CIMARRON CORPORATION LETTER OF TRANSMITTAL

DATE: 3/12/98

TO: Mr. Dave Fauver, Project Manager
Facilities Decommissioning Section
Division of Low-Level
Waste Management & Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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

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1	3/12/98	Docket No. 70-0925; License No. SNM-928 Final Status Survey Report for Phase III Sub Area "O" Uranium Waste Ponds #1 & #2 (Subsurface)

These are transmitted as checked below:
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SIGNATURE: Mickey Hodo

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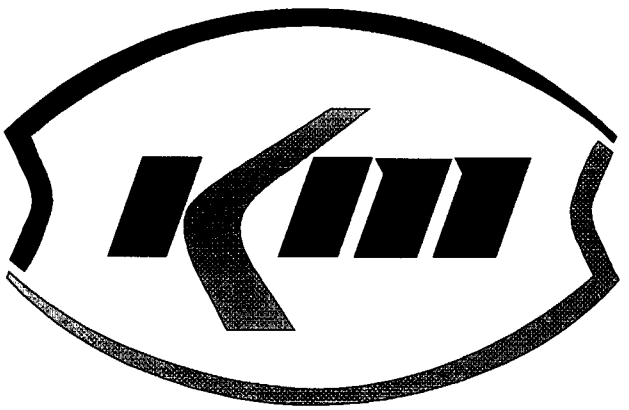
KERR-McGEE CORPORATION



FINAL STATUS SURVEY REPORT
PHASE III - SUB-AREA 'O'
SUB-SURFACE

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

March, 1998

License Number: SNM-928
Docket No. 70-0925

CIMARRON CORPORATION
CRESCENT, OKLAHOMA

CIMARRON CORPORATION

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

S.JESS LARSEN
VICE PRESIDENT

March 12, 1998

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

RE: Docket No. 70-925; License No. SNM-928
Final Status Survey Report for Phase III Sub Area "O"
Uranium Waste Ponds #1 & #2 (Subsurface)

Dear Mr. Kalman:

Cimarron Corporation has recently completed Sub Area "O" subsurface survey using NRC's guidance for volumetric averaging of subsurface residual activity. The attached Final Status Survey Report is submitted herewith in accordance with the guidance provided in your letter dated February 25, 1997.

The purpose of this letter is to provide the above referenced report to the NRC. Please find attached three(3) copies of this report for your review and approval. Two (2) copies of this report are for you and your staff and one (1) copy is for Mr. Dave Fauver. One (1) copy of this report has been submitted to the NRC Docket and one (1) copy has been provided to Mr. Louis Carson at NRC, Region IV.

Please feel free to contact me if there are any questions or concerns.

Sincerely,

Jess Larsen

Jess Larsen
Vice President

Enclosures

FINAL STATUS SURVEY REPORT FOR PHASE III SUBAREA O URANIUM WASTE PONDS #1 AND #2 (SUBSURFACE)

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

License Number: SNM-928
Docket Number: 70-0925

March 1998

Prepared for:

Cimarron Corporation
Oklahoma City, Oklahoma

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E. Drawings Showing Average Concentrations per 25 m^2 at 0 to 6 Foot, (0-2 m) and 0 to 9 Foot (0-3 m) Soil Depths. These Drawings Represent Soil Volumes of 50 m^3 and 75 m^3 Respectively.
F. Average Concentrations per 25 m^2, 50 m^3, and 75 m^3 Soil Volumes Presented in Tabular Form.
G. Calculation of Mean and 95% Confidence Levels.

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. 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.

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

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

9. 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.

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

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. Cimarron Corporation, "Final Status Survey Report Phase II Subarea "J" for Cimarron Corporation Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma", September 1997.

15. USNRC Letter from Mr. Kenneth L. Kalman, Project Manger to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated January 9, 1998.

16. 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.

17. USNRC Letter from Mr. Kenneth Kalman, Project Manager to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated October 3, 1997.

18. Cimarron Corporation letter from Mr. Jess Larsen, Vice President, Cimarron Corporation to Mr. Kenneth L. Kalman, Project Manager, USNRC, dated December 5, 1997.

19. USNRC Letter from Mr. Kenneth Kalman, Project Manager to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated February 9, 1998.

20. Cimarron Corporation letter from Mr. Jess Larsen, Vice President, to Mr. Michael F. Weber, Chief, Low-Level Waste Management and Decommissioning Projects Branch, U.S. NRC, dated October 9, 1996.

21. Cimarron Corporation letter from Mr. Jess Larsen, Vice President, to Mr. Kenneth L. Kalman, Project Manager, U.S. NRC, dated February 14, 1997.

22. U.S. NRC letter from Mr. Kenneth L. Kalman, Project Manager to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated April 22, 1997.

23. Cimarron Corporation letter from Mr. Jess Larsen, Project Manager to Mr. Michael Weber, Chief, Low-Level Waste Management and Decommissioning Project Branch, U.S. NRC, dated June 21, 1995.

24. State of Oklahoma Letter from Mr. Robert L. Craig, Director, Radiation Protection Division to Mr. W. J. Shelley, Director, Regulations and Control, Kerr-McGee Nuclear Corporation, dated March 2, 1978.

25. USNRC Letter from Mr. Richard W. Starostecki, Chief, Fuel Reprocessing and Recycle Branch to Mr. W. J. Shelley, Director, Regulation and Control, Kerr-McGee Nuclear Corporation, dated July 10, 1978.

26. USNRC Region III Letter from Mr. A. B. Davis, Chief, Fuel Facility and Materials Safety Branch to Mr. W. J. Shelley, Director, Regulation and Control, Kerr-McGee Corporation, dated December 14, 1978.

27. USNRC Letter from Mr. Jerry J. Swift, Section Leader, Advanced Fuel and Special Facilities Section, Office of Nuclear Material Safety and Safeguards to Dr. Edwin T. Still, Vice President, Kerr-McGee Corporation, dated January 8, 1993.

28. USNRC Letter from Mr. Kenneth L. Kalman, Project Manager to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated July 1, 1997.

29. Cimarron Corporation Letter from Mr. Jess Larsen, Vice President to Mr. Kenneth L. Kalman, Project Manager, Facilities Decommissioning Section, US Nuclear Regulatory Commission, dated August 26, 1997.

30. 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.

31. NRC Guidance "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil", transmitted by letter from Mr. Kenneth L. Kalman, Project Manager, Facilities Decommissioning Section, to Mr. Jess Larsen, Vice President, Cimarron Corporation, dated February 25, 1997.

32. 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.

33. 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.

34. 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.

35. 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.

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

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

38. Idaho National Engineering Laboratory, "Selected Radionuclides Important to Low-Level Radioactive Waste Management", DOE/LLW-238, November 1996.

FINAL STATUS SURVEY REPORT FOR DECOMMISSIONING CIMARRON FACILITY SUBAREA O (SUBSURFACE)

1.0 Purpose

This Final Status Survey Report addresses an area on the Cimarron site designated as Phase III Subarea "O" (Subsurface). Specifically, Subarea O includes the former areas occupied by Uranium Waste Ponds Nos. #1 and #2. This affected Subarea is shown on Drawing No. 95 MOST-RF3. This report provides a discussion of the characterization survey performed to define the extent and magnitude of residual contamination present in the subsurface soils located within this Subarea. The characterization data generated during the initial surveys were utilized while remediating impacted soils within this Subarea. Upon completion of the remediation phase of the decommissioning process, the final status survey was performed for both Uranium Waste Ponds #1 and #2 areas to demonstrate that the approved BTP Option 1 guideline value for enriched uranium had been met. The results of the Subarea O (subsurface) Final Status Survey and the volumetric averaging methodology are presented in this Report as justification for unrestricted release of the Subarea O subsurface soils.

The Final Status Survey for the remediated surface of Subarea O will be performed after completing closure of this subarea and will be submitted as a separate report in the future.

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].

Based upon historic knowledge of site operations and the characterization work completed to date, Cimarron Corporation submitted in October 1994 the Cimarron Radiological Characterization Report[5] for License SNM-928. As discussed in this report, the site was divided into affected and unaffected areas. The affected and unaffected areas are shown on Drawing No. 95 MOST-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. 95 MOST-RF3 and are designated by Roman Numerals I, II, and III (herein referenced as Phases I, II, and III). These three major areas were then further subdivided into smaller sections (i.e. A, B, C, D, etc.).

Decommissioning efforts involving characterization, decontamination and remediation 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. A large area, consisting of Subareas A, B, C, D, and E, was unaffected and was released from license on April 23, 1996[6] for unrestricted use. The status of the three phases, with respect to decommissioning, are discussed below:

2.1 Phase I Area

As presented in the Cimarron Decommissioning Plan,[7] 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[8]) was approved by the NRC via letter dated May 1, 1995[9]. The Final Status Survey Report[10] 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 #13 from the NRC to release this area from

License SNM-928 effective April 23, 1996[6]. 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. 95 MOST-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 is 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[14], submitted to the NRC in September 1997, was the first subarea from Phase II to be submitted to the NRC for final license release for unrestricted use. This Final Status Survey Report has been reviewed by the NRC and the Commission staff has forwarded comments to Cimarron by letter dated January 9, 1998[15].

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. 95 MOST-RF3 and includes Subareas K, L, M, N, and O. The Final Status Survey Plan for release of this area from the site license was submitted to the NRC[16] for approval in June 1997. Cimarron's responses to the NRC's October 3, 1997[17] comments on the Phase III FSSP were submitted to the NRC on December 5, 1997[18]. On February 9, 1998[19], Cimarron received four additional questions from the NRC pertaining to the Phase III Final Status Survey Plan. Cimarron is preparing a response to these questions.

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 BTP Option 2 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. Subarea O includes the areas formerly occupied by Uranium Waste Ponds #1 and #2; and includes approximately 6.5 acres.

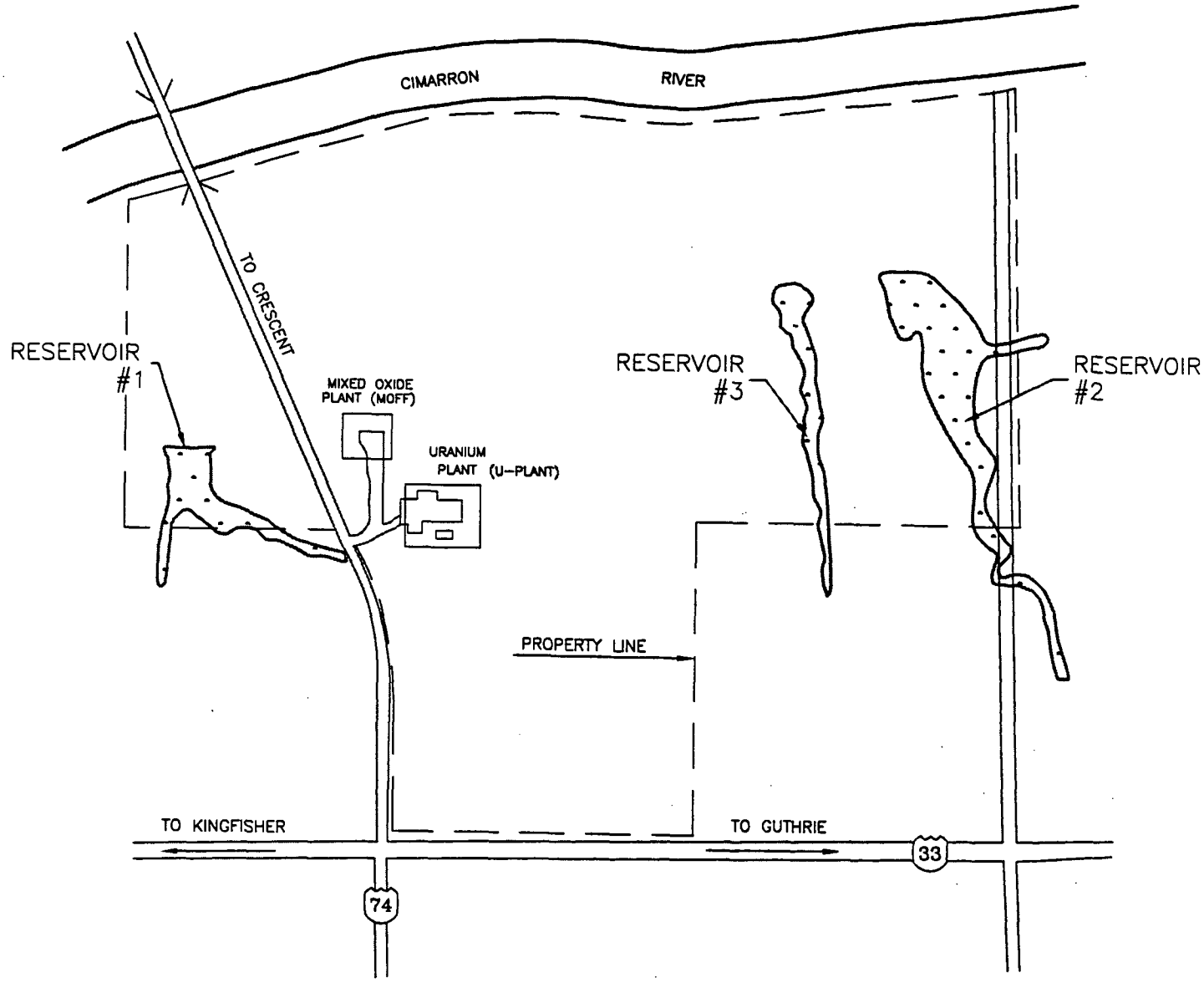
3.0 Site Description

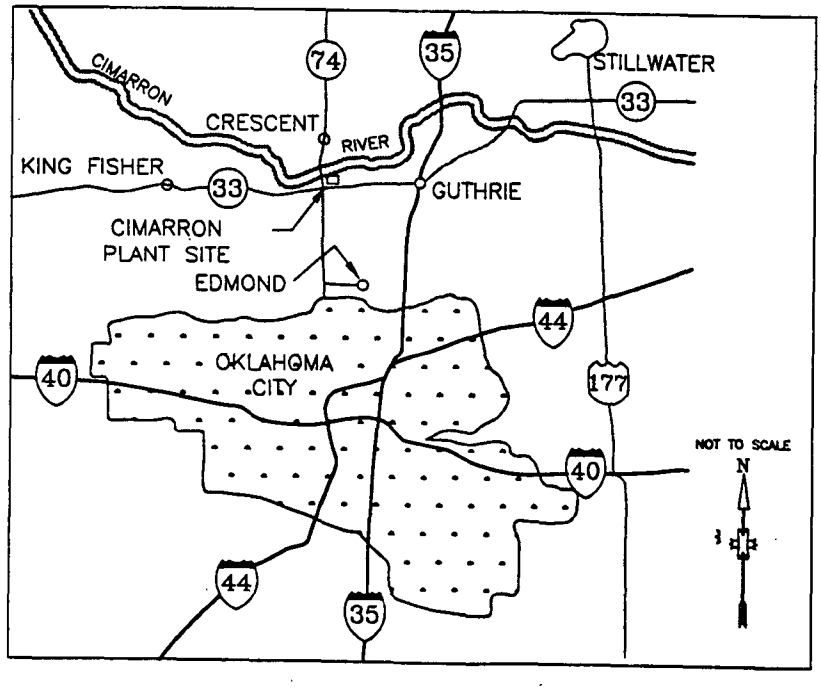
The Cimarron Facility is located in Logan County, Oklahoma, on the south side of the Cimarron River approximately 0.5 miles north of the intersection of Oklahoma State Highways #33 and #74. Figure 3.1 shows the site location. The 840-acre site (recently reduced to 152 acres) is located in an area of 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. A topographic map of the site is included in Appendix I by Drawing No. 95 SITE. 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 O is located within Phase III and includes the areas formerly occupied by both Uranium Waste Ponds #1 and #2. These two waste ponds were process evaporation ponds that were removed from service, closed and released in 1978 under approvals of NRC and Oklahoma Department of Health.

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





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Cimarron Corporation
Crescent Oklahoma Facility
Location Map
Figure 3.1

production of fuel pins. In 1970 facilities were added for the production of the fuel elements. 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 Operating History

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 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[7].

6.0 Decommissioning Activities

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

6.1 Identification of Soil 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, U-238 and Tc-99. The uranium is comprised of natural (background) and enriched forms, with an average enrichment above the naturally occurring level. The average U-235 enrichment at Cimarron previously has been established as approximately 2.7 weight percent. The Tc-99 was an impurity in the enriched uranium received by the site for processing. Cimarron addressed the occurrences of Tc-99 at the site by letters to the

NRC dated October 9, 1996[20] and February 14, 1997[21]. In NRC's response[22] to the Cimarron letters, they recommended that Tc-99 in groundwater be addressed. Tc-99 in soil is addressed in Section 8.3 and in groundwater in other Cimarron reports.

Thorium analyses were performed on all soil samples collected. Thorium was not processed at the facility and since the activities determined are at background levels, they were not presented on the data sheets or drawings included with this Report.

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 composition, 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, an average background value of 4 pCi/g total uranium was used when the soil sample analytical results were compared to NRC guideline values. The establishment of background was reported in Cimarron's June 21, 1995 letter[23] to the NRC.

6.3 History of Subarea Characterization Efforts

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 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 O has been designated a survey unit. Cimarron personnel have completed the characterization, remediation, and final status survey (i.e., subsurface) of this unit.

As discussed in Section 2.0, the Phase III area comprises only affected areas including several areas which were previously released for backfilling by the NRC. Uranium Waste Ponds #1 and #2 are two of the five former waste water ponds previously released by the State of Oklahoma and the NRC in 1978.

The five former waste water ponds, discussed in this section, provided a method of liquid waste management and control during facility operations. These five ponds included Uranium Waste Ponds #1 and #2, the Plutonium Evaporation and Emergency Ponds and the Uranium Emergency Pond. By early 1977, these ponds contained no freestanding liquids. The sludge remaining in four of these ponds was removed, mixed with cement, and shipped off-site for disposal at a licensed LLRW burial site. The other pond, Uranium Waste Pond #2, was an evaporation pond that received only decanted liquid from Waste Pond #1 and did not contain any sludge. Additional information concerning the history of the five former waste ponds is contained in Section 12.0 of the Characterization Report[5].

After the sludge was removed, Cimarron staff, the Oklahoma State Department of Health (October 1977), and the NRC (November 1977) sampled the soils/liner materials from each of the five ponds. Based upon the analysis results, Cimarron Corporation received written permission from the Oklahoma State Department of Health to backfill and cover these ponds on March 2, 1978[24]. Cimarron Corporation also received written authorization from the NRC to backfill and cover these ponds on July 10, 1978[25]. These five ponds were backfilled and covered between August 3, 1978 and November 1, 1978. An October 30, 1978, NRC inspection, which was documented via letter dated December 14, 1978[26], states that closure of the "five liquid effluent retention ponds was completed during the inspection". Initial seeding as well as fencing of the areas was performed between November 2, 1978 and March 20, 1979. Sprigging and fertilizing of the cap soil was performed from July 18, 1979 to October 30, 1979. Even though closed in accordance with "current guidelines" as stated in the NRC letter dated January 8, 1993[27], the NRC informed Cimarron Corporation that "the five former waste water ponds that were closed in 1978 must be addressed in detail". In response to this requirement, additional characterization work was conducted in 1993 by Cimarron Corporation in these pond areas, specifically Uranium Waste Ponds #1 and #2. As stated above, the analytical data is discussed in detail in Section 12.0 of the Cimarron Characterization Report. The characterization data represented soil samples collected on 10 m x 10 m grids at the surface and at various depths below grade. Beginning in 1996, additional soil sample data was collected to supplement the 1993 data. This sampling event increased the sample frequency to the equivalent of a minimum 5 m x 5 m grid, similar to the guidance contained in Draft NUREG/CR 5849. Off set sampling also was performed at numerous locations to determine the aerial extent of residual activity.

In response to the NRC's comments dated July 1, 1997[28], regarding the Cimarron Decommissioning Plan[7], Cimarron Corporation, by letter dated August 26, 1997[29], agreed to re-enter and decommission Uranium Waste Ponds #1 and #2 in accordance with the BTP[30] Option #1 criteria as identified in NRC's guidance on "Methods for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil"[31]. The

derivation of the enriched uranium guideline values based upon the NRC's guidance on subsurface averaging is presented in Appendix II. Utilization of the NRC guidance, coupled with Cimarron's desire to assure full compliance, resulted in the recent excavation of numerous discrete soil volumes in both waste ponds and the performance of additional soil sampling and confirmation surveys. The complete set of data from Uranium Waste Ponds #1 and #2 was evaluated against the volumetric averaging criteria (guideline values) to demonstrate that the soils within these two former pond areas meet the BTP Option 1 release criteria. The final status survey guideline values are tabulated in Section 7.2 and the final status survey data, including a comparison to the guideline values, is addressed in Section 8.0.

6.3.1 Characterization Data - Uranium Waste Pond #1

The characterization data collected in 1993 for Uranium Waste Pond #1 (U-Pond #1) were previously submitted and discussed in Section 12.0 of the Characterization Report[5]. The soil analytical data were collected, in general, on a 10 m x 10 m grid within the boundary of Subarea O and to a depth of six feet, with twelve locations cored to twelve feet. Soil samples were collected at one foot increments for total uranium analysis. In 1996, the former pond area again was sampled to supplement the original 10 m x 10 m grids with a sampling frequency equivalent to a 5 m x 5 m grid. These additional samples also were collected at one foot intervals to a depth of six feet. Approximately 1,600 soil samples were collected during these sampling events. The soil analytical data collected to a depth of 6 feet (on a 5 m x 5 m grid) for Subarea O (U-Pond #1) are presented on Drawing Nos. 97PRP1SS-0 through 97PRP1SS-5 which is included in Appendix III.

