.15±0.01	0.10±0.002	0.13±0.006	0.15±0.04	0.13±0.02	0.14±0.02
ESE-4.7	0.17±0.02	0.10±0.03	0.16±0.01	0.23±0.06	0.16±0.03	0.19±0.08
SE-1.3	0.15±0.02	0.10±0.01	0.14±0.007	0.13±0.10	0.13±0.03	0.15±0.03
SE-3.85	0.15±0.01	0.11±0.002	0.13±0.01	0.18±0.08	0.14±0.03	0.17±0.05
SE-4.6	0.15±0.04	0.10±0.007	0.12±0.01	0.17±0.06	0.13±0.03	0.16±0.03
SSE-1.3	0.18±0.01	0.09±0.007	0.13±0.003	0.10±0.01	0.13±0.04	0.16±0.04
SSE-4.5	0.16±0.01	0.08±0.01	0.13±0.009	0.22±0.08	0.15±0.03	0.16±0.03
SSE-4.4	0.16±0.02	0.11±0.01	0.14±0.005	0.12±0.03	0.13±0.02	0.17±0.008

*TLD missing.

**TLD in field from 04/21/93 to 01/05/94

TABLE 2

(PAGE 2 OF 2)

T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

Direct Radiation - Thermoluminescent Dosimetry

Results in mR/day ± 2 s. d.

Station	FIRST QUARTER 01/13-04/15/93	SECOND QUARTER 04/15-07/14/93	THIRD QUARTER 07/14-10/13/93	FOURTH QUARTER 10/13/93-01/05/94	AVERAGE ± 2 S.D.	ANNUAL 01/13/93-01/05/94
S-1.5	0.14±0.02	0.08±0.004	0.12±0.008	0.16±0.07	0.12±0.02	0.15±0.02
S-4.2	0.15±0.004	0.09±0.01	0.12±0.008	0.11±0.03	0.12±0.01	0.16±0.03
SSW-1.1	0.16±0.04	0.11±0.01	0.13±0.008	0.20±0.07	0.15±0.03	0.17±0.05
SSW-4.4	0.15±0.03	0.13±0.01	0.14±0.02	0.14±0.04	0.14±0.02	0.18±0.004
SW-0.9	0.15±0.03	0.10±0.007	0.13±0.01	0.16±0.04	0.14±0.02	0.18±0.01
SW-4.8	0.15±0.007	0.10±0.009	0.13±0.01	0.17±0.06	0.14±0.02	0.15±0.03
SW-12.3	0.15±0.03	0.12±0.01	0.14±0.01	0.19±0.04	0.15±0.02	0.16±0.01
WSW-1	0.15±0.02	0.10±0.005	0.13±0.01	0.17±0.03	0.14±0.02	0.17±0.02
WSW-5.35	0.15±0.01	0.06±0.003	0.13±0.01	0.18±0.08	0.13±0.03	0.16±0.04
WSW-7	0.14±0.02	0.12±0.03	0.15±0.01	0.21±0.06	0.15±0.03	0.18±0.01
W-1	0.14±0.01	0.05±0.008	0.11±0.001	0.13±0.02	0.11±0.01	0.16±0.02
W-2	0.14±0.005	0.07±0.009	0.12±0.01	0.15±0.04	0.12±0.02	0.13±0.02
W-5.5	0.13±0.01	0.09±0.02	0.12±0.007	0.17±0.03	0.13±0.02	0.14±0.03
WNW-1	0.16±0.02	0.11±0.02	0.13±0.01	0.13±0.04	0.13±0.02	0.16±0.03
WNW-5	0.16±0.01	0.10±0.003	0.13±0.01	0.10±0.03	0.12±0.02	0.15±0.03
WNW-6.7	0.14±0.008	0.09±0.02	0.12±0.008	0.17±0.05	0.13±0.02	0.10±0.01
NW-1	0.15±0.03	0.09±0.004	0.12±0.008	0.19±0.07	0.14±0.03	0.15±0.04
NW-5.7	0.16±0.01	0.10±0.01	0.13±0.02	0.19±0.02	0.15±0.01	0.17±0.03
NW-9.9	0.10±0.004	0.10±0.01	0.11±0.005	0.14±0.05	0.11±0.02	0.12±0.02
NNW-1.35	*	0.05±0.002	0.12±0.007	0.15±0.04	0.11±0.02	0.09±0.02**
NNW-4.6	0.13±0.02	0.08±0.009	0.15±0.02	0.19±0.05	0.14±0.02	0.16±0.02

* TLD missing

**TLD in field from 04/21/93 to 01/05/94

TABLE 3
(PAGE 1 OF 3)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF I-131 IN FILTERED AIR
Results in Units of pCi/m^3 ± 2 s.d.

STATION COLLECTION DATE	NW-1.0	SW/WSW-0.95	S/SSW-1.2	SW-12.3	SSE-4.5	E-3.5	N-1.45	N-9.4
JANUARY								
12/29-01/05/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
01/05-01/12/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.04	<0.04	<0.04
01/12-01/19/93	<0.02	<0.02	<0.01	<0.02	<0.04	<0.04	<0.04	<0.04
01/19-01/26/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.04	<0.04	<0.04
01/26-02/02/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
FEBRUARY								
02/02-02/09/93	<0.04	<0.04	<0.04	<0.04	[illegible]	<0.03	<0.03	<0.03
02/09-02/16/93	<0.02	<0.02	<0.02	<0.02	[illegible]	<0.02	<0.02	<0.02
02/16-02/23/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
02/23-03/02/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02
MARCH								
03/02-03/09/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
03/09-03/16/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
03/16-03/23/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02
03/23-03/30/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
APRIL								
03/30-04/06/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.02
04/06-04/13/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
04/13-04/20/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
04/20-04/27/93	<0.02	<0.02	<0.02	<0.02	<0.03	<0.03	<0.03	<0.02

TABLE 3
(PAGE 2 OF 3)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF I-131 IN FILTERED AIR
Results in Units of pCi/m^3 ± 2 s.d.

STATION COLLECTION DATE	NW-1.0	SW/WSW-0.95	S/SSW-1.2	SW-12.3	SSE-4.5	E-3.5	N-1.45	N-9.4
MAY								
04/27-05/04/93	<0.02	*	<0.02	<0.02	**	<0.02	<0.01	<0.01
05/04-05/11/93	<0.02	***	<0.02	<0.02	****<0.03	<0.02	<0.02	<0.02
05/11-05/18/93	*	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
05/18-05/25/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.03	<0.03	<0.03
05/25-06/01/93	<0.01	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01
JUNE								
06/01-06/08/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.03	<0.03	<0.03
06/08-06/15/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02
06/15-06/22/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
06/22-06/29/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02
JULY								
06/29-07/06/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
07/06-07/13/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
07/13-07/20/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02
07/20-07/26/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02
07/26-08/03/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AUGUST								
08/03-08/10/93	<0.01	*	<0.01	<0.01	<0.01	*****	<0.009	<0.01
08/10-08/16/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
08/16-08/24/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
08/24-08/30/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

*Sample not collected - power out.
** Sample not collected - broken vanes.
***Power out - in the field from 05/10-05/11.
****Broken vanes - in the field from 05/06-05/11.
*****Sample not collected - personnel error.

TABLE 3
(PAGE 3 OF 3)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF I-131 IN FILTERED AIR
Results in Units of pCi/m^3 ± 2 s.d.

STATION COLLECTION DATE	NW-1.0	SW/WSW-0.95	S/SSW-1.2	SW-12.3	SSE-4.5	E-3.5	N-1.45	N-9.4
SEPTEMBER								
08/30-09/07/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
09/07-09/14/93	<0.02	<0.02	<0.02	<0.02	<0.03	<0.03	<0.03	<0.03
09/14-09/21/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
09/21-09/27/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
OCTOBER								
09/27-10/05/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
10/05-10/12/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	**	<0.02
10/12-10/19/93	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
10/19-10/26/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
10/26-11/02/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02
NOVEMBER								
11/02-11/09/93	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
11/09-11/16/93	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
11/16-11/23/93	<0.03	*	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02
11/23-11/30/93	<0.03	*	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
DECEMBER								
11/30-12/07/93	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
12/07-12/14/93	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02	<0.02
12/14-12/21/93	<0.02	<0.02	<0.02	<0.02	<0.03	<0.03	<0.03	<0.03
12/21-12/28/93	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02	<0.02

*Power failure.
**Pump failure - insufficient volume.

TABLE 4
(PAGE 1 OF 3)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GROSS BETA EMITTERS IN AIR PARTICULATES
Results in Units of 10^{-3} pCi/m^3 ± 2 s.d.

STATION COLLECTION DATE	NW-1.0	SW/WSW-0.95	S/SSW-1.2	SW-12.3	SSE-4.5	E-3.5	N-1.45	N-9.4
JANUARY								
12/29-01/05/93	25±3	25±3	26±3	22±3	31±4	28±3	26±4	28±3
01/05-01/12/93	24±3	27±3	28±3	24±3	31±3	27±3	29±4	26±3
01/12-01/19/93	48±5	45±4	54±5	47±5	67±5	49±5	54±5	47±5
01/19-01/26/93	7.3±2.6	9.5±2.7	9.5±2.7	9.2±2.7	12±2	9.9±2.7	11±3	6.8±2.6
01/26-02/02/93	22±3	25±3	26±3	25±3	20±3	23±3	29±3	24±3
FEBRUARY								
02/02-02/09/93	22±3	20±3	22±3	24±3	20±3	20±3	24±3	21±3
02/09-02/16/93	19±3	20±3	18±3	19±3	21±3	17±3	20±3	18±3
02/16-02/23/93	30±3	24±3	25±3	23±3	29±3	24±3	27±3	27±3
02/23-03/02/93	21±3	19±3	18±3	20±3	19±3	16±3	23±3	20±3
MARCH								
03/02-03/09/93	18±3	21±3	21±3	18±3	23±3	18±3	22±3	23±3
03/09-03/16/93	16±3	17±3	12±3	13±3	19±3	14±3	15±3	17±3
03/16-03/23/93	13±3	14±3	14±3	16±3	16±3	12±3	18±3	17±3
03/23-03/30/93	19±3	21±3	15±3	23±3	20±3	16±3	18±3	19±3
APRIL								
03/30-04/06/93	9.4±2.9	7.8±2.8	12±3	17±3	11±3	10±3	14±3	13±3
04/06-04/13/93	18±3	20±3	18±3	18±3	21±3	16±3	17±3	14±3
04/13-04/20/93	16±3	14±3	16±3	15±3	16±3	14±3	17±3	15±3
04/20-04/27/93	20±3	16±3	19±3	19±3	24±3	20±3	18±3	20±3

TABLE 4
(PAGE 2 OF 3)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GROSS BETA EMITTERS IN AIR PARTICULATES
Results in Units of 10^{-3} pCi/m^3 ± 2 s.d.

