

# WOLF CREEK

NUCLEAR OPERATING CORPORATION

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April 30, 1992

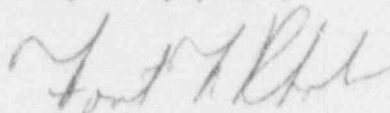
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U. S. Nuclear Regulatory Commission  
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Re: Docket No. 50-482: Annual Radiological Environmental  
Operating Report

Re: the Annual Radiological Environmental Operating Report which is  
being submitted pursuant to Wolf Creek Generating Station (WCGS) Technical  
Specification 6.9.1.6. This report covers the operation of Wolf Creek  
Generating Station (WCGS) for the period of January 1, 1991, through  
December 31, 1991.

Very truly yours,



Forrest T. Rhodes  
Vice President  
Engineering & Technical Services

FTR/mes

Attachment

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WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

1991 ANNUAL RADIOLOGICAL

ENVIRONMENTAL OPERATING REPORT

APRIL 17, 1992

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## INTRODUCTION

This is the 1991 Annual Radiological Environmental Operating Report for Wolf Creek Generating Station (WCGS), located in Coffey County, Kansas, approximately five miles northeast of Burlington, Kansas. This report covers the period from January 1 to December 31, 1991.

Fuel loading began at WCGS on March 12, 1985. The operational phase of the Radiological Environmental Monitoring Program began with initial criticality on May 22, 1985, with the first detectable quantities of radioactivity reported in plant effluents in June, 1985.

This report contains a description of the Radiological Environmental Monitoring Program conducted by Wolf Creek Nuclear Operating Corporation (WCNOC), results of sample analyses performed by Teledyne Isotopes, a discussion of monitoring program results, a discussion of program deviations and revisions, and a discussion of the results of the Environmental Protection Agency (EPA) Interlaboratory Comparison Program. Individual sample results and a summary of results in the Nuclear Regulatory Commission (NRC) Branch Technical Position specified format are included as appendices to the report.

No radiological effects of plant operation were detected in airborne particulate or radioiodine filters, fish, irrigated crops, milk, or drinking water.

Tritium from routine plant releases was detected in Wolf Creek Cooling Lake (WCCL) throughout the year. Additionally, tritium was detected in two ground water samples in low concentrations, just above the Lower Limit of Detection (LLD). All WCCL tritium results were below applicable reporting levels.

Activation products were detected in aquatic plant (algae), shoreline soil, and bottom sediment samples obtained during 1991.

Fission products were also detected in broadleaf vegetation samples. The data suggests that the activity did not result from plant operations.

No measurable impact on human exposure due to plant operations was seen for the year.

## I. PROGRAM DESCRIPTION

Radiological environmental samples were collected according to the schedule in Table 5-1 and Section 5.0 of the WCGS Offsite Dose Calculation Manual (ODCM). All samples were collected by WCNO's Radiological Services, Emergency Planning, and Environmental Management Groups and sent to Teledyne Isotopes of Westwood, New Jersey for analysis. Table 1 lists sampling pathways and frequencies of sampling and analysis. Table 2 lists sample location directions and distances. Samples in addition to those required by the WCGS ODCM were obtained in conjunction with sampling efforts of the Kansas Department of Health and Environment (KDHE) and to monitor additional parameters.

During 1991, the program description and requirements were moved from WCGS Technical Specifications to the WCGS ODCM. Throughout this report, references to the WCGS ODCM are intended to include that portion of the year in which the program was still governed by Technical Specifications.

The following is a description of the sampling and analysis program by individual pathways. Deviations are permitted from the required sampling schedule if specimens are not attainable due to hazardous conditions, seasonable unavailability, malfunction of automatic sampling equipment, and other legitimate reasons. Deviations from the routine sampling schedule and other problems encountered during the year are described in Section IV, Monitoring Program Deviations.

### Airborne:

Low volume air sampling pumps continuously collected particulate samples on 47 mm glass fiber filters; samples were then drawn through charcoal canisters to collect I-131. Filters and charcoal canisters were changed out weekly, labeled, and shipped to Teledyne Isotopes for analysis. Total sample volume used to calculate air concentrations was determined from the average of the initial and final sampling flowrate and the total time of collection. Totalizer time meter readouts are used to check elapsed time versus the run time for each air sample pump.

Gross beta analysis of the air particulate samples was performed approximately 72 hours following filter collection to allow decay of radon and thoron daughter products. Each filter was mounted on a stainless steel planchette and counted on an automatic alpha-beta counter.

Weekly air particulate filters were combined into quarterly composites for each location and analyzed for gamma emitting isotopes on a Ge(Li) detector.

Charcoal canisters were routinely counted in groups of five to determine the presence or absence of I-131. Positive indication of airborne I-131 would have been supplemented by separated analysis of individual canisters for each location.

Air samples were collected from the three sectors with the highest ground level D/Q, the nearby community of New Strawn, and a control location. Distances and directions to sampling locations from the plant site are listed in Table 2; locations are shown in Figure 1 (nearby locations) and Figure 2 (distant locations).

#### Direct Radiation:

The thermoluminescent dosimeter (TLDs) used during 1991 were provided by Teledyne Isotopes. The TLDs consisted of rectangular teflon wafers impregnated with  $\text{CaSO}_4:\text{Dy}$ . Prior to placement in the field, the dosimeters were annealed for at least one hour at between 250 and 260 degrees centigrade, then placed in polyethylene pouches and holders containing 0.093 inches of copper shielding to filter out low energy radiation. Additional discussion of the TLD program and results is included in Appendix C. New field dosimeters were exchanged with the exposed dosimeters and the exposed dosimeters were returned to Teledyne Isotopes for analysis. Freshly annealed control dosimeters were sent with the exposed TLDs to record transit exposures received during shipment as well as system background of the TLD reader.

Gamma exposures were measured on a Teledyne Model 8300 TLD reader; individual dosimeters were then re-irradiated with a known exposure from a  $\text{Cs-137}$  source and read again to determine individual dosimeter calibration factors.

In general, TLDs were located 3-4 feet above the ground on utility poles; they were placed inside either plastic thermostat boxes or fiberglass air particulate sampler housings to protect them from moisture and tampering. Two TLDs were placed at each location to provide duplicate measurements. TLD locations are shown on Figure 2 (plant vicinity) and Figure 5 (distant). Table 2 provides distances and directions of each location from the WCGS site.

#### Waterborne:

All water samples were sent to Teledyne Isotopes for analysis and were analyzed on a  $\text{Ge(Li)}$  detector to determine if gamma emitters were present. In addition to gamma analysis, a radiochemical analysis for  $\text{I-131}$  was performed on drinking water and ground water samples. Gross beta analysis was also performed on drinking water samples. Tritium analysis was performed by liquid scintillation counting on a quarterly basis for drinking water and on a monthly basis for surface water. Tritium analysis for ground water was performed quarterly by gas counting. All water sampling locations are listed in Table 2 and shown in Figures 3 and 5.



Drinking water sampling locations are at the water treatment stations for the towns of Burlington (upstream control location) and LeRoy (downstream indicator location). Monthly composite samples of drinking water were collected by continuously drawing aliquots at one hour intervals.

Grab samples of surface water were collected on a monthly basis. Surface water sampling locations are at the John Redmond Reservoir outfall (control), Wolf Creek Cooling Lake discharge cove (indicator), and Wolf Creek Cooling Lake main dam (indicator).

Ground water samples were collected quarterly. Ground water is sampled from three wells located hydrologically downgradient from Wolf Creek Cooling Lake and from an upgradient control well.

Semiannual samples of shoreline sediment were collected from the discharge cove area (location "DC" on Figure 3) of Wolf Creek Cooling Lake. Gamma analysis was performed on each sample.

Semiannual samples of bottom sediment were collected from the discharge cove area (location "DC" on Figure 3) and from the ultimate heat sink (location "UHS" on Figure 3) of Wolf Creek Cooling Lake. Control samples were obtained from John Redmond Reservoir (location "JRR" on Figure 3). Gamma analysis was performed on each sample.

Semiannual samples of aquatic vegetation were collected from the discharge cove area (location "DC" on Figure 3) of Wolf Creek Cooling Lake. Gamma analysis was performed on each sample.

#### Ingestion:

Milk samples were collected on a semi-monthly basis from April through November (while milk animals were on pasture grass) and on a monthly basis the remainder of the year (when animals were on stored feed). During 1991 there were no locations for milk produced for human consumption in the vicinity (within a 5 miles) of the plant. Thus only control samples were obtained. Samples were sent to Teledyne Isotopes where radiochemical analyses for I-131 and gamma analyses were performed on each sample. The location is shown in Figure 5.

Broadleaf vegetation samples were collected monthly during the growing season from three gardens identified as having highest D/Q values. Alternate sampling locations were also used when quantities of vegetation were limited, such as early or late in the growing season or during dry periods. Additionally, samples of crops irrigated with water from the Neosho River downstream (indicator) of effluents of Wolf Creek Cooling Lake were collected during or shortly after harvest. An irrigated crop control sample is obtained upstream of the confluence of Wolf Creek and the Neosho River. All vegetation samples were sent to Teledyne Isotopes and analyzed by gamma spectroscopy. Locations are shown in Figures 4 and 5.

Fish samples were collected semi-annually with several recreationally important species being sampled. Samples of boneless meat portions were sent to Teledyne Isotopes and analyzed by gamma spectroscopy. Locations are shown in Figure 4.

Annual game animal and bird samples were obtained in the immediate vicinity of Wolf Creek Cooling Lake. Samples of boneless meat portions were sent to Teledyne Isotopes and analyzed by gamma spectroscopy. Control samples were obtained in the vicinity of Hartford, Kansas. Other control samples were obtained (milk, air, and broadleaf vegetation) in or near Hartford.

All sampling locations above are listed in Table 2.

## II. DISCUSSION OF RESULTS

Analysis results for all pathways are summarized in Appendix A using the format described in NRC Radiological Assessment Branch Technical Position, Revision 1, November 1979; results for individual samples are listed in Appendix B.

In this section, results are discussed by pathway and analysis type. Operational results are related to control location results, preoperational values, sources of radioactivity, and effluent releases when applicable. Trends or seasonal effects seen in the data are also discussed.

### Airborne:

Results of gross beta analysis of weekly air particulate filters are shown in Table 3. In addition, the four indicator locations are averaged and plotted graphically with the control location in Figure 6. Figure 7 illustrates the ratio of the average indicator value to the control value for each week expressed as a percentage. Figure 8 illustrates 'smoothed' historical data trends for airborne particulate gross beta analyses. Each data point represents an average of ten values with the tenth value corresponding to the date represented on the graph (x-axis). The smoothed graph should illustrate long term trends and minimize the effect of random fluctuations. Figures 6, 7, and 8 demonstrate the indicator and control locations trending closely together.

The gross beta values for the second week of 1991 (1/08 - 1/15) were elevated compared to the gross beta results for the rest of the year. No iodine activity was detected for the same sample period. The first quarter air particulate composite gamma analysis (which would have included the week in question) showed no irregularities. The control location gross beta was also elevated. No direct cause for the elevated values has been determined. Since both the control and indicator location results trended together, the elevated gross beta values were not attributed to plant operation.

No airborne radiiodines were detected during the year.

Results of the quarterly gamma analysis of air particulate filter composites are summarized in Table 4. The table shows that naturally occurring Be-7 and K-40 were detected regularly, as was the case during preoperational monitoring.

No effects of plant operation were seen via the airborne pathway for the year.



### Direct Radiation:

Quarterly gamma exposures measured at each location for 1991 are shown in Table 5. Values are normalized to a standard 90-day quarter.

Results from TLDs located near the plant site (less than approximately three mile distant), which would be most sensitive to changes due to plant operation, were combined into quarterly averages. These nearsite averages, using locations 1, 2, 7, 8, 9, 10, 11, 12, 13, 14, 18, 25, 27, 28, 29, 30, 37, and 38, are compared to control TLD (locations 39 and 40) results in Figure 9. In addition, the percentage of the nearsite averages to the control locations results are displayed graphically in Figure 10. These figures also include preoperational data for comparison. Note that the nearsite average exposures trended higher than the control locations both prior to and after WCNOC began operation.

During 1990, the thickness of the shielding material used with the TLDs was changed. The former shields consisted of 0.022 inch thick copper while the latter consisted of 0.093 inch thick copper. As stated in the 1990 Annual Report, an evaluation of the two shield thicknesses was conducted for three quarters during 1990 and 1991. The evaluation results and discussion are contained in Appendix C.

No changes to area gamma exposure rates as a result of plant operation were identified.

### Waterborne:

#### Drinking Water

Results of gross beta analysis of drinking water samples are listed in Table 6; Figure 11 depicts these results graphically.

No effects of operation were evident in drinking water analyses.

#### Surface Water

Tritium, attributable to WCGS operation, was detected in all surface water samples collected from WCCL in 1991. A total of 717.2 Curies were released to WCCL during the year. Measured concentrations are shown in Table 7. In Figure 12, WCCL tritium concentrations are plotted since WCGS began operation. Figure 13 illustrates a "smoothed" 10 point average plotted vs. time. The date of the tenth data point of each average corresponds with the dates on the x-axis.

It can be seen in Figures 12 and 13 that monthly surface water tritium concentrations appear to be slightly increasing since plant start-up. This is expected until the lake concentration reaches equilibrium. A discussion of the predicted equilibrium concentration for tritium was included in the 1990 Annual Report.

All tritium concentrations measured were below applicable reporting levels.

There were no gamma emitters detected in surface water for the year.

An additional surface water location SP (ALT) was added to the sample collections in August 1990 and continued through April 1991 in anticipation of moving the spillway sampling point. The location was moved from SP to SP (ALT) and redesignated as SP in May to facilitate sampling and improve general sampling safety. The present sample point is on the WCCL Main Dam several yards east of its previous location, beside the auxiliary spillway which allows discharges from WCCL. The results indicated that moving the sample location did not have any appreciable affect on the analysis results.

#### Ground Water

Tritium was detected in two ground water locations during 1991. The concentrations were 140 +/- 70 pCi/liter at B-12 (control) and 190 +/- 90 pCi/liter at C-49 (indicator) during the third quarter. The LLDs for ground water tritium ranged from 90 to 200 pCi/liter for the year. A discussion of tritium levels in various waterborne pathways is included in Appendix C of the 1990 Annual Radiological Environmental Operating Report. In that Appendix, dose projections for higher historical ground water tritium concentrations (810 pCi/liter) were discussed. The dose contribution due to the low ground water tritium concentrations found during 1991 was negligible.

The only gamma emitter detected in any ground water sample was K-40 (5.08 pCi/liter) at location B-12 on 5/21.

#### Shoreline Sediment

Table 8 shows gamma emitters detected in shoreline soil collected during 1991. In addition to the naturally occurring nuclides (K-40, Ra-226, and Th-228), two other radionuclides were detected. Co-58 and Co-60 were detected in the sample collected on October 9, 1991. This activity would be attributable to plant operations.

#### Ingestion:

##### Milk

There were no indicator samples available during 1991 (see Program Deviation section for explanation). A control sample was routinely obtained for analysis. All milk samples analyzed contained naturally occurring K-40 at concentrations consistent with preoperational levels. The yearly average concentration was 1260 pCi/liter.

No other gamma emitters were detected.

#### Food and Garden Crops

Gamma analysis of broadleaf vegetation samples revealed naturally occurring gamma emitters K-40 and Be-7 at concentrations comparable to preoperational and background levels.

Cs-137 was also detected at Locations R-1 (indicator) and S-4 (control) during July. The concentrations were 0.0431 pCi/gm and 0.213 pCi/gm respectively. In addition, Cs-137 was detected at Location G-1 in September, 0.0218 pCi/gm. These concentrations for Cs-137 are attributed to fallout. The range of fallout Cs-137 seen in preoperational samples was 0.0131 to 0.0478 pCi/gm. Also, Cs-137 was not detected in the airborne effluent releases from the plant during the third quarter of 1991. Finally, Cs-134 was not detected, although it would be expected if the occurrence of Cs-137 was related to plant operation (Cs-134 decays with a shorter half-life than Cs-137; detection of Cs-137 alone indicates older fallout as opposed to newly produced fission products).

No other gamma emitters were detected for the remainder of the year, and no effects of plant operation were identified.

In addition to broadleaf vegetation, crop samples were collected which were irrigated with water from the Neosho River below the Wolf Creek Cooling Lake outfall. Gamma analysis revealed naturally occurring K-40 to be present in the samples, with no nuclides detected which could be attributable to plant operation.

#### Fish

Naturally occurring K-40 was found in all fish samples collected with an average concentration of 4.63 pCi/gm (wet weight) for WCCL samples and 6.88 pCi/gm (wet weight) for the control samples. These concentrations are within the range reported during the preoperational period.

No other radionuclides were detected in fish during the year.

#### Special Samples (not required by Technical Specifications):

##### Game Animal and Bird

Naturally occurring K-40 was measured in all game animal and bird samples at concentrations consistent with preoperational levels.

No other radionuclides were detected and no effects of plant operation were seen for this pathway.

#### Bottom Sediment

Table 8 shows gamma emitters detected in bottom sediment samples collected from Wolf Creek Cooling Lake and John Redmond Reservoir during 1991. In addition to the naturally occurring nuclides (K-40, Ra-226, and Th-228), several other radionuclides were detected.

Co-58 and Co-60 are activation products whose presence in the WCCL samples is attributed to plant operation.

The Cs-137 concentrations measured are considered to be primarily due to fallout rather than plant operation since they are at or below concentrations measured during preoperation studies and are comparable to the concentrations seen in the control sample from John Redmond Reservoir. Also, Cs-134 was not detected although it would be expected if the occurrence of Cs-137 was related to plant operation.

#### Aquatic Vegetation

A combination of naturally occurring nuclides, fission products, and activation products were detected in an algae sample from the WCCL discharge cove during the year. Rooted aquatic vegetation was not available again this year. A summary of the concentrations measured is shown in Table 10.

Naturally occurring nuclides measured were Be-7, K-40, Ra-226, and Th-228.

Activation products seen in the sample was Mn-54, Cr-51, Co-58, and Co-60; all of these are attributable to operational releases.

Fission products Cs-137 and Cs-134 were detected in the algae sample. The fission products seen in the algae samples are due to fallout and plant effluents. Preoperational algae samples did contain measurable concentrations of Cs-137. However, the concentration of Cs-137 measured in the algae sample is slightly higher than the range of concentrations measured during the preoperational phase of environmental monitoring. The detection of Cs-134 implies a recent source of activity.



### III. ANNUAL LAND USE SURVEY RESULTS AND PROGRAM REVISIONS

The purpose of the Land Use Census is to identify within a distance of 5 miles the location in each of the 16 meteorological sectors the nearest residence, the nearest milk animal, and the nearest garden of greater than 50 square meters producing broadleaf vegetation.

The 1991 Annual Land Use Survey was completed in October. Information was collected using a combination of mailed survey forms, telephone contacts, and door-to-door contacts. In the summary of changes shown below, each noted change is presented in the format: Location designator/Distance from the plant in miles. Table 11 summarizes the results of the Survey.

Comparing this year's results to the 1990 census results, the nearest resident location has changed in Sectors C, F, K, L, and P.

In sector C the nearest resident is no longer at C-12/1.9 mi. but is now at C-01/2.0 mi.

In sector F the nearest resident is no longer at F-07/1.9 mi. but is now at F-01/1.8 mi.

In sector K the nearest resident is no longer at K-06/2.6 mi. but is now at K-01/4.1 mi.

In sector P the nearest resident is no longer at P-26/2.8 mi. but is now at P-02/2.9 mi.

The only other move affecting this category is L-9/2.1 mi. to L-01/2.1 mi., which is a move that affects location and not distance from the plant.

As in 1990, there was no milk production for human consumption identified in the area covered by the survey.

The resident at A-04 did not indicate any dairy cattle this year, contrary to what they had indicated in the past.

The resident at B-06 indicated that dairy cattle were being kept at that location but they were being used to raise calves and no milk was produced for human consumption.

The residents at D-03 and M-19 have indicated dairy cattle in past surveys and have not historically participated in the REMP. In 1990, management of the cattle at M-19 changed from milk production to breeding purposes only. The residents at D-03 and M-19 did not respond to the 1991 survey nor could they be contacted by telephone or personal visits.

The last change in 1991 is at location F-13. The resident at F-13 did not indicate owning goats as they have in the past.

Several location changes were noted for the nearest garden in Sectors C, F, H, L, N, P, and Q.

In sectors F, H, and P, residents had moved which resulted in the nearest garden in the sector now being located farther from the plant.

In several sectors residents had moved that resulted in gardens that are in closer proximity to the plant. Those include C-02/2.2 mi. to C-01/2.0 mi., L-16/3.1 mi. to L-03/2.8 mi., and Q-04/3.2 mi. to Q-03/2.3 mi.

No gardens were identified in sector N last year. A garden was reported at N-03/2.6 mi. this year.

Based on the data obtained from the 1990 Land Use Census no changes were required for the Radiological Environmental Monitoring Program. As in the past, it should be noted that dose calculations are performed for airborne and liquid pathways for a hypothetical individual at the exclusion area boundary in the highest X/Q and D/Q sector (for airborne pathways) and at the circulating water discharge point (for liquid pathways). Calculated doses are therefore not affected by changes in residence, milk animal, and broadleaf vegetation locations identified by the Annual Land Use Survey.

#### IV. PROGRAM DEVIATIONS

##### Airborne

Location 2 (1/23/91 to 1/30/91): WCNOG air sampling pumps used to obtain REMP air samples are equipped with totalizer meters that indicate motor run time in hours. Data is recorded weekly to calculate both the elapsed time (clock time) and the totalizer (motor run time) time since the prior week's filter/cartridge replacement. Normally the time readings from the totalizer are used to calculate the flow volume through the filter and cartridge. A comparison is made between the elapsed time and the totalizer time to ensure that the pump has run during the entire previous week to collect samples.

During normal weekly changeout of the particulate filter and charcoal cartridge, a discrepancy of approximately 21 hours was discovered between the elapsed clock time and the sampling pump hour totalizer. No power outages had occurred during the sampling period; therefore the totalizer readings were suspect. The discrepancy was resolved through several actions. The calculated elapsed time, rather than totalizer readings was used to calculate the flow volume for the sampling period. The vendor was notified of the corrected volume calculations. The pump was removed from service. Subsequent testing confirmed that the totalizer was faulty. After the totalizer was replaced, the pump was run for several hours to confirm operability prior to its return to service.

First Quarter 1991: Following normal quarterly replacement of air sample pumps for maintenance and calibration, several of the recently removed pumps were found to have undergone calibration shifts. A subsequent evaluation of the calibration shifts was performed with respect to Regulatory Guide 8.25, "Calibration and Error Limits of Air Sampling Instruments for Total Volume of Air Sampled". The evaluation found that in each case the calibration shifts were within the criteria set forth in the Regulatory Guide mentioned. No further evaluation was necessary.

All Locations, 06/04/91 to 06/11/91: Miscalculated air sample volumes were sent with the particulate filters and charcoal cartridges to the vendor for analysis. The error was discovered, reported to the program coordinator, and the vendor was notified. No further corrective actions were necessary.

Location 3, 09/10/91 to 09/17/91: An erroneous air sample volume was sent to the vendor with the particulate filter and charcoal cartridge for analysis. The error was discovered, reported to the program coordinator, and the vendor notified prior to analysis. No further corrective actions were necessary.



Location 37, 10/22/91 to 10/29/91: An air sample was not collected for the specified time period. The air sample pump was not running when personnel arrived at the sample station for routine sample collection. The inoperative pump was replaced with a spare air sample pump. A defective power switch was found to be the cause. The switch was replaced during routine calibration and maintenance. The pump was run for several hours to confirm operability prior to returning the pump to the field.

Waterborne:

Location LW-40, Drinking Water, 02/05/91 to 03/05/91: The automatic composite drinking water sampler malfunctioned due to a loose intake tube. The problem apparently occurred early in the month because of the small volume of sample collected, approximately 50 ml. Normally, over the course of a month approximately 7 to 9 liters are collected by the samplers. The sampler appeared to be operating correctly and should have collected the sample had the intake tubing been connected. The cause of the disconnected tubing is unknown. Corrective actions included reconnecting the intake tubing, manually confirming the operability of the sampler, and obtaining a grab sample. The sampler was returned to service the same day as the problem was discovered, 03/05/91. The grab sample was analyzed since no composite sample was available. The sampler has since been replaced with a new, more reliable automatic composite water sampler.

Location BW-15, Drinking Water, 02/05/91 to 03/05/91: This deviation, while concurrent with the drinking water deviation above, was unrelated to the above noted deviation. The automatic composite drinking water sampler malfunctioned due to a burst intake tube. The problem apparently occurred early in the month because of the small volume of sample collected. The burst tubing allowed the sample to leak from the sample pump prior to the sample being deposited in the collection container. Otherwise, the sampler appeared to be operating correctly and should have collected the sample had the intake tubing not burst. Corrective actions included replacing the intake tubing, manually checking the operability of the sampler, and obtaining a grab sample. The sampler was returned to service the same day as the problem was discovered, 03/05/91. The sampler has since been replaced with a new, more reliable automatic composite water sampler.

Locations LW-40 and BW-15, Drinking Water, 11/05/91 to 12/03/91: The samples (approximately 1 gallon) were obtained as scheduled from both drinking water sample points. Recent sampling procedure revisions directed that sample information and/or calculations be reviewed prior to shipment for analysis by a second qualified person. No additional qualified

personnel were available to review the sample data at the time, so shipment of the drinking water samples was delayed until the review could be performed. In the time between sampling and shipping, the sample containers both leaked. Approximately 1300 mls and 900 mls of the samples, respectively, were recovered. The sample containers were of a different design than those usually used to ship REMP samples to the vendor. The containers did not have any markings to indicate that they were not of a leakproof design. Subsequent telephone conversations with the vendor confirmed that the amounts of each sample recovered were sufficient to perform the gross beta and gamma isotopic analyses. The amount of sample recovered was not sufficient to perform radioiodine distillations (necessary to attain the required I-131 LLD) on either sample. On 12/06/91, additional grab samples from both sample locations were obtained and shipped to the vendor for I-131 analyses. The non-leakproof sample bottles were removed from the stock of REMP supplies to prevent their future usage.

Locations SP and SP (ALT), Surface Water, 01/15/91: No surface water samples were obtained because the sample points were covered by ice. These samples are not required by the WCGS ODCM.

Locations B-12, C-10, C-49, and D-65, Ground Water, 03/08/91: The ground water samples were obtained and shipped to the vendor as scheduled. An isolated vendor error caused the samples in question to be lost. WCNOC was promptly notified and the locations were resampled on 03/12/91. The resampling occurred within the grace period allowed per the WCGS ODCM. The second set of samples were sent to the vendor and the analyses were completed properly.

#### Aquatic Vegetation:

Location DC, Aquatic Plants. While not required per the WCGS ODCM, aquatic plants are normally cosampled semiannually with the KDHE from company owned property and continue to be collected when available. No rooted aquatic plants were available in the sampling location. An algae sample was obtained in October.

Direct Radiation:

All locations, first and second quarter 1991: In the 1990 Annual Radiological Environmental Operating Report, it was noted that shields of improper thickness had been used with the direct radiation samplers. Two shield thicknesses had been used, 0.093 inches and 0.022 inches. The use of the improper 0.022 inch thick shields could have caused the TLDs to over respond by up to 2.5 times for gamma rays of less than 200 KeV. As stated in the 1990 Report, one TLD with 0.093" shielding and one TLD with 0.022" shielding were placed at each station for the fourth quarter 1990 and the first two quarters of 1991 to gather data for evaluation of possible impact on historical exposures. The TLD data for the first two quarters of 1991 shown in Table 5 does not reflect the exposure data from those TLDs that utilized the 0.022 inch thick shields. A more thorough discussion of the results is included in Appendix C.

Location 16, first quarter 1991: Both TLDs at this location were missing, along with the small housing used to protect them from environmental conditions. Apparently the pole used to support the TLD station had been removed by a utility crew sometime during the quarter. A new station was attached to a nearby tree and the samples were gathered at this location during the remaining quarters of the year.

Ingestion:

Milk:

There were no deviations in milk sampling. However, there are still no indicator sampling locations available within five miles of the plant. Refer to Section III, Annual Land Use Survey Results and Program Revisions.

Broadleaf Vegetation:

Broadleaf vegetation is sampled when seasonably available. No broadleaf vegetation deviations occurred during 1992. Listed below are those sample locations and dates when the samples were unavailable. No corrective actions were necessary. Samples are collected at the secondary location G-1 when samples are unavailable at the primary locations A-1 and R-1.

All locations (4/91):	Samples unavailable, Gardens not yet established.
Location G-1 (5/91):	Sample unavailable.
Locations G-1, R-1 (8/91)	Samples unavailable, Dry and hot conditions.
Location R-1, (9/91):	Sample unavailable, R-1 done producing for season.
Locations G-1, R-1, S-4 (10/91)	Samples unavailable, Nearing end of growing season.
All Locations (11/91)	Samples unavailable, Growing season completed

V. EPA INTERLABORATORY COMPARISON PROGRAM RESULTS

Teledyne Isotopes is contracted to perform radiological analysis of environmental samples for WCNOC. Teledyne participated in the EPA Interlaboratory Comparison Program during 1991.

Table 12 shows intercomparison test results received during the year. The table lists the sample number and date, the sample media, the nuclide or analysis type, the known value reported by the EPA, the measured value reported by Teledyne Isotopes (based on triplicate analysis), and the normalized deviation from the known. Results are listed in the table for sample media and analysis types corresponding to those performed for WCNOC.

The gross alpha results for the air sample dated 3/29/91 were higher than the EPA value. A second sample dated 8/30/91 was analyzed after corrective actions were performed and results were in agreement with EPA values.

The K results for the Milk sample dated 09/27/91 were lower than the EPA value. The associated footnote (d) explains results. An earlier sample showed K to be in agreement with the EPA samples.

Teledyne has provided additional training for technicians for water gross alpha and beta analyses. Weekly gross alpha and beta spikes have since been performed with both accurate and consistent results.



TABLE 1

1991 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM			
EXPOSURE PATHWAY/ SAMPLE	NUMBER OF SAMPLES AND	SAMPLE COLLECTION	TYPE AND FREQUENCY OF ANALYSIS
	<u>SAMPLE LOCATIONS</u>	<u>SAMPLING AND COLLECTION FREQUENCY</u>	
AIRBORNE			
Iodine & particu- lates	Samples from five locations	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Analyze radioiodine canister weekly for I-131.
	Samples from loca- tions near the site boundary in three sectors having the highest calculated annual average D/Q (Locations 2, 3 and 37 on Figure 1);		Analyze particulate filter weekly for gross beta acti- vity; perform quarterly gamma isotopic analysis composite (by loca- tion).
	Sample from the vicinity of a community having the highest calculated annual average D/Q (Location 32 on Figure 1, New Strawn);		
	Sample from a control location 10 - 20 miles distant in a low D/Q sector (Location 40 on Figure 5).		
DIRECT RADIATION			
	40 routine monitoring stations with two or more dosimeters measur- ing dose continuously, placed as follows:	Quarterly	Gamma dose quarterly

TABLE 1 (cont'd)

1991 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM  
SAMPLE COLLECTION

<u>EXPOSURE PATHWAY/ SAMPLE</u>	<u>NUMBER OF SAMPLES AND SAMPLE LOCATIONS</u>	<u>SAMPLING AND COLLECTION FREQUENCY</u>	<u>TYPE AND FREQUENCY OF ANALYSIS</u>
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## DIRECT RADIATION (cont'd)

An inner ring of stations, one in each meteorological sector 0 - 3 mile range from the site (Locations 1 - 14, 18, 26 - 31, 37, and 38 on Figure 2).

An outer ring of stations, one in each meteorological sector 3 - 5 mile range from the site (Locations 15, 16, 17, 19 - 22, 24, 25, and 32 - 36 on Figure 2).

The balance of the stations to be placed in special interest areas such as population centers (Locations 23 and 32), nearby residences (Many locations are near a residence), schools (Location 23), and in one or two areas to serve as control stations 10 - 20 miles distant from the site (Locations 39 and 40). (Locations are on Figures 2 and 5)

Locations 41, 42, and 43 on Figure 2 are not part of the required program but have been added as special interest locations.



TABLE 1 (cont'd)

1991 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM  
SAMPLE COLLECTION

<u>EXPOSURE PATHWAY/ SAMPLE</u>	<u>NUMBER OF SAMPLES AND SAMPLE LOCATIONS</u>	<u>SAMPLING AND COLLECTION FREQUENCY</u>	<u>TYPE AND FREQUENCY OF ANALYSIS</u>
WATERBORNE			
Surface	One sample upstream (Location MUSH on Figure 3) and two samples downstream (Locations DC and SP on Figure 3)  An additional sample, SP(ALT), in the same vicinity as SP has been added in preparation for relocating SP.	Monthly grab sample	Monthly gamma isotopic analysis and composite for tritium analysis quarterly.
Ground	Samples from one or two sources only if likely to be affected.  Indicator samples at locations hydrologically downgradient of the site (Locations C-10, C-49 and D-65 on Figure 3); Control sample at a location hydrologically upgradient of the site (Location B-12 on Figure 3).	Quarterly	Quarterly gamma isotopic and tritium analysis.
Drinking	Sample of municipal water supply at an indicator location downstream of the site (Location LW-40 on Figure 5); control sample from location upstream of the site (Location BW-15 on Figure 3).	Monthly composite	Monthly gamma isotopic analysis and gross beta analysis of composite sample. Quarterly tritium analysis of composite.

TABLE 1 (cont'd)

1991 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM  
SAMPLE COLLECTION

<u>EXPOSURE PATHWAY/ SAMPLE</u>	<u>NUMBER OF SAMPLES AND SAMPLE LOCATIONS</u>	<u>SAMPLING AND COLLECTION FREQUENCY</u>	<u>TYPE AND FREQUENCY OF ANALYSIS</u>
WATERBORNE (cont'd)			
Shoreline Sediment	One sample from the vicinity of Wolf Creek Cooling Lake discharge cove (Location DC on Figure 3) and one sample from John Redmond Reservoir (Location JRR on Figure 3).	Semiannually	Semiannual gamma isotopic analysis.
Bottom Sediment	One sample from the vicinity of Wolf Creek Cooling Lake discharge cove (Location DC on Figure 3) and one sample from John Redmond Reservoir (Location JRR on Figure 3). Special samples were taken in the vicinity of the Ultimate Heat Sink.	Semiannually	Semiannual gamma isotopic analysis.
Rooted Aquatics or Algae	One sample from the vicinity of Wolf Creek Cooling Lake discharge cove (Location DC on Figure 3).	Semiannually	Semiannual gamma isotopic analysis.
INGESTION			
Milk	Samples from milking animals at three indicator locations within 5 miles of the site having the highest dose potential (currently there	Semimonthly while animals are on pasture (April to November); monthly at other times (December to March).	Gamma isotopic analysis and I-131 analysis of each sample.

TABLE 1 (cont'd)

1991 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM  
SAMPLE COLLECTION

<u>EXPOSURE PATHWAY/ SAMPLE</u>	<u>NUMBER OF SAMPLES AND SAMPLE LOCATIONS</u>	<u>SAMPLING AND COLLECTION FREQUENCY</u>	<u>TYPE AND FREQUENCY OF ANALYSIS</u>
INGESTION (cont'd)			
Milk (cont'd)	are no locations producing milk for human consumption within 5 miles of the site); one sample from a control location greater than 10 miles from the site (Location S-3 on Figure 5).		
Fish	Indicator samples of 1 to 3 recreationally important species from Wolf Creek Cooling Lake (several sampling areas indicated on Figure 4); control samples of similar species from John Redmond Reservoir indicated on Figure 4).	Semiannually	Gamma isotopic Analysis on edible portions.
Broadleaf Vegetation	Samples of available broadleaf vegetation from two indicator locations with highest calculated annual average D/Q (Locations A-1 and R-1 and alternate Location G-1 on Figure 4); sample of similar broadleaf vegetation from a control location greater than 10 miles from the site in a low D/Q sector (Location S-4 on Figure 5).	Monthly when available	Gamma isotopic analysis on edible portions.

