CIMARRON CORPORATION LETTER OF TRANSMITTAL

DATE: 09/11/97

TO: **Ken Kalman, Project Manager**
Low Level Waste & Decommissioning Project Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
MAIL DROP T2F27

FROM: **Mickey Hodo, Quality Assurance Manager**
Cimarron Corporation
P.O. Box 315
Crescent, OK 73028

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2	09/97	FINAL STATUS SURVEY REPORT FOR PHASE II, SUBAREA "J"

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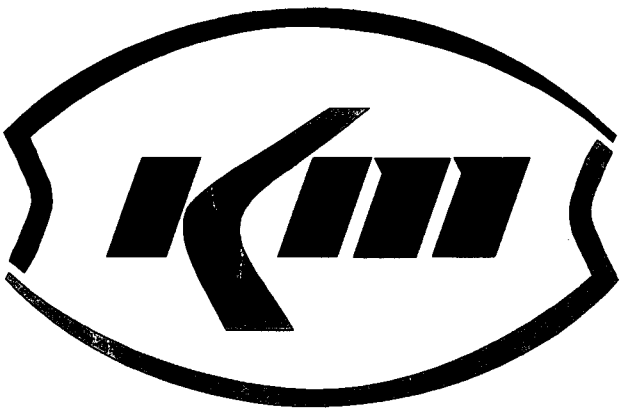

FINAL STATUS SURVEY REPORT
PHASE II - SUB-AREA 'J'

for
Cimarron Corporation's Former
Nuclear Fuel Fabrication Facility
Crescent, Oklahoma

September, 1997

License Number: SNM-928

CIMARRON CORPORATION
OKLAHOMA CITY, OKLAHOMA

CIMARRON CORPORATION
P. O. BOX 25861 • OKLAHOMA CITY, OKLAHOMA 73125

S. JESS LARSEN
VICE PRESIDENT

September 5, 1997

Mr. Kenneth L. Kalman, Project Manager
Facilities Decommissioning Section
Low-Level Waste and Decommissioning Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: Docket No. 70-925; License No. SNM-928
Cimarron Corporation
Final Status Survey Report for Phase II Subarea J dated September 1997

Dear Mr. Kalman,

Cimarron Corporation submits the enclosed "Final Status Survey Report for Phase II Subarea J dated September 1997." The report is submitted to fulfill the Subarea J requirements contained in the previously approved "Final Status Survey Plan for Phase II Areas," and to request license amendment to remove the Subarea J property from the license.

Cimarron Corporation previously submitted the "Final Status Survey Plan for Phase II areas on July 25, 1995. That plan was subsequently approved by NRC on March 14, 1997.

This report provides all the data necessary to demonstrate that all radiological parameters of the property designated as Subarea J have been satisfied and that unrestricted release from license is appropriate.

Your prompt review and approval of this report and the license release amemdment will be greatly appreciated. Please contact me if there are any questions or concerns.

Sincerely,

Jess Larsen

Jess Larsen
Vice President

Enclosure
jl090597.le1

FINAL STATUS SURVEY REPORT FOR PHASE II SUBAREA J

for
Cimarron Corporation's Former
Nuclear Fuel Fabrication Facility
Crescent, Oklahoma

License Number: SNM-928

Prepared for:

Cimarron Corporation
Oklahoma City, Oklahoma

September 1997

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REFERENCES

1. Cimarron Corporation Nuclear Materials License, SNM-928 Docket No. 070-00925, issued for possession only March 31, 1982; Amendment No. 10, issued November 4, 1994.

2. Cimarron Corporation Nuclear Materials License, SNM-1174, Docket No. 070-1193, terminated February 5, 1993.

3. Cimarron Corporation Letter to USNRC, August 20, 1990.

4. USNRC Letter from Mr. Richard E. Cunningham, Director , Division of Industrial and Medical Nuclear Safety to Dr. John Stauter, Director of Environmental Services, Cimarron Corporation, dated February 5, 1993.

5. Chase Environmental Group, Inc. "Radiological Characterization Report for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma", October 1994.

6. Chase Environmental Group, Inc. "Decommissioning Plan for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma", April 1995.

7. Chase Environmental Group, Inc. "Final Status Survey Plan for Unaffected Areas for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma", October 1994.

8. USNRC Letter from Mr. Michael F. Weber, Chief Low-Level Waste and Decommissioning Project Branch, Division of Waste Management, to Mr. Jess Larsen, Vice President Kerr-McGee Corporation, dated May 1, 1995.

9. Cimarron Corporation, "Final Status Survey Report, Phase I Areas at the Cimarron Facility, License No. SNM-928", July 1995.

10. USNRC Letter from Mr. R. A. Nelson Acting Chief Low-Level Waste and Decommissioning Project Branch, Division of Waste Management, to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated April 23, 1996.

11. Chase Environmental Group, Inc., "Final Status Survey Plan for Phase II Areas for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility", Crescent, Oklahoma, July 1995.

12. USNRC Letter from Mr. Kenneth L. Kalman, Project Manager, Low-Level Waste and Decommissioning Projects Branch, to Mr. Jess Larsen, Vice President, Cimarron Corporation, Dated March 14, 1997.

13. US NRC Letter from Mr. George M. McCann, Chief, Materials Licensing Section to Dr. John Stauter, Vice President, Kerr-McGee Corporation, dated December 30, 1992.

14. Chase Environmental Group, Inc. "Final Status Survey Plan for Phase III Area for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility", Crescent, Oklahoma, June 1997.

15. ORAU Final Report, "Confirmatory Survey of the Cimarron Corporation Mixed Oxide Fuel Fabrication Plant", January 1991.

16. USNRC, "Branch Technical Position on Disposal or On-site Storage of Residual Thorium and Uranium from Past Operations", FR. Vol. 46, No. 205, Page 52061, October 23, 1981.

17. J.D. Berger, "Manual for Conducting Radiological Surveys in Support of License Termination"; Draft Report for Comment, Oak Ridge Associated Universities, NUREG/CR-5849, June 1992.

18. USNRC, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for By-Product, Source, or Special Nuclear Material", August 1987.

19. USNRC letter from Mr. Ross A. Scarano, Director Division of Nuclear Materials Safety to Mr. S. Jess Larsen, Vice President, Cimarron Corporation, dated July 31, 1997.

20. E.W. Abelquist, "Confirmatory Survey for the South Uranium Yard Remediation, Kerr-McGee Corporation, Cimarron Facility, Crescent, Oklahoma,", Oak Ridge Institute for Science and Education, November 1995.

21. USNRC Letter from Mr. Michael F. Weber, Chief, Low-Level Waste and Decommissioning Project Branch, Division of Waste Management to Mr. Jess Larsen, Vice President, Kerr-McGee Corporation, dated May 31, 1995.

22. Cimarron Corporation By-Product Materials License 35-12636-02, Amendment No. 13, November 22, 1993.

23. American Society of Mechanical Engineers, "Quality Assurance Requirements for Nuclear Facility Applications", ASME NQA-1, 1994.

FINAL STATUS SURVEY REPORT FOR DECOMMISSIONING CIMARRON FACILITY SUBAREA J

1.0 Purpose

This Final Status Survey Report is being submitted by Cimarron Corporation to the Nuclear Regulatory Commission (NRC) for an area on the Cimarron site designated as Phase II Subarea J. This subarea is shown on Drawing No. 95MOST-RF3, and includes both affected and unaffected areas that have been surveyed as part of the ongoing site decommissioning process. This report includes a discussion of the characterization survey performed to more precisely define the extent and magnitude of residual contamination present in the soil located within this subarea. The characterization data generated by the initial survey was utilized in preparing the final status survey that was approved by the NRC as part of the Phase II Final Status Survey Plan. The final status survey was performed for the entire area to demonstrate that the approved guideline values have been met. The results of Subarea J Final Status Survey are presented in this Report as justification to release this subarea from License SNM-928.

2.0 Background

Cimarron Corporation, a subsidiary of Kerr-McGee Corporation, operated two plants near Crescent, Oklahoma, for the manufacture of enriched uranium and mixed oxide reactor fuels. The 840-acre Cimarron site was originally licensed under two separate SNM Licenses. License SNM-928[1] was issued in 1965 for the Uranium Plant (U-Plant) and License SNM-1174[2] was issued in 1970 for the Mixed Oxide Fuel Fabrication (MOFF) Facility. Both facilities operated through 1975, at which time they were shut down and decommissioning work was initiated.

Decommissioning efforts at the MOFF Facility were completed in 1990 and Cimarron Corporation applied to the NRC on August 20, 1990[3], to terminate License SNM-1174. After confirmatory surveys, the NRC terminated the MOFF Facility License, SNM-1174, on February 5, 1993[4].

Decommissioning efforts involving characterization, decontamination and decommissioning for the 840-acres, licensed under SNM-928, were initiated in 1976 and are still ongoing. The goal of the decommissioning effort is to release the entire 840-acre site for unrestricted use.

Based upon historic knowledge of site operations and the characterization work completed to date, Cimarron Corporation completed and submitted in October 1994 the Cimarron Radiological Characterization Report.[5] As discussed in this report, the site has been divided into affected and unaffected areas. The affected and unaffected areas are shown on Drawing No. 95MOST-RF3, included in Appendix I. For the Final Status Survey Plan, the entire 840-acre site has been divided into three major areas which contain both affected and unaffected areas. Each of these three major areas are also shown on Drawing No. 95MOST-RF3 and are designated by

Roman Numerals I, II, and III (herein referenced as Phases I, II, and III). These three major areas are then further subdivided into smaller sections (i.e. A, B, C, D, etc.).

2.1 Phase I Area

As presented in the Cimarron Decommissioning Plan,[6] the Final Status Survey Plan (Phases I, II and III) was discussed in general terms, with the understanding that each of the three phases would be submitted to the NRC under separate cover for approval. The Final Status Survey Plan for the first of these three phases (Phase I[7]) was approved by the NRC via letter dated May 1, 1995.[8] The Final Status Survey Report[9] for Phase I was submitted to the NRC and confirmatory sampling for the Phase I areas has been completed by the Oak Ridge Institute for Science and Education (ORISE). Cimarron Corporation received license Amendment #14 from the NRC to release this area from SNM-928; the amendment was forwarded by letter dated April 23, 1996[10]. This amendment reduced the licensed facility acreage from 840 to 152-acres.

2.2 Phase II Area

The area designated as Phase II on Drawing No. 95MOST-RF3 contains both affected and some contiguous unaffected areas, and represents approximately 122 of the remaining licensed 152-acres. The Final Status Survey Plan for Phase II was submitted to the NRC in July 1995[11] and approved by the NRC on March 14, 1997[12]. Phase II includes subareas F, G, H, I and J. Included within Phase II are Burial Area #1 which was released in December 1992 by the NRC[13], backfilled with clean soil, and seeded. Also included in Phase II are the East and West Sanitary Lagoons, the MOFF Plant Building exterior and yard area, the Emergency Building, the Warehouse Building (Building #4) and surrounding yard, and numerous drainage areas. Cimarron has substantially completed the remediation of each subarea and final status surveys are currently underway. The Final Status Survey Report for Subarea J is the first area from Phase II to be submitted to the NRC for final license release. This subarea is West of Highway #74, and includes approximately 7 of the 122 licensed acres originally included in Phase II. Additionally, land purchased in September 1995 (approximately 15-acres not included under License SNM-928) has been added to Subarea J to facilitate surveying of all drainage ways west of the Uranium Buildings. The recently acquired acreage is south of the N81 parallel. With the addition of the recently purchased acreage, Subarea J now totals 22-acres.

2.3 Phase III Area

The Phase III area survey is the last phase for completing the final status survey for the entire Cimarron site, and represents approximately 30-acres. This area is designated as Phase III on Drawing No. 95MOST-RF3. The Final Status Survey Plan for release of this area from the site license, has been submitted to the NRC[14] for approval. The Phase III area includes the Uranium Processing buildings and yard area, Burial Areas #2 and #3,

the New Sanitary Lagoon, the New On-site Disposal Cell (Burial Area #4), and the Five Former Waste Water Ponds. These five former waste water ponds consist of Uranium Waste Ponds #1 and #2, the Plutonium Waste Pond, the Uranium Emergency Pond, and the Plutonium Emergency Pond.

3.0 Site Description

The Cimarron Facility is located in Logan County, State of Oklahoma, on the south side of the Cimarron River approximately 0.5 miles north of the intersection of Oklahoma State Highways #33 and #74. Figure 3.1 shows the site location. The 840-acre site (recently reduced to 152 acres) is located in an area of low, rolling hills and incised drainages. Local elevations range from about 940 feet along the river to 1,010 feet Mean Sea Level at the plant. The county is primarily rural with an economy primarily based upon agriculture and ranching. The entire site is owned by Cimarron Corporation, a wholly owned subsidiary of Kerr-McGee Corporation.

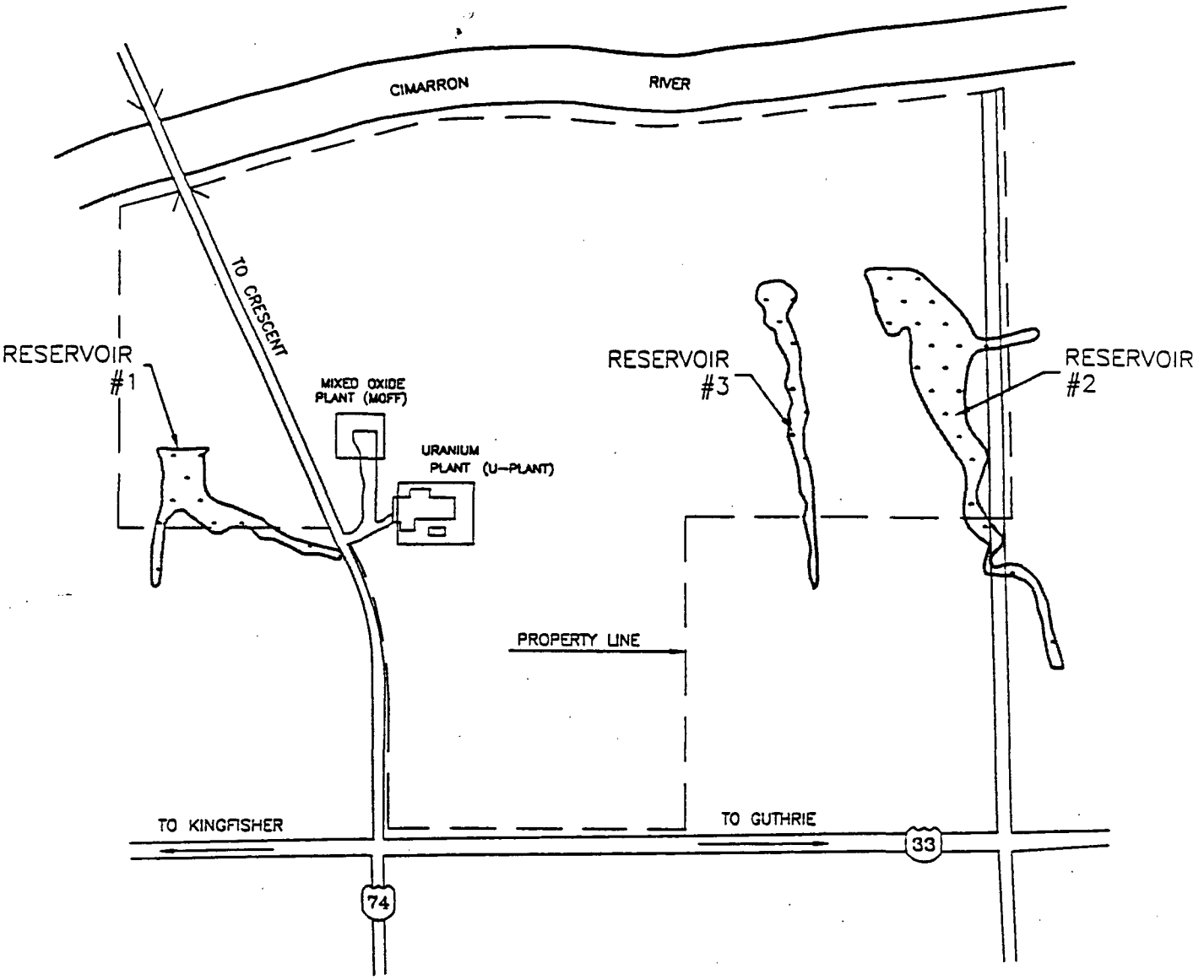
Subarea J is located west of the Uranium Facility and includes Reservoir #1 and the drainage areas west of Highway #74 to the reservoir. The reservoir collected drainage generally from areas south of the Uranium Buildings. Additionally, Subarea J includes the drainage way from the Reservoir to Subarea E, which was previously released from License SNM-928 by Amendment #14, as part of the Phase I area.