STATION COLLECTION DATE	NW-1.0	SW/WSW-0.95	S/SSW-1.2	SW-12.3	SSE-4.5	E-3.5	N-1.45	N-9.4
MAY								
04/27-05/04	16±3	*	18±3	15±3	**	15±2	16±3	16±2
05/04-05/11	12±3	***	13±3	12±3	****14±4	10±3	13±3	13±3
05/11-05/18	*	16±3	17±3	20±3	21±3	17±3	20±3	18±3
05/18-05/25	19±3	18±3	20±3	18±3	19±3	16±3	20±3	17±3
05/25-06/01	13±3	15±3	14±3	15±3	20±3	15±3	17±3	18±3
JUNE								
06/01-06/08	17±3	23±3	20±3	18±3	18±3	20±3	18±3	19±3
06/08-06/15	12±3	13±3	12±3	12±3	13±3	13±3	15±3	11±3
06/15-06/22	12±3	13±3	8.9±2.4	9.0±2.4	11±3	9.7±2.4	11±3	8.9±2.4
06/22-06/29	13±3	11±2	11±2	10±2	13±3	9.9±2.4	11±2	12±3
JULY								
06/29-07/06	25±3	25±3	25±3	21±3	25±3	25±3	22±3	27±3
07/06-07/13	21±3	21±3	20±3	20±3	19±3	17±3	15±3	20±3
07/13-07/20	26±4	27±4	26±4	28±4	38±[illegible]	29±4	26±4	32±4
07/20-07/26	23±3	21±3	22±3	24±3	28±4	24±3	22±3	24±3
07/26-08/03	22±3	19±3	19±3	19±3	19±3	20±3	19±3	25±3
AUGUST								
08/03-08/10	19±3	*	1[illegible]±3	20±3	18±3	*****	23±4	27±4
08/10-08/16	21±3	18±3	17±3	19±3	19±3	18±3	18±3	21±3
08/16-08/24	26±3	26±3	27±3	28±3	31±3	25±3	30±3	28±3
08/24-08/30	25±3	26±3	26±3	23±3	22±3	24±3	22±3	25±3

*Sample not collected - power out.
** Sample not collected - broken vanes.
***Power out - in the field from 05/10-05/11.
****Broken vanes - in the field from 05/06-05/11.
*****Sample not collected - personnel error.

TABLE 4
(PAGE 3 OF 3)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GROSS BETA EMITTERS IN AIR PARTICULATES
Results in Units of 10^{-3} $pCi/m^3 \pm 2$ s.d.

STATION COLLECTION DATE	NW-1.0	SW/WSW-0.95	S/SSW-1.2	SW-12.3	SSE-4.5	E-3.5	N-1.45	N-9.4
SEPTEMBER								
08/30-09/07	22±3	23±3	18±3	18±3	21±3	19±3	24±3	19±3
09/07-09/14	24±3	25±3	24±3	26±3	23±3	27±3	26±3	21±3
09/14-09/21	16±3	17±3	15±3	15±3	16±3	15±3	18±3	13±3
09/21-09/27	13±3	13±3	10±3	13±3	11±3	8.8±3.0	13±3	11±3
OCTOBER								
09/27-10/05	30±3	29±3	29±3	26±3	24±3	22±3	29±3	23±3
10/05-10/12	31±4	28±4	31±4	23±3	24±3	31±4	**	30±4
10/12-10/19	21±3	19±3	16±3	18±3	17±3	19±3	19±3	19±3
10/19-10/26	20±3	16±3	17±3	13±3	17±3	16±3	19±3	15±3
10/26-11/02	24±3	26±3	26±3	23±3	23±3	23±3	26±3	22±3
NOVEMBER								
11/02-11/09	29±4	27±3	25±3	24±3	17±3	27±4	27±4	22±3
11/09-11/16	18±3	14±3	16±3	12±3	18±3	15±3	17±3	14±3
11/16-11/23	24±3	*	24±3	22±3	27±4	26±3	26±4	22±3
11/23-11/30	4.3±2	*	33±4	34±4	39±4	36±4	38±4	35±4
DECEMBER								
11/30-12/07	23±3	19±3	24±3	20±3	22±3	22±3	24±3	20±3
12/07-12/14	26±3	23±3	21±3	20±3	24±3	24±3	26±3	25±3
12/14-12/21	30±3	30±3	27±3	39±5	49±5	15±3	50±5	44±5
12/21-12/28	16±3	22±3	18±3	21±3	21±3	21±3	22±3	23±3

*Power Failure.
**Power Failure - insufficient volume.

TABLE 5
(PAGE 1 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN AIR PARTICULATE FILTERS
Results in Units of E-03 pCi/m^3 ± 2 s.d.

LOCATION	COMPOSITE PERIOD	Be-7	K-40	RU-103	Cs-134	CS-137
FIRST QUARTER						
NW-1.0	12/29/92-03/30/93	52.8±5.9	<8	<0.4	<0.4	<0.4
SW/WSW-0.95	12/29/92-03/30/93	48.8±5.4	17.0±4.9	<0.5	<0.5	<0.5
S/SSW-1.2	12/29/92-03/30/93	70.4±7.0	<10	<0.6	<0.6	<0.6
SW-12.3	12/29/92-03/30/93	59.4±5.9	<7	<0.4	<0.4	<0.4
SSE-4.5	12/29/92-03/30/93	70.7±7.6	9.7±4.0	<0.6	<0.6	<0.5
E-3.5	12/29/92-03/30/93	48.2±5.4	<9	<0.6	<0.5	<0.7
N-1.45	12/29/92-03/30/93	56.9±5.7	<9	<0.5	<0.4	<0.7
N-9.4	12/29/92-03/30/93	49.9±6.1	<20	<0.7	<0.7	<0.6
SECOND QUARTER						
NW-1.0	03/30/93-06/29/93	67.0±6.7	<9	<0.5	<0.4	<0.5
SW/WSW-0.95	03/30/93-06/29/93	87.2±9.7	10.1±4.0	<0.8	<0.7	<0.6
S/SSW-1.2	03/30/93-06/29/93	64.4±6.8	<20	<0.7	<0.6	<0.6
SW-12.3	03/30/93-06/29/93	56.8±6.4	<9	<0.7	<0.5	<0.7
SSE-4.5	03/30/93-06/29/93	79.5±8.0	<9	<0.7	<0.5	<0.5
E-3.5	03/30/93-06/29/93	56.9±5.7	<7	<0.5	<0.4	<0.3
N-1.45	03/30/93-06/29/93	68.7±6.9	<7	<0.4	<0.4	<0.3
N-9.4	03/30/93-06/29/93	72.1±7.2	<10	<0.7	<0.6	<0.5

*All other gamma emitters were <LLD.

TABLE 5
(PAGE 2 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN AIR PARTICULATE FILTERS
Results in Units of E-03 pCi/m^3 ± 2 s.d.

LOCATION	COMPOSITE PERIOD	Be-7	K-40	RU-103	Cs-134	CS-137
THIRD QUARTER						
NW-1.0	06/29/93-09/27/93	78.4±7.8	<20	<0.7	<0.6	<0.6
SW/WSW-0.95	06/29/93-09/27/93	83.3±8.3	7.62±4.27	<0.7	<0.5	<0.7
S/SSW-1.2	06/29/93-09/27/93	85.9±8.6	<9	<0.6	<0.5	<0.5
SW-12.3	06/29/93-09/27/93	73.7±7.4	12±4.8	<0.6	<0.5	<0.5
SSE-4.5	06/29/93-09/27/93	79.5±8.0	<8	<0.6	<0.4	<0.5
E-3.5	06/29/93-09/27/93	78.5±7.8	<7	<0.5	<0.4	<0.4
N-1.45	06/29/93-09/27/93	72.4±7.2	<8	<0.5	<0.3	<0.3
N-9.4	06/29/93-09/27/93	74.2±7.4	<20	<0.7	<0.6	<0.5
FOURTH QUARTER						
NW-1.0	09/27/93-12/28/93	81.2±8.1	<9	<0.6	<0.5	<0.4
SW/WSW-0.95	09/27/93-12/28/93	79.3±7.9	<10	<0.7	<0.6	<0.5
S/SSW-1.2	09/27/93-12/28/93	67.0±6.7	18.7±4.6	<0.6	<0.5	<0.5
SW-12.3	09/27/93-12/28/93	85.1±8.5	<8	<0.5	<0.4	<0.4
SSE-4.5	09/27/93-12/28/93	78.6±7.9	<8	<0.5	<0.4	<0.4
E-3.5	09/27/93-12/28/93	65.6±6.6	<6	<0.4	<0.3	<0.3
N-1.45	09/27/93-12/28/93	83.6±8.4	5.32±2.54	<0.4	<0.4	<0.4
N-9.4	09/27/93-12/28/93	68.4±6.8	<20	<0.6	<0.5	<0.6

*All other gamma emitters were <LLD.

TABLE 6
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF I-131 IN MILK
Results in pCi/l ± 2 s.d.

MONTH	COLLECTION DATE	SW-13.5
JANUARY	01/12/93	<0.2
FEBRUARY	02/09/93	<0.3
MARCH	03/09/93	<0.2
APRIL	04/06/93	<0.2
MAY	05/04/93	<0.2
	05/18/93	<0.2
JUNE	06/01/93	<0.2
	06/15/93	<0.3
	06/29/93	<0.2
JULY	07/13/93	<0.2
	07/26/93	<0.2
AUGUST	08/10/93	<0.2
	08/24/93	<0.2
SEPTEMBER	09/08/93	<0.2
	09/21/93	<0.2
OCTOBER	10/05/93	<0.1
	10/19/93	<0.2
NOVEMBER	11/16/93	<0.02
DECEMBER	12/14/93	<0.2

TABLE 7
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN MILK
Results in Units of pCi/liter ± 2 s.d.

LOCATION	COLLECTION DATE	K-40	Cs-134	Cs-137	La-140/Ba-140
STATION SW-13.5					
JANUARY	01/12/93	1300±130	<3	<4	<6
FEBRUARY	02/09/93	1350±140	<4	<4	<6
MARCH	03/09/93	1250±120	<3	<3	<4
APRIL	04/06/93	1370±140	<4	<4	<6
MAY	05/04/93	1260±130	<5	<5	<6
	05/18/93	1410±140	<3	<3	<4
JUNE	06/01/93	1400±140	<4	<4	<5
	06/15/93	1290±130	<4	<4	<5
	06/29/93	1310±130	<4	<4	<6
JULY	07/13/93	1270±130	<4	<4	<6
	07/26/93	1470±150	<4	<4	<5
AUGUST	08/10/93	1580±160	<3	<4	<5
	08/24/93	1390±140	<4	<4	<6
SEPTEMBER	09/08/93	1460±150	<4	<4	<5
	09/21/93	1420±140	<3	<3	<4
OCTOBER	10/05/93	1200±120	<4	<4	<6
	10/19/93	1390±140	<3	<3	<5
NOVEMBER	11/16/93	1380±140	<4	<4	<6
DECEMBER	12/14/93	1440±140	<4	<4	<6

*All other gamma emitters were <LLD.

TABLE 8

(PAGE 1 OF 2)

T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

CONCENTRATIONS OF GAMMA EMITTERS* IN GROUNDWATER

Results in Units of pCi/l ± 2 s.d.

COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb/Zr-95	Cs-134	Cs-137	Ba/La-140
STATION W-1.2									
01/05/93	<3	<3	<7	<4	<7	<4	<3	<4	<7
04/07/93	<3	<4	<8	<4	<7	<4	<4	<4	<7
07/06/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
10/05/93	<3	<3	<8	<4	<7	<4	<4	<4	<7
12/31/93	<3	<4	<7	<3	<7	<4	<4	<4	<6
STATION WSW-0.1									
01/05/93	<3	<3	<7	<3	<7	<3	<4	<4	<6
04/07/93	<3	<3	<6	<3	<7	<3	<3	<3	<5
07/06/93	<3	<4	<8	<3	<8	<4	<4	<4	<4
10/05/93	<4	<3	<7	<4	<7	<4	<4	<4	<6
12/31/93	**								
STATION SSE-4.6									
01/05/93	<3	<4	<8	<3	<8	<4	<4	<4	<7
04/06/93	<3	<4	<8	<4	<7	<4	<3	<4	<6
07/06/93	<3	<3	<5	<3	<7	<3	<3	<3	<4
10/05/93	<3	<4	<8	<4	<8	<4	<4	<4	<6
12/31/93	<3	<4	<8	<3	<7	<4	<4	<4	<7
STATION N-9.8									
01/05/93	<4	<4	<8	<3	<8	<4	<4	<4	<7
04/06/93	<3	<3	<7	<3	<7	<3	<3	<4	<6
07/06/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
10/05/93	<3	<3	<7	<3	<7	<3	<3	<5	<5
12/31/93	**								

* All other gamma emitters were LLD.