A review of the characterization data presented by the drawings referenced above shows that subsurface residual activity is present below the 3 foot depth and is within the perimeter of the former pond area. Also, bedrock is encountered at a shallow depth on the east side of the former pond area and is encountered more frequently as the soil depth increases. Outside the waste pond area, the characterization data shows concentrations of

total uranium in soil varying from 3 pCi/g to 10 pCi/g; with all sample results being below the Option 1 guideline value. Since the residual activity was isolated within the former pond area, all subsequent data gathered and discussed in this Report falls within the perimeter of the former pond area. Drawing No. 96PRP1DD-0 which shows analytical results for soil corings down to 12 feet, presents a pictorial of the residual activity across U-Pond #1 with depth. This drawing is included in Appendix III. This data demonstrates that residual activity dissipates with depth and is contained within a depth range from 4 to 10 feet. This was further confirmed by additional final status survey data within the perimeter of the former pond area which is discussed below.

Based upon a review of the 5 m x 5 m grid data, Cimarron collected additional soil data within the former boundaries of the U-Pond. The twenty-one locations showing elevated activity at the five to six foot depth were selected for this additional off-set sampling. These samples were collected to a depth of 0 to 10 feet in one foot intervals. Samples were not collected below the depths where rock was encountered. A total of 780 samples were collected for analysis. In 1997 additional grid locations were selected for sampling below the 6 foot depth to further add to the characterization data base. One meter samples (i.e., 3 foot increments) were collected at twelve 5 m x 5 m grid intersect locations below the 6 foot depth, and the resulting analytical data were added to the characterization data for evaluation. The tabulation of the entire characterization data set is included with Appendix III, along with Drawings showing the location, depth and analysis results for all soil samples. The Drawings are Nos. 97PRP1SS-0 through 97PRP1SS-9.

In 1997, a review of the most recent quarterly quality control (QC) soil analytical data for U-Ponds #1 and #2 prompted Cimarron to perform an evaluation of all existing U-Pond QC data. The purpose of the review was to determine if Cimarron's on-site soil counter met the data quality objectives for the Cimarron Quality Assurance Program. This review indicated that Cimarron's on-site counting system was biased high for soil containing activity less than or equal to approximately 50 pCi/g total uranium and biased low for

activities greater than 50 pCi/g. The evaluation indicated that the low bias was attributable to the soil activities not being corrected for soil moisture. The average soil moisture content was determined to be approximately 10% for the soil data reviewed. The samples sent to the independent laboratory were weighed and dried prior to analysis. These weights were used to calculate an average soil moisture. Based upon this review, Cimarron's procedure for on-site soil analysis was revised to require soil moisture corrections for all soil sample results with total uranium concentrations greater than 50 pCi/g. Also, a 10% correction was applied to the previous U-Pond's characterization data for those locations showing greater than 50 pCi/g. These corrections were made to all U-Pond characterization data not previously corrected for moisture prior to determining which U-Pond locations were to be remediated.

Cimarron has been remediating the site to the 30 pCi/g total uranium maximum Option 1 guideline value for all other affected areas, thus, the low bias was not an issue. The 30 pCi/g cleanup standard is far below the 50 pCi/g value and is biased high at this soil counter range. Therefore, sitewide decisions pertaining to the cessation of remediation to meet the Option 1 criteria, have been conservative.

A comprehensive review of the characterization data identified fourteen locations with one foot composite samplings exceeding 220 pCi/g, the initial guideline selected by Cimarron for soil remediation. This administrative guideline was far more restrictive than the value determined per the NRC's guidance on subsurface volumetric averaging (i.e., 242 pCi/g for a soil volume of $1m^3$) to meet the BTP Option 1 criteria for a single sample. The details of the derivation of this guideline value are provided in Appendix II, and are further discussed in Section 7.2.1.

6.3.2 Characterization Data - Uranium Waste Pond #2

The characterization data that were collected in 1993 for Uranium Waste Pond #2 (U-Pond #2) has been presented in Section 12.0 of the Characterization Report[5]. The soil analytical data were collected, in general, to a depth of six feet, with three locations cored

to twelve feet. Soil samples were collected at one foot increments for analysis. In 1996, the pond area again was sampled to fill in the original 10m x 10m grids with a sampling frequency equivalent to a 5 m x 5 m grid. These additional samples were collected at one foot intervals to a depth of five feet. Samples were collected only to five feet because the previous sampling event in 1993 did not show residual activity above 30 pCi/g below this depth with the exception of the three locations cored to 12 feet. Over 3,300 soil samples were collected for these two sampling events. These data are presented on Drawings Nos. 97PRP2SS-0 through 97PRP2SS-5 included in Appendix IV. The sample results for the deep corings are shown on Drawing No. 96PRP2DD-0 also included in Appendix IV.

A review of the characterization data, in general, shows that residual activity is present below the one foot layer down to the five foot level. Similar to Waste Pond #1, the elevated concentrations are within the perimeter of the former pond area. Outside of the waste pond area the characterization data shows concentrations of total uranium in soil varying from 3 pCi/g to 17 pCi/g; with one location showing a concentration of 48 pCi/g. The slightly elevated analysis (i.e., 48 pCi/g) is located at N480-E595 at a depth of 4 to 5 foot. If this 5 m x 5 m by 1 foot in depth soil volume is averaged with the three adjacent 5 m x 5 m grids showing uranium concentrations of 8, 6, and 4 pCi/g, the 10 m x 10 m by 1 foot in depth soil volume's average concentration is 16.5 pCi/g. This average is below the Option 1 guideline value, and this location was not included in the subsurface volumetric averaging. Based upon the characterization data, the volumetric averaging performed for the final status survey focused on soils within the perimeter of the waste pond.

The fact that residual activity was present at a depth of just over one foot below grade prompted Cimarron to commit in the Decommissioning Plan[7] to removing the vegetation and topsoil from the waste pond area (approximately 1 foot of soil) and to place four feet of compacted clean fill over the pond area as a closure cap.

A preliminary review of the characterization data identified 29 one foot composite sample locations with residual activity above the administrative guideline value of 220 pCi/g total uranium. Based upon the review of the characterization data gathered and prior to remediation, Cimarron decided to collect off-set samples surrounding these 29 previously sampled grid locations that had the elevated concentrations. A total of approximately 400 additional soil samples were collected to depths up to five feet for analysis. The 29 locations were subsequently scheduled for remediation and were excavated. As discussed in Section 6.3.1, the administrative guideline of 220 pCi/g is far more restrictive than the value determined per the NRC's guidance on subsurface averaging to meet the BTP Option 1 criteria for a single sample. The derivation of the guideline value of 242 pCi/g for a single composite sample is presented in Appendix II.

The 400 additional analyses were added to the characterization database for evaluation. The tabulation of the characterization data is included with Appendix IV, along with Drawings showing the locations, depth, and analysis of the one foot composite samples. The Drawings are Nos. 97PRP2SS-0 through 97PRP2SS-5.

As discussed in Section 6.3.1, a 10% correction was applied to the previous U-Pond characterization data for those locations showing greater than 50 pCi/g. These corrections were made to all data not previously corrected for moisture.

6.3.3 Remediation of U-Ponds #1 and #2

Remediation of the selected locations for both U-Ponds #1 and #2 was performed with a track-hoe excavator. One to four feet of soil was removed from above the impacted soils in order to gain access to the contaminated soils with concentrations above the administrative guideline value. The excavation continued as necessary down to "rock" and in some cases into the rock. Excavations varied in depth from four to six feet for U-Pond #2 and ten to twelve feet for U-Pond #1. Impacted soils removed from the excavation were stockpiled for preliminary analysis for determining the proper disposal method, i.e., placement in the Option 2 on-site disposal cell or drummed for shipment to a

licensed LLRW facility. Soils placed into the on-site disposal cells were sampled in accordance with the NRC approved in-situ sampling protocol.

For the areas remediated, representative soil samples were collected for total uranium analysis from corings next to the pit walls to determine if sufficient soil had been removed. The method used for sample collection was dependent upon the excavation depth. The analytical data was reviewed and if deemed acceptable per the volumetric averaging guideline values presented in Section 7.2, the pit bottom soils were sampled for total uranium. Stockpiled soils, initially removed from the excavations were analyzed for total uranium and placed into the BTP Option 2 on-site disposal cell. Soils from unaffected areas on-site were utilized for pit backfill. The backfilled soils were sampled and analyzed for total uranium prior to or after being placed into the excavated pits. This analytical data were incorporated into the previous survey data for final status survey volumetric averaging, with resulting averages being compared to the guideline values.

The decision was made to backfill the excavations as soon as possible after the areas were deemed to meet the volumetric averaging guidelines discussed in Section 7.2.1 to mitigate two potential hazards. The open excavations were (1) a health and safety hazard because of their depth, vertical walls and narrow dimensions, and (2) the excavations filled with water during each rainfall event creating recharge to the shallow groundwater.

6.3.3.1 Closure of U-Pond #1

The fourteen locations that were remediated in U-Pond #1 were excavated to a minimum depth of 10 feet at which time "bottom of hole" soil samples were collected for analysis. The locations selected and soil volumes excavated were conservative due to the fact that the administrative guideline for remediation was 220 pCi/g total uranium for a one foot composite soil sample in lieu of the allowable guideline value of 242 pCi/g for a $1m^2$ by 3 foot deep composited soil sample (i.e., 1 m^3 soil volume). The remediated locations and the approximate arial extent of the excavations are shown on Drawing No. 97PRPIBK-0 which is included in Appendix V. The soil volume excavated from the fourteen locations

was approximately 23,000 cubic feet. Upon completion of remedial activities, U-Pond #1 was backfilled and graded.

6.3.3.2 Closure of U-Pond #2

The locations and the approximate aerial extent of excavation for U-Pond #2 are shown on Drawing No. 97PRPRAB-0 included in Appendix V. The excavations were completed to a depth of from four to six feet, with one location down to nine feet. The deep excavations, at location 530N - 580E, correspond to the elevated activity detected in the corings completed in the northeast corner of the former pond area.

Approximately one foot of soil and vegetation were removed from the U-Pond #2 area prior to remediation. The 29 designated areas were remediated and soil samples were collected for analysis to verify that sufficient soil had been removed. The soil volume excavated from the 29 locations was approximately 7,000 cubic feet. With the completion of remedial activities, all excavations were backfilled with soils from unaffected areas on-site. Additionally, four feet of compacted clay soil excavated from unaffected areas was placed over the entire former U-Pond #2 area. These clay soils were analyzed for total uranium as they were being placed. Finally, the surface of U-Pond #2 was contoured with additional soils, also excavated from an unaffected area on site. The surface contouring was performed to promote drainage and will be seeded when weather and site conditions permit.

Cimarron personnel will perform the final status survey on the Subarea O surface soils after final contouring and seeding of this area. This surface survey data developed during this final phase of the final status survey will be presented in a separate report.

7.0 Final Status Survey Procedure

This section details the methodology utilized for the collection of the survey data presented in this Report as Final Status Survey data for Subarea O (subsurface). The survey methodology employed is identical to that utilized for the release of other areas on-site with adjustments made

for volumetric averaging of subsurface residual activity as outlined in NRC's guidance[31]. The final survey data will be used to demonstrate that the applicable radiological parameters (i.e., Option 1 guideline values) are satisfied for release of Subarea O (subsurface) from License SNM-928. The guideline values utilized for comparison to the final status survey data are described in this section.

For this Phase III Area Final Status Survey, Cimarron Corporation previously committed to the NRC to follow their guidance for volumetric averaging of subsurface soil[31], and the survey methodology prescribed in NUREG/CR-5849[32]. This Final Status Survey was conducted after comprehensive efforts were made to identify, evaluate, and remove as necessary any soils with residual activity exceeding the guideline values. This Report includes all necessary data to support the Final Status Survey for Subarea O (Subsurface).

7.1 Survey Methods

In general, survey and soil sampling data were collected utilizing established methodologies which have been demonstrated during the release of other site areas from License SNM-928. Additionally, the NRC guidance for volumetric averaging of subsurface soil containing residual contamination was followed in order to demonstrate compliance with the BTP Option 1 criteria, and are discussed further below in this section.

7.1.1 Grid Areas

For purposes of data evaluation, the Cimarron site was initially subdivided into the 100 m x 100 m grid patterns shown on Drawing No. 95 MOST-RF3, and this grid was utilized for locating soil sampling and survey points. Subarea O's 100 m grid areas were further subdivided into 5 m x 5 m grid areas for soil and survey data collection. Cimarron utilizes 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 ± 1m. 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 survey for future reference.

7.1.2 Soil Sample Locations

The soil sampling frequency was specified in the Cimarron Special Work Permit(s) and Work Plan(s). Wherever practicable, subsurface soil samples were collected at a frequency equivalent to, and in many cases greater than, that recommended for affected areas as described in NUREG/CR-5849[32] (i.e., 5 m x 5 m grid intersects). In general, subsurface soil sampling was performed to various depths down to "rock" within the Subarea O with greater emphasis placed on the soils within the perimeter of both U-Ponds. Samples were collected originally at one foot intervals and composited for analysis. After review of the NRC guidance[31] for subsurface soil averaging, composite soil samples were collected at intervals of either one or three feet in depth. The three foot composite samples were considered equivalent to one meter. All soil samples collected were analyzed for total uranium using the on-site soil counter.

7.2 Guidelines Established

The radiological guidelines discussed in this section are utilized for comparison to the final survey data as justification for the unrestricted release of Subarea O (Subsurface) soils. The derivation of these guideline values is included in Appendix II.

7.2.1 Volumetric Averaging of Subsurface Soils

The NRC guidance for volumetric averaging of subsurface soils containing residual contamination was followed for demonstrating compliance with the BTP Option 1 criteria. During a meeting with the NRC on October 2 - 3, 1996, the NRC staff recommended that Cimarron consider applying the subsurface averaging methodology for residual activity being developed by the NRC for other licensees. The NRC guidance document that provides this method for averaging elevated areas of subsurface soil concentrations was sent to Cimarron by cover letter from Mr. Ken Kalman dated February 25, 1997[31]. This document titled "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil", describes a set of

decommissioning performance objectives for subsurface soils that the NRC has found acceptable at other sites. As stated in Mr. Kalman's cover letter, "[a]lthough the methodology was written for thorium it can be applied to uranium as well."

This NRC guidance assumes that soils containing residual contamination are excavated and brought to the surface where both the BTP[30] surface exposure pathways and the surface averaging methods apply. The surface averaging method used for excavated subsurface soils is consistent (although modified by the new guidance) with that used in NUREG/CR-5849[32]. The acceptable concentrations (guideline values) which have been calculated by Cimarron for comparison to the final status survey data for U-Ponds #1 and #2 are a function of the modeled excavated soil volumes. The calculated guideline values result in projected exposures similar to those representative of BTP Option 1 soils (maximum 30 pCi/g total uranium) with widespread surface contamination.

The methodology, the derived guideline values, and the preliminary data evaluations completed by Cimarron for both waste ponds were discussed with the NRC in Washington on April 10, 1997. The NRC representatives at that meeting included Mr. Dave Fauver, Mr. Ken Kalman, Mr. Tim Johnson, and Mr. John Hickey. At that meeting Cimarron discussed the preliminary soil survey data based upon one foot soil sampling increments and committed to removing several soil areas within both waste ponds that exceeded the administrative guideline value of 220 pCi/g. Also, Cimarron discussed the fact that the final survey data would be evaluated and presented in one meter (i.e., 3 to 4 ft.) increments in accordance with the methodology contained in the NRC's subsurface volumetric averaging guidance. NRC representatives at that meeting indicated that this approach for data presentation met their guidance criteria. However, Mr. Fauver suggested that additional soil samples be collected and analyzed for U-Pond #1 at the 6-10 ft depth. Additional sampling therefore was performed and these data are presented with the final status survey data discussed herein.

Based upon the NRC's volumetric averaging methodology, the soil concentration guideline values required to meet the Option 1 criteria were determined for comparison to the residual uranium concentrations remaining below grade. The guideline values are listed in Table 7-1 (the calculations performed to derive these guidelines are included in Appendix II). It should be noted that the guideline values were determined in 0 to 3 foot, 3 to 6 foot, etc., increments in lieu of meter increments due to the fact that Cimarron historically has collected soil samples in one foot increments. These depth increments (i.e., 0-3 feet) are considered equivalent for discussion and evaluation purposes to one meter intervals and are referenced in this report as one, two, or three meter depth increments. Also, for simplicity of discussion the soil volumes are presented in this report as equivalent cubic meters such as 10's or 100's. The actual and equivalent (for discussion purposes) soil volumes are noted in Table 7-1.

Table 7-1
Guideline Values for Total Uranium
By Soil Depths and Volumes

Soil Location and Depth	Actual Soil Volume (m^3)	Equivalent Soil Volume for Discussion (m^3)	Average Soil Concentrations (pCi/g)
~~Any Depth~~	.9	1	242
~~5 m x 5 m @ 1 ft~~	7.6	7.5	*
10 m x 1 m @ 0 – 3 ft	9.1	10	130
10 m x 10 m @ 0 – 3 ft.	91.1	100	94
10 m x 10 m @ 0 – 6 ft	182.9	200	69
10 m x 10 m @ 0 – 9 ft	274.3	300	43
10 m x 10 m @ 0 – 10 ft.	304.8	300	38
Volume from surface to depth "x"			30
5 m x 5 m x 3 ft	22.0	25	*
5 m x 5 m x 4 ft	30.2	25	*
5 m x 5 m @ 0 – 6 ft.	45.7	50	102
5 m x 5 m @ 0 – 9 ft.	68.6	75	97
5 m x 5 m @ 0 – 10 ft.	76.2	75	96

*No Guideline Values Established

The average residual activities measured for subsurface soils within the former waste pond areas were evaluated to demonstrate that the subsurface soils meet the Option 1 averaging concentration guidelines in Table 7-1 and can be left in place.

7.3 Equipment Selection

Special Work Permits (SWP) and Work Plans (WP) were written and approved in accordance with facility procedures prior to the commencement of the 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 Sites 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.

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

An SWP was written and approved prior to commencement of the field work covered under this Final Status Survey. The instrumentation utilized by site personnel for this subarea's remediation and final status survey is discussed below.

7.3.1.1 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 are 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%. In 1997 Cimarron installed a new analyzer (Counter #2) which is programmed to determine the total uranium present in the soil sample by calculating the U-234 present from the U-235 values detected in the soil. Additionally, these two values then are summed with the detected U-238 value to determine the total U concentration. Counter #2 also adjusts for variation in background, whereas Counter #1 utilizes a constant for background subtraction. The data discussed and presented in this Report was generated by both Counter #1 and Counter #2. 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.

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. Independent laboratory analyses and typical Counter #1, Counter #2 analyses of these standards are presented in Table 7-2.

Table 7-2
Total Uranium Analytical Results (pCi/g)
Cimarron Soil Counter Standards

ID	Date	KM Tech Center	Other Labs	Core Lab	Teledyne Brown	Assigned Value	Soil Counter #1	Soil Counter #2
U-1-2 STD	8/1/86	27.39 ± 0.43	Isotopic Analysis 29.92	----	----	28.6	29.0	28.6
TH-1 STD	8/1/86	10.54 ± 0.96	UST Testing 9.04	----	----	9.7	9.9	9.5
BKG Soil STD*	8/1/86	6.27 ± 0.25 2.78 ± 0.39	----	----	----	4.5	7.9	5.6
DP-1	4/15/94	-----	----	289.6 ± 34.4	293.5 ± 13.5	291.5	295.8	309.5
DP-2	4/15/94	----	----	132.2 ± 18.3	137.0 ± 18.3	134.6	120.0	123.6

*split sample

Cimarron personnel determine total uranium and total thorium activities based upon the evaluation of net counts from the soil counter. Concentrations 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 also are made as necessary.

An example of the calculations showing the derivations for on-site soil counter efficiency, correction factors and minimum detectable activity (MDA) are included in Appendix VI.

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[33]). 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[34], and DAP-3 stockpile[35] verified previously that Cimarron's on-site counter results are statistically identical to ORISE's results.

As discussed in Section 6.3.1, a review of 1997 quarterly quality control (QC) soil analytical data for the U-Ponds prompted Cimarron to perform an additional comparative evaluation of all existing U-Pond QC data. The data evaluation indicated that Cimarron's on-site counting system was biased high for soils containing activity less than or equal to approximately 50 pCi/g total uranium and biased low for soil concentrations exceeding 50 pCi/g. The low bias was found to be due to the fact that soil moisture was not being accounted for in the calculations. Subsequently, Cimarron's procedure for on-site soil analysis was revised to require that all soil sample results with total uranium activity greater than 50 pCi/g be corrected for soil moisture.

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 O (subsurface) 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 directly 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. In general, 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[1] and By-Product License 35-12636-02[36]. 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 exercise appropriate radiation protection precautions throughout the decommissioning work and final survey process.

Independent Kerr-McGee Corporate audits for regulatory and internal requirements are conducted on a periodic basis (quarterly) and include among other items 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 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[37].

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. Such quality controls would allow for the independent verification of analysis results by a third party review.

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 O 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 (samples 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.

This review resulted in the modification to the counting procedure to adjust for soil moisture with soil concentrations greater than 50 pCi/g.

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 Final Status Survey Data

As discussed in Section 1.0, final status survey data were generated for Subarea O (subsurface) to justify the unrestricted release of the subarea's subsurface soils in accordance with NRC guidelines. The survey findings, including the statistical methodology employed to evaluate the data for Subarea O, are discussed in this section.