TABLE 1 (cont'd)

1991 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM  
SAMPLE COLLECTION

<u>EXPOSURE PATHWAY/ SAMPLE</u>	<u>NUMBER OF SAMPLES AND SAMPLE LOCATIONS</u>	<u>SAMPLING AND COLLECTION FREQUENCY</u>	<u>TYPE AND FREQUENCY OF ANALYSIS</u>
INGESTION (cont'd)			
Irrigated Crops	Sample of crops irrigated with water from the Neosho River downstream of the Neosho River - Wolf Creek confluence (Location NR-D2 on Figure 5). Control sample of crops irrigated with water from the Neosho River upstream of the Neosho River - Wolf Creek confluence (Location NR-U1 on Figure 5).	At time of harvest	Gamma isotopic analysis on edible portions.
Game birds and animals	Indicator samples of region specific recreationally important species from the vicinity of Wolf Creek Lake; control samples of similar species from the vicinity of John Redmond Reservoir.	Annually	Gamma isotopic analysis on edible portions.

TABLE 2

## SAMPLE LOCATION NUMBERS, DISTANCES (miles) AND DIRECTIONS

<u>Location Number</u>	<u>Distance/Direction</u>	<u>Location Number</u>	<u>Distance/Direction</u>	<u>Location Number</u>	<u>Distance/Direction</u>
<u>TLD and Air Particulate</u>					
1	1.4/N	15	4.5/ESE	29	2.6/SSW
2	2.7/N	16	4.2/E	30	2.2/W
3	3.0/NNE	17	3.6/SE	31	3.0/WNW
4	4.0/NNE	18	3.2/SSE	32	3.2/WNW
5	4.0/NE	19	4.0/SSE	33	3.7/WNW
6	4.4/ENE	20	3.3/S	34	4.0/NW
7	1.9/NE	21	3.8/S	35	4.6/NNW
8	1.6/NNE	22	4.1/SSW	36	4.2/N
9	2.0/ENE	23	4.5/SW	37	2.1/NNW
10	2.4/ENE	24	4.1/WSW	38	1.2/NW
11	1.5/E	25	3.6/W	39	13.0/N
12	1.8/ESE	26	2.6/WSW	40	>15.0/WNW
13	1.5/SE	27	2.1/SW	41	0.8/NNW
14	2.6/SE	28	2.8/SW	42	0.8/SSE
				43	0.8/WNW
<u>Ground Water</u>		<u>Drinking Water</u>		<u>Surface Water</u>	
B-12	2.2/NNE	BW-15	3.9/SW	MUSH	3.6/W
C-10	2.8/W	LW-40	10/SSE	DC	0.6/WNW
C-49	2.9/SW			SP	2.9/S
D-65	3.9/S			SP(ALT)	2.9/S
<u>Milk</u>		<u>Broadleaf Vegetation</u>		<u>Irrigated Crops</u>	
S-3	>15.0/WNW	A-1	1.4/N	NR-U1	4.2/SW
		R-1	2.1/NNW	NR-D2	>10.0/S
		G-1	1.6/SE		
		S-4	>15.0/WNW		
<u>Fish</u>		<u>Shoreline and Bottom Sediment</u>		<u>Aquatic Vegetation /Algae</u>	
WCCL	0.6/WNW	DC	0.6/WNW	DC	0.6/WNW
JRR	4/W	JRR	4/W		
		UHS	0.6/E		
<u>Game Birds and Animals</u>					
WCCL	General Vicinity				
JRR	General Vicinity				

TABLE 3

1991 AIR PARTICULATE SAMPLES  
GROSS BETA ANALYSIS RESULTS

(pCi / cubic meter)

DATE	INDICATOR LOCATIONS				INDICATOR AVERAGE	STANDARD DEVIATION	CONTROL LOC40
	LOC2	LOC3	LOC32	LOC37			
01/02 - 01/08	0.057	0.047	0.048	0.053	0.0513	0.005	0.052
01/08 - 01/15	0.089	0.086	0.080	0.079	0.0835	0.005	0.081
01/15 - 01/22	0.032	0.033	0.025	0.031	0.0303	0.004	0.031
01/22 - 01/30	0.026	0.024	0.024	0.021	0.0238	0.002	0.030
01/30 - 02/05	0.035	0.036	0.033	0.034	0.0345	0.001	0.031
02/05 - 02/12	0.024	0.023	0.024	0.031	0.0255	0.004	0.028
02/12 - 02/19	0.025	0.024	0.025	0.026	0.0250	0.001	0.025
02/19 - 02/26	0.021	0.020	0.021	0.024	0.0215	0.002	0.022
02/26 - 03/05	0.024	0.018	0.029	0.028	0.0249	0.005	0.027
03/05 - 03/12	0.015	0.022	0.027	0.025	0.0248	0.002	0.027
03/12 - 03/19	0.017	0.015	0.016	0.017	0.0163	0.001	0.015
03/19 - 03/26	0.022	0.020	0.023	0.024	0.0223	0.002	0.023
03/26 - 04/02	0.022	0.022	0.023	0.026	0.0233	0.002	0.020
04/02 - 04/09	0.022	0.026	0.026	0.030	0.0260	0.003	0.023
04/09 - 04/16	0.018	0.019	0.016	0.019	0.0180	0.001	0.017
04/16 - 04/23	0.017	0.016	0.017	0.020	0.0175	0.002	0.020
04/23 - 04/30	0.019	0.014	0.019	0.015	0.0168	0.003	0.018
04/30 - 05/07	0.017	0.016	0.016	0.016	0.0163	0.001	0.016
05/07 - 05/14	0.018	0.017	0.021	0.020	0.0190	0.002	0.018
05/14 - 05/21	0.015	0.016	0.011	0.016	0.0145	0.002	0.015
05/21 - 05/28	0.015	0.016	0.016	0.014	0.0153	0.001	0.014
05/28 - 06/04	0.017	0.015	0.021	0.020	0.0183	0.003	0.019
06/04 - 06/11	0.021	0.021	0.021	0.021	0.0210	0.000	0.020
06/11 - 06/18	0.018	0.022	0.020	0.019	0.0198	0.002	0.018
06/18 - 06/25	0.014	0.030	0.027	0.028	0.0248	0.007	0.027
06/25 - 07/02	0.018	0.023	0.018	0.019	0.0195	0.002	0.013
07/02 - 07/09	0.026	0.030	0.029	0.025	0.0275	0.002	0.028
07/09 - 07/16	0.021	0.024	0.019	0.024	0.0220	0.002	0.022
07/16 - 07/23	0.028	0.034	0.029	0.031	0.0305	0.003	0.031
07/23 - 07/30	0.022	0.023	0.022	0.023	0.0225	0.001	0.021



TABLE 3 (Cont'd)

1991 AIR PARTICULATE SAMPLES  
GROSS BETA ANALYSIS RESULTS

(pCi / cubic meter)

DATE	INDICATOR LOCATIONS				INDICATOR AVERAGE	STANDARD DEVIATION	CONTROL LOC40
	LOC2	LOC3	LOC32	LOC37			
07/30 - 08/06	0.031	0.033	0.033	0.029	0.032	0.002	0.027
08/06 - 08/13	0.022	0.027	0.025	0.024	0.025	0.002	0.022
08/13 - 08/20	0.026	0.030	0.029	0.026	0.028	0.002	0.027
08/20 - 08/27	0.039	0.038	0.037	0.037	0.038	0.001	0.036
08/27 - 09/03	0.027	0.026	0.028	0.027	0.027	0.001	0.026
09/03 - 09/10	0.020	0.023	0.022	0.025	0.023	0.002	0.024
09/10 - 09/17	0.023	0.019	0.020	0.021	0.021	0.002	0.017
09/17 - 09/24	0.020	0.019	0.018	0.022	0.020	0.002	0.023
09/24 - 10/01	0.022	0.020	0.022	0.022	0.022	0.001	0.017
10/01 - 10/08	0.033	0.026	0.030	0.027	0.029	0.003	0.026
10/08 - 10/15	0.032	0.030	0.036	0.031	0.032	0.003	0.030
10/15 - 10/22	0.023	0.019	0.028	0.027	0.024	0.004	0.028
10/22 - 10/29	0.024	0.024	0.020	*	0.023	0.002	0.019
10/29 - 11/05	0.032	0.029	0.048	0.032	0.035	0.009	0.030
11/05 - 11/12	0.036	0.033	0.040	0.039	0.037	0.003	0.032
11/12 - 11/19	0.040	0.034	0.035	0.038	0.037	0.003	0.033
11/19 - 11/26	0.024	0.023	0.025	0.031	0.026	0.004	0.021
11/26 - 12/03	0.028	0.028	0.034	0.026	0.029	0.003	0.032
12/03 - 12/10	0.030	0.029	0.030	0.025	0.029	0.002	0.029
12/10 - 12/17	0.032	0.026	0.032	0.028	0.030	0.003	0.027
12/17 - 12/23	0.018	0.019	0.020	0.019	0.019	0.001	0.022
12/23 - 12/30	0.028	0.029	0.032	0.022	0.028	0.004	0.030

\* - Sampling equipment malfunction, see Section IV.



TABLE 4

1991 AIR PARTICULATE COMPOSITE  
QUARTERLY GAMMA ANALYSIS RESULTS

(pCi / cubic meter)

ISOTOPE	QTR	INDICATOR LOCATIONS				CONTROL LOC 40
		LOC 2	LOC 3	LOC 32	LOC 37	
BE-7	1	0.0594	0.0575	0.0583	0.0652	0.0759
	2	0.0509	0.0771	0.0641	0.0738	0.0744
	3	0.0616	0.0750	0.0607	0.0727	0.0636
	4	0.0591	0.0518	0.0641	0.0479	0.0532
K-40	1	ND	ND	ND	ND	ND
	2	ND	ND	ND	ND	ND
	3	ND	ND	ND	ND	ND
	4	0.0053	ND	0.0107	0.0118	0.0153

ND - NOT DETECTED

No other gamma emitters detected.

TABLE 5  
1991 TLD RESULTS  
(mR / Standard Qtr\*)

LOC	FIRST** QUARTER		SECOND** QUARTER		THIRD QUARTER		FOURTH QUARTER	
	AVG	SDEV	AVG	SDEV	AVG	SDEV	AVG	SDEV
1	15.8	0.7	15.9	2.2	15.5	1.1	16.2	0.7
2	13.0	1.8	13.1	2.2	13.7	0.7	14.9	1.0
3	16.8	0.4	15.6	3.5	14.3	0.9	15.5	0.8
4	15.3	0.1	14.2	0.9	14.9	0.4	16.2	3.3
5	14.5	0.8	15.2	1.6	14.2	1.2	14.4	0.6
6	14.4	2.9	12.8	0.5	14.3	1.5	15.2	0.8
7	14.1	1.0	12.4	1.2	13.7	1.3	13.5	1.0
8	16.3	0.7	14.5	1.7	15.4	0.7	16.1	0.8
9	13.6	1.3	13.4	0.6	13.7	0.5	14.9	0.9
10	15.4	0.7	15.0	0.8	17.1	1.0	15.4	0.8
11	17.4	1.4	15.1	1.8	16.0	1.5	16.6	1.0
12	15.4	1.2	13.8	1.9	15.3	0.4	15.5	0.9
13	15.9	2.1	15.4	4.9	15.2	0.7	15.8	1.3
14	16.2	0.8	13.8	0.8	15.7	0.7	15.8	0.7
15	12.9	0.6	13.3	1.3	15.3	0.7	15.7	0.9
16	***	***	14.1	1.5	14.8	0.7	15.0	0.9
17	12.9	1.1	12.7	1.0	15.2	0.9	14.6	1.8
18	13.6	1.1	18.0	5.4	26.4	6.2	16.2	1.3
19	13.5	0.9	14.3	1.4	15.7	0.8	14.8	0.6
20	13.5	0.8	13.4	1.6	15.7	0.9	15.4	1.5
21	11.4	0.5	11.8	5.0	13.3	0.4	14.0	1.2
22	13.1	0.9	14.1	1.2	15.1	0.9	14.8	0.9
23	13.8	1.0	13.6	1.2	14.8	1.2	13.9	3.5
24	13.1	0.3	14.1	1.2	15.4	0.5	15.7	0.7
25	11.8	0.8	10.8	0.9	10.8	3.6	13.8	1.2
26	11.7	0.3	11.9	3.0	13.8	0.8	14.7	1.1
27	14.3	0.7	13.6	1.4	15.8	1.0	16.0	1.3
28	11.4	0.6	12.3	1.0	13.7	0.7	13.7	0.7
29	10.8	0.1	12.1	0.9	11.9	0.7	13.0	0.6
30	13.6	0.6	13.4	1.1	14.8	0.7	14.8	0.8

TABLE 5 (Cont'd)

## 1991 TLD RESULTS

(mR / Standard Ctr\*)

LOC	FIRST** QUARTER		SECOND** QUARTER		THIRD QUARTER		FOURTH QUARTER	
	AVG	SDEV	AVG	SDEV	AVG	SDEV	AVG	SDEV
31	13.1	0.6	15.1	2.0	15.3	1.0	15.1	0.9
32	12.5	0.6	12.6	0.9	15.4	0.9	15.1	0.9
33	14.7	0.8	15.2	1.4	16.9	1.3	14.8	1.3
34	13.7	0.6	14.5	1.0	16.3	1.4	16.4	0.6
35	13.5	0.5	14.7	1.3	16.6	0.9	15.8	0.7
36	13.3	0.5	14.2	1.0	15.8	0.8	15.3	0.9
37	12.5	0.9	13.2	1.2	14.1	2.4	15.1	0.6
38	14.3	0.7	15.0	1.9	17.4	0.7	16.2	1.4
39	13.3	0.7	13.7	1.6	14.8	0.8	15.7	0.7
40	11.9	0.3	11.7	0.9	14.1	0.6	13.7	1.1
41	14.3	2.1	13.9	1.8	16.9	1.0	16.2	0.9
42	8.9	1.4	9.0	0.8	9.6	0.6	10.6	0.4
43	8.4	0.3	8.6	0.2	9.3	1.0	9.5	0.7

\* - 90 days per Standard Quarter

\*\* - Based on the results of one TLD due to shield thickness discrepancy. See Appendix C.

\*\*\* - TLDs missing, no data available.

TABLE 6

1991 DRINKING WATER SAMPLES  
GROSS BETA ANALYSIS RESULTS

(pCi / Liter)

MONTH	CONTROL BW15	INDICATOR LW40
JAN	12.0 +/- 2	12.0 +/- 2
FEB	8.0 +/- 1.4	6.6 +/- 1.3
MAR	5.6 +/- 2.1	6.7 +/- 2.3
APR	9.1 +/- 1.6	6.8 +/- 1.4
MAY	8.5 +/- 1.6	7.1 +/- 1.5
JUN	8.2 +/- 1.5	8.4 +/- 1.6
JUL	8.6 +/- 1.4	7.4 +/- 1.4
AUG	8.6 +/- 1.5	6.6 +/- 1.4
SEP	8.9 +/- 1.4	11.0 +/- 2
OCT	7.1 +/- 1.3	6.9 +/- 1.5
NOV	3.9 +/- 1.6	6.0 +/- 1.9
DEC	7.0 +/- 1.7	7.3 +/- 1.3

No gamma emitters or tritium were detected  
in drinking water samples during 1991.

TABLE 7  
1991 SURFACE WATER TRITIUM RESULTS  
(pCi / Liter)

DATE	INDICATOR LOCATIONS			CONTROL MUSH
	DC	SP	SP ALT	
01/15	6700 +/- 600	NS	NS	< 800
02/19	6400 +/- 500	7200 +/- 500	6300 +/- 500	< 500
03/19	6900 +/- 700	7000 +/- 700	7400 +/- 700	< 1000
04/16	6600 +/- 600	6800 +/- 700	6600 +/- 600	< 900
05/21	7100 +/- 600	8400 +/- 600	N/A	< 500
06/18 *	10000 +/- 1000	7500 +/- 600	N/A	< 900
06/18	10000 +/- 1000	7500 +/- 600	N/A	< 900
07/16	9000 +/- 700	8900 +/- 700	N/A	< 900
07/16 **	8600 +/- 500			
08/20	8300 +/- 600	8500 +/- 500	N/A	< 500
09/17	7300 +/- 600	7700 +/- 60'	N/A	< 900
10/15	8500 +/- 700	8500 +/- 700	N/A	< 600
11/19	9300 +/- 500	7400 +/- 500	N/A	< 900
12/17	7300 +/- 500	6600 +/- 500	N/A	< 600

\* - Samples reanalyzed for confirmation per WCNOG request.

\*\* - Duplicate analysis, Teledyne QC check.

NS - Not sampled, sample unavailable; see Section IV,  
"Monitoring Program Deviations"

N/A- Sample location no longer applicable, see Section II,  
"Discussion of Results".



TABLE 8

1991 SHORELINE SOIL ANALYSIS RESULTS  
( pCi / gram-dry )

LOCATION DATE	DC 04/16	JRR* 04/16	DC 10/09
K-40	1.02 +/-0.10	1.18 +/-0.12	9.57 +/- 0.96
CO-58	< 0.04	< 0.04	0.0758 +/-0.0398
CO-60	< 0.04	< 0.04	0.0715 +/-0.0072
CS-134	< 0.04	< 0.04	< 5.0
CS-137	< 0.04	< 0.03	< 5.0
RA-226	1.47 +/-0.50	1.55 +/- .53	2.77 +/- 0.59
TH-228	0.88 +/-0.09	1.42 +/-0.14	1.25 +/- 0.13

\* - JRR designated as control location.

No other gamma emitters detected during 1991.

1991 BOTTOM SEDIMENT  
GAMMA ANALYSIS RESULTS  
(pCi / gram - dry)

	DC	JRR	DC	JRR	UHS
DATE	04/16	04/16	09/19	09/19	09/19
K-40	13.7	14.4	14.3	15.4	12.8
CO-60	0.436 <	0.04	0.658 <	0.02	0.059
CS-134	< 0.06 <	0.05	< 0.04 <	0.02	< 0.04
CS-137	0.446	0.225	0.463	0.255	0.286
RA-226	2.14	2.21	1.97	2.21	2.07
TH-228	1.28	1.27	1.36	1.32	1.21

TABLE 9

1991 BROAD LEAF VEGETABLES  
GAMMA ISOTOPIC ANALYSIS RESULTS

(pCi / gram - wet)

LOC	TYPE	DATE	BE-7	K-40	CS-137
A-1	SWISS CHARD	05/28	0.41	4.84	< 0.01
A-1	SWISS CHARD	06/25	0.102	1.62	< 0.02
A-1	SWISS CHARD	07/23	0.605	1.44	< 0.02
A-1	SWISS CHARD	08/27	0.887	1.41	< 0.01
A-1	SWISS CHARD	09/24	0.369	5.32	< 0.009
A-1	SWISS CHARD	10/22	0.253	0.105	< 0.01
G-1	LETTUCE	06/25	0.713	6.37	< 0.02
G-1	LETTUCE	07/23	0.333	5.32	< 0.01
G-1	LETTUCE	09/24	0.466	6.81	0.0218
R-1 *	LETTUCE	05/28	0.848	4.36	< 0.02
R-1 *	LETTUCE	06/25	0.372	8.92	< 0.02
R-1 *	LETTUCE	07/23	0.22	2.14	0.0431
S-4	CABBAGE	05/28	0.454	3.05	< 0.01
S-4	CABBAGE	06/25	0.428	4.21	< 0.03
S-4	CABBAGE	06/25	0.549	2.95	< 0.02
S-4	CABBAGE	07/23	0.756	5.35	0.0213
S-4	CABBAGE	08/27	0.811	1.46	< 0.009
S-4	CABBAGE	09/24	0.636	3	< 0.006

1991 IRRIGATED CROP  
GAMMA ISOTOPIC ANALYSIS RESULTS

(pCi / gram - wet)

NRD1	CORN	10/22	ND	2.91	< 0.01
NRD2	CORN	09/17	ND	3	< 0.02
NRD2	SOYBEANS	10/22	ND	15.6	< 0.02
NRU1*	CORN	09/24	ND	2.04	< 0.004

No other gamma emitters were detected during 1991.

\* - Control locations: S-4 for Broad Leaf Vegetables, NRU1 for Irrigated Crops.

ND - None Detected

TABLE 10

1991 ALGAE ANALYSIS RESULTS  
(pCi / gram-wet)

LOCATION	DC	
DATE	10/15	
NUCLIDE	CONC	STD DEV
BE-7	0.591 +/-	0.017
K-40	2.11 +/-	0.21
MN-54	0.486 +/-	0.049
CO-58	1.27 +/-	0.13
CO-60	2.33 +/-	0.23
CS-134	0.795 +/-	0.080
CS-137	1.24 +/-	0.12
RA-226	0.507 +/-	0.268
TH-228	0.299 +/-	0.030
CR-51	0.561 +/-	0.149

No other gamma emitters were detected during 1991.

Rooted aquatic vegetation was unavailable at Location DC.

TABLE 11

## Results of the 1991 Land Use Census

<u>Sector</u>	<u>Total Population*</u>	<u>No. of Responses/ Households</u>	<u>Distance (miles)/Location of Nearest Residence</u>	<u>Milk Animal</u>	<u>Garden</u>
A	41	7/7	1.4/A-01	NONE/**	1.4/A-01
B	18	6/9	3.1/B-02	4.1/B-06**	3.1/B-02
C	21	8/11	2.0/C-01**	NONE/	2.0/C-01
D	15	5/8	2.1/D-01	NONE/	2.1/D-01**
E	16	5/7	1.8/E-01	NONE/	1.8/E-01
F	36	12/15	1.8/F-01**	NONE/**	1.8/F-01**
G	19	8/10	1.6/G-01	NONE/	1.6/G-01
H	25	8/10	3.1/H-02	NONE/	4.9/H-06**
J	16	5/9	3.3/J-01	NONE/	3.8/J-02
K	10	5/6	4.1/K-01**	NONE/	4.1/K-01
L	64	23/31	2.1/L-01**	NONE/	2.8/L-03**
M	40	16/20	2.4/M-02	NONE/**	2.4/M-02
N	10	5/8	2.1/N-01	NONE/	2.6/N-03**
P	52	17/24	2.9/P-02**	NONE/	4.7/P-03**
Q	14	7/10	1.4/Q-02	NONE/	2.3/Q-03**
R	<u>9</u> 406	<u>5/6</u> 142/163	2.1/R-01	NONE/	2.1/R-01

\* Excludes residents of Burlington, New Strawn and Barrett's Trailer Park.

\*\* Indicates change from 1990 data.

TABLE 12  
RESULTS OF EPA INTERLABORATORY COMPARISON PROGRAM

COLLECTION DATE	MEDIA	NUCLIDE	EPA RESULT (a)		TELEDYNE	
					ISOTOPES RESULT (b)	
01/25/91	Water	Gr-Alpha	5.0	± 5.	9.00	± 1.00
		Gr-Beta	5.0	± 5.0	7.00	± 0.00
02/08/91	Water	Co-60	40.0	± 5.0	39.33	± 3.06
		Zn-65	149.0	± 15.0	147.00	± 1.00
		Ru-106	186.0	± 19.0	176.67	± 17.56
		Cs-134	8.0	± 5.0	7.33	± 0.58
		Cs-137	8.0	± 5.0	7.67	± 3.21
		Ba-133	75.0	± 8.0	75.67	± 5.51
02/15/91	Water	I-131	75.0	± 8.0	70.00	± 5.29
02/22/91	Water	H-3	4418.0	± 442.0	4500.00	± 173.21
03/29/91(c)	Air Filter	Gr-Alpha	25.0	± 6.0	42.67	± 0.58
		Gr-Beta	124.0	± 6.0	126.67	± 5.77
		Cs-137	40.0	± 5.0	43.00	± 5.29
04/16/91	Lab Perf.	Gr-Alpha	54.0	± 14.0	59.67	± 4.04
	Water	Gr-Beta	115.0	± 17.0	110.00	± 0.00
		Cs-134	24.0	± 5.0	25.00	± 1.00
		Cs-137	25.0	± 5.0	24.00	± 1.73
04/26/91	Milk	I-131	60.0	± 6.0	53.33	± 2.31
		Cs-137	49.0	± 5.0	52.67	± 1.53
		K	1650.0	± 83.0	1590.00	± 61.85
05/17/91	Water	Gr-Alpha	24.0	± 6.0	24.33	± 2.52
		Gr-Beta	46.0	± 5.0	50.33	± 1.53
06/07/91	Water	Co-60	10.0	± 5.0	10.33	± 0.58
		Zn-65	108.0	± 11.0	106.00	± 2.65
		Ru-106	149.0	± 15.0	136.67	± 3.79
		Cs-134	15.0	± 5.0	13.67	± 1.53
		Cs-137	14.0	± 5.0	13.67	± 1.53
		Ba-133	62.0	± 6.0	56.33	± 1.53
06/21/91	Water	H-3	12480.0	± 1248.0	12833.33	± 115.50
08/09/91	Water	I-131	20.0	± 6.0	19.33	± 0.58
08/30/91	Air Filter	Gr-Alpha	25.0	± 6.0	27.00	± 2.00
		Gr-Beta	92.0	± 10.0	100.00	± 0.00
		Cs-137	30.0	± 5.0	33.33	± 3.21

See footnotes at end of table.



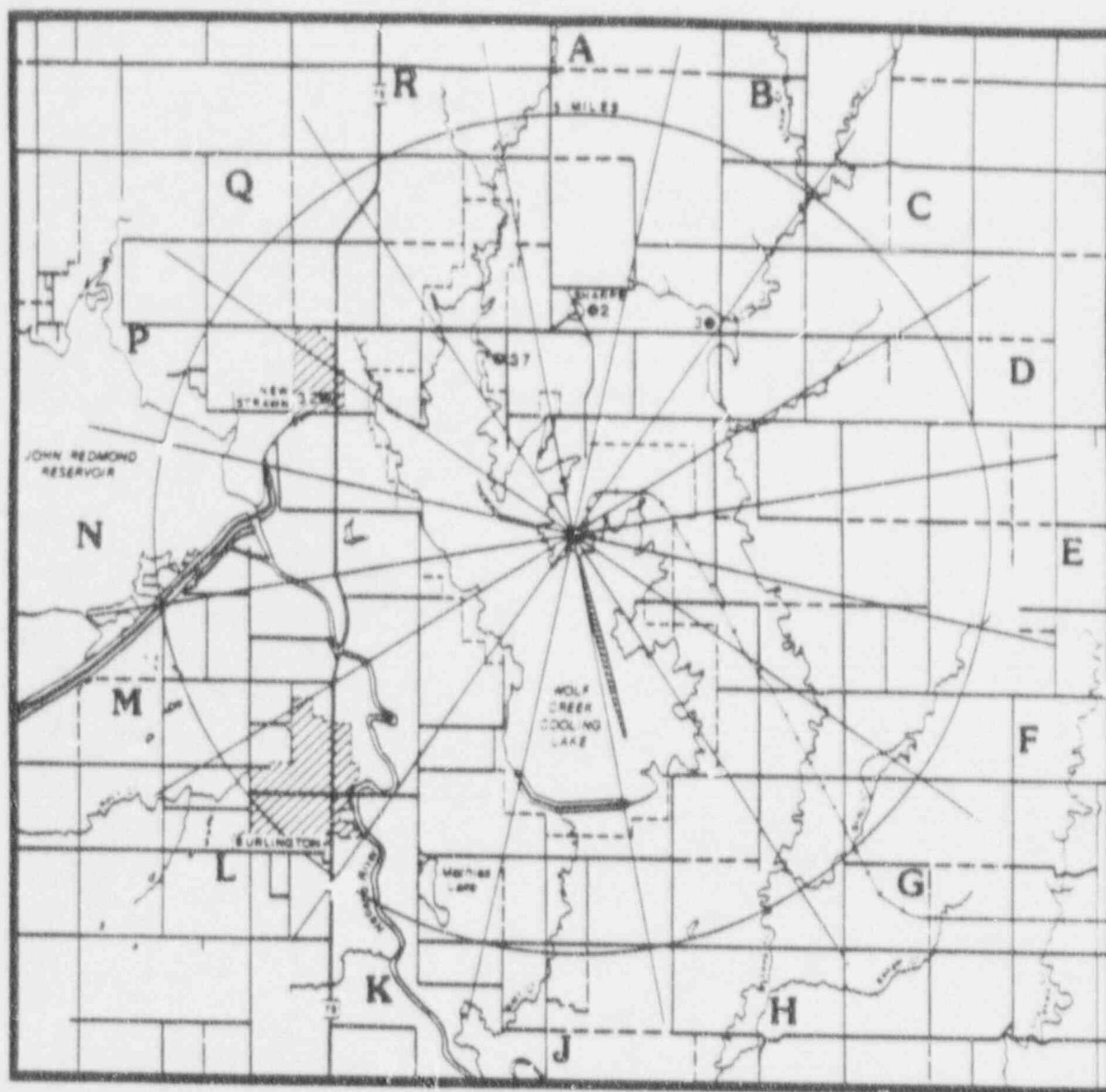
TABLE 12 (Cont'd)

COLLECTION DATE	MEDIA	NUCLIDE	EPA RESULT(a)		TELEDYNE ISOTOPES RESULT(b)	
9/20/91	Air	Gr-Alpha	10.0	± 5.0	11.67	± 0.58
		Gr-Beta	20.0	± 5.0	21.00	± 0.00
9/27/91(d)	Milk	I-131	108.0	± 11.0	113.33	± 5.77
		Cs-137	30.0	± 5.0	29.00	± 3.61
		K	1740.0	± 87.0	1503.33	± 75.06
10/04/91	Lab Perf.	Co-60	29.0	± 5.0	30.33	± 2.08
	Water	Zn-65	73.0	± 7.0	72.67	± 7.09
		Ru-106	199.0	± 20.0	197.67	± 7.51
		Cs-134	10.0	± 5.0	10.33	± .58
		Cs-137	10.0	± 5.0	11.33	± .58
		Ba-133	98.0	± 10.0	97.00	± 8.72
10/18/91	Water	H-1	2454.0	± 353.0	2333.33	± 57.74
10/22/91(c)	Lab Perf.	Gr-Alpha	82.0	± 21.0	55.00	± 4.36
	Water	Gr-Beta	65.0	± 10.0	56.00	± 1.00
		Co-60	20.0	± 5.0	19.67	± 0.58
		Cs-134	10.0	± 5.0	10.33	± 2.08
		Cs-137	11.0	± 5.0	13.67	± 0.58

**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) The sample presents a different counting geometry. The EPA deposits activity in a 3/4 inch diameter circle, on a plastic disk approximately 3/32 inch thick. A special calibration for EPA filters will be performed. The laboratory has obtained blank filters from the Las Vegas facility, and will simulate their deposits.
- (d) There is no apparent cause for the low K-40 results. Two other isotopes spiked in the sample were in good agreement with EPA values. Unit conversions were reviewed and found to be correctly applied. Possible background errors in geometry were investigated and found to have an insignificant effect.
- (e) Probably failure to transfer all sample residue to the counting planchet. Analysts are being tested using in-house and other EPA spikes.