** Sample not collected -- See Appendix C for explanation.

TABLE 8
(PAGE 2 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN GROUNDWATER
Results in Units of pCi/l ± 2 s.d.

COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb/Zr-95	Cs-134	Cs-137	Ba/La-140
STATION N-1.45									
01/05/93	<3	<3	<7	<4	<7	<3	<3	<4	<6
04/06/93	<3	<3	<8	<3	<7	<4	<4	<4	<6
07/06/93	<3	<3	<6	<3	<7	<3	<3	<4	<4
10/05/93	<3	<3	<6	<3	<5	<3	<3	<4	<5
12/31/93	<3	<3	<7	<3	<6	<3	<3	<3	<5

* All other gamma emitters were LLD.

TABLE 9
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF TRITIUM IN GROUNDWATER
Results in pCi/l ± 2 s.d.

QUARTER	COLLECTION PERIOD	LOCATION	TRITIUM ACTIVITY
1	01/05/93	W-1.2	<100
	01/05/93	WSW-0.1	<100
	01/05/93	SSE-4.6	<100
	01/05/93	N-9.8	<100
	01/05/93	N-1.45	<100
2	04/07/93	W-1.2	<200
	04/07/93	WSW-0.1	<200
	04/06/93	SSE-4.6	<200
	04/06/93	N-9.8	<200
	04/06/93	N-1.45	<200
3	07/06/93	W-1.2	<200
	07/06/93	WSW-0.1	<200
	07/06/93	SSE-4.6	<200
	07/06/93	N-9.8	<200
	07/06/93	N-1.45	<200
4	10/05/93	W-1.2	<2000
	10/05/93	WSW-0.1	<2000
	10/05/93	SSE-4.6	<2000
	10/05/93	N-9.8	<2000
	10/05/93	N-1.45	<2000

TABLE 9
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF TRITIUM IN GROUNDWATER
Results in pCi/l ± 2 s.d.

QUARTER	COLLECTION PERIOD	LOCATION	TRITIUM ACTIVITY
4	12/31/93	W-1.2	<100
	12/31/93	WSW-0.1	*
	12/31/93	SSE-4.6	<100
	12/31/93	N-9.8	*
	12/31/93	N-1.45	<100

*Sample not collected -- see Appendix C for explanation.

TABLE 10
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
GROSS BETA CONCENTRATIONS IN WATER-SURFACE/DRINKING
Results in pCi/l ± 2 s.d.

MONTH	COLLECTION DATE	NNW-0.1	N-9.9
JANUARY	12/23/92-01/12/93	14±3	10±3
FEBRUARY	01/19/93-02/09/93	14±3	7.2±2.5
	02/16/93-03/09/93	14±3	9.4 ± 2.5
MARCH	03/16/93-04/06/93	16±3	8.2±2.3
APRIL	04/13/93-05/04/93	16±3	10±3
MAY	05/11/93-06/01/93	16±3	10±3
JUNE	06/08/93-06/29/93	13±3	13±3
JULY	07/06/93-07/26/93	19±3	14±3
AUGUST	08/03/93-08/24/93	21±4	13±3
SEPTEMBER	08/30/93-09/21/93	11±6	11±4
OCTOBER	09/28/93-10/19/93	21±4	19±4
NOVEMBER	10/26/93-11/16/93	15±4	11±3
	11/23/93-11/30/93	16±3	16±2
DECEMBER	11/23/93-12/14/93	16±3	12±3
	12/21/93-01/11/94	17±4	6.2±2.7

TABLE 11
(PAGE 1 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN WATER SURFACE/DRINKING
Results in Units of pCi/l ± 2 s.d.

COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb/Zr-95	Cs-134	Cs-137	Ba/La-140
STATION NNW-0.1									
12/23/92-01/12/93	<4	<4	<8	<4	<7	<4	<4	<4	<6
01/19/93-02/09/93	<3	<3	<6	<3	<6	<3	<3	<3	<5
02/16/93-03/09/93	<3	<3	<7	<3	<7	<3	<3	<4	<6
03/16/93-04/06/93	<3	<3	<8	<3	<7	<4	<3	<3	<7
04/13/93-05/04/93	<3	<3	<7	<3	<6	<3	<3	<3	<4
05/11/93-06/01/93	<3	<3	<7	<4	<7	<4	<4	<4	<6
06/08/93-06/29/93	<3	<3	<6	<3	<6	<3	<3	<3	<6
07/06/93-07/26/93	<3	<3	<8	<4	<7	<4	<4	<4	<6
08/03/93-08/24/93	<3	<3	<7	<3	<7	<4	<3	<4	<6
08/30/93-09/21/93	<3	<3	<7	<3	<7	<3	<4	<5	<6
09/28/93-10/19/93	<4	<4	<9	<4	<8	<4	<4	<4	<7
10/26/93-11/16/93	<2	<2	<5	<2	<5	<2	<2	<3	<4
11/23/93-11/30/93	<4	<4	<8	<4	<8	<4	<4	<4	<6
11/23/93-12/14/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
12/21/93-01/11/94	<3	<3	<6	<3	<6	<3	<3	<3	<5

* All other gamma emitters were LLD.

TABLE 11
(PAGE 2 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN WATER SURFACE/DRINKING
Results in Units of pCi/l ± 2 s.d.

COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb/Zr-95	Cs-134	Cs-137	Ba/La-140
STATION N-9.9									
12/23/92-01/12/93	<3	<3	<8	<4	<8	<4	<4	<4	<5
01/19/93-02/09/93	<3	<3	<6	<3	<6	<3	<3	<3	<5
02/16/93-03/09/93	<3	<3	<7	<3	<6	<3	<3	<3	<5
03/16/93-04/06/93	<3	<4	<8	<3	<7	<4	<4	<4	<8
04/13/93-05/04/93	<3	<4	<8	<3	<7	<4	<4	<4	<6
05/11/93-06/01/93	<3	<3	<7	<4	<8	<3	<3	<4	<5
06/08/93-06/29/93	<3	<3	<6	<3	<6	<3	<3	<3	<6
07/06/93-07/26/93	<3	<3	<7	<3	<7	<3	<4	<4	<4
08/03/93-08/24/93	<3	<3	<7	<3	<7	<3	<3	<3	<5
08/30/93-09/21/93	<3	<4	<7	<4	<8	<4	<4	<4	<7
09/28/93-10/19/93	<3	<4	<8	<4	<7	<4	<4	<5	<8
10/26/93-11/16/93	<3	<3	<7	<3	<6	<3	<3	<3	<5
11/23/93-11/30/93	<3	<3	<7	<4	<7	<3	<4	<5	<6
11/23/93-12/14/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
12/21/93-01/11/94	<3	<3	<7	<3	<7	<3	<3	<4	<5

* All other gamma emitters were LLD.

TABLE 12

T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

CONCENTRATIONS OF I-131 IN WATER-SURFACE/DRINKING

Results in pCi/l ± 2 s.d.

MONTH	COLLECTION DATE	NNW-0.1	N-9.9
JANUARY	12/23/92-01/12/93	<0.2	<0.2
	01/19/93-01/26/93	<0.2	<0.3
FEBRUARY	02/16/93-02/23/93	<0.2	<0.2
	02/16/93-03/09/93	<0.4	<0.4
MARCH	03/16/93-03/23/93	<0.3	<0.2
	03/16/93-04/06/93	<0.4	<0.4
APRIL	04/13/93-04/20/93	<0.2	<0.3
	04/13/93-05/04/93	<0.5	<0.4
MAY	05/11/93-05/18/93	<0.3	<0.2
	05/11/93-06/01/93	<0.5	<0.5
JUNE	06/08/93-06/15/93	<0.3	<0.2
	06/08/93-06/29/93	<0.5	<0.5
JULY	07/06/93-07/13/93	<0.2	<0.2
	07/06/93-07/26/93	<0.4	<0.4
AUGUST	08/03/93-08/10/93	<0.4	<0.3
	08/03/93-08/24/93	<0.4	<0.4
SEPTEMBER	08/30/93-09/07/93	<0.2	<0.2
	08/30/93-09/21/93	<0.9	<0.6
OCTOBER	09/27/93-10/05/93	<0.2	<0.2
	09/28/93-10/19/93	<0.4	<0.4
	10/26/93-11/02/93	<0.3	<0.2
NOVEMBER	10/26/93-11/16/93	<0.4	<0.4
	11/23/93-11/30/93	<0.3	<0.3
DECEMBER	11/23/93-12/14/93	<0.4	<0.4
	12/21/93-01/11/94	<0.4	<0.5
	12/21/93-12/28/93	<0.2	<0.3

TABLE 13
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF TRITIUM IN WATER-SURFACE/DRINKING
Results in pCi/l ± 2 s.d.

QUARTER	COLLECTION PERIOD	NNW-0.1	N-9.9
1	12/23/92-03/09/93	3800±200	<200
2	03/16/93-06/29/93	4500±1200	<2000
3	07/06/93-09/21/93	4800±1300	<2000
4	09/28/93-12/14/93	4500±200	<100

TABLE 14
(PAGE 1 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN SURFACE WATER
Results in Units of pCi/l ± 2 s.d.

COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb/Zr-95	Cs-134	Cs-137	Ba/La-140
STATION ESE-1.4									
12/23/92-01/12/93	<3	<3	<7	<3	<7	<4	<3	<4	<5
01/19/93-02/09/93	<4	<4	<8	<3	<9	<4	<4	<4	<6
02/16/93-03/09/93	<3	<3	<7	<3	<7	<3	<4	<4	<5
03/16/93-04/06/93	<3	<3	<7	<3	<7	<4	<3	<4	<6
04/13/93-05/04/93	<3	<4	<7	<3	<7	<4	<4	<4	<5
05/11/93-06/01/93	<3	<3	<8	<4	<7	<4	<4	<4	<6
06/08/93-06/29/93	<3	<3	<7	<3	<7	<3	<3	<3	<6
07/06/93-07/26/93	<4	<4	<9	<4	<9	<4	<5	<5	<5
08/03/93-08/24/93	<3	<4	<7	<3	<7	<4	<4	<4	<5
08/30/93-09/21/93	<3	<3	<7	<3	<6	<4	<4	<4	<6
09/28/93-10/19/93	<3	<3	<6	<3	<8	<4	<3	<3	<6
10/26/93-11/16/93	<3	<3	<7	<3	<7	<4	<4	<4	<5
11/23/93-12/14/93	<3	<4	<8	<4	< 9	<4	<4	<4	<5
12/21/93-01/11/94	<2	<3	<5	<3	<5	<3	<3	<3	<5
STATION N-1.5									
12/23/92-01/12/93	<4	<4	<10	<4	<10	<5	<5	<5	<7
01/19/93-02/09/93	<2	<3	<6	<3	<6	<3	<3	<3	<5
02/16/93-03/09/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
03/16/93-04/06/93	<4	<5	<10	<4	<10	<5	<5	<5	<7
04/13/93-05/04/93	<3	<4	<7	<3	<7	<4	<4	<4	<6
05/11/93-06/01/93	<3	<3	<7	<3	<7	<4	<4	<4	<6
06/08/93-06/29/93	<3	<3	<7	<3	<6	<3	<3	<3	<5
07/06/93-07/26/93	<3	<3	<6	<4	<6	<3	<3	<3	<4
08/03/93-08/24/93	<3	<3	<6	<3	<6	<3	<3	<3	<5
08/30/93-09/21/93	<4	<3	<8	<4	<7	<4	<4	<4	<6
09/28/93-10/19/93	<3	<3	<6	<3	<6	<3	<3	<3	<5
10/26/93-11/16/93	<3	<3	<6	<4	<7	<4	<4	<4	<6
11/23/93-12/14/93	<3	<3	<5	<3	<6	<3	<3	<3	<3
12/21/93-01/11/94	<3	<3	<7	<3	<8	<3	<4	<4	<5

* All other gamma emitters were <LLD.