8.1 Data Evaluation

As discussed in NUREG/CR-5849[32], the guideline values for soil activity concentrations are average values (above background) established for areas of survey units. In order to compare the total uranium analytical and survey data developed for the final status survey with guideline values, data at specific survey grid locations are averaged for comparison to the respective guideline value. The guideline values for leaving soils in place are the BTP Option 1 criteria as determined under the NRC's subsurface volumetric averaging criteria. The Option 1 guideline values for Subarea O are presented in Table 7-1 for subsurface volumetric averaging of residual uranium concentrations.

For subsurface residual activity determinations, final status survey data within each 5 m x 5 m grid were averaged first in one foot increments (i.e., representing a soil volume of 7.5 m^3) and then in 3 to 4 foot depth increments (i.e., representing a soil volume of 25 m^3). It should be noted that U-Pond #1 has survey data for a soil depth of 6 to 10 feet that equates to 4 feet in thickness, all other intervals are 3 feet in thickness. All final status survey data within each 5 m x 5 m grid were averaged by multiplying an area weighting factor times the total uranium concentration in pCi/g associated with a specific sample

location. These average concentrations were then summed for determining the average concentration in pCi/g assigned to the specific 5 m x 5 m by one foot deep grid interval (i.e., soil volumes of 7.5 m^3). An example of the method used for averaging the concentration within a 7.5 m^3 soil volume with one center sample location and four one meter off-set locations, was to assign a 1 m^2 area to the center location and a 6 m^2 area to each of the four off-set sample locations. Examples of the typical methods followed in determining the 7.5 m^3 average concentrations are presented in Appendix VII. After all 7.5 m^3 soil volume average concentrations were determined, then the three individual soil volumes were averaged over one meter depths (i.e., either 3 or 4 feet) for initial guideline screening. These average soil concentrations represented 25 m^3 soil volumes. For both U-Ponds, the 7.5 and 25 m^3 average soil concentrations for total uranium are presented on drawings referenced later within this section.

Next the 25 m^3 soil volume were averages into increments of 50 m^3 and 75 m^3 representing soil depth of 0-2 meters and 0-3 meters respectively.

If the average soil concentration within a 25 m^2 grid at depths of 0-1, 0-2, or 0-3 meters exceeded the guideline value then an average concentration for the maximum 100 m^2 grid was calculated and evaluated. These average concentrations represented soils within 100 cubic meter, 200 cubic meter, and 300 cubic meter soil volumes. These average values for the survey unit volumes (i.e., 100 m^3, 200 m^3 and 300 m^3) were compared to the guideline values. If the average concentrations including the background activity were below the guideline values, further remediation was not required and the data were presented as final status survey data. Additionally, the average soil concentrations (i.e., total uranium in pCi/g) for the samples representing soil volumes of 50 m^3 and 75 m^3 were compared to the guideline values. Finally, the average total uranium concentrations for the entire soil volumes within the perimeter of both U-Ponds were calculated to demonstrate that the overall residual concentrations present are below the 30 pCi/g total uranium (plus background) guideline value as required for meeting the BTP Option 1 soils criteria.

8.2 Comparison With Guideline Values

The final status survey data for Subarea O (subsurface) were compared to the guideline value criteria and are discussed separately below:

8.2.1 Evaluation of U-Pond #1 Survey Data

This section evaluates the data collected from the subsurface surveys performed for Subarea O from within the perimeter of the area formally occupied by U-Pond #1. The final status survey data for soil samples collected from within the U-Pond #1 perimeter are presented in tabular form in Appendix VIII. These data are presented in one foot increments. Additionally, these data are plotted on the location drawings, also included in Appendix VIII as Drawing Nos. 97POP1SS-0 through 97POP1SS-9. This set of soil data was utilized for calculating the subsurface soil volumetric averages for comparison to the guideline values presented in Table 7-1.

The first step in the evaluation was to review the final status survey data within the 0 to 1 meter depth (i.e., 0-3 ft depth) for comparison to the 10 m^3 guideline value of 130 pCi/g total uranium. This criteria represents an assumed excavated soil volume simulating the construction of a house without a basement. The final status survey data for total uranium representing the one foot composited samples within the first meter of soil ranges from 2 to 59 pCi/g with no locations exceeding the 130 pCi/g guideline value. Thus, the average activity for any 10 m^3 soil volume would be below the 130 pCi/g total uranium guideline value. Thus, no further data evaluations were required.

The next step in the evaluation and as discussed in Section 8.1, was to determine the average total uranium concentrations for each 25 m^2 by 1 foot deep soil volumes (i.e., representing a soil volume of 7.5 m^3). The concentration of total uranium in each 7.5 m^3 soil volume was determined by assigning an area weighting factor to each grid sample location and then multiplying this factor times the activity in pCi/g (representing a one foot composite sample) at the specific location. All results were summed for determining the weighted average concentrations for total uranium in pCi/g representative of soils

within each 25 m^2 by one foot depth grid volume (i.e., 7.5 m^3). These average concentrations are shown by location on Drawing Nos. 97POP1SS-0 through 97POP1SS-9 included in Appendix VIII. Several typical examples of the methodology followed for determining the average grid concentrations are included in Appendix VI. These examples include various scenarios representing grids with different sample locations and number of samples.

The next evaluation included averaging the 7.5 m^3 soil concentrations within each one foot layer that is, in general, within the perimeter of the U-Pond. This evaluation was performed for determining overall trending by soil layer. The average concentrations for each one foot layer of soil are shown in Table 8-1. Also included in this Table is the average concentration for soils collected after remediation from the bottom of each excavation and from the eight deep corings (i.e., BH). The data presented in the Table shows the upward trend in soil concentrations as soil depths increase past the four foot soil cover and then the downward trends in concentrations with depth after the peak of 36 pCi/g is reached at the 6 - 7 foot level.

Table 8-1
Uranium Waste Pond # 1
Average Concentrations per 1 ft. Soil Layer

Depth	Total Uranium (pCi/g)
0-1	8.0
1-2	8.0
2-3	8.6
3-4	11.9
4-5	12.6
5-6	19.4
6-7	36.0
7-8	28.6
8-9	25.0
9-10	18.6
BH	16.7

The next step in the data evaluation was to average the soil concentrations in each 25 m^2 by one foot in depth volumes (i.e., 7.5 m^3) in increments of 1 meter at the 0-1, 1-2, and 2-3 meter depths to arrive at average soil concentrations per 25 m^3 soil volumes. The average total uranium concentration for these 25 m^3 soil volumes are shown in tabular form and on Drawing Nos. 97AVP1-0, 97AVP1-1 and 97AVP1-2 which are included in Appendix VIII. As noted in Table 7-1, there is no guideline for the 25 m^3 soil volumes.

The average total uranium concentrations for soils within these 25 m^3 soil volumes at the 0-1 meter depth varies from 4.3 pCi/g to 24.1 pCi/g with a mean of 8.2 pCi/g. The 1-2 meter average concentrations for the 25 m^3 soil volumes vary from 5.0 pCi/g to 103.8 pCi/g, with a mean of 15.1 pCi/g. Finally, the 2 to 3 meter average concentrations for the 25 m^3 soil volumes vary from 4.0 pCi/g to 63.2 pCi/g, with a mean of 29.0 pCi/g. The average concentration for the bottom of hole samples (BH) ranges from 3.0 pCi/g to 38.0 pCi/g with a mean of 16.7 pCi/g total uranium.

The 2-3 m averages concentrations are biased high because the majority of the samples collected from this depth were from areas containing elevated residual activity at the 1-2 m depth. Also, the bottom of the hole soil samples represent six inch samples and not one meter composite samples. For these reasons, the overall soil averages for both of these levels are considered biased high.

The next evaluation compared the soil concentrations within a soil volume representing each 25 m^2 by 0 to 2 meter soil depth (i.e., a soil volume of 50 m^3) and 0 to 3 meter soil depth (i.e., a soil volume of 75 m^3) to the guideline values (see Table 7-1). The guideline values for any two sampling events representing a soil volume of 50 m^3 is 102 pCi/g total uranium. The range of average concentrations for the 50 m^3 soil volume range from 4.5 pCi/g to 60.2 pCi/g. The average concentrations are shown in tabular form and by locations on Drawing No. 97AVP1-3; both are included in Appendix VIII. All 50 m^3 soil volume averages at the 0-2 meter depth are below the 102 pCi/g total uranium guideline value.

The guideline value for any three sampling events representing a soil volume of 75 m^3 (0-3 m in depth) is 96 pCi/g total uranium. The average concentrations for the 0-3 meter samples for any 75 m^3 soil volume ranges from 4.5 pCi/g to 55.8 pCi/g. The average concentrations are shown in tabular form and by location on Drawing No. 97AVP1-4; both are included in Appendix VIII. All 75 m^3 soil averages at the 0-3 m depth are below the 96 pCi/g guideline value.

The next evaluation compared the average soil concentration within soils representing the volumes of 100, 200, and 300 m^3 to the applicable guideline value. The guideline values were presented in Table 7-1 and are shown below in Table 8-2 for U-Pond #1. Based upon a review of the 25, 50 and 75 m^3 average soil concentrations further evaluations were performed at several grid locations for comparison to the 100, 200 and 300 m^3 guideline values. For example, if the 25 m^3 average soil activities were all below the 100 m^3 guideline values (i.e., Table 8-2) no further data analyses were required and the volumetric averaging criteria to meet the BTP Option 1 guideline is met.

Table 8-2
Uranium Waste Pond #1
Guideline Values for 100m^2 Grids
Total Uranium

Actual Depth	Equivalent Depth	Soil Volumes	Average Concentration*
0-3'	0-1m	100 m^3	94 pCi/g
0-6'	0-2m	200 m^3	69 pCi/g
0-10'	0-3m	300 m^3	38 pCi/g

*Concentrations above background.

For the 0-1 meter soil depth there were no 25 m^3 soil volume with average concentrations close to the 100m^3 guideline of 94 pCi/g total uranium; thus, all 100 m^3 soil volumes would be below the guideline values. The highest 25 m^3 grid average concentration was 24.1 pCi/g total uranium (including background); thus no further evaluations were required for any of the 100 m^3 soil volumes that represent the 0-1 meter soil depth.

For the 0-2 meter soil depth, the grid at N405-E315 representing a 50 m^3 soil volume had the highest concentration at 60.2 pCi/g total uranium; this location, although below the 200 m^3 guideline of 69 pCi/g, was evaluated as the bounding case. Averaging this 25 m^2 by 0-2 meter soil volume with the surrounding 25 m^2 soil grids resulted in the four 200 m^3 soil volumes scenarios shown in Table 8-3.

Table 8-3
Uranium Waste Pond #1
Average Soil Concentrations at 0-2 meters (pCi/g Total U)

25 m^2 Grids Evaluated	25 m^2 @ 0-2 m 50 m^3 Grid Average*	100 m^2 @ 0–2 m 200 m^3 Grid Average*	Guideline Value
N405-E315	60.2	25.0	69
N405-E320	3.7		
N400-E320	8.5		
N400-E315	27.5		
N405-E310	7.4	25.8	69
N405-E315	60.2		
N400-E315	27.5		
N400-E310	8.3		
N410-E310	18.1	23.3	69
N410-E315	7.5		
N405-E315	60.2		
N405-E310	7.4		
N410-E320	7.5	19.7	69
N410-E315	7.5		
N405-E320	3.7		
N405-E315	60.2		

*Background not subtracted.

As expected, the average concentrations for these four soil volumes all are substantially below the guideline value of 69 pCi/g total uranium plus background. Thus, all 200 m^3 soil volumes representing soils at the 0-2 meter depth within the U-Pond perimeter would be below the guideline value.

For the 0-3 meter depth, soil volumes for four 100 m^2 grids (i.e., a 300 m^3 soil volume) were evaluated for comparison to the guideline value of 38 pCi/g total uranium above

background. These four grids represent the bounding locations for determining the 300 m^3 average soil concentrations. The average soil concentrations for the 25 m^2 at 0-3 meters in depth (75 m^3) soil volumes evaluated along with the corresponding average concentrations for the 300 m^3 soil volumes referenced are tabulated in Table 8-4.

Table 8-4
Uranium Waste Pond #1
Average Soil Concentrations at 0-3 m (pCi/g Total U)

25 m^2 Grids Evaluated	25 m^2 @ 0-3m 75 m^3 Grid Averages*	100 m^2 @ 0-3 m 300 m^3Grid Averages*	Guideline Value
N410-E290	25.9		
N410-E295	32.2		
N405-E295	7.7		
N405-E290	20.7	28.9	38
N415-E290	24.9		
N415-E295	8.3		
N410-E295	32.2		
N410-E290	25.9	30.4	38
N420-E285	31.1		
N420-E290	14.2		
N415-E290	24.9		
N415-E285	10.0	26.7	38
N430-E295	12.6		
N430-E300	32.2		
N425-E300	28.5		
N425-E295	24.5	24.5	38

*Background not subtracted.

For these four bounding locations, all 300 m^3 average soil concentrations are below the guideline value of 38 pCi/g total uranium above background. The highest average concentrations is 30.4 pCi/g (including background) which represents the average soil concentrations for the four 25 m^2 grids surrounding and including the N405-E290 grid. With background subtracted, this concentration becomes 26.4 pCi/g total uranium. Since

these four locations were considered bounding, there was no need to perform additional analyses.

Next, the final status survey results for the soils collected from the bottom of the holes were averaged as an indication of the total uranium concentration representative of the bottom soil layer investigated. A total of seventeen samples collected from the bottom of the excavations (areas remediated) and six samples from the deep soil coring (i.e., 10-12 feet) were averaged together. These twenty-three locations averaged 16.7 pCi/g total uranium; 12.7 pCi/g with background subtracted. This average is considered conservative because the bottom of hole samples were collected from remediated areas that represented locations where the highest residual activity was found.

The entire U-Pond soil volume was then averaged to determine the average concentration of total uranium within the perimeter of the former pond. The average concentration is 17.8 pCi/g total uranium (13.8 pCi/g with background subtracted); which is below the 30 pCi/g Option 1 guideline value for the entire subsurface soils volume investigated.

8.2.2 Evaluation of U-Pond #2 Survey Data

This section evaluates the data collected from the subsurface surveys performed for Subarea O from within the perimeter of the area occupied by former U-Pond #2. The survey data presented in this section were evaluated in a fashion identical to the U-Pond #1 data as discussed in Section 8.2.1. It should be noted that soils in the 0-4 foot depth discussed and evaluated in this section are at site background levels and were recently placed over the former U-Pond #2 area as the final cap. This cap placement was completed to meet Cimarron's prior commitment to the NRC to place a 4 foot cap over the area.

The final status survey data for soil samples collected within the perimeter of the U-Pond #2 area are presented in tabular form in Appendix IX. This data is presented in one foot increments. Additionally, this data is plotted on the location drawings, also included in

Appendix IX as Drawing Nos. 97POP2SS-0 through 97POP2SS-8. This set of soil data was utilized for calculating the subsurface soil averages for comparison to the guideline values presented in Table 7-1.

The first step in the evaluation was to review the final status survey data within the 0 to 1 meter soil depth for comparison to the 10 m^3 guideline value of 130 pCi/g total uranium. Since the 0 to 1 meter soils include the recently placed cap constructed from unaffected soils at background levels of residual activity, the average concentrations for any 10 m^3 soil volume is below the 130 pCi/g total uranium guideline value.

The next step in the evaluation was to determine the average total uranium activity for each 25 m^2 by 1 foot deep soil volumes (i.e., representing a soil volume of 7.5 m^3). The average concentrations for the 7.5 m^3 soil volumes are shown by location on Drawing Nos. 97P2AVG-0 through 97PSAVG-8 included in Appendix IX.

The next evaluation included averaging the 7.5 m^3 total uranium concentrations within each one foot layer of soil within the perimeter of U-Pond #2 for determining the one foot layer average. This evaluation was performed to determine overall trending by soil depth. These average concentrations are shown in Table 8-5. The uranium concentrations for soils at depths form 0-4 feet reflect background conditions for soils excavated from unaffected areas on-site and placed as a cap. Also, included in Table 8-5 is the average concentration for the bottom of hole (BH) soil samples collected after remediation was completed. The data in this table includes the contribution from natural background which has been determined to average 4 pCi/g.

Table 8-5 Uranium Waste Pond #2 Average Concentrations per 1 ft. Soil Layer	
Depth	**Total Uranium (pCi/g)**
0-1	7.0*
1-2	7.4*
2-3	6.5*
3-4	4.9*
4-5	11.4
5-6	32.7
6-7	26.6
7-8	15.4
8-9	13.1
BH	14.8

* Soils placed for cap, excavated from unaffected areas on-site.

The next step in the data evaluation was to average the soil concentration in each 25 m^2 by one foot in depth soil volumes (i.e., 7.5 m^3) in increments of 1 meter at the 0-1, 1-2, and 2-3 meter depths. The average total uranium concentration for these 25 m^3 soil volumes are shown in tabular form and on Drawing Nos. 97AVP2-0, 97AVP2-1 and 97AVP2-2; both data presentations are included in Appendix IX.

The average total uranium concentrations for soils within these 25 m^3 soil volumes at the 0-1 meter depth were 7.0 pCi/g. The 1-2 meter average soil concentrations for the 25 m^3 soil volumes vary from 4.3 pCi/g to 68.3 pCi/g, with a mean of 16.3 pCi/g. Finally, the 2-3 meter average soil concentrations for the 25 m^3 soil volumes vary from 4.0 pCi/g to 111.0 pCi/g, with a mean of 21.2 pCi/g total uranium. The average concentrations for the bottom of hole samples (BH) ranges from 3.0 pCi/g to 39.0 pCi/g with a mean of 14.8 pCi/g. The BH samples represent soil samples collected from the bottom of the excavation and not one meter composite samples. For this reason, these overall averages are considered biased high.

The next evaluation compared the soil concentrations within a soil volume representing each 25 m^2 by 0-2 meter (i.e., a soil volume of 50 m^3) and 0-3 meter (i.e., a soil volume of

75 m^3) in depth to the guideline values (See Table 7-1). The guideline values for any two sampling events representing a soil volume of 50 m^3 is 102 pCi/g. The range of average concentrations for the 50 m^3 soil volume range from 5.7 pCi/g to 37.7 pCi/g. The average concentrations are shown in tabular form and by location on Drawing No. 97AVP2-3; both are included in Appendix IX. All 50 m^3 soil volume concentrations are below the 102 pCi/g total uranium guideline value.

The guideline value for any three sampling events representing a soil volume of 75 m^3 (0-3 meters in depth) is 97 pCi/g total uranium. The average concentrations for the 0-3 meter samples for the 75 m^3 soil volumes range from 5.7 pCi/g to 43.3 pCi/g. All 75 m^3 soil volumes were below the guideline value. The average concentrations are shown in tabular form and by location on Drawing No. 97AVP2-4; both data presentations are included in Appendix IX.

The next evaluation compared the average soil concentration within soils representing volumes of 100, 200, and 300 m^3 to the applicable guideline value. The guideline values as presented in Table 7-1 and are restated below for U-Pond #2 in Table 8-6. Based upon a review of the 25, 50, and 75 m^3 averages, further evaluations were required for comparisons to the 100, 200, and 300 m^3 guideline values. If the 25 m^3 average soil activities were all below the guideline values in Table 8-6 then no further data manipulations were required and the volumetric averaging to meet the BTP Option 1 guideline is met.

Table 8-6
Uranium Waste Pond #2
Guideline Values for 100m^2 Grids
Total Uranium

Actual Depth	Equivalent Depth	Soil Volume	Average Concentration
0-3'	0-1m	100 m^3	94 pCi/g
0-6'	0-2m	200 m^3	69 pCi/g
0-9'	0-3m	300 m^3	43 pCi/g

As discussed in the prior paragraph, any 25 m^3 soil volume with an average concentration exceeding the above guideline values was further evaluated by averaging adjacent grids for comparison to the 100 m^3 guideline value shown in Table 8-6. For the 0-1 meter soil depth there were no 25 m^3 soil volumes with an average concentration close to the 94 pCi/g guideline. This layer of soil represents soil removed from an unaffected area on site and placed as a cap over the former U-Pond area. Thus, the average activity of 7.0 pCi/g total uranium represents background soils. For this reason, no further evaluations were required for the 0-1 meter soil depth.

For the 0-2 meter soil depth, the highest concentration was found in the grid located at N530-E525; it's average concentration was 37.7 pCi/g total uranium. This location was far below the guideline of 69 pCi/g, so no further evaluations were performed at this soil depth.

For the 0-3 meter soil depth, three elevated 75 m^3 grid locations were evaluated to verify that they would meet the guideline value of 43 pCi/g total uranium above background for a 300 m^3 soil volume. These three locations represent the bounding locations for determining the 300 m^3 average soil concentrations. The average concentrations for the 75 m^3 soil volumes and the 300 m^3 soil volumes referenced are tabulated in Table 8-8.

Table 8-8 Uranium Waste Pond #2 Average Soil Concentrations at 0-3m (pCi/g Total U)			
25 m^2 Grids Evaluated	**25 m^2 @ 0-3m 75 m^3 Grid Averages***	**100 m^2 @ 0-3m 300 m^3 Grid Averages***	**Guideline Value**
N565-E580	41.8		
N565-E585	15.8		
N560-E580	9.9		
N560-E585	43.3	27.7	43
N540-E580	17.5		
N540-E585	41.6		
N535-E580	37.0		
N535-E585	43.3	34.9	43
N540-E575	35.5		
N540-E580	17.5		
N535-E575	38.1		
N535-E580	37.0	32.1	43

*Background not subtracted.

For these three bounding locations, all 300 m^3 average soil concentrations are below the guideline value of 43 pCi/g total uranium above background. The highest average activity is 34.9 (including background) for the 100 m^2 grid located at N540/535-E580/585. With background subtracted, this value becomes 30.9 pCi/g total uranium. Since locations listed in Table 8-8 were considered bounding, there was no need to perform additional comparisons.