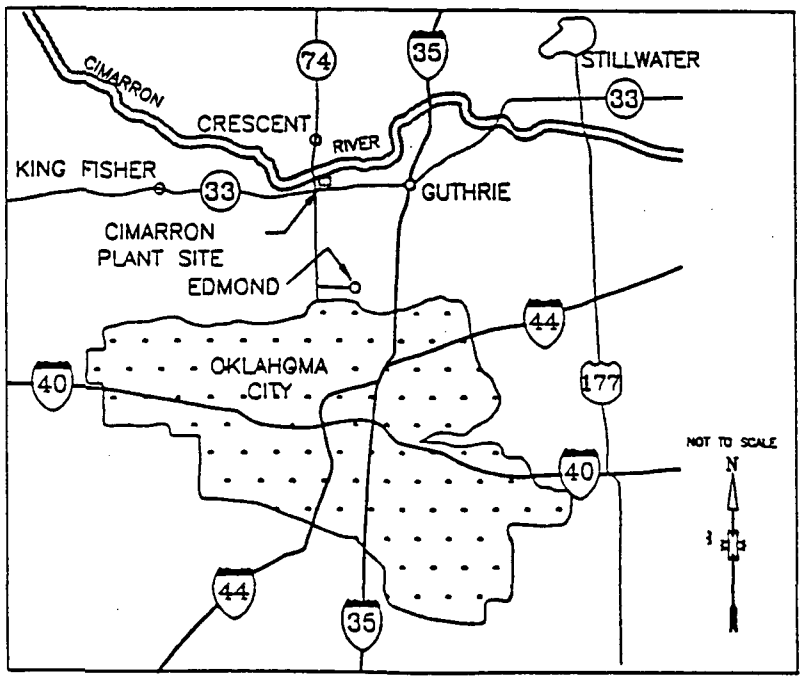
4.0 Facility Description

License SNM-928 was originally issued in 1965 to Kerr-McGee Nuclear Corporation for the manufacture of enriched uranium reactor fuels. The Uranium Plant (U-Plant) was constructed to be a complete nuclear fuel service facility. Initial equipment provided for the production of UO_2, UF_4, uranium metal and the recovery of scrap materials. In 1968 the plant was expanded by increasing the UO_2 and Pellet facilities through the installation of another complete production line for the fabrication of fuel pellets. In 1969 fabrication facilities were added for the production of fuel pins. In 1970 facilities were added for the production of the fuel elements. Equipment initially installed for the recovery of enriched scrap material was not used after work performed under a scrap recovery contract was completed in 1970. All equipment utilized in fuel production activities has been either decontaminated and removed from the site for salvage or packaged and transported offsite for disposal at a commercial LLRW facility.

5.0 History of Site Operations

The Cimarron Facility was originally licensed under two separate licenses. License SNM-928 was issued for the U-Plant Facility and License SNM-1174 was issued for the MOFF Facility. Both facilities terminated production operations in 1975. Decontamination and decommissioning





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Cimarron Corporation
Crescent Oklahoma Facility
Location Map
Figure 3.1

of the MOFF Facility was completed by 1990, and the license was terminated by the NRC in 1993. The U-Plant Facility decommissioning is in progress and nearing completion. A complete history of site operations can be found in both the Characterization Report[5] and the Decommissioning Plan[6].

6.0 Decommissioning Activities

The purpose of this section is to discuss briefly the status of the on-going site decommissioning activities in Subarea J and to present the radiological criteria and guideline values utilized throughout the remediation and final status survey. Also, included in this section is a brief discussion of the results of the characterization work performed prior to commencement of the final status survey.

6.1 Identification of Contaminants

Based upon the knowledge of past site operations, the results of numerous characterization efforts to date, and other independent characterization efforts by regulatory agencies and their respective subcontractors, the possible radiological contaminants within this subarea have been determined to consist of U-234, U-235 and U-238. The uranium is comprised of natural, depleted, and enriched forms, with an average enrichment above the naturally occurring level. The average U-235 enrichment at Cimarron has been previously established as approximately 2.7 weight percent.

Thorium, although not considered a contaminant of concern for this subarea, has been included in the soil analysis and reported on the data summary sheets with the total uranium values.

6.2 Site Background Levels

Natural background levels for uranium in soil have been established through numerous measurements by Cimarron personnel utilizing the on-site soil counter and through independent laboratory analysis. Analytical results from Cimarron Corporation's environmental sampling program are reported to the NRC annually in Environmental Reports. These reports provide sample analysis results for soil samples collected from numerous off-site locations which are representative of background in surrounding soils.

Cimarron personnel collected and analyzed 30 surface soil samples from the perimeter of the Cimarron site during the first quarter of 1995 to further validate background levels. Total uranium ranged from 2.3 pCi/g to 6.6 pCi/g, with the average being 4.0 ± 2.6 (2σ) pCi/g. These values were obtained as a result of using the Cimarron on-site soil counter (Counter #1). This on-site soil counter is calibrated to assume an enrichment of 2.7 weight percent as this is the average enrichment found throughout the site. When a correction factor (0.67/1.5) is applied to these results to convert the values from an

assumed 2.7 weight percent enrichment to a natural enrichment, the converted results ranged from 1.0 pCi/g to 2.9 pCi/g with an average of 1.8 ± 1.0 (2σ) pCi/g total uranium. Based upon these results, the average value of 4 pCi/g total uranium for background was used when the soil sample analytical results were compared to guideline values.

Background exposure rates have been established at the Cimarron site by taking micro-R readings and pressurized ion chamber (PIC) readings at off-site sample locations in addition to Cimarron site areas which are unaffected by past operations. Site background exposure rates of approximately 7 μR/h have been observed in background areas by Cimarron personnel utilizing a Ludlum Micro-R survey meter, and have been used in past reports to the NRC. Site background exposure rates of approximately 7 μR/h have also been determined by ORISE personnel utilizing similar instrumentation. In addition, site background exposure rates were measured by ORAU (now ORISE) personnel utilizing a PIC[15], and were determined to be 9 to 10 μR/h. Based on the PIC measurements, the site background was determined to be approximately 10 μR/h. Thus, depending upon instrumentation utilized, the background exposure rate at the Cimarron site ranges from 7 to 10 μR/h. Since Cimarron utilizes a Ludlum Micro-R Survey Meter, 7 μR/h represents average background.

Cimarron personnel performed exposure rates measurements at background locations in Subarea "F" in 1995 using a Micro-R meter. Confirmatory measurements were obtained at the same locations in 1997 using a Reuter-Stokes PIC. These data are tabulated below in Table 6.1. The average background as measured using the Micro-R meter was 7.6 ± 1.3 (2σ) μR/h, and is about 15 percent less than the average for the PIC measurements of 9.0 ± 1.1 (2σ) μR/h. These differences are not significant and indicate good agreement between the Micro-R measurements and the PIC measurements. Cimarron will continue the use of 7 μR/h as representative of background exposure rates for Micro-R measurements in accordance with past reports.

TABLE 6.1

Sample ID No.	Grid Location	Micro-R Reading (μR/h)	PIC Reading (μR/h)
UAF-BKG-1	819W-81N	9	9.8
UAF-BKG-7	1600E-120N	7	7.6
UAF-BKG-11	840W-700S	8	9.5
UAF-BKG-13	840W-288S	9	9.8
UAF-BKG-16	808W-282S	8	9.7
UAF-BKG-19	640W-700S	9	10.5
UAF-BKG-23	1610E-300S	5	7.8
UAF-BKG-25	1610E-69N	6	7.6
UAF-BKG-27	1610E-469N	7	7.8
UAF-BKG-28	1610E-634N	8	9.6
	AVERAGE	**7.6 ± 2.7 (2σ)**	**9.0 ± 2.3 (2σ)**

6.3 Characterization Data

The Cimarron site has been subdivided into survey units. These units are naturally distinguishable or have a common history of characterization and decommissioning activities. Throughout most of the decommissioning process at the Cimarron site, a unit was characterized, remediated (if required), and resurveyed. The description of the decommissioning activities and the final status survey data were then submitted to the NRC for review and approval. After review of the submittal, the NRC either released the unit and/or contracted with ORISE (previously ORAU) to perform a confirmatory survey. Based upon the ORISE confirmatory survey (if requested by the NRC), the NRC either would release the unit or require additional remediation. Subarea J is one such unit. Cimarron personnel have completed the characterization and final status survey of this unit.

Reservoir #1 and the drainage area from Highway #74 to the Reservoir are located within Subarea J and have been designated as affected areas by Cimarrron. Cimarron personnel conducted an investigation of the drainage area west of Highway #74 to determine if runoff from the southern portion of the Uranium Building yard has affected this area. This preliminary investigation revealed soil concentrations up to 70 pCi/g total uranium in the drainage area leading to Reservoir #1. This drainage area was characterized and remediated. All contaminated soils identified with total uranium concentrations above 30 pCi/g were removed and stockpiled on-site. This soil subsequently has been re-characterized and placed in the Option #2[16] on-site disposal cell. At the completion of this remediation effort, the drainage area was characterized again along with the banks and the bottom of Reservoir #1. Soil samples around Reservoir #1 and within the drainage area leading to Reservoir #1 were collected in 1991. The soil sampling was conducted on a 10 m x 10 m grid at depths of 0 to 4 feet in the drainage area. Also, soil samples were collected on an approximate 10 m linear grid at a depth of 0 to 6 inches around the perimeter of Reservoir #1, during a period of low water elevation. In addition, random sludge samples were taken from the bottom of Reservoir #1. The characterization data for this reservoir and the drainage to the reservoir were presented in Section 16.0 of the Characterization Report[5]. The soil sampling did not reveal any locations with concentrations above the guideline value of 30 pCi/g total uranium above background.

6.4 Environmental Monitoring Data

Subarea J includes one location where environmental monitoring has been performed in accordance with the Cimarron Environmental Sampling Program. The location is a surface water sample location (location #1204) which monitors Reservoir #1. Gross α concentrations have ranged from 1.1 to 23 pCi/l, and gross β concentrations have been <20 pCi/l. Total U has been reported at above detection limits on three occasions ranging from 2.1 to 12.2 pCi/l.

The final status survey for this subarea included the collection and analysis of water samples from this Reservoir. These results are discussed in Section 8.2.2 of this Report.

7.0 Final Status Survey Procedure

The purpose of this section is to discuss the methodology utilized for the collection of the survey data presented in this Report as Final Status Survey data. The survey methodology employed is similar to that utilized for the release of other areas on-site. The final survey data will be used to demonstrate that the applicable radiological parameters (guideline values) are satisfied for release of this subarea from License SNM-928. The guideline values utilized for comparison to the final status survey data are described in this section.

In general, for Phase II areas, Cimarron Corporation has committed to follow the methodology prescribed in NUREG/CR-5849[17] for performing the Final Status Survey. This Final Status Survey was conducted after fairly comprehensive efforts were made to identify, evaluate, and if necessary, remove any areas of residual activity exceeding the guideline value. This Report includes all necessary data to support the final status survey for Subarea J.

7.1 Survey Method

In general, survey and soil sampling data were collected utilizing established methodologies which have been demonstrated through the release of other areas from License SNM-928 at the Cimarron site. These methods are discussed below:

7.1.1 Grid Areas

For purposes of data evaluation, Subarea J was subdivided into the 100 m x 100 m grid pattern shown on Drawing No. 95MOST-RF3 and this grid was utilized for locating soil sampling and survey points for this final survey. Cimarron employs a Global Positioning System (GPS) unit to check pre-established grid points and to locate sample collection and survey positions in the field. This GPS unit is accurate to less than ± 1 m. The 0.0 grid point is located just south and slightly west of the main Uranium Building. This grid point has been tied into a permanent marker for future reference.

7.1.2 Surveys (Open Land Areas)

In general, the affected areas were 100% scanned utilizing a 3" x ½" unshielded NaI detector and the unaffected areas were 10% scanned. The specific instruments used were selected by the RSO/Health Physics Supervisor. The instrumentation available for use by site personnel and the minimum detectable activity (MDA) for those instruments are listed in Table 7.1. Where possible, in

TABLE 7.1

RADIATION MONITORING INSTRUMENTS

INSTRUMENT TYPE	NUMBER AVAILABLE	RADIATION DETECTED	SCALE RANGE	BKG	TYPICAL MDA 95% CONFIDENCE LEVEL
Scintillation (Ludlum 2224) Scaler/Ratemeter	2	Alpha Beta	0-500,000 cpm	< 10 cpm < 300 cpm	100 dpm/100 cm^2 500 dpm/100cm^2
Micro-R Meter (Ludlum) 1" x 1" Nal Detector	1	Gamma	0 - 5,000 µR/h	7 µR/h	7 uR/h
Ion Chamber (Victoreen)	2	Gamma	0.1 - 300 mR/h	<.0 1 mR/h	<0.2 mR/h
3" x 1/2" Nal Scintillation Detector Digital Scaler	3	Gamma	0 - 500,000 cpm	3,000 cpm avg shielded 9,000 cpm avg unshielded	250 cpm 500 cpm
100 cm^2 gas flow (43-68) Digital Scaler	1	Alpha	0 - 500,000 cpm	<10 cpm	100 dpm/100 cm^2
60 cm^2 gas flow (43-4) Digital Scaler	1	Alpha	0 - 500,000 cpm	<10 cpm	200 dpm/100 cm^2
60 cm^2 Count Rate Meter (PRM-6)	6	Alpha	0 - 500,000 cpm	<100 cpm	350 dpm/100 cm^2
50 cm^2 Personnel Room Monitor (Ludlum 177)	3	Alpha	0 - 500,000 cpm	<100 cpm	500 dpm/100 cm^2
5" Slide-Drawer Counter	1	Alpha	0 - 500,000 cpm	<0.3 cpm	2 dpm
Eberline 2" GM Tube (Pancake)	1	Beta, Gamma	0 - 500,000 cpm 720 cpm = 0.2 mR/h	<200 cpm	70 cpm
Ludlum 2" GM Tube (Pancake)	2	Alpha, Beta, Gamma	0 - 500,000 cpm 720 cpm = 0.2 mR/h	<200 cpm	70 cpm
Tennelec LB5100 Computer Based Auto Sample Counter	1	Alpha Beta	0 - 99,999,999 cpm	<0.3 cpm 1.5 cpm	0.4 dpm 1.5 dpm
Soil Counter - Computer Linked 4" x 4" x16" Nal (T1) Detector	1	Gamma	---	4 pCi/g Total U 1.5 pCi/g Th (Nat)	10 pCi/g U (5 minute count) 4 pCi/g U (30 minute count) .25 pCi/g Th (Nat)
100 cm^2 Gas Flow Digital Scaler	2	Beta, Gamma	0 - 10,000 cpm	<300 cpm	600 dpm/100 cm^2
Reuter-Stokes PIC Model RSS-112	1	Gamma	0-100mR/h	9-10 µR/h	9-10 µR/h

selecting an instrument for surveying, the MDA for the instrument should be ≤25% of the guideline value.

Where possible, 10 m x 10 m grid areas were surveyed by technicians who surveyed the grid by traversing back and forth within the grid area. Each traverse performed by the technician covered an area approximately 2 meters in width. In some cases, affected and unaffected areas were less than ten (10) meters in width; thus requiring fewer traverses. The highest reading found within each 10 m x 10 m grid area or approximate ten (10) meter length was recorded. Survey performance, documentation, and record retention was performed in accordance with the Cimarron Radiation Protection Program. In the event that any of these survey readings exceeded the limits discussed in Section 7.2.3, their location was flagged for subsequent survey and/or soil sampling. The procedures followed for both the affected and unaffected areas were specified in Cimarron site Special Work Permit(s) and Work Plan(s).

7.1.3 Soil Sample Locations

The soil sampling frequency was specified in the Cimarron Special Work Permit(s) and Work Plan(s). For the unaffected area, a minimum of thirty surface soil samples (0 to 6 inches deep) were collected within the boundary of Subarea J. The samples from the designated unaffected area were selected from the 10 m x 10 m grid intersect points within the unaffected area utilizing a random number generator. All soil samples were analyzed for total uranium using the on-site soil counter.

Where practicable, for affected areas, surface soil samples were collected at 5 m x 5 m intersect locations and at 5 meter intervals along the length of drainage ways when the width of such affected areas were less than 5 meters. Additionally, random subsurface soil sampling to a depth of 4 feet was performed within the affected area. Subsurface samples were collected at a frequency of one (1) out of every twenty (20) 5 m x 5 m grid point located within this Subarea J open land affected area. One sample location out of every twenty (20) 5 m x 5 m grid areas equates to one (1) sample location for every 500 square meters. All soil samples collected were analyzed for total uranium using the on-site soil counter.

7.1.4 Reservoir #1

As stated in the NRC approval, Phase II Final Status Survey Plan[12], the Reservoir was sampled as follows:

- At approximately 10 m intervals, sediments were collected across the reservoir in an East/West direction at approximately N190 (8 samples).

- At approximately 10 m intervals, sediments were collected the length of the reservoir in a North/South direction at approximately W290 (11 samples).

- Additionally, in a North/South direction at location approximately W320 on a 50 m interval (6 samples).

- An additional 5 samples were collected randomly throughout the reservoir, including the southern inlet to the reservoir.

- Samples were taken throughout the depth of the sediments where practicable and composited.

- Samples were analyzed for total uranium.

Three water samples were collected from the reservoir; one at the southern inlet, one at the eastern drainage inlet, and one at the reservoir discharge. Water samples were analyzed for total uranium and plutonium.

7.1.5 Concrete Rubble Utilized for Erosion Control

One small area located in the Subarea J unaffected area includes concrete rubble which previously had been released from the restricted area for use on-site for erosion control. The concrete rubble had been placed on an embankment above the drainage way from Reservoir #1. Even though the concrete rubble previously had been surveyed, Cimarron had committed to perform further surveys in the area encompassing the concrete. The concrete rubble surface areas were 100% scanned for both alpha and beta/gamma to the extent practicable with a Ludlum 2224 detector. Also, systematic surveys were completed at 1 m grid intersects with the NaI detector and the alpha and beta/gamma instrumentation. Soil samples also were collected in the area where the concrete rubble is located.

7.2 Guidelines Established

The radiological guidelines discussed in this section are utilized for comparison to the final survey data to verify that Subarea J can be released from License SNM-928.