TABLE 14
(PAGE 2 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN SURFACE WATER
Results in Units of pCi/l ± 2 s.d.

COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb/Zr-95	Cs-134	Cs-137	Ba/La-140
STATION NE-7.4									
12/23/92-01/12/93	<3	<3	<7	<4	<7	<3	<3	<4	<6
01/19/93-02/09/93	<3	<3	<6	<3	<6	<3	<3	<3	<5
02/16/93-03/09/93	<3	<3	<7	<3	<6	<3	<4	<4	<5
03/16/93-04/06/93	<3	<3	<8	<4	<6	<4	<3	<4	<5
04/13/93-05/04/93	<3	<3	<7	<3	<6	<3	<4	<4	<4
05/11/93-06/01/93	<3	<3	<7	<4	<8	<4	<4	<4	<6
06/08/93-06/29/93	<4	<4	<8	<4	<8	<4	<4	<4	<7
07/06/93-07/26/93	<3	<3	<7	<4	<8	<4	<4	<4	<5
08/03/93-08/24/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
08/30/93-09/21/93	<4	<4	<8	<4	<8	<4	<4	<4	<6
09/28/93-10/19/93	<4	<4	<7	<4	<7	<4	<4	<4	<6
10/26/93-11/16/93	<4	<4	<8	<4	<8	<4	<4	<4	<5
11/23/93-12/14/93	<3	<3	<6	<4	<6	<3	<3	<3	<5
12/21/93-01/11/94	<4	<4	<10	<4	<10	<5	<5	<5	<7
STATION N-19.3									
12/23/92-01/12/93	<3	<3	<8	<3	<7	<4	<4	<4	<6
01/19/93-02/09/93	<3	<3	<7	<3	<7	<3	<3	<4	<6
02/16/93-03/09/93	<4	<4	<8	<4	<8	<4	<4	<4	<7
03/16/93-04/06/93	<3	<3	<7	<3	<7	<4	<4	<4	<7
04/13/93-05/04/93	<4	<4	<7	<4	<8	<4	<4	<5	<6
05/11/93-06/01/93	<4	<4	<9	<4	<7	<4	<4	<4	<6
06/08/93-06/29/93	<3	<3	<7	<3	<7	<3	<3	<3	<5
07/06/93-07/26/93	<4	<3	<8	<4	<8	<4	<4	<4	<5
08/03/93-08/24/93	<4	<4	<8	<3	<8	<4	<4	<4	<5
08/30/93-09/21/93	<3	<3	<7	<3	<7	<3	<3	<5	<6
09/28/93-10/19/93	<3	<3	<7	<4	<6	<4	<3	<4	<7
10/26/93-11/16/93	<3	<3	<7	<4	<6	<4	<3	<5	<5
11/23/93-12/14/93	<3	<3	<6	<3	<6	<3	<3	<3	<4
12/21/93-01/11/94	<3	<3	<6	<3	<7	<3	<3	<3	<4

* All other gamma emitters were <LLD.

TABLE 15
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF TRITIUM IN SURFACE WATER
Results in pCi/l ± 2 s.d.

QUARTER	COLLECTION PERIOD	ESE-1.4	N-1.5	NE-7.4	N-19.3
1	12/23/92-03/09/93	3800±200	3800±200		
1	01/12/93-03/09/93			<200	<100
2	03/16/93-06/29/93	3400±1200	4000±1200		
2	04/06/93-06/29/93			<2000	<2000
3	07/06/93-09/21/93	4800±1300	5700±1300		
3	07/26/93-09/21/93			<2000	<2000
4	09/28/93-12/14/93	4600±200	4400±200		
4	10/19/93-12/14/93			<100	<200

TABLE 16

T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

CONCENTRATIONS OF GAMMA EMITTERS* IN FISH

Results in pCi/Kg (wet) ± 2 s.d.

COLLECTION DATE	STATION	DESCRIPTION	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
06/04/93	ENE-2.0	Channel Cat	2590±370	<20	<30	<70	<30	<60	<30	28±17
06/04/93	ENE-2.0	Sand Bass	1830±300	<20	<30	<60	<20	<60	<30	49±20
06/04/93	ENE-2.0	Hybrid Strip	2930±570	<50	<60	<100	<50	<100	<60	<70
06/04/93	ENE-2.0	Crappie	2690±450	<30	<30	<70	<30	<60	<30	<40
06/04/93	ENE-2.0	Yellow Cat	3600±400	<30	<20	<70	<20	<60	<30	<30
11/05/93	ENE-2.0	Lrg Mouth Bass	2310±230	<10	<10	<30	<10	<30	<10	<10
11/05/93	ENE-2.0	Crappie	1590±200	<20	<20	<50	<20	<40	<20	38±16
06/10/93	NNE-8.0	Stripped Bass	3160±450	<30	<30	<60	<30	<60	<30	<30
10/23/93	NNE-8.0	Channel Cat	2680±270	<10	<20	<40	<10	<30	<10	<10
10/23/93	NNE-8.0	Stripped Bass	2810±280	<10	<20	<50	<10	<30	<20	<20

*All other gamma emitters were LLD.

TABLE 17
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN SEDIMENT
Results in pCi/kg (dry) ± 2 s.d.

COLLECTION DATE	STATION	Be-7	K-40	Cs-134	Cs-137	Pb-212	Bi-214	Pb-214	Ra-226	Th-228
STATION N-9.9										
01/12/93	SS2	<200	4310±430	<20	<20	197±34	215±38	172±35	<400	191±33
07/13/93	SS2	<200	691±212	<20	<20	90±26	377±45	479±51	700±335	87±25
STATION NNE-1.0										
01/13/93	SS1	309±141	2690±310	<20	<20	154±24	279±39	301±40	734±308	149±23
07/13/93	SS1	<200	1810±250	<20	47±18	122±23	386±42	451±45	563±243	119±22
STATION NE-7.4										
01/12/93	SS3	<200	2540±260	<20	<20	89±17	209±35	238±33	475±217	86±16
07/13/93	SS3	<100	1890±210	<20	<20	134±18	227±29	316±32	482±243	130±18

*All other gamma emitters were LLD.

TABLE 18

(PAGE 1 OF 1)

T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

CONCENTRATIONS OF GAMMA EMITTERS* IN FOOD PRODUCTS

Results in Units of pCi/kg (wet) ± 2 s.d.

STATION	DESCRIPTION	COLLECTION DATE	Be-7	K-40	I-131	Cs-134	Cs-137
E-4.2		01/12/93 ***					
		02/09/93 ***					
		03/09/93 ***					
		04/06/93 ***					
	FP-2 Spinach	05/04/93	194±39	5080±510	<10**	<6	<6
	FP-2 Grn Beans	06/01/93	<100	4960±500	<20**	<10	<10
	FP-2 Pickle cuke	06/29/93	<50	2130±210	<10**	<6	<6
	FP-2 Wtrmelon	07/26/93	<60	1120±110	<10**	<7	<7
	FP-2 Pickle Cuke	08/24/93	<50	1520±150	<10**	<6	<6
	FP-2 Squash	09/21/93	<40	2320±230	<8 **	<5	<5
	FP-2	10/12/93***					
	FP-2	11/16/93***					
	FP-2	12/14/93***					
SW-12.2		01/12/93 ***					
		02/09/93 ***					
		03/09/93 ***					
		04/06/93 ***					
	FP-4 Lettuce	05/04/93	873±87	6330±630	[illegible]**	<9	<8
	FP-4 Squash	06/02/93	<50	1670±170	<10**	<6	<6
	FP-4 Ylw Squash	06/29/93	<70	1250±130	<20**	<9	<8
	FP-4 Squash	07/26/93	<50	1520±150	<9**	<6	<6
	FP-4 Potatoes	08/24/93	<50	4580±460	<10**	<6	<6
	FP-4	09/21/93***					
	FP-4	10/12/93***					
	FP-4	11/16/93***					
	FP-4	12/14/93***					
ENE-9.0	FP-1 Pecan	10/12/93	<90	3210±320	<60	<10	<10

* All other gamma emitters were <LLD.

** By gamma spectroscopy

***Sample not collected. See Appendix C for explanation.

TABLE 19

(PAGE 1 OF 2)

T U ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

CONCENTRATIONS OF GAMMA EMITTERS* IN BROADLEAF VEGETATIONr

Re ults in Units of pCi/kg (wet) ± 2 s.d.

STATION	DESCRIPTION	COLLECTION DATE	Be-7	K-40	I-131	Cs-134	Cs-137
SW-13.5		01/12/93	**				
(BL3)		02/09/93	**				
		03/09/93	**				
	Bloodweed	04/06/93	646±67	7060±710	<10***	<8	<8
	Bloodweed	05/04/93	1810±180	6740±670	<4***	<10	<10
	Bloodweed	06/01/93	1900±190	9240±920	<4***	<10	<10
	Bloodweed	06/29/93	1240±120	7190±720	<10***	<7	<7
	Hackberry	07/26/93	2730±270	4030±400	<20***	<10	<10
	Hackberry	08/24/93	1850±180	5270±530	<5***	<20	<20
	Hackberry	09/21/93	1280±150	4960±500	<10***	<20	<20
	Johnson Grass	10/19/93	1660±170	3710±370	<10***	<10	<10
	Bloodweed	11/16/93	3940±390	1310±210	<20***	<20	<20
		12/14/93**					
N-1.45		01/12/93	**				
(BL1)		02/09/93	**				
		03/09/93	**				
		04/06/93	**				
	Sumac	05/04/93	1210±130	4000±400	<5***	<20	<20
	Sumac	06/01/93	1290±140	4150±420	<6***	<20	<20
	Sumac	06/29/93	1580±160	4590±460	<20***	<20	<20
	Sumac	07/26/93	1010±130	2090±210	<40***	<20	<20
	Sumac	08/24/93	2310±230	4850±480	<9***	<10	<10
	Sumac	09/21/93	1590±160	5840±580	<20***	<10	<10
	Sumac	10/19/93	2710±270	2010±200	<5***	<10	<10
	Sumac	11/16/93	2990±300	3210±320	<20***	<20	<20
		12/14/93**					

* All other gamma emitters are LLD

** Sample Not Collected. See Appendix C for explanation.

*** By Radiochemical Analysis

TABLE 19
(PAGE 2 OF 2)
T U ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
CONCENTRATIONS OF GAMMA EMITTERS* IN BROADLEAF VEGETATION
Results in Units of pCi/kg (wet) ± 2 s.d.