Finally, the entire U-Pond #2 soils volume was averaged to determine the average concentration of total uranium within the perimeter of the former pond. The average concentration is 14.6 pCi/g total uranium or 10.6 pCi/g with background subtracted; this average is below the 30 pCi/g Option 1 guideline value for the entire subsurface soil volume.

8.3 Soil Analysis for Tc-99

As discussed in Section 6.1, the occurrence of Tc-99 at the Cimarron site has been addressed with the NRC. The behavior of Tc-99 in soils is governed by its chemical form. The predominant form of Tc-99 in waste is the pertechnetate which is highly mobile in the environment. Several studies[38] have shown that the sorption of Tc-99 on soil is essentially zero. To verify that Tc-99 in soils occupied by the former waste ponds have been reduced through the movement of infiltrating moisture; soil analyses were performed on both U-Ponds. The Tc-99 analytical results are shown below in Table 8-9.

Table 8-9
Tc-99 Analytical Results (pCi/g)

U-Pond#	Total Uranium	Tc-99
1	59.1 ± 7.6	ND* ± 16.3
1	316.1 ± 57.2	ND ± 9.8
1	44.8 ± 5.9	0.8 ± 14.1
2	44.3 ± 7.9	ND ± 10.8
2	62.3 ± 11.9	ND ± 11.3
2	375.8 ± 75.9	25.2 ± 14.6

*Not Detected

These samples were collected from impacted areas within the former U-Pond areas and demonstrates that either the concentrations of Tc-99 were at levels below detection or at very low concentrations.

8.4 QA/QC Procedures

Cimarron Corporation SWP's/WP's form 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 and with another independent laboratory. These comparative analyses were part of the confirmatory analysis performed for Pit #3[33] of Burial Area #4 (Option #2 Disposal Cell). 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.

Additionally, in accordance with the Phase III Final Status Survey Plan, a minimum of two randomly selected soil samples from Subarea O were to be analyzed on site and then sent off-site to an independent laboratory for confirmatory analysis. Actually, numerous samples were collected from Subarea O for comparative analysis. The data comparison is shown in Table 8-10.

The total uranium analytical results show good agreement between the independent laboratory and the two on-site counters.

9.0 Summary

A Final Status Survey for Subarea O (Subsurface) was performed in accordance with the Phase III Final Status Survey Plan, and the NRC's guidance for volumetric averaging of subsurface residual activity. This NRC guidance is titled "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil". This Report presents the characterization data utilized for planning the decommissioning effort, and discusses the location and extent of the remediation performed.

The final status survey data is presented along with a comparison of these results to the calculated subsurface volumetric concentration guideline values. The comparison of these survey results presented herein demonstrates that all criteria (guideline values) have been met and/or exceeded and thus Subarea O (Subsurface) can be released for unrestricted use. This final status survey data verifies that subsurface residual activities within the perimeter of the former U-Ponds #1 and #2 are substantially below the BTP Option 1 criteria for unrestricted release (30 pCi/g above background). Also, the overall concentrations of total uranium shows a decreasing trend with depth. Finally, the total uranium remaining within the two former waste pond areas was estimated at approximately 0.17 curies for U-Pond #1 and 0.44 curies for U-Pond #2.

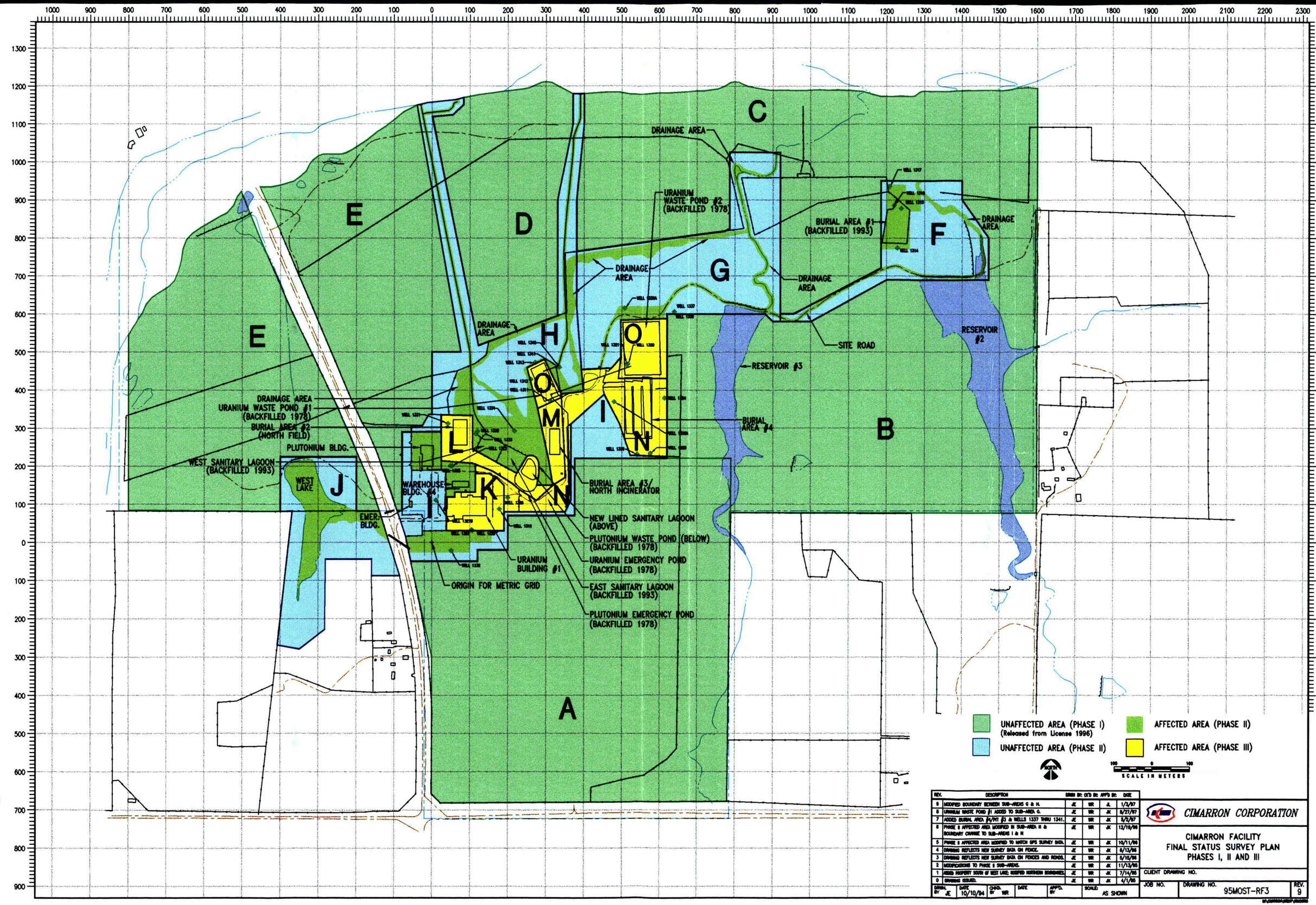
TABLE 8-10 QA/QC URANIUM ANALYTICAL SAMPLE RESULTS (pCi/g)				
		Core Lab*	Cimarron Soil Counter**	
No.	Sample	Total -U	#1-Total-U	#2-Total U
1	A0-1984	221.7 ± 38.5	217.8 ± 7	
2	A0-2195	1.4 ± 0.8	5.0 ± 5	
3	A0-2110	165.5 ± 28.7	157.1 ± 8	
4	A0-2093	75.3 ± 13.2	82.1 ± 6	
5	A0-2024	104.3 ± 18.5	106.6 ± 6	
6	A0-1999	215.6 ± 42.3	194.4 ± 7	
7	A0-570	44.3 ± 7.9	44.6 ± 4.6	
8	A0-658	62.3 ± 11.9	46.8 ± 5.1	
9	A0-824	375.8 ± 75.6	333.2 ± 11.5	
10	MWP-1-1301	59.1 ± 7.6	48.0 ± 4.9	
11	MWP-1-1451	316.1 ± 57.2	312.6 ± 9.5	
12	MWP-1-456	44.8 ± 5.9	46.4 ± 7.8	
13	MWP-1-1422	76.7 ± 19.2	79.7 ±5.3	81.2 ± 3.2
14	MWP-1-1917	102.0 ± 24.8	106.1 ± 6.0	112.0 ± 3.1
15	MWP-1-1923	129.1 ± 31.4	123.1 ± 9.9	128.8 ± 4.0
16	MWP-1-1472	144.5 ± 42.8	123.7 ± 6.0	131.9 ± 3.8
17	MWP-1-1906	180.8 ± 51.1	158.0 ± 6.5	165.9 ± 4.4
18	MWP-1-1401	189.9 ± 45.5	175.0 ± 6.0	179.3 ± 3.5
19	MWP-1-1580	166.7 ± 38.5	164.3 ± 6.2	181.5 ± 4.3
20	MWP-1-1182	216.2 ± 50.9	189.5 ± 7.1	201.1 ± 4.3
21	MWP-1-1907	202.0 ± 50.8	194.3 ±6.8	207.0 ± 4.4
22	A0-523	39.6 ± 10.6	46.0 ± 4.6	46.7 ± 3.2
23	A0-1060	81.2 ± 21.5	70.3 ± 5.7	69.5 ± 3.9
24	A0-1047	97.7 ± 24.3	88.2 ± 6.4	90.7 ± 4.3
25	A0-1430	100.1 ± 25.1	101.1 ± 6.0	101.4 ± 4.1
26	A0-1402	142.0 ± 37.4	130.4 ± 6.2	138.1 ± 3.7
27	A0-3299	162.5 ± 39.8	146.8 ± 10.6	159.4 ± 3.8
28	A0-1426	151.8 ± 34.3	152.8 ± 9.9	160.8 ± 3.8
29	A0-3237	139.2 ± 34.0	154.3 ± 8.1	159.2 ± 4.5
30	A0-3294	229.7 ± 62.0	185.8 ± 7.9	201.3 ± 4.9
31	A0-3173	281.8 ± 73.7	232.5 ± 9.9	250.6 ± 5.3

*Core Lab analysis were alpha pulse height, with U-235/234/238 summed.

**Cimarron gamma spec performed on 600 to 1100 g soil samples.

As stated earlier, the Subarea O Final Status Survey for the surface will be completed after area contouring and the data generated will be submitted as a separate report. Based upon the exposure data presented in the Characterization Report[5] for these areas, Cimarron expects that exposures at the surface and at one meter will be indistinguishable from background levels. Prior surveys performed during initial characterization efforts and before any subsurface remediation indicated exposure rates ranging from 6 to 9 μR/h, with an average of 7μR/h which is representative of background.

Characterization, remediation and final status surveys for this subarea resulted in the collection, analysis and evaluation of over 6,000 soil samples. This extensive effort and the voluminous data and analyses all clearly confirm that Subarea O (U-Ponds #1 and #2 Subsurface) are conservatively within the range of BTP Option 1 criteira. As was the case in 1978 when these ponds were previously released by the NRC, this data again confirms that these ponds areas can be released for unrestricted use.



REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
9	MODIFIED BOUNDARY BETWEEN SUB-AREAS G & H.	JE	WR	JK	1/3/97
8	URANIUM WASTE POND #1 ADDED TO SUB-AREA G.	JE	WR	JK	6/27/97
7	ADDED BURIAL AREA #4/WT #3 & WELLS 1337 THRU 1341.	JE	WR	JK	5/2/97
6	PHASE II AFFECTED AREA MODIFIED IN SUB-AREA H & 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

DRWN. BY	DATE	CHKD. BY	DATE	APP'D. BY	SCALE:
JE	10/10/94	WR			AS SHOWN

CIMARRON CORPORATION

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

CLIENT DRAWING NO.

JOB NO.	DRAWING NO.	REV.
	95MOST-RF3	9

DRAINAGE AREA

URANIUM WASTE POND #2 (BACKFILLED 1978)

BURIAL AREA #1 (BACKFILLED 1993)

SITE ROAD

RESERVOIR #3

BURIAL AREA #4

URANIUM WASTE POND #1 (BACKFILLED 1978)

BURIAL AREA #2 (NORTH FIELD)

PLUTONIUM BLDG.

WEST SANITARY LAGOON (BACKFILLED 1993)

WAREHOUSE BLDG. #4

EMER. BLDG.

BURIAL AREA #3/ NORTH INCINERATOR

NEW LINED SANITARY LAGOON (ABOVE)

PLUTONIUM WASTE POND (BELOW) (BACKFILLED 1978)

URANIUM EMERGENCY POND (BACKFILLED 1978)

URANIUM BUILDING #1

ORIGIN FOR METRIC GRID

EAST SANITARY LAGOON (BACKFILLED 1993)

PLUTONIUM EMERGENCY POND (BACKFILLED 1978)

NORTH

SCALE IN METERS

REV.	DESCRIPTION	DRAWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/17/98

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

CIMARRON CORPORATION

CIMARRON FACILITY
CIMARRON SITE PLAN

CLIENT DRAWING NO.

JOB NO. | DRAWING NO. 95SITE | REV. 0

CONCENTRATION AVERAGING METHOD FOR URANIUM IN SOILS

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

License Number: SNM-928
Docket No. 70-0925

Prepared for:

Cimarron Corporation
Oklahoma City, Oklahoma

March, 1998

REFERENCES

1. 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.

2. 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 February 25, 1997.

3. USNRC, "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil", Prepared by NRC Staff in Connection with the Review of the AAR "Site Remediation Plan for the Former Brooks and Perkins, Inc. Site".

4. C. Yu, et. al., "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0" (Working Draft for Comment), Argonne National Laboratory, ANL/EAD/LD-2, September, 1993.

5. 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.

6. USNRC, "Environmental Assessment of a Proposed Disposal of Uranium-Contaminated Soil at the Cimarron Uranium Plant", March, 1994.

7. USNRC, "Scenarios for Assessing Potential Doses Associated with Residual Radioactivity", Policy and Guidance Directive PG-8-08.

CONCENTRATION AVERAGING METHOD FOR URANIUM IN SOILS CIMARRON FACILITY

1.0 Introduction

This paper presents the volumetric averaging technique that was used to determine concentrations of enriched uranium that meet the NRC Branch Technical Position[1] (BTP) Option #1 guideline criteria for enriched uranium in soils. The averaging technique presented in this paper was selected based upon numerous discussions and suggestions from NRC staff. The methods have previously been suggested by the NRC for use by other licensees for the release of soils containing Thorium. The methods were transmitted to Cimarron Corporation via letter from Mr. Kenneth L. Kalman to Mr. Jess Larsen dated February 25, 1997[2] (Attachment #1). The volumetric averaging technique used by Cimarron uses the same methodology as that described in the NRC's "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil"[3] (Attachment #1), except that Cimarron has derived values for the isotopic uranium mixture found in soils at it's site.

The guideline values for soils that are applied to the methods described in this paper are from the criteria for release of contaminated soils as described in the NRC's "Branch Technical Position for Disposal or On-site Storage of Thorium or Uranium from Past Operations"[1]. The guideline values proposed by this paper were derived from dose calculations obtained through the use of the RESRAD[4] computer code. These dose calculations were then compared to dose calculations for soils with concentrations equal to the BTP Option #1 guideline value. Since the total dose is dependent, in part, on both the concentration and the volume of soil, the guideline value should be higher for smaller quantities of contaminated materials that are excavated and brought to the surface.

The soil concentrations calculated in this paper utilize these techniques, and result in guideline values for total uranium in small volumes of soil which are higher than described in the BTP, but which will result in approximately the same dose when using the RESRAD computer code.

2.0 Discussion

Draft NUREG/CR-5849, "Manual for a Conducting Radiological Surveys in Support of License Termination"[5], assumes that soil samples are collected from the ground surface. In the case of Waste Ponds #1 and #2, most of the residual activity is contained in subsurface soils ranging up to several meters in depth. As stated in Reference #3, "...the NUREG/CR-5849 averaging method, may not be appropriate if significant subsurface contamination is present." The reason for this statement is that conventional pathway analysis concludes that the dose from subsurface contamination is insignificant, except for the groundwater pathway.

The evaluations performed in this paper assume that the contaminated materials in the waste ponds are disturbed and brought to the ground surface, where it can result in a more significant

dose pathway. The evaluation assesses two scenarios for bringing the material to the surface. The first scenario assumes the construction of a slab-on-grade house. The second scenario assumes construction of a house with a basement. The soil volumes that are assumed to be excavated and the potential dose pathways are addressed in detail in Reference #3 (Attachment #1).

After the impacted soil is brought to the surface, the surface exposure pathways, and surface averaging methods apply. Reference #3 provides for modifications to the surface averaging procedure in draft NUREG/CR-5849. Reference #3 states that the $(100/A)^{1/2}$ criteria for evaluation of elevated areas is based upon the most restrictive radionuclides which were evaluated. Therefore, specific evaluation for the radionuclide of interest is likely to result in allowable concentrations that are higher than those allowed by the $(100/A)^{1/2}$ formula. Reference #3 states that RESRAD is appropriate for these evaluations, and will provide averaging criteria that are less restrictive and more realistic.

The evaluations performed for the Waste Ponds utilize the same assumptions as were used for the Thorium evaluation performed in Reference #3, except that the Waste Pond evaluation utilizes the radionuclide activity ratios for enriched uranium that are present at Cimarron. These isotopic ratios are the same ratios that were accepted by the NRC and used in the "Environmental Assessment of a Proposed Disposal of Uranium-Contaminated Soil at the Cimarron Uranium Plant"[6]. The parameters which were input into the RESRAD computer code for dose pathway modeling follow the guidance presented in NRC Policy and Guidance Directive PG-8-08, "Scenarios for Assessing Potential Doses Associated with Residual Radioactivity"[7].

The approach used for the dose modeling was identical to that which is described in the attached Reference #3. A baseline scenario consisting of one foot of impacted soil covering an area of 10,000 m^2 was evaluated. The concentration of U-234, U-235, and U-238 was assumed as 23.7 pCi/g, 0.5 pCi/g, and 6 pCi/g, respectively. The maximum hypothetical annual dose to a resident was calculated by the RESRAD code as 12.6 millirem. A RESRAD printout for the baseline scenario, showing all parameters and output from the computer code, is presented in Attachment #2.

Next, identical calculations were performed for selected excavated volumes of contaminated soils. The scenarios assume that the excavated soil is spread out in a uniform thickness of one foot (0.3048 meter). Thus, a 1m x 10m x 3 foot excavation would cover a surface area of 30 square meters with a one foot layer of contaminated soil. The scenarios identified for evaluation are based upon those required to construct the slab-on-grade and basement houses, as described previously. In addition, "vertical average" evaluations were performed to obtain concentration averaging guidelines for samples located in the same vertical borehole. The RESRAD printouts for the eight scenarios are provided in Attachment #3. Scenarios #3 and #4 had different options for the depth selected due to differences in the sampling data that were available for Waste Pond #1 versus Waste Pond #2 (i.e., 10 feet for Waste Pond #1 versus 9 feet for Waste Pond #2).

The concentration averaging guideline varied from 30 pCi/g for the baseline scenario to 242 pCi/g for the single sample (1m x 1m x 3') scenario. Table 2.1 summarizes the data from the

RESRAD calculations and presents the applicable scenario information. As an example, Scenario #2 had a calculated maximum annual dose of 2.895 millirem. The "ratio" is determined by dividing 12.6 (the baseline scenario maximum annual dose) into 2.895, which is equal to 0.23. The calculated maximum concentration is then obtained by dividing the ratio (0.23) into the baseline scenario guideline value (30 pCi/g), which results in the calculated maximum concentration of 131 pCi/g.

The maximum soil concentrations (i.e., guideline values) presented in this paper are from the final calculations performed using RESRAD for Windows Version 7.0. The guideline values in this paper may differ from those presented in the Final Status Survey Report for Subarea "O" (Sub-surface) by one pCi/g due to the version of code utilized for earlier calculations (Version 5.621) as well as rounding performed on the final results. For the three scenarios where there is a difference (Scenarios #1, 4a, and 4b), the final calculated guideline values are one pCi/g higher than those presented in the FSSR for Subarea "O" (which are 130 pCi/g, 43 pCi/g, and 38 pCi/g). Therefore, the guideline values utilized in the FSSR for Subarea "O" reflect more conservative values than those that were calculated and presented in this paper.

3.0 Conclusion

Cimarron Corporation has two Waste Ponds with soils containing residual enriched uranium. The NRC's "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil" was utilized to calculate allowable guideline values for soils to be left in place. The method used satisfies the intent of draft NUREG/CR-5849 through the application of radionuclide specific dose calculations. In addition, the NRC "Branch Technical Position for Disposal or On-site Storage of Thorium or Uranium from Past Operations" Option #1 criteria for enriched uranium contaminated soils was incorporated into the baseline scenario to ensure that the dose from the soils to be left in place would not exceed that which was evaluated for the BTP scenarios. The calculated maximum concentrations ranged from 30 pCi/g to 242 pCi/g total uranium and varied depending on the quantity excavated.