7.2.1 Concrete Rubble

Current release limits for all materials and equipment are to comply with Facility License SNM-928 and are identical to the limits specified in Table 1 of the NRC's "Guidance for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use[18]". Subarea J contains no buildings or equipment, but does contain concrete rubble which was placed onto an embankment for erosion

control. Any concrete located in Subarea J was surveyed for comparison to the regulatory guideline values for uranium surface contamination in affect when the concrete was surveyed for free release. Although considered "free released", the concrete recently was scanned and systematic surveys were performed at 1 m grid intervals as opposed to 10 m grid intervals as allowed under NUREG-5849 for "open land areas". This survey data was compared to the Table 1 guideline values.

7.2.2 Volumetric Activity of Soil

For Subarea J, the guideline value for residual concentrations of total uranium which may remain in the soil is specified as Option #1 material. For enriched uranium, as specified in Table 2 of the BTP[16], the Option #1 limit is up to 30 pCi/g total uranium above background. For affected areas, systematic soil sampling was performed within each 10 m x 10 m grid area to determine the average value for residual activity. This systematic sampling equates to four samples (5 m x 5 m grid) per 100 m^2 area. This average value then was compared to the guideline values. Hot-spot averaging was performed for all locations which contained average total uranium concentrations in excess of 30 pCi/g above background as described in NUREG/CR-5849. Areas of elevated activity were determined based upon discrete sampling within the grid or were assumed to have a constant value (e.g., 25 m^2 based upon 5 m x 5 m grid sampling frequency). The maximum enriched uranium soil concentration within any 10 m x 10 m grid area may not exceed three times the BTP Option #1 limit (90 pCi/g total uranium above background).

For an unaffected area, NUREG/CR-5849 recommends reclassifying an area if any individual sample result exceeds 75% of the guideline value (i.e. 22.5 pCi/g total uranium above background for BTP Option #1 enriched uranium). Prior to reclassifying any unaffected area as an affected area, the NRC also recommends investigating any individual sample analysis result which exceeds 25% of the guideline value. The average value for total uranium concentration in background soil, as determined by the Cimarron soil counter (Counter #1) when calibrated for 2.7% enriched uranium, is approximately 4.0 pCi/g. The total uranium concentration corresponding to 25% of the guideline value of 30 pCi/g is 7.5 pCi/g. This value is then added to the average background value for the Cimarron site to derive the corresponding limit of 11.5 pCi/g total uranium. Therefore, any soil samples in unaffected areas with total uranium concentrations greater than 11.5 pCi/g were investigated further. In most cases, remediation of a small area is more appropriate than reclassification of an entire area.

7.2.3 Gamma Surface Survey (Open Land Areas)

Cimarron personnel utilize a shielded or unshielded 3" X 0.5" sodium iodide (NaI) detector as a final screening device for qualitative identification of residual contamination in soil. This type of detector is utilized in both unaffected and affected areas to assist in characterization activities.

The unshielded detector was utilized during the initial scan survey for both the affected and unaffected areas of Subarea J to identify elevated areas. When this type of detector is used, any survey instrument reading (in counts per minute) greater than twice background is used as an indication that an area requires additional investigation. As stated above, this instrument is utilized only for qualitative measurements. Quantitative measurement of residual contamination levels in soil is performed with the Cimarron soil counter.

7.2.4 Exposure Rate Survey (Open Land Areas)

For either affected or unaffected areas, the average exposure rate may not exceed 10 μR/h above background, at 1 meter above the surface. Exposure rates may be averaged over a 100 m^2 grid area as described in NUREG/CR-5849. The maximum exposure rate at any discrete location within a 100 square meter area cannot exceed 20 μR/h above background. Any areas with average exposure rates greater than 10 μR/h above background and any discrete locations within a 100 square meter area with exposure rates greater than 20 μR/h above background were delineated and remediated as required. Cimarron has recorded 7 μR/h as the average background exposure rate.

7.3 Equipment Selection

Special Work Permits (SWP) and Work Plans (WP) were written and approved prior to the commencement of field work required for this final status survey. The SWP and/or WP for this project specified the type of instrumentation to be utilized in performing the site surveys. The instrumentation utilized by site personnel is discussed below.

7.3.1 Equipment and Instrumentation

The instrumentation utilized to generate the characterization and final status survey data discussed in this Report was calibrated and maintained in accordance with the Radiation Protection Program procedures. These procedures utilize the guidance contained in ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration". Specific requirements for instrumentation include traceability to NIST standards, field checks for operability, background radioactivity checks, operation of instruments within established environmental bounds (i.e. temperature and pressure), training of individuals, scheduled

performance checks, calibration with isotopes of energies similar to those to be measured, quality assurance tests, data review, and recordkeeping.

Portable survey instruments utilized during the survey (micro-R survey meters, α/β survey meters, dose rate instruments, scalers/ratemeters, etc.), were calibrated on a quarterly basis. All instrumentation is calibrated with NIST traceable standards. Where applicable, activities of sources utilized for calibration are corrected for decay. In addition to the quarterly calibration requirements, source checks are performed on a daily basis for all instruments being utilized for characterization and final status surveys. A calibrated electronic pulse generator is utilized for instrument scale linearity checks.

All calibration and source check records are completed, reviewed, signed off and retained in accordance with Cimarron Quality Assurance Program requirements.

An SWP was written and approved prior to commencement of field work covered under this Final Status Survey Plan. The SWP specified the type of instrumentation to be utilized in performing the site surveys. The instrumentation utilized by site personnel is discussed below.

7.3.1.1 Unshielded 3" x 0.5" NaI Gamma Detector

The 3" x 0.5" detector is a sodium iodide (NaI) crystal gamma detector which is unshielded around the sides and socket end. The NaI detector is utilized with a portable scaler/ratemeter that has single channel analyzer capability. Americium-241, Uranium-235, and Natural Thorium sources are utilized to set the instrumentation window and threshold to detect gamma energies in the range of 50 to 250 keV. This energy range corresponds to the energies of interest when surveying for uranium and natural thorium contamination. The instrument is normally operated in the window "out" mode, meaning that this instrument response is for the entire range of detectable energies.

7.3.1.2 Shielded 3" x 0.5" NaI Gamma Detector

The 3" x 0.5" detector is a NaI crystal gamma detector which is shielded with lead around the top socket and sides to improve the directional sensing capabilities of the equipment. Similar to the unshielded detector, the shielded detector is utilized with a portable scaler/rate meter that has single channel analyzer capacity. This instrument is normally utilized in areas where background may be elevated.

7.3.1.3 Micro-R Survey Meter

The Micro-R meter was a 1" x 1" NaI/Tl crystal gamma detector and measured exposure rates between 0 and 5,000 μR/h. Background readings are obtained daily at a defined location prior to placing each instrument into service. This instrument is utilized, in general, for determination of exposure rates at both systematic and random locations, and at locations of elevated radiation as identified by area scans.

Quarterly comparisons and/or confirmatory measurements are obtained routinely to provide information concerning any measurement bias. These comparisons or confirmatory measurements are made using a pressurized ion chamber. The confirmatory measurements for Subarea J are shown below. The confirmatory measurements included in Table 7.2 indicate good agreement between the Micro-R meter measurements and the PIC measurements.

TABLE 7.2

Sample ID No.	Grid Location	Micro-R Reading (μR/h)	PIC Reading (μR/h)
Phase II Affected Area J	150W-55N	8	8.9
Phase II Affected Area J	200W-80N	9	9.4
Phase II Affected Area J	140W-20S	9	9.8
Phase II Affected Area J	240W-30N	8	9.9
Phase II Affected Area J	370W-200S	8	8.9
Phase II Affected Area J	370W-30N	10	10.0
	Average	**8.7 ± 1.6 (2σ)**	**9.5 ± 1.0 (2σ)**

7.3.1.4 Soil Counters (Gamma Spectroscopy)

The Cimarron Soil Counter consists of a 4" x 4" x 16" sodium iodide crystal housed in a shielded chamber which is computer linked to a multi-channel analyzer (MCA). Cimarron currently has two counting systems, Counter #1 and Counter #2.

Data from the MCA is processed through an analysis program (Counter #1) which, in turn, determines uranium and thorium concentrations in soil samples. Counter #1 assumes an enrichment of 2.7%. Recently, Cimarron installed a new analyzer which is programmed (Counter #2) to determine the total uranium present in the soil sample by calculating the U-234 present from the U-235 valued detected in the soil. Additionally, these two values then are summarized with the detected U-238 value for determining total U. Counter #2 also adjusts for system

background, where as Counter #1 utilized a constant for background. The majority of the data discussed and presented in this Report was generated by Counter #1. Presently, Counter #2 is the primary counting system with Counter #1 only utilized as an emergency backup. Calibration of this counting system is performed annually and is traceable to NIST standards through contractor laboratory evaluations of the on-site standards.

ORISE has been used by the NRC for verification of a majority of the decommissioning work completed to date at the Cimarron site. ORISE has conducted an evaluation of the Cimarron Soil Counting system's ability to measure accurately total uranium concentrations in soil samples. This was done by comparing ORISE sample analysis results obtained by alpha pulse height analysis and gamma spectroscopy with the results obtained from the use of the Cimarron Soil Counter. ORISE and Cimarron analysis results compared favorably at levels above background as demonstrated by the most recent confirmatory analysis performed for the On-Site Disposal Cell, Pit #3 (NRC cover letter dated July 31, 1997)[19]. NRC inspection Report #70-925/97-02, which accompanied this letter, states that "no significant bias or statistical errors between the license's soil results and the NRC's results were identified". Additionally, the confirmatory analysis performed on select soil samples collected during ORISE's site visit to investigate the South U-Yard[20], and DAP-3 stockpile[21] verified previously that Cimarron's on-site counter results are statistically identical to ORISE's results.

Established quality assurance measures for the soil counter include Cesium-137 centroid checks, Chi-square tests, background determinations, and the counting of soil standards. All of these quality assurance controls are recorded on control charts and are trended on a continuing basis.

Standards used for calibration and quality assurance checks for the soil counter have been analyzed by outside laboratories and are NIST traceable through these analyses. Comparisons have been made between the standards as counted using the soil counter and two off-site laboratories. The assigned values for the standards are the average of the results obtained from the off-site laboratories, when the standards were analyzed by more than one laboratory. The standards range in concentration from 4.5 pCi/g total uranium to 292 pCi/g total uranium.

Cimarron personnel determine uranium and thorium activities based upon the evaluation of net counts from the soil counter. Activities are calculated through the use of efficiency and correction factors obtained using appropriate standards. Soil concentrations are calculated by dividing the net activity by the soil mass. Soil masses are determined on a laboratory scale which is checked on a daily basis (when in use) utilizing NIST traceable standards. Corrections for soil moisture content are also made as necessary.

7.4 Procedures/Plans

As discussed in Section 7.3, SWP's and WP's were written and approved prior to commencement of field work required for this final status survey. These SWP's and WP's are an integral part of this site's radiation protection and quality assurance program. Project organization and responsibilities, which are a part of the site's quality assurance program, are discussed in this section.

7.4.1 Organization

The Subarea J final status survey was performed by a survey team consisting of qualified personnel from the Cimarron site. The final survey team operated under the general direction of a Project Manager who reported directly to the Site Manager at the Cimarron Facility.

The selection of field measurement equipment and sample collection techniques was under the direction of the RSO/Health Physics Supervisor who also reports to the Cimarron Site Manager. Actual field measurements and sample collection were under the direction of the Project Manager. The Project Manager was responsible for developing the SWP and WP for this subarea with input from the RSO/Health Physics Supervisor and the Cimarron Site Manager. The SWP and WP were reviewed and approved by the Cimarron Site Manager.

7.4.2 Training

Cimarron Corporation provides continuing training to Cimarron personnel and any other personnel (i.e., contractors, visitors, etc.) who are allowed access to the site. All members of the final status survey team attended an in-house training session on the SWP and WP prior to commencement of work under the final status survey plan. All survey procedures and quality assurance requirements were reviewed during this training session.

7.4.3 Radiation Protection Program

Cimarron Corporation maintains a radiation protection program which meets and/or exceeds all of the applicable regulatory requirements associated with activities conducted under Special Nuclear Materials License SNM-928 and By-Product License 35-12636-02.[22] The Cimarron Radiation Protection Program currently in place for all decommissioning activities is administered through the use of the following documents:

- Cimarron Quality Assurance Plan and Procedures
- Cimarron Radiation Protection Procedures

- Cimarron Site Health and Safety Plan
- Cimarron Emergency Plan

It is the policy of Cimarron Corporation to perform all work in strict compliance with applicable regulatory and internal requirements. The goal of the Cimarron decommissioning effort is to conduct all operations at a level of excellence which exceeds regulatory requirements. Cimarron staff will continue to exercise appropriate radiation protection precautions throughout the remaining decommissioning work and final survey process.

Independent Kerr-McGee Corporate audits for regulatory and internal requirements are conducted on a periodic basis and include the review of the Cimarron Radiation Protection Program and associated programs. Assessments of program effectiveness also are performed periodically by the Cimarron RSO/Health Physics Supervisor. Additionally, the Cimarron Radiation Protection Program is inspected for compliance with applicable rules and regulations by NRC Region IV and NRC Headquarters staff.

7.4.4 Cimarron Quality Assurance Program

The Cimarron Corporation QAP is an integral part of the Cimarron Radiation Protection Program. A principal component of the QAP is the confirmation of the quality of project work performed during decommissioning by assuring that all tasks are performed in a quality manner by qualified personnel. The Program ensures that samples are collected, controlled, and analyzed in accordance with applicable quality controls to provide adequate confidence in the resulting data accuracy and validity are verifiable. Such quality controls allow for the independent verification of analysis results by a third party review.

The Cimarron QAP is implemented and maintained in accordance with written policies, procedures, and instructions. This Program is administered under the direction of the Quality Assurance Manager. Periodic audits and reviews are conducted to ensure that all aspects of the Program are addressed. The Cimarron QAP satisfies all of the applicable requirements of ASME NQA-1[23].

Written procedures, designated as SWP's and WP's, are prepared, reviewed and approved for activities involved in carrying out the decommissioning process. The Subarea J Survey SWP and WP were written in accordance with the Cimarron QAP. These documents designated the type of surveys to be performed, samples to be collected, frequency of sample collection, number of samples to be split with an off-site independent laboratory, and the type of field instrumentation required for the tasks required.

The facility performs its own radiological soil analysis in accordance with written procedures and QA/QC protocols. Field data are gathered and maintained in logs for all samples in accordance with the Cimarron QAP. Necessary data are transferred to the on-site laboratory sample log when the sample is brought to the on-site laboratory for analysis. The sample logs provide a record of sample collection and transport (chain of custody) and are incorporated into the facility quality assurance records.

In addition, off-site independent radiological analysis of split samples (sample are first counted on-site and then sent to an off-site independent laboratory) is an integral part of the Cimarron QAP. Samples sent to an off-site independent laboratory for analysis are accompanied by a chain of custody form in accordance with the Cimarron QAP. These forms provide documentation for all aspects of sample control and are maintained by the Quality Assurance Manager as permanent records.

Sample and survey data are reviewed by the Health Physics Department for accuracy and consistency and are compared to the guideline values. Reviews are performed on a regular basis. When identified, corrections to recognized deficiencies are performed.

Planned and periodic audits of Cimarron's Quality Assurance Program are performed by individuals who do not have direct responsibilities for the areas being audited. Audit results are documented for review by management.

8.0 Survey Findings

As discussed in Section 1.0, final status survey data was generated for Subarea J to justify the release of this subarea from License SNM-928. The survey findings, including the statistical methodology employed to evaluate the data for Subarea J, are discussed in this section.

8.1 Data Evaluation

As discussed in NUREG/CR-5849, the guideline values for soil activity concentrations and exposure rates are average values (above background) established for areas of survey units. In order to compare the analytical and survey data developed for the final status survey with guideline values, data at each individual survey grid location was compared to the respective guideline value. The guideline value for leaving soil in place for both affected and unaffected areas is Option #1 material (up to 30 pCi/g total uranium above background).

For an affected area , if an individual soil activity measurement (representing 25 m^2) exceeded the applicable guideline value, then the average for the four samples within a

100 square meter survey unit area was determined. Areas of residual activity exceeding the guideline value, known as elevated areas, were acceptable provided they did not exceed the guideline value by greater than a factor of $(100/A)^{½}$, where A was the area of residual activity in m^2, and provided the activity level at any location did not exceed three times the guideline value. The average for the survey unit was compared to the guideline value. If the average value was below the guideline plus background, further remediation was not required and the data was presented as final status survey data.

For the unaffected area, soil samples which exceeded 11.5 pCi/g (25% of guideline plus background) were further investigated. Any unaffected area containing a soil sample with an activity greater than 22.5 pCi/g (75% of the guideline plus background) was reclassified as an affected area and surveyed as an affected area.

8.2 Comparison With Guideline Values

The data for Subarea J were compared to the guideline value criteria and are discussed separately below:

8.2.1 Affected Area Soil Survey Data

This section evaluates the data collected from both the 100% scan and the systematic survey performed at the grid intersects for affected areas within Subarea J. The data includes a total of 218 soil sample analytical results and systematic survey readings collected on 5 m x 5 m grid intersects. The data, tabulation, statistical analyses, and drawings are presented in Appendix II.