STATION	DESCRIPTION	COLLECTION DATE	Be-7	K-40	I-131	Cs-134	Cs-137
SW-1.0 (BL2)		01/12/93**					
		02/09/93**					
		03/09/93**					
		04/06/93**					
	Sumac	05/06/93	1480±150	4180±420	<3***	<10	<10
	Sumac	06/01/93	1080±110	3710±370	<6***	<10	<10
	Sumac	06/29/93	1590±160	2700±270	<20***	<8	<8
	Sumac	07/26/93	1410±140	4100±410	<30***	<10	<10
	Hackberry	08/25/93	2140±210	3350±340	<6***	<10	<10
	Sumac	09/21/93	1160±120	3750±370	<9***	<6	<5
	Hackberry	10/19/93	3810±380	3780±380	<5***	<20	<20
	Sumac	11/16/93	6030±600	4690±470	<30***	<20	<20
		12/14/93**					

* All other gamma emitters were <LLD.
** Sample not available
***By Radiochemical Analysis

TABLE 20

(PAGE 1 OF 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

T U ELECTRIC - COMANCHE PEAK STEAM ELECTRIC STATION

JANUARY 1 TO DECEMBER 31, 1993

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD) (1)	All Indicator Locations Mean Range	Location with Highest Mean Name Distance and Direction	Location with Highest Mean Mean (f)(2) Range	Control Locations Mean (f)(2) Range	Number of Nonroutine Reported Measurements
TLDs (Quarterly) (mR/day)	Gamma (170)		0.14(162/162) (0.05-0.23)	ENE-5	0.18(4/4) (0.15-0.22)	0.15(8/8) (0.12-0.21)	0
TLDs (Annual) (mR/day)	Gamma (43)		0.16(41/41) (0.09-0.21)	E-3.5	0.22(1/1) --	0.17(2/2) (0.16-0.18)	0
Air Iodine-131 (10^{-3} pci/m^3)	I-131(407)	70	-(0/355) --	NA	NA	-(0/52) --	0
Air Particulate (10^{-3} pci/m^3)	Gross (407) Beta	10	21(355/355) (4.3-67)	N-1.45	22(52/52) (11-54)	20(52/52) (9-47)	0
	Gamma (32)						
	Be-7	-	70(28/28) (48-87)	SSE-4.5	77(4/4) (71-80)	69(4/4) (57-85)	0
	K-40	-	11(6/28) (5.3-19)	S/SSW-1.2	19(1/4) --	12(1/4) --	0
	Ru-103	-	-(0/28)	N/A	N/A	-(0/4)	0
	Cs-134	-	-(0/28)	N/A	N/A	-(0/4)	0
	Cs-137	-	-(0/28)	N/A	N/A	-(0/4)	0

(1) LLD is lower limit of detection as defined and required in USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program., Revision 1, November 1979.

(2) (f) is the ratio of positive results to the number of samples analyzed for the parameter of interest, means are of positive results only.

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(PAGE 2 OF 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

T U ELECTRIC - COMANCHE PEAK STEAM ELECTRIC STATION

JANUARY 1 TO DECEMBER 31, 1993

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD) (1)	All Indicator Locations Mean Range	Location with Highest Mean Name Distance and Direction	Location with Highest Mean Mean (f)(2) Range	Control Location Mean (f)(2) Range	Number of Nonroutine Reported Measurements
Milk (pCi/l)	I-131 (19) (BY RADIOCHEMISTRY)	-	NA --	NA	NA	-(0/19) --	0
	Gamma (19)						
	K-40	-	N/A --	SW-13.5	1365(19/19) (1200-1580)	1365(19/19) (1200-1580)	0
	Cs-137	-	NA --	NA	NA	-(0/19) --	0
Surface Water (pCi/l)	Gamma (56)						
	K-40		-(0/42) --	NA	NA	-(0/14) --	0
	Tritium (16)	-	4313(8/12) (3400-5700)	N-1.5	4475(4/4) (3800-5700)	-(0/4) --	0
Ground Drinking Water (pCi/l)	Gamma (2[illegible])	-					
	K-40	-	133(1/19) --	N-1.45	133(1/5) --	-(0/4) --	0
	Tritium (23)	-	-(0/19) --	NA	NA	-(0/4) --	0

(1) LLD is lower limit of detection as defined and required in USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program., Revision 1, November 1979.

(2) (f) is the ratio of positive results to the number of samples analyzed for the parameter of interest, means are of positive results only.

TABLE 20

(PAGE 3 OF 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

T U ELECTRIC - COMANCHE PEAK STEAM ELECTRIC STATION

JANUARY 1 TO DECEMBER 31, 1993

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD) (1)	All Indicator Locations Mean Range	Location with Highest Mean Name Distance and Direction	Location with Highest Mean Mean (f)(2) Range	Control Location Mean (f)(2) Range	Number of Nonroutine Reported Measurements
Water-Surface Drinking (pCi/l)	Gamma (30)	-	-(0/15) --	NA	NA	-(0/15) --	
	Tritium (8)	-	4400(4/4) (3800-4800)	NNW-0.1	3800(4/4) (3800-4800)	-(0/4) --	0
	Gross Beta (30)	-	16(15/15) (11-21)	NNW-0.1	16(15/15) (11-21)	11(15/15) (6.2-19)	0
	I-131 (52) (BY RADIOCHEMISTRY)	-	-(0/26) --	NA	NA	-(0/26) --	0
Fish (pCi/kg/dry)	Gamma (10)						
	K-40	-	2506(7/7) (1590-3600)	NNE-8.0	2883(3/3) (2680-3160)	2883(3/3) (2680-3160)	0
	CS-137		38(3/7) (28-49)	ENE-2.0	38(3/7) (28-49)	-(0/3) --	0
Shoreline Sediments (pCi/kg dry)	Gamma (6)						
	K-40	-	2233(4/4) (1810-2690)	N-9.9	2501(2/2) (691-4310)	2501(2/2) (691-4310)	0
	Cs-137	-	47(1/4) --	NNE-1.0	47(1/2) --	-(0/2) --	0
	Pb-212	-	125(4/4) (89-154)	N-9.9	144(2/2) (90-197)	144(2/2) (90-197)	0

(1) LLD is lower limit of detection as defined and required in USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program., Revision 1, November 1979.

(2) (f) is the ratio of positive results to the number of samples analyzed for the parameter of interest, means are of positive results only.

TABLE 20

(PAGE 4 OF 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

T U ELECTRIC - COMANCHE PEAK STEAM ELECTRIC STATION

JANUARY 1 TO DECEMBER 31, 1993

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD) (1)	All Indicator Locations Mean Range	Location with Highest Mean Name Distance and Direction	Location with Highest Mean Mean (f)(2) Range	Control Location Mean (f)(2) Range	Number of Nonroutine Reported Measurements
Shoreline Sediments (pCi/kg dry)	Gamma (6)						
	Bi-214	-	275(4/4) (209-386)	NNE-1.0	333(2/2) (279-386)	296(2/2) (215-377)	0
	Pb-214	-	327(4/4) (238-451)	NNE-1.0	376(2/2) (301-451)	326(2/2) (172-479)	0
	Ra-226	-	564(4/4) (475-734)	N-9.9	702(1/2) --	702(1/2) --	0
	Th-228	-	121(4/4) (86-149)	N-9.9	139(2/2) (87-191)	139(2/2) (87-191)	0

(1) LLD is lower limit of detection as defined and required in USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program., Revision 1, November 1979.

(2) (f) is the ratio of positive results to the number of samples analyzed for the parameter of interest, means are of positive results only.

TABLE 20

(PAGE 5 OF 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

T U ELECTRIC - COMANCHE PEAK STEAM ELECTRIC STATION

JANUARY 1 TO DECEMBER 31, 1993

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD) (1)	All Indicator Locations Mean Range	Location with Highest Mean Name Distance and Direction	Location with Highest Mean Mean (f)(2) Range	Control Location Mean (f)(2) Range	Number of Nonroutine Reported Measurements
Broadleaf Vegetation (pCi/kg wet)	Gamma (25)						
	Be-7	-	2087(16/16) (1010-6030)	SW-1.0	2338(8/8) (1080-6030)	1895(9/9) (646-3940)	0
	K-40	-	3813(16/16) (2010-5840)	SW-13.5	5501(9/9) (1310-9240)	5501(9/9) (1310-9240)	0
	I-131	-	-(0/16) --	NA	NA --	-(0/9) --	0
	Cs-134	-	-(0/16) --	NA	NA --	-(0/9) --	0
	Cs-137	-	-(0/16) --	NA	NA --	-(0/9) --	0

(1) LLD is lower limit of detection as defined and required in USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program., Revision 1, November 1979.

(2) (f) is the ratio of positive results to the number of samples analyzed for the parameter of interest, means are of positive results only.

TABLE 20

(PAGE 6 OF 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

T U ELECTRIC - COMANCHE PEAK STEAM ELECTRIC STATION

JANUARY 1 TO DECEMBER 31, 1993

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD) (1)	All Indicator Locations Mean Range	Location with Highest Mean Name Distance and Direction	Location with Highest Mean Mean (f)(2) Range	Control Location Mean (f)(2) Range	Number of Nonroutine Reported Measurements
Food Products (pCi/kg wet)	Gamma (12)						
	Be-7	-	194(1/7) --	SW-12.2	873(1/5) --	873(1/5) --	0
	K-40	-	2906(7/7) (1120-5080)	ENE-9.0	3210(1/1) --	3070(5/5) (1250-6330)	0
	I-131	-	-(0/7) --	NA	NA --	-(0/5) --	0
	Cs-134	-	-(0/7) --	NA	NA --	-(0/5) --	0
	Cs-137	-	-(0/7) --	NA	NA --	-(0/5) --	0

(1) LLD is lower limit of detection as defined and required in USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program., Revision 1, November 1979.

(2) (f) is the ratio of positive results to the number of samples analyzed for the parameter of interest. means are of positive results only.

APPENDIX A

EPA CROSS-CHECK PROGRAM

EPA INTERLABORATORY COMPARISON PROGRAM 1993

Collection Date	Media	Nuclide	EPA Result(a)		Teledyne Isotopes Result(b)		Deviation(c)	
01/15/93	Water	Sr-89	15.0 ±	5.0	12.67 ±	1.15	-0.81	
		Sr-90	10.0 ±	5.0	8.33 ±	1.15	-0.58	
01/22/93	Water	Pu-239	20.0 ±	2.0	18.00 ±	1.00	-1.73	
01/29/93	Water	Gr-Alpha	34.0 ±	9.0	17.33 ±	1.15	-3.21	(d)
		Gr-Beta	44.0 ±	5.0	52.00 ±	1.00	2.77	(e)
02/05/93	Water	I-131	100.0 ±	10.0	106.67 ±	5.77	1.15	
02/12/93	Water	U	7.6 ±	3.0	6.93 ±	0.15	-0.38	
03/05/93	Water	Ra-226	9.8 ±	1.5	7.67 ±	0.12	-2.46	(f)
		Ra-228	18.5 ±	4.6	19.33 ±	2.31	0.31	
04/20/93	Water	Gr-Alpha	95.0 ±	24.0	94.33 ±	1.15	-0.05	
		Ra-226	24.9 ±	3.7	19.00 ±	1.00	-2.76	(f)
		Ra-228	19.0 ±	4.8	18.33 ±	0.58	-0.24	
		Gr-Beta	177.0 ±	27.0	150.0 ±	0.00	-1.73	
		Sr-89	41.0 ±	5.0	35.33 ±	1.53	-1.96	
		Sr-90	29.0 ±	5.0	27.33 ±	0.58	-0.58	
		Co-60	39.0 ±	5.0	40.67 ±	3.51	0.58	
		Cs-134	27.0 ±	5.0	23.67 ±	1.53	-1.15	
		Cs-137	32.0 ±	5.0	34.33 ±	2.08	0.81	
06/04/93	Water	H-3	9844.0 ±	984.0	9366.67 ±	152.75	-0.84	
06/11/93	Water	Co-60	15.0 ±	5.0	16.33 ±	1.53	0.46	
		Zn-65	103.0 ±	10.0	121.33 ±	20.09	3.18	(g)
		Ru-106	119.0 ±	12.0	106.33 ±	15.89	-1.83	
		Cs-134	5.0 ±	5.0	5.67 ±	0.58	0.23	
		Cs-137	5.0 ±	5.0	6.67 ±	0.58	0.58	
		Ba-133	99.0 ±	10.0	104.33 ±	9.29	0.92	
07/16/93	Water	Sr-89	34.0 ±	5.0	31.67 ±	2.52	-0.81	
		Sr-90	25.0 ±	5.0	24.00 ±	0.00	-0.35	
07/23/93	Water	Gr-Alpha	15.0 ±	5.0	18.67 ±	2.08	1.27	
		Gr-Beta	43.0 ±	6.9	42.67 ±	2.52	-0.08	
08/13/93	Water	U	25.3 ±	3.0	24.33 ±	0.58	-0.56	
08/27/93	Air Filter	Gr-Alpha	19.0 ±	5.0	17.00 ±	0.00	-0.69	
		Gr-Beta	47.0 ±	5.0	49.00 ±	1.73	0.69	
		Sr-90	19.0 ±	5.0	17.67 ±	0.58	-0.46	
		Cs-137	9.0 ±	5.0	9.67 ±	0.58	0.23	