TABLE 2.1

Hot Spot Calculations for Uranium at Cimarron Corporation

based upon the NRC's "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Surface Soil"

Scenario #, volume (cubic meters), grid	Area (square meters)	Depth (m)	Resrad Calculated Max. Dose (mrem)	Ratio	Calculated Maximum Concentration (pCi/g)
Baseline, 3048 (100mx100mx1')	10000	0.3048	12.600	1.000	30
#1, 9.144 (1mx10mx3')	30	0.3048	2.895	0.230	131
#2, 91.44 (10mx10mx3')	300	0.3048	4.033	0.320	94
#3a, 68.58 (5mx5mx9')	225	0.3048	3.893	0.309	97
#3b, 76.2 (5mx5mx10')	250	0.3048	3.943	0.313	96
#4a, 274.3 (10mx10mx9')	900	0.3048	8.687	0.689	44
#4b, 304.8 (10mx10mx10')	1000	0.3048	9.815	0.779	39
#5, 0.9144 (1mx1mx3')	3	0.3048	1.561	0.124	242
#6, 182.9 (10mx10mx6')	600	0.3048	5.497	0.436	69
#7, 365.8 (10mx10mx12')	1200	0.3048	11.780	0.935	32
#8, 45.72 (5mx5mx6')	150	0.3048	3.702	0.294	102

AVERAGING CRITERIA FOR TOTAL U
(U-234+U-235+U-238)

0-3 foot depth	maximum individual sample	242
	9.144m3 average	131
	91.44m3 average	94
3-6 foot depth	max. indiv. sample	242
	182.9m3 average	69
6-9 foot depth	max. indiv. sample	242
	274.3m3 average	44
6-10 foot depth	max. indiv. sample	242
	304.8m3 average	39
9-12 foot depth	maximum individual sample	242
	91.44m3 average	94
	365.8m3 average	32
10-12 foot depth	maximum individual sample	242
	91.44m3 average	94
	365.8m3 average	32
>10 foot depth	maximum individual sample	242
	volume from surface to depth "x"	30

The average of the 2 samples from 0-6 feet in the same borehole (45.7m3) <	102
The average of the 3 samples from 0-9 feet in the same borehole (68.6m3) <	97
The average of the 3 samples from 0-10 feet in the same borehole (76.2m3) <	96

Note: Assumed uranium activity ratio is based upon the on-site disposal, i.e., for 30 pCi/g, U-234=23.7 pCi/g, U-235=0.5 pCi/g, U-238=6 pCi/g

Appendix I

of

APPENDIX II

7-1-37-1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 25, 1997

Mr. Jess Larsen, Vice President
Cimarron Corporation
P.O. Box 25861
Oklahoma City, OK 73125

Dear Mr. Larsen:

Enclosed, for your information, is a copy of a letter to AAR Corporation with an attached "Method for Surveying and Averaging Concentrations of Thorium in Contaminated Subsurface Soil." Although the methodology was written for thorium it can be applied to uranium as well. If so desired, I can arrange a telephone conference with cognizant NRC staff to discuss this document with you. Please contact me at (301) 415-6664, if you have any questions about this methodology or would like to schedule a telephone conference.

Sincerely,

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

Docket No. 70-925
License No. SNM-928

Enclosure: As stated

cc: Cimarron distribution list

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 13, 1997

Mr. Howard A. Pulsifer
Vice President, General Counsel & Secretary
AAR Corporation
1111 Nicholas Boulevard
Elk Grove Village, Illinois 60007

SUBJECT: NRC REVIEW OF THE AAR *Site Remediation Plan for the Former Brooks and Perkins, Inc. Site*, DATED APRIL 8, 1996

Dear Mr. Pulsifer:

On April 8, 1996, AAR Manufacturing Group, Inc. submitted the "Site Remediation Plan for the Former Brooks and Perkins, Inc. Site" to the Nuclear Regulatory Commission for review and approval. NRC conducted an administrative review of AAR's proposed plan, and determined that the Remediation Plan was sufficient to warrant a technical review. Based on our technical review, the NRC staff concludes that AAR's proposed remediation approach for outdoor areas is unacceptable as presented.

AAR's proposed approach consists of off-site disposal of surface soils and subsurface soils containing concentrations of thorium resulting in exposure rates of ≥10 μR/hr above background measured 1 meter above ground surface. In addition, AAR performed a radiological dose assessment that generally follows the guidance presented in Policy and Guidance Directive PG-8-08 entitled, "Scenarios for Assessing Potential Doses Associated with Residual Radioactivity."

Although the staff recognizes that 10 μR/hr is consistent with the NRC's exposure rate limit for outdoor areas, and the dose assessment indicates public exposures of less than 11 mRem/yr for a resident scenario, we have two concerns with the analysis presented in the remediation plan. First, the remediation plan does not include a comparison of the thorium soil concentration values with the NRC's 10 pCi/g guideline value presented in "Branch Technical Position for Disposal or On-site Storage of Thorium or Uranium from Past Operations." Further, the plan does not include analyses to compare surface and subsurface soil activity with the averaging criteria presented in the NRC guidance document "Manual for Conducting Radiological Surveys in Support of License Termination," (NUREG/CR-5849). Second, the radiological assessment assumes that thorium contamination is evenly distributed throughout the site even though site characterization data indicates that the contamination is not uniform, and that some areas are elevated. Our concerns over AAR's lack of consideration of 1) the 10 pCi/g soil concentration guideline, and 2) the nonuniform elevated areas, both subsurface and surface, are the basis for our conclusion that the remediation plan is unacceptable as presented.

Enclosure

In previous guidance involving subsurface soil contamination exceeding the unrestricted use criteria (10 pCi/g for thorium), NRC approved the application of the averaging criteria in NUREG/CR-5849 for each 1-3 foot subsurface plane. While this approach is conservative and provides adequate public health protection, there are alternative ways to assess the potential dose associated with subsurface contamination. One such method acceptable to the NRC staff is discussed in the attached document, "Method for Surveying and Averaging Concentration of Thorium in Contaminated Subsurface Soil." This attachment describes a set of decommissioning performance objectives for subsurface soil that the NRC would find acceptable for use at AAR's Livonia site, as well as guidance on designing final surveys to demonstrate compliance with the performance objectives. However, in order to demonstrate compliance with the performance objectives, it appears that additional sampling will be required.

AAR has the option of proceeding in one of the following four ways: (1) revise the sampling and remediation plan consistent with meeting the performance objectives identified in the attachment; (2) revise the remediation plan based on an alternative analysis, performed by AAR, evaluating potential doses to individuals due to the presence of nonuniform subsurface and surface contamination; (3) use NUREG/CR-5849 averaging criteria for each 3 foot planar level; or (4) provide additional justification for assuming uniform distribution of thorium contamination at the site.

The concerns identified above need to be resolved before the staff can complete its comprehensive technical review of the remediation plan. If you would like to discuss the issues identified in this letter or approaches for resolving these issues, please contact me at 301-415-6607.

Sincerely,

John T. Buckley

John T. Buckley
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Docket No: 040-00235
License No: STB-0362

Attachment: As stated

cc: B. Koh & Associates

METHOD FOR SURVEYING AND AVERAGING CONCENTRATIONS OF THORIUM IN CONTAMINATED SUBSURFACE SOIL

Prepared by NRC Staff in Connection
With the Review of the AAR "Site
Remediation Plan for the Former Brooks
and Perkins, Inc. Site," Docket #040-00235
NRC Contact: David Fauver, 301-415-6625

I. INTRODUCTION

Current NRC guidance for conducting final surveys at decommissioning facilities is contained in Draft NUREG/CR-5849, "Manual for Conducting Surveys in Support of License Termination." NUREG/CR-5849 primarily addresses the final surveys of surface contamination on both buildings and open land areas, including guidance on acceptable averaging methods for surface contamination that exceeds the unrestricted use criteria (i.e., elevated areas). However, methods for surveying and averaging subsurface contamination are not discussed. This document provides a method for averaging elevated areas of subsurface soil contamination. Note that the potential for exposure from subsurface contamination via the groundwater pathway is not addressed in this document. The groundwater pathway should be evaluated on a case-by-case basis.

The averaging method in NUREG/CR-5849 assumes that soil samples are collected from the ground surface (first 15 cm). This sampling and averaging method is acceptable for the majority of decommissioning sites since the surface samples are considered sufficiently representative to assess the potential dose using conventional pathway analysis. However, conventional pathway analysis, and the NUREG/CR-5849 averaging method, may not be appropriate if significant subsurface contamination is present.

Conventional pathway analysis concludes that the dose from subsurface contamination is essentially zero, except from the groundwater pathway (see discussion below for other exceptions). This conclusion assumes that the contamination will remain at depth for very long periods of time (the typical pathway analysis is run for a 1000 year period). Since it is not reasonable to assume that the subsurface soil will remain undisturbed for a 1000 year period, simple scenarios were developed to predict how subsurface soil would be excavated in the future, the volume of the excavated soil, and the dose consequences of the contaminated soil in the post-excavation geometry. Based on the predicted excavation volumes and the dose consequences, surveying and averaging protocol were developed for in-situ subsurface soil.

Two excavation scenarios were evaluated. The first scenario assumes the construction of a slab-on-grade house; the second a house with a basement. For each of the construction scenarios, the volume of excavated soil and the extent of surface spreading, as well as the depth of surfaces on which the foundations could be built, were estimated. The potential dose from the subsurface soil, after excavation, was estimated by: 1) calculating the dose

from the contaminated soil spread on the ground surface and 2) calculating the dose from the in-situ contaminated surface that is exposed after excavation, assuming that the foundation of the house is built on the exposed surface.

It is recognized that subsurface contamination contained closer to the surface, say 0-1 meter, may deliver dose without being excavated. This exposure may occur from: 1) direct gamma radiation from in-situ soil closer to the surface, 2) the root uptake pathway down to about the first meter, and 3) the uncovering of contaminated surfaces through grading during construction, and surface erosion over time, which could then cause dose through surface exposure pathways. However, the average concentration allowed for the in-situ soil from 0-1 meter would be greater than that allowed under the excavation scenario due to the soil being spread over a larger area after excavation. Therefore, the excavation scenario is used to determine acceptable averaging limits for the 0-1 meter layer. This conservatism is appropriate because of the uncertainty as to potential exposure pathways for near surface contamination.

Finally, after the concentrations and averaging volumes were determined, a survey method was developed that would be acceptable to NRC for demonstrating that the averaging criteria are met. Section II describes the survey method. The technical basis for the averaging concentrations and survey method is presented in Section III.

II. SURVEY METHOD FOR SUBSURFACE THORIUM CONTAMINATION

The final survey method for subsurface contamination should ensure that the number and location of samples are sufficient to; 1) demonstrate, with reasonable confidence, that a significant volume of subsurface contamination is identified by one of the samples, and 2) demonstrate that the average contamination level in the identified volume would not result in a significant dose after excavation.

The survey method described below can be used to satisfy the above two objectives. The technical basis for this survey method is presented in Section III. The concentration values are based on the current unrestricted use limit of 10 pCi/g total thorium for widespread surface contamination. If the guideline value changes, the averaging criteria will change accordingly. Other survey methods may be acceptable if they are justified on a dose basis and provide sufficient confidence that significant volumes of soil are identified.

Survey Assumptions:

1. Samples are collected on a 5 meter square grid.

2. Samples are composited over each 1 meter layer of soil.

3. Each sample is assumed to represent 25 m^3.

4. 100 m^3 averages are represented by the average of four samples collected from each 1 meter layer of soil.

5. Volumetric averages greater than 100 m^3 are calculated assuming each sample represents 25 m^3.

Averaging Criteria for Total Thorium (Th-232 + Th-228):

0-1 meter depth	Maximum Individual Sample < 50 pCi/g 10 m^3 average < 20 pCi/g 100 m^3 average < 13 pCi/g
1-2 meter depth	Maximum < 50 pCi/g 200 m^3 (0-2 m depth) < 10 pCi/g
2-3 meter depth	Maximum < 50 pCi/g 300 m^3 (0-3 m depth) < 10 pCi/g
3-4 meter depth	Maximum < 50 pCi/g 100 m^3 < 13 pCi/g 400 m^3 (0-4 m depth) < 10 pCi/g
> 4 meter depth	maximum < 50 pCi/g volume from surface to depth "x" < 10 pCi/g
survey unit	The volumetric average over the entire survey unit < the unrestricted use limit (10 pCi/g for total thorium)

The averaging criteria apply to any contiguous volume defined by the given number of 5 m grid samples, where each sample represents 25 m^3. For averaging over a 100 m^3 volume, each combination of four samples in a given 1 m layer should be evaluated. This would only be necessary if an individual sample exceeds 10 pCi/g. To calculate the average for volumes greater than 100 m^3, consider the samples in a given 10 m X 10 m area projected to the depth of interest. For example, the 300 m^3 volume average is calculated by averaging 12 samples represented by the four samples in the 0-1 m layer of a given 10 X 10 m area (assuming 5 m grid), and the 4 samples each in the 1-2 m and 2-3 m layers directly below the given 10 X 10 area. The samples at the respective depths would likely be from the same borehole.

In addition to the above, a vertical averaging criteria is also defined. This averaging criteria is intended to identify significant volumes of contiguous contamination in the vertical, as opposed to the horizontal, direction. The sampling and averaging described below also assumes a 5 m grid size.

- The average of the two samples from 0-2 meters in same borehole (50 m^3) < 14 pCi/g total thorium

- The average of the three samples from 0-3 meters in same borehole (75 m^3) < 13 pCi/g total thorium

III. TECHNICAL BASIS FOR SUBSURFACE SURVEYING AND AVERAGING METHOD

Discussion

After the contaminated soil is excavated and brought to the surface, the surface exposure pathways, and the surface averaging methods apply. The surface averaging method used for excavated subsurface soil is consistent with that used in NUREG/CR-5849. However, the NUREG/CR-5849 procedure was modified to reduce the conservatism. A discussion of how the NUREG/CR-5849 averaging method for surface contamination was modified is presented in the following section. How the modified averaging method was applied to excavated subsurface soil is presented in subsequent sections.

The averaging method in NUREG/CR-5849 was based on a combination of past practice and dose assessments. The averaging method has three steps:

1) elevated areas should be less than 3 times the release criteria,

2) the concentration in the elevated area should not be greater than $(100/A)^{1/2}$ times the release criteria, where "A" is the size of the elevated area in m^2, and

3) the average over any 100 m^2 area should be less than the release criteria.

The maximum criterion of 3 times the average limit in NUREG/CR-5849 (step #1 above) was based on a qualitative ALARA judgement and a comparison with the maximum criteria in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," which also uses 3 times the average value as the maximum. Since radionuclide specific evaluations will be performed (as described below), the 3 times maximum criterion was not used in the volumetric averaging method for subsurface contamination. The maximum criterion was determined by estimating the minimum volume of soil that could be excavated without mixing with surrounding soil and assessing the relative dose from this volume of soil compared to uniform, widespread contamination.

The area averaging criterion in NUREG/CR-5849 (step #2 above) was based on a dose assessment made in 1985 for the Department of Energy using the DOE "Manual for Implementing Residual Radioactivity Guidelines." This manual was eventually updated and codified in 1989 as DOE's RESRAD pathway analysis/dose assessment code. The dose from elevated areas of various sizes was estimated using default input parameters for the code. The conclusion from these dose estimations was that the dose is reduced as the area of contamination is reduced, assuming the same concentration. The extent of the reduction in dose as a function of area depends on whether the predominant dose pathway is from direct exposure, or from one or more of the other pathways such as inhalation and ingestion. In general, there is a greater dose reduction for elevated

areas containing radionuclides that deliver a significant fraction of the dose through the inhalation and ingestion pathway than for radionuclides that deliver a higher fraction of dose via the direct exposure pathway. The formula in NUREG/CR-5849 (restated below) was derived from the 1985 DOE study of the dose consequences of elevated areas of various sizes.

$$\text{Allowable Concentration in Elevated Area} < C(100/A)^{1/2}$$

where: C = unrestricted use criteria
A = area of elevated area, m^2

The above formula represents the lower bound of acceptable concentrations in an elevated area of size "A" for all of the radionuclides evaluated. A similar dose assessment for a specific radionuclide will very likely result in an allowable concentration exceeding that calculated using the above formula. This is evidenced by Enclosure 1, which shows the nuclide specific dose consequences of elevated areas (represented by the multiple of the authorized limit on the Y axis) ranging in size from 1 m^2 to 100 m^2. Enclosure 1 also includes a line defined by the $(100/A)^{1/2}$ formula. Note that the $(100/A)^{1/2}$ line is below all of the nuclide specific curves, and represents the most conservative result.

Enclosure 1 was generated in 1985 and summarizes the results of the dose assessments used to select the $(100/A)^{1/2}$ formula for determining acceptable concentrations of contamination in elevated areas. To ensure that the current version of RESRAD is consistent with the 1985 dose assessments, a similar series of dose assessments were conducted using a recent version of RESRAD. As shown in Enclosure 2, the results are very similar. This demonstrates that RESRAD is appropriate, and will provide averaging criteria that is consistent with, albeit less conservative than, the $(100/A)^{1/2}$ criteria. Therefore, in order to provide more realistic criteria, the volumetric averaging method described below relies on radionuclide specific dose assessments, using the DOE RESRAD code, to determine the acceptable concentration in subsurface soil containing elevated contamination levels.

The third part of the averaging method in NUREG/CR-5849 (step #3 above) is that the average over any 100 m^2 should be less than the release criteria. The 100 m^2 average limitation was intended to address the potential for a 10 m x 10 m house being built on the 100 m^2 parcel of land. The 10 m x 10 m averaging criteria is essentially maintained in the subsurface volumetric averaging method.

The following sections describe the assumptions and calculations used to develop the volumetric averaging criteria for subsurface soil.

Excavation Assumptions

- Excavation scenarios for both a house w/basement and a house w/out basement
- House Size: 10 m x 10 m

- Dimensions of footers for house w/no basement:
  1 m deep x 1 m wide x 10 m long

- Basement Depth: 3 m

- Excavation Equipment Bucket Size: 1 m^3

- Five excavation scenarios evaluated:

  1) each of four 1 m deep x 1 m wide x 10 m long footer excavation for a house w/out basement is placed in separate pile

  2) the 1 m deep x 10 m wide x 10 m long portion of soil from the surface to a depth of 1 m is excavated for a house with no basement and placed in separate pile

  3) each 3 m deep x 2.5 m wide x 10 m long portion of soil for basement excavation placed in separate pile

  4) entire 3 m deep x 10 m wide x 10 m long excavation for house w/basement placed in one pile

  5) one bucket (1 m x 1 m x 1 m) of excavated soil placed in separate pile

- Each excavated pile uniformly blended

- Each pile spread over a 1 foot depth

Method for Calculating Acceptable Averaging Volumes and Concentrations for Subsurface Contamination

To determine the averaging volume for subsurface contamination, and the acceptable concentration as a function of volume, the first step was to calculate the volume of soil excavated in each of the above five scenarios. The dose from the excavated soil was then estimated and compared to the dose from widespread, uniform contamination.

To estimate the dose, the soil volumes defined by the five excavation scenarios were assumed to be brought to the surface and spread over a 1 foot depth. Using the resulting calculated surface area as input to the RESRAD code, the dose from the excavated soil was estimated using the resident farmer scenario and the input parameters from Policy and Guidance Directive PG-8-08 "Scenarios for Assessing Potential Doses Associated with Residual Radioactivity," May 1994. A second RESRAD run was then made, using the same concentration, and assuming the default area of 10,000 m^2. The ratio of the dose from the 10,000 m^2 area to the dose from the calculated area was then multiplied by the unrestricted use criteria to determine the acceptable concentration in the elevated area, and hence the corresponding subsurface volume. This concentration is considered acceptable since the dose from the elevated area containing this concentration will deliver the same dose as a large area contaminated at the unrestricted use level. To determine

compliance with the volumetric averaging criteria, the average concentration over the in-situ volume of soil defined in the scenario must be less than the above ratio times the guideline.

For example, the following calculation provides the averaging volume and concentration for excavation Scenario #1, assuming that the contamination is total thorium (Th-232 + Th-228):

1. Volume of 1 m deep x 1 m wide x 10 m long footer is 10 m^3.

2. Assuming the 10 m^3 volume is excavated and spread over a 1 foot depth, the area of contamination on the surface would be 30 m^2.

3. Run RESRAD to estimate dose assuming 10 pCi/g total thorium and assuming that the contaminated area is 30 m^2 (Enclosure 3).

4. Run RESRAD to estimate dose, also assuming 10 pCi/g total thorium, but using the RESRAD default area of 10,000 m^2 (Enclosure 4).

5. Calculate the ratio of the dose from Step 4 to the dose from Step 3. For total thorium, the ratio is 2.0.

6. Multiply the ratio, i.e., 2.0, by the unrestricted use limit for total thorium, i.e., 10 pCi/g. The resulting concentration is 20 pCi/g, which represents the acceptable average concentration in a 10 m^3 volume of soil.

Note that Scenario #1 applies only to volumes of soil starting on the surface and ending at the first meter since the excavation is assumed to be for a footer, and would not go below 1 m.

The same calculations were performed for the other four excavation scenarios. The resulting five volumetric averaging guidelines for subsurface thorium contamination are listed below. The criteria for other radionuclides should be developed on a case-by-case basis. The excavation scenarios described above for housing construction are assumed to result in conservative averaging criteria since excavations for larger structures should result in larger excavated volumes, and a greater degree of mixing with surrounding soil.

Volumetric Averaging Guidelines For Subsurface Thorium Contamination

The five excavation scenarios were evaluated to determine acceptable averaging volumes and concentrations for subsurface thorium contamination. Enclosure 5 contains the RESRAD output for each of the five evaluations.

1) The average concentration of total thorium in a 10 m^3 volume should be less than 20 pCi/g.