The 100% NaI scan that was performed prior to the systematic survey did not identify any locations that exceeded twice background. For the surface sampling, soil sample analytical results for this unit were all below the total uranium guideline value (i.e. 30 pCi/g total uranium above background), except for one location. This location was at 220W-70N, and had a concentration of 41 pCi/g total uranium. The mean value for all 218 samples was 8.8 pCi/g total uranium, with a standard deviation of 3.5 pCi/g. The soil sample locations and analytical results for total uranium are shown on Drawing No. 97POASSS-0. The NaI detector survey results for the grid intersect sample locations ranged from 5,256 to 10,418 CPM. All survey results were less than twice background (i.e. 2 x 7,958 CPM as described in Section 7.4.2). The survey results are presented on Drawing No. 97POAJ3D. The exposure rates at the surface and at one meter above the surface as measured using a μR meter both ranged from 5 to 11 μR/h, with the mean being 8 μR/h. The exposure rates are presented on Drawing Nos. 97POAJUR-0 and 97POAJUR-1.

Fifteen random subsurface soil samples were collected within the affected area, including the sample location at 220W-70N (i.e., 41 pCi/g total uranium). The

samples were collected and composited at intervals of 0-6", 6"-1', 1'-2', 2'-3' and 3'-4'. In addition, off-set samples were collected and analyzed around the elevated location at 220W-70N for averaging over the 25 m^2 planar area. The sample locations and analytical results are shown on Drawing Nos. 97POAJSS-CONF-0 thru 97POAJSS-CONF-5. These drawings and the data tabulation sheets are included in Appendix III. The 25 m^2 average total uranium concentrations in soil for the elevated location listed by depth are presented below in Table 8.1.

TABLE 8.1
AVERAGE SOIL ACTIVITY AT LOCATION 220W-70N

DEPTH	AVERAGE ACTIVITY (pCi/g)
0 - 6"	20.5
6" - 1'	16.1
1' - 2'	17.4
2' - 3'	11.7
3' - 4'	10.3

The average sample results at each incremental depth all are below the guideline value of 30 pCi/g. Thus, both the elevated location of 220W-70N and for all other random locations sampled within the affected area are below 30 pCi/g total uranium.

Surface soil samples were also collected at approximate 10 m linear increments in the drainage way between Highway #74 and Reservoir #1. This drainage way traverses the affected area which was discussed above as being sampled on a 5 m x 5 m grid interval. A total of 25 soil samples were collected with total uranium concentrations ranging from 3 pCi/g to 17 pCi/g, with a mean equal to 7.6 pCi/g. One sample location at 220W-80N, was sampled to a depth of four feet. The total uranium concentration from the composited soil samples ranged from 6 pCi/g to 14 pCi/g. All locations were below the guideline value of 30 pCi/g above background. The sample locations, results and data tabulation are included in Appendix IV.

8.2.2 Reservoir #1

This section evaluates the data from both the sludge and the water samples collected within Reservoir #1. The data includes soil (sludge) sample results for the sample locations discussed in Section 7.1.4. A total of 30 soil samples were collected from this unit. The data, tabulation, statistical analyses, and drawings are presented in Appendix V.

The sludge samples that were taken from the reservoir bottoms were collected utilizing a sampler constructed by Cimarron personnel. The sampler was built from PVC pipe with a flexible membrane over the sample end to prevent water from entering the tube during sample collection. Cimarron personnel lowered the tube into the reservoir from a boat and pushed it into the sludge until a slight resistance was encountered. A hand auger was then placed in the tube, the membrane was breached, and the sample was collected. The sludge sample was retained within the tube while being withdrawn from the Reservoir bottom. The depth of the sludge samples ranged from 1 to 3 feet. The samples were containerized and labeled. Once collected, the 30 samples were allowed to air dry prior to being composited for on-site analysis.

All 30 soil sample analytical results for this unit were at or below the total uranium guideline value (i.e. 30 pCi/g total uranium above background). The mean value was 10 pCi/g total uranium, with a standard deviation of 3.6 pCi/g. The highest total uranium concentration was 19 pCi/g at location 360W x 190N. The 95% confidence level value was calculated at 11.1 pCi/g which also is below the guideline value for total uranium. The soil sample locations and analytical results are shown on Drawing No. 97POLJSS-0 located in Appendix V.

The three water sample total uranium results ranged from 2.1 to 5.9 pCi/l with all three results being below the total uranium concentration recorded for the Cimarron River upstream from the site. The upstream river results (environmental sample #1201) have ranged from 6.7 to 8.2 pCi/l. The three samples were also analyzed for Pu-239/240, with the results showing background concentrations.

8.2.3 Unaffected Open Land Area

This section evaluates the data collected from the 10% scan of the unaffected area; the 100% scan of the boundary between Subarea J and Subarea E; the systematic survey performed at the random grid intersect locations; and the soil samples collected at the random grid locations. A total of 32 random surface soil samples were collected from the unaffected area at the locations noted on Drawing No. 97POUSSS-0. This drawing is located in Appendix VI. The soil sample analysis results for this unit all were below the total uranium guideline value (i.e., 11.5 pCi/g), ranging from 5 pCi/g to 11 pCi/g, with a mean of 7 pCi/g.

The 10% NaI scan that was performed prior to the systematic surveys did not identify any locations that exceeded twice background. The NaI detector survey results for the 32 grid intersect soil samples locations ranged from 5,506 CPM to 14,800 CPM with a mean value of 7,983 CPM. The reading at 110W-80S (14,800 CPM) exceeded twice background (7,238 CPM). However, the soil sample result of 8.9 pCi/g was below the guideline value for additional

investigation (11.5 pCi/g), so no further surveys were justified. The dose rates at the surface and at one meter above the surface ranged from 6 to 11 μr/h, with a mean of 8 μR/h. The tabulation for all values collected and drawings showing survey locations are included in Appendix VI.

The 100% surface scan of the boundary between Subarea J and Subarea E was performed followed by a systematic survey at 10 m intervals. The scan did not reveal any readings exceeding twice background. The systematic survey results for the unshielded NaI detector, and the μR-meter were all within the guideline values and are included on Drawings Nos. 97POBJ3D-0, 97POBJUR-0 and 97POBJUR-1. These drawings and their applicable data survey tables are included in Appendix VII.

8.2.4 Area Containing Concrete Rubble

As discussed in Section 7.1.5, concrete rubble removed from the process buildings and previously surveyed was placed along an embankment west of Reservoir #1 for erosion control. The location of the concrete is shown on Drawing No. 97POCJ3D-0. This drawing is included in Appendix VIII. The two 5 m grid intersects at 405W-190N and 400W-190N which are designated on the drawing show the concrete rubble location. These two grid intersects fall within the area where the concrete rubble is located. The systematic survey results for the two 5 m grid locations are shown on the Drawings included in Appendix VIII. The systematic surveys include recorded readings taken with the NaI detector, the Ludlum 2224 alpha and beta/gamma survey meter, and the Micro-R dose rate meter. These survey results were all less than the guideline values.

Although the two 5 m grid results were all less than the guideline values, Cimarron Corporation decided to perform a 100% scan of the concrete area and to increase the frequency of the systematic concrete survey by reducing the grid size for this area to 1 m x 1 m. The 100% scan with the Ludlum 2224 detector did not identify any location that exceeded 5,000 DPM/100 cm^2 for alpha and beta/gamma. Also, a total of 66 locations were systematic surveyed, with the results tabulated in Appendix VIII. The 3" NaI survey results ranged from 1,486 to 3,944 CPM, with a mean of 1,484 CPM. Background was recorded at 1,436 CPM. Four locations exceeded twice background; however, the follow-up beta/gamma surveys for these four locations ranged from 1,443 to 3,130 DPM/100 cm^2, which are less than the guideline value for uranium surface contamination on released materials.

The systematic alpha surveys ranged from 0 to 1,010 DPM/100 cm^2 with a mean of 54 DPM/100 cm^2. The beta/gamma survey for the 66 locations ranged from 208 to 5,525 DPM/100 cm^2, with a mean of 1,102 DPM/100 cm^2.

Additional surveys were taken around the 5,525 DPM/100 cm^2 location (186N-400W) to verify that this was an isolated elevated location. These additional surveys verified that the overall average for this section of concrete (approximate 1 m^2 area) would be well below the 5,000 DPM/100 cm^2 used as a guideline value for this concrete rubble survey.

Soil samples also were collected for analysis at seven locations surrounding the concrete rubble area. The soil sample results for total uranium are presented below in Table 8.2.

TABLE 8.2
TOTAL URANIUM SOIL SAMPLE RESULTS

LOCATION	ANALYTICAL RESULTS (pCi/g)
403W - 184N	5
410W - 190N	3
405W - 190N	6
408W - 197N	6
404W - 192N	1
406W - 197N	8
398W - 185 N	4

The above soil sample results were all below the unaffected guideline value of 11.5 pCi/g total uranium, and are representative of background activity levels in soil. The soil sample located at 406W-197N was re-analyzed, increasing the count time from 5 minutes to 15 minutes. The sample also was sent off site for confirmatory analysis. The independent laboratory result was 1.5 ± 0.7 pCi/g total U; Cimarron's on-site counter measured 2.1 ± 1.7 pCi/g total U. These results are comparable.

Since the recorded average surface activities were all below 5,000 DPM/100 cm^2 and the soil samples were below 11.5 pCi/g, no further investigation, survey, or data evaluation of this survey unit was deemed necessary.

8.3 QA/QC Procedures

As discussed in Section 7.5.2.4, Cimarron Corporation SWP's/WP's are an integral part of the overall site decommissioning program and include off-site independent analysis of split samples. For the soil activity ranges that apply to this affected area survey, soil samples recently have been split with the NRC for off-site analysis. These comparative analyses were part of the confirmatory analysis performed for Pit #3[19]. The soil samples were first analyzed by the Cimarron on-site counter prior to being given to the NRC for analysis at an independent laboratory (both NRC and ORISE). The averages (mean) for

the Cimarron/ORISE samples analyzed, first on-site and then off-site, were 43.7 pCi/g total uranium from the independent laboratory versus 44.9 pCi/g total uranium for the Cimarron on-site counter. These sample results continue to show excellent agreement.

In accordance with the Phase II Final Status Survey Plan, two soil samples from Subarea J were analyzed on site and then sent off site to an independent laboratory for confirmatory analysis. The samples were collected from the unaffected area of Subarea J. Since the samples were collected from an unaffected area, with results at or near background levels, the Cimarron soil counter results (Counter #1) were corrected for the natural uranium enrichment. The data comparison is shown in Table 8.2.

8.3

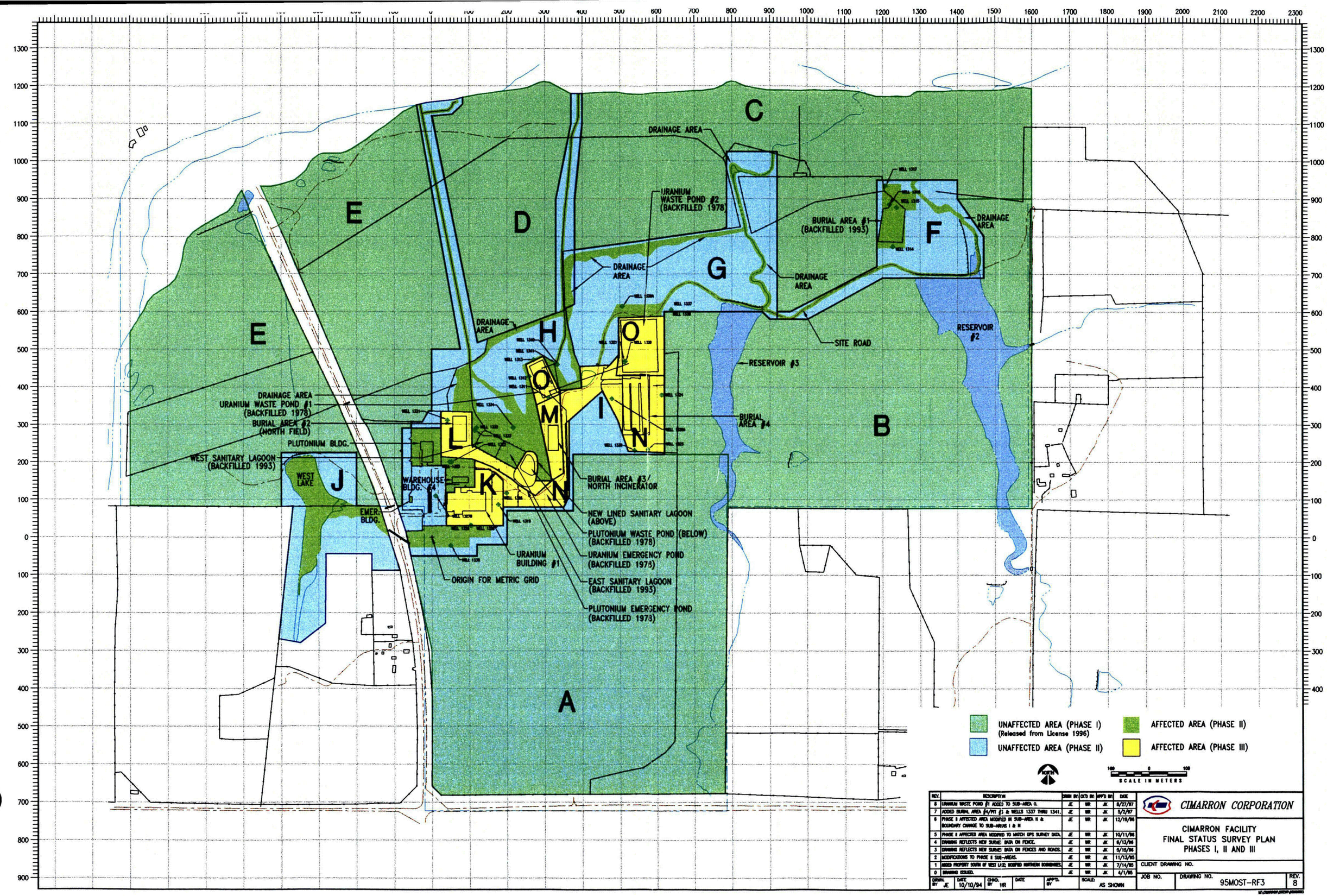
TABLE 8.2
QA/QC URANIUM ANALYTICAL SAMPLE RESULTS

Sample No.	Core Results (pCi/g)	Cimarron Results pCi/g	Cimarron Corrected Results (pCi/g)
JU-04	1.9 ± 0.9	7.3 ± 4.0	3.3 ± 1.8
JU-08	0.8 ± 0.7	8.4 ± 4.9	3.8 ± 2.2

The results are comparable for background levels for the two different analytical methods utilized.

9.0 Summary

A Final Status Survey was performed in accordance with the approved Phase II Final Status Survey Plan for Subarea J. This Report presents a comparison of the survey results of the Final Status Survey to the guideline values for both unaffected and affected areas contained within Subarea J at the Cimarron site. The comparison of these survey results presented herein demonstrates that all criteria (guidelines values) have been met and/or exceeded and thus Subarea J can now be released from License SNM-928.



REV.	DESCRIPTION	DRAWN BY:	CK'D BY:	APP'D BY:	DATE
8	URANIUM WASTE POND #1 ADDED TO SUB-AREA O.	JE	WR	JK	8/27/97
7	ADDED BURIAL AREA #4/PIT #5 & WELLS 1337 THRU 1341.	JE	WR	JK	5/2/97
6	PHASE II AFFECTED AREA MODIFIED IN SUB-AREA N & BOUNDARY CHANGE TO SUB-AREAS I & N	JE	WR	JK	12/19/96
5	PHASE II AFFECTED AREA MODIFIED TO MATCH GPS SURVEY DATA.	JE	WR	JK	10/11/96
4	DRAWING REFLECTS NEW SURVEY DATA ON FENCE.	JE	WR	JK	6/13/96
3	DRAWING REFLECTS NEW SURVEY DATA ON FENCES AND ROADS.	JE	WR	JK	6/10/96
2	MODIFICATIONS TO PHASE II SUB-AREAS.	JE	WR	JK	11/13/95
1	ADDED PROPERTY SOUTH OF WEST LAKE, MODIFIED NORTHERN BOUNDARIES.	JE	WR	JK	7/14/95
0	DRAWING ISSUED.	JE	WR	JK	4/1/95

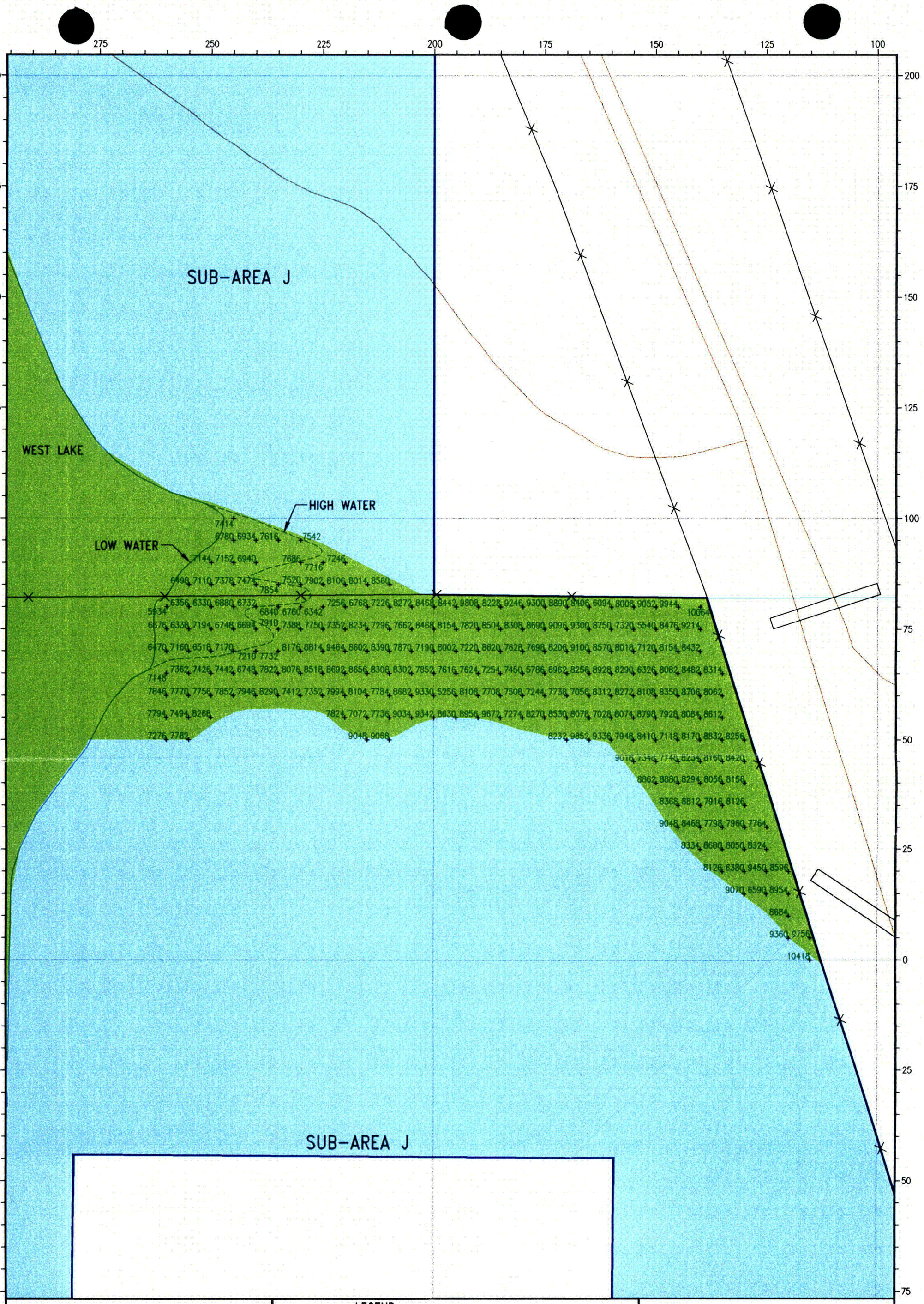
DRAWN BY: JE | DATE: 10/10/94 | CHK'D BY: WR | DATE | APP'D BY | SCALE: AS SHOWN

CIMARRON CORPORATION

CIMARRON FACILITY
FINAL STATUS SURVEY PLAN
PHASES I, II AND III

CLIENT DRAWING NO.