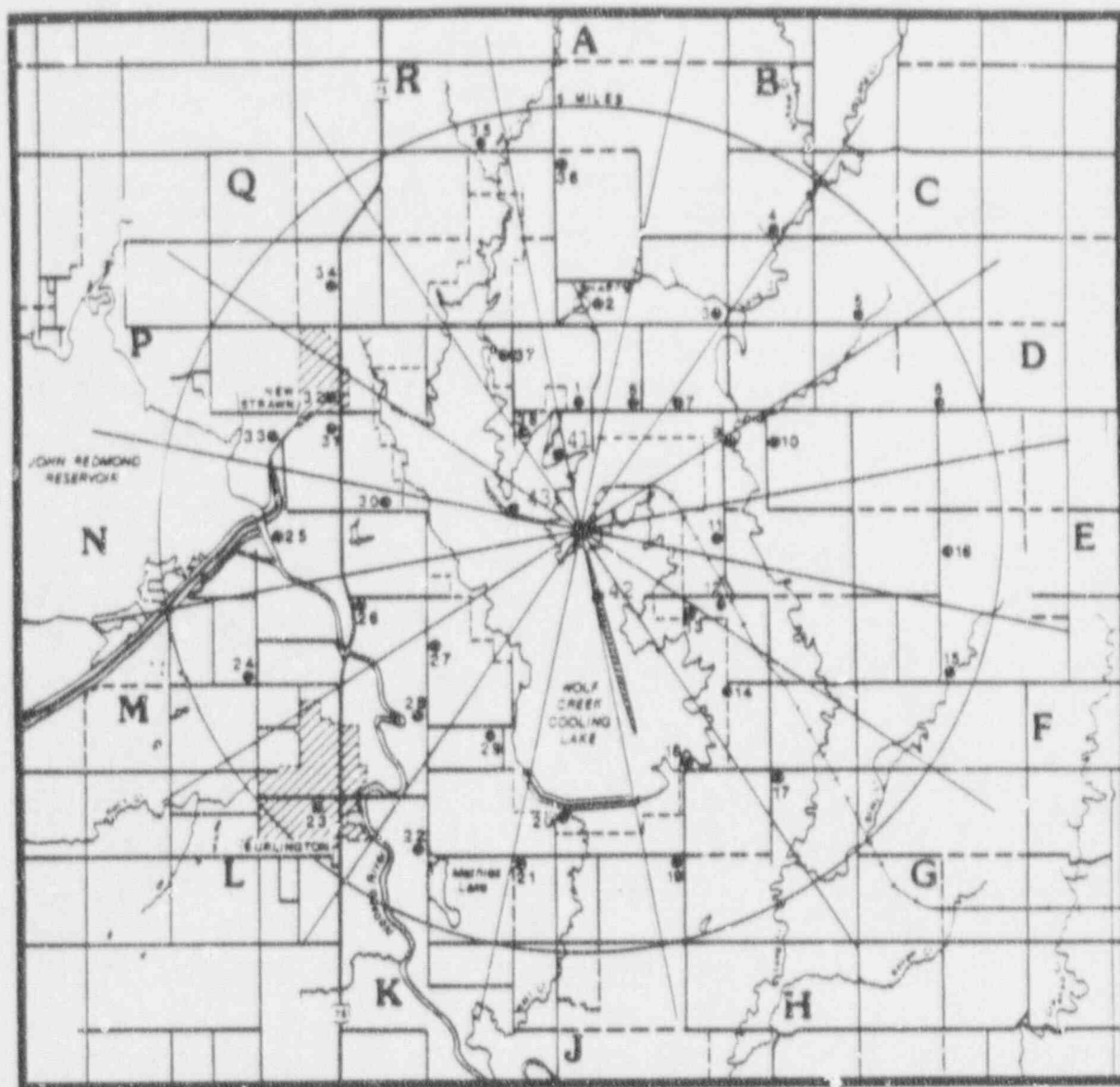
FIGURE 1



**AIRBORNE PATHWAY SAMPLING LOCATIONS**

• -AIRBORNE PARTICULATE AND RADIOIODINE

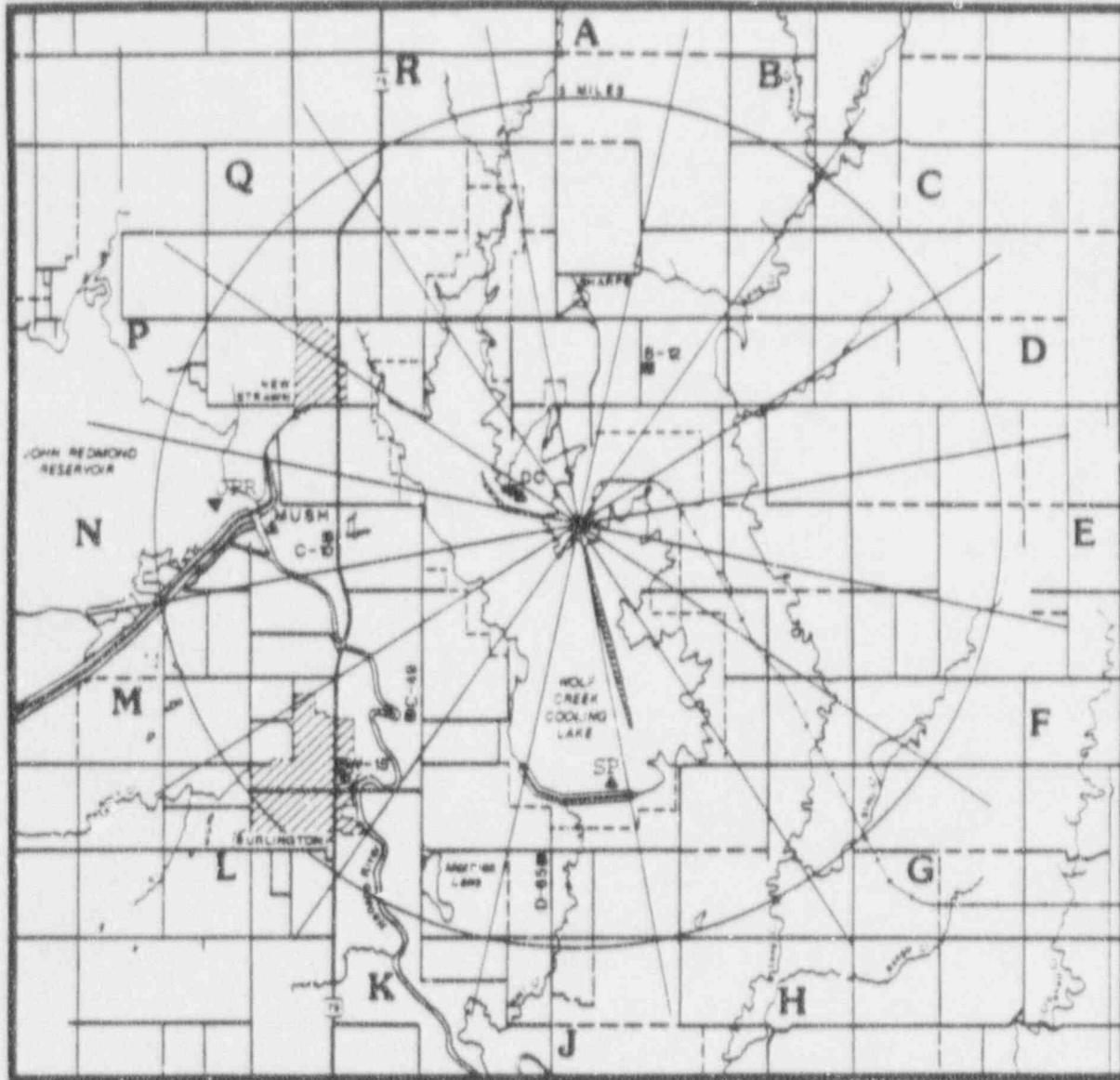
FIGURE 2



**DIRECT RADIATION PATHWAY SAMPLING LOCATIONS**

• -TLD LOCATIONS

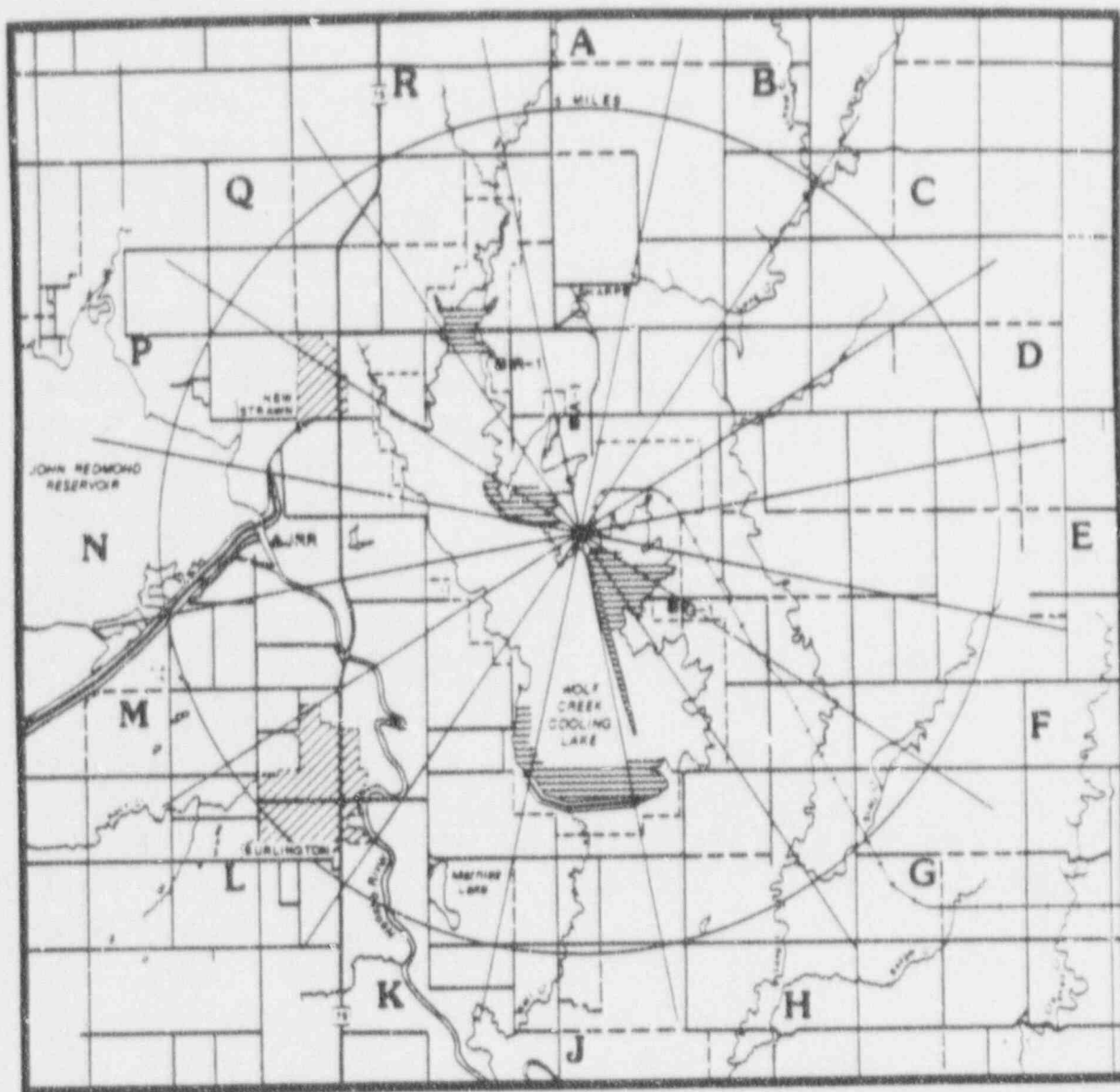
FIGURE 3



### WATERBORNE PATHWAY SAMPLING LOCATIONS

- -DRINKING WATER
- ▲ -SURFACE WATER
- -GROUND WATER
- ▼ -SHORELINE SEDIMENT  
BOTTOM SEDIMENT  
AQUATIC VEGETATION

FIGURE 4

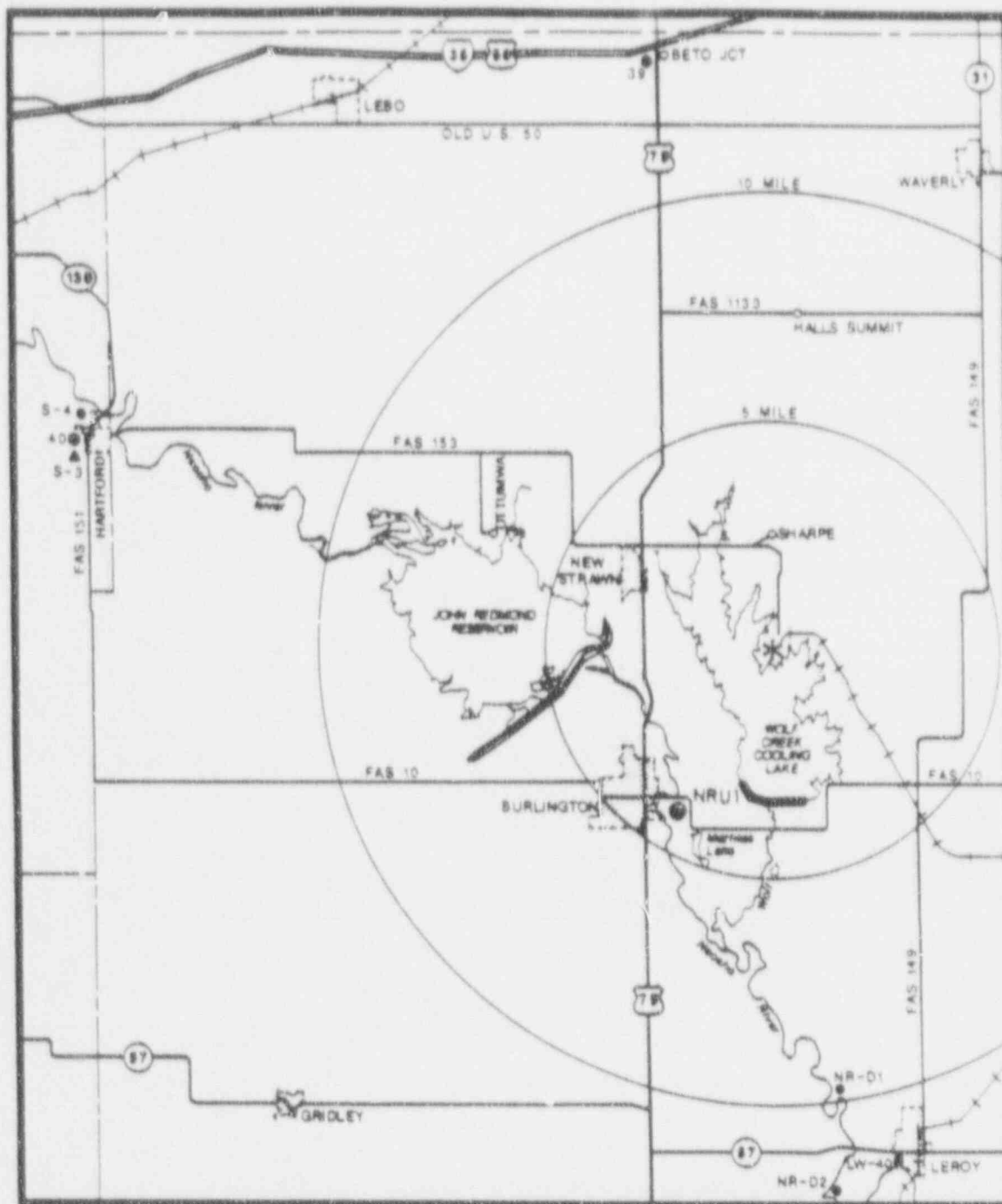


### INGESTION PATHWAY SAMPLING LOCATIONS

- -FOOD PRODUCTS
- ▤ -FISH (WOCL)
- ▲ -FISH (JRR)



FIGURE 5



### DISTANT SAMPLING LOCATIONS

- - TLD      ■ - DRINKING WATER
- ▲ - MILK      ♦ - BROADLEAF VEGETATION / IRRIGATED CROPS

## 1991 AIRBORNE PARTICULATE ACTIVITY

Average Indicator and Control Value

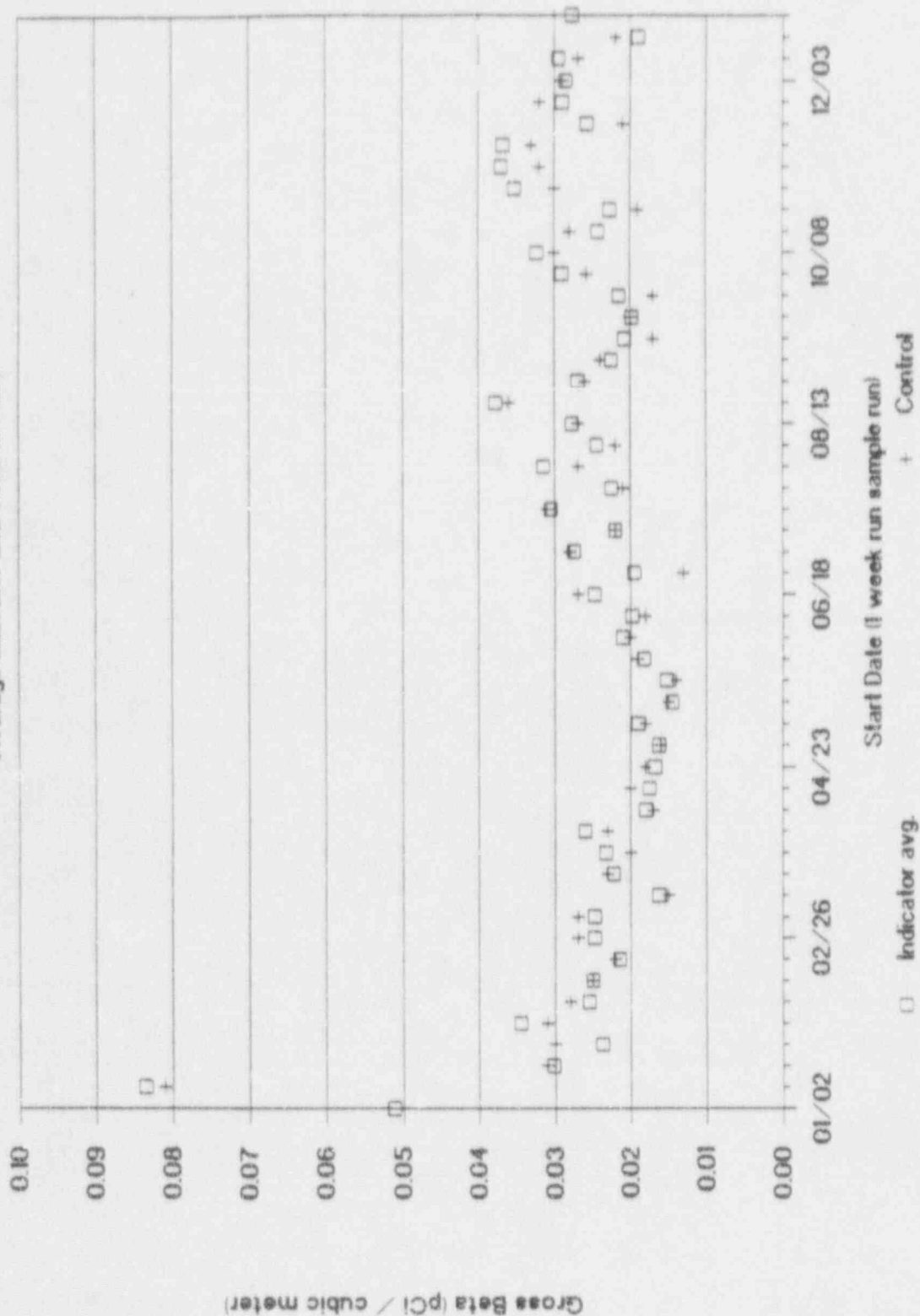
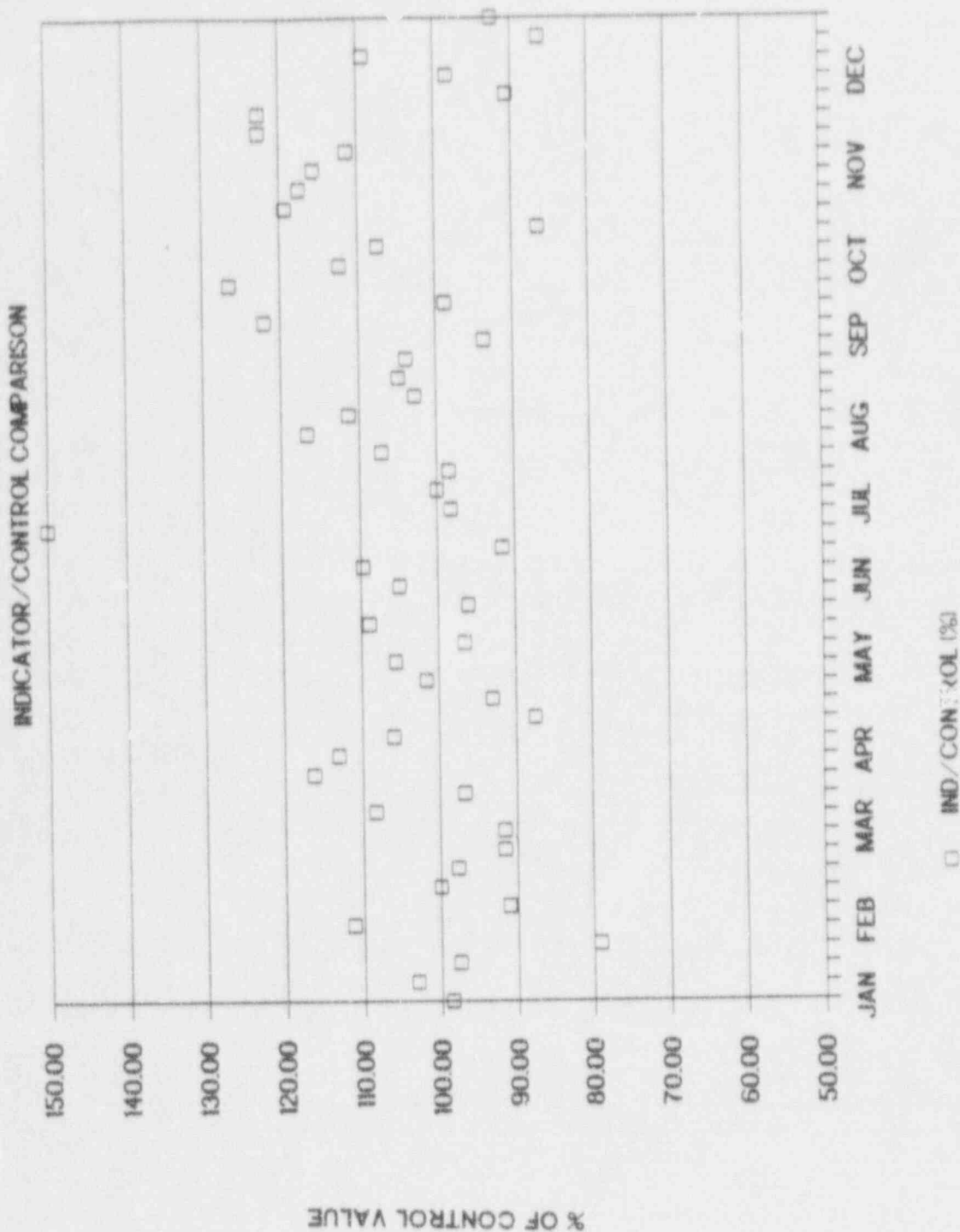


FIGURE 7

## 1991 AIRBORNE PARTICULATE ACTIVITY



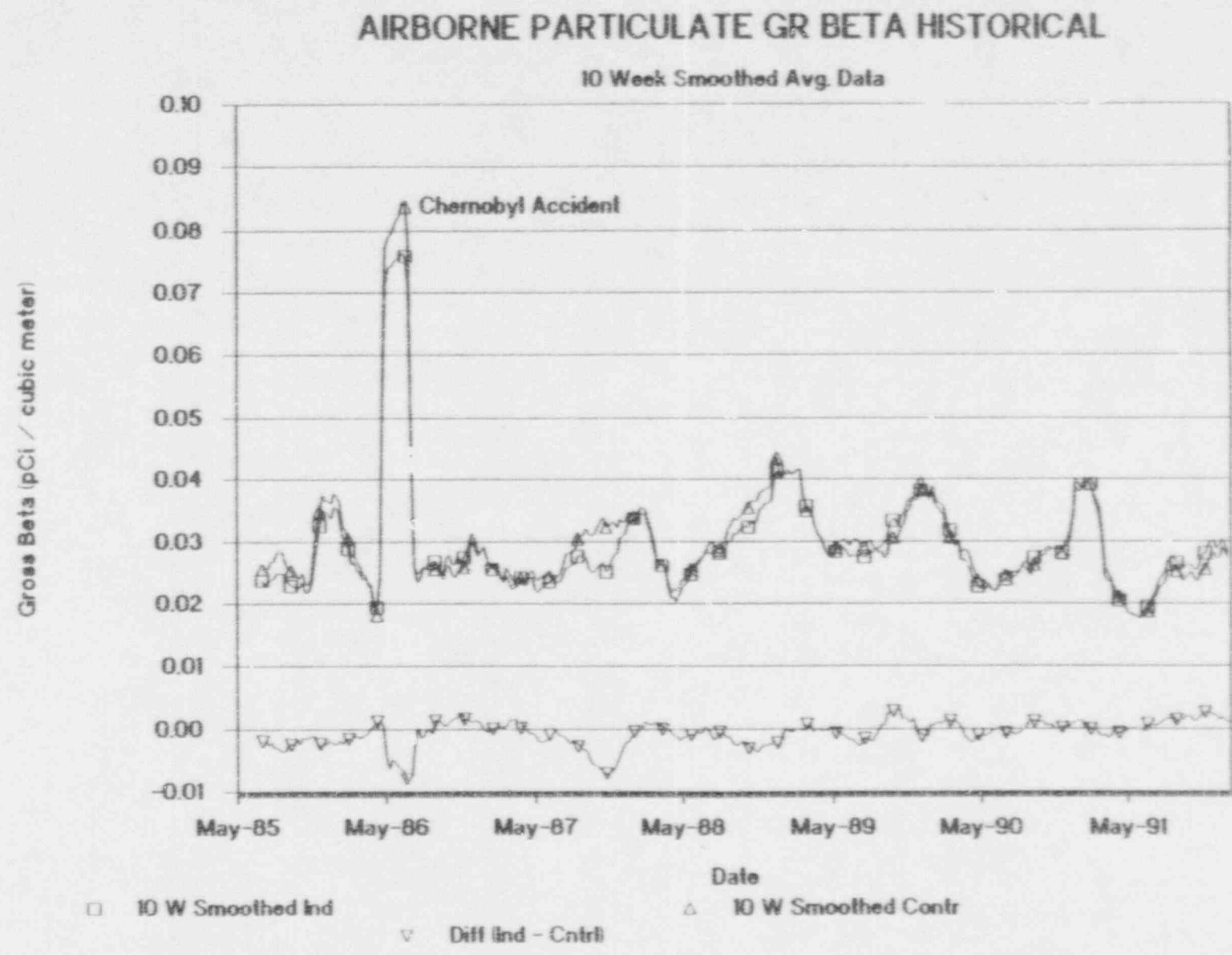


FIGURE 8

# OPERATIONAL TLD RESULTS

## NEARSITE AND CONTROL LOCATION AVERAGES

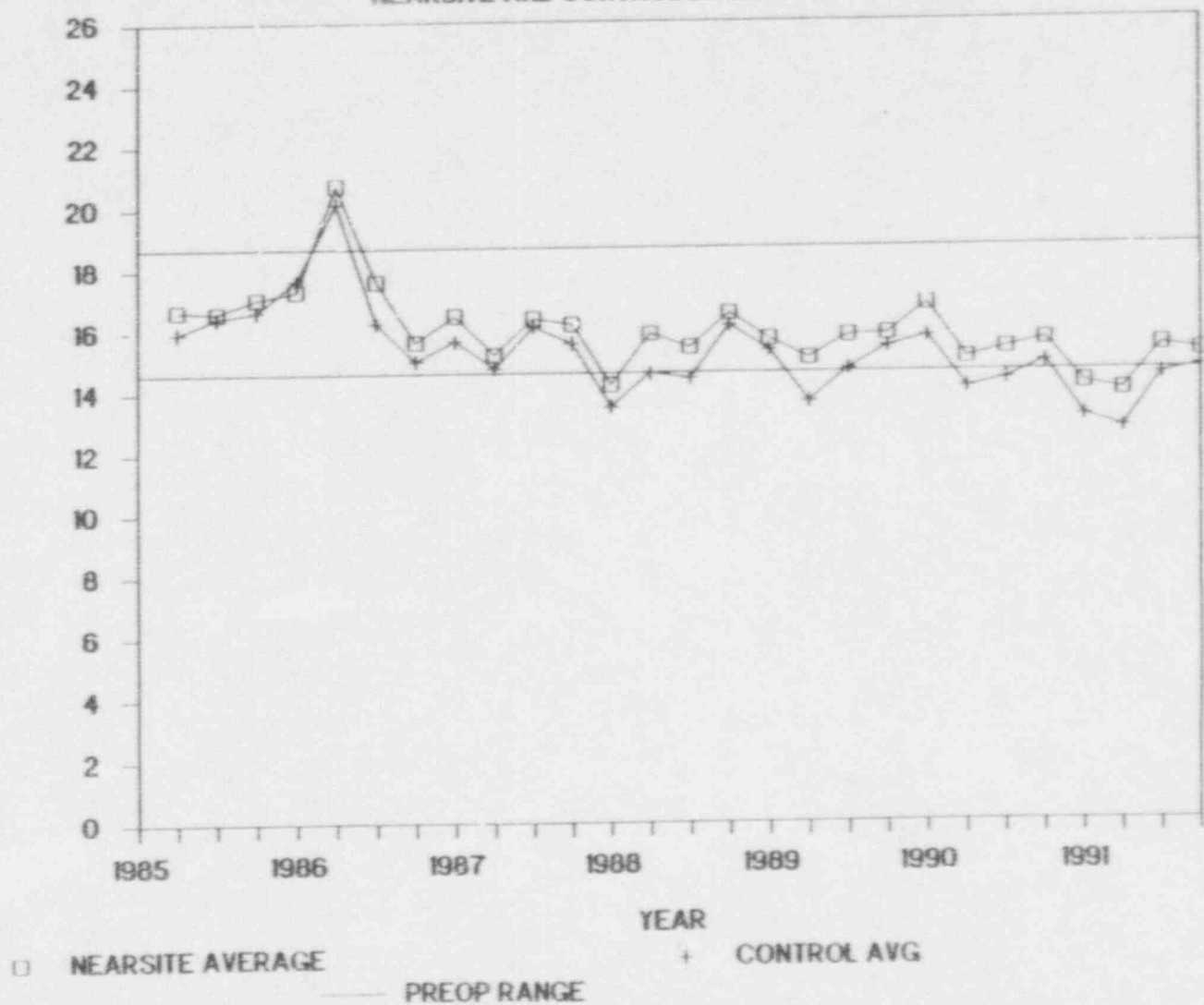


FIGURE 9



## VARIATION OF NEARSITE TLD AVERAGES

[% OF CONTROL LOCATION AVERAGE VALUES]

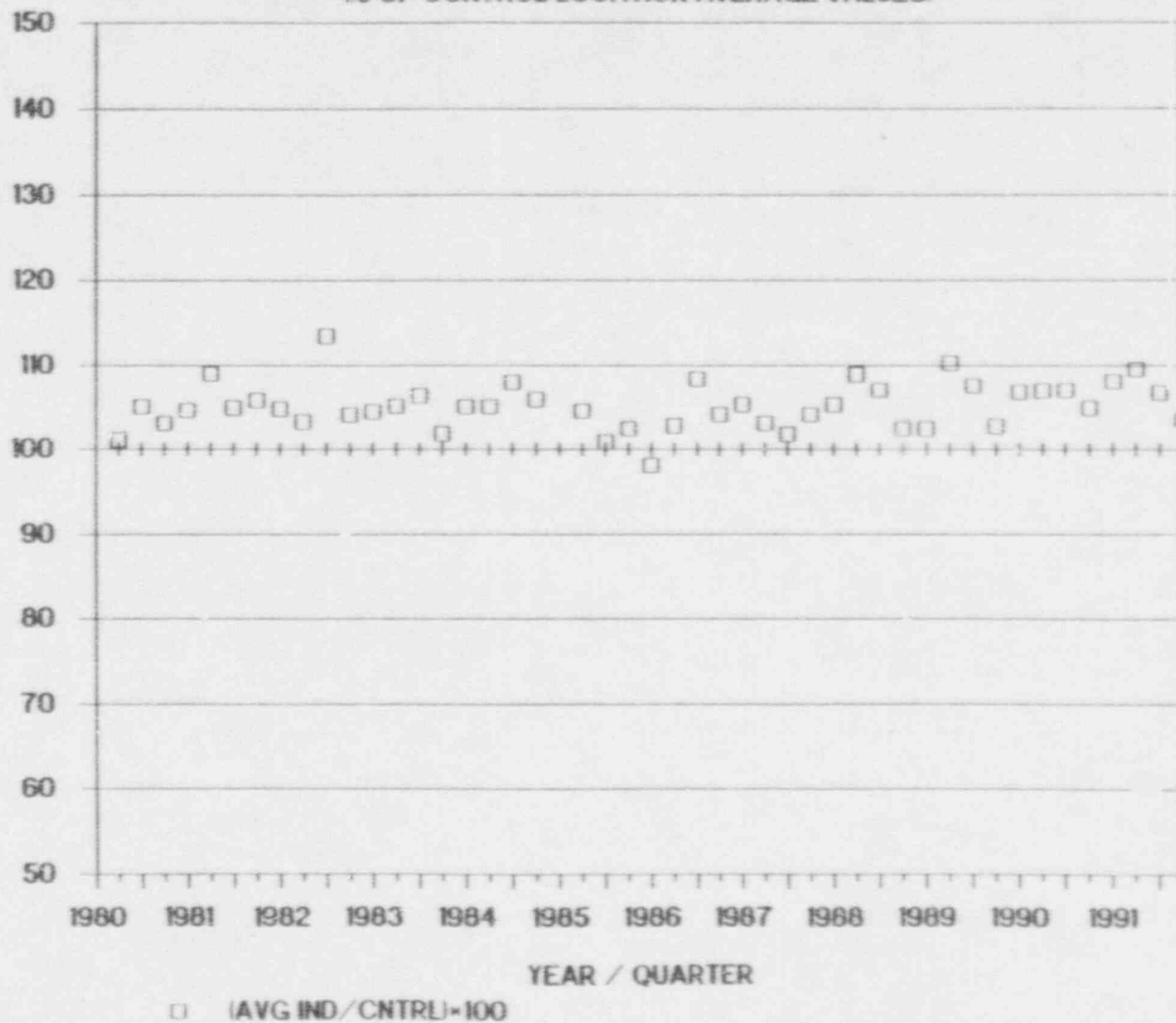


FIGURE 10

## 1991 DRINKING WATER ANALYSIS

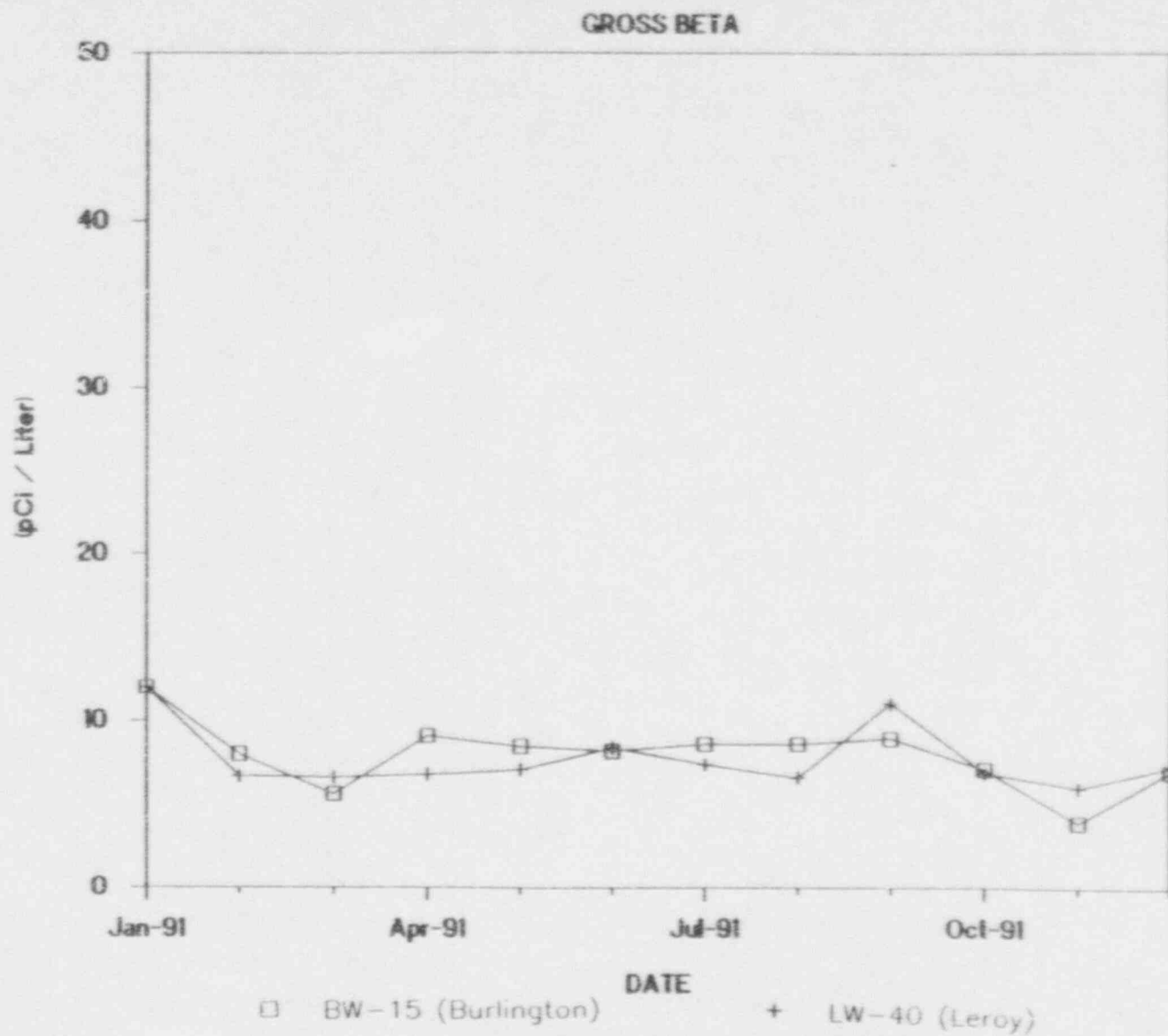


FIGURE 11

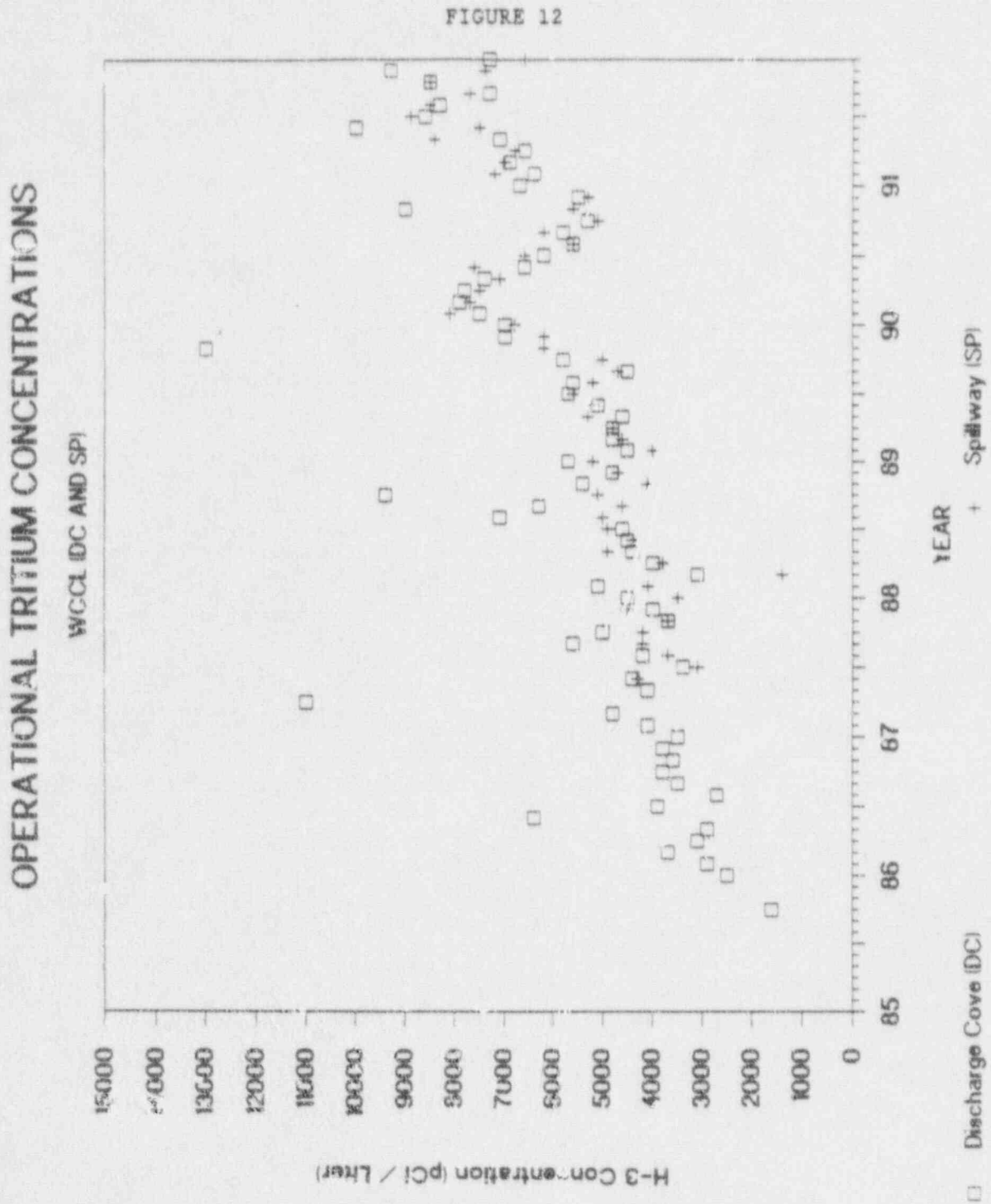
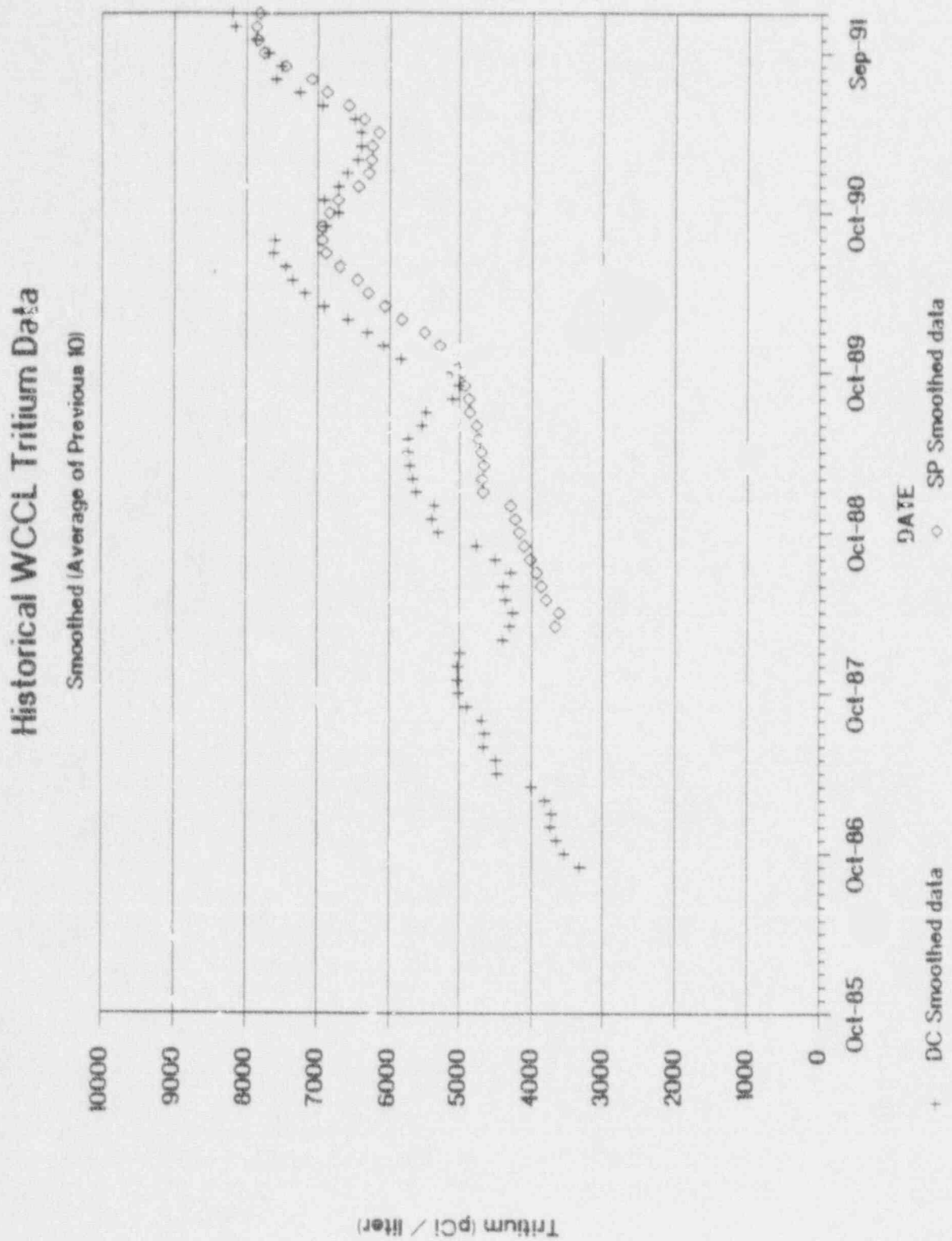