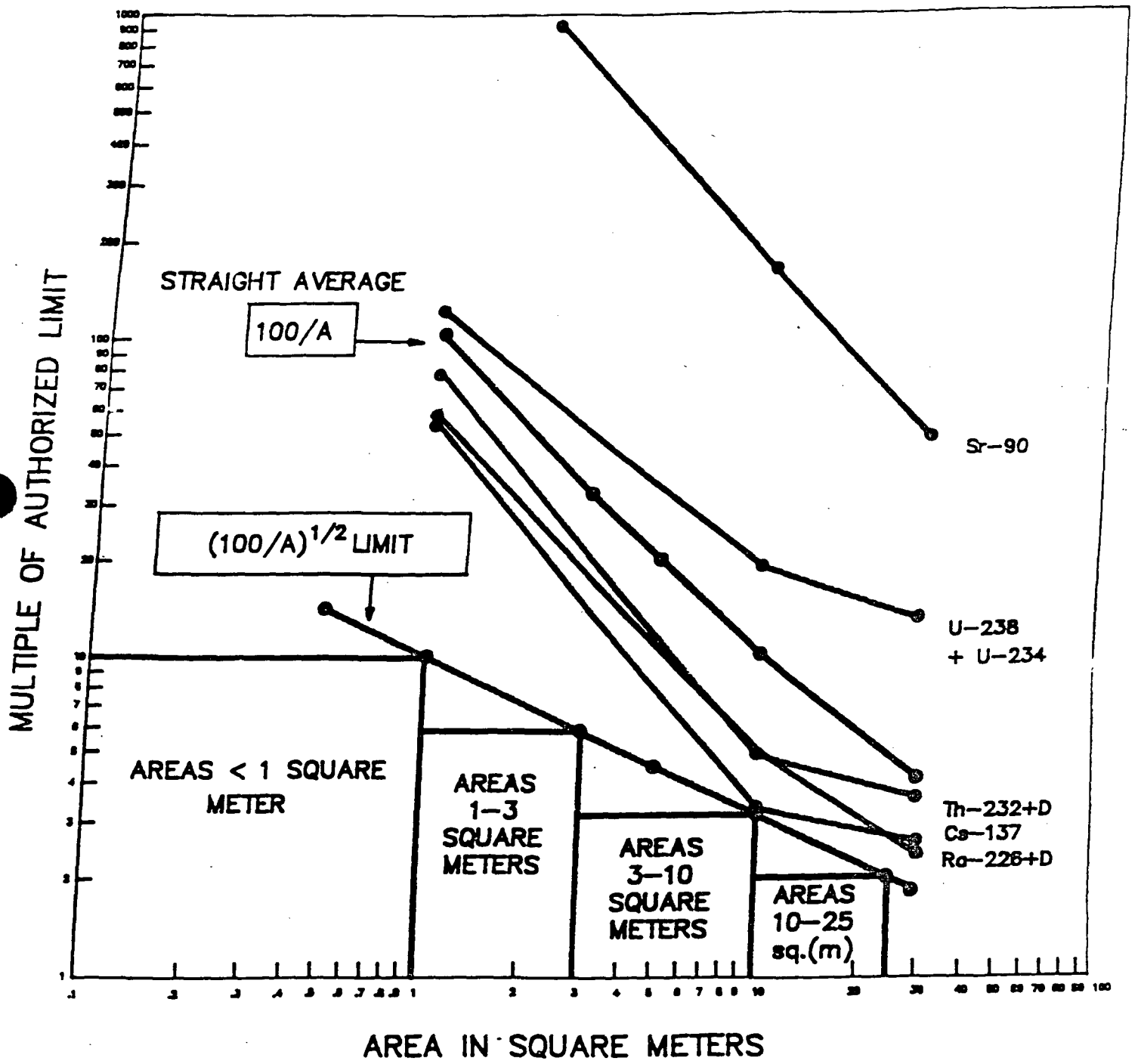
2) The average concentration of total thorium in a 100 m^3 volume of soil should be less than 13 pCi/g.

3) The average concentration of thorium in a 75 m^3 volume of soil should be less than 13 pCi/g.

4) The average concentration of thorium in a 300 m^3 volume of soil should be less than 10 pCi/g.

5) The average concentration of thorium in a 1 m^3 volume of soil should be less than 50 pCi/g. This concentration is considered the maximum value for an individual sample composited over a 1 meter depth.

The above averaging guidelines were developed assuming that the soil is excavated and placed on the ground surface. The final step is to ensure that the volumetric averaging does not result in a layer of exposed soil with excessive concentrations. The soil layers of concern are the layer from 0-1 m and 3-4 m, which are the layers upon which the foundations for the slab-on-grade house and a house with a basement, respectively, are assumed to be built. To control these scenarios, the average over the 100 m^3 defined for these layers will be limited to the 100 m^3 averaging criteria.

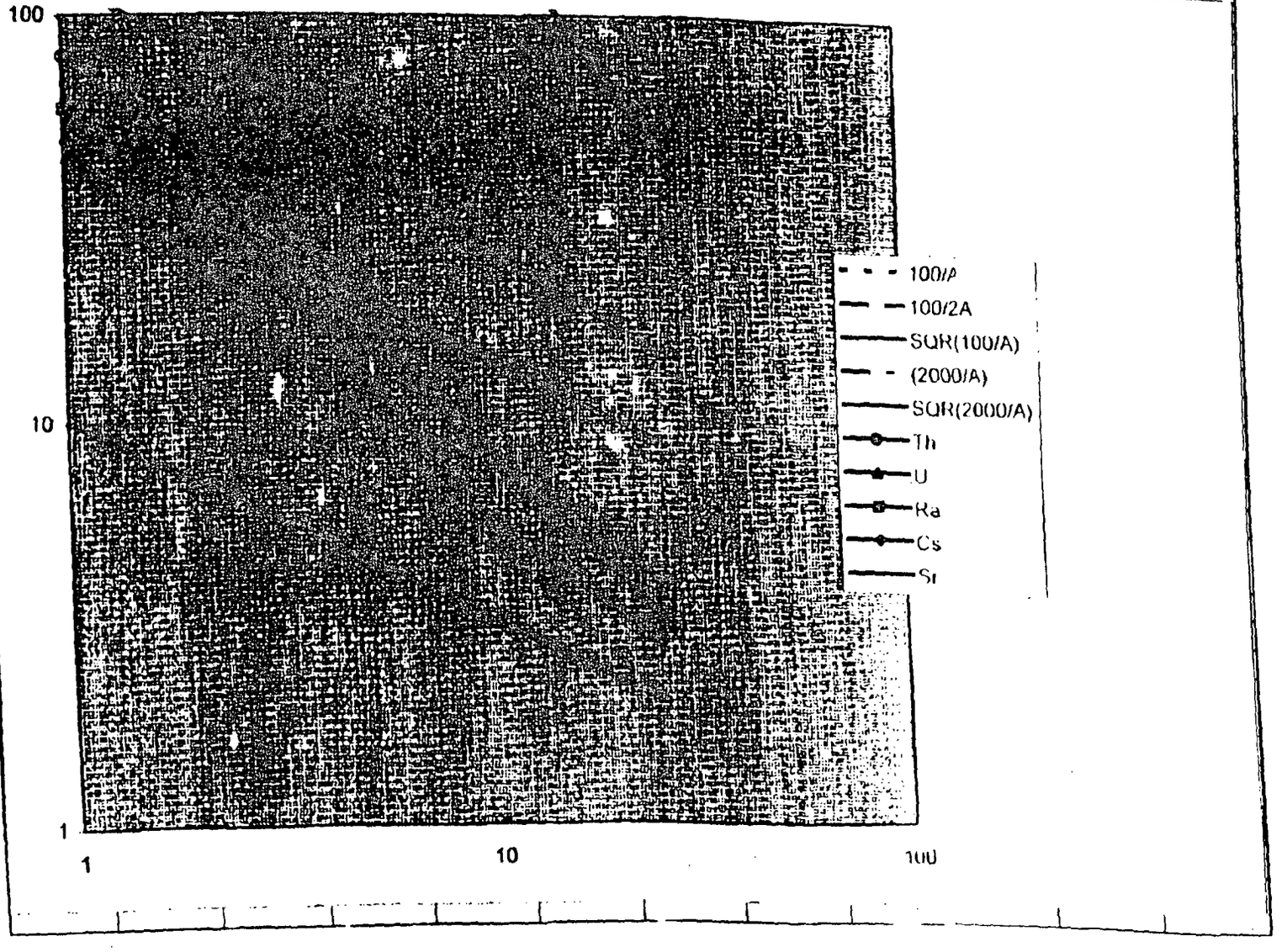


COMPARISION OF HOT SPOT LIMITS BASED ON $(100/A)^{1/2}$ AND mrem DOSE LIMIT

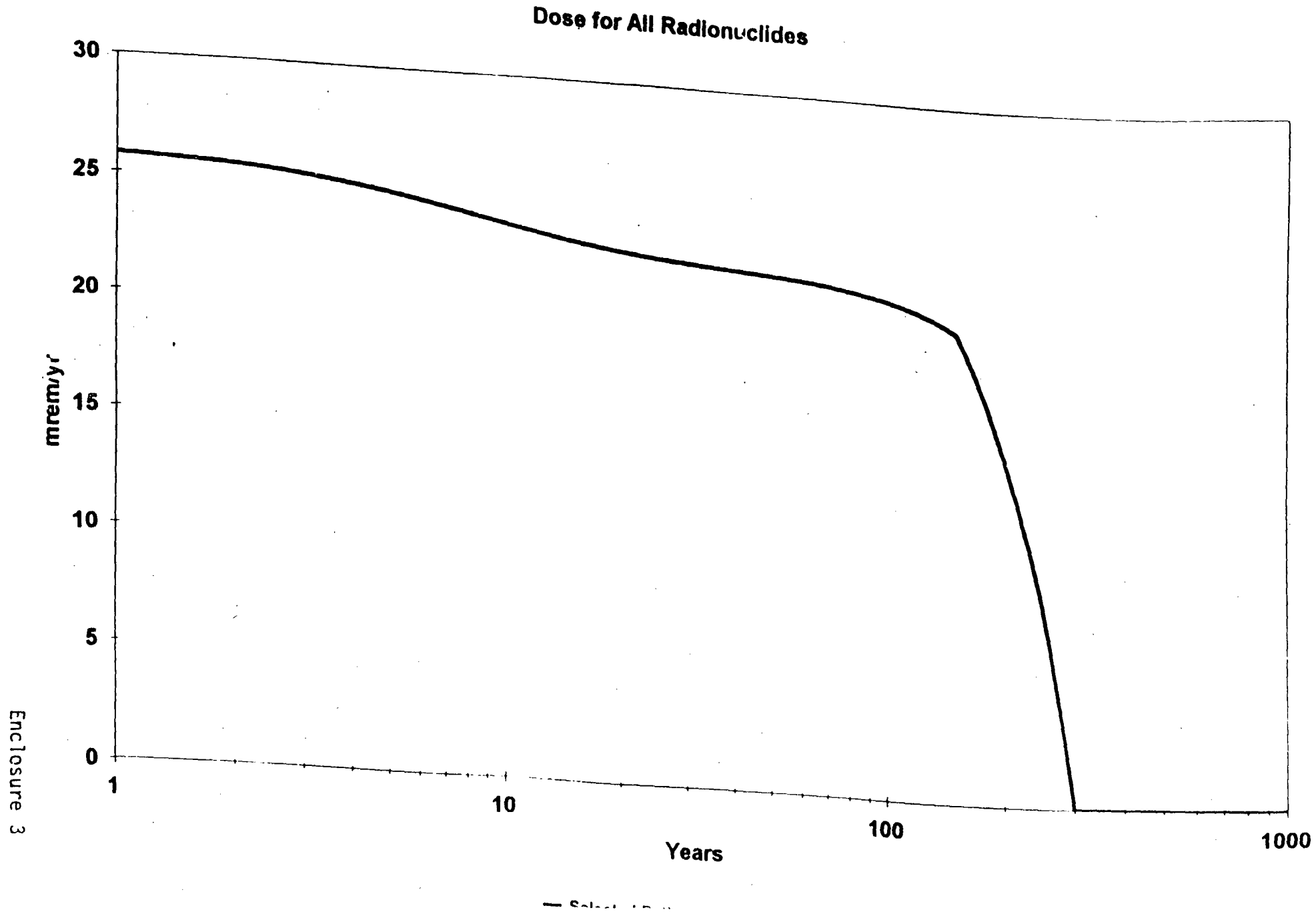
Enclosure 1

5849 info

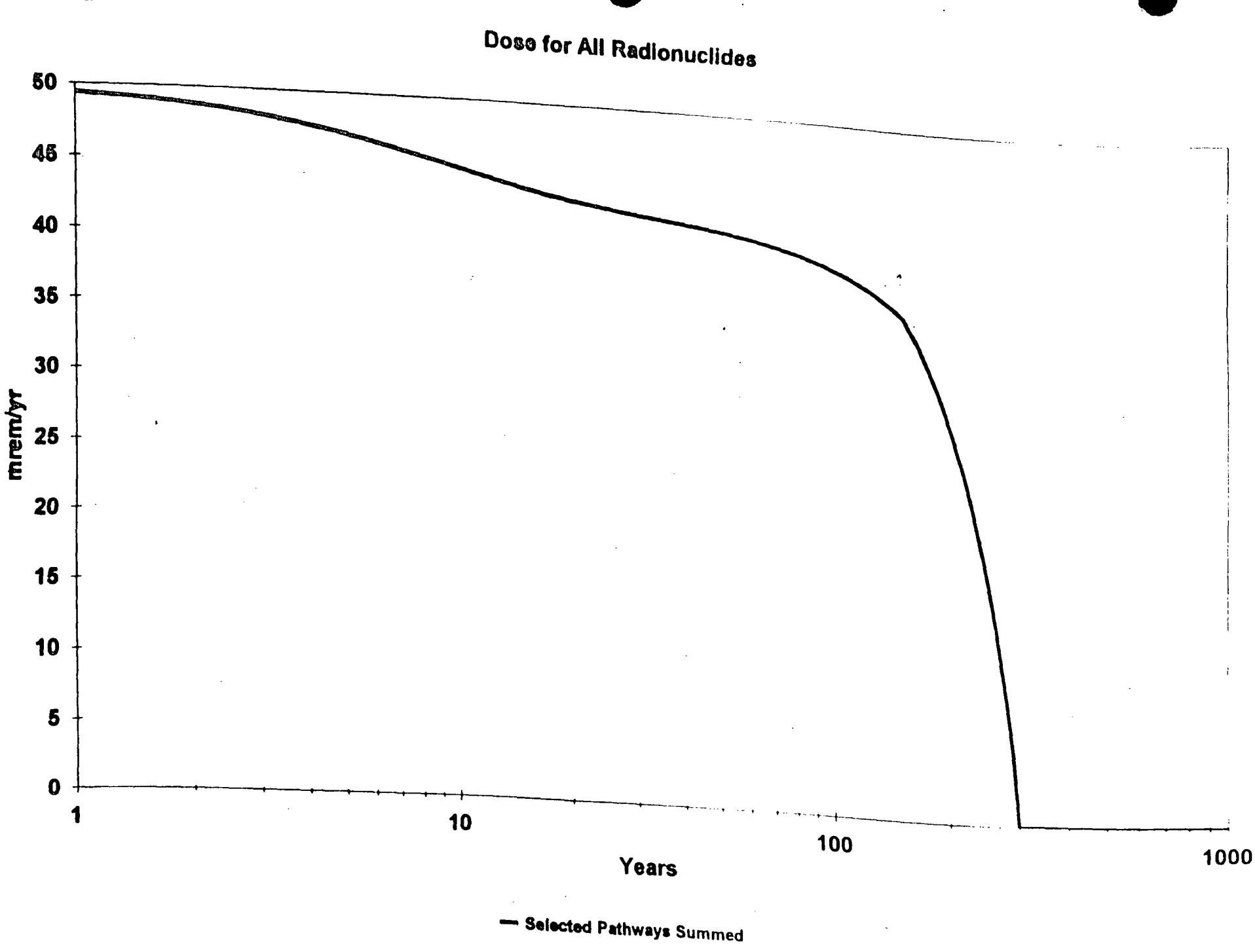
Area	100/A	100/2A	SQR(100/	(2000/A)	SQR(2000	Th	U	Ra	Cs	Sr	
1	100	50	10	2000	44.72136	80	120	60	60		
3	33.33333	16.66667	5.773503	666.6667	25.81989	34	68	28	24		
10	10	5	3.162278	200	14.14214	8	27	8	5.5	180	
25	4	2	2	80	8.944272	4	15	3.3	2.8	50	



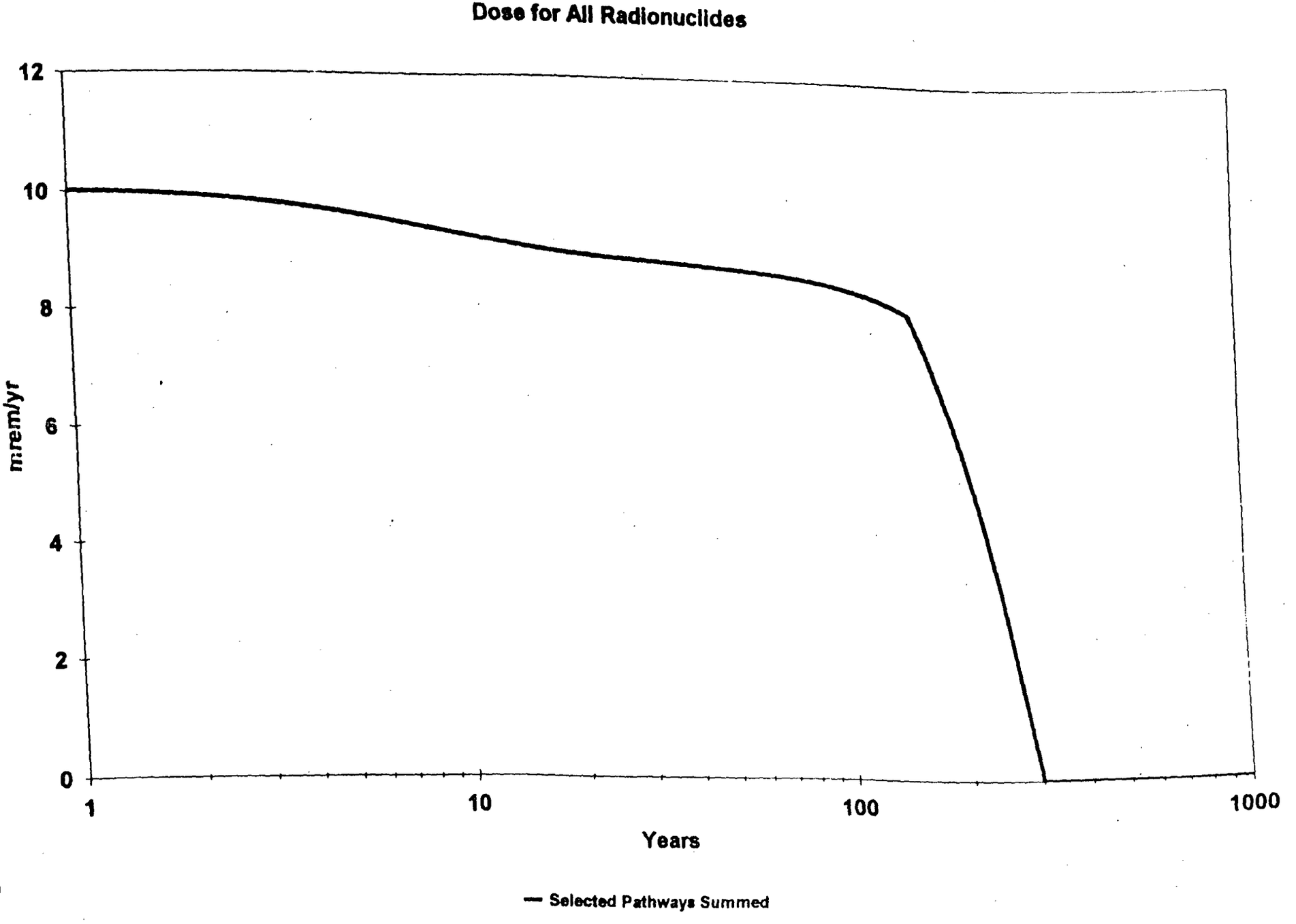
Enclosure 2


Dose for All Radionuclides
30
25
20
15
10
5
0
mrem/yr
1
10
100
1000
Years

Enclosure 3


Dose for All Radionuclides
50
45
40
35
30
25
20
15
10
5
0
mrem/yr
1
10
100
1000
Years
Selected Pathways Summed

Enclosure 4


Dose for All Radionuclides
12
10
8
6
4
2
0
m:rem/yr
1
10
100
1000
Years
— Selected Pathways Summed

Enclosure 5

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	3.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.008E+01	1.001E+01	9.828E+00	9.295E+00	8.872E+00	8.479E+00	3.692E-09	2.756E-10
M(t):	3.360E-01	3.336E-01	3.276E-01	3.098E-01	2.957E-01	2.826E-01	1.231E-10	9.187E-12