JOB NO. | DRAWING NO. 95MOST-RF3 | REV. 8



NOTES:

INSTRUMENT: LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR

BACKGROUND: 7916 CPM

-+ FIELD SURVEY READING NOT TAKEN OVER STANDING WATER

20 0 20

SCALE IN METERS

NORTH

LEGEND

UNAFFECTED AREA (PHASE II)

AFFECTED AREA (PHASE II)

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JK	8/20/97

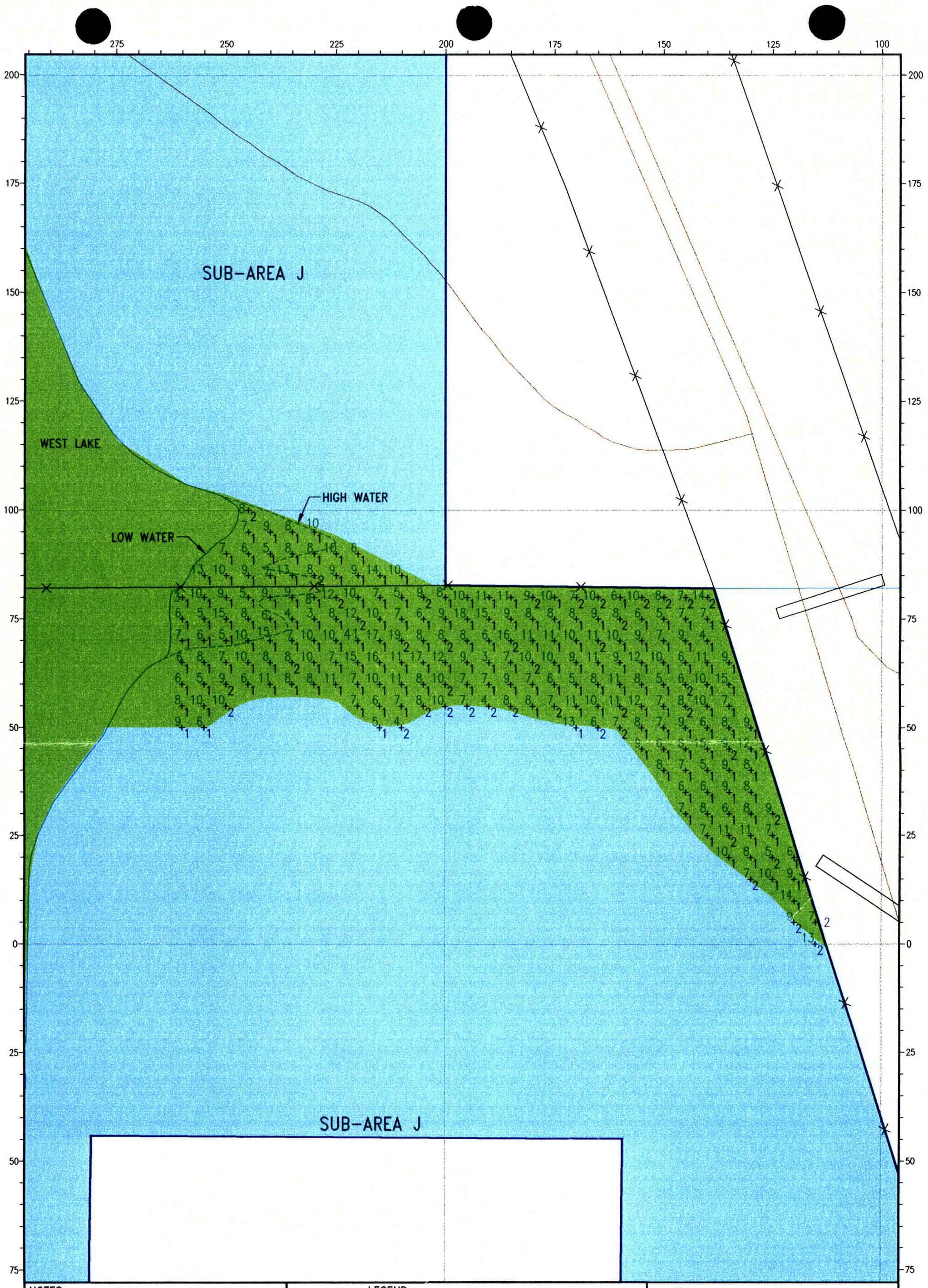
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE II – SUB-AREA J
POST REMEDIATION AFFECTED AREA
GAMMA SURVEY (1997)

DRWN. BY	DATE	SCALE
JE	7/9/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97POAJ3D-0	0

...\CIMARRON\SUBAREAJ\97POAJ3D



NOTES:

SAMPLES ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U) AND THORIUM (pCi/g Th).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF 4 pCi/g U & 1.5 pCi/g Th, NOT SUBTRACTED.

$^{8}_{+}$ URANIUM
$_{+1}$ THORIUM

20 0 20

SCALE IN METERS

NORTH

LEGEND

UNAFFECTED AREA (PHASE II)

AFFECTED AREA (PHASE II)

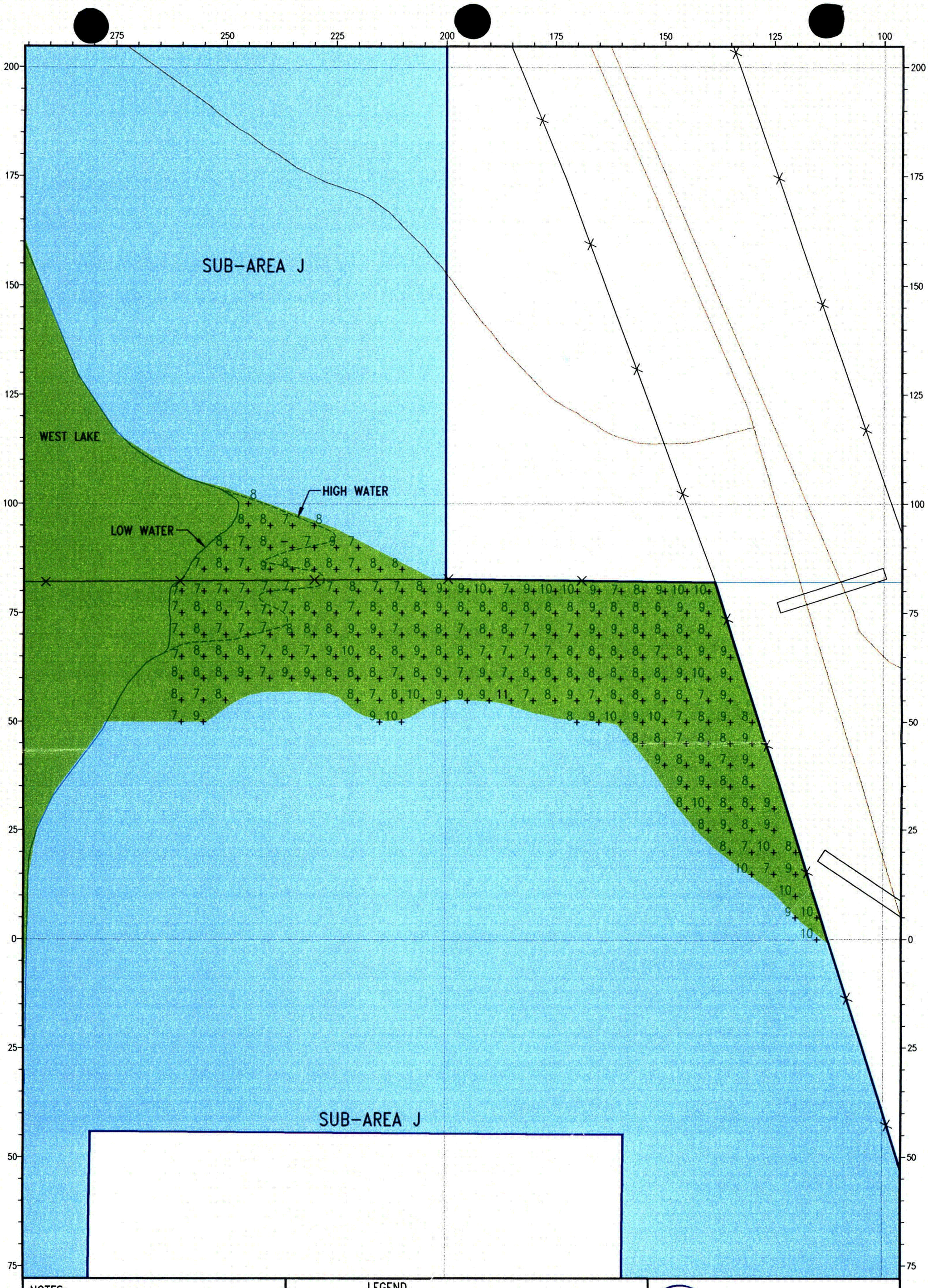
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JK	8/20/97

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE II – SUB-AREA J
POST REMEDIATION AFFECTED AREA
SOIL SAMPLE RESULTS (1997)
SOIL SAMPLE ALIQUOT: 0-6"

DRWN. BY	DATE	SCALE
JE	7/3/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97POAJSS-0	0

...\CIMARRON\SUBAREAJ\97POAJSS



NOTES:

READINGS ARE IN MICRO-R/Hr. (μR/Hr.)

INSTRUMENT: LUDLUM MICRO-R METER
MODEL NO.: 19
BACKGROUND: 7 μR/Hr.

20 0 20

SCALE IN METERS

NORTH

LEGEND

UNAFFECTED AREA (PHASE II)

AFFECTED AREA (PHASE II)

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JK	8/20/97

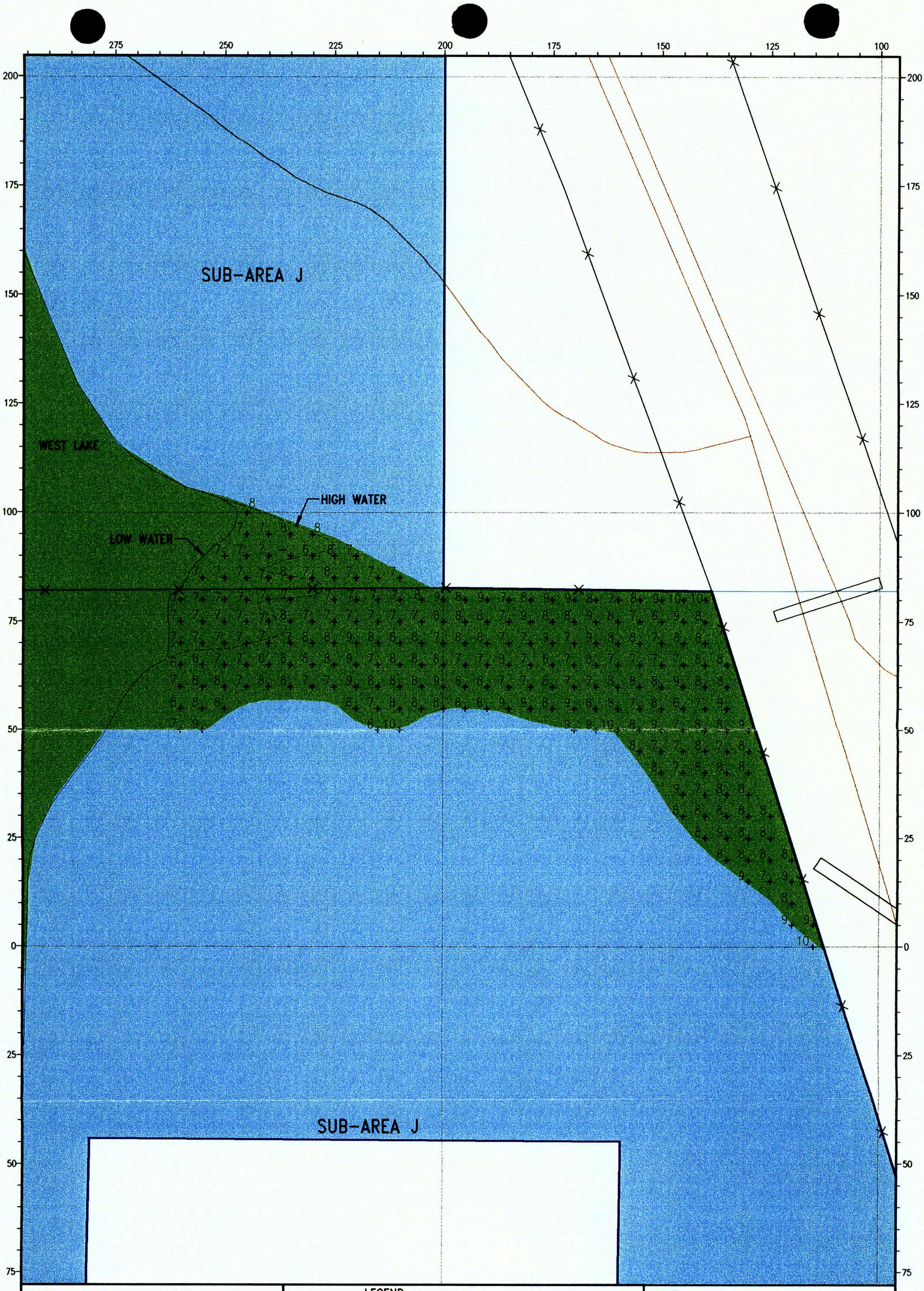
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE II - SUB-AREA J
POST REMEDIATION AFFECTED AREA
MICRO-R SURVEY (1997)
AT LAND SURFACE

DRWN. BY	DATE	SCALE
JE	7/9/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97POAJUR-0	0

...\CIMARRON\SUBAREAJ\97POAJUR



NOTES:

READINGS ARE IN MICRO-R/Hr. (μR/Hr.)

INSTRUMENT: LUDLUM MICRO-R METER
MODEL NO.: 19
BACKGROUND: 7 μR/Hr.