FIGURE 13



Appendix A

Summary tables in format of NRC Radiological  
Assessment Branch Technical Position  
Revision 1, November 1979



## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-482Location of Facility Coffey County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Name Distance and Directions	Annual Mean ** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements**
Station No. 40							
Air Particulate ( $\times 10^{-3}$ pCi/Cu.M.)	Gross (250)	3	26(207/207) (11-89)	32 3.2 miles NNW	27(52/52) (11-80)	26(52/52) (13-81)	0
	Beta						
	I-131 (250)	7	-40/207)	N/A	N/A	-40/52)	
	Gamma (20)						
	Be 7	1	63(16/16) (48-77)	40 >15 miles WNW	67(4/4) (53-76)	67(4/4) (53-76)	0
	K-40	24	9.4(5/16) (5.3-12)	40 >15 miles WNW	15(1/4)	15(1/4)	0
Stations 39 and 40							
External Radiation (mR/day)	TLD (318) Quarterly	0.05	0.17(302/302) (0.10-0.33)	18 3.2 miles SSE	0.22(8/8) (0.15-0.30)	0.15(16/16) (0.13-0.18)	0

\* Nominal Lower Limit of Detection (LLD)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-482Location of Facility Colby County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (n) ** Range	Location with Highest Name Distance and Directions	Annual Mean ** Mean (n) ** Range	Control Locations ** Mean (n) ** Range	Number of Nonroutine Reported Measurements**
J. Redmond Reservoir							
Fish (pCi/g wet)	Gamma (9)						
	K-40	0.5	4.6(6/6) (2.8-10)	JRR 4.0 miles W	6.9(3/3) (2.9-14)	6.9(3/3) (2.9-14)	0
Food and Garden Crops (pCi/g wet weight)	Gamma (18)					8-4	
	Be-7	0.09	0.71(12/12) (0.25-2.2)	R-1 2.1 miles NNW	1.1(3/3) (0.37-2.2)	0.61(6/6) (0.43-0.81)	0
	K-40	0.5	10(12/12) (4.4-21)	R-1 2.1 miles NNW	12(3/3) (4.4-21)	3.3(6/6) (1.5-5.4)	0
	Cs-137	0.08	0.032(2/12) (0.021-0.043)	R-1 2.1 miles NNW	0.043(1/3) --	0.021(1/6) --	0
	Ra-226	0.2	0.58(1/12) --	R-1 2.1 miles NNW	0.58(1/4) --	(0/6) --	0
	Th-228	0.02	0.079(2/12) (0.054-0.10)	R-1 2.1 miles NNW	0.10(1/3) --	(0/6) --	0
Irrigated Crop (pCi/g dry weight)	Gamma (4)					NRU1	
	K-40	0.5	7.2(3/3) (2.9-16)	NRD2 > 10 miles S	9.3(2/2) (3.0-16)	2.0(1/1) --	0

\* Nominal Lower Limit of Detection (LLD)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (n)

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-482Location of Facility Osage County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) **Range	Location with Highest Name Distance and Directions	Annual Mean **Mean (f) **Range	Control Locations **Mean (f) **Range	Number of Nonroutine Reported Measurements**
						Station 8-3	
Milk (pCi/l)	I-131 (21)	3	--	--		(0/21)	0
	Gamma (21)						
	K-40	100	--	--		1268(21/21) (900-1590)	0

\* Nominal Lower Limit of Detection (LLD)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-482

Location of Facility Coffey County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations		Location with Highest Name Distance and Directions	Annual Mean		Control Locations --Mean (f) --Range	Number of Nonroutine Reported Measurements**
			-- Mean (f) --Range	--Mean (f) --Range					
Sediment/Silt (pCi/g dry weight)	Gamma (5)								
	K-40	0.5	14(3/3) (13-14)		JRR 4 miles W	15(2/2) (14-15)	15(2/2) (14-15)	0	
	Co-58	0.02	-(0/3)		NA	NA	-(0/2)	0	
	Ce-60	0.02	0.55(3/3) (0.06-0.66)		DC 0.6 mile WNW	0.55(2/2) (0.44-0.66)	-(0/2)	0	
	Cs-137	0.06	0.40(3/3) (0.29-0.46)		DC 0.6 mile WNW	0.45(2/2) (0.45-0.46)	0.24(2/2) (0.23-0.26)	0	
	Ra-226	0.5	2.1(3/3) (2.0-2.1)		UHS	2.1(1/1)	1.9(2/2) (1.6-2.2)	0	
	Th-228	0.04	1.3(3/3) (1.2-1.4)		DC 0.6 mile WNW	1.3(2/2) (1.3-1.4)	1.3(2/2) (1.3-1.3)	0	

\* Nominal Lower Limit of Detection (LLD)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)



## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-482Location of Facility Coffey County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Name Distance and Directions	Annual Mean ** Mean (f) ** Range	Control Locations ** Mean (f) ** Range Station No. JRR	Number of Nonroutine Reported Measurements**
Shoreline Soil (pCi/g dry weight)	Gamma (3)						
	K-40	0.5	10(2/2) (9.6-10)	JRR 4.0 miles W	12(1/1) --	12(1/1) --	0
	Co-60		0.72(1/2) --	DC 0.6 miles WNW	0.72(1/3) --	(0/1) --	0
	Cs-137	0.06	(0/2) --	NA	NA --	(0/1) --	0
	Ra-226	0.5	2.1(2/2) (1.5-2.8)	DC 0.6 miles WNW	2.1(2/2) (1.5-2.8)	1.6(1/1) --	0
	Th-228	0.04	1.1(2/2) (0.88-1.3)	JRR 4.0 miles W	1.4(1/1) --	1.4(1/1) --	0

\* Nominal Lower Limit of Detection (LLD)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)





## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-482Location of Facility Coffey County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Name Distance and Directions	Annual Mean ** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements**
BW-15							
Water Drinking (pCi/l)	I-131 (24)	0.5	-(0/12)	NA	NA	-(0/12)	0
	Gross (24) Beta	2	7.7(12/12) (6.0-12)	BW15 3.9 miles SW	8.0(12/12) (3.9-12)	8.0(12/12) (3.9-12)	0
	Gamma (24)	--	-(0/12)	NA	NA	-(0/12)	0
	Tritium (8)	1000	-(0/4)	NA	NA	-(0/4)	0
B-12							
Water, Ground (pCi/l)	I-131 (16)	0.5	-(0/12)	NA	NA	-(0/4)	0
	Gamma (16)						
	K-40	100	-(0/12)	B-12	51(1/4)	51(1/4)	0
	Tritium (16)	1000	-(0/12)	NA	NA	-(0/4)	0

\* Nominal Lower Limit of Detection (LLD)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Wolf Creek Nuclear Docket No. STN 50-432

Location of Facility Coffey County, Kansas Reporting Period Annual 1991  
(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (d, l, b)	All Indicator Locations		Location with Highest Name Distance and Direction	Annual Mean		Control Locations		Number of Nonroutine Reported Measurements**
			Mean (f)	Range		Mean (f)	Range	Mean (f)	Range	
Water Surface (pCi/l)	Gamma (40) K-40		74(1/28)		DC 0.6 miles WNW	74(1/28)		-(0/12)		0
	Tritium (40) 1000		7632(28/28)	(6300-10000)	DC 0.6 miles WNW	7846(13/13)	(6400-10000)	-(0/12)		0

\* Nominal Lower Limit of Detection (d, l, b)

\*\* Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

Appendix B

Individual Sample Results

## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 02

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M)
01/02	01/08	2.65E 08	CC	01/25	5.7 ± 0.4 E-02	01/12	L.T. 2. E-02
01/08	01/15	2.89E 08	CC	01/29	8.9 ± 0.5 E-02	01/21	L.T. 3. E-02
01/15	01/22	3.01E 08	CC	01/30	3.2 ± 0.3 E-02	01/24	L.T. 2. E-02
01/22	01/30	3.47E 08	CC	02/08	2.6 ± 0.3 E-02	02/01	L.T. 2. E-02
01/22*	01/30	3.47E 08	CC	02/08	3.0 ± 0.3 E-02	02/03	L.T. 1. E-02
01/30	02/05	2.50E 08	CC	02/15	3.5 ± 0.4 E-02	02/08	L.T. 3. E-02
02/05	02/12	2.97E 08	CC	02/22	2.4 ± 0.3 E-02	02/15	L.T. 2. E-02
02/12	02/19	2.97E 08	CC	03/01	2.5 ± 0.3 E-02	02/22	L.T. 2. E-02
02/19	02/26	3.09E 08	CC	03/08	2.1 ± 0.3 E-02	03/01	L.T. 1. E-02
02/19*	02/26	3.09E 08	CC	03/08	2.3 ± 0.3 E-02	03/04	L.T. 2. E-02
02/26	03/05	3.06E 08	CC	03/15	2.4 ± 0.3 E-02	03/09	L.T. 2. E-02
03/05	03/12	3.10E 08	CC	03/25	2.5 ± 0.3 E-02	03/17	L.T. 2. E-02
03/12	03/19	3.05E 08	CC	04/01	1.7 ± 0.2 E-02	03/23	L.T. 1. E-02
03/19	03/26	3.07E 08	CC	04/04	2.2 ± 0.3 E-02	03/28	L.T. 1. E-02
03/26	04/02	3.06E 08	CC	04/23	2.2 ± 0.3 E-02	04/04	L.T. 2. E-02
04/02	04/09	3.17E 08	CC	04/20	2.2 ± 0.3 E-02	04/13	L.T. 2. E-02
04/09	04/16	2.91E 08	CC	04/29	1.8 ± 0.3 E-02	04/21	L.T. 2. E-02
04/16	04/23	2.95E 08	CC	05/05	1.7 ± 0.3 E-02	04/26	L.T. 2. E-02

\*Duplicate Analysis



WOLF CREEK NUCLEAR OPERATING CORPORATION  
AIR PARTICULATE AND CHARCOAL FILTERS  
STATION NUMBER 02

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M.)
04/23	04/30	3.06E 08	CC	05/09	1.9 ± 0.3 E-02	05/02	L.T. 2. E-02
04/30	05/07	3.05E 08	CC	05/17	1.7 ± 0.3 E-02	05/09	L.T. 2. E-02
05/07	05/14	3.12E 08	CC	05/24	1.8 ± 0.3 E-02	05/19	L.T. 2. E-02
05/14	05/21	3.01E 08	CC	06/04	1.5 ± 0.3 E-02	05/26	L.T. 2. E-02
05/21	05/28	3.14E 08	CC	06/07	1.5 ± 0.2 E-02	05/31	L.T. 2. E-02
05/28	06/04	2.99E 08	CC	06/14	1.7 ± 0.3 E-02	06/08	L.T. 2. E-02
06/04	06/11	3.02E 08	CC	06/22	2.1 ± 0.3 E-02	06/15	L.T. 1. E-02
06/11	06/18	2.93E 08	CC	06/27	1.8 ± 0.3 E-02	06/22	L.T. 2. E-02
06/18	06/25	3.05E 08	CC	07/05	1.4 ± 0.2 E-02	06/28	L.T. 2. E-02
06/25	07/02	3.03E 08	CC	07/19	1.8 ± 0.3 E-02	07/05	L.T. 1. E-02
07/02	07/09	3.02E 08	CC	07/23	2.6 ± 0.3 E-02	07/12	L.T. 2. E-02
07/09	07/16	2.92E 08	CC	07/26	2.1 ± 0.3 E-02	07/23	L.T. 3. E-02
07/16	07/23	2.97E 08	CC	08/05	2.8 ± 0.3 E-02	07/28	L.T. 2. E-02
07/23	07/30	2.97E 08	CC	08/09	2.2 ± 0.3 E-02	08/05	L.T. 2. E-02
07/30	08/06	3.28E 08	CC	08/14	3.1 ± 0. E-02	08/11	L.T. 1. E-02
08/06	08/13	2.96E 08	CC	08/22	2.2 ± 0.3 E-02	08/15	L.T. 2. E-02
08/06*	08/13	2.55E 08	CC	08/22	2.6 ± 0.3 E-02	08/16	L.T. 8. E-03
08/13	08/20	2.93E 08	CC	08/30	2.6 ± 0.3 E-02	08/22	L.T. 2. E-02

\*Duplicate Analysis

WOLF CREEK NUCLEAR OPERATING CORPORATION  
AIR PARTICULATE AND CHARCOAL FILTERS  
STATION NUMBER 02

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M)
08/20	08/27	3.02E 08	CC	09/07	3.9 ± 0.4 E-02	08/29	L.T. 2. E-02
08/27	09/03	2.98E 08	CC	09/13	2.7 ± 0.3 E-02	09/06	L.T. 2. E-02
09/03	09/10	2.90E 08	CC	09/20	2.0 ± 0.3 E-02	09/12	L.T. 2. E-02
09/10	09/17	2.96E 08	CC	09/26	2.3 ± 0.3 E-02	09/20	L.T. 2. E-02
09/17	09/24	3.00E 08	CC	10/02	2.0 ± 0.3 E-02	09/29	L.T. 2. E-02
09/24	10/01	2.96E 08	CC	10/09	2.2 ± 0.3 E-02	10/05	L.T. 2. E-02
10/01	10/08	2.94E 08	CC	10/18	3.3 ± 0.3 E-02	10/13	L.T. 2. E-02
10/08	10/15	2.96E 08	CC	10/25	3.2 ± 0.3 E-02	10/19	L.T. 2. E-02
10/15	10/22	3.02E 08	CC	11/01	2.3 ± 0.3 E-02	10/26	L.T. 2. E-02
10/22	10/29	2.99E 08	CC	11/07	2.4 ± 0.3 E-02	11/02	L.T. 2. E-02
10/29	11/05	3.19E 08	CC	11/14	3.2 ± 0.3 E-02	11/09	L.T. 1. E-02
11/05	11/12	3.02E 08	CC	11/22	3.6 ± 0.4 E-02	11/14	L.T. 2. E-02
11/12	11/19	2.84E 08	CC	11/26	4.0 ± 0.4 E-02	11/22	L.T. 1. E-02
11/19	11/26	2.81E 08	CC	12/06	2.4 ± 0.3 E-02	11/30	L.T. 2. E-02
11/26	12/03	2.80E 08	CC	12/19	2.8 ± 0.3 E-02	12/13	L.T. 3. E-02
12/03	12/10	3.18E 08	CC	12/21	3.0 ± 0.3 E-02	12/17	L.T. 3. E-02
12/10	12/17	3.12E 08	CC	01/02	3.2 ± 0.3 E-02	12/23	L.T. 3. E-02
12/17	12/23	2.66E 08	CC	01/06	1.8 ± 0.3 E-02	12/28	L.T. 2. E-02
12/23	12/30	3.25E 08	CC	01/13	2.8 ± 0.3 E-02	01/02	L.T. 1. E-02

## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 03

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M.)
01/02	01/08	2.69E 08	CC	01/25	4.7 ± 0.4 E-02	01/12	LT. 2. E-02
01/08	01/15	3.04E 08	CC	01/29	8.6 ± 0.5 E-02	01/21	LT. 3. E-02
01/15	01/22	3.01E 08	CC	01/30	3.3 ± 0.3 E-02	01/24	LT. 2. E-02
01/22	01/30	3.41E 08	CC	02/08	2.4 ± 0.3 E-02	02/01	LT. 2. E-02
01/30	02/05	2.58E 08	CC	02/15	3.6 ± 0.4 E-02	02/08	LT. 3. E-02
02/05	02/12	2.05E 08	CC	02/22	2.3 ± 0.3 E-02	02/15	LT. 3. E-02
02/12	02/19	2.94E 08	CC	03/01	2.4 ± 0.3 E-02	02/22	LT. 2. E-02
02/19	02/26	2.97E 08	CC	03/08	2.0 ± 0.3 E-02	03/01	LT. 1. E-02
02/26	03/05	2.86E 08	CC	03/15	1.8 ± 0.3 E-02	03/09	LT. 2. E-02
03/05	03/12	2.90E 08	CC	03/25	2.2 ± 0.3 E-02	03/17	LT. 2. E-02
03/12	03/19	2.90E 08	CC	04/01	1.5 ± 0.2 E-02	03/23	LT. 1. E-02
03/19	03/26	2.84E 08	CC	04/04	2.0 ± 0.3 E-02	03/28	LT. 2. E-02
03/26	04/02	2.86E 08	CC	04/23	2.2 ± 0.3 E-02	04/04	LT. 2. E-02
03/26*	04/02	2.86E 08	CC	04/23	3.4 ± 0.4 E-02	04/06	LT. 8. E-03
04/02	04/09	2.92E 08	CC	04/20	2.6 ± 0.3 E-02	04/13	LT. 2. E-02
04/09	04/16	3.09E 08	CC	04/29	1.9 ± 0.3 E-02	04/21	LT. 2. E-02
04/16	04/23	2.90E 08	CC	05/05	1.6 ± 0.3 E-02	04/26	LT. 2. E-02
04/23	04/30	3.11E 08	CC	05/09	1.4 ± 0.2 E-02	05/02	LT. 2. E-02
04/30	05/07	3.08E 08	CC	05/17	1.6 ± 0.3 E-02	05/09	LT. 2. E-02

\*Duplicate Analysis

## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 03

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA [pCi/Cu.M]	MID COUNT TIME DATE	CHARCOAL FILTER I-131 [pCi/Cu.M]
05/07	05/14	3.02E 08	CC	05/24	1.7 ± 0.3 E-02	05/19	L.T. 2. E-02
05/14	05/21	2.81E 08	CC	06/04	1.6 ± 0.3 E-02	05/26	L.T. 2. E-02
05/21	05/28	2.83E 08	CC	06/07	1.6 ± 0.3 E-02	05/31	L.T. 2. E-02
05/28	06/04	2.79E 08	CC	06/14	1.5 ± 0.3 E-02	06/08	L.T. 2. E-02
06/04	06/11	2.87E 08	CC	06/22	2.1 ± 0.3 E-02	06/15	L.T. 2. E-02
06/11	06/18	2.66E 08	CC	06/27	2.2 ± 0.3 E-02	06/22	L.T. 2. E-02
06/18	06/25	2.70E 08	CC	07/05	3.0 ± 0.3 E-02	06/28	L.T. 2. E-02
06/25	07/02	2.75E 08	CC	07/19	2.5 ± 0.3 E-02	07/05	L.T. 1. E-02
07/02	07/09	2.84E 08	CC	07/23	3.0 ± 0.3 E-02	07/12	L.T. 2. E-02
07/09	07/16	2.62E 08	CC	07/26	2.4 ± 0.3 E-02	07/23	L.T. 3. E-02
07/09*	07/16	2.62E 08	CC	07/26	2.8 ± 0.4 E-02	07/24	L.T. 4. E-02
07/16	07/23	2.72E 08	CC	08/05	3.4 ± 0.4 E-02	07/28	L.T. 2. E-02
07/23	07/30	2.67E 08	CC	08/09	3.3 ± 0.3 E-02	08/05	L.T. 2. E-02
07/30	08/06	2.74E 08	CC	08/14	3.3 ± 0.4 E-02	08/11	L.T. 2. E-02
08/06	08/13	2.94E 08	CC	08/22	2.7 ± 0.3 E-02	08/15	L.T. 2. E-02
08/13	08/20	2.91E 08	CC	08/30	3.0 ± 0.3 E-02	08/22	L.T. 2. E-02

\*Duplicate Analysis



## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 03

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M.)
08/20	08/27	2.97E 08	CC	09/07	3.8 ± 0.4 E-02	08/29	L.T. 2. E-02
08/27	09/03	2.98E 08	CC	09/13	2.6 ± 0.3 E-02	09/06	L.T. 2. E-02
09/03	09/10	2.90E 08	CC	09/20	2.3 ± 0.3 E-02	09/12	L.T. 2. E-02
09/10	09/17	2.96E 08	CC	09/26	1.9 ± 0.3 E-02	09/20	L.T. 2. E-02
09/17	09/24	2.91E 08	CC	10/02	1.9 ± 0.3 E-02	09/29	L.T. 2. E-02
09/24	10/01	2.90E 08	CC	10/09	2.0 ± 0.3 E-02	10/05	L.T. 2. E-02
10/01	10/08	2.94E 08	CC	10/18	2.6 ± 0.3 E-02	10/13	L.T. 2. E-02
10/08	10/15	2.93E 08	CC	10/25	3.0 ± 0.3 E-02	10/19	L.T. 2. E-02
10/15	10/22	2.99E 08	CC	11/01	1.9 ± 0.3 E-02	10/26	L.T. 2. E-02
10/22	10/29	2.99E 08	CC	11/07	2.4 ± 0.3 E-02	11/02	L.T. 2. E-02
10/29	11/05	2.94E 08	CC	11/14	2.9 ± 0.3 E-02	11/09	L.T. 2. E-02
11/05	11/12	2.97E 08	CC	11/22	3.3 ± 0.4 E-02	11/14	L.T. 2. E-02
11/12	11/19	3.05E 08	CC	11/26	3.4 ± 0.3 E-02	11/22	L.T. 1. E-02
11/19	11/26	3.02E 08	CC	12/06	2.3 ± 0.3 E-02	11/30	L.T. 2. E-02
11/26	12/03	3.00E 08	CC	12/19	2.8 ± 0.3 E-02	12/13	L.T. 3. E-02
12/03	12/10	3.14E 08	CC	12/21	2.9 ± 0.3 E-02	12/17	L.T. 3. E-02
12/03*	12/10	3.14E 08	CC	12/21	2.8 ± 0.3 E-02	12/18	L.T. 1. E-02
2/10	12/17	2.97E 08	CC	01/02	2.6 ± 0.3 E-02	12/23	L.T. 3. E-02

\*Duplicate Analysis



WOLF CREEK NUCLEAR OPERATING CORPORATION  
 AIR PARTICULATE AND CHARCOAL FILTERS  
 STATION NUMBER 03

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M.)
12/17	12/23	2.49E 08	CC	01/06	$1.9 \pm 0.3 \text{ E-02}$	12/28	L.T. 3. E-02
12/23	12/30	3.03E 08	CC	01/13	$2.9 \pm 0.3 \text{ E-02}$	01/02	L.T. 1. E-02

## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 32

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M)
01/02	01/08	2.79E 08	CC	01/25	4.8 ± 0.4 E-02	01/12	L.T. 2. E-02
01/08	01/15	3.29E 08	CC	01/29	8.0 ± 0.5 E-02	01/21	L.T. 3. E-02
01/15	01/22	3.26E 08	CC	01/30	2.5 ± 0.3 E-02	01/24	L.T. 2. E-02
01/22	01/30	3.75E 08	CC	02/08	2.4 ± 0.2 E-02	02/01	L.T. 2. E-02
01/30	02/05	2.85E 08	CC	02/15	3.3 ± 0.3 E-02	02/08	L.T. 2. E-02
02/05	02/12	3.27E 08	CC	02/22	2.4 ± 0.3 E-02	02/15	L.T. 2. E-02
02/12	02/19	2.91E 08	CC	03/01	2.5 ± 0.3 E-02	02/22	L.T. 2. E-02
02/19	02/26	2.93E 08	CC	03/08	2.1 ± 0.3 E-02	03/01	L.T. 2. E-02
02/26	03/05	2.88E 08	CC	03/15	2.9 ± 0.3 E-02	03/09	L.T. 2. E-02
03/05	03/12	3.00E 08	CC	03/25	2.7 ± 0.3 E-02	03/17	L.T. 2. E-02
03/12	03/19	2.97E 08	CC	04/01	1.6 ± 0.2 E-02	03/23	L.T. 1. E-02
03/19	03/26	3.02E 08	CC	04/04	2.3 ± 0.3 E-02	03/28	L.T. 2. E-02
03/26	04/02	2.99E 08	CC	04/23	2.3 ± 0.3 E-02	04/04	L.T. 2. E-02
04/02	04/09	3.01E 08	CC	04/20	2.6 ± 0.3 E-02	04/13	L.T. 2. E-02
04/09	04/16	3.22E 08	CC	04/29	1.6 ± 0.2 E-02	04/21	L.T. 2. E-02
04/09*	04/16	3.22E 08	CC	04/29	1.7 ± 0.3 E-02	04/24	L.T. 3. E-02
04/16	04/23	3.10E 08	CC	05/05	1.7 ± 0.3 E-02	04/26	L.T. 2. E-02
04/23	04/30	3.07E 08	CC	05/09	1.9 ± 0.3 E-02	05/02	L.T. 2. E-02
04/30	05/07	3.07E 08	CC	05/17	1.6 ± 0.3 E-02	05/09	L.T. 2. E-02

\*Duplicate Analysis

## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 32

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu M.)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu M.)
05/07	05/14	3.12E 08	CC	05/24	2.1 ± 0.3 E-02	05/19	L.T. 2. E-02
05/14	05/21	3.13E 08	CC	06/04	1.1 ± 0.2 E-02	05/26	L.T. 2. E-02
05/21	05/28	3.05E 08	CC	06/07	1.6 ± 0.3 E-02	06/31	L.T. 2. E-02
05/28	06/04	3.13E 08	CC	06/14	2.1 ± 0.3 E-02	06/08	L.T. 2. E-02
06/04	06/11	3.20E 08	CC	06/22	2.1 ± 0.3 E-02	06/15	L.T. 1. E-02
06/11	06/18	3.13E 08	CC	06/27	2.0 ± 0.3 E-02	06/22	L.T. 2. E-02
06/18	06/25	3.21E 08	CC	07/05	2.7 ± 0.3 E-02	06/28	L.T. 2. E-02
06/25	07/02	3.20E 08	CC	07/19	1.8 ± 0.3 E-02	07/05	L.T. 1. E-02
07/02	07/09	3.16E 08	CC	07/23	2.9 ± 0.3 E-02	07/12	L.T. 2. E-02
07/09	07/16	3.09E 08	CC	07/26	1.9 ± 0.3 E-02	07/23	L.T. 3. E-02
07/16	07/23	3.03E 08	CC	08/05	2.9 ± 0.3 E-02	07/28	L.T. 2. E-02
07/23	07/30	3.02E 08	CC	08/09	2.2 ± 0.3 E-02	08/05	L.T. 2. E-02
07/30	08/06	3.09E 08	CC	08/14	3.3 ± 0.3 E-02	08/11	L.T. 1. E-02
08/06	08/13	2.99E 08	CC	08/22	2.5 ± 0.3 E-02	08/15	L.T. 2. E-02
08/13	08/20	2.96E 08	CC	08/30	2.9 ± 0.3 E-02	08/22	L.T. 2. E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 32

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu M)	MID COUNT TIME DATE	CHARCOAL FILTER 1-131 (pCi/Cu M)
08/20	08/27	2.97E 08	CC	09/07	3.7 ± 0.4 E-02	08/29	L.T. 2. E-02
08/27	09/03	2.97E 08	CC	09/13	2.2 ± 0.3 E-02	09/06	L.T. 2. E-02
09/03	09/10	2.78E 08	CC	09/20	2.2 ± 0.3 E-02	09/12	L.T. 2. E-02
09/10	09/17	2.88E 08	CC	09/26	2.0 ± 0.3 E-02	09/20	L.T. 2. E-02
09/10*	09/17	2.88E 08	CC	10/03	2.3 ± 0.3 E-02	09/22	L.T. 8. E-03
09/17	09/24	2.88E 08	CC	10/02	1.8 ± 0.3 E-02	09/29	L.T. 2. E-02
09/24	10/01	2.85E 08	CC	10/09	2.2 ± 0.3 E-02	10/05	L.T. 2. E-02
10/01	10/08	2.85E 08	CC	10/18	3.0 ± 0.3 E-02	10/13	L.T. 2. E-02
10/08	10/15	2.86E 08	CC	10/25	3.6 ± 0.3 E-02	10/19	L.T. 2. E-02
10/15	10/22	2.94E 08	CC	11/01	2.8 ± 0.3 E-02	10/26	L.T. 2. E-02
10/22	10/29	2.96E 08	CC	11/07	2.0 ± 0.3 E-02	11/02	L.T. 2. E-02
10/29	11/05	2.96E 08	CC	11/14	4.8 ± 0.4 E-02	11/09	L.T. 2. E-02
11/05	11/12	2.76E 08	CC	11/22	4.0 ± 0.4 E-02	11/14	L.T. 2. E-02
11/12	11/19	2.84E 08	CC	11/26	3.5 ± 0.4 E-02	11/22	L.T. 1. E-02
11/19	11/26	2.71E 08	CC	12/06	2.5 ± 0.3 E-02	11/30	L.T. 2. E-02
11/26	12/03	2.76E 08	CC	12/19	3.4 ± 0.4 E-02	12/13	L.T. 3. E-02
12/03	12/10	2.82E 08	CC	12/21	3.0 ± 0.3 E-02	12/17	L.T. 3. E-02
12/10	12/17	2.82E 08	CC	01/02	3.2 ± 0.4 E-02	12/23	L.T. 3. F-02
12/17	12/23	2.35E 08	CC	01/06	2.0 ± 0.3 E-02	12/28	L.T. 3. E-02
12/23	12/30	2.78E 08	CC	01/13	3.2 ± 0.3 E-02	01/02	L.T. 1. E-02

\*Duplicate Analysis

## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 37

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M)
01/02	01/08	2.76E 08	CC	01/25	5.3 ± 0.4 E-02	01/12	L.T. 2. E-02
01/08	01/15	2.95E 08	CC	01/29	7.9 ± 0.5 E-02	01/21	L.T. 3. E-02
01/15	01/22	3.06E 08	CC	01/30	3.1 ± 0.3 E-02	01/24	L.T. 2. E-02
01/22	01/30	3.41E 08	CC	02/08	2.1 ± 0.2 E-02	02/01	L.T. 2. E-02
01/30	02/05	2.58E 08	CC	02/15	3.4 ± 0.4 E-02	02/08	L.T. 3. E-02
02/05	02/12	3.02E 08	CC	02/22	3.1 ± 0.3 E-02	02/15	L.T. 2. E-02
02/12	02/19	3.08E 08	CC	03/01	2.6 ± 0.3 E-02	02/22	L.T. 2. E-02
02/19	02/26	3.09E 08	CC	03/08	2.4 ± 0.3 E-02	03/01	L.T. 1. E-02
02/26	03/05	3.01E 08	CC	03/15	2.8 ± 0.3 E-02	03/09	L.T. 2. E-02
03/05	03/12	3.02E 08	CC	03/25	2.5 ± 0.3 E-02	03/17	L.T. 2. E-02
03/12	03/19	2.97E 08	CC	04/01	1.7 ± 0.2 E-02	03/23	L.T. 1. E-02
03/19	03/26	3.02E 08	CC	04/04	2.4 ± 0.3 E-02	03/28	L.T. 2. E-02
03/26	04/02	3.00E 08	CC	04/23	2.6 ± 0.3 E-02	04/04	L.T. 2. E-02
04/02	04/09	2.99E 08	CC	04/20	3.0 ± 0.3 E-02	04/13	L.T. 2. E-02
04/09	04/16	3.02E 08	CC	04/29	1.9 ± 0.3 E-02	04/21	L.T. 2. E-02
04/16	04/23	3.10E 08	CC	05/05	2.0 ± 0.3 E-02	04/26	L.T. 2. E-02
04/23	04/30	3.12E 08	CC	05/09	1.5 ± 0.2 E-02	05/02	L.T. 2. E-02
04/30	05/07	3.08E 08	CC	05/17	1.6 ± 0.3 E-02	05/09	L.T. 2. E-02