Maximum TDOSE(t): 1.008E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

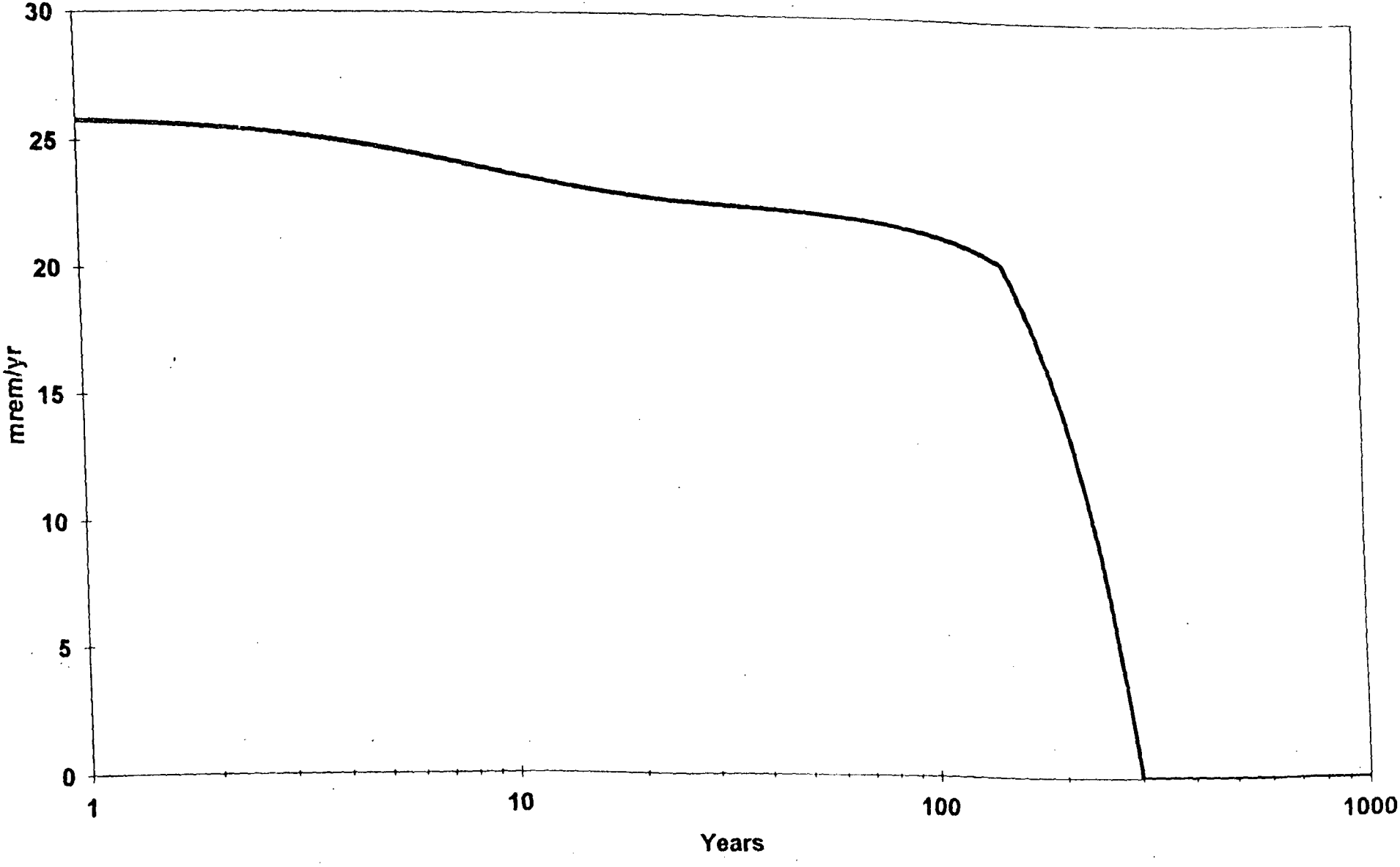
Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	2.405E+00	0.2386	9.480E-03	0.0009	0.000E+00	0.0000	2.538E-02	0.0025	9.422E-05	0.0000	1.321E-04	0.0000	2.996E-04	0.0000
Th-228	3.933E+00	0.3902	6.438E-01	0.0639	0.000E+00	0.0000	3.555E-04	0.0000	1.955E-06	0.0000	1.568E-07	0.0000	1.681E-04	0.0000
Th-232	2.657E-04	0.0000	3.060E+00	0.3036	0.000E+00	0.0000	1.217E-03	0.0001	6.751E-06	0.0000	5.312E-07	0.0000	5.680E-04	0.0001
Total	6.339E+00	0.6288	3.714E+00	0.3684	0.000E+00	0.0000	2.695E-02	0.0027	1.029E-04	0.0000	1.327E-04	0.0000	1.036E-03	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.441E+00	0.2421
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.578E+00	0.4541
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.062E+00	0.3038
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.008E+01	1.0000

*Sum of all water independent and dependent pathways.

Dose for All Radionuclides



Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	30.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.599E+01	2.578E+01	2.525E+01	2.371E+01	2.253E+01	2.154E+01	3.713E-08	2.771E-09
M(t):	8.663E-01	8.593E-01	8.417E-01	7.903E-01	7.510E-01	7.179E-01	1.238E-09	9.237E-11

Maximum TDOSE(t): 2.599E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

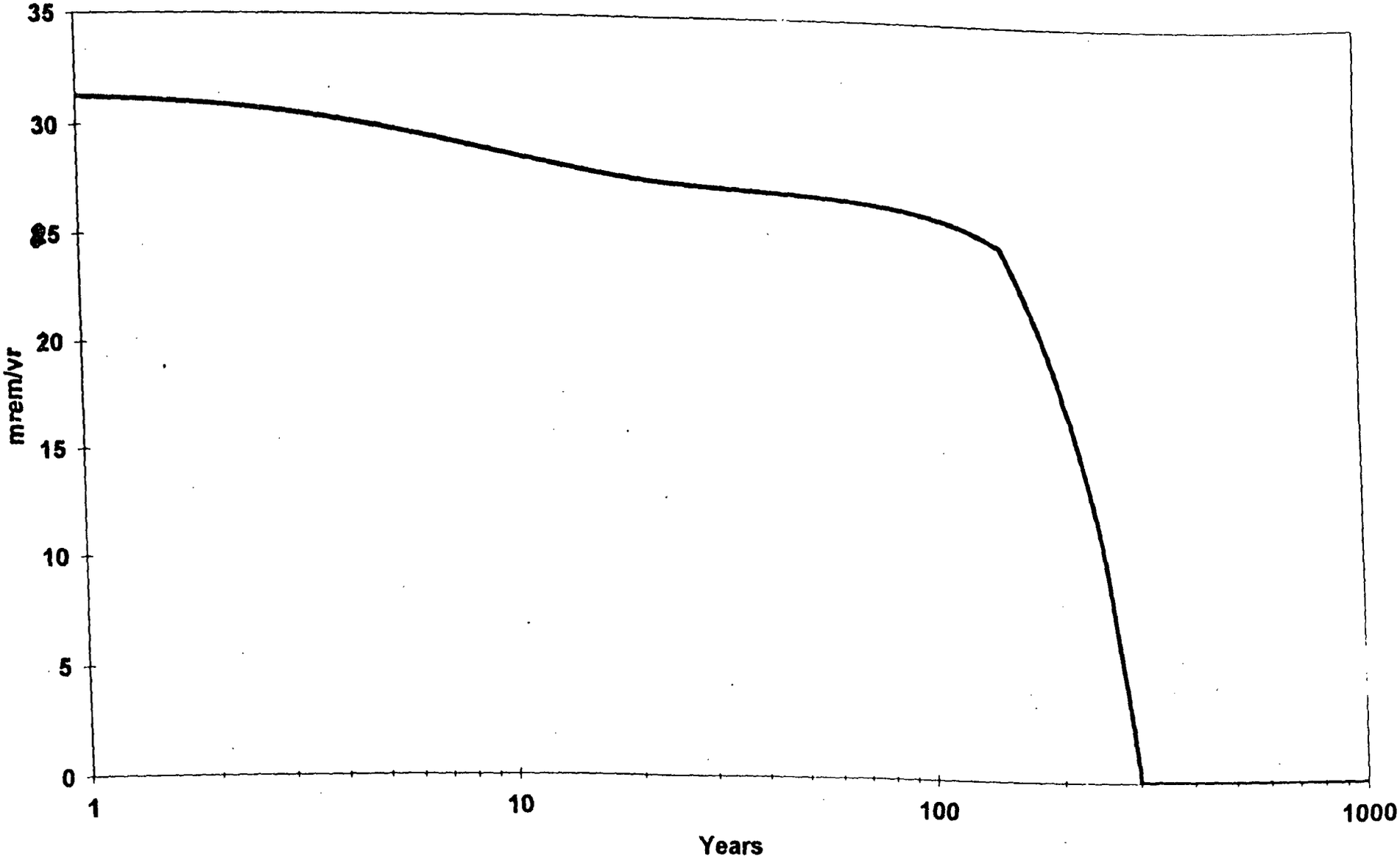
Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	7.218E+00	0.2777	1.673E-02	0.0006	0.000E+00	0.0000	2.539E-01	0.0098	9.426E-04	0.0000	1.321E-03	0.0001	2.996E-03	0.0001
Th-228	1.193E+01	0.4592	1.136E+00	0.0437	0.000E+00	0.0000	3.575E-03	0.0001	1.957E-05	0.0000	1.570E-06	0.0000	1.681E-03	0.0001
Th-232	7.110E-04	0.0000	5.402E+00	0.2079	0.000E+00	0.0000	1.224E-02	0.0005	6.758E-05	0.0000	5.317E-06	0.0000	5.680E-03	0.0002
Total	1.915E+01	0.7369	6.555E+00	0.2522	0.000E+00	0.0000	2.697E-01	0.0104	1.030E-03	0.0000	1.328E-03	0.0001	1.036E-02	0.0004

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.494E+00	0.2883
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.308E+01	0.5031
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.421E+00	0.2086
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.599E+01	1.0000

*Sum of all water independent and dependent pathways.

Dose for All Radionuclides



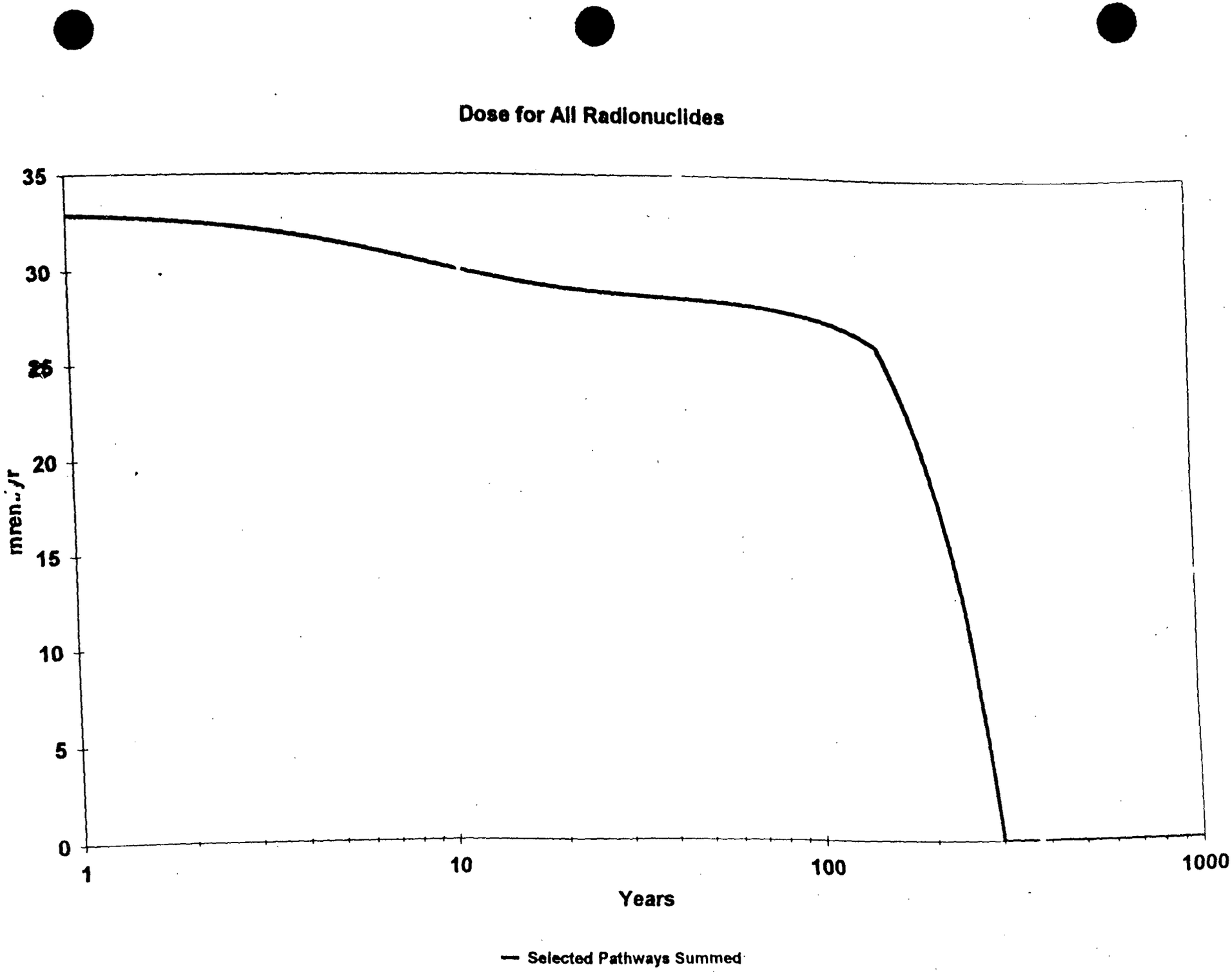
FAUVER RAD 01/14/97 Includes All Pathways

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	75.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.154E+01	3.128E+01	3.063E+01	2.875E+01	2.733E+01	2.619E+01	1.076E-06	8.034E-08
M(t):	1.051E+00	1.043E+00	1.021E+00	9.583E-01	9.109E-01	8.731E-01	3.588E-08	2.678E-09

Maximum TDOSE(t): 3.154E+01 mrem/yr at t = 0.000E+00 years

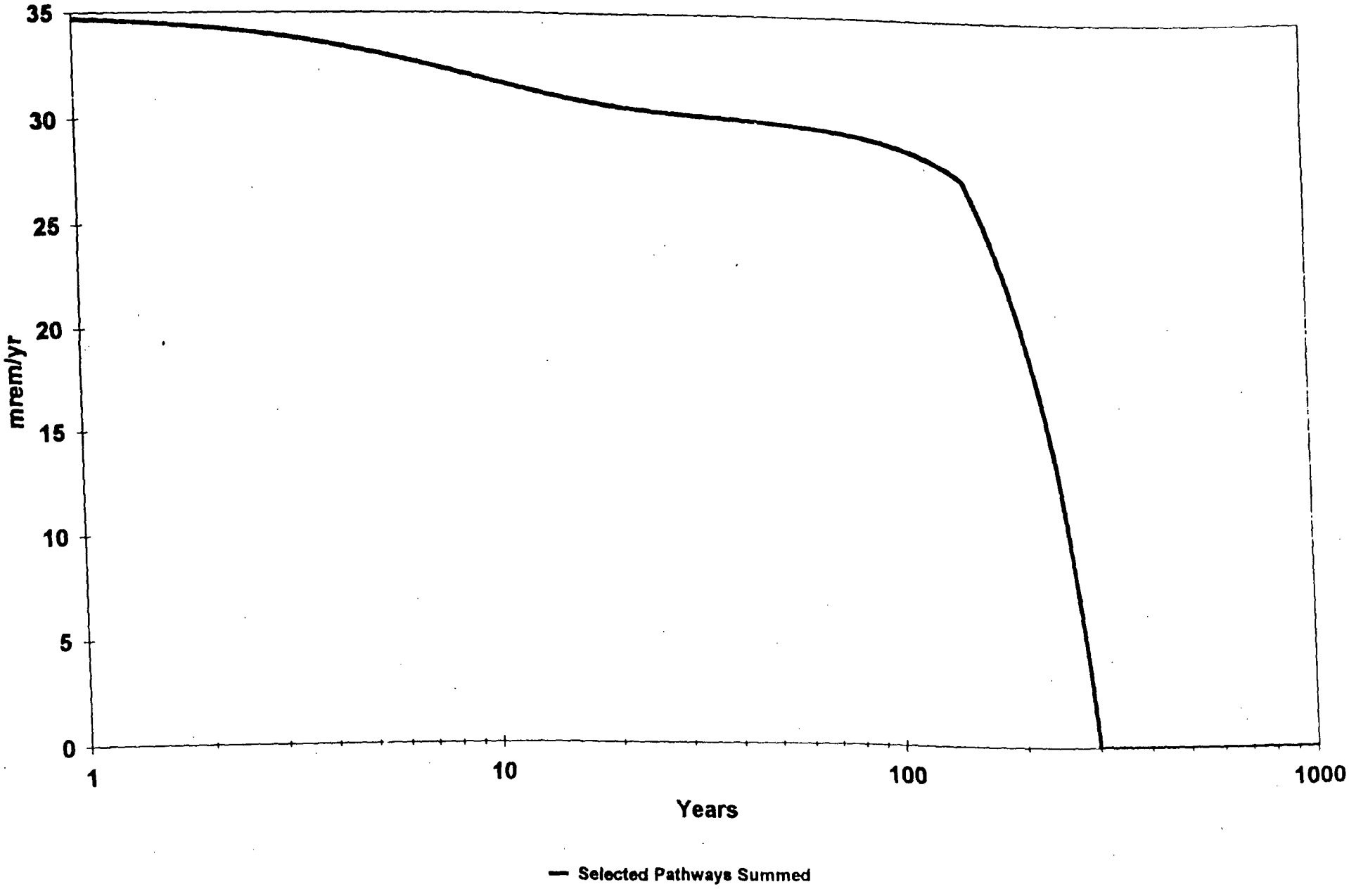

Dose for All Radionuclides
35
30
25
20
15
10
5
0
mrem/yr
1
10
100
1000
Years
Selected Pathways Summed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	100.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.319E+01	3.292E+01	3.223E+01	3.025E+01	2.875E+01	2.756E+01	1.255E-06	9.366E-08
M(t):	1.106E+00	1.097E+00	1.074E+00	1.008E+00	9.583E-01	9.188E-01	4.183E-08	3.122E-09

Maximum TDOSE(t): 3.319E+01 mrem/yr at t = 0.000E+00 years

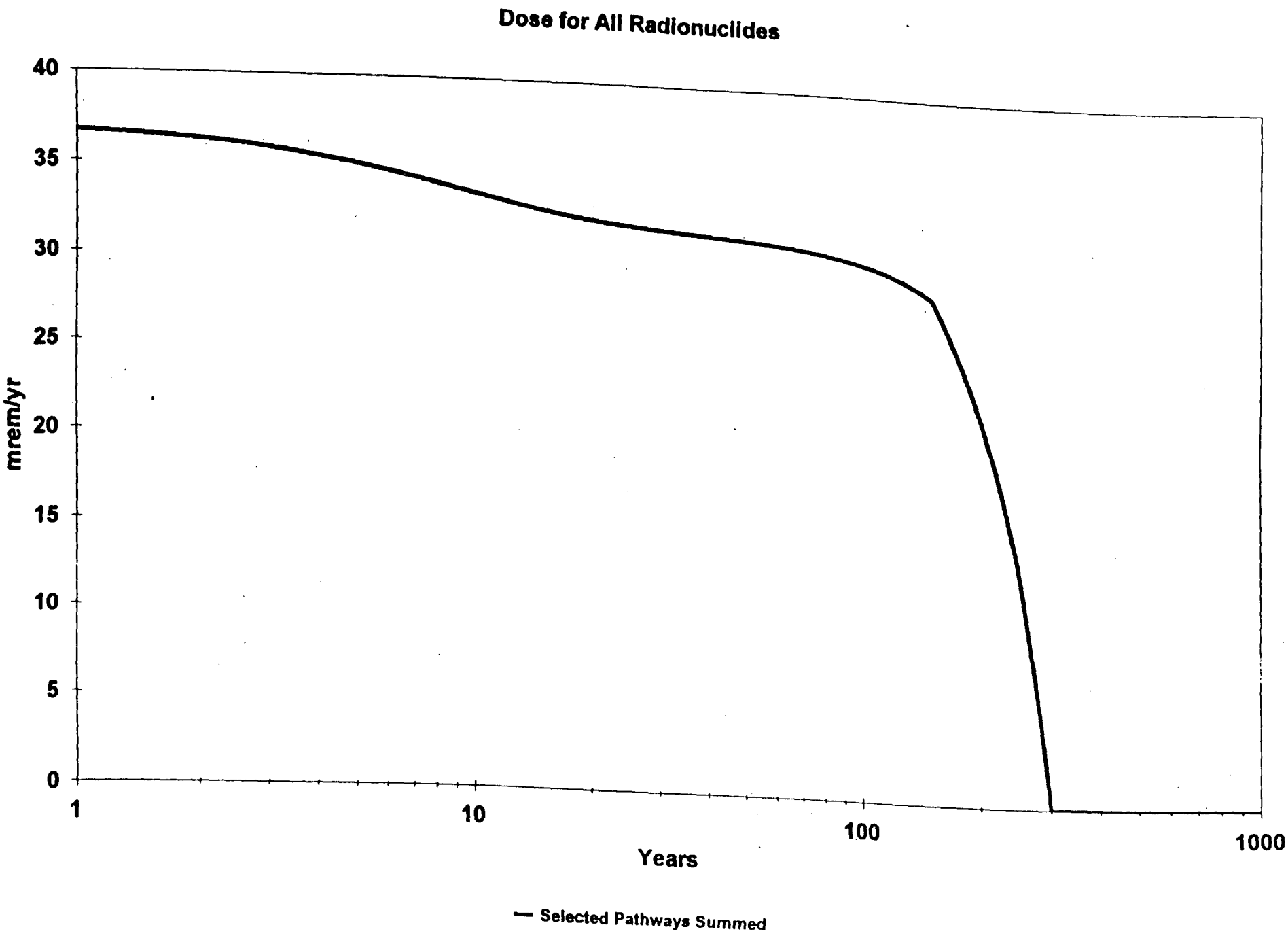

Dose for All Radionuclides
35
30
25
20
15
10
5
0
mrem/yr
1
10
100
1000
Years
Selected Pathways Summed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	150.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.499E+01	3.470E+01	3.397E+01	3.187E+01	3.029E+01	2.902E+01	1.558E-06	1.163E-07
M(t):	1.166E+00	1.157E+00	1.132E+00	1.062E+00	1.010E+00	9.672E-01	5.194E-08	3.877E-09