20 0 20

SCALE IN METERS

NORTH

LEGEND

UNAFFECTED AREA (PHASE II)

AFFECTED AREA (PHASE II)

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JK	8/20/97

CIMARRON CORPORATION

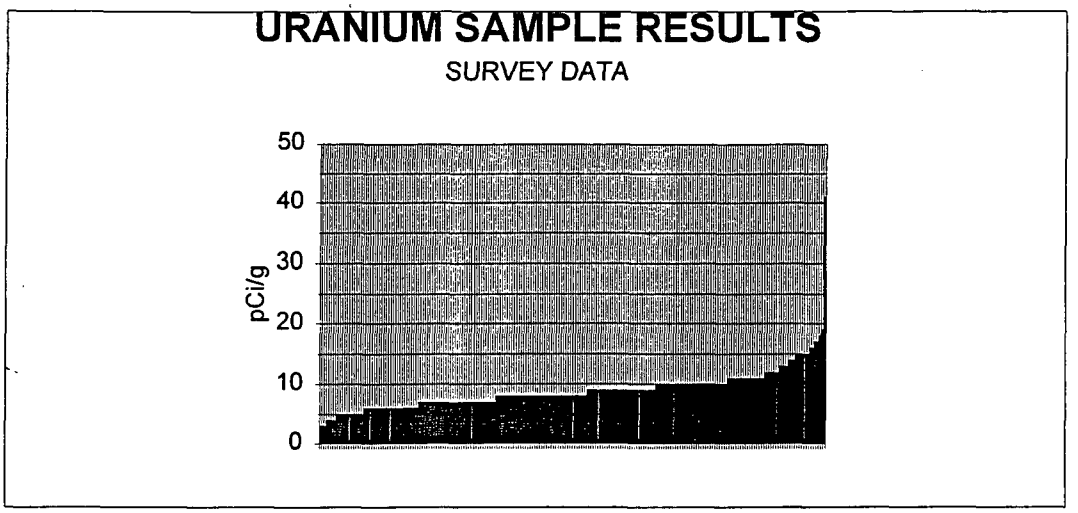
CIMARRON FACILITY
PHASE II - SUB-AREA J
POST REMEDIATION AFFECTED AREA
MICRO-R SURVEY (1997)
AT ONE METER ABOVE SURFACE

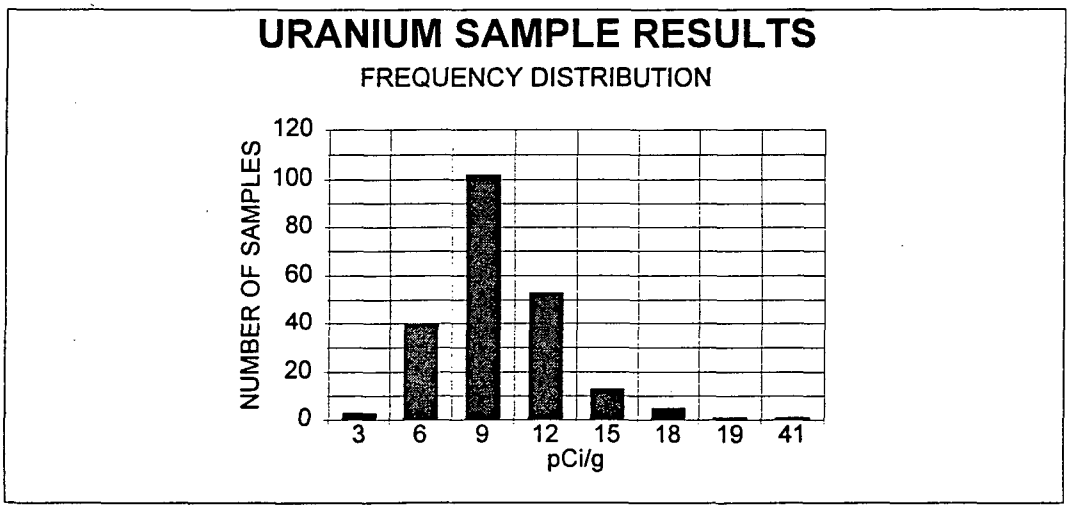
DRWN. BY	DATE	SCALE
JE	7/9/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97POAJUR-1	0

...\CIMARRON\SUBAREAJ\97POAJUR

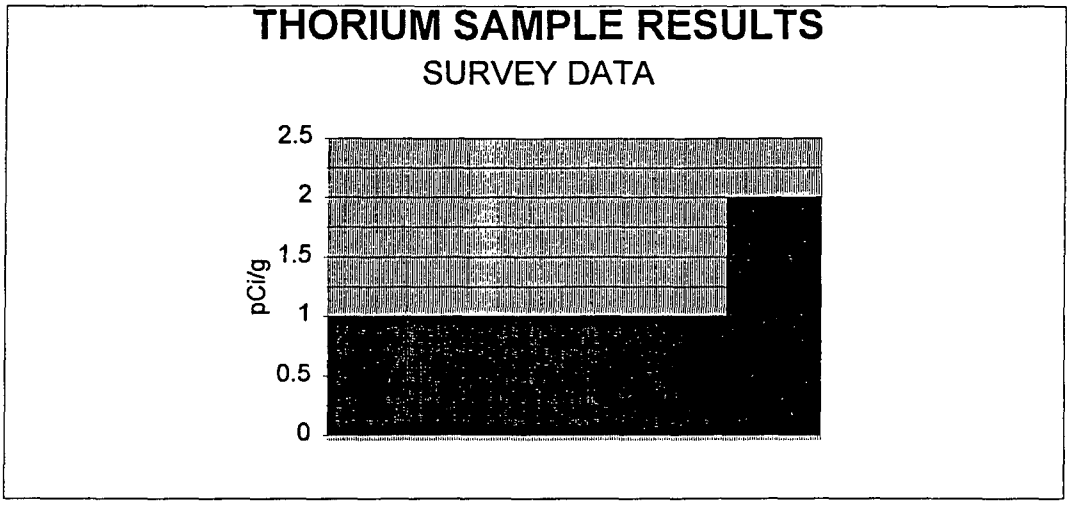
PHASE II, SUB-AREA "J" - SURFACE AFFECTED AREA
CIMARRON SOIL COUNTER
TOTAL URANIUM SAMPLE RESULTS
SITE BACKGROUND OF 4 pCi/g NOT SUBTRACTED
APRIL 1997

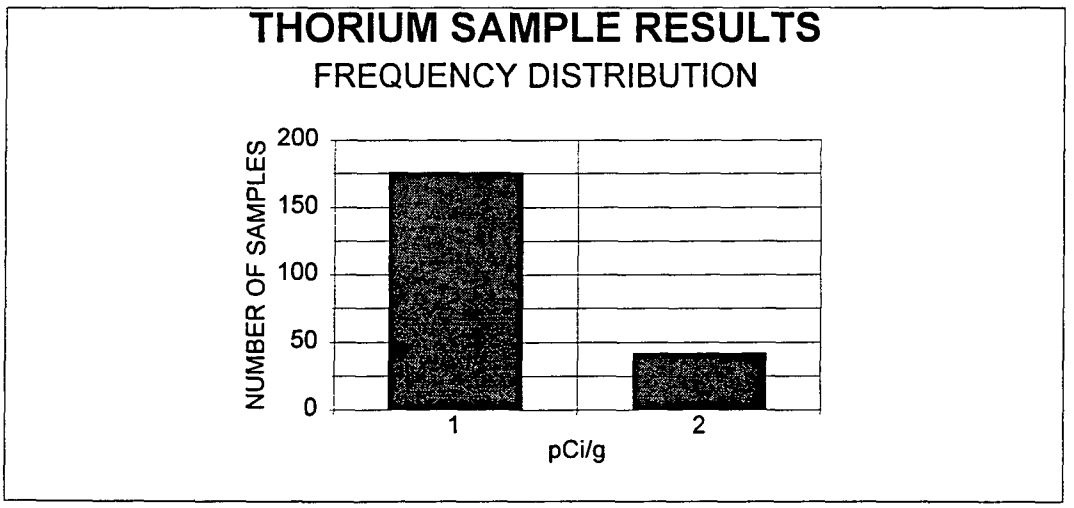




NUMBER OF SAMPLES	218
AVERAGE SAMPLE	9
MINIMUM SAMPLE	3
MAXIMUM SAMPLE	41
STANDARD DEVIATION	4

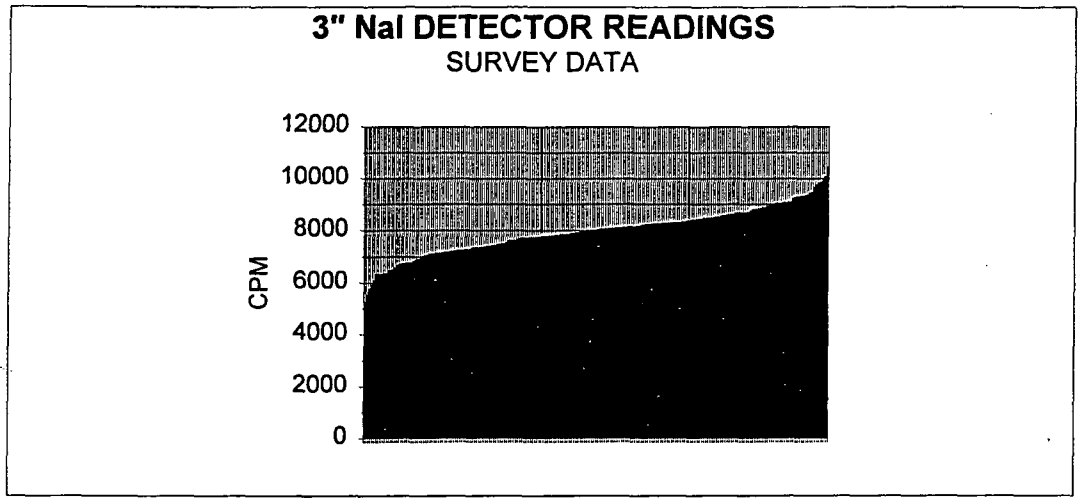
PHASE II, SUB-AREA "J" - SURFACE AFFECTED AREA
CIMARRON SOIL COUNTER
THORIUM (NAT) SAMPLE RESULTS
SITE BACKGROUND OF 1.5 pCi/g NOT SUBTRACTED
APRIL 1997

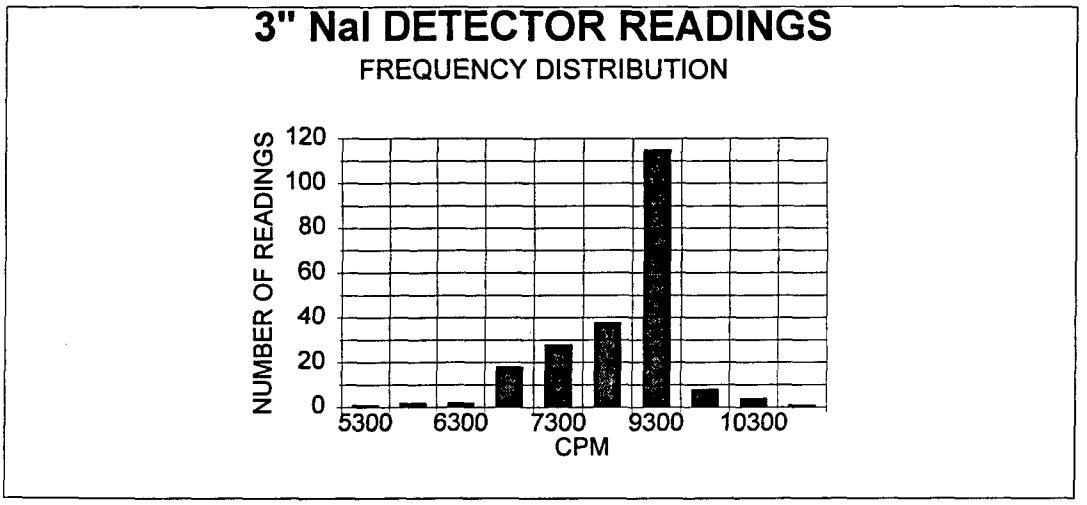




NUMBER OF SAMPLES	218
AVERAGE SAMPLE	1
MINIMUM SAMPLE	1
MAXIMUM SAMPLE	2
STANDARD DEVIATION	0

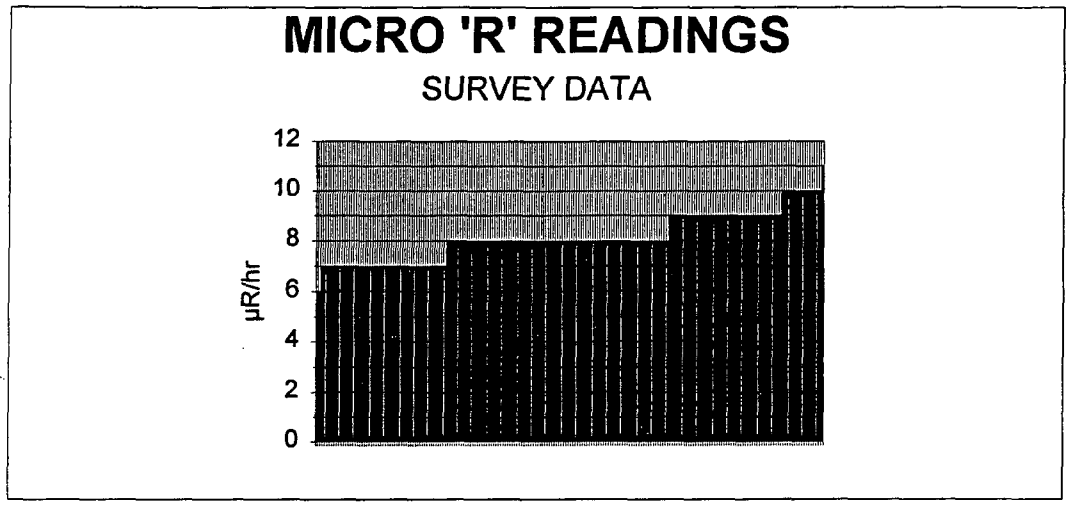
PHASE II, SUB-AREA "J" - SURFACE
AFFECTED AREA
GROSS GAMMA READINGS IN CPM
LUDLUM MODEL 2221, S/N 97264
BACKGROUND AVERAGE: 7916
APRIL 1997

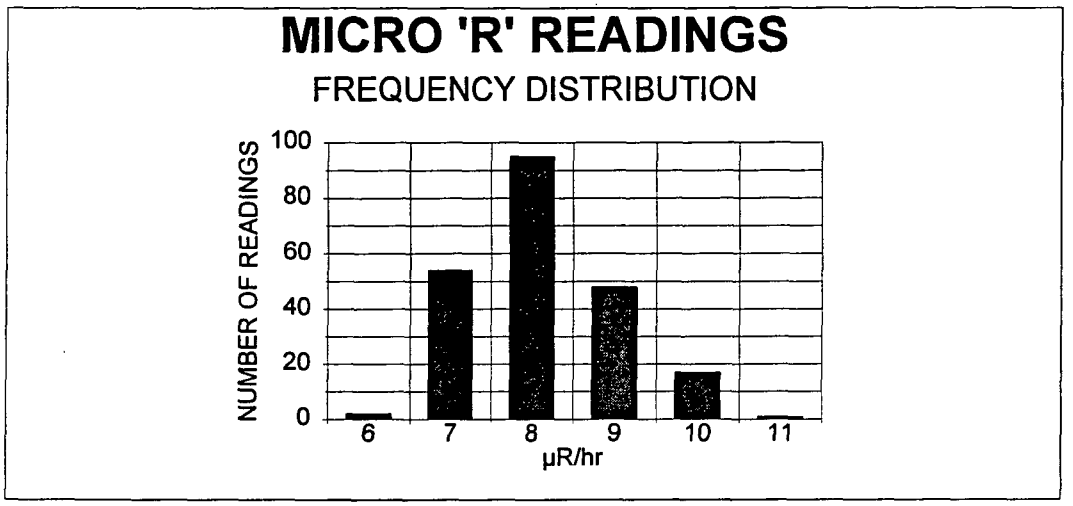




NUMBER OF READINGS	217
AVERAGE READING	7958
MINIMUM READING	5256
MAXIMUM READING	10418
STANDARD DEVIATION	876

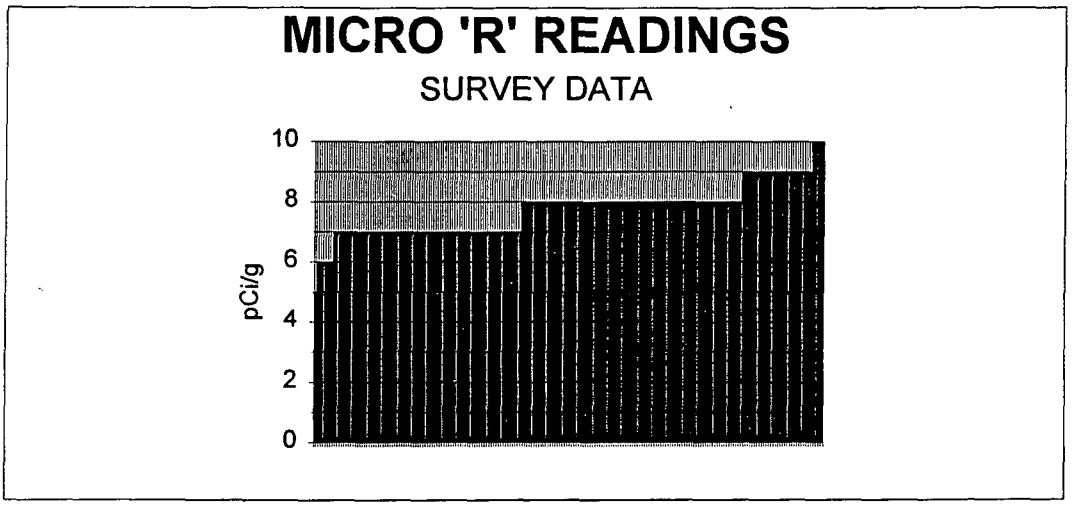
PHASE II, SUB-AREA "J" - SURFACE AFFECTED AREA
MICRO 'R' READINGS AT SURFACE
LUDLUM MODEL 19, S/N 111299
RESULTS IN µR/hr
APRIL 1997