**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**AIR PARTICULATE AND CHARCOAL FILTERS**

STATION NUMBER 37

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER 1-131 (pCi/Cu.M.)
05/07	05/14	3.02E 08	CC	05/24	2.0 ± 0.3 E-02	05/19	L.T. 2. E-02
05/14	05/21	2.96E 08	CC	06/04	1.6 ± 0.3 E-02	05/26	L.T. 2. E-02
05/14*	05/21	2.96E 08	CC	06/04	1.5 ± 0.3 E-02	05/29	L.T. 1. E-02
05/21	05/28	2.96E 08	CC	06/07	1.4 ± 0.2 E-02	05/31	L.T. 2. E-02
05/28	06/04	2.92E 08	CC	06/14	2.0 ± 0.3 E-02	06/08	L.T. 2. E-02
06/04	06/11	3.02E 08	CC	06/22	2.1 ± 0.3 E-02	06/15	L.T. 1. E-02
06/11	06/18	3.01E 08	CC	06/27	1.9 ± 0.3 E-02	06/22	L.T. 2. E-02
06/18	06/25	3.05E 08	CC	07/05	2.8 ± 0.3 E-02	06/28	L.T. 2. E-02
06/25	07/02	2.92E 08	CC	07/19	1.9 ± 0.3 E-02	07/05	L.T. 1. E-02
07/02	07/09	2.96E 08	CC	07/23	2.5 ± 0.3 E-02	07/12	L.T. 2. E-02
07/09	07/16	2.93E 08	CC	07/26	2.4 ± 0.3 E-02	07/23	L.T. 3. E-02
07/16	07/23	3.07E 08	CC	08/05	3.1 ± 0.3 E-02	07/28	L.T. 2. E-02
07/23	07/30	3.02E 08	CC	08/09	2.3 ± 0.3 E-02	08/05	L.T. 2. E-02
07/30	08/06	3.09E 08	CC	08/14	2.9 ± 0.3 E-02	08/11	L.T. 1. E-02
08/06	08/13	2.99E 08	CC	08/22	2.4 ± 0.3 E-02	08/15	L.T. 2. E-02
08/13	08/20	2.86E 08	CC	08/30	2.6 ± 0.3 E-02	08/22	L.T. 2. E-02

\*Duplicate Analysis

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**AIR PARTICULATE AND CHARCOAL FILTERS**

STATION NUMBER 37

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M)
08/20	08/27	3.02E 08	CC	09/07	3.7 ± 0.4 E-02	08/29	L.T. 2. E-02
08/27	09/03	2.88E 08	CC	09/13	2.7 ± 0.3 E-02	09/06	L.T. 2. E-02
09/03	09/10	2.93E 08	CC	09/20	2.5 ± 0.3 E-02	09/12	L.T. 2. E-02
09/10	09/17	3.09E 08	CC	09/26	2.1 ± 0.3 E-02	09/20	L.T. 2. E-02
09/17	09/24	3.08E 08	CC	10/02	2.2 ± 0.3 E-02	09/29	L.T. 2. E-02
09/24	10/01	3.00E 08	CC	10/09	2.2 ± 0.3 E-02	10/05	L.T. 2. E-02
10/01	10/08	3.09E 08	CC	10/18	2.7 ± 0.3 E-02	10/13	L.T. 2. E-02
10/08	10/15	3.11E 08	CC	10/25	3.1 ± 0.3 E-02	10/19	L.T. 1. E-02
10/08*	10/15	3.11E 08	CC	10/25	3.4 ± 0.3 E-02	10/23	L.T. 2. E-02
10/15	10/22	3.14E 08	CC	11/01	2.7 ± 0.3 E-02	10/26	L.T. 1. E-02
10/22	10/29	SAMPLE NOT COLLECTED					
10/29	11/05	2.94E 08	CC	11/14	3.2 ± 0.3 E-02	11/09	L.T. 2. E-02
11/05	11/12	2.87E 08	CC	11/22	3.9 ± 0.4 E-02	11/14	L.T. 2. E-02
11/12	11/19	2.84E 08	CC	11/26	3.8 ± 0.4 E-02	11/22	L.T. 1. E-02
11/19	11/26	2.86E 08	CC	12/06	3.1 ± 0.4 E-02	11/30	L.T. 2. E-02
11/26	12/03	3.12E 08	CC	12/19	2.6 ± 0.3 E-02	12/13	L.T. 3. E-02
12/03	12/10	3.18E 08	CC	12/21	2.5 ± 0.3 E-02	12/17	L.T. 3. E-02
12/10	12/17	3.02E 08	CC	01/02	2.8 ± 0.3 E-02	12/23	L.T. 3. E-02
12/17	12/23	2.51E 08	CC	01/06	1.9 ± 0.3 E-02	12/28	L.T. 3. E-02
12/23	12/30	2.98E 08	CC	01/13	2.2 ± 0.3 E-02	01/02	L.T. 1. E-02

\*Duplicate Analysis

WOLF CREEK NUCLEAR OPERATING CORPORATION  
AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 40

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER I 131 (pCi/Cu.M.)
01/02	01/08	2.83E 08	CC	01/25	5.2 ± 0.4 E-02	01/12	L.T. 2. E-02
01/08	01/15	3.05E 08	CC	01/29	8.1 ± 0.5 E-02	01/21	L.T. 2. E-02
01/15	01/22	3.06E 08	CC	01/30	3.1 ± 0.3 E-02	01/24	L.T. 2. E-02
01/22	01/30	3.46E 08	CC	02/08	3.0 ± 0.3 E-02	02/01	L.T. 1. E-02
01/30	02/05	2.64E 08	CC	02/15	3.1 ± 0.3 E-02	02/08	L.T. 2. E-02
02/05	02/12	3.07E 08	CC	02/22	2.8 ± 0.3 E-02	02/15	L.T. 2. E-02
02/12	02/19	2.98E 08	CC	03/01	2.5 ± 0.3 E-02	02/22	L.T. 1. E-02
02/19	02/26	3.04E 08	CC	03/08	2.2 ± 0.3 E-02	03/01	L.T. 8. E-03
02/26	03/05	3.11E 08	CC	03/15	2.7 ± 0.3 E-02	03/09	L.T. 1. E-02
03/05	03/12	3.10E 08	CC	03/25	2.7 ± 0.3 E-02	03/17	L.T. 1. E-02
03/12	03/19	3.02E 08	CC	04/01	1.5 ± 0.2 E-02	03/23	L.T. 8. E-03
03/19	03/26	3.02E 08	CC	04/04	2.3 ± 0.3 E-02	03/28	L.T. 1. E-02
03/26	04/02	2.98E 08	CC	04/23	2.0 ± 0.3 E-02	04/04	L.T. 1. E-02
04/02	04/09	2.96E 08	CC	04/20	2.3 ± 0.3 E-02	04/13	L.T. 1. E-02
04/09	04/16	3.06E 08	CC	04/29	1.7 ± 0.3 E-02	04/21	L.T. 1. E-02
04/16	04/23	3.01E 08	CC	05/05	2.0 ± 0.3 E-02	04/26	L.T. 1. E-02
04/23	04/30	3.07E 08	CC	05/09	1.8 ± 0.3 E-02	05/02	L.T. 1. E-02
04/30	05/07	3.02E 08	CC	05/17	1.6 ± 0.3 E-02	05/09	L.T. 1. E-02

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**AIR PARTICULATE AND CHARCOAL FILTERS**

STATION NUMBER 4

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu M)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu M)
05/07	05/14	3.05E 08	CC	05/24	1.8 ± 0.3 E-02	05/19	L.T. 1. E-02
05/14	05/21	3.05E 08	CC	06/04	1.5 ± 0.3 E-02	05/26	L.T. 7. E-03
05/21	05/28	2.92E 08	CC	06/07	1.4 ± 0.2 E-02	05/31	L.T. 1. E-02
05/28	06/04	3.02E 08	CC	06/14	1.9 ± 0.3 E-02	06/08	L.T. 7. E-03
06/04	06/11	2.99E 08	CC	06/22	2.0 ± 0.3 E-02	06/15	L.T. 1. E-02
06/11	06/18	3.00E 08	CC	06/27	1.8 ± 0.3 E-02	06/22	L.T. 1. E-02
06/11*	06/18	3.00E 08	CC	07/09	2.1 ± 0.3 E-02	06/26	L.T. 2. E-02
06/18	06/25	3.11E 08	CC	07/05	2.7 ± 0.3 E-02	06/28	L.T. 8. E-03
06/25	07/02	3.07E 08	CC	07/19	1.3 ± 0.2 E-02	07/05	L.T. 1. E-02
07/02	07/09	2.98E 08	CC	07/23	2.8 ± 0.3 E-02	07/12	L.T. 1. E-02
07/09	07/16	2.92E 08	CC	07/26	2.2 ± 0.3 E-02	07/24	L.T. 1. E-02
07/16	07/23	3.18E 08	CC	08/05	3.1 ± 0.3 E-02	07/28	L.T. 7. E-03
07/23	07/30	3.18E 08	CC	08/09	2.1 ± 0.3 E-02	08/05	L.T. 1. E-02
07/30	08/06	3.35E 08	CC	08/14	2.7 ± 0.3 E-02	08/11	L.T. 8. E-03
08/06	08/13	2.82E 08	CC	08/22	2.2 ± 0.3 E-02	08/15	L.T. 8. E-03
08/13	08/20	2.96E 08	CC	08/30	2.7 ± 0.3 E-02	08/22	L.T. 7. E-03

\*Duplicate Analysis



**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**AIR PARTICULATE AND CHARCOAL FILTERS**

STATION NUMBER 40

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BEIA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER 1-131 (pCi/Cu.M.)
08/20	08/27	2.87E 08	CC	09/07	3.6 ± 0.4 E-02	08/29	L.T. 8. E-03
08/27	09/03	2.94E 08	CC	09/13	2.6 ± 0.3 E-02	09/06	L.T. 1. E-02
09/03	09/10	2.85E 08	CC	09/20	2.4 ± 0.3 E-02	09/12	L.T. 1. E-02
09/10	09/17	2.96E 08	CC	09/26	1.7 ± 0.3 E-02	09/20	L.T. 1. E-02
09/17	09/24	2.96E 08	CC	10/02	2.0 ± 0.3 E-02	09/29	L.T. 2. E-02
09/24	10/01	2.81E 08	CC	10/09	1.7 ± 0.3 E-02	10/05	L.T. 9. E-03
10/01	10/08	2.83E 08	CC	10/18	2.5 ± 0.3 E-02	10/13	L.T. 1. E-02
10/08	10/15	2.96E 08	CC	10/25	3.0 ± 0.3 E-02	10/19	L.T. 9. E-03
10/15	10/22	3.00E 08	CC	11/01	2.8 ± 0.3 E-02	10/26	L.T. 9. E-03
10/22	10/29	2.88E 08	CC	11/07	1.9 ± 0.3 E-02	11/02	L.T. 2. E-02
10/29	11/05	3.76E 08	CC	11/14	3.0 ± 0.3 E-02	11/09	L.T. 7. E-03
11/05	11/12	3.42E 08	CC	11/22	3.2 ± 0.3 E-02	11/14	L.T. 7. E-03
11/05*	11/12	3.42E 08	CC	11/22	3.2 ± 0.3 E-02	11/14	L.T. 7. E-03
11/12	11/19	3.55E 08	CC	11/26	3.3 ± 0.3 E-02	11/22	L.T. 7. E-03
11/19	11/26	3.52E 08	CC	12/06	2.1 ± 0.3 E-02	11/30	L.T. 1. E-02
11/26	12/03	3.46E 08	CC	12/19	3.2 ± 0.3 E-02	12/13	L.T. 1. E-02
12/03	12/10	3.68E 08	CC	12/21	2.9 ± 0.3 E-02	12/17	L.T. 2. E-02
12/10	12/17	3.28E 08	CC	01/02	2.7 ± 0.3 E-02	12/23	L.T. 1. E-02
12/17	12/23	2.86E 08	CC	01/06	2.2 ± 0.3 E-02	12/28	L.T. 1. E-02
12/23	12/30	3.48E 08	CC	01/13	3.0 ± 0.3 E-02	01/02	L.T. 6. E-03

\*Duplicate Analysis



## WOLF CREEK NUCLEAR OPERATING CORPORATION

## AIR PARTICULATE AND CHARCOAL FILTERS

## STATION NUMBER 40

COLLECTION START DATE	DATE STOP DATE	VOLUME	UNITS	MID COUNT TIME DATE	A P FILTER GROSS BETA (pCi/Cu.M.)	MID COUNT TIME DATE	CHARCOAL FILTER I-131 (pCi/Cu.M.)
12/23*	12/30	3.48E 08	CC	01/22	2.9 ± 0.3 E-02	01/03	L.T. 1. E-02

\*Duplicate Analysis

## WOLF CREEK NUCLEAR OPERATING CORPORATION

AIR PARTICULATE FILTERS  
EXPOSURE PATHWAY - AIRBORNE

## ISOTOPIC ANALYSIS ON QUARTERLY COMPOSITE

(pCi/Cu.M.)

STATION NUMBER 02

DATE COLLECTED:	01/02-04/02	04/02-07/02	07/02-10/01	10/01-12/30
GAMMA SPECTRUM ANALYSIS:				
BE-7	5.94±0.72 E-02	5.09±0.74 E-02	6.16±0.67 E-02	5.91±0.59 E-02
K-40	LT. 1. E-02	LT. 9. E-03	LT. 8. E-03	5.30±2.43 E-03
MN-54	LT. 5. E-04	LT. 5. E-04	LT. 3. E-04	LT. 3. E-04
CO-58	LT. 5. E-04	LT. 4. E-04	LT. 5. E-04	LT. 3. E-04
FE-59	LT. 1. E-03	LT. 1. E-03	LT. 1. E-03	LT. 6. E-04
CO-60	LT. 5. E-04	LT. 5. E-04	LT. 5. E-04	LT. 3. E-04
ZN-65	LT. 1. E-03	LT. 1. E-03	LT. 7. E-04	LT. 6. E-04
NB-95/ZR-95	LT. 5. E-04	LT. 6. E-04	LT. 4. E-04	LT. 2. E-04
RU-103	LT. 7. E-04	LT. 7. E-04	LT. 4. E-04	LT. 3. E-04
RU-106	LT. 4. E-03	LT. 4. E-03	LT. 3. E-03	LT. 2. E-03
I-131	LT. 6. E-03	LT. 6. E-06	LT. 2. E-03	LT. 1. E-03
CS-134	LT. 4. E-04	LT. 4. E-04	LT. 4. E-04	LT. 3. E-04
CS-137	LT. 6. E-04	LT. 5. E-04	LT. 4. E-04	LT. 3. E-04
LA-140/BA-140	LT. 3. E-03	LT. 2. E-03	LT. 1. E-03	LT. 9. E-04
CE-141	LT. 1. E-03	LT. 1. E-03	LT. 7. E-04	LT. 5. E-04
CE-144	LT. 3. E-03	LT. 3. E-03	LT. 2. E-03	LT. 1. E-03
RA-226	LT. 1. E-03	LT. 9. E-03	LT. 8. E-03	LT. 4. E-03
TH-228	LT. 8. E-04	LT. 8. E-04	LT. 7. E-04	LT. 5. E-04

## WOLF CREEK NUCLEAR OPERATING CORPORATION

AIR PARTICULATE FILTERS  
EXPOSURE PATHWAY - AIRBORNE

## ISOTOPIC ANALYSIS ON QUARTERLY COMPOSITE

(pCi/Ca.M.)

STATION NUMBER 03

DATE COLLECTED:	01/02-04/02	04/02-07/02	07/02-10/02	10/01-12/30
GAMMA SPECTRUM ANALYSIS:				
BE-7	5.75±0.71 E-02	7.71±0.85 E-02	7.50±0.84 E-02	5.18±0.52 E-02
K-40	LT. 1. E-02	LT. 1. E-02	7.64±4.05 E-03	LT. 7. E-05
MN-54	LT. 5. E-04	LT. 5. E-04	LT. 4. E-04	LT. 3. E-04
CO-58	LT. 6. E-04	LT. 6. E-04	LT. 7. E-04	LT. 4. E-04
FE-59	LT. 2. E-03	LT. 1. E-03	LT. 1. E-03	LT. 8. E-04
CO-60	LT. 6. E-04	LT. 7. E-04	LT. 7. E-04	LT. 5. E-04
ZN-65	LT. 1. E-03	LT. 1. E-03	LT. 1. E-03	LT. 7. E-04
N3-95/ZR-95	LT. 7. E-04	LT. 5. E-04	LT. 8. E-04	LT. 4. E-04
RU-103	LT. 8. E-04	LT. 7. E-04	LT. 8. E-04	LT. 5. E-04
RU-106	LT. 4. E-03	LT. 4. E-03	LT. 5. E-03	LT. 3. E-03
I-131	LT. 7. E-03	LT. 5. E-03	LT. 3. E-03	LT. 2. E-03
CS-134	LT. 5. E-04	LT. 5. E-04	LT. 7. E-04	LT. 4. E-04
CS-137	LT. 5. E-04	LT. 5. E-04	LT. 6. E-04	LT. 4. E-04
LA-140/BA-140	LT. 2. E-03	LT. 3. E-03	LT. 2. E-03	LT. 1. E-03
CE-141	LT. 1. E-03	LT. 1. E-03	LT. 2. E-03	LT. 6. E-04
CE-144	LT. 3. E-03	LT. 3. E-03	LT. 5. E-03	LT. 2. E-03
RA-226	LT. 8. E-03	LT. 8. E-03	LT. 1. E-02	LT. 6. E-03
TH-228	LT. 9. E-04	LT. 1. E-03	LT. 1. E-03	LT. 7. E-04

## WOLF CREEK NUCLEAR OPERATING CORPORATION

AIR PARTICULATE FILTERS  
EXPOSURE PATHWAY - AIRBORNE

## ISOTOPIC ANALYSIS ON QUARTERLY COMPOSITE

(pCi/Cu.M.)

STATION NUMBER 32

DATE COLLECTED:	01/02-04/02	04/02-07/02	07/02-10/01	10/01-12/30
GAMMA SPECTRUM ANALYSIS:				
BE-7	5.93±0.8 E-02	6.41±0.67 E-02	6.07±0.66 E-02	6.41±0.64 E-02
K-40	LT. 1. E-02	LT. 9. E-03	LT. 2. E-02	1.07±0.44 E-02
MN-54	LT. 6. E-04	LT. 4. E-04	LT. 5. E-04	LT. 5. E-04
CO-58	LT. 6. E-04	LT. 5. E-04	LT. 7. E-04	LT. 5. E-04
FE-59	LT. 2. E-03	LT. 1. E-03	LT. 2. E-03	LT. 1. E-03
CO-60	LT. 6. E-04	LT. 6. E-04	LT. 6. E-04	LT. 5. E-04
ZN-65	LT. 1. E-03	LT. 1. E-03	LT. 1. E-03	LT. 1. E-03
NB-95/ZR-95	LT. 7. E-04	LT. 6. E-04	LT. 7. E-04	LT. 6. E-04
RU-103	LT. 1. E-03	LT. 7. E-04	LT. 7. E-04	LT. 7. E-04
RU-106	LT. 5. E-03	LT. 4. E-03	LT. 6. E-03	LT. 5. E-03
I-131	LT. 8. E-03	LT. 5. E-03	LT. 3. E-03	LT. 3. E-03
CS-134	LT. 7. E-04	LT. 4. E-04	LT. 6. E-04	LT. 6. E-04
CS-137	LT. 6. E-04	LT. 5. E-04	LT. 6. E-04	LT. 6. E-04
LA-140/BA-140	LT. 4. E-03	LT. 3. E-03	LT. 2. E-03	LT. 2. E-03
CE-141	LT. 1. E-03	LT. 1. E-03	LT. 8. E-04	LT. 1. E-03
CE-144	LT. 3. E-03	LT. 2. E-03	LT. 3. E-03	LT. 4. E-03
RA-226	LT. 1. E-02	LT. 9. E-03	LT. 8. E-03	LT. 9. E-03
TH-228	LT. 1. E-03	LT. 8. E-04	LT. 8. E-04	LT. 1. E-03

## WOLF CREEK NUCLEAR OPERATING CORPORATION

AIR PARTICULATE FILTERS  
EXPOSURE PATHWAY - AIRBORNE

## ISOTOPIC ANALYSIS ON QUARTERLY COMPOSITE

(pCi/Cu M.)

STATION NUMBER 37

DATE COLLECTED:	01/02-04/02	07/02-10/01	10/01-12/30
GAMMA SPECTRUM ANALYSIS:			
BE-7	6.52±0.75 E-02	7.27±0.78 E-02	4.79±0.61 E-02
K-40	LT. 2. E-02	LT. 9. E-03	1.18±0.59 E-02
MN-54	LT. 6. E-04	LT. 4. E-04	LT. 6. E-04
CO-58	LT. 7. E-04	LT. 4. E-04	LT. 6. E-04
FE-59	LT. 2. E-03	LT. 1. E-03	LT. 1. E-03
CO-60	LT. 6. E-04	LT. 5. E-04	LT. 6. E-04
ZN-65	LT. 1. E-03	LT. 1. E-03	LT. 1. E-03
NB-95/ZR-95	LT. 8. E-04	LT. 6. E-04	LT. 7. E-04
RU-103	LT. 9. E-04	LT. 7. E-04	LT. 7. E-04
RU-106	LT. 6. E-03	LT. 4. E-03	LT. 5. E-03
I-131	LT. 7. E-03	LT. 2. E-03	LT. 3. E-03
CS-134	LT. 6. E-04	LT. 5. E-04	LT. 6. E-04
CS-137	LT. 6. E-04	LT. 7. E-04	LT. 6. E-04
LA-140/Ba-140	LT. 4. E-03	LT. 2. E-03	LT. 2. E-03
CE-141	LT. 1. E-03	LT. 9. E-04	LT. 1. E-03
CE-144	LT. 3. E-03	LT. 3. E-03	LT. 3. E-03
RA-226	LT. 9. E-03	LT. 9. E-03	LT. 9. E-03
TH-228	LT. 8. E-04	LT. 9. E-04	LT. 8. E-04



## WOLF CREEK NUCLEAR OPERATING CORPORATION

AIR PARTICULATE FILTERS  
EXPOSURE PATHWAY - AIRBORNE

## ISOTOPIC ANALYSIS ON QUARTERLY COMPOSITE

(pCi/Ci.M.)

STATION NUMBER 40

DATE COLLECTED:	01/02-04/02	04/02-07/02	07/02-10/01	10/01-12/30
GAMMA SPECTRUM ANALYSIS:				
BE-7	7.59±0.80 E-02	7.44±0.94 E-02	6.36±0.86 E-02	5.32±0.62 E-02
K-40	L.T. 8. E-03	L.T. 9. E-03	L.T. 2. E-02	1.53±0.60 E-02
MN-54	L.T. 4. E-04	L.T. 5. E-04	L.T. 7. E-04	L.T. 5. E-04
CO-58	L.T. 4. E-04	L.T. 5. E-04	L.T. 7. E-04	L.T. 6. E-04
FE-59	L.T. 1. E-03	L.T. 1. E-03	L.T. 2. E-03	L.T. 1. E-03
CO-60	L.T. 4. E-04	L.T. 6. E-04	L.T. 8. E-04	L.T. 6. E-04
ZN-65	L.T. 1. E-03	L.T. 1. E-03	L.T. 2. E-03	L.T. 1. E-03
NB-95/ZR-95	L.T. 5. E-04	L.T. 6. E-04	L.T. 9. E-04	L.T. 7. E-04
RU-103	L.T. 6. E-04	L.T. 6. E-04	L.T. 9. E-04	L.T. 7. E-04
RU-106	L.T. 4. E-03	L.T. 4. E-03	L.T. 6. E-03	L.T. 5. E-03
I-131	L.T. 6. E-03	L.T. 5. E-03	L.T. 3. E-03	L.T. 3. E-03
CS-134	L.T. 5. E-04	L.T. 5. E-04	L.T. 8. E-04	L.T. 6. E-04
CS-137	L.T. 5. E-04	L.T. 5. E-04	L.T. 7. E-04	L.T. 6. E-04
LA-140/BA-140	L.T. 2. E-03	L.T. 3. E-03	L.T. 2. E-03	L.T. 2. E-03
CE-141	L.T. 1. E-03	L.T. 1. E-03	L.T. 1. E-03	L.T. 9. E-04
CE-144	L.T. 3. E-03	L.T. 3. E-03	L.T. 4. E-03	L.T. 3. E-03
RA-226	L.T. 8. E-03	L.T. 9. E-03	L.T. 1. E-02	L.T. 8. E-03
TH-228	L.T. E-04	L.T. 8. E-04	L.T. 1. E-03	L.T. 7. E-04

## WOLF CREEK NUCLEAR OPERATING CORPORATION

EXPOSURE PATHWAY - AIRBORNE  
THERMOLUMINESCENT DOSIMETERS

(net mR/day)

STATION NUMBER	FIRST QUARTER 01/03/91-04/03/91	SECOND QUARTER 04/03/91-07/03/91	THIRD QUARTER 07/03/91-10/02/91	FOURTH QUARTER 10/02/91-01/08/92
STA-01	0.175±0.008	0.177±0.024	0.178±0.022	0.184±0.014
STA-02	0.145±0.020	0.146±0.007	0.151±0.008	0.161±0.010
STA-03	0.186±0.004	0.173±0.038	0.159±0.018	0.175±0.014
STA-04	0.170±0.011	0.158±0.010	0.170±0.005	0.154±0.064
STA-05	0.161±0.009	0.169±0.018	0.157±0.010	0.167±0.010
STA-06	0.160±0.032	0.143±0.005	0.166±0.032	0.155±0.012
STA-07	0.157±0.011	0.138±0.013	0.154±0.016	0.155±0.016
STA-08	0.181±0.008	0.161±0.019	0.159±0.011	0.181±0.016
STA-09	0.151±0.014	0.149±0.007	0.160±0.004	0.178±0.018
STA-10	0.171±0.008	0.167±0.009	0.175±0.022	0.172±0.015
STA-11	0.193±0.015	0.168±0.020	0.185±0.010	0.185±0.015
STA-12	0.171±0.013	0.154±0.021	0.171±0.005	0.174±0.009
STA-13	0.177±0.023	0.171±0.054	0.182±0.009	0.180±0.015
STA-14	0.180±0.009	0.154±0.009	0.183±0.005	0.177±0.012
STA-15	0.144±0.007	0.148±0.014	0.169±0.008	0.175±0.014
STA-16	*	0.157±0.016	0.166±0.010	0.167±0.012
STA-17	0.144±0.012	0.141±0.011	0.171±0.014	0.164±0.024
STA-18	0.151±0.012	0.264±0.054	0.285±0.101	0.182±0.010
STA-19	0.150±0.010	0.159±0.015	0.177±0.009	0.169±0.009
STA-20	0.150±0.009	0.149±0.018	0.178±0.016	0.166±0.032
STA-21	0.127±0.005	0.137±0.011	0.147±0.004	0.161±0.023
STA-22	0.146±0.010	0.157±0.013	0.169±0.012	0.163±0.016
STA-23	0.154±0.011	0.151±0.013	0.166±0.015	0.171±0.002
STA-24	0.146±0.003	0.157±0.013	0.168±0.009	0.179±0.011

\*TLD missing

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AIRBORNE  
THERMOLUMINESCENT DOSIMETERS

(net mR/day)

STATION NUMBER	FIRST QUARTER 01/03/91-04/09/91	SECOND QUARTER 04/09/91-07/03/91	THIRD QUARTER 07/03/91-10/02/91	FOURTH QUARTER 10/02/91-01/08/92
STA 25	0.132±0.009	0.120±0.010	0.099±0.079	0.137±0.014
STA 26	0.130±0.003	0.133±0.013	0.151±0.012	0.160±0.021
STA 27	0.159±0.008	0.151±0.015	0.177±0.011	0.178±0.019
STA 28	0.127±0.007	0.137±0.011	0.164±0.013	0.146±0.005
STA 29	0.120±0.001	0.135±0.010	0.144±0.012	0.144±0.013
STA 30	0.151±0.007	0.149±0.012	0.161±0.015	0.162±0.014
STA 31	0.146±0.007	0.168±0.022	0.164±0.004	0.169±0.015
STA 32	0.139±0.007	0.140±0.010	0.159±0.015	0.171±0.014
STA 33	0.163±0.009	0.169±0.015	0.182±0.015	0.157±0.020
STA 34	0.152±0.007	0.161±0.011	0.183±0.031	0.186±0.009
STA 35	0.150±0.005	0.163±0.014	0.195±0.016	0.179±0.034
STA 36	0.148±0.005	0.158±0.011	0.178±0.018	0.163±0.012
STA 37	0.139±0.010	0.147±0.013	0.151±0.053	0.167±0.011
STA 38	0.159±0.008	0.167±0.021	0.201±0.005	0.180±0.025
STA 39	0.148±0.008	0.152±0.018	0.163±0.016	0.175±0.011
STA 40	0.133±0.003	0.130±0.010	0.159±0.005	0.150±0.024
STA 41	0.159±0.023	0.155±0.020	0.194±0.019	0.182±0.014
STA 42	0.099±0.015	0.100±0.009	0.111±0.005	0.114±0.008
STA 43	0.104±0.003	0.095±0.002	0.103±0.007	0.104±0.013

## WOLF CREEK NUCLEAR OPERATING CORPORATION

EXPOSURE PATHWAY - AIRBORNE  
THERMOLUMINESCENT DOSIMETERS

(incl mR/day)

STATION NUMBER	FIRST QUARTER 01/03/91-04/02/91	SECOND QUARTER 04/03/91-07/02/91	THIRD QUARTER 07/03/91-10/02/91	FOURTH QUARTER 10/02/91-01/02/92
STA-01	0.188±0.005	0.204±0.003	0.167±0.008	0.175±0.005
STA-02	0.160±0.004	0.158±0.008	0.152±0.012	0.170±0.019
STA-03	0.175±0.008	0.144±0.049	0.159±0.010	0.169±0.010
STA-04	0.191±0.013	0.172±0.029	0.162±0.005	0.206±0.035
STA-05	0.162±0.004	0.161±0.029	0.158±0.024	0.155±0.009
STA-06	0.169±0.004	0.162±0.009	0.152±0.009	0.184±0.013
STA-07	0.168±0.030	0.150±0.019	0.150±0.022	0.146±0.015
STA-08	0.192±0.008	0.179±0.015	0.173±0.012	0.177±0.007
STA-09	0.164±0.008	0.151±0.013	0.144±0.010	0.155±0.009
STA-10	0.194±0.008	0.172±0.009	0.205±0.005	0.171±0.008
STA-11	0.201±0.003	0.183±0.008	0.171±0.031	0.184±0.014
STA-12	0.184±0.005	0.162±0.009	0.170±0.005	0.171±0.016
STA-13	0.196±0.014	0.174±0.009	0.179±0.013	0.171±0.023
STA-14	0.184±0.010	0.201±0.013	0.167±0.012	0.174±0.010
STA-15	0.180±0.009	0.160±0.011	0.172±0.013	0.174±0.012
STA-16	*	0.169±0.013	0.163±0.011	0.167±0.014
STA-17	0.181±0.009	0.169±0.010	0.168±0.012	0.161±0.031
STA-18	0.177±0.008	0.200±0.059	0.303±0.092	0.179±0.026
STA-19	0.183±0.008	0.163±0.016	0.172±0.012	0.161±0.011
STA-20	0.181±0.010	0.173±0.008	0.172±0.009	0.178±0.011
STA-21	0.144±0.016	0.140±0.007	0.148±0.007	0.149±0.012
STA-22	0.173±0.010	0.169±0.012	0.157±0.014	0.167±0.010
STA-23	0.197±0.013	0.163±0.019	0.163±0.021	0.138±0.076
STA-24	0.178±0.015	0.164±0.008	0.174±0.005	0.170±0.012

\* TLD missing

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AIRBORNE  
THERMOLUMINESCENT DOSIMETERS  
(net mrad/day)

STATION NUMBER	FIRST QUARTER 01/03/91-04/09/91	SECOND QUARTER 04/09/91-07/03/91	THIRD QUARTER 07/03/91-10/02/91	FOURTH QUARTER 10/02/91-01/08/92
STA 25	0.145±0.012	0.135±0.012	0.141±0.003	0.170±0.021
STA 26	0.158±0.007	0.151±0.010	0.155±0.012	0.167±0.013
STA 27	0.174±0.005	0.163±0.004	0.174±0.020	0.178±0.022
STA 28	0.154±0.003	0.155±0.008	0.140±0.007	0.158±0.013
STA 29	0.147±0.008	0.137±0.016	0.122±0.008	0.145±0.004
STA 30	0.158±0.003	0.155±0.013	0.168±0.004	0.167±0.011
STA 31	0.171±0.012	0.168±0.009	0.177±0.022	0.168±0.011
STA 32	0.169±0.016	0.154±0.010	0.183±0.011	0.166±0.013
STA 33	0.185±0.019	0.178±0.009	0.193±0.025	0.173±0.022
STA 34	0.188±0.005	0.150±0.012	0.183±0.008	0.179±0.011
STA 35	0.185±0.004	0.171±0.009	0.174±0.009	0.172±0.014
STA 36	0.179±0.005	0.160±0.012	0.174±0.005	0.177±0.015
STA 37	0.168±0.020	0.167±0.018	0.162±0.007	0.169±0.008
STA 38	0.194±0.014	0.129±0.093	0.186±0.014	0.181±0.018
STA 39	0.173±0.013	0.161±0.008	0.166±0.007	0.173±0.010
STA 40	0.170±0.003	0.149±0.013	0.154±0.012	0.154±0.003
STA 41	0.208±0.008	0.164±0.012	0.182±0.010	0.181±0.014
STA 42	0.126±0.002	0.095±0.008	0.102±0.012	0.121±0.004
STA 43	0.118±0.004	0.095±0.008	0.104±0.022	0.106±0.007



WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FEED & FORAGE - CORN

(pCi/GM DRY)

STATION NUMBER NRD1

DATE COLLECTED: 10/22

GAMMA SPECTRUM ANALYSIS:

BE-7	LT. 1.	E-01
K-40	2.91±0.29	E-00
MN-54	LT. 1.	E-02
CO-58	LT. 1.	E-02
FE-59	LT. 3.	E-02
CO-60	LT. 1.	E-02
ZN-65	LT. 2.	E-02
NB-95/ZR-95	LT. 1.	E-02
RU-103	LT. 1.	E-02
RU-106	LT. 1.	E-01
I-131	LT. 2.	E-02
CS-134	LT. 1.	E-02
CS-137	LT. 1.	E-02
LA-140/BA-140	LT. 2.	E-02
CE-141	LT. 2.	E-02
CE-144	LT. 9.	E-02
RA-226	LT. 3.	E-01
TH-228	LT. 2.	E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FEED & FORAGE - SOYBEANS

(pCi/GM DRY)

STATION NUMBER NRD2

DATE COLLECTED: 10/22

GAMMA SPECTRUM ANALYSIS:

BE-7	L.T. 2	E-01
K-40	1.56±0.16	E-01
MN-54	L.T. 2	E-02
CO-58	L.T. 2	E-02
FE-59	L.T. 5	E-02
CO-60	L.T. 2	E-02
ZN-65	L.T. 5	E-02
NB-95/ZR-95	L.T. 2	E-02
RU-103	L.T. 2	E-02
RU-106	L.T. 2	E-01
I-131	L.T. 3	E-02
CS-134	L.T. 2	E-02
CS-137	L.T. 2	E-02
LA-140/BA-140	L.T. 2	E-02
CE-141	L.T. 3	E-02
CE-144	L.T. 1	E-01
RA-226	L.T. 4	E-01
TH-228	L.T. 4	E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FEED & FORAGE - CORN

(pCi/GM DRY)

STATION NUMBER NRD2

DATE COLLECTED: 09/17

GAMMA SPECTRUM ANALYSIS:

BE-7	L.T. 1.	E-01
K-40	3.00±0.30	E-00
MN-54	L.T. 1.	E-02
CO-58	L.T. 2.	E-02
FE-59	L.T. 4.	E-02
CO-60	L.T. 2.	E-02
ZN-65	L.T. 3.	E-02
NB-95/ZR-95	L.T. 2.	E-02
RU-103	L.T. 2.	E-02
RU-106	L.T. 1.	E-01
I-131	L.T. 3.	E-02
CS-134	L.T. 2.	E-02
CS-137	L.T. 2.	E-02
LA-140/BA-140	L.T. 2.	E-02
CE-141	L.T. 3.	E-02
CE-144	L.T. 1.	E-01
RA-226	L.T. 4.	E-01
TH-228	L.T. 4.	E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FEED & FORAGE - CORN

(pCi/GM DRY)

STATION NUMBER NRUI

DATE COLLECTED: 09/24

GAMMA SPECTRUM ANALYSIS:

BE-7	LT. 5.	E-02
K-40	2.04±0.20	E 00
MN-54	LT. 4.	E-03
CO-58	LT. 5.	E-03
FE-59	LT. 1.	E-02
CO-60	LT. 4.	E-03
ZN-65	LT. 1.	E-02
NB-95/ZR-95	LT. 5.	E-03
RU-103	LT. 6.	E-03
RU-106	LT. 4.	E-02
I-131	LT. 5.	E-02
CS-134	LT. 4.	E-03
CS-137	LT. 4.	E-03
LA-140/BA-140	LT. 2.	E-02
CE-141	LT. 1.	E-02
CE-144	LT. 3.	E-02
RA-226	LT. 7.	E-02
TH-228	LT. 7.	E-03

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FISH

(pCi/GM WET)

STATION NUMBER DC

DATE COLLECTED:	04/02
	WALLEYE
GAMMA SPECTRUM ANALYSIS:	
BE-7	L.T. 1. E-01
K-40	4.07±0.41 E 00
MN-54	L.T. 1. E-02
CO-58	L.T. 1. E-02
FE-59	L.T. 3. E-02
CO-60	L.T. 1. E-02
ZN-65	L.T. 3. E-02
NB-95/TR-95	L.T. 1. E-02
RU-103	L.T. 2. E-02
RU-106	L.T. 1. E-01
I-131	L.T. 6. E-02
CS-134	L.T. 1. E-02
CS-137	L.T. 1. E-02
LA-140 A-140	L.T. 3. E-02
CE-141	L.T. 3. E-02
CE-144	L.T. 8. E-02
RA-226	L.T. 3. E-01
TH-228	L.T. 2. E-02



WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

## FISH

(pCi/GM WET)

STATION NUMBER JRR

DATE COLLECTED:	04/16 BUFFALO	09/19 BUFFALO	09/19 GAME COMPOSITE*
GAMMA SPECTRUM ANALYSIS:			
BE-7	L.T. 1. E-01	L.T. 3. E-01	L.T. 1. E-00
K-40	2.91±0.29 E-00	3.42±0.41 E-00	1.43±0.14 E-01
MN-54	L.T. 2. E-02	L.T. 2. E-02	L.T. 8. E-02
CO-58	L.T. 2. E-02	L.T. 3. E-02	L.T. 1. E-01
FE-59	L.T. 4. E-02	L.T. 1. E-01	L.T. 4. E-01
CO-60	L.T. 2. E-02	L.T. 2. E-02	L.T. 8. E-02
ZN-65	L.T. 4. E-02	L.T. 6. E-02	L.T. 2. E-01
NB-95/ZR-95	L.T. 2. E-02	L.T. 4. E-02	L.T. 1. E-01
RU-103	L.T. 2. E-02	L.T. 6. E-02	L.T. 2. E-01
RU-106	L.T. 1. E-01	L.T. 2. E-01	L.T. 7. E-01
I-131	L.T. 4. E-02	L.T. 3. E-00	L.T. 1. E-01
CS-134	L.T. 2. E-02	L.T. 2. E-02	L.T. 8. E-02
CS-137	L.T. 2. E-02	L.T. 2. E-02	L.T. 7. E-02
LA-140/BA-140	L.T. 3. E-02	L.T. 5. E-01	L.T. 1. E-00
CE-141	L.T. 3. E-02	L.T. 8. E-02	L.T. 4. E-01
CE-144	L.T. 1. E-01	L.T. 1. E-01	L.T. 6. E-01
RA-226	L.T. 3. E-01	L.T. 3. E-01	L.T. 2. E-00
TH-228	L.T. 3. E-02	L.T. 3. E-02	L.T. 1. E-01

\*Game fish composite (channel catfish, crappie, white bass)

WOLF CREEK : NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

## FISH

(pCi/GM WET)

## STATION NUMBER WCCL

DATE COLLECTED:	04/02 CRAPPIE	04/02 CARP	10/09 CHANNEL CAT	10/09 BUFFALO	10/09 WHITES
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 2 E-01	LT. 2 E-01	LT. 4 E-01	LT. 5 E-01	LT. 4 E-01
K-40	9.98±1.00 E-09	3.16±0.32 E-00	3.40±0.47 E-00	2.80±0.55 E-00	4.39±0.44 E-00
MN-54	LT. 2 E-02	LT. 1 E-02	LT. 3 E-02	LT. 3 E-02	LT. 3 E-02
CO-58	LT. 2 E-02	LT. 2 E-02	LT. 4 E-02	LT. 4 E-02	LT. 4 E-02
FE-59	LT. 5 E-02	LT. 4 E-02	LT. 9 E-02	LT. 1 E-01	LT. 1 E-01
CO-60	LT. 2 E-02	LT. 2 E-02	LT. 3 E-02	LT. 3 E-02	LT. 3 E-02
ZN-65	LT. 4 E-02	LT. 3 E-02	LT. 6 E-02	LT. 8 E-02	LT. 7 E-02
NB 95/ZR 95	LT. 2 E-02	LT. 1 E-02	LT. 3 E-02	LT. 5 E-02	LT. 4 E-02
RU-103	LT. 2 E-02	LT. 2 E-02	LT. 5 E-02	LT. 7 E-02	LT. 5 E-02
RU-106	LT. 2 E-01	LT. 1 E-01	LT. 2 E-01	LT. 3 E-01	LT. 3 E-01
I-131	LT. 7 E-02	LT. 6 E-02	LT. 9 E-01	LT. 1 E-00	LT. 1 E-00
CS-134	LT. 2 E-02	LT. 2 E-02	LT. 2 E-02	LT. 3 E-02	LT. 3 E-02
CS-137	LT. 2 E-02	LT. 2 E-02	LT. 3 E-02	LT. 3 E-02	LT. 4 E-02
LA 140/BA 140	LT. 4 E-02	LT. 3 E-02	LT. 3 E-01	LT. 2 E-01	LT. 2 E-01
CE-141	LT. 5 E-02	LT. 3 E-02	LT. 9 E-02	LT. 1 E-01	LT. 8 E-02
CE-144	LT. 2 E-01	LT. 1 E-01	LT. 2 E-01	LT. 3 E-01	LT. 2 E-01
RA-226	LT. 4 E-01	LT. 3 E-01	LT. 5 E-01	LT. 9 E-01	LT. 5 E-01
TH-228	LT. 4 E-02	LT. 3 E-02	LT. 5 E-02	LT. 8 E-02	LT. 5 E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FOOD/GARDEN CROPS

(PCI/GM WET)

STATION NUMBER A-1

DATE COLLECTED:	05/28 SWISS CHARD	06/25 SWISS CHARD	07/23 SW CHARD	08/27 SW CHARD	09/24 SW CHARD
GAMMA SPECTRUM ANALYSIS:					
BE-7	4.10±0.92 E-01	1.02±0.17 E-00	6.05±1.34 E-01	8.87±1.15 E-01	3.69±0.81 E-01
K-40	4.84±0.48 E-00	1.62±0.16 E-01	1.44±0.14 E-01	1.41±0.14 E-01	5.32±0.53 E-00
MN-54	LT. 6. E-03	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 8. E-03
CO-58	LT. 9. E-03	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 9. E-03
FE-59	LT. 2. E-02	LT. 5. E-02	LT. 4. E-02	LT. 4. E-02	LT. 3. E-02
CO-60	LT. 1. E-02	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 8. E-03
ZN-65	LT. 2. E-02	LT. 5. E-02	LT. 5. E-02	LT. 3. E-02	LT. 2. E-02
NB-95/ZR-95	LT. 9. E-03	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 9. E-03
Rb-103	LT. 1. E-02	LT. 3. E-02	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02
RU-106	LT. 8. E-02	LT. 2. E-01	LT. 2. E-01	LT. 3. E-01	LT. 8. E-02
I-131	LT. 2. E-02	LT. 1. E-02	LT. 4. E-02	LT. 6. E-02	LT. 5. E-02
CS-134	LT. 9. E-03	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 9. E-03
CS-137	LT. 1. E-02	LT. 2. E-02	LT. 2. E-02	LT. 4. E-02	LT. 9. E-03
LA-140/BA-140	LT. 2. E-02	LT. 5. E-02	LT. 3. E-02	LT. 3. E-02	LT. 2. E-02
CE-141	LT. 2. E-02	LT. 5. E-02	LT. 4. E-02	LT. 2. E-02	LT. 2. E-02
CE-144	LT. 8. E-02	LT. 2. E-01	LT. 1. E-01	LT. 7. E-02	LT. 6. E-02
RA-226	LT. 2. E-01	LT. 5. E-01	LT. 4. E-01	LT. 2. E-01	LT. 1. E-01
TH-228	LT. 2. E-02	LT. 4. E-02	LT. 4. E-02	LT. 2. E-02	LT. 1. E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FOOD/GARDEN CROPS

(PCI/GM WET)

STATION NUMBER A-1

DATE COLLECTED:

10/22

SWISS CHARD

GAMMA SPECTRUM ANALYSIS:

BE-7	2.5J±0.89	E-01
K-40	1.05±0.11	E-01
MN-54	LT. 1.	E-02
CO-58	LT. 1.	E-02
FE-59	LT. 3.	E-02
CO-60	LT. 1.	E-02
ZN-65	LT. 3.	E-02
NB-95/ZR-95	LT. 1.	E-02
RU-103	LT. 1.	E-02
RU-106	LT. 1.	E-01
I-131	LT. 2.	E-02
CS-134	LT. 1.	E-02
CS-137	LT. 1.	E-02
LA-140/BA-140	LT. 2.	E-02
CE-141	LT. 2.	E-02
CE-144	LT. 7.	E-02
RA-226	LT. 2.	E-01
TH-228	LT. 2.	E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FOOD/GARDEN CROPS

(PCI/GM WET)

STATION NUMBER G-1

DATE COLLECTED:	06/25 BL VEGETABLES	07/23 LETTUCE	09/24 LETTUCE
GAMMA SPECTRUM ANALYSIS:			
BE-7	7.13±1.40 E-01	3.33±1.02 E-01	4.66±0.71 E-01
K-40	6.37±0.64 E-00	5.32±0.53 E-00	6.81±0.68 E-00
MN-54	L.T. 2 E-02	L.T. 1 E-02	L.T. 7 E-03
CO-58	L.T. 2 E-02	L.T. 1 E-02	L.T. 8 E-03
FE-59	L.T. 4 E-02	L.T. 3 E-02	L.T. 2 E-02
CO-60	L.T. 2 E-02	L.T. 1 E-02	L.T. 8 E-03
ZN-65	L.T. 4 E-02	L.T. 3 E-02	L.T. 2 E-02
NB-95/ZR-95	L.T. 2 E-02	L.T. 1 E-02	L.T. 9 E-03
RU-103	L.T. 2 E-02	L.T. 1 E-02	L.T. 1 E-02
RU-106	L.T. 1 E-01	L.T. 1 E-01	L.T. 7 E-02
I-131	L.T. 2 E-02	L.T. 3 E-02	L.T. 6 E-02
CS-134	L.T. 2 E-02	L.T. 2 E-02	L.T. 8 E-03
CS-137	L.T. 2 E-02	L.T. 1 E-02	2.18±0.66 E-02
LA-140/BA-140	L.T. 4 E-02	L.T. 2 E-02	L.T. 2 E-02
CE-141	L.T. 3 E-02	L.T. 2 E-02	L.T. 2 E-02
CE-144	L.T. 1 E-01	L.T. 9 E-02	L.T. 5 E-02
RA-226	L.T. 3 E-01	L.T. 3 E-01	L.T. 2 E-01
TH-228	L.T. 3 E-02	L.T. 2 E-02	5.41±0.67 E-02



WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FOOD/GARDEN CROPS

(PCI/GM WET)

STATION NUMBER R 1

DATE COLLECTED:	05/28 LETTUCE	06/25 LETTUCE	07/23 LETTUCE
GAMMA SPECTRUM ANALYSIS:			
BE-7	8.48±1.20 E-01	3.72±1.19 E-01	2.20±0.23 E-00
K-40	4.36±0.44 E-00	8.92±0.89 E-00	2.14±0.21 E-01
MN-54	LT. 1. E-02	LT. 1. E-02	LT. 2. E-02
CO-58	LT. 1. E-02	LT. 2. E-02	LT. 3. E-02
FE-59	LT. 3. E-02	LT. 4. E-02	LT. 7. E-02
CO-60	LT. 1. E-02	LT. 1. E-02	LT. 3. E-02
ZN-65	LT. 3. E-02	LT. 3. E-02	LT. 7. E-02
NB-95/ZR-95	LT. 1. E-02	LT. 2. E-02	LT. 3. E-02
RU-103	LT. 1. E-02	LT. 2. E-02	LT. 3. E-02
RU-106	LT. 1. E-01	LT. 1. E-01	LT. 2. E-01
I-131	LT. 3. E-02	LT. 2. E-02	LT. 5. E-02
CS-134	LT. 1. E-02	LT. 2. E-02	LT. 3. E-02
CS-137	LT. 2. E-02	LT. 2. E-02	4.31±1.18 E-02
LA-140/BA-140	LT. 2. E-02	LT. 4. E-02	LT. 3. E-02
CE-141	LT. 3. E-02	LT. 3. E-02	LT. 3. E-02
CE-144	LT. 1. E-01	LT. 9. E-02	LT. 1. E-01
RA-226	LT. 1. E-01	LT. 3. E-01	5.80±2.98 E-01
TH-228	LT. 3. E-02	LT. 2. E-01	1.04±0.23 E-01

**WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION**

FOOD/GARDEN CROPS

(PCI/GM WET)

STATION NUMBER S-4

DATE COLLECTED:	05/28 CABBAGE	06/25 CABBAGE	*06/25 CABBAGE	07/23 CABBAGE	08/27 CABBAGE
GAMMA SPECTRUM ANALYSIS:					
BE-7	4.54±0.89 E-01	5.49±1.54 E-01	4.28±1.10 E-01	7.58±1.20 E-01	6.11±0.85 E-01
K-40	3.05±0.31 E-00	2.95±0.30 E-00	4.21±0.42 E-00	5.35±0.53 E-00	1.46±0.15 E-00
MN-54	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	LT. 1. E-02	LT. 8. E-03
CO-58	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	LT. 1. E-02	LT. 9. E-03
FE-59	LT. 2. E-02	LT. 4. E-02	LT. 3. E-02	LT. 3. E-02	LT. 2. E-02
CO-60	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	LT. 1. E-02	LT. 8. E-03
ZN-65	LT. 2. E-02	LT. 4. E-02	LT. 3. E-02	LT. 3. E-02	LT. 2. E-03
NB-95/ZR-95	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	LT. 1. E-02	LT. 9. E-03
RU-103	LT. 1. E-02	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 1. E-02
RU-106	LT. 9. E-02	LT. 2. E-01	LT. 1. E-01	LT. 1. E-01	LT. 8. E-02
I-131	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02	LT. 3. E-02	LT. 4. E-02
CS-134	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	LT. 1. E-02	LT. 8. E-03
CS-137	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	2.13±1.06 E-02	LT. 9. E-03
LA-140/BA-140	LT. 2. E-02	LT. 4. E-02	LT. 3. E-02	LT. 2. E-02	LT. 2. E-02
CE-141	LT. 2. E-02	LT. 3. E-02	LT. 3. E-02	LT. 2. E-02	LT. 2. E-02
CE-144	LT. 6. E-02	LT. 1. E-01	LT. 1. E-01	LT. 8. E-02	LT. 5. E-02
RA-226	LT. 2. E-01	LT. 4. E-01	LT. 3. E-01	LT. 3. E-01	LT. 2. E-01
TH-228	LT. 2. E-02	LT. 3. E-02	LT. 2. E-02	LT. 2. E-02	LT. 1. E-02

\*Duplicate Analysis

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

FOOD/GARDEN CROPS

(PCI/GM WET)

STATION NUMBER S-4

DATE COLLECTED:	09/24
	CABBAGE
GAMMA SPECTRUM ANALYSIS:	
BE-7	6.36±0.64 E-01
K-40	3.00±0.30 E-02
MN-54	L.T. 6. E-03
CO-58	L.T. 7. E-03
FE-59	L.T. 2. E-02
CO-60	L.T. 6. E-03
ZN-65	L.T. 2. E-02
NB-95/ZR-95	L.T. 7. E-03
RU-103	L.T. 8. E-03
RU-106	L.T. 5. E-02
I-131	L.T. 4. E-02
CS-134	L.T. 6. E-03
CS-137	L.T. 6. E-03
LA-140/BA-140	L.T. 2. E-02
CE-141	L.T. 1. E-02
CE-144	L.T. 4. E-02
RA-226	L.T. 1. E-01
TH-228	L.T. 1. E-02

\*Duplicate Analysis

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - INGESTION**

MILK

(PCI/LITER)

STATION NUMBER S-3

DATE COLLECTED:	01/08	02/12	03/13	03/13*	04/09
<b>RADIOCHEMICAL ANALYSIS:</b>					
I-131	LT. 2 E-01	LT. 2 E-01	LT. 4 E-01	LT. 5.0 E-01	LT. 2 E-01
<b>GAMMA SPECTRUM ANALYSIS:</b>					
BE-7	LT. 4 E-01	LT. 3 E-01	LT. 3 E-01	LT. 3 E-01	LT. 4 E-01
K-40	1.59±0.16 E-03	1.18±0.12 E-03	1.31±0.13 E-03	1.36±0.14 E-03	1.24±0.12 E-03
MN-54	LT. 5 E-00	LT. 4 E-00	LT. 3 E-00	LT. 3 E-00	LT. 5 E-00
CO-58	LT. 5 E-00	LT. 4 E-00	LT. 3 E-00	LT. 3 E-00	LT. 5 E-00
FE-59	LT. 1 E-01	LT. 9 E-00	LT. 8 E-00	LT. 9 E-00	LT. 1 E-01
CO-60	LT. 5 E-00	LT. 4 E-00	LT. 4 E-00	LT. 4 E-00	LT. 5 E-00
ZN-65	LT. 1 E-01	LT. 9 E-00	LT. 9 E-00	LT. 9 E-00	LT. 1 E-01
NB-95/ZR-95	LT. 5 E-00	LT. 4 E-00	LT. 3 E-00	LT. 3 E-00	LT. 5 E-00
RU-103	LT. 5 E-00	LT. 4 E-00	LT. 4 E-00	LT. 4 E-00	LT. 6 E-00
RU-106	LT. 4 E-01	LT. 3 E-01	LT. 3 E-01	LT. 3 E-01	LT. 4 E-01
I-131	LT. 4 E-01	LT. 7 E-00	LT. 6 E-00	LT. 6 E-00	LT. 9 E-00
CS-134	LT. 6 E-00	LT. 4 E-00	LT. 4 E-00	LT. 5 E-00	LT. 5 E-00
CS-137	LT. 6 E-00	LT. 4 E-00	LT. 4 E-00	LT. 4 E-00	LT. 6 E-00
LA-140/BA-140	LT. 7 E-00	LT. 6 E-00	LT. 4 E-00	LT. 5 E-00	LT. 7 E-00
CE-141	LT. 9 E-00	LT. 8 E-00	LT. 7 E-00	LT. 7 E-00	LT. 9 E-00
CE-144	LT. 4 E-01	LT. 3 E-01	LT. 3 E-01	LT. 3 E-01	LT. 3 E-01
RA-226	LT. 1 E-02	LT. 8 E-01	LT. 9 E-01	LT. 8 E-01	LT. 9 E-01
TH-228	LT. 1 E-01	LT. 7 E-00	LT. 7 E-00	LT. 7 E-00	LT. 9 E-00

\*Duplicate Analysis

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - INGESTION**

**MILK**  
**(PCI/LITER)**

**STATION NUMBER S-3**

DATE COLLECTED:	04/23	05/14	05/28	06/11	06/25
RADIOCHEMICAL ANALYSIS:					
I-131	LT. 2 E-01	LT. 2 E-01	LT. 1 E-01	LT. 1 E-01	LT. 1 E-01
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 4 E 01	LT. 3 E 01	LT. 3 E 01	LT. 4 E 01	LT. 3 E 01
K-40	9.38±0.94 E 02	1.41±0.14 E 03	1.25±0.12 E 03	1.54±0.15 E 03	1.37±0.14 E 03
MN-54	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 5 E 00	LT. 3 E 00
CO-58	LT. 4 E 00	LT. 4 E 00	LT. 3 E 00	LT. 5 E 00	LT. 3 E 00
FE-59	LT. 1 E 01	LT. 9 E 00	LT. 8 E 00	LT. 1 E 01	LT. 8 E 00
CO-60	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 6 E 00	LT. 4 E 00
ZN-65	LT. 1 E 01	LT. 9 E 00	LT. 8 E 00	LT. 1 E 01	LT. 9 E 00
NB-95/ZR-95	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 5 E 00	LT. 3 E 00
RU-103	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00	LT. 6 E 00	LT. 4 E 00
RU-106	LT. 4 E 01	LT. 3 E 01	LT. 3 E 01	LT. 5 E 01	LT. 3 E 01
I-131	LT. 9 E 00	LT. 7 E 00	LT. 7 E 00	LT. 1 E 01	LT. 7 E 00
CS-134	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00	LT. 6 E 00	LT. 4 E 00
CS-137	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00	LT. 6 E 00	LT. 4 E 00
LA-140/BA-140	LT. 6 E 00	LT. 6 E 00	LT. 5 E 00	LT. 8 E 00	LT. 5 E 00
CE-141	LT. 8 E 00	LT. 6 E 00	LT. 8 E 00	LT. 9 E 00	LT. 7 E 00
CE-144	LT. 3 E 01	LT. 2 E 01	LT. 3 E 01	LT. 4 E 01	LT. 3 E 01
RA-226	LT. 9 E 01	LT. 7 E 01	LT. 8 E 01	LT. 1 E 02	LT. 8 E 01
TH-228	LT. 8 E 00	LT. 7 E 00	LT. 7 E 00	LT. 1 E 01	LT. 7 E 00



**WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION**

**M.LK**

**(PCI/LITER)**

**STATION NUMBER S-3**

DATE COLLECTED:	07/02	07/23	08/13	08/27	09/10
RADIOCHEMICAL ANALYSIS:					
I-131	LT. 2 E-01	LT. 1 E-01	LT. 6 E-01	LT. 9 E-02	LT. 2 E-01
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 3 E 01	LT. 4 E 01	LT. 4 E 01	LT. 3 E 01	LT. 4 E 01
K-40	1.41±0.14 E 03	1.10±0.11 E 03	9.00±0.90 E 02	1.26±0.13 E 03	1.26±0.13 E 03
MN-54	LT. 3 E 00	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 5 E 00
CO-58	LT. 3 E 00	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00
FE-59	LT. 9 E 00	LT. 1 E 01	LT. 1 E 01	LT. 9 E 00	LT. 1 E 01
CO-60	LT. 3 E 00	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00	LT. 5 E 00
ZN-65	LT. 8 E 00	LT. 1 E 01	LT. 1 E 01	LT. 9 E 00	LT. 1 E 01
NB-95/ZR-95	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 4 E 00	LT. 5 E 00
RU-103	LT. 4 E 00	LT. 5 E 00	LT. 5 E 00	LT. 4 E 00	LT. 5 E 00
RU-106	LT. 3 E 01	LT. 4 E 01	LT. 4 E 01	LT. 3 E 01	LT. 4 E 01
I-131	LT. 1 E 01	LT. 8 E 00	LT. 8 E 00	LT. 8 E 00	LT. 9 E 00
CS-134	LT. 3 E 00	LT. 5 E 00	LT. 5 E 00	LT. 4 E 00	LT. 5 E 00
CS-137	LT. 4 E 00	LT. 5 E 00	LT. 5 E 00	LT. 4 E 00	LT. 6 E 00
LA-140/BA-140	LT. 8 E 00	LT. 7 E 00	LT. 7 E 00	LT. 6 E 00	LT. 8 E 00
CE-141	LT. 8 E 00	LT. 8 E 00	LT. 8 E 00	LT. 6 E 00	LT. 8 E 00
CE-144	LT. 3 E 01	LT. 3 E 01	LT. 3 E 01	LT. 2 E 01	LT. 3 E 01
RA-226	LT. 7 E 01	LT. 9 E 01	LT. 9 E 01	LT. 7 E 01	LT. 9 E 01
TH-228	LT. 6 E 00	LT. 8 E 00	LT. 8 E 00	LT. 6 E 00	LT. 1 E 01

**WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION**

**MILK  
(PCI/LITER)**

**STATION NUMBER S-3**

DATE COLLECTED:	09/24		10/08		10/22		11/12		11/26	
RADIOCHEMICAL ANALYSIS:										
I-131	LT. 2	E-01	LT. 1	E-01	LT. 2	E-01	LT. 2	E-01	LT. 2	E-01
GAMMA SPECTRUM ANALYSIS:										
BE-7	LT. 4	E 01	LT. 4	E 01	LT. 3	E 01	LT. 3	E 01	LT. 3	E 01
K-40	1.26±0.13 E 03		1.45±0.14 E 03		1.22±0.12 E 03		1.22±0.12 E 03		1.17±0.12 E 03	
MN-54	LT. 5	E 00	LT. 5	E 00	LT. 3	E 00	LT. 4	E 00	LT. 3	E 00
CO-58	LT. 4	E 00	LT. 5	E 00	LT. 4	E 00	LT. 4	E 00	LT. 4	E 00
FE-59	LT. 1	E 01	LT. 1	E 01	LT. 9	E 00	LT. 9	E 00	LT. 9	E 00
CO-60	LT. 6	E 00	LT. 6	E 00	LT. 4	E 00	LT. 4	E 00	LT. 4	E 00
ZN-65	LT. 1	E 01	LT. 1	E 01	LT. 8	E 00	LT. 9	E 00	LT. 1	E 01
NB-95/ZR-95	LT. 5	E 00	LT. 5	E 00	LT. 4	E 00	LT. 4	E 00	LT. 4	E 00
RU-103	LT. 5	E 00	LT. 5	E 00	LT. 4	E 00	LT. 4	E 00	LT. 4	E 00
RU-106	LT. 4	E 01	LT. 5	E 01	LT. 3	E 01	LT. 3	E 01	LT. 3	E 01
I-131	LT. 1	E 01	LT. 9	E 00	LT. 1	E 01	LT. 6	E 00	LT. 8	E 00
CS-134	LT. 6	E 00	LT. 5	E 00	LT. 4	E 00	LT. 4	E 00	LT. 4	E 00
CS-137	LT. 6	E 00	LT. 6	E 00	LT. 5	E 00	LT. 4	E 00	LT. 4	E 00
LA-140/BA-140	LT. 8	E 00	LT. 7	E 00	LT. 7	E 00	LT. 5	E 00	LT. 6	E 00
CE-141	LT. 9	E 00	LT. 8	E 00	LT. 7	E 00	LT. 8	E 00	LT. 8	E 00
CE-144	LT. 3	E 01	LT. 3	E 01	LT. 3	E 01	LT. 3	E 01	LT. 3	E 01
RA-226	LT. 1	E 02	LT. 9	E 01	LT. 7	E 01	LT. 8	E 01	LT. 8	E 01
TH-228	LT. 1	E 01	LT. 1	E 01	LT. 6	E 00	LT. 7	E 00	LT. 7	E 00

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - INGESTION

MILK

(PCI/LITER)

STATION NUMBER S-3

DATE COLLECTED:	12/10	
RADIOCHEMICAL ANALYSIS:		
I-131	LT. 2	E-01
GAMMA SPECTRUM ANALYSIS:		
BE-7	LT. 3	E-01
K-40	1.20±0.12	E-03
MN-54	LT. 3	E-00
CO-58	LT. 2	E-00
FE-59	LT. 7	E-00
CO-60	LT. 4	E-00
ZN-65	LT. 8	E-00
NB 95/ZR-95	LT. 3	E-00
RU-103	LT. 4	E-00
RU-106	LT. 3	E-01
I-131	LT. 6	E-00
CS-134	LT. 4	E-00
CS-137	LT. 5	E-00
LA-140/BA-140	LT. 5	E-00
CE-141	LT. 6	E-00
CE-144	LT. 2	E-01
RA-226	LT. 7	E-01
TH-228	LT. 6	E-00

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AQUATIC

SEDIMENT/SILT

(pCi/GM DRY)

STATION NUMBER DC

DATE COLLECTED: 04/16

09/19

GAMMA SPECTRUM ANALYSIS:

BE-7	LT. 4. E-01	LT. 3. E-01
K-40	1.37±0.14 E 01	1.43±0.14 E 01
MN-54	LT. 5. E-02	LT. 3. E-02
CO-58	LT. 5. E-02	LT. 3. E-02
FE-59	LT. 1. E-01	LT. 8. E-02
CO-60	1.36±0.59 E-01	6.58±0.66 E 01
ZN-65	LT. 1. E-01	LT. 7. E-01
NB-95/ZR-95	LT. 6. E-02	LT. 4. E-02
RU-103	LT. 5. E-02	LT. 4. E-02
RU-106	LT. 4. E-01	LT. 2. E-01
I-131	LT. 1. E-01	LT. 2. E-01
CS-134	LT. 6. E-02	LT. 4. E-02
CS-137	4.46±0.57 E-01	4.63±0.46 E-01
LA-140/BA-140	LT. 9. E-02	LT. 1. E-01
CE-141	LT. 8. E-02	LT. 6. E-02
CE-144	LT. 3. E-01	LT. 2. E-01
RA-226	2.14±0.61 E 00	1.97±0.39 E 00
TH-228	1.28±0.13 E 00	1.36±0.14 E 00

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AQUATIC

SEDIMENT SILT

(pCi/gm DRY)

STATION NUMBER JRR

DATE COLLECTED:

04/16

09/19

GAMMA SPECTRUM ANALYSIS:

BE-7	L.T. 4. E-01	L.T. 2. E-01
K-40	1.44±0.14 E 01	1.5±0.15 E 01
MN-54	L.T. 4. E-02	L.T. 2. E-02
CO-58	L.T. 4. E-02	L.T. 2. E-02
FE-59	L.T. 1. E-01	L.T. 5. E-02
CC-60	L.T. 4. E-02	L.T. 2. E-02
ZN-65	L.T. 9. E-02	L.T. 5. E-02
NB-95/ZR-95	L.T. 5. E-02	L.T. 3. E-02
RU-103	L.T. 5. E-02	L.T. 3. E-02
RU-106	L.T. 4. E-01	L.T. 2. E-01
I-131	L.T. 2. E-01	L.T. 2. E-01
CS-134	L.T. 5. E-02	L.T. 2. E-02
CS-137	2.25±0.43 E-01	2.55±0.25 E-01
LA-140/BA-140	L.T. 2. E-01	L.T. 6. E-02
CE-141	L.T. 9. E-02	L.T. 5. E-02
CE-144	L.T. 3. E-01	L.T. 1. E-01
RA-226	1.61±0.66 E 00	2.21±0.34 E 00
TH-228	1.27±0.13 E 00	1.32±0.13 E 00



WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AQUATIC

SEDIMENT SILT

(pCi/GM DRY)

STATION NUMBER UHS

DATE COLLECTED: 09/19

GAMMA SPECTRUM ANALYSIS:

BE-7	LT. 3. E-01
K-40	1.28±0.13 E 01
MN-54	LT. 3. E-2
CO-58	LT. 3. E-02
FE-59	LT. 8. E-02
CO-60	5.96±2.51 E-02
ZN-65	LT. 8. E-02
NB-95/ZR-95	LT. 4. E-02
RU-103	LT. 4. E-02
RU-106	LT. 3. E-01
I-131	LT. 2. E-01
CS-134	LT. 4. E-02
CS-137	2.86±0.33 E-01
LA-140/BA-140	LT. 1. E-01
CE-141	LT. 7. E-02
CE-144	LT. 2. E-01
RA-226	2.07±0.49 E 00
Th-228	1.21±0.12 E 00

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AQUATIC

SHORELINE SOIL

(pCi/GM DRY)

STATION NUMBER DC

DATE COLLECTED: 04/16

10/09

GAMMA SPECTRUM ANALYSIS:

BE-7	LT. 4. E-01	LT. 5. E-01
K-40	1.02±0.10 E 01	9.57±0.96 E 00
MN-54	LT. 4. E-02	LT. 5. E-02
CO-58	LT. 4. E-02	7.58±3.98 E-02
CO-59	LT. 9. E-02	LT. 1. E-01
CO-60	LT. 4. E-02	7.15±0.72 E-01
ZN-65	LT. 8. E-02	LT. 9. E-02
NB-95/ZR-95	LT. 4. E-02	LT. 6. E-02
RU-103	LT. 5. E-02	LT. 7. E-02
RU-106	LT. 3. E-01	LT. 4. E-01
I-131	LT. 2. E-01	LT. 8. E-01
CS-134	LT. 4. E-02	LT. 5. E-02
CS-137	LT. 4. E-02	LT. 5. E-02
LA-140/BA-140	LT. 1. E-01	LT. 3. E-01
CE-141	LT. 7. E-02	LT. 1. E-01
CE-144	LT. 2. E-01	LT. 2. E-01
RA-226	1.47±0.50 E 00	2.77±0.59 E 00
TH-228	8.79±0.88 E-01	1.25±0.13 E 00

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AQUATIC

SHORELINE SOIL

(pCi/GM DRY)

STATION NUMBER JRR

DATE COLLECTED: 04/16

GAMMA SPECTRUM ANALYSIS:

BE-7	LT. 3.	E-01
K-40	1.18±0.12	E-01
MN-54	LT. 3.	E-02
CO-58	LT. 3.	E-02
FE-59	LT. 9.	E-02
CO-60	LT. 3.	E-02
ZN-65	LT. 9.	E-02
NB-95/ZR-95	LT. 5.	E-02
RU-103	LT. 5.	E-02
RU-106	LT. 3.	E-01
I-131	LT. 2.	E-01
CS-134	LT. 4.	E-02
CS-137	LT. 3.	E-02
LA-140/BA-140	LT. 8.	E-02
CE-141	LT. 8.	E-02
CE-144	LT. 7.	E-01
RA-226	1.55±0.53	E-00
TH-228	1.42±0.14	E-00

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - AQUATIC

VEGETATION - AQUATIC

(pCi/GM WET)

STATION NUMBER DC

DATE COLLECTED: 10/15

GAMMA SPECTRUM ANALYSIS:

BE-7	5.91±1.70 E-01
K-40	2.11±0.21 E 00
CR-51	5.61±1.49 E-01
MN-54	4.86±0.49 E-01
CO-58	1.27±0.13 E 00
FE-59	L.T. 5. E-02
CO-60	2.33±0.23 E 00
ZN-65	L.T. 5. E-02
NB-95/ZR-95	L.T. 2. E-02
RU-103	L.T. 2. E-02
RU-106	L.T. 2. E-01
I-131	L.T. 5. E-02
CS-134	7.95±0.80 E-01
CS-137	1.24±0.12 E 00
LA-140/BA-140	L.T. 2. E-02
CF-141	L.T. 3. E-02
CE-144	L.T. 1. E-01
RA-226	5.97±2.68 E-01
TH-228	2.99±0.30 E-01

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - WATERBORNE**

**DRINKING WATER**

(PCI/LITER)

STATION NUMBER BW15

DATE COLLECTED:	01/02-02/05	03/05-04/02	04/05	04/02-05/07	05/07-06/04
<b>RADIOCHEMICAL ANALYSIS:</b>					
GRB	1.2±0.2 E 01	5.6±2.1 E 00	8.0±1.4 E 00	9.1±1.6 E 00	8.5±1.6 E 00
I-131	LT. 2 E 01	LT. 1 E 01	LT. 3 E 01	LT. 1 E 01	LT. 1 E 01
<b>GAMMA SPECTRUM ANALYSIS:</b>					
EE-7	LT. 3 E 01	LT. 4 E 01	LT. 5 E 01	LT. 4 E 01	LT. 4 E 01
K-40	LT. 1 E 02	LT. 2 E 02	LT. 9 E 01	LT. 1 E 02	LT. 7 E 01
MN-54	LT. 3 E 00	LT. 4 E 00	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00
CO-58	LT. 4 E 00	LT. 4 E 00	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00
FE-59	LT. 7 E 00	LT. 1 E 01	LT. 1 E 01	LT. 8 E 00	LT. 9 E 00
CO-60	LT. 4 E 00	LT. 5 E 00	LT. 6 E 00	LT. 3 E 00	LT. 5 E 00
ZN-65	LT. 8 E 00	LT. 9 E 00	LT. 1 E 01	LT. 8 E 00	LT. 1 E 01
NB 95/ZR 95	LT. 4 E 00	LT. 5 E 00	LT. 5 E 00	LT. 4 E 00	LT. 4 E 00
RU-103	LT. 4 E 00	LT. 5 E 00	LT. 6 E 00	LT. 4 E 00	LT. 5 E 00
RU-106	LT. 3 E 01	LT. 4 E 01	LT. 5 E 01	LT. 3 E 01	LT. 4 E 01
I-131	LT. 5 E 00	LT. 1 E 01	LT. 1 E 01	LT. 1 E 01	LT. 9 E 00
CS-134	LT. 4 E 00	LT. 4 E 00	LT. 6 E 00	LT. 4 E 00	LT. 5 E 00
CS-137	LT. 4 E 00	LT. 5 E 00	LT. 6 E 00	LT. 4 E 00	LT. 4 E 00
LA-140/BA-140	LT. 5 E 00	LT. 7 E 00	LT. 8 E 00	LT. 7 E 00	LT. 7 E 00
CE-141	LT. 7 E 00	LT. 1 E 01	LT. 1 E 01	LT. 7 E 00	LT. 1 E 01
CE-144	LT. 3 E 01	LT. 4 E 01	LT. 4 E 01	LT. 3 E 01	LT. 4 E 01
RA-226	LT. 8 E 01	LT. 1 E 02	LT. 1 E 02	LT. 7 E 01	LT. 1 E 02
TH-228	LT. 6 E 00	LT. 9 E 00	LT. 1 E 01	LT. 6 E 00	LT. 1 E 01
<b>TRITIUM ANALYSIS:</b>	01/02-04/02*				
H-3	LT. 7 E 02				

\*Quarterly tritium analysis is without drinking water sample for 02/05-03/05. Grab sample obtained on 03/05 was included in composite. See Section IV, Monitoring Program Deviations.