EPA INTERLABORATORY COMPARISON PROGRAM 1993

Collection Date	Media	Nuclide	EPA Result(a)		Teledyne Isotopes Result(b)		
09/09/93	Water	Ra-226	14.9 ±	2.2	15.33 ±	0.58	0.34
		Ra-228	20.4 ±	5.1	20.67 ±	1.15	0.09
09/24/93	Milk	Sr-89	30.0 ±	5.0	35.67 ±	3.51	1.96
		Sr-90	25.0 ±	5.0	24.00 ±	1.73	-0.35
		I-131	120.0 ±	12.0	126.67 ±	5.77	0.96
		Cs-137	49.0 ±	5.0	50.67 ±	1.15	0.58
		K	1679.0 ±	84.0	1620.00 ±	17.32	-1.22
10/08/93	Water	I-131	117.0 ±	12.0	103.33 ±	5.77	-1.97
10/19/93	Water	Gr-Beta	58.0 ±	10.0	51.33 ±	3.21	-1.15
		Sr-89	15.0 ±	5.0	15.00 ±	1.00	0.00
		Sr-90	10.0 ±	5.0	10.00 ±	0.00	0.00
		Co-60	10.0 ±	5.0	12.00 ±	1.00	0.69
		Cs-134	12.0 ±	5.0	9.00 ±	1.00	-1.04
		Cs-137	10.0 ±	5.0	12.67 ±	2.52	0.92
		Gr-Alpha	40.0 ±	10.0	39.67 ±	0.58	-0.06
		Ra-226	9.9 ±	1.5	10.10 ±	0.79	0.23
		Ra-228	12.5 ±	3.1	14.67 ±	1.15	1.21
10/29/93	Water	Gr-Alpha	20.0 ±	5.0	20.33 ±	2.08	0.12
		Gr-Beta	15.0 ±	5.0	15.67 ±	2.08	0.23
11/5/93	Water	H-3	7398.0 ±	740.0	6900.00 ±	100.00	-1.17
11/12/93	Water	Co-60	30.0 ±	5.0	28.67 ±	2.89	-0.46
		Zn-65	150.0 ±	15.0	152.00 ±	9.17	0.23
		Ru-106	201.0 ±	20.0	177.33 ±	5.51	-2.05 (h)
		Cs-134	59.0 ±	5.0	53.33 ±	4.93	-1.96
		Cs-137	40.0 ±	5.0	41.33 ±	3.06	0.46
		Ba-133	79.0 ±	8.0	69.33 ±	3.06	-2.09 (i)

Footnotes:

(a) EPA Results-Expected laboratory precision (1 sigma). Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters.

(b) Teledyne Results - Average ± one sigma. Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters.

(c) Normalized deviation from the known.

(d) The EPA switched from Am-241 to Th-230 alpha spike. We calibrated with Th-230, using sodium nitrate to generate a self-absorption curve. The EPA water, however has minerals which have greater self-absorption than the sodium nitrate matrix. The EPA has agreed to send us a gallon of their water which we can use to prepare a self-absorption curve with Th-230.

(e) By oversight, we did not use the special self-absorption curve which we had previously derived using EPA water and Cs-137 standard. We will use the EPA curve in the future. We may also re-derive this curve using a water sample which the EPA has agreed to send us.

(f) The counting data and backgrounds were verified Possibly some efficiencies used were erroneously high, causing low values. A less likely cause is an error in dilution. New Ra-226 standards will be prepared. Closer monitoring of out of control efficiencies will be done and extra care in preparation of the sample will be maintained.

(g) The calculations were checked and found to be correct. The results of six gamma emitting isotopes were reported to the EPA. The results of four were within 1 normalized deviation; a fifth, within 2 normalized deviations. Only the Zn-65 average was outside the control limits. There is no obvious reason why one isotope would be outside the control limits, while five other isotopes were within control limits.

(h) Although the Tl average (177.3) was 2.05 deviations low compared to the EPA value, the agreement was good with the average (175.2) of 173 participants. The data was reviewed for accuracy including half life and branching intensity used. No problems were found. No corrective action anticipated because of the good agreement with the average of all participants.

APPENDIX B

SYNOPSIS OF ANALYTICAL PROCEDURES

APPENDIX B

APPLICABLE PROCEDURES

NUMBER	TITLE	DATE	PAGE
PRO-032-1	Determination of Gross Alpha and/or Gross Beta in Water Samples	03/21/86	B-3
PRO-042-5	Determination of Gamma Emitting Radioisotopes	04/24/93	B-5
PRO-032-10	Determination of Gross Beta in Air Particulate Filters	03/01/87	B-7
PRO-032-11	Determination of Radioiodine in Milk and Water Samples	12/15/92	B-8
PRO-032-12	Determination of Radioiodine in Vegetation Samples	12/15/82	B-9
PRO-342-17	Environmental Thermoluminescent Dosimetry (TLD)	09/04/87	B-10
PRO-032-35	Determination of Tritium in Water by Liquid Scintillation	10/01/93	B-11

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER SAMPLES

1.0 INTRODUCTION

The procedures described in this section are used to measure the overall radioactivity of water samples without identifying the radioactive species present. No chemical separation techniques are involved.

One liter of the sample is evaporated on a hot plate. Different volumes may be used if the sample has a significant salt content as measured by a conductivity meter, or if unusual sensitivity is desired. If requested by the customer, the sample is filtered through No. 54 filter paper before evaporation, removing particles greater than 30 microns in size.

After evaporating to a small volume in a beaker, the sample is rinsed into a 2-inch diameter stainless steel planchet which is stamped with a concentric ring pattern to distribute residue evenly. Final evaporation to dryness takes place under heat lamps. Samples which appear to be hygroscopic are dried again under heat lamps just prior to counting.

Residue mass is determined by weighing the planchet before and after mounting the sample. The planchet is counted for alpha and/or beta activity on an automatic proportional counter. Results are calculated using empirical self-absorption curves which allow for the change in effective counting efficiency caused by the residue mass.

2.0 DETECTION CAPABILITY

Detection capability depends upon the sample volume actually represented on the planchet, the background and the efficiency of the counting instrument, and upon self-absorption of alpha and beta particles by the mounted sample. Because the radioactive species are not identified, no decay corrections are made and the reported activity refers to the counting time.

The minimum detectable level (MDL) for water samples is nominally 1.6 picocuries per liter for gross beta at the 4.66 sigma level (1.0 pCi/l at the 2.83 sigma level), assuming that 1 liter of sample is used and that 1/2 gram of sample residue is mounted on the planchet. These figures are based upon a nominal counting time of 50 minutes and upon representative values of counting efficiency and background of 0.2 and 1.2 cpm, respectively. The MDL for gross alpha activity is nominally 2.3 picocuries per liter at the 4.66 sigma level (1.4 pCi/l at the 2.83 sigma level) also assuming that 1 liter of sample is used and 1/2 gram of sample residue is mounted on the planchet. These figures are based upon a nominal 200 minute counting time and upon a representative efficiency of 0.02 and a background of 0.1 cpm.

The MDL becomes significantly lower as the mount weight decreases because of reduced self-absorption. At a zero mount weight, the 4.66 sigma MDL for gross beta is 0.9 picocuries per liter and the MDL for gross alpha is 0.3 picocuries per liter. These values reflect a beta counting efficiency of 0.38 and an alpha counting efficiency of 0.18.

DETERMINATION OF GAMMA EMITTING RADIOISOTOPES

Milk and Water

A 1.0 liter Marinelli beaker is filled with a representative aliquot of the sample. The sample is then counted for at least 1000 minutes with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Dried Solids Other Than Soils and Sediments

A large quantity of the sample is dried at a low temperature, less than 100°C. As much as possible (up to the total sample) is loaded into a tared 1-liter Marinelli and weighed. The sample is then counted for at least 1000 minutes with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Fish

As much as possible (up to the total sample) of the edible portion of the sample is loaded into a tared Marinelli and weighed. The sample is then counted for at least 1000 minutes with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Soils and Sediments

Soils and sediments are dried at a low temperature, less than 100°C. The soil or sediment is loaded fully into a tared, standard 300 cc container and weighed. The sample is then counted for at least six hours with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Charcoal Cartridges (Air Iodine)

Charcoal cartridges are counted up to five at a time, with one positioned on the face of a Ge(Li) detector and up to four on the side of the Ge(Li) detector. Each Ge(Li) detector is calibrated for both positions. The detection limit for I-131 of each charcoal cartridge can be determined (assuming no positive I-131) uniquely from the volume of air which passed through it. In the event I-131 is observed in the initial counting of a set, each charcoal cartridge is then counted separately, positioned on the face of the detector.

Air Particulate

The four or five (depending on the calendar month) air particulate filters for a monthly composite for each field station are aligned one in front of another and then counted for at least six hours with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

A mini-computer software program defines peaks by certain changes in the slope of the spectrum. The program also compares the energy of each peak with a library of peaks for isotope identification and then performs the radioactivity calculation using the appropriate fractional gamma ray abundance, half-life, detector efficiency, and net counts in the peak region. The calculation of results, two sigma error and the lower limit of detection (LLD) in pCi/volume or pCi/mass:

RESULT = (S-B)/(2.22 t E V F DF)

TWO SIGMA ERROR = $2(S+B)^{1/2}/(2.22\ t\ E\ V\ F\ DF)$

LLD = $4.66(B)^{1/2}/(2.22\ t\ E\ V\ F\ DF)$

where:	S	=	Area, in counts, of sample peak and background (region of spectrum of interest)
	B	=	Background area, in counts, under sample peak, determined by a linear interpolation of the representative backgrounds on either side of the peak
	t	=	length of time in minutes the sample was counted
	2.22	=	dpm/pCi
	E	=	detector efficiency for energy of interest and geometry of sample
	V	=	sample aliquot size (liters, cubic meters, kilograms, or grams)
	F	=	fractional gamma abundance (specific for each emitted gamma)
	DF	=	decay factor from the collection to the counting date

DETERMINATION OF GROSS BETA IN AIR PARTICULATE FILTERS

Air Particulates

After a delay of five or more days, allowing for the radon-222 and radon-220 (thoron) daughter products to decay, the filters are counted in a gas-flow proportional counter. An unused air particulate filter, supplied by T U Electric, is counted as the blank.