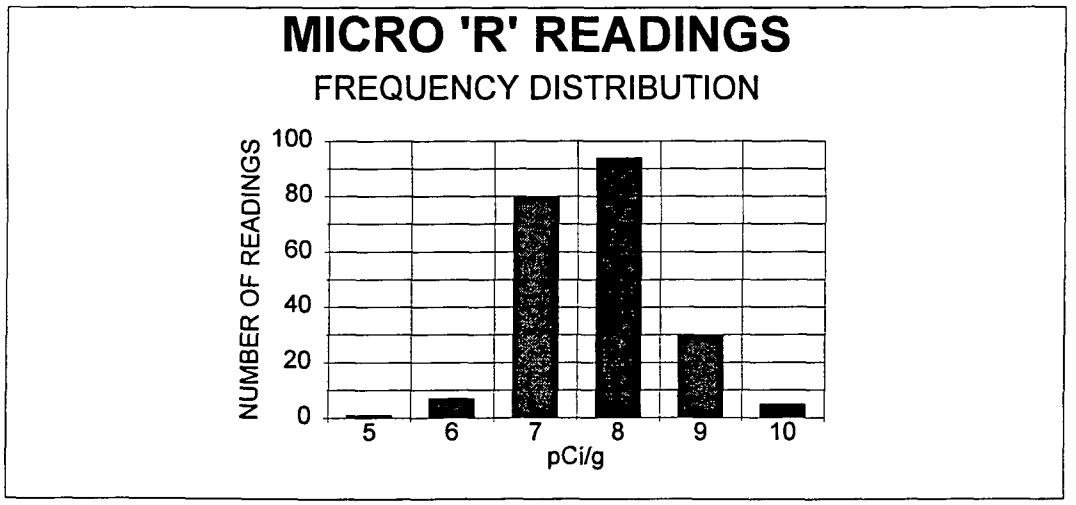




NUMBER OF READINGS	217
AVERAGE READING	8
MINIMUM READING	6
MAXIMUM READING	11
STANDARD DEVIATION	1

PHASE II, SUB-AREA "J" - SURFACE AFFECTED AREA
MICRO 'R' READINGS AT 1 METER ABOVE SURFACE
LUDLUM MODEL 19, S/N 111299
RESULTS IN µR/hr
APRIL 1997





NUMBER OF READINGS	217
AVERAGE READING	8
MINIMUM READING	5
MAXIMUM READING	10
STANDARD DEVIATION	1

CIMARRON CORPORATION - CIMARRON FACILITY

TRUE MEAN ACTIVITY VS. GUIDELINE VALUE AT 95% CONFIDENCE (SUB - AREA "J") AFFECTED AREA (SURFACE)

n = pCi/g TOTAL U

Number	n	(n-N)	$(n-N)^2$
1	3	-5.84	34.15
2	3	-5.84	34.15
3	3	-5.84	34.15
4	4	-4.84	23.46
5	4	-4.84	23.46
6	4	-4.84	23.46
7	4	-4.84	23.46
8	5	-3.84	14.78
9	5	-3.84	14.78
10	5	-3.84	14.78
11	5	-3.84	14.78
12	5	-3.84	14.78
13	5	-3.84	14.78
14	5	-3.84	14.78
15	5	-3.84	14.78
16	5	-3.84	14.78
17	5	-3.84	14.78
18	5	-3.84	14.78
19	5	-3.84	14.78
20	6	-2.84	8.09
21	6	-2.84	8.09
22	6	-2.84	8.09
23	6	-2.84	8.09
24	6	-2.84	8.09
25	6	-2.84	8.09
26	6	-2.84	8.09
27	6	-2.84	8.09
28	6	-2.84	8.09
29	6	-2.84	8.09
30	6	-2.84	8.09
31	6	-2.84	8.09
32	6	-2.84	8.09
33	6	-2.84	8.09
34	6	-2.84	8.09
35	6	-2.84	8.09
36	6	-2.84	8.09
37	6	-2.84	8.09
38	6	-2.84	8.09
39	6	-2.84	8.09
40	6	-2.84	8.09
41	6	-2.84	8.09
42	6	-2.84	8.09
43	6	-2.84	8.09
44	7	-1.84	3.40
45	7	-1.84	3.40
46	7	-1.84	3.40
47	7	-1.84	3.40
48	7	-1.84	3.40
49	7	-1.84	3.40
50	7	-1.84	3.40
	374		105.51
	440		18.10
	534		203.42
	302		1798.11
	1928		2716.70
	Sum(n)		$Sum(n-N)^2$

No. of Samples (x) : **218**

COUNT TIME: 5 MINUTES

Sample Mean (N) = Sum(n) ÷ (x)

Sample Mean (N) : **8.84**

Standard Deviation (Sd) = SQRT [$(n-N)^2$ + (x - 1)]

Standard Deviation: **3.5**

2 Std Deviations: **7.1**

Degree of Freedom(df) = (x) - 1 Data listed on Table B-1

(df) = **1.655**

Area's Average Level (Aμ) = (N) + (df) x [(Sd)/(x)]

(Aμ) = **9.24** pCi/gU TOTAL U

GUIDELINE VALUE: **30** pCi/gU TOTAL U

Acceptable Level: **34.0** pCi/gU TOTAL U

(30 PLUS BACKGROUND)

TABLE B - 1

Factors for Comparision of Survey Data with Guidelines

(df)	95%	97.5%	(df)	95%	97.5%
1	6.314	12.706	19	1.729	2.093
2	2.92	4.303	20	1.725	2.086
3	2.353	3.182	21	1.721	2.08
4	2.132	2.776	22	1.717	2.074
5	2.015	2.571	23	1.714	2.069
6	1.943	2.447	24	1.711	2.064
7	1.895	2.365	25	1.708	2.06
8	1.86	2.306	26	1.706	2.056
9	1.833	2.262	27	1.703	2.052
10	1.812	2.228	28	1.701	2.048
11	1.796	2.201	29	1.699	2.045
12	1.782	2.179	30	1.697	2.042
13	1.771	2.16	40	1.684	2.021
14	1.761	2.145	60	1.671	2
15	1.753	2.131	120	1.658	1.98
16	1.746	2.12	400	1.649	1.966
17	1.74	2.11	Infinite	1.645	1.96
18	1.734	2.101			

For values of Degrees of Freedom not listed:
Interpolate between the listed values.

(df) high value(Z)	400	is (B)	1.649	95%
(df) low value(Y)	120	is (A)	1.658	95%
Desired value(df) (X)	217	is calculated as follow:		

EXP[((Ln(B)-Ln(A)) + (Z-Y)) (X-Y) + Ln(A)]

The (df) value for (X	217	1.655	95%

PERFORMED BY: Irving Powell DATE: 4-16-97

REVIEWED BY: W.A. Rogers DATE: 4-16-97

CIMARRON CORPORATION - CIMARRON FACILITY

TRUE MEAN ACTIVITY VS. GUIDELINE VALUE AT 95% CONFIDENCE (SUB - AREA "J") AFFECTED AREA (SURFACE)

n = pCi/g TOTAL U

Number	n	(n-N)	$(n-N)^2$
51	7	-1.84	3.40
52	7	-1.84	3.40
53	7	-1.84	3.40
54	7	-1.84	3.40
55	7	-1.84	3.40
56	7	-1.84	3.40
57	7	-1.84	3.40
58	7	-1.84	3.40
59	7	-1.84	3.40
60	7	-1.84	3.40
61	7	-1.84	3.40
62	7	-1.84	3.40
63	7	-1.84	3.40
64	7	-1.84	3.40
65	7	-1.84	3.40
66	7	-1.84	3.40
67	7	-1.84	3.40
68	7	-1.84	3.40
69	7	-1.84	3.40
70	7	-1.84	3.40
71	7	-1.84	3.40
72	7	-1.84	3.40
73	7	-1.84	3.40
74	7	-1.84	3.40
75	7	-1.84	3.40
76	7	-1.84	3.40
77	8	-0.84	0.71
78	8	-0.84	0.71
79	8	-0.84	0.71
80	8	-0.84	0.71
81	8	-0.84	0.71
82	8	-0.84	0.71
83	8	-0.84	0.71
84	8	-0.84	0.71
85	8	-0.84	0.71
86	8	-0.84	0.71
87	8	-0.84	0.71
88	8	-0.84	0.71
89	8	-0.84	0.71
90	8	-0.84	0.71
91	8	-0.84	0.71
92	8	-0.84	0.71
93	8	-0.84	0.71
94	8	-0.84	0.71
95	8	-0.84	0.71
96	8	-0.84	0.71
97	8	-0.84	0.71
98	8	-0.84	0.71
99	8	-0.84	0.71
100	8	-0.84	0.71
	374		**105.51**
	Sum(n)		**Sum(n-N)²**

n = pCi/g TOTAL U

Number	n	(n-N)	$(n-N)^2$
101	8	-0.84	0.71
102	8	-0.84	0.71
103	8	-0.84	0.71
104	8	-0.84	0.71
105	8	-0.84	0.71
106	8	-0.84	0.71
107	8	-0.84	0.71
108	8	-0.84	0.71
109	8	-0.84	0.71
110	8	-0.84	0.71
111	8	-0.84	0.71
112	8	-0.84	0.71
113	8	-0.84	0.71
114	8	-0.84	0.71
115	8	-0.84	0.71
116	9	0.16	0.02
117	9	0.16	0.02
118	9	0.16	0.02
119	9	0.16	0.02
120	9	0.16	0.02
121	9	0.16	0.02
122	9	0.16	0.02
123	9	0.16	0.02
124	9	0.16	0.02
125	9	0.16	0.02
126	9	0.16	0.02
127	9	0.16	0.02
128	9	0.16	0.02
129	9	0.16	0.02
130	9	0.16	0.02
131	9	0.16	0.02
132	9	0.16	0.02
133	9	0.16	0.02
134	9	0.16	0.02
135	9	0.16	0.02
136	9	0.16	0.02
137	9	0.16	0.02
138	9	0.16	0.02
139	9	0.16	0.02
140	9	0.16	0.02
141	9	0.16	0.02
142	9	0.16	0.02
143	9	0.16	0.02
144	9	0.16	0.02
145	9	0.16	0.02
146	10	1.16	1.34
147	10	1.16	1.34
148	10	1.16	1.34
149	10	1.16	1.34
150	10	1.16	1.34
	440		**18.10**
	Sum(n)		**Sum(n-N)²**

CIMARRON CORPORATION - CIMARRON FACILITY

TRUE MEAN ACTIVITY VS. GUIDELINE VALUE AT 95% CONFIDENCE (SUB - AREA "J") AFFECTED AREA (SURFACE)

n = pCi/g TOTAL U

Number	n	(n-N)	$(n-N)^2$
151	10	1.16	1.34
152	10	1.16	1.34
153	10	1.16	1.34
154	10	1.16	1.34
155	10	1.16	1.34
156	10	1.16	1.34
157	10	1.16	1.34
158	10	1.16	1.34
159	10	1.16	1.34
160	10	1.16	1.34
161	10	1.16	1.34
162	10	1.16	1.34
163	10	1.16	1.34
164	10	1.16	1.34
165	10	1.16	1.34
166	10	1.16	1.34
167	10	1.16	1.34
168	10	1.16	1.34
169	10	1.16	1.34
170	10	1.16	1.34
171	10	1.16	1.34
172	10	1.16	1.34
173	10	1.16	1.34
174	10	1.16	1.34
175	10	1.16	1.34
176	10	1.16	1.34
177	11	2.16	4.65
178	11	2.16	4.65
179	11	2.16	4.65
180	11	2.16	4.65
181	11	2.16	4.65
182	11	2.16	4.65
183	11	2.16	4.65
184	11	2.16	4.65
185	11	2.16	4.65
186	11	2.16	4.65
187	11	2.16	4.65
188	11	2.16	4.65
189	11	2.16	4.65
190	11	2.16	4.65
191	11	2.16	4.65
192	11	2.16	4.65
193	12	3.16	9.96
194	12	3.16	9.96
195	12	3.16	9.96
196	12	3.16	9.96
197	12	3.16	9.96
198	12	3.16	9.96
199	13	4.16	17.27
200	13	4.16	17.27
	534		**203.42**
	Sum(n)		**Sum(n-N)²**

n = pCi/g TOTAL U

Number	n	(n-N)	$(n-N)^2$
201	13	4.16	17.27
202	13	4.16	17.27
203	14	5.16	26.58
204	14	5.16	26.58
205	14	5.16	26.58
206	15	6.16	37.90
207	15	6.16	37.90
208	15	6.16	37.90
209	15	6.16	37.90
210	15	6.16	37.90
211	15	6.16	37.90
212	16	7.16	51.21
213	16	7.16	51.21
214	17	8.16	66.52
215	17	8.16	66.52
216	18	9.16	83.83
217	19	10.16	103.14
218	41	32.16	1034.01
219			
220			
221			
222			
223			
224			
225			
226			
227			
228			
229			
230			
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232			
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239			
240			
241			
242			
243			
244			
245			
246			
247			
248			
249			
250			
	302		**1798.11**
	Sum(n)		**Sum(n-N)²**

CIMARRON CORPORATION - CIMARRON FACILITY

TRUE MEAN ACTIVITY VS. GUIDELINE VALUE AT 95% CONFIDENCE (SUB - AREA "J") AFFECTED AREA (SURFACE)

n = pCi/g Th (NAT)

Number	n	(n-N)	$(n-N)^2$
1	1	-0.19	0.04
2	1	-0.19	0.04
3	1	-0.19	0.04
4	1	-0.19	0.04
5	1	-0.19	0.04
6	1	-0.19	0.04
7	1	-0.19	0.04
8	1	-0.19	0.04
9	1	-0.19	0.04
10	1	-0.19	0.04
11	1	-0.19	0.04
12	1	-0.19	0.04
13	1	-0.19	0.04
14	1	-0.19	0.04
15	1	-0.19	0.04
16	1	-0.19	0.04
17	1	-0.19	0.04
18	1	-0.19	0.04
19	1	-0.19	0.04
20	1	-0.19	0.04
21	1	-0.19	0.04
22	1	-0.19	0.04
23	1	-0.19	0.04
24	1	-0.19	0.04
25	1	-0.19	0.04
26	1	-0.19	0.04
27	1	-0.19	0.04
28	1	-0.19	0.04
29	1	-0.19	0.04
30	1	-0.19	0.04
31	1	-0.19	0.04
32	1	-0.19	0.04
33	1	-0.19	0.04
34	1	-0.19	0.04
35	1	-0.19	0.04
36	1	-0.19	0.04
37	1	-0.19	0.04
38	1	-0.19	0.04
39	1	-0.19	0.04
40	1	-0.19	0.04
41	1	-0.19	0.04
42	1	-0.19	0.04
43	1	-0.19	0.04
44	1	-0.19	0.04
45	1	-0.19	0.04
46	1	-0.19	0.04
47	1	-0.19	0.04
48	1	-0.19	0.04
49	1	-0.19	0.04
50	1	-0.19	0.04
	50		1.856
	50		1.856
	74		16.608
	36		11.732
	260		33.908
	Sum(n)		$Sum(n-N)^2$

No. of Samples (x) : **218**

COUNT TIME: 5 MINUTES

Sample Mean (N) = Sum(n) ÷ (x)

Sample Mean (N) : **1.19**

Standard Deviation (Sd) = SQRT [$(n-N)^2$ ÷ (x - 1)]

Standard Deviation: **0.40**

2 Std Deviations: **0.79**

Degree of Freedom(df) = (x) - 1 Data listed on Table B-1

(df) = **1.655**

Area's Average Level (Aμ) = (N) + (df) x [(Sd)/(x)]

(Aμ) = **1.24** pCi/gTh (NAT)

GUIDELINE VALUE: **10** pCi/gTh (NAT)

Acceptable Level: **4.0** pCi/gTh (NAT)

(25% OF GUIDELINE PLUS BACKGROUND)

TABLE B - 1

Factors for Comparision of Survey Data with Guidelines

(df)	95%	97.5%	(df)	95%	97.5%
1	6.314	12.706	19	1.729	2.093
2	2.92	4.303	20	1.725	2.086
3	2.353	3.182	21	1.721	2.08
4	2.132	2.776	22	1.717	2.074
5	2.015	2.571	23	1.714	2.069
6	1.943	2.447	24	1.711	2.064
7	1.895	2.365	25	1.708	2.06
8	1.86	2.306	26	1.706	2.056
9	1.833	2.262	27	1.703	2.052
10	1.812	2.228	28	1.701	2.048
11	1.796	2.201	29	1.699	2.045
12	1.782	2.179	30	1.697	2.042
13	1.771	2.16	40	1.684	2.021
14	1.761	2.145	60	1.671	2
15	1.753	2.131	120	1.658	1.98
16	1.746	2.12	400	1.649	1.966
17	1.74	2.11	Infinite	1.645	1.96
18	1.734	2.101			

For values of Degrees of Freedom not listed:

Interpolate between the listed values.