**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - WALL-ROCK**

**DRINKING WATER**

(PCI/LITER)

**STATION NUMBER BW15**

DATE COLLECTED:	06/03-07/02	07/02-08/06	08/06-09/03	09/03-10/01
<b>RADIOCHEMICAL ANALYSIS:</b>				
GR B	8.2 ± 1.5 E 00	8.6 ± 1.4 E 00	8.6 ± 1.5 E 00	8.9 ± 1.4 E 00
I-131	L.T. 1. E 01	L.T. 1. E 01	L.T. 1. E 01	L.T. 1. E 01
<b>GAMMA SPECTRUM ANALYSIS:</b>				
BE-7	L.T. 4. E 01	L.T. 3. E 01	L.T. 3. E 01	L.T. 4. E 01
K-40	L.T. 7. E 01	L.T. 4. E 01	L.T. 1. E 02	L.T. 1. E 02
MN-54	L.T. 4. E 00	L.T. 2. E 00	L.T. 4. E 00	L.T. 4. E 00
CO-58	L.T. 4. E 00	L.T. 3. E 00	L.T. 4. E 00	L.T. 4. E 00
FE-59	L.T. 8. E 00	L.T. 6. E 00	L.T. 8. E 00	L.T. 1. E 01
CO-60	L.T. 5. E 00	L.T. 2. E 00	L.T. 4. E 00	L.T. 5. E 00
ZN-65	L.T. 8. E 00	L.T. 5. E 00	L.T. 8. E 00	L.T. 1. E 01
NB-95/ZR-95	L.T. 4. E 00	L.T. 3. E 00	L.T. 4. E 00	L.T. 5. E 00
RU-103	L.T. 5. E 00	L.T. 3. E 00	L.T. 4. E 00	L.T. 5. E 00
RU-106	L.T. 4. E 01	L.T. 2. E 01	L.T. 3. E 01	L.T. 4. E 01
I-131	L.T. 9. E 00	L.T. 1. E 01	L.T. 9. E 00	L.T. 1. E 01
CS-134	L.T. 4. E 00	L.T. 2. E 00	L.T. 4. E 00	L.T. 5. E 00
CS-137	L.T. 5. E 00	L.T. 3. E 00	L.T. 4. E 00	L.T. 5. E 00
LA-140/BA-140	L.T. 6. E 00	L.T. 7. E 00	L.T. 6. E 00	L.T. 9. E 00
CE-141	L.T. 1. E 01	L.T. 6. E 00	L.T. 7. E 00	L.T. 8. E 00
CE-144	L.T. 4. E 01	L.T. 2. E 01	L.T. 3. E 01	L.T. 3. E 01
RA-226	L.T. 1. E 02	L.T. 5. E 01	L.T. 8. E 01	L.T. 5. E 01
TH-228	L.T. 1. E 01	L.T. 5. E 00	L.T. 6. E 00	L.T. 8. E 00

**TRITIUM ANALYSIS:**

04/02-07/02

H-3

L.T. 6. E 02

07/02-10/01

L.T. 4. E 02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

DRINKING WATER

(PCI/LITER)

STATION NUMBER BW15

DATE COLLECTED:	11/05	11/05-12/03	12/06	12/06
RADIOCHEMICAL ANALYSIS:				
GR-B	7.1 ± 1.3 E 00	3.9 ± 1.6 E 00	7.0 ± 1.7 E 00	L.T. 2 E 01
I-131	L.T. 1 E 01		L.T. 1 E 00	
GAMMA SPECTRUM ANALYSIS:				
BE-7	L.T. 3 E 01	L.T. 3 E 01	L.T. 3 E 01	L.T. 3 E 01
K-40	L.T. 5 E 01	L.T. 7 E 01	L.T. 6 E 01	L.T. 6 E 01
MN-54	L.T. 3 E 00	L.T. 3 E 00	L.T. 3 E 00	L.T. 3 E 00
CO-58	L.T. 3 E 00	L.T. 3 E 00	L.T. 4 E 00	L.T. 4 E 00
FE-59	L.T. 6 E 00	L.T. 7 E 00	L.T. 8 E 00	L.T. 8 E 00
CO-60	L.T. 3 E 00	L.T. 4 E 00	L.T. 4 E 00	L.T. 4 E 00
ZN-65	L.T. 6 E 00	L.T. 7 E 00	L.T. 8 E 00	L.T. 8 E 00
N-395/ZR-95	L.T. 3 F 00	L.T. 4 E 00	L.T. 3 E 00	L.T. 3 E 00
RU-103	L.T. 3 E 00	L.T. 4 E 00	L.T. 4 E 00	L.T. 4 E 00
RU-106	L.T. 2 E 01	L.T. 3 E 01	L.T. 3 E 01	L.T. 3 E 01
I-131	L.T. 7 E 00	L.T. 8 E 00	L.T. 1 E 01	L.T. 1 E 01
CS-134	L.T. 3 E 00	L.T. 4 E 00	L.T. 4 E 00	L.T. 4 E 00
CS-137	L.T. 4 E 00	L.T. 4 E 00	L.T. 4 E 00	L.T. 4 E 00
LA-140/BA-140	L.T. 5 E 00	L.T. 6 E 00	L.T. 8 E 00	L.T. 8 E 00
CE-141	L.T. 7 E 00	L.T. 9 E 00	L.T. 8 E 00	L.T. 8 E 00
CE-144	L.T. 3 E 01	L.T. 4 E 01	L.T. 3 E 01	L.T. 3 E 01
RA-226	L.T. 8 E 01	L.T. 1 E 02	L.T. 7 E 01	L.T. 7 E 01
TH-228	L.T. 6 E 00	L.T. 9 E 00	L.T. 6 E 00	L.T. 6 E 00
TRITIUM ANALYSIS:	11/05 01/07			
H-3	L.T. 6 E 02			

**WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE**

**DRINKING WATER**

(PCI/LITER)

**STATION NUMBER LW40**

DATE COLLECTED:	01/02-02/05	03/05-04/02	03/05	04/02-05/07	05/07-06/04
<b>RADIOCHEMICAL ANALYSIS:</b>					
GR B	1.2 ± 0.2 E 01	6.7 ± 2.3 E 00	6.6 ± 1.3 E 00	6.8 ± 1.4 E 00	7.1 ± 1.5 E 00
I-131	L.T. 2	L.T. 1	L.T. 3	L.T. 1	L.T. 1
<b>GAMMA SPECTRUM ANALYSIS:</b>					
BE-7	L.T. 2	L.T. 4	L.T. 4	L.T. 3	L.T. 5
K-40	L.T. 5	L.T. 1	L.T. 1	L.T. 1	L.T. 2
MN-54	L.T. 3	L.T. 5	L.T. 4	L.T. 3	L.T. 5
CO-58	L.T. 2	L.T. 5	L.T. 4	L.T. 4	L.T. 5
FE-59	L.T. 5	L.T. 1	L.T. 9	L.T. 8	L.T. 1
CO-60	L.T. 3	L.T. 5	L.T. 4	L.T. 4	L.T. 6
ZN-65	L.T. 5	L.T. 1	L.T. 9	L.T. 7	L.T. 1
NB-95/ZR-95	L.T. 2	L.T. 5	L.T. 5	L.T. 4	L.T. 6
RU-103	L.T. 3	L.T. 5	L.T. 5	L.T. 4	L.T. 6
RU-106	L.T. 2	L.T. 4	L.T. 4	L.T. 3	L.T. 5
I-131	L.T. 4	L.T. 1	L.T. 8	L.T. 9	L.T. 1
CS-134	L.T. 3	L.T. 5	L.T. 5	L.T. 4	L.T. 6
CS-137	L.T. 4	L.T. 5	L.T. 5	L.T. 4	L.T. 6
LA-140/BA-140	L.T. 4	L.T. 8	L.T. 6	L.T. 7	L.T. 8
CE-141	L.T. 5	L.T. 9	L.T. 1	L.T. 9	L.T. 1
CE-144	L.T. 2	L.T. 3	L.T. 4	L.T. 3	L.T. 4
RA-226	L.T. 6	L.T. 9	L.T. 1	L.T. 9	L.T. 1
TH-228	L.T. 5	L.T. 8	L.T. 9	L.T. 7	L.T. 1
<b>TRITIUM ANALYSIS:</b>	01/02-04/02*				
H-3	L.T. 5	E 02			

\*Quarterly tritium analysis is without drinking water sample for 02/05-03/05. Grab sample obtained on 03/05 was included in composite. See Section IV. Monitoring Program Deviations.

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - WATERBORNE**

**DRINKING WATER**

(PCI/LITER)

STATION NUMBER LW40

DATE COLLECTED:	06/03-07/02	07/02-08/06	08/06-09/03	09/03-10/01
<b>RADIOCHEMICAL ANALYSIS:</b>				
GR B	8.4 ± 1.6 E 00	7.4 ± 1.4 E 00	6.6 ± 1.4 E 00	1.1 ± 0.2 E 01
I-131	LT 1. E 01	LT 1. E 01	LT 1. E 01	LT 1. E 01
<b>GAMMA SPECTRUM ANALYSIS:</b>				
BE-7	LT 4. 7 01	LT 3. E 01	LT 4. E 01	LT 4. E 01
K 40	LT 8. E 01	LT 4. E 01	LT 1. E 02	LT 1. 5 02
MN 54	LT 4. E 00	LT 3. E 00	LT 4. E 00	LT 4. E 00
CO-58	LT 4. E 00	LT 3. E 00	LT 4. E 00	LT 4. E 00
FE-59	LT 8. E 00	LT 6. E 00	LT 9. E 00	LT 9. E 00
CO-60	LT 5. E 00	LT 3. E 00	LT 4. E 00	LT 4. E 00
ZN 65	LT 1. E 01	LT 6. E 00	LT 8. E 00	LT 9. E 00
NB 95/ZR 95	LT 5. E 00	LT 3. E 00	LT 4. E 00	LT 4. E 00
RU-103	LT 5. E 00	LT 4. E 00	LT 5. E 00	LT 5. E 00
RU-106	LT 4. E 01	LT 2. E 01	LT 3. E 01	LT 4. E 01
I-131	LT 8. E 00	LT 1. E 01	LT 1. E 01	LT 1. E 01
CS-134	LT 5. E 00	LT 3. E 00	LT 4. E 00	LT 4. E 00
CS-137	LT 6. E 00	LT 3. E 00	LT 4. E 00	LT 5. E 00
LA-140/BA 14C	LT 7. E 00	LT 7. E 00	LT 7. E 00	LT 7. E 00
CE-141	LT 8. E 00	LT 7. E 00	LT 7. E 00	LT 9. E 00
CE-144	LT 3. E 01	LT 2. E 01	LT 3. E 01	LT 3. E 01
RA-226	LT 9. E 01	LT 6. E 01	LT 8. E 01	LT 9. E 01
TH-228	LT 1. F 01	LT 5. E 00	LT 7. E 00	LT 7. E 00
<b>TRITIUM ANALYSIS:</b>	04/02-07/02			07/02-10/01
H 3	LT 6. E 02			LT 4. E 02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

DRINKING WATER

(PCI/LITER)

STATION NUMBER LW40

DATE COLLECTED:	11/05	11/05-12/03	12/03-01/07	12/06
RADIOCHEMICAL ANALYSIS:				
GR B	6.9 ± 1.5 E 00	6.0 ± 1.9 E 00	7.3 ± 1.3 E 00	
I-131	LT. 2. E 01		LT. 1. E 00	LT. 2. E 01
GAMMA SPECTRUM ANALYSIS:				
BE 7	LT. 3. E 01	LT. 4. E 01	LT. 5. E 01	
K-40	LT. 5. E 01	LT. 1. E 02	LT. 1. E 02	
MN-54	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00	
CO-58	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00	
FE-59	LT. 6. E 00	LT. 1. E 01	LT. 1. E 01	
CO-60	LT. 5. E 00	LT. 4. E 00	LT. 5. E 00	
*N-65	LT. 7. E 00	LT. 1. E 01	LT. 1. E 01	
J-95/ZR-55	LT. 3. E 00	LT. 4. E 00	LT. 5. E 00	
U-103	LT. 4. E 00	LT. 5. E 00	LT. 6. E 00	
RU-106	LT. 3. E 01	LT. 4. E 01	LT. 4. E 01	
I-131	LT. 8. E 00	LT. 1. E 01	LT. 1. E 01	
CS-134	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00	
CS-137	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00	
LA 140/BA 140	LT. 5. E 00	LT. 8. E 00	LT. 9. E 00	
CE-141	LT. 7. E 00	LT. 9. E 00	LT. 9. E 00	
CE-144	LT. 3. E 01	LT. 3. E 01	LT. 3. E 01	
RA-226	LT. 7. E 01	LT. 1. E 02	LT. 9. E 01	
TH-228	LT. 5. E 00	LT. 9. E 00	LT. 8. E 00	
TRITIUM ANALYSIS:	11/05-01/07			
H-3	LT. 6. E 02			



WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

GROUND WATER

(PCI/LITER)

STATION NUMBER B-12

DATE COLLECTED:	03/12	05/21	08/20	11/19
RADIOCHEMICAL ANALYSIS:				
I-131	LT. 2. E-01	LT. 2. E-01	LT. 1. E-01	LT. 1. E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	LT. 3. E-01	LT. 4. E-01	L. 5. E-01	LT. 3. E-01
K-40	LT. 5. E-01	5.08±2.68 E-01	LT. 1. E-02	LT. 1. E-02
MN-54	LT. 3. E-00	LT. 3. E-00	LT. 5. E-00	LT. 3. E-00
CO-58	LT. 3. E-00	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00
FE-59	LT. 7. E-00	LT. 9. E-00	LT. 1. E-01	LT. 7. E-00
CO-60	LT. 3. E-00	LT. 3. E-00	LT. 4. E-00	LT. 4. E-00
ZN-65	LT. 7. E-00	LT. 8. E-00	LT. 1. E-01	LT. 9. E-00
NB-95/ZR-95	LT. 3. E-00	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00
RU-103	LT. 4. E-00	LT. 5. E-00	LT. 6. E-00	LT. 4. E-00
RU-106	LT. 3. E-01	LT. 3. E-01	LT. 4. E-01	LT. 3. E-01
I-131	LT. 1. E-01	LT. 1. E-01	LT. 2. E-01	LT. 7. E-00
CS-134	LT. 3. E-00	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00
CS-137	LT. 3. E-00	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00
LA-140/BA-140	LT. 7. E-00	LT. 8. E-00	LT. 1. E-01	LT. 5. E-00
CE-141	LT. 7. E-00	LT. 8. E-00	LT. 1. E-01	LT. 6. E-00
CE-144	LT. 2. E-01	LT. 3. E-01	LT. 4. E-01	LT. 2. E-01
RA-226	LT. 7. E-01	LT. 8. E-01	LT. 9. E-01	LT. 7. F-01
TH-228	LT. 6. E-00	LT. 7. E-00	LT. 8. E-00	LT. 6. E-00
TRITIUM ANALYSIS:				
H-3	LT. 1. E-02	LT. 1. E-02	1.4 ± 0.7 E-02	LT. 1. E-02

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - WATERBORNE**

**GROUND WATER**

(PCI/LITER)

STATION NUMBER C-10

DATE COLLECTED:	02/19	05/21	08/20	11/19
RADIOCHEMICAL ANALYSIS:				
I-131	LT. 3. E-01	LT. 1. E-01	LT. 1. E-01	LT. 2. E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	LT. 3. E-01	LT. 3. E-01	LT. 5. E-01	LT. 4. E-01
K-40	LT. 6. E-01	LT. 5. E-01	LT. 1. E-02	LT. 1. E-02
MN-54	LT. 3. E-00	LT. 3. E-00	LT. 5. E-00	LT. 4. E-00
CO-58	LT. 3. E-00	LT. 3. E-00	LT. 5. E-00	LT. 5. E-00
FE-59	LT. 6. E-00	LT. 7. E-00	LT. 1. E-01	LT. 1. E-01
CO-60	LT. 3. E-00	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00
ZN-65	LT. 6. E-00	LT. 7. E-00	LT. 1. E-01	LT. 1. E-01
NB-95/ZR-95	LT. 3. E-00	LT. 3. E-00	LT. 6. E-00	LT. 5. E-00
RU-103	LT. 4. E-00	LT. 4. E-00	LT. 6. E-00	LT. 5. E-00
RU-106	LT. 3. E-01	LT. 3. E-01	LT. 5. E-01	LT. 4. E-01
I-131	LT. 9. E-00	LT. 1. E-01	LT. 2. E-01	LT. 9. E-00
CS-134	LT. 3. E-00	LT. 3. E-00	LT. 5. E-00	LT. 5. E-00
CS-137	LT. 3. E-00	LT. 3. E-00	LT. 5. E-00	LT. 5. E-00
LA-140/BA-140	LT. 6. E-00	LT. 8. E-00	LT. 1. E-01	LT. 6. E-00
CE-141	LT. 8. E-00	LT. 6. E-00	LT. 1. E-01	LT. 8. E-00
CE-144	LT. 3. E-01	LT. 2. E-01	LT. 3. E-01	LT. 3. E-01
RA-226	LT. 9. E-01	LT. 6. E-01	LT. 9. E-01	LT. 9. E-01
TH-228	LT. 7. E-00	LT. 6. E-00	LT. 8. E-00	LT. 8. E-00
TRITIUM ANALYSIS:				
I-3	LT. 1. E-02	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

GROUND WATER

(PCI/LITER)

STATION NUMBER C-49

DATE COLLECTED:	02/19	05/21	08/20	11/19
RADIOCHEMICAL ANALYSIS:				
I-131	LT. 3. E-01	LT. 1. E-01	LT. 1. E-01	LT. 3. E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	LT. 4. E-01	LT. 4. E-01	LT. 4. E-01	LT. 4. E-01
K-40	LT. 1. E-02	LT. 1. E-02	LT. 1. E-02	LT. 1. E-02
MN-54	LT. 3. E-00	LT. 4. E-00	LT. 3. E-00	LT. 4. E-00
CO-58	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00	LT. 4. E-00
FE-59	LT. 8. E-00	LT. 1. E-01	LT. 8. E-00	LT. 9. E-00
CO-60	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00	LT. 4. E-00
Zn-65	LT. 8. E-00	LT. 1. E-01	LT. 8. E-00	LT. 9. E-00
NB-95/ZR-95	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00	LT. 4. E-00
RU-103	LT. 5. E-00	LT. 6. E-00	LT. 4. E-00	LT. 5. E-00
RU-106	LT. 3. E-01	LT. 4. E-01	LT. 3. E-01	LT. 5. E-00
I-131	LT. 1. E-01	LT. 2. E-01	LT. 1. E-01	LT. 4. E-01
CS-134	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00	LT. 9. E-00
CS-137	LT. 4. E-00	LT. 5. E-00	LT. 4. E-00	LT. 4. E-00
LA-140/BA-140	LT. 7. E-00	LT. 9. E-00	LT. 9. E-00	LT. 5. E-00
CE-141	LT. 8. E-00	LT. 9. E-00	LT. 8. E-00	LT. 6. E-00
CE-144	LT. 3. E-01	LT. 3. E-01	LT. 3. E-01	LT. 1. E-01
RA-226	LT. 8. E-01	LT. 9. E-01	LT. 8. E-01	LT. 4. E-01
TH-228	LT. 7. E-00	LT. 8. E-00	LT. 7. E-00	LT. 1. E-02
TRITIUM ANALYSIS:				
H-3	LT. 1. E-02	LT. 1. E-02	1.9 ± 0.9 E-02	LT. 2. E-02

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

GROUND WATER

(PCI/LITER)

STATION NUMBER D-65

DATE COLLECTED:	02/19	05/21	08/20	11/19	
RADIOCHEMICAL ANALYSIS:					
I-131	LT. 1. E-01	LT. 1. E-01	LT. 1. E-01	LT. 3. E-01	
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 3. E-01	LT. 4. E-01	LT. 5. E-01	LT. 3. E-01	
K-40	LT. 5. E-01	LT. 1. E-02	LT. 2. E-02	LT. 1. E-02	
MN-54	LT. 3. E-00	LT. 4. E-00	LT. 4. E-00	LT. 3. E-00	
CO-58	LT. 3. E-00	LT. 5. E-00	LT. 5. E-00	LT. 4. E-00	
FE-59	LT. 6. E-00	LT. 9. E-00	LT. 1. E-01	LT. 8. E-00	
CO-60	LT. 3. E-00	LT. 4. E-00	LT. 5. E-00	LT. 3. E-00	
ZN-65	LT. 6. E-00	LT. 9. E-00	LT. 1. E-01	LT. 8. E-00	
NB-95/ZR-95	LT. 3. E-00	LT. 5. E-00	LT. 5. E-00	LT. 4. E-00	
RU-103	LT. 3. E-01	LT. 5. E-01	LT. 6. E-01	LT. 4. E-01	
RU-106	LT. 3. E-01	LT. 4. E-01	LT. 4. E-01	LT. 3. E-01	
I-131	LT. 8. E-00	LT. 1. E-01	LT. 2. E-01	LT. 7. E-00	
CS-134	LT. 3. E-00	LT. 5. E-00	LT. 5. E-00	LT. 4. E-00	
CS-137	LT. 4. E-00	LT. 5. E-00	LT. 5. E-00	LT. 4. E-00	
LA-140/BA-140	LT. 6. E-00	LT. 1. E-01	LT. 1. E-01	LT. 6. E-00	
C-141	LT. 6. E-00	LT. 9. E-00	LT. 1. E-01	LT. 6. E-01	
CE-144	LT. 2. E-01	LT. 3. E-01	LT. 4. E-01	LT. 2. E-01	
RA-226	LT. 6. E-01	LT. 9. E-01	LT. 1. E-02	LT. 8. E-01	
TH-228	LT. 6. E-00	LT. 8. E-00	LT. 9. E-00	LT. 7. E-00	
TRITIUM ANALYSIS:					
H-3	LT. 1. E-02	LT. 1. E-02	LT. 1. E-02	LT. 1. E-02	

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

SURFACE WATER

(PCI/LITER)

STATION NUMBER DC

DATE COLLECTED:	01/15	02/19	03/19	04/16	05/21
GAMMA SPECTRUM ANALYSIS:					
BE 7	LT 3, E 01	LT 3, E 01	LT 5, E 01	LT 4, E 01	LT 5, E 01
K 40	LT 3, E 01	LT 6, E 01	LT 8, E 01	LT 4, E 01	LT 1, E 02
MN 54	LT 3, E 00	LT 3, E 00	LT 4, E 00	LT 4, E 00	LT 5, E 00
CO 58	LT 3, E 00	LT 3, E 00	LT 4, E 00	LT 4, E 00	LT 5, E 00
FE 59	LT 7, E 00	LT 8, E 00	LT 1, E 01	LT 8, E 00	LT 1, E 01
CO 60	LT 3, E 00	LT 4, E 00	LT 4, E 00	LT 4, E 00	LT 4, E 00
ZN 65	LT 7, E 00	LT 7, E 00	LT 8, E 00	LT 8, E 00	LT 1, E 01
NB 95/ZR 95	LT 4, E 00	LT 4, E 00	LT 5, E 00	LT 4, E 00	LT 5, E 00
RU 103	LT 4, E 00	LT 1, E 00	LT 5, E 00	LT 4, E 00	LT 6, E 00
RU 166	LT 3, E 01	LT 3, E 01	LT 4, E 01	LT 4, E 01	LT 4, E 01
I 131	LT 8, E 00	LT 1, E 01	LT 2, E 01	LT 1, E 01	LT 2, E 01
CS 134	LT 4, E 00	LT 4, E 00	LT 5, E 00	LT 4, E 00	LT 5, E 00
CS 137	LT 4, E 00	LT 4, E 00	LT 5, E 00	LT 4, E 00	LT 5, E 00
LA 140/BA 140	LT 7, E 00	LT 8, E 00	LT 1, E 01	LT 8, E 00	LT 1, E 01
CE 141	LT 8, E 00	LT 9, E 00	LT 1, E 01	LT 8, E 00	LT 1, E 01
CE 144	LT 3, E 01	LT 3, E 01	LT 4, E 01	LT 3, E 01	LT 3, E 01
RA 226	LT 9, E 01	LT 1, E 02	LT 1, E 02	LT 8, E 01	LT 9, E 01
TH 228	LT 8, E 00	LT 9, E 00	LT 1, E 01	LT 7, E 00	LT 8, E 00

TRITIUM ANALYSIS:

H-3	6.7 ± 0.6 E 03	6.4 ± 0.5 E 03	6.9 ± 0.7 E 03	6.6 ± 0.6 E 03	7.1 ± 0.6 E 03
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WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

SURFACE WATER

(PCI/LITER)

STATION NUMBER DC

DATE COLLECTED:	06/18	07/16	*07/16	08/20	09/17
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 4. E 01	LT. 3. E 01	LT. 3. E 01	LT. 4. E 01	LT. 4. E 01
K-40	LT. 1. E 02	LT. 6. E 01	LT. 5. E 01	LT. 1. E 02	LT. 1. E 02
MN-54	LT. 4. E 00	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 4. E 00
CO-58	LT. 4. E 00	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 4. E 00
FE-59	LT. 9. E 00	LT. 7. E 00	LT. 7. E 00	LT. 1. E 01	LT. 1. E 01
CO-60	LT. 4. E 00	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 4. E 00
ZN-65	LT. 8. E 00	LT. 6. E 00	LT. 6. E 00	LT. 9. E 00	LT. 9. E 00
NB 95/ZR 95	LT. 4. E 00	LT. 4. E 00	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00
RU-103	LT. 5. E 00	LT. 4. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00
RU-106	LT. 4. E 01	LT. 3. E 01	LT. 3. E 01	LT. 4. E 01	LT. 4. E 01
I-131	LT. 2. E 01	LT. 2. E 01	LT. 1. E 01	LT. 1. E 01	LT. 1. E 01
CS-134	LT. 4. E 00	LT. 3. E 00	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00
CS-137	LT. 4. E 00	LT. 4. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00
LA-140/BA-140	LT. 1. E 01	LT. 8. E 00	LT. 8. E 00	LT. 9. E 00	LT. 7. E 00
CE-141	LT. 9. E 00	LT. 1. E 01	LT. 7. E 00	LT. 1. E 01	LT. 9. E 00
CE-144	LT. 3. E 01	LT. 3. E 01	LT. 2. E 01	LT. 3. E 01	LT. 3. E 01
RA-226	LT. 8. E 01	LT. 9. E 01	LT. 6. E 01	LT. 9. E 01	LT. 9. E 01
TH-228	LT. 7. E 00	LT. 7. E 00	LT. 6. E 00	LT. 8. E 00	LT. 8. E 00
TRITIUM ANALYSIS:					
H-3	1.0 ± 0.1 E 04	8.6 ± 0.7 E 03	9.0 ± 0.7 E 03	8.3 ± 0.5 E 03	7.3 ± 0.6 E 03

\*Duplicate analysis

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

SURFACE WATER

(PCI/LITER)

STATION NUMBER DC

DATE COLLECTED:	10/15	11/19	12/17
GAMMA SPECTRUM ANALYSIS:			
BE-7	LT. 2. E 01	LT. 3. E 01	LT. 1. E 01
K-40	LT. 4. E 01	LT. 5. E 01	LT. 3. E 01
MN-54	LT. 2. E 00	LT. 3. E 00	LT. 1. E 00
CO-58	LT. 3. E 00	LT. 3. E 00	LT. 1. E 00
FE-59	LT. 5. E 00	LT. 7. E 00	LT. 3. E 00
CO-60	LT. 3. E 00	LT. 4. E 00	LT. 1. E 00
ZN-65	LT. 6. E 00	LT. 7. E 00	LT. 2. E 00
NB 95/ZR 95	LT. 3. E 00	LT. 3. E 00	LT. 1. E 00
RU-103	LT. 3. E 00	LT. 4. E 00	LT. 2. E 00
RU-106	LT. 2. E 01	LT. 3. E 01	LT. 1. E 01
I-131	LT. 7. E 00	LT. 6. E 00	LT. 2. E 01
CS-134	LT. 3. E 00	LT. 4. E 00	LT. 1. E 00
CS-137	LT. 4. E 00	LT. 4. E 00	LT. 1. E 00
LA-140/BA-140	LT. 5. E 00	LT. 5. E 00	LT. 7. E 00
CE-141	LT. 5. E 00	LT. 4. E 00	LT. 2. E 00
CE-144	LT. 2. E 01	LT. 2. E 01	LT. 5. E 00
RA-226	LT. 5. E 01	LT. 6. E 01	LT. 2. E 01
TH-228	LT. 5. E 00	LT. 6. E 00	LT. 1. E 00
TRITIUM ANALYSIS:			
H-3	8.5 ± 0.6 E 03	9.3 ± 0.7 E 03	7.3 ± 0.5 E 03

\*Duplicate analysis

**WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE**

**SURFACE WATER**

(PCI/LITER)

STATION NUMBER SP

DATE COLLECTED:	02/19	03/19	03/19 *	04/16	05/21
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 3. E 01	LT. 3. E 01	LT. 3. E 01	LT. 4. E 01	LT. 4. E 01
K-40	LT. 5. E 01	LT. 6. E 01	LT. 7. E 01	LT. 1. E 02	LT. 1. E 02
MN-54	LT. 3. E 00	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 4. E 00
CO-58	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 5. E 00	LT. 4. E 00
FE-59	LT. 7. E 00	LT. 9. E 00	LT. 8. E 00	LT. 1. E 01	LT. 1. E 01
CO-60	LT. 3. E 00	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 4. E 00
ZN-65	LT. 6. E 00	LT. 6. E 00	LT. 7. E 00	LT. 1. E 01	LT. 9. E 00
NB-95/ZR-95	LT. 3. E 00	LT. 4. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00
RU-103	LT. 4. E 00	LT. 4. E 00	LT. 5. E 00	LT. 6. E 00	LT. 5. E 00
RU-106	LT. 3. E 01	LT. 3. E 01	LT. 3. E 01	LT. 4. E 01	LT. 4. E 01
I-131	LT. 9. E 00	LT. 1. E 01	LT. 1. E 01	LT. 2. E 01	LT. 2. E 01
CS-134	LT. 3. E 00	LT. 3. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00
CS-137	LT. 4. E 00	LT. 3. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00
LA-140/BA-140	LT. 7. E 00	LT. 6. E 00	LT. 7. E 00	LT. 1. E 01	LT. 1. E 01
CE-141	LT. 6. E 00	LT. 9. E 00	LT. 1. E 01	LT. 9. E 00	LT. 1. E 01
CE-144	LT. 2. E 01	LT. 3. E 01	LT. 4. E 01	LT. 3. E 01	LT. 4. E 01
RA-226	LT. 6. E 01	LT. 8. E 01	LT. 1. E 02	LT. 9. E 01	LT. 1. E 02
TH-228	LT. 6. E 00	LT. 7. E 00	LT. 8. E 00	LT. 1. E 00	LT. 9. E 00

TRITIUM ANALYSIS:

H-3	7.2 ± 0.5 E 03	7.0 ± 0.7 E 03	6.9 ± 0.7 E 03	6.8 ± 0.7 E 03	8.4 ± 0.6 E 03
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\*Duplicate Analysis

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

SURFACE WATER

(PCI/LITER)

STATION NUMBER SP

DATE COLLECTED:	06/18	07/18	08/20	09/17	10/15
GAMMA SPECTRUM ANALYSIS:					
BE-7	LT. 4. E 01	LT. 3. E 01	LT. 5. E 01	LT. 4. E 01	LT. 4. E 01
K-40	LT. 1. E 02	LT. 9. E 01	LT. 1. E 02	LT. 1. E 02	LT. 1. E 02
MN-54	LT. 4. E 00	LT. 3. E 00	LT. 4. E 00	LT. 5. E 00	LT. 4. E 00
CO-58	LT. 4. E 00	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00	LT. 4. E 00
FE-59	LT. 1. E 01	LT. 9. E 00	LT. 1. E 01	LT. 1. E 01	LT. 8. E 00
CO-60	LT. 4. E 00	LT. 3. E 00	LT. 5. E 00	LT. 5. E 00	LT. 4. E 00
ZN-65	LT. 9. E 00	LT. 7. E 00	LT. 1. E 01	LT. 1. E 01	LT. 8. E 00
NB-95/ZR-95	LT. 5. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00	LT. 4. E 00
RU-103	LT. 5. E 00	LT. 4. E 00	LT. 6. E 00	LT. 5. E 00	LT. 4. E 00
RU-106	LT. 4. E 01	LT. 3. E 01	LT. 4. E 01	LT. 4. E 01	LT. 3. E 01
I-131	LT. 2. E 01	LT. 2. E 01	LT. 2. E 01	LT. 1. E 01	LT. 1. E 01
CS-134	LT. 4. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00	LT. 5. E 00
CS-137	LT. 5. E 00	LT. 4. E 00	LT. 5. E 00	LT. 5. E 00	LT. 4. E 00
LA-140/BA-140	LT. 1. E 01	LT. 9. E 00	LT. 1. E 01	LT. 8. E 00	LT. 6. E 00
CE-141	LT. 9. E 00	LT. 7. E 00	LT. 1. E 01	LT. 9. E 00	LT. 8. E 00
CE-144	LT. 3. E 01	LT. 2. E 01	LT. 3. E 01	LT. 3. E 01	LT. 3. E 01
RA-226	LT. 8. E 01	LT. 7. E 01	LT. 9. E 01	LT. 9. E 01	LT. 7. E 01
TH-228	LT. 7. E 00	LT. 6. E 00	LT. 8. E 00	LT. 8. E 00	LT. 6. E 00