Calculations of the results, the two sigma error and the lower limit of detection (LLD), are performed as follows:

RESULT (pCi/m^3) = $((S/T) - (B/t))/(2.22 \ V \ E)$

TWO SIGMA ERROR (pCi/m^3) = $2((S/T^2+(B/t^2))^{1/2}/(2.22 \ V \ E)$

LLD (pCi/m^3) = $4.66(B/t/T)^{1/2}/(2.22 \ V \ E)$

where:	S	=	Gross counts of sample including blank
	B	=	Counts of blank
	E	=	Counting efficiency
	T	=	Number of minutes sample was counted
	t	=	Number of minutes blank was counted
	V	=	Sample aliquot size (cubic meters)
	2.22	=	dpm/pCi

DETERMINATION OF RADIOIODINE IN MILK AND WATER SAMPLES

Two liters of sample are first equilibrated with stable iodide carrier. A batch treatment with anion exchange resin is used to remove iodine from the sample. The iodine is then stripped from the resin with sodium hypochlorite solution, is reduced with hydroxylamine hydrochloride and is extracted into toluene as free iodine. It is then back-extracted as iodide into sodium bisulfite solution and is precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchet for low level beta counting. The chemical yield is corrected by measuring the stable iodide content of the milk or the water with a specific ion electrode.

Calculation of results, two sigma error and the lower limit of detection (LLD) in pCi/l, are performed as follows:

RESULT = $(N/\Delta t - B)/(2.22\ E\ V\ Y\ DF)$

TWO SIGMA ERROR = $2((N/\Delta t + B)/\Delta t)^{1/2}\ (2.22\ E\ V\ Y\ DF)$

LLD = $4.66(B/\Delta t)^{1/2}/(2.22\ E\ V\ Y\ DF)$

where:

- N = total counts from sample (counts)
- Δt = counting time for sample (min)
- B = background rate of counter (cpm)
- 2.22 = dpm/pCi
- V = volume or weight of sample analyzed
- Y = chemical yield of the mount or sample counted
- DF = decay factor from the collection to the counting date
- E = efficiency of the counter for I-131, corrected for self absorption effects by the formula:

  = $E_s(\exp -0.0085M)/(\exp -0.0085M_s)$
- E_s = efficiency of the counter determined from an I-131 standard mount
- M_s = mass of PdI_2 on the standard mount, mg
- M = mass of PdI_2 on the sample mount, mg

DETERMINATION OF RADIOIODINE IN VEGETATION SAMPLES

Broadleaf Vegetation

This procedure presents radiochemical methods for determining the I-131 activity in vegetation samples. Stable iodide carrier is first added to 25-100 grams of the chopped sample. The sample is then leached with sodium hydroxide solution, evaporated to dryness and fused in a muffle furnace. The melt is dissolved in water, filtered and treated with sodium hypochlorite. The iodine is then reduced with hydroxylamine hydrochloride and is extracted into toluene. It is then back-extracted as iodide into sodium bisulfite solution and is precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchet for low level beta counting.

Calculation of results, two sigma error and the lower limit of detection (LLD) in pCi/l, are performed as follows:

RESULT = $(N/\Delta t-B)/(2.22\ E\ V\ Y\ DF)$

TWO SIGMA ERROR = $2((N/\Delta t+B)/\Delta t)^{1/2}/(2.22\ E\ V\ Y\ DF)$

LLD = $4.66(B/\Delta t)^{1/2}/(2.22\ E\ V\ Y\ DF)$

where:

N = total counts from sample (counts)

Δt = counting time for sample (min)

B = background rate of counter (cpm)

2.22 = dpm/pCi

V = volume or weight of sample analyzed

Y = chemical yield of the mount or sample counted

DF = decay factor from the collection to the counting date

E = efficiency of the counter for I-131, corrected for self absorption effects by the formula:

= $E_s(\exp\text{-}0.0085M)/(\exp\text{-}0.0085M_s)$

E_s = efficiency of the counter determined from an I-131 standard mount

M_s = mass of PdI_2 on the standard mount, mg

M = mass of PdI_2 on the sample mount, mg

ENVIRONMENTAL THERMOLUMINESCENT DOSIMETRY (TLD)

Teledyne Isotopes uses a $CaSO_4$:Dy thermoluminescent dosimeter (TLD) which the company manufactures. This material has a high light output, negligible thermally induced signal loss (fading), and negligible self dosing. The energy response curve (as well as all other features) satisfies NRC Reg. Guide 4.13. Transit doses are accounted for by use of separate TLDs.

Following the field exposure period the TLDs are placed in a Teledyne Isotopes Model 8300. One fourth of the rectangular TLD is heated at a time and the measured light emission (luminescence) is recorded. The TLD is then annealed and exposed to a known Cs-137 dose; each area is then read again. This provides a calibration of each area of each TLD after every field use. The transit controls are read in the same manner.

Calculation of results and the two sigma error in net milliRoetgen (mR) are performed as follows:

RESULT $D = (D_1+D_2+D_3+D_4)/4$

TWO SIGMA ERROR $= 2((D_1-D)^2+(D_2-D)^2+(D_3-D)^2+(D_4-D)^2)/3)^{1/2}$

where: D_1 = the net mR of area 1 of the TLD, and similarly for D_2, D_3, and D_4

$= I_1 K/R_1 - A$

I_1 = the instrument reading of the field dose in area 1

K = the known exposure by the Cs-137 source

R_1 = the instrument reading due to the Cs-137 dose on area 1

A = average dose in mR, calculated in similar manner as above, of the transit control TLDs

DETERMINATION OF TRITIUM IN WATER BY LIQUID SCINTILLATION

Ten milliliters of water is added to 10 ml of liquid scintillation solution in a 25 ml vial. The sample is inserted into a Liquid Scintillator and counted for 100 minutes.

Calculations of the results, the two sigma error and the lower limit of detection (LLD), are performed as follows:

RESULT (pCi/l) = $(N-B)/(2.22\ V\ E)$

TWO SIGMA ERROR (pCi/l) = $2((N + B)/\Delta t)^{1/2}/(2.22\ V\ E)$

LLD (pCi/l) = $4.66(B/\Delta t)^{1/2}/(2.22\ V\ E)$

where:

N	=	the gross cpm of the sample
B	=	the background of the detector in cpm
2.22	=	conversion factor changing dpm to pCi
V	=	volume of the sample in ml
E	=	efficiency of the detector
Δt	=	counting time for the sample

APPENDIX C

EXCEPTIONS TO THE 1993 REMP

APPENDIX C

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXCEPTIONS FOR SCHEDULED SAMPLING AND ANALYSIS DURING 1993

LOCATION	DESCRIPTION	DATE OF SAMPLING	REASONS FOR LOSS/ EXCEPTION
SW/WSW-0.95	Air Charcoal	04/27-05/04	Power out.
SSE-4.5	Air Charcoal	04/27-05/04	Broken vane.
SW/WSW-0.95	Air Charcoal	05/06-05/11	Power out.
SSE-4.5	Air Charcoal	05/06-05/11	Broken vane.
NW-1.0	Air Charcoal	05/11-05/18	Bad connection.
SW/WSW-0.95	Air Charcoal	08/03-08/10	Power out.
E-3.5	Air Charcoal	08/03-08/10	Pump off - personnel error.
N-1.45	Air Charcoal	10/05-10/12	Pump failure.
SW/WSW-0.95	Air Charcoal	11/16-11/23	Power failure
SW/WSW-0.95	Air Charcoal	11/23-11/30	Power failure.
SW/WSW-0.95	Air Filter	04/27-05/04	Power out.
SSE-4.5	Air Filter	04/27-05/04	Broken vane.
SW/WSW-0.95	Air Filter	05/10-05/11	Power out.
SSE-4.5	Air Filter	05/06-05/11	Broken vane.
NW-1.0	Air Filter	05/11-05/18	Bad connection.
SW/WSW-0.95	Air Filter	08/03-08/10	Power out.
E-3.5	Air Filter	08/03-08/10	Pump off - personnel error
N-1.45	Air Filter	10/05-10/12	Pump failure.
SW/WSW-0.95	Air Filter	11/16-11/17	Power failure

APPENDIX C

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXCEPTIONS FOR SCHEDULED SAMPLING AND ANALYSIS DURING 1993

LOCATION	DESCRIPTION	DATE OF SAMPLING	REASONS FOR LOSS/ EXCEPTION
SW/WSW-0.95	Air Filter	11/29-11/30	Power failure.
SW-12.2	Food Product	01/12/93	Sample not available
E-4.2	Food Product	01/12/93	Sample not available
SW-12.2	Food Product	02/09/93	Sample not available
E-4.2	Food Product	02/09/93	Sample not available
SW-12.2	Food Product	03/09/93	Sample not available
E-4.2	Food Product	03/09/93	Sample not available
SW-12.2	Food Product	04/06/93	Sample not available
E-4.2	Food Product	04/06/93	Sample not available
SW-12.2	Food Product	09/21/93	Sample not available
SW-12.2	Food Product	10/12/93	Sample not available
E-4.2	Food Product	10/12/93	Sample not available
SW-12.2	Food Product	11/16/93	Sample not available
E-4.2	Food Product	11/16/93	Sample not available
SW-12.2	Food Product	12/14/93	Sample not available
E-4.2	Food Product	12/14/93	Sample not available
NE-4.8	TLD	01/13-04/15	TLD missing.
NNW-1.35	TLD	01/13-04/15	TLD missing.
SW-13.5	Vegetation	01/12/93	Sample not available
N-1.45	Vegetation	01/12/93	Sample not available

APPENDIX C

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXCEPTIONS FOR SCHEDULED SAMPLING AND ANALYSIS DURING 1993

LOCATION	DESCRIPTION	DATE OF SAMPLING	REASONS FOR LOSS/ EXCEPTION
SW-1.0	Vegetation	01/12/93	Sample not available
SW-13.5	Vegetation	02/09/93	Sample not available
N-1.45	Vegetation	02/09/93	Sample not available
SW-1.0	Vegetation	02/09/93	Sample not available
SW-13.5	Vegetation	03/09/93	Sample not available.
N-1.45	Vegetation	03/09/93	Sample not available.
SW-1.0	Vegetation	03/09/93	Sample not available.
N-1.45	Vegetation	04/06/93	Sample not available
SW-1.0	Vegetation	04/06/93	Sample not available
SW-13.5	Vegetation	12/14/93	Sample not available
N-1.45	Vegetation	12/14/93	Sample not available
SW-1.0	Vegetation	12/14/93	Sample not available
WSW-0.1	Groundwater	12/31/93	Pump out of service.
N-9.8	Groundwater	12/31/93	Unable to sample. Storage tank undergoing repair.