(df) high value(Z)	**400**	is (B)	**1.649**	95%
(df) low value(Y)	**120**	is (A)	**1.658**	95%

Desired value(df) (X) **217** is calculated as follow:

EXP[((Ln(B)-Ln(A)) ÷ (Z-Y)) (X-Y) + Ln(A)]

The (df) value for (X	**217**	**1.655**	95%

PERFORMED BY: Irving Powell DATE: 4-16-97

REVIEWED BY: W.A. Rogers DATE: 4-16-97

CIMARRON CORPORATION - CIMARRON FACILITY

TRUE MEAN ACTIVITY VS. GUIDELINE VALUE AT 95% CONFIDENCE (SUB - AREA "J") AFFECTED AREA (SURFACE)

Number	n = pCi/g Th (NAT) n	(n-N)	(n-N)²
51	1	-0.19	0.04
52	1	-0.19	0.04
53	1	-0.19	0.04
54	1	-0.19	0.04
55	1	-0.19	0.04
56	1	-0.19	0.04
57	1	-0.19	0.04
58	1	-0.19	0.04
59	1	-0.19	0.04
60	1	-0.19	0.04
61	1	-0.19	0.04
62	1	-0.19	0.04
63	1	-0.19	0.04
64	1	-0.19	0.04
65	1	-0.19	0.04
66	1	-0.19	0.04
67	1	-0.19	0.04
68	1	-0.19	0.04
69	1	-0.19	0.04
70	1	-0.19	0.04
71	1	-0.19	0.04
72	1	-0.19	0.04
73	1	-0.19	0.04
74	1	-0.19	0.04
75	1	-0.19	0.04
76	1	-0.19	0.04
77	1	-0.19	0.04
78	1	-0.19	0.04
79	1	-0.19	0.04
80	1	-0.19	0.04
81	1	-0.19	0.04
82	1	-0.19	0.04
83	1	-0.19	0.04
84	1	-0.19	0.04
85	1	-0.19	0.04
86	1	-0.19	0.04
87	1	-0.19	0.04
88	1	-0.19	0.04
89	1	-0.19	0.04
90	1	-0.19	0.04
91	1	-0.19	0.04
92	1	-0.19	0.04
93	1	-0.19	0.04
94	1	-0.19	0.04
95	1	-0.19	0.04
96	1	-0.19	0.04
97	1	-0.19	0.04
98	1	-0.19	0.04
99	1	-0.19	0.04
100	1	-0.19	0.04
	50		**1.856**
	Sum(n)		**Sum(n-N)²**

Number	n = pCi/g Th (NAT) n	(n-N)	(n-N)²
101	1	-0.19	0.04
102	1	-0.19	0.04
103	1	-0.19	0.04
104	1	-0.19	0.04
105	1	-0.19	0.04
106	1	-0.19	0.04
107	1	-0.19	0.04
108	1	-0.19	0.04
109	1	-0.19	0.04
110	1	-0.19	0.04
111	1	-0.19	0.04
112	1	-0.19	0.04
113	1	-0.19	0.04
114	1	-0.19	0.04
115	1	-0.19	0.04
116	1	-0.19	0.04
117	1	-0.19	0.04
118	1	-0.19	0.04
119	1	-0.19	0.04
120	1	-0.19	0.04
121	1	-0.19	0.04
122	1	-0.19	0.04
123	1	-0.19	0.04
124	1	-0.19	0.04
125	1	-0.19	0.04
126	1	-0.19	0.04
127	1	-0.19	0.04
128	1	-0.19	0.04
129	1	-0.19	0.04
130	1	-0.19	0.04
131	1	-0.19	0.04
132	1	-0.19	0.04
133	1	-0.19	0.04
134	1	-0.19	0.04
135	1	-0.19	0.04
136	1	-0.19	0.04
137	1	-0.19	0.04
138	1	-0.19	0.04
139	1	-0.19	0.04
140	1	-0.19	0.04
141	1	-0.19	0.04
142	1	-0.19	0.04
143	1	-0.19	0.04
144	1	-0.19	0.04
145	1	-0.19	0.04
146	1	-0.19	0.04
147	1	-0.19	0.04
148	1	-0.19	0.04
149	1	-0.19	0.04
150	1	-0.19	0.04
	50		**1.856**
	Sum(n)		**Sum(n-N)²**

CIMARRON CORPORATION - CIMARRON FACILITY

TRUE MEAN ACTIVITY VS. GUIDELINE VALUE AT 95% CONFIDENCE (SUB - AREA "J") AFFECTED AREA (SURFACE)

n = pCi/g Th (NAT)

Number	n	(n-N)	$(n-N)^2$
151	1	-0.19	0.04
152	1	-0.19	0.04
153	1	-0.19	0.04
154	1	-0.19	0.04
155	1	-0.19	0.04
156	1	-0.19	0.04
157	1	-0.19	0.04
158	1	-0.19	0.04
159	1	-0.19	0.04
160	1	-0.19	0.04
161	1	-0.19	0.04
162	1	-0.19	0.04
163	1	-0.19	0.04
164	1	-0.19	0.04
165	1	-0.19	0.04
166	1	-0.19	0.04
167	1	-0.19	0.04
168	1	-0.19	0.04
169	1	-0.19	0.04
170	1	-0.19	0.04
171	1	-0.19	0.04
172	1	-0.19	0.04
173	1	-0.19	0.04
174	1	-0.19	0.04
175	1	-0.19	0.04
176	1	-0.19	0.04
177	2	0.81	0.65
178	2	0.81	0.65
179	2	0.81	0.65
180	2	0.81	0.65
181	2	0.81	0.65
182	2	0.81	0.65
183	2	0.81	0.65
184	2	0.81	0.65
185	2	0.81	0.65
186	2	0.81	0.65
187	2	0.81	0.65
188	2	0.81	0.65
189	2	0.81	0.65
190	2	0.81	0.65
191	2	0.81	0.65
192	2	0.81	0.65
193	2	0.81	0.65
194	2	0.81	0.65
195	2	0.81	0.65
196	2	0.81	0.65
197	2	0.81	0.65
198	2	0.81	0.65
199	2	0.81	0.65
200	2	0.81	0.65
	74		**16.608**
	Sum(n)		**Sum(n-N)²**

n = pCi/g Th (NAT)

Number	n	(n-N)	$(n-N)^2$
201	2	0.81	0.65
202	2	0.81	0.65
203	2	0.81	0.65
204	2	0.81	0.65
205	2	0.81	0.65
206	2	0.81	0.65
207	2	0.81	0.65
208	2	0.81	0.65
209	2	0.81	0.65
210	2	0.81	0.65
211	2	0.81	0.65
212	2	0.81	0.65
213	2	0.81	0.65
214	2	0.81	0.65
215	2	0.81	0.65
216	2	0.81	0.65
217	2	0.81	0.65
218	2	0.81	0.65
219			
220			
221			
222			
223			
224			
225			
226			
227			
228			
229			
230			
231			
232			
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243			
244			
245			
246			
247			
248			
249			
250			
	36		**11.732**
	Sum(n)		**Sum(n-N)²**

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	115W-0N	10418	10	10	13	2
2	115W-5N	9756	10	9	7	2
3	120W-5N	9360	9	9	9	2
4	120W-10N	8684	10	8	14	1
5	120W-15N	8954	9	9	9	1
6	120W-20N	8596	8	8	6	1
7	125W-15N	6590	7	7	10	1
8	125W-20N	9450	10	8	5	2
9	125W-25N	8324	9	8	7	1
10	125W-30N	7764	9	8	9	2
11	130W-15N	9070	10	9	7	2
12	130W-20N	6380	7	8	8	1
13	130W-25N	8050	8	8	11	1
14	130W-30N	7960	8	8	8	1
15	130W-35N	8126	8	8	8	1
16	130W-40N	8156	9	8	8	1
17	130W-45N	8420	9	8	12	1
18	130W-50N	8256	8	9	9	1

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William J. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	135W-20N	8126	8	8	10	1
2	135W-25N	8680	9	9	11	2
3	135W-30N	7798	8	8	6	1
4	135W-35N	7916	8	8	9	1
5	135W-40N	8056	7	8	9	1
6	135W-45N	8160	8	7	9	2
7	135W-50N	8832	9	8	8	1
8	135W-55N	8612	9	9	7	1
9	135W-60N	8062	9	8	15	1
10	135W-65N	8314	9	8	9	1
11	140W-25N	8334	8	8	7	1
12	140W-30N	8468	10	8	8	1
13	140W-35N	8812	9	7	6	1
14	140W-40N	8294	9	8	5	1
15	140W-45N	8234	8	8	15	1
16	140W-50N	8170	8	8	6	1
17	140W-55N	8084	7	7	10	1
18	140W-60N	8706	10	8	10	1

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample	
					Total-U	Th (Nat)
1	140W-65N	8482	9	8	11	1
2	140W-70N	8432	8	8	4	1
3	140W-75N	9214	9	8	7	1
4	140W-80N	10064	10	10	14	2
5	145W-30N	9048	8	8	7	1
6	145W-35N	8368	9	9	6	1
7	145W-40N	8880	8	7	7	1
8	145W-45N	7748	7	7	8	1
9	145W-50N	7118	7	7	9	1
10	145W-55N	7928	8	8	8	2
11	145W-60N	8350	9	9	6	2
12	145W-65N	8082	8	7	6	1
13	145W-70N	8154	8	8	9	1
14	145W-75N	8476	9	9	7	1
15	145W-80N	9944	10	10	7	2
16						
17						
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	150W-40N	8862	9	8	8	1
2	150W-45N	7348	8	7	6	1
3	150W-50N	8410	10	9	7	1
4	150W-55N	8798	8	8	7	1
5	150W-60N	8108	8	8	5	1
6	150W-65N	6326	7	7	10	1
7	150W-70N	7120	8	7	7	1
8	150W-75N	5540	6	6	5	1
9	150W-80N	9052	9	9	8	2
10	155W-45N	9018	8	8	9	1
11	155W-50N	7948	9	8	8	1
12	155W-55N	8074	8	7	12	1
13	155W-60N	8272	8	8	8	1
14	155W-65N	8290	8	7	12	1
15	155W-70N	8018	8	8	9	1
16	155W-75N	7320	8	7	6	1
17	155W-80N	8008	8	8	10	2
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	160W-50N	9336	10	10	7	2
2	160W-55N	7028	8	8	11	2
3	160W-60N	8312	8	8	11	1
4	160W-65N	8928	8	7	9	1
5	160W-70N	8570	9	8	10	1
6	160W-75N	8750	8	8	8	2
7	160W-80N	6094	7	7	6	1
8	165W-50N	9852	9	9	6	2
9	165W-55N	8078	7	8	10	1
10	165W-60N	7056	8	7	8	1
11	165W-65N	8256	8	8	11	1
12	165W-70N	9100	9	9	11	2
13	165W-75N	9300	9	9	9	1
14	165W-80N	8406	9	8	10	2
15						
16						
17						
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

Gilbert T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	170W-50N	8232	8	9	13	1
2	170W-55N	8530	9	9	11	1
3	170W-60N	7738	8	7	5	1
4	170W-65N	6962	8	7	9	1
5	170W-70N	8206	7	7	10	1
6	170W-75N	9096	8	8	8	1
7	170W-80N	8890	10	9	7	2
8	175W-55N	8270	8	8	7	2
9	175W-60N	7244	8	8	6	1
10	175W-65N	5786	7	6	10	1
11	175W-70N	7698	9	9	11	1
12	175W-75N	8690	8	8	8	1
13	175W-80N	9300	10	9	10	1
14						
15						
16						
17						
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample	
					Total-U	Th (Nat)
1	180W-55N	7274	7	9	8	1
2	180W-60N	7508	8	7	7	1
3	180W-65N	7450	7	7	10	2
4	180W-70N	7628	7	7	11	1
5	180W-75N	8308	8	9	8	1
6	180W-80N	9246	9	8	9	2
7	185W-55N	9672	11	9	8	2
8	185W-60N	7708	7	7	9	1
9	185W-65N	7254	7	8	7	1
10	185W-70N	8620	8	7	16	2
11	185W-75N	8504	8	7	9	1
12	185W-80N	8228	7	7	11	1
13	190W-55N	8956	9	8	4	2
14	190W-60N	8108	9	8	7	1
15	190W-65N	7624	7	7	3	1
16	190W-70N	7220	8	8	6	1
17	190W-75N	7820	8	8	15	1
18	190W-80N	9808	10	9	11	1

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William F. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	195W-55N	8630	9	8	7	2
2	195W-60N	5256	7	6	7	1
3	195W-65N	7616	8	7	9	1
4	195W-70N	8002	7	8	8	1
5	195W-75N	8154	8	8	18	1
6	195W-80N	8442	9	8	10	1
7	200W-55N	9342	9	8	10	2
8	200W-60N	9330	9	9	10	2
9	200W-65N	7852	8	8	12	1
10	200W-70N	7190	8	7	8	2
11	200W-75N	8468	9	8	9	1
12	200W-80N	8468	9	9	8	1
13	205W-55N	9034	10	8	8	2
14	205W-60N	8682	8	8	8	1
15	205W-65N	8302	9	8	17	1
16	205W-70N	7870	8	8	8	1
17	205W-75N	7662	8	7	6	1
18	205W-80N	8272	8	8	9	2

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

s/ William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	210W-50N	9068	10	10	4	2
2	210W-55N	7736	8	8	7	1
3	210W-60N	7784	7	8	11	1
4	210W-65N	8308	8	8	11	1
5	210W-70N	8390	7	8	19	2
6	210W-75N	7296	8	7	7	1
7	210W-80N	7226	7	7	5	1
8	210W-85N	8560	8	7	10	1
9	215W-50N	9048	9	8	5	1
10	215W-55N	7072	7	7	6	1
11	215W-60N	8104	8	8	10	1
12	215W-65N	8656	8	7	16	1
13	215W-70N	8602	9	8	17	1
14	215W-75N	8234	8	7	10	1
15	215W-80N	6768	7	7	7	1
16	215W-85N	8014	8	7	14	1
17						
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	220W-55N	7824	8	8	7	1
2	220W-60N	7994	8	9	7	1
3	220W-65N	8692	10	9	15	1
4	220W-70N	9464	9	9	41	1
5	220W-75N	7352	7	7	12	2
7	220W-80N	7256	8	7	10	1
8	220W-85N	8106	7	7	9	1
9	220W-90N	7246	7	7	6	1
10	225W-60N	7352	8	7	11	1
11	225W-65N	8518	9	8	7	1
12	225W-70N	8814	8	8	10	1
13	225W-75N	7750	8	7	8	1
14	225W-80N	6342	7	7	12	2
15	225W-85N	7902	8	8	9	1
16	225W-90N	7716	9	8	10	1
17						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

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PHASE II, SUB-AREA "J", SURFACE
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DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample	
					Total-U	Th (Nat)
1	230W-60N	7412	9	7	8	1
2	230W-65N	8076	7	8	10	1
3	230W-70N	8176	8	8	10	1
4	230W-75N	7388	8	7	3	1
5	230W-80N	6760	6	5	8	1
6	230W-85N	7520	8	7	8	2
7	230W-90N	7686	7	6	8	1
8	230W-95N	7542	8	8	10	1
9	235W-60N	8290	9	8	8	1
10	235W-65N	7822	8	8	8	2
11	235W-70N	7732	8	7	7	1
12	235W-75N	7910	7	8	4	1
13	235W-80N	6840	7	7	9	1
14	235W-85N	7854	8	8	13	1
15	235W-90N	LAKE WATER	LAKE WATER	LAKE WATER	8	1
16	235W-95N	7616	7	8	8	1
17						
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample Total-U	0-6" Sample Th (Nat)
1	240W-60N	7946	7	8	11	1
2	240W-65N	6748	7	6	8	1
3	240W-70N	7210	7	7	15	1
4	240W-75N	6694	7	7	6	1
5	240W-80N	6732	7	7	9	1
6	240W-85N	7474	9	7	7	1
7	240W-90N	6940	8	7	5	1
8	240W-95N	6934	8	7	9	1
9	245W-60N	7852	9	7	6	1
10	245W-65N	7442	8	7	10	1
11	245W-70N	7170	7	7	10	1
12	245W-75N	6748	7	7	8	1
13	245W-80N	6880	7	7	5	1
14	245W-85N	7378	7	7	9	1
15	245W-90N	7152	7	7	6	1
16	245W-95N	6780	8	7	7	1
17	245W-100N	7414	8	8	8	2
18						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William F. Rhodes DATE: 4-11-97

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CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample	
					Total-U	Th (Nat)
1	250W-55N	8268	8	8	10	2
2	250W-60N	7756	8	8	9	2
3	250W-65N	7426	8	7	7	1
4	250W-70N	6518	7	7	5	1
5	250W-75N	7194	8	7	15	1
6	250W-80N	6330	7	7	9	1
7	250W-85N	7110	8	7	10	1
8	250W-90N	7144	8	7	7	1
9	255W-50N	7782	9	9	6	1
10	255W-55N	7494	7	8	10	1
11	255W-60N	7770	8	8	5	1
12	255W-65N	7362	8	6	8	1
13	255W-70N	7160	8	7	6	1
14	255W-75N	6338	8	7	5	1
15	255W-80N	6356	7	7	10	1
16	255W-85N	6498	7	7	13	1

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

Wilbur T. Rhodes DATE: 4-11-97

FILE: AJAASURF

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE II, SUB-AREA "J", SURFACE
AFFECTED AREA

DATE: 03/20/97

LN #	GRID NUMBER	3" DETECT C.P.M.	MICRO R' SURF	MICRO R' 1 METER	0-6" Sample	
					Total-U	Th (Nat)
1	260W-50N	7276	7	7	9	1
2	260W-55N	7794	8	8	8	1
3	260W-60N	7846	8	7	6	1
4	260W-65N	7148	7	6	6	1
5	260W-70N	6470	7	7	7	1
6	260W-75N	6676	7	7	6	1
7	260W-80N	5934	7	7	3	1
8						
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18						
19						
20						

INSTRUMENTS:	RESULTS IN:		BACKGROUND	MDA
LUDLUM MICRO 'R' METER - MODEL 19 S/N 111299	µR/hr		7-10	7
LUDLUM 2221, UNSHIELDED 3" X 1/2" NaI DETECTOR S/N 97264	CPM		7916	N/A
		Total U	4	10
CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR	pCi/g	Th(Nat)	1.5	0.25

BACKGROUND NOT SUBTRACTED

William T. Rhodes DATE: 4-11-97

FILE: AJAASURF