TRITIUM ANALYSIS:

H-3	7.5 ± 0.7 E 03	8.9 ± 0.7 E 03	8.5 ± 0.5 E 03	7.7 ± 0.6 E 03	8.5 ± 0.6 E 03
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WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

SURFACE WATER

(PCI/LITER)

STATION NUMBER SP

DATE COLLECTED:	11/19	12/17
GAMMA SPECTRUM ANALYSIS:		
BE-7	LT. 3. E 01	LT. 1. E 01
K-40	LT. 1. E 02	LT. 2. E 01
MN-54	LT. 4. E 00	LT. 1. E 00
CO-58	LT. 4. E 00	LT. 1. E 00
FE-59	LT. 8. E 00	LT. 3. E 00
CO-60	LT. 4. E 00	LT. 1. E 00
ZN-65	LT. 8. E 00	LT. 2. E 00
NB-95/ZR-95	LT. 4. E 00	LT. 2. E 00
RU-103	LT. 4. E 00	LT. 2. E 00
RU-106	LT. 3. E 01	LT. 1. E 01
I-131	LT. 6. E 00	LT. 2. E 01
CS-134	LT. 4. E 00	LT. 1. E 00
CS-137	LT. 4. E 00	LT. 1. E 00
LA-140/BA-140	LT. 5. E 00	LT. 9. E 00
CE-141	LT. 6. E 00	LT. 3. E 00
CE-144	LT. 2. E 01	LT. 6. E 00
RA-226	LT. 8. E 01	LT. 2. E 01
TH-228	LT. 7. E 00	LT. 2. E 00

TRITIUM ANALYSIS:

H-3	7.4 ± 0.7 E 03	6.6 ± 0.5 E 03
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**WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE**

**SURFACE WATER**

(PCI/LITER)

STATION NUMBER MUSH

DATE COLLECTED:	01/15		02/19		03/19		04/16		05/21	
GAMMA SPECTRUM ANALYSIS:										
BE-7	LT. 3.	E 01	LT. 3.	E 01	LT. 3.	E 01	LT. 4.	E 01	LT. 5.	E 01
K-40	LT. 5.	E 01	LT. 5.	E 01	LT. 5.	E 01	LT. 1.	E 02	LT. 1.	E 02
MN-54	LT. 3.	E 00	LT. 3.	E 00	LT. 3.	E 00	LT. 4.	E 00	LT. 4.	E 00
CO-58	LT. 3.	E 00	LT. 3.	E 00	LT. 3.	E 00	LT. 4.	E 00	LT. 5.	E 00
FE-59	LT. 7.	E 00	LT. 7.	E 00	LT. 7.	E 00	LT. 1.	E 01	LT. 1.	E 01
CO-60	LT. 3.	E 00	LT. 4.	E 00	LT. 4.	E 00	LT. 4.	E 00	LT. 4.	E 00
ZN-65	LT. 7.	E 00	LT. 6.	E 00	LT. 7.	E 00	LT. 9.	E 00	LT. 1.	E 01
NB-95/ZR-95	LT. 3.	E 00	LT. 3.	E 00	LT. 4.	E 00	LT. 5.	E 00	LT. 5.	E 00
RU-103	LT. 4.	E 00	LT. 4.	E 00	LT. 4.	E 00	LT. 5.	E 00	LT. 6.	E 00
RU-106	LT. 3.	E 01	LT. 3.	E 01	LT. 3.	E 01	LT. 4.	E 01	LT. 4.	E 01
CS-131	LT. 8.	E 00	LT. 1.	E 01	LT. 1.	E 01	LT. 2.	E 01	LT. 2.	E 01
CS-134	LT. 3.	E 00	LT. 3.	E 00	LT. 3.	E 00	LT. 5.	E 00	LT. 5.	E 00
CS-137	LT. 4.	E 00	LT. 4.	E 00	LT. 4.	E 00	LT. 5.	E 00	LT. 5.	E 00
LA-140/BA-140	LT. 7.	E 00	LT. 6.	E 00	LT. 7.	E 00	LT. 9.	E 00	LT. 1.	E 01
CE-141	LT. 8.	E 00	LT. 8.	E 00	LT. 7.	E 00	LT. 1.	E 01	LT. 1.	E 01
CS-144	LT. 3.	E 01	LT. 3.	E 01	LT. 2.	E 01	LT. 4.	E 01	LT. 3.	E 01
RA-226	LT. 8.	E 01	LT. 8.	E 01	LT. 7.	E 01	LT. 1.	E 02	LT. 9.	E 01
TH-228	LT. 7.	E 00	LT. 7.	E 00	LT. 7.	E 00	LT. 9.	E 00	LT. 8.	E 00
TRITIUM ANALYSIS:										
H-3	LT. 8.	E 02	LT. 5.	E 02	LT. 1.	E 03	LT. 9.	E 02	LT. 5.	E 02

## SURFACE WATER

(PCI/LITER)

## STATION NUMBER MUSI

DATE COLLECTED:	06/18	07/16	08/20	09/17	10/15
GAMMA SPECTRUM ANALYSIS:					
BE-7	L.T. 3. E 01	L.T. 3. E 01	L.T. 4. E 01	L.T. 4. E 01	L.T. 3. E 01
K-40	L.T. 5. E 01	L.T. 5. E 01	L.T. 8. E 01	L.T. 2. E 02	L.T. 8. E 01
MAN-54	L.T. 3. E 00	L.T. 3. E 00	L.T. 4. E 00	L.T. 4. E 00	L.T. 3. E 00
CO-58	L.T. 3. E 00	L.T. 3. E 00	L.T. 4. E 00	L.T. 4. E 00	L.T. 3. E 00
FE-59	L.T. 7. E 00	L.T. 7. E 00	L.T. 1. E 01	L.T. 9. E 00	L.T. 7. E 00
CO-60	L.T. 3. E 00	L.T. 3. E 00	L.T. 5. E 00	L.T. 4. E 00	L.T. 3. E 00
ZN-65	L.T. 6. E 00	L.T. 7. E 00	L.T. 9. E 00	L.T. 9. E 00	L.T. 7. E 00
NB 95/ZR 95	L.T. 3. E 00	L.T. 3. E 00	L.T. 5. E 00	L.T. 5. E 00	L.T. 3. E 00
RU-103	L.T. 4. E 00	L.T. 4. E 00	L.T. 6. E 00	L.T. 5. E 00	L.T. 3. E 00
RU-106	L.T. 2. E 01	L.T. 3. E 01	L.T. 4. E 01	L.T. 4. E 01	L.T. 3. E 01
P-131	L.T. 1. E 01	L.T. 2. E 01	L.T. 2. E 01	L.T. 1. E 01	L.T. 8. E 00
CS-134	L.T. 3. E 00	L.T. 3. E 00	L.T. 5. E 00	L.T. 5. E 00	L.T. 3. E 00
CS-137	L.T. 3. E 00	L.T. 3. E 00	L.T. 5. E 00	L.T. 5. E 00	L.T. 3. E 00
LA 140/BA-140	L.T. 7. E 00	L.T. 1. E 01	L.T. 1. E 01	L.T. 7. E 00	L.T. 6. E 00
CE-141	L.T. 8. E 00	L.T. 5. E 00	L.T. 9. E 00	L.T. 1. E 01	L.T. 6. E 00
CE-144	L.T. 3. E 01	L.T. 3. E 01	L.T. 3. E 01	L.T. 4. E 01	L.T. 2. E 01
RA-226	L.T. 7. E 01	L.T. 7. E 01	L.T. 9. E 01	L.T. 1. E 02	L.T. 7. E 01
TH-228	L.T. 6. E 00	L.T. 6. E 00	L.T. 1. E 01	L.T. 9. E 00	L.T. 6. E 00

## TRITIUM ANALYSIS:

 Springer

L.T. 6. E 02

E 02

Q. T.

E 02

L.T. 5.

E 02

L.T. 9.

E 02

L.T. 9.

4. *Staphylococcus aureus*

9  
X

WOLF CREEK NUCLEAR OPERATING CORPORATION  
EXPOSURE PATHWAY - WATERBORNE

SURFACE WATER

(PCI/LITER)

STATION NUMBER MUSH

DATE COLLECTED:	11/19	12/17
GAMMA SPECTRUM ANALYSIS:		
BE-7	LT. 4. E 01	LT. 9. E 00
K-40	LT. 1. E 02	LT. 1. E 01
MN-54	LT. 4. E 00	LT. 9. E-01
CO-58	LT. 4. E 00	LT. 1. E 00
FE-59	LT. 1. E 01	LT. 3. E 00
CO-60	LT. 5. E 00	LT. 1. E 00
ZN-65	LT. 9. E 00	LT. 2. E 00
NB-95/ZR-95	LT. 5. E 00	LT. 1. E 00
RU-103	LT. 5. E 00	LT. 1. E 00
RU-106	LT. 4. E 01	LT. 7. E 00
I-131	LT. 8. E 00	LT. 1. E 01
CS-134	LT. 5. E 00	LT. 9. E-01
CS-137	LT. 5. E 00	LT. 9. E-01
LA-140/BA-140	LT. 7. E 00	LT. 7. E 00
CE-141	LT. 1. E 01	LT. 2. E 00
CE-144	LT. 4. E 01	LT. 4. E 00
RA-226	LT. 1. E 02	LT. 1. E 01
TH-228	LT. 9. E 00	LT. 1. E 00

TRITIUM ANALYSIS:

H-3	LT. 9. E 02	LT. 6. E 02
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**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**EXPOSURE PATHWAY - WATERBORNE**

**SURFACE WATER**

(PCI/LITER)

STATION NUMBER SPAL

DATE COLLECTED:	02/13	03/19	04/16
GAMMA SPECTRUM ANALYSIS:			
BE-7	L.T. 6. E 01	L.T. 4. E 01	L.T. 3. E 01
K-40	L.T. 2. E 02	L.T. 6. E 01	L.T. 5. E 01
MN-54	L.T. 6. E 00	L.T. 3. E 00	L.T. 3. E 00
CO-58	L.T. 6. E 00	L.T. 4. E 00	L.T. 4. E 00
FE-59	L.T. 1. E 01	L.T. 7. E 00	L.T. 8. E 00
CO-60	L.T. 7. E 00	L.T. 4. E 00	L.T. 4. E 00
ZN-65	L.T. 1. E 01	L.T. 7. E 00	L.T. 7. E 00
NB-95/ZR-95	L.T. 6. E 00	L.T. 4. E 00	L.T. 4. E 00
RU-103	L.T. 7. E 00	L.T. 5. E 00	L.T. 4. E 00
RU-106	L.T. 5. E 01	L.T. 3. E 01	L.T. 3. E 01
I-131	L.T. 2. E 01	L.T. 1. E 01	L.T. 1. E 01
CS-134	L.T. 6. E 00	L.T. 3. E 00	L.T. 4. E 00
CS-137	L.T. 7. E 00	L.T. 4. E 00	L.T. 4. E 00
LA-140/BA-140	L.T. 1. E 01	L.T. 8. E 00	L.T. 1. E 01
CE-141	L.T. 1. E 01	L.T. 8. E 00	L.T. 7. E 00
CE-144	L.T. 4. E 01	L.T. 3. E 01	L.T. 2. E 01
RA-226	L.T. 1. E 02	L.T. 8. E 01	L.T. 7. E 01
TH-228	L.T. 1. E 01	L.T. 7. E 00	L.T. 6. E 00

TRITIUM ANALYSIS:

H-3	6.3 ± 0.5 E 03	7.4 ± 0.7 E 03	6.6 ± 0.6 E 03
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\*Duplicate Analysis

APPENDIX C

Discussion of TLD Shielding Changes



During 1990, it was determined that WCNOC had been using an improper thickness of shielding material with environmental TLDs. The WCGS program includes a requirement that environmental thermoluminescent dosimeters will conform to the detection capabilities set forth in Regulatory Guide 4.13, Revision 1, July 1977, "Performance, Testing, and Procedural Specifications for Thermoluminescent Dosimetry: Environmental Applications" and ANSI N545-1975, "Performance, Testing, and Procedural Specifications for Thermoluminescent Dosimetry (environmental applications)". Vendor documentation indicates that the proper copper shield thickness to meet the recommendations of Regulatory Guide 4.13 and ANSI N545-1975 is 0.093 inches (0.093"). Contrary to this requirement, 0.022 inch thick (0.022") shields were in use at WCGS prior to the discovery of the discrepancy in 1990. The 0.022" shields were purchased prior to the issuance of the WCGS Technical Specifications and were in use since 1981. It was determined that discrepancy of shield thickness constituted a program deviation since the TLDs did not fully meet the recommendations of Regulatory Guide 4.13. Several corrective actions were taken.

The deviation was reported as required in the 1990 Annual Radiological Environmental Operating Report.

Subsequent discussions with the vendor were initiated to determine the impact of using the 0.022" copper shields. It was determined that the 0.022" shields would cause a conservative over response of up to 250%, depending on the energy of the incident gamma rays. The vendor determined that TLDs shielded by either 0.022" or 0.093" shields would respond the same to normal cosmic and terrestrial background radiation. WCGS TLD results were compared to Kansas Department of Health and Environment and NRC results over the same time period. WCGS results indicated normal background levels.

New TLD cases utilizing 0.093" shields were acquired and placed in the field in the fourth quarter of 1990. For three quarters, a TLD shielded by 0.093" material and a TLD shielded by 0.022" material was placed at each sampling location to determine the actual impact on exposure readings. The data for the three quarters is shown in Table C-1. The data for the fourth quarter of 1990 and the first two quarters of 1991 is plotted in Figures C-1 through C-3.

All of the TLD cases with the 0.022 inch thick shielding material were removed from the field after three quarters of data were obtained to determine the impact of the improper shields.

Figures C-1 through C-3 illustrate the exposure data for each sample point for three consecutive quarters. Each figure shows an obvious trend. Most TLDs shielded with 0.022" copper recorded a slightly higher exposure than the TLDs shielded with 0.093" material. Figure C-4 illustrates the variance or difference between the 0.093" and 0.022" shield exposure readings for the three quarter period. The total number of observations is equal to 43 stations times 3 quarters minus one set of missing TLDs for 128 observations. The average difference for all of the stations for the three quarter period was -1.55 mR per standard 90 day quarter. The negative sign indicates that the 0.022" readings were biased high as the vendor had suggested and thus the historical data since 1981 is conservative.

TABLE C-1

TLD SHIELD THICKNESS COMPARISON  
0.093" AND 0.022" THICK COPPER

YEAR	QTR	LOC	TLD 1	TLD 2	VARIANCE	VARIANCE
			0.093	0.022	TLD1 -	TLD1 -
			INCH	INCH	TLD2	TLD2
			EXPOSURES	EXPOSURES	EXPRESSED	EXPRESSED
			mR/Std Qtr	mR/Std Qtr	mR/Std Qtr	IN 1
1990	4	1	16.40	16.69	-0.29	-1.79%
1990	4	2	15.44	15.44	0.00	0.00%
1990	4	3	15.16	16.14	-0.98	-6.45%
1990	4	4	15.36	16.53	-1.17	-7.64%
1990	4	5	15.07	16.14	-1.08	-7.14%
1990	4	6	13.79	15.46	-1.66	-12.06%
1990	4	7	14.46	14.36	0.10	0.68%
1990	4	8	17.10	16.91	0.20	1.14%
1990	4	9	16.61	15.05	1.56	9.41%
1990	4	10	16.42	16.03	0.39	2.38%
1990	4	11	18.27	18.86	-0.59	-3.21%
1990	4	12	16.42	17.30	-0.88	-5.36%
1990	4	13	16.71	18.08	-1.37	-8.19%
1990	4	14	16.32	17.59	-1.27	-7.78%
1990	4	15	15.36	17.71	-2.35	-15.29%
1990	4	16	14.87	17.51	-2.64	-17.76%
1990	4	17	15.07	17.02	-1.96	-12.99%
1990	4	18	16.63	18.78	-2.15	-12.94%
1990	4	19	14.28	18.98	-4.70	-32.88%
1990	4	20	15.75	18.20	-2.45	-15.53%
1990	4	21	13.11	16.24	-3.13	-23.88%
1990	4	22	14.38	16.92	-2.54	-17.69%
1990	4	23	14.69	15.77	-1.08	-7.33%
1990	4	24	15.38	16.75	-1.37	-8.92%
1990	4	25	11.85	13.91	-2.06	-17.36%
1990	4	26	13.71	15.87	-2.15	-15.71%
1990	4	27	15.57	17.33	-1.76	-11.32%
1990	4	28	13.03	16.84	-3.82	-29.32%
1990	4	29	13.22	14.69	-1.47	-11.11%
1990	4	30	13.51	16.26	-2.74	-20.29%
1990	4	31	14.98	16.35	-1.37	-9.15%
1990	4	32	14.90	16.08	-1.18	-7.89%
1990	4	33	15.96	18.90	-2.94	-18.40%
1990	4	34	14.87	17.32	-2.45	-16.45%
1990	4	35	15.64	17.30	-1.66	-10.62%
1990	4	36	15.73	16.71	-0.98	-6.21%
1990	4	37	15.23	17.96	-2.73	-17.95%

TABLE C-1 (Cont'd)

TLD SHIELD THICKNESS COMPARISON  
0.093" AND 0.022" THICK COPPER

YEAR	QTR	LOC	TLD 1	TLD 2	VARIANCE	VARIANCE
			0.093	0.022	TLD1 -	TLD1 -
			INCH	INCH	TLD2	TLD2
			EXPOSURES	EXPOSURES	EXPRESSED	EXPRESSED
			mR/Std Qtr	mR/Std Qtr	mR/Std Qtr	IN %
1990	4	38	16.11	18.64	-2.54	-15.76%
1990	4	39	15.60	16.48	-0.88	-5.62%
1990	4	40	14.22	14.71	-0.49	-3.45%
1990	4	41	16.30	17.57	-1.27	-7.78%
1990	4	42	11.13	11.23	-0.10	-0.88%
1990	4	43	9.57	10.25	-0.68	-7.14%
1991	1	1	15.77	16.89	-1.13	-7.14%
1991	1	2	13.03	14.44	-1.41	-10.79%
1991	1	3	16.69	15.75	0.94	5.62%
1991	1	4	15.28	17.16	-1.88	-12.27%
1991	1	5	14.53	14.63	-0.09	-0.65%
1991	1	6	14.34	15.19	-0.84	-5.88%
1991	1	7	14.08	15.02	-0.94	-6.67%
1991	1	8	16.24	17.27	-1.03	-6.36%
1991	1	9	13.61	14.83	-1.22	-8.97%
1991	1	10	15.39	17.46	-2.06	-13.41%
1991	1	11	17.34	18.09	-0.75	-4.32%
1991	1	12	15.37	16.50	-1.13	-7.32%
1991	1	13	15.94	17.63	-1.69	-10.59%
1991	1	14	16.13	16.59	-0.47	-2.91%
1991	1	15	12.92	16.20	-3.28	-25.36%
1991	1	16				
1991	1	17	12.83	16.20	-3.37	-26.28%
1991	1	18	13.58	15.83	-2.25	-16.55%
1991	1	19	13.49	16.48	-3.00	-22.22%
1991	1	20	13.49	16.30	-2.81	-20.83%
1991	1	21	11.43	12.92	-1.50	-13.11%
1991	1	22	13.11	15.64	-2.53	-19.29%
1991	1	23	13.78	17.81	-4.03	-29.25%
1991	1	24	13.13	15.94	-2.81	-21.43%
1991	1	25	11.81	13.03	-1.22	-10.32%
1991	1	26	11.71	14.14	-2.43	-20.80%
1991	1	27	14.33	15.64	-1.31	-9.15%
1991	1	28	11.43	13.86	-2.43	-21.31%
1991	1	29	10.77	13.20	-2.43	-22.61%

TABLE C-1 (Cont'd)

TLD SHIELD THICKNESS COMPARISON  
0.093" AND 0.022" THICK COPPER

YEAR	QTR	LOC	TLD 1	TLD 2	VARIANCE	VARIANCE
			0.093 INCH EXPOSURES	0.022 INCH EXPOSURES	TLD1 - TLD2 EXPRESSED	TLD1 - TLD2 EXPRESSED IN %
			mR/Std Qtr	mR/Std Qtr	mR/Std Qtr	
1991	1	30	13.67	14.24	-0.56	-4.11%
1991	1	31	13.13	15.37	-2.25	-17.14%
1991	1	32	12.49	15.22	-2.72	-21.80%
1991	1	33	14.64	16.70	-2.06	-14.10%
1991	1	34	13.78	16.78	-3.00	-21.77%
1991	1	35	13.49	16.58	-3.09	-22.92%
1991	1	36	13.30	16.11	-2.81	-21.13%
1991	1	37	12.47	15.09	-2.63	-21.05%
1991	1	38	14.34	17.44	-3.09	-21.57%
1991	1	39	13.38	15.53	-2.15	-16.08%
1991	1	40	11.93	15.31	-3.38	-28.35%
1991	1	41	14.33	18.64	-4.31	-30.07%
1991	1	42	8.89	11.32	-2.43	-27.37%
1991	1	43	8.33	10.67	-2.34	-28.09%
1991	2	1	15.78	18.42	-2.65	-16.78%
1991	2	2	13.02	14.19	-1.16	-8.94%
1991	2	3	15.56	12.92	2.65	17.01%
1991	2	4	14.19	15.14	-0.95	-6.72%
1991	2	5	15.25	14.51	0.74	4.86%
1991	2	6	12.81	14.61	-1.80	-14.05%
1991	2	7	12.39	13.55	-1.16	-9.40%
1991	2	8	14.51	16.09	-1.59	-10.95%
1991	2	9	13.34	13.55	-0.21	-1.59%
1991	2	10	14.93	15.46	-0.53	-3.55%
1991	2	11	15.05	16.43	-1.38	-9.15%
1991	2	12	12.78	14.63	-0.85	-6.15%
1991	2	13	15.37	15.69	-0.32	-2.07%
1991	2	14	13.78	18.02	-4.24	-30.77%
1991	2	15	13.36	14.42	-1.06	-7.94%
1991	2	16	14.10	15.16	-1.06	-7.52%
1991	2	17	12.71	15.14	-2.44	-19.17%
1991	2	18	23.82	17.89	5.93	24.89%
1991	2	19	14.29	14.72	-0.42	-2.96%
1991	2	20	13.45	15.56	-2.12	-15.75%
1991	2	21	12.28	12.60	-0.32	-2.59%

TABLE C-1 (Cont'd)

TLD SHIELD THICKNESS COMPARISON  
0.093" AND 0.022" THICK COPPER

YEAR	QTR	LOC	TLD 1	TLD 2	VARIANCE	VARIANCE
			0.093 INCH EXPOSURES	0.022 INCH EXPOSURES	TLD1 - TLD2 EXPRESSED	TLD1 - TLD2 EXPRESSED
			mR/Std Qtr	mR/Std Qtr	mR/Std Qtr	IN %
1991	2	22	14.08	15.25	-1.16	-8.27%
1991	2	23	13.63	14.68	-1.06	-7.75%
1991	2	24	14.07	14.81	-0.74	-5.26%
1991	2	25	10.79	12.16	-1.37	-12.75%
1991	2	26	11.96	13.66	-1.69	-14.16%
1991	2	27	13.54	14.70	-1.16	-8.59%
1991	2	28	12.37	13.96	-1.59	-12.82%
1991	2	29	12.07	12.28	-0.21	-1.75%
1991	2	30	13.45	13.87	-0.42	-3.15%
1991	2	31	15.04	15.14	-0.11	-0.70%
1991	2	32	12.59	13.75	-1.16	-9.24%
1991	2	33	15.23	15.97	-0.74	-4.86%
1991	2	34	14.43	16.24	-1.80	-12.50%
1991	2	35	14.61	15.46	-0.85	-5.80%
1991	2	36	14.19	14.40	-0.21	-1.49%
1991	2	37	13.22	15.02	-1.80	-13.60%
1991	2	38	15.02	29.51	-14.49	-96.48%
1991	2	39	13.66	14.51	-0.85	-6.20%
1991	2	40	11.75	13.45	-1.69	-14.41%
1991	2	41	13.98	14.82	-0.85	-6.06%
1991	2	42	9.01	8.59	0.42	4.71%
1991	2	43	8.59	8.59	0.00	0.00%



## SHIELD THICKNESS COMPARISON

4TH QTR 1990

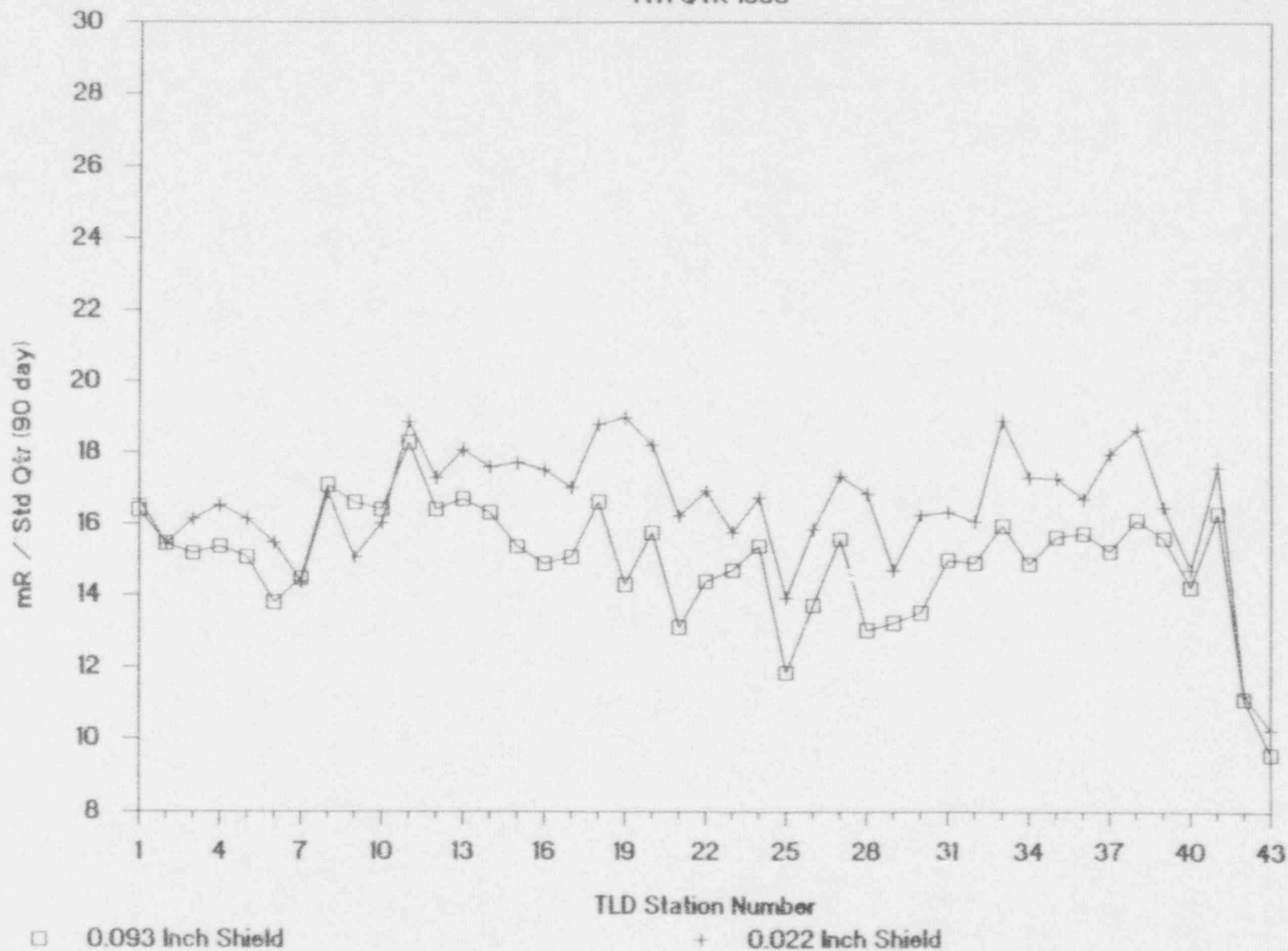


FIGURE C-1

## SHIELD THICKNESS COMPARISON

1ST QTR 1991

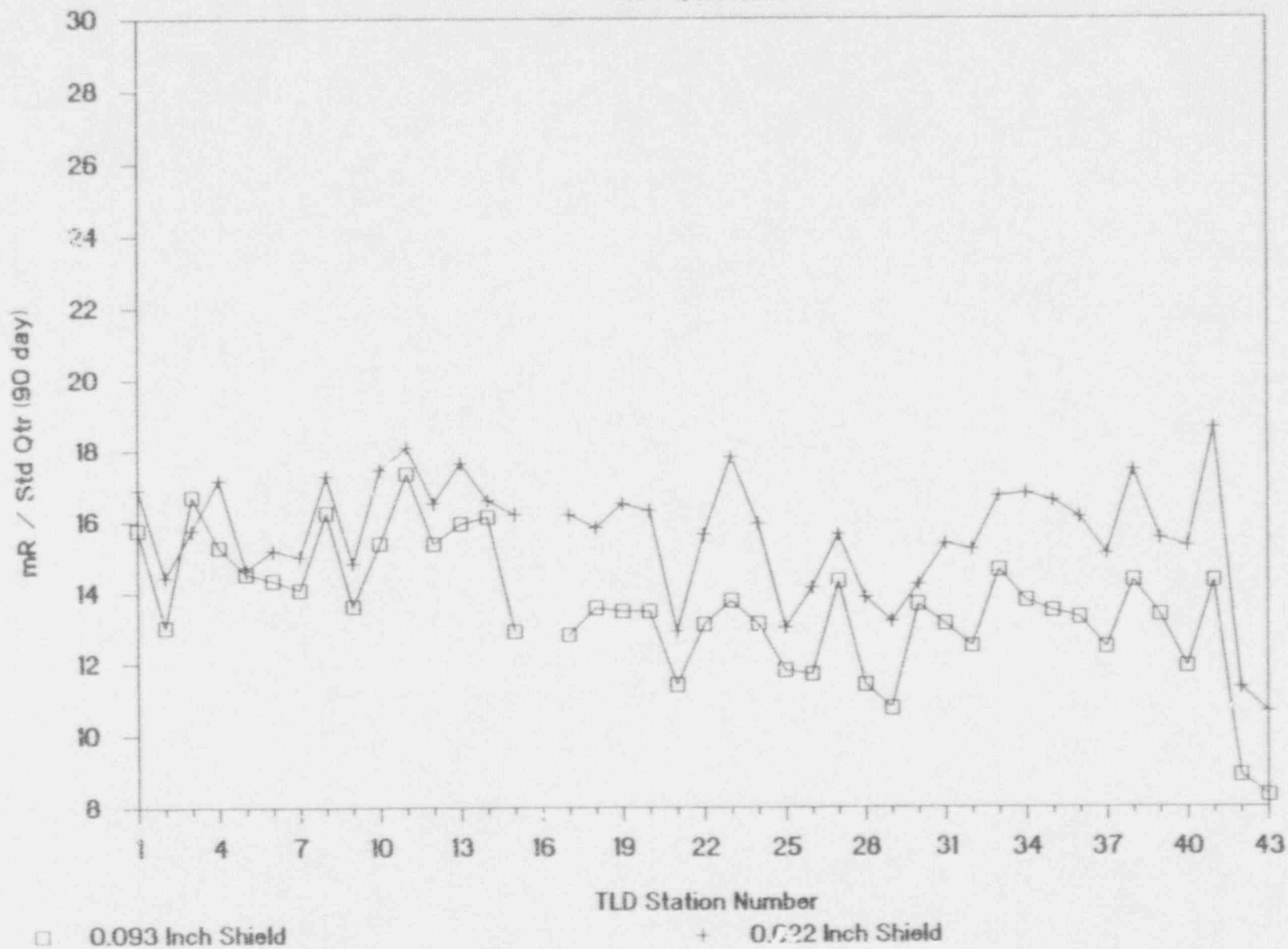


FIGURE C-2

## SHIELD THICKNESS COMPARISON

2ND QTR 1991

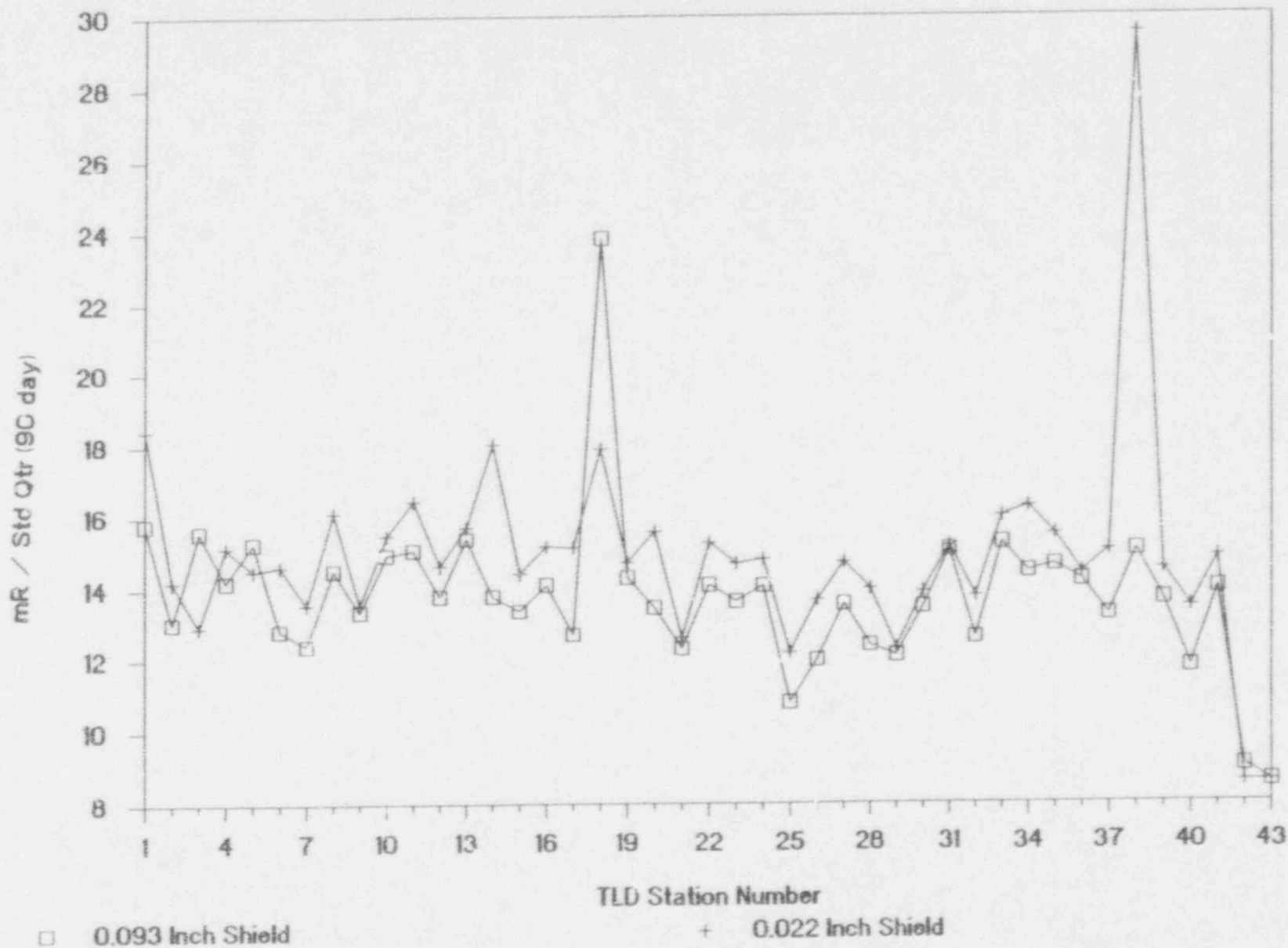


FIGURE C-3

# SHIELD THICKNESS COMPARISON

4TH QTR 90, 1ST & 2ND QTRS 91