APPENDIX D

EXCEEDED REPORTING LEVELS

APPENDIX D

EXCEEDED REPORTING LEVELS

1993	None of the analytical measurements exceeded any notification level.

APPENDIX E

LAND USE CENSUS

TUELECTRIC

CPSES-9317715
November 19, 1993

To: John C. Finneran, Jr. (C39)

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION LAND USE CENSUS

Supersedes: CPSES-9230978

The Land Use Census identified receptors within a five (5) mile radius of the plant in each of the sixteen (16) meteorological sectors. The Land Use Census includes the following items:

1. Population by Sector and Distance
2. Nearest Resident by Sector and Distance
3. Nearest Garden by Sector and Distance
4. Nearest Milk Animal by Sector and Distance
5. A Map with an Accompanying Map Legend

Listed below are public use areas within the five (5) mile radius and the approximate attendance for the areas in 1992:

1. Camp Arrowhead - 3,250
2. Dinosaur State Park - 268,915
3. Glen Lake Camp - 12,000
4. Cedar Brake Girl Scout Camp - 180
5. Squaw Creek Park - 39,019
6. Keller's Camp - 7,200 March to November
7. Tres Rios Camp - 35,000 to 45,000
8. Oakdale Camp & Fish - 5,500
9. Oakdale Park - 110,000
10. Creation Science Museum - 14,000
11. Texas Amphitheater - Glen Rose - 80,000
12. CPSES Visitors Center - 19,354
13. Exposition Center - Glen Rose - Under Construction
14. Cherokee Rose Manor Nursing Home - Glen Rose - 34 Permanent Residents
15. Somervell Training Center - 3082

P.O. Box 1002 Glen Rose, Texas 76043-1002

Listed below are public use areas within the ten (10) mile radius and the approximate attendance for the areas in 1992:

1. Fossil Rim Wildlife Ranch - 80,000+
2. Granbury Opera House - 77,000
3. Granbury Queen Riverboat - 26,000
4. Other Fishing Camps - 10,000
5. Stevens Ranch Girl Scout Camp - 2,814

As required by commitment 22585 and Memorandum NE-24059, reference shipment and storage of liquified chlorine gas within 5 miles of CPSES, the following conditions were found.

1. No new areas of usage of chlorine gas was found within 5 miles of CPSES.

2. The following places were called to assure any changes or uses of chlorine gas within their areas. These areas reported no change in uses as reported in letter THP-88-0040, December 20, 1988.

   Happy Hill Farm
   Oakdale Park
   Glen Lake Camp
   City of Stephenville
   City of Glen Rose

Donna Kay Cole

Donna Kay Cole (T01)
Environmental Technician

DKC:am

Attachments

cc:	CCS	E06
	D. N. Hood	T02
	R. J. Prince	M37

Population (*) By Sector and Distance

	0-1	1-2	2-3	3-4	4-5	Total
N	-	-	(1)2	27	72	101
NNE	-	-	8	69	13	90
NE	-	-	48	72	245	365
ENE	-	-	43	19	21	83
E	-	-	32	(2)186	(3)26	244
ESE	-	(4)2	8	96	109	215
SE	-	8	66	27	43	144
SSE	-	27	35	37	(5)2471	2570
S	-	32	21	21	96	170
SSW	-	3	5	(6)2	37	47
SW	-	59	3	35	35	132
WSW	13	72	3	11	3	102
W	-	48	6	43	6	103
WNW	-	-	3	24	82	109
NW	-	-	3	-	3	6
NNW	-	-	3	35	8	46
TOTAL	13	251	289	704	3270	4527**

* Based on an average of 2.66 residents per house. (Obtained from North Central Texas Council of Governments), 1992 based on an average from 2.57 for Hood County and 2.74 for Somervell County.

(1) Includes permanent residents at Squaw Creek Park of 2 residents.

(2) Includes permanent residents at Happy Hill Children's Home of 165 residents.

(3) Includes permanent residents at Camp Arrowhead of 5 residents and Keller's Camp of 2 residents.

(4) Includes permanent residents at Somervell Training Center of 2 residents.

(5) Includes permanent resident at Cherokee Rose Manor of 34 residents and the Glen Rose population of 2,400 residents.

(6) Includes permanent residents at Dinosaur Valley State Park of 2 residents.

** Difference in population for 1993 Census is due to using an estimate for Glen Rose on 1992 Census based on telephones, water meters, and volume of wastewater treated. Population of 2,400 as stated by Byron St. Clair, City Superintendent.

Nearest Resident by Sector and Distance

Sector	Distance (Miles)
N	2.2
NNE	2.4*
NE	2.3
ENE	2.4
E	2.4
ESE	2.0
SE	1.9*
SSE	1.5*
S	1.5*
SSW	1.9
SW	1.1*
WSW	1.0
W	1.5
WNW	2.95
NW	2.7
NNW	2.7

* Denotes change from previous year

Nearest Garden by Sector and Distance

Sector	Distance (Miles)
N	3.4*
NNE	2.5
NE	2.5
ENE	2.4*
E	3.5*
ESE	3.3*
SE	None*
SSE	2.3*
S	1.8
SSW	4.4*
SW	1.7*
WSW	1.1*
W	1.5
WNW	3.0*
NW	None
NNW	3.7

Nearest Milk Animal by Sector and Distance

Sector	Distance (Miles)
NNW	4.9*
SSE	2.2
E	3.5*
NE	None *

* Denotes change from previous year.

Map Legend

N-1.0 to 2.5	Squaw Creek Park
N-3.4 to 3.5	Gardens
N-4.4	15 SC
N-4.5 to 4.8	Gardens
N-4.7	Business
NNE-2.4	Garden
NNE-3.2	2 SC, Garden
NNE-3.3	100 SC, Gardens
NNE-3.4	40 SC
NNE-3.5 to 3.6	Gardens
NNE-3.7	Business with 6 Cabins - Flip's
NNE-3.8	6 SC, Gardens
NNE-4.4	Gardens
NNE-4.5	50 SC
NNE-4.7	35 SC, 15 Goats
NE-2.5 to 2.9	Gardens
NE-2.8	RV Park-Midway Pines
NE-3.0	Business with RV Park
NE-3.2	20 SC, Gardens
NE-3.5	40 SC
NE-3.8	13 SC
NE-3.9	Garden
NE-4.1	Gardens
NE-4.3 TO 4.9	Gardens
NE-4.8	100 SC
ENE-2.5	Garden
ENE-2.6	Garden, 4 SC
ENE-2.8	Garden, 6 SC
ENE-4.0	Business - Sand & Gravel
ENE-4.2	50 SC
ENE-4.3	Pecan Orchard
ENE-4.5	40 SC
ENE-4.9	Garden
E-2.4	Garden
E-3.5	Garden, 15 SC, 4 DC, 6 Goats, 8 Sheep - Happy Hill Children's Home
E-3.9	Business - RV Park (Oakdale Camp and Fish)
E-4.0	Keller's Camp - RV Park
E-4.4	Truck Garden - Hornick
E-4.8	Camp Arrowhead - 250 SC
ESE-2.0	T.U. Electric - Somervell Training Center
ESE-2.4	35 SC

ESE-2.8	100 SC
ESE-3.3 to 3.4	Businesses, Garden
ESE-3.4	100 SC
ESE-3.7 to 3.9	Gardens, 50 SC
ESE-4.1	Garden
ESE-4.7 to 4.9	Gardens
ESE-4.7	Business
SE-3.0	Texas Amphitheater - Glen Rose
SE-4.3	New Exposition Center
SE-4.5	Squaw Valley Golf Course
SE-5.0	Camp Tres Rios
SSE-2.3	Garden
SSE-2.2	Daffan Dairy
SSE-4.2	35 SC
SSE-4.3	Cherokee Rose Manor
SSE-4.5	City of Glen Rose, Texas
SSE-4.7	Oakdale Park
SSE-4.8	Glen Lake Camp
S-1.8	Garden
S-2.2	100 SC
S-2.6	30 SC
S-4.0	Business
S-4.9	Business - Day Care Center, Garden, 20 SC
SSW-3.0 to 4.0	Dinosaur Valley State Park
SSW-4.4	Garden
SSW-4.8	Creation Science Museum, 3 SC
SSW-4.9	Business
SW-1.1 to 1.7	Trailer Park
SW-1.7	Businesses, Garden
SW-1.9	Garden
SW-2.0	30 SC
SW-3.6	Garden
SW-4.6	Cedar Brake Girl Scout Camp, 35 SC
WSW-1.1 to 1.7	Gardens
WSW-1.6	Trailer Park, Gardens
WSW-2.8	Gardens
WSW-3.4	Garden
WSW-4.9	Garden
W-1.5	Gardens, 30 SC
W-1.9	100 SC
W-3.4	Garden
W-3.8	Garden, Hill City
WNW-3.0	Garden
WNW-3.3	100 SC

WNW-3.7	50 SC
WNW-4.4	30 SC
WNW-4.6	Gardens
WNW-4.8	Business
NW-	Squaw Creek Ranching Area
NNW-2.5 to 2.9	Squaw Creek Ranching Area, 200 SC
NNW-3.6	Gardens, 10 SC
NNW-3.7	3 SC
NNW-4.4	50 SC
NNW-4.6	Garden
NNW-4.9	Garden, 10 SC, 20 DC

DC - Dairy Cattle
SC - Stocker Cattle
⊙ Occupied Residence
Unoccupied House
Institutions/Recreational Areas (Green)

Business
▲ Dairy
Truck Farm (Red)
Gardens (Red)

Evaluation of the 1993 Land Use Census

The results of the 1993 Land Use Census were reviewed for impact on the Radiological Environmental Monitoring Program (REMP). The specific areas reviewed, that could be affected by changes found in the land use census, were the sampling requirements for Milk, Broadleaf Vegetation and Food Products.

Reviewing the milk sampling requirements from the ODCM Table 3.12-1 reveals that samples are to be obtained from milking animals in three locations within a 5 km distance having the highest potential dose. If none are available, samples are acceptable from milking animals in locations 5 to 8 km distance where doses are calculated to be greater than 1 mrem per year. A sample is also required at a control location.

Currently the only location where milk samples are collected is at a control location (SW-13.5). There are currently no identified milking animals (cow or goat) within the specified distances.

Since not all milk samples are available the broadleaf vegetation sampling specified in ODCM Table 3.12-1 is being performed. Broadleaf sample requirements are such that samples of broadleaf vegetation are to be collected from each of two offsite locations of highest predicted annual average D/Q if milk sampling is not performed at all required locations.

Currently, broadleaf vegetation samples are collected at two indicator locations (N-1.45 and SW-1.0) and one control location (SW-13.5). These locations are near the site boundary in sectors where broadleaf vegetation is available and D/Q is greatest. Therefore, no changes to the broadleaf sampling program are required.

Food Product sample requirements of ODCM Table 3.12-1 requires that one sample of each principal class of food product be collected from any area that is irrigated with water in which liquid plant wastes have been discharged. Of the gardens identified in the land census, no new gardens were located in an area that irrigate with water in which liquid plant wastes are discharged. Currently, food products are sampled from two indicator locations (ENE-9.0, pecans; E-4.2, vegetables) and one control location (SW-12.2). Therefore, no changes are required in the Food Product sampling program.

In summary, the 1993 Land Use Census did not identify any new locations that are available for sampling and would yield a calculated dose greater than at the current sampling locations.

In addition to reviewing the sampling location requirements for milk, broadleaf and food products, changes to the controlling receptor locations and pathways and associated atmospheric dispersion parameters given in ODCM, Part II, Table 2.5 were reviewed. This table will also require revision as these parameters are used in dose calculations required by Radiological Effluent Control 4.11.2.3. Table 2.5 will be revised to reflect the 1993 Land Use Census data changes.

Besides the required reviews and changes mentioned above the census pointed out that the permanent resident population in the census zone has not changed significantly and the attendance at public use facilities increased only slightly compared to 1992.

Evaluation performed by: Eric T Lloyd Date: 1-17-94