Maximum TDOSE(t): 3.499E+01 mrem/yr at t = 0.000E+00 years


Dose for All Radionuclides
40
35
30
25
20
15
10
5
0
mrem/yr
1
10
100
1000
Years
Selected Pathways Summed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	225.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.699E+01	3.668E+01	3.590E+01	3.368E+01	3.199E+01	3.058E+01	2.895E-07	2.160E-08
M(t):	1.233E+00	1.223E+00	1.197E+00	1.123E+00	1.066E+00	1.019E+00	9.650E-09	7.201E-10

Maximum TDOSE(t): 3.699E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

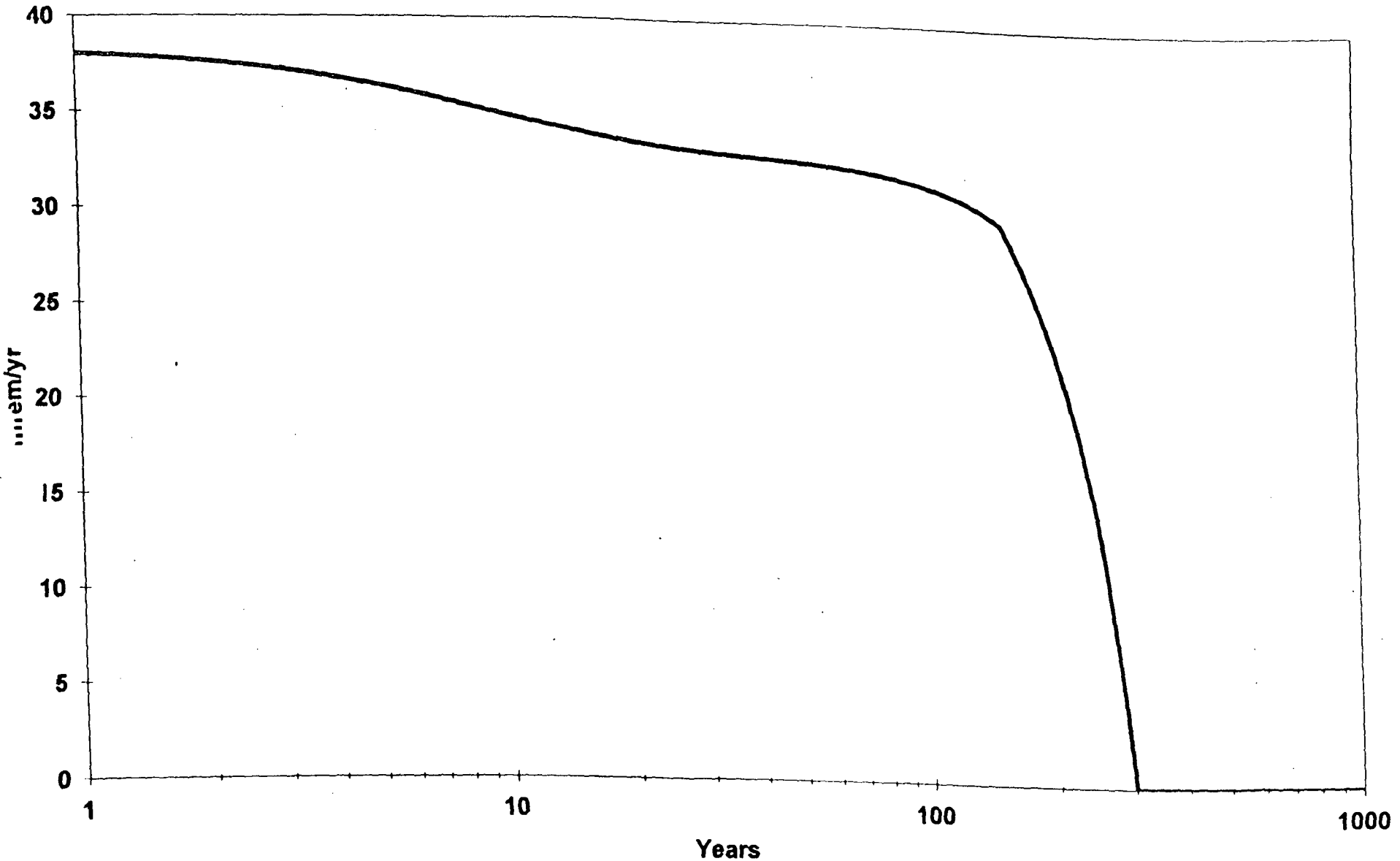
Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	9.869E+00	0.2668	2.158E-02	0.0006	0.000E+00	0.0000	1.904E+00	0.0515	7.071E-03	0.0002	9.910E-03	0.0003	2.247E-02	0.0006
Th-228	1.655E+01	0.4474	1.466E+00	0.0396	0.000E+00	0.0000	2.691E-02	0.0007	1.469E-04	0.0000	1.178E-05	0.0000	1.261E-02	0.0003
Th-232	9.030E-04	0.0000	6.968E+00	0.1883	0.000E+00	0.0000	9.213E-02	0.0025	5.072E-04	0.0000	3.990E-05	0.0000	4.260E-02	0.0012
Total	2.642E+01	0.7142	8.455E+00	0.2285	0.000E+00	0.0000	2.023E+00	0.0547	7.725E-03	0.0002	9.961E-03	0.0003	7.768E-02	0.0021

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.183E+01	0.3199
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.806E+01	0.4881
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.104E+00	0.1920
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.699E+01	1.0000

*Sum of all water independent and dependent pathways.

Dose for All Radionuclides



FAUVER.RAD 10/22/96 Includes All Pathways

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	300.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.833E+01	3.801E+01	3.719E+01	3.487E+01	3.310E+01	3.155E+01	3.917E-07	2.923E-08
M(t):	1.278E+00	1.267E+00	1.240E+00	1.162E+00	1.103E+00	1.052E+00	1.306E-08	9.742E-10

Maximum TDOSE(t): 3.833E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	1.002E+01	0.2615	2.208E-02	0.0006	0.000E+00	0.0000	2.539E+00	0.0662	9.429E-03	0.0002	1.321E-02	0.0003	2.996E-02	0.0008
Th-228	1.684E+01	0.4392	1.499E+00	0.0391	0.000E+00	0.0000	3.590E-02	0.0009	1.958E-04	0.0000	1.570E-05	0.0000	1.681E-02	0.0004
Th-232	9.119E-04	0.0000	7.127E+00	0.1859	0.000E+00	0.0000	1.229E-01	0.0032	6.763E-04	0.0000	5.320E-05	0.0000	5.680E-02	0.0015
Total	2.686E+01	0.7007	8.648E+00	0.2256	0.000E+00	0.0000	2.698E+00	0.0704	1.030E-02	0.0003	1.328E-02	0.0003	1.036E-01	0.0027

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.264E+01	0.3297
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.839E+01	0.4797
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.308E+00	0.1906
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.833E+01	1.0000

*Sum of all water independent and dependent pathways.

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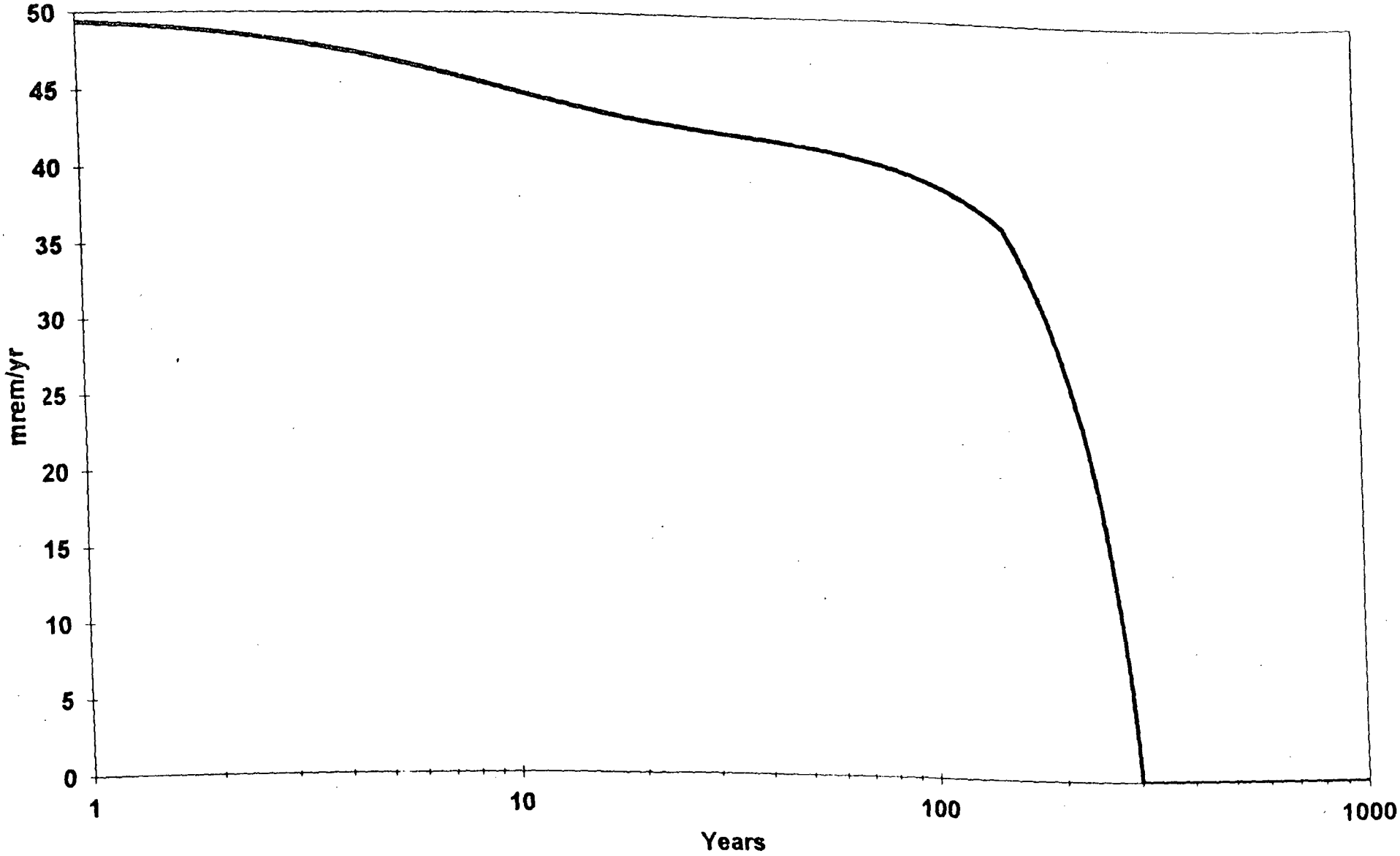
Part I: Mixture Sums and Single Radionuclide Guidelines

Dose for All Radionuclides



FAUVER RAD 10/22/96 Includes All Pathways

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(1)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(2)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(3)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(1)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(2)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(3)
D-34	Food transfer factors:			
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(1,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(1,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(2,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(3,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(3,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(1,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(1,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(2,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(2,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(3,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(3,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	---	THICKO
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ra-228	5.000E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Th-228	5.000E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E+00	0.000E+00	---	S1(3)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(3)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVERO
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02		

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.630E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.274E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.658E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.658E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R017	Inhalation rate (m**3/yr)	1.051E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	3.300E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.500E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.100E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(11)
					RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	
R017	Ring 2	not used	2.732E-01	---	FRACA(1)
R017	Ring 3	not used	0.000E+00	---	FRACA(2)
R017	Ring 4	not used	0.000E+00	---	FRACA(3)
R017	Ring 5	not used	0.000E+00	---	FRACA(4)
R017	Ring 6	not used	0.000E+00	---	FRACA(5)
R017	Ring 7	not used	0.000E+00	---	FRACA(6)
R017	Ring 8	not used	0.000E+00	---	FRACA(7)
R017	Ring 9	not used	0.000E+00	---	FRACA(8)
R017	Ring 10	not used	0.000E+00	---	FRACA(9)
R017	Ring 11	not used	0.000E+00	---	FRACA(10)
R017	Ring 12	not used	0.000E+00	---	FRACA(11)
					FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.660E+02	1.600E+02	---	
R018	Leafy vegetable consumption (kg/yr)	1.100E+01	1.400E+01	---	DIET(1)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(2)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(3)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(4)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(5)
R018	Soil ingestion rate (g/yr)	1.825E+01	3.650E+01	---	DIET(6)
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	SOIL
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	DWI
R018	Contamination fraction of household water	not used	1.000E+00	---	FDW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FIRW
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FR9
R018	Contamination fraction of meat	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of milk	-1	-1	0.500E+00	FMEAT
					FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI5
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LFI6
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI5
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LWI6
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	LSI
					MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12WTR
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CSOIL
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	CAIR
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	DMC
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	EVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	REVSN
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG4
					AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(1)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(3)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(4)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(6)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(8)
					STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	FLOOR
R021	Total porosity of the cover material	not used	4.000E-01	---	DENSFL
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPCV
R021	Volumetric water content of the cover material	not used	5.000E-02	---	TPFL
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OCV
R021	Diffusion coefficient for radon gas (m/sec):				PH2OFL
R021	in cover material	not used	2.000E-06	---	
R021	in foundation material	not used	3.000E-07	---	DIFCV
R021	in contaminated zone soil	not used	2.000E-06	---	DIFFL
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	DIFCZ
R021	Average annual wind speed (m/sec)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	WIND
R021	Height of the building (room) (m)	not used	2.500E+00	---	REXG
R021	Building interior area factor	not used	0.000E+00	---	HRM
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	FAI
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	DMFL
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(1)
					EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	10000.00 square meters	Ra-228	5.000E+00
Thickness:	0.30 meters	Th-228	5.000E+00
Cover Depth:	0.00 meters	Th-232	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.986E+01	4.938E+01	4.821E+01	4.507E+01	4.251E+01	3.955E+01	1.938E-06	1.445E-07
M(t):	1.662E+00	1.646E+00	1.607E+00	1.502E+00	1.417E+00	1.318E+00	6.459E-08	4.817E-09

Maximum TDOSE(t): 4.986E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/y.	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	1.112E+01	0.2230	2.515E-02	0.0005	0.000E+00	0.0000	8.463E+00	0.1698	3.143E-01	0.0063	4.405E-01	0.0088	9.986E-02	0.0020
Th-228	1.876E+01	0.3763	1.708E+00	0.0343	0.000E+00	0.0000	1.199E-01	0.0024	6.531E-03	0.0001	5.237E-04	0.0000	5.603E-02	0.0011
Th-232	9.864E-04	0.0000	8.118E+00	0.1628	0.000E+00	0.0000	4.106E-01	0.0082	2.255E-02	0.0005	1.774E-03	0.0000	1.893E-01	0.0038
Total	2.988E+01	0.5993	9.851E+00	0.1976	0.000E+00	0.0000	8.994E+00	0.1804	3.434E-01	0.0069	4.428E-01	0.0089	3.452E-01	0.0069

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.046E+01	0.4104
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.065E+01	0.4142
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.743E+00	0.1754
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.986E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	1.492E+01	0.3022	5.033E-01	0.0102	0.000E+00	0.0000	7.396E+00	0.1498	2.771E-01	0.0056	3.813E-01	0.0077	1.023E-01	0.0021
Th-228	1.306E+01	0.2644	1.189E+00	0.0241	0.000E+00	0.0000	8.321E-02	0.0017	4.545E-03	0.0001	3.645E-04	0.0000	3.900E-02	0.0008
Th-232	1.597E+00	0.0323	8.152E+00	0.1651	0.000E+00	0.0000	1.367E+00	0.0277	5.845E-02	0.0012	5.129E-02	0.0010	2.016E-01	0.0041
Total	2.957E+01	0.5989	9.844E+00	0.1994	0.000E+00	0.0000	8.846E+00	0.1791	3.401E-01	0.0069	4.330E-01	0.0088	3.429E-01	0.0069

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.358E+01	0.4776
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.437E+01	0.2910
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.143E+01	0.2314
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.938E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Independent Pathways (Inhalation exclude: radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	1.695E+01	0.3516	9.015E-01	0.0187	0.000E+00	0.0000	5.553E+00	0.1152	2.091E-01	0.0043	2.854E-01	0.0059	9.402E-02	0.0020
Th-228	6.323E+00	0.1312	5.759E-01	0.0119	0.000E+00	0.0000	4.005E-02	0.0008	2.201E-03	0.0000	1.765E-04	0.0000	1.890E-02	0.0004
Th-232	5.546E+00	0.1150	8.332E+00	0.1728	0.000E+00	0.0000	2.903E+00	0.0602	1.165E-01	0.0024	1.307E-01	0.0027	2.255E-01	0.0047
Total	2.882E+01	0.5978	9.809E+00	0.2035	0.000E+00	0.0000	8.495E+00	0.1762	3.278E-01	0.0068	4.163E-01	0.0086	3.384E-01	0.0070

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.399E+01	0.4977
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.960E+00	0.1444
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.725E+01	0.3579
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.821E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	9.213E+00	0.2044	6.046E-01	0.0134	0.000E+00	0.0000	2.007E+00	0.0445	7.662E-02	0.0017	1.033E-01	0.0023	4.347E-02	0.0010
Th-228	4.997E-01	0.0111	4.558E-02	0.0010	0.000E+00	0.0000	3.097E-03	0.0001	1.741E-04	0.0000	1.396E-05	0.0000	1.496E-03	0.0000
Th-232	1.692E+01	0.3754	9.026E+00	0.2003	0.000E+00	0.0000	5.737E+00	0.1273	2.256E-01	0.0050	2.789E-01	0.0062	2.826E-01	0.0063
Total	2.663E+01	0.5909	9.676E+00	0.2147	0.000E+00	0.0000	7.747E+00	0.1719	3.024E-01	0.0067	3.822E-01	0.0085	3.276E-01	0.0073

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.205E+01	0.2673
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.500E-01	0.0122
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.247E+01	0.7205
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.507E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	5.683E-01	0.0134	3.867E-02	0.0009	0.000E+00	0.0000	1.067E-01	0.0025	4.194E-03	0.0001	5.648E-03	0.0001	2.615E-03	0.0001
Th-228	3.540E-04	0.0000	3.247E-05	0.0000	0.000E+00	0.0000	2.057E-06	0.0000	1.237E-07	0.0000	9.924E-09	0.0000	1.065E-06	0.0000
Th-232	2.449E+01	0.5760	9.536E+00	0.2243	0.000E+00	0.0000	6.823E+00	0.1605	2.750E-01	0.0065	3.463E-01	0.0081	3.181E-01	0.0075
Total	2.506E+01	0.5894	9.574E+00	0.2252	0.000E+00	0.0000	6.930E+00	0.1630	2.792E-01	0.0066	3.519E-01	0.0083	3.207E-01	0.0075

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.261E-01	0.0171
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.897E-04	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.179E+01	0.9829
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.251E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	2.413E-05	0.0000	1.706E-06	0.0000	0.000E+00	0.0000	3.485E-06	0.0000	1.565E-07	0.0000	2.125E-07	0.0000	1.153E-07	0.0000
Th-228	3.276E-15	0.0000	3.134E-16	0.0000	0.000E+00	0.0000	1.482E-17	0.0000	1.182E-18	0.0000	9.501E-20	0.0000	1.028E-17	0.0000
Th-232	2.403E+01	0.6075	9.550E+00	0.2415	0.000E+00	0.0000	5.115E+00	0.1293	2.378E-01	0.0060	2.994E-01	0.0076	3.197E-01	0.0081
Total	2.403E+01	0.6075	9.550E+00	0.2415	0.000E+00	0.0000	5.115E+00	0.1293	2.378E-01	0.0060	2.994E-01	0.0076	3.197E-01	0.0081

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	9.812E-07	0.0000	3.332E-09	0.0000	0.000E+00	0.0000	1.942E-07	0.0000	2.154E-08	0.0000	3.585E-08	0.0000	3.104E-05	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.615E-15	0.0000
Th-232	1.484E-07	0.0000	5.020E-10	0.0000	0.000E+00	0.0000	2.937E-08	0.0000	3.260E-09	0.0000	5.424E-09	0.0000	3.955E+01	1.0000
Total	1.130E-06	0.0000	3.834E-09	0.0000	0.000E+00	0.0000	2.235E-07	0.0000	2.480E-08	0.0000	4.127E-08	0.0000	3.955E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	5.656E-16	0.0000	1.922E-18	0.0000	0.000E+00	0.0000	1.119E-16	0.0000	1.240E-17	0.0000	2.064E-17	0.0000	7.124E-16	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.537E-06	0.7931	5.220E-09	0.0027	0.000E+00	0.0000	3.059E-07	0.1579	3.372E-08	0.0174	5.612E-08	0.0290	1.938E-06	1.0000
Total	1.537E-06	0.7931	5.220E-09	0.0027	0.000E+00	0.0000	3.059E-07	0.1579	3.372E-08	0.0174	5.612E-08	0.0290	1.938E-06	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.147E-07	0.7938	3.882E-10	0.0027	0.000E+00	0.0000	2.270E-08	0.1571	2.519E-09	0.0174	4.194E-09	0.0290	1.445E-07	1.0000
Total	1.147E-07	0.7938	3.882E-10	0.0027	0.000E+00	0.0000	2.270E-08	0.1571	2.519E-09	0.0174	4.194E-09	0.0290	1.445E-07	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated
DSR(j,t) (mrem/yr)/(pCi/g)

Parent (i)	Product (j)	Branch Fraction	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	Ra-228	1.000E+00	4.092E+00	3.541E+00	2.650E+00	9.618E-01	5.307E-02	2.300E-06	1.423E-16	0.000E+00
Ra-228	Th-228	1.000E+00	0.000E+00	1.176E+00	2.148E+00	1.448E+00	9.216E-02	3.908E-06	2.105E-19	0.000E+00
Ra-228	ΣDSR(j)		4.092E+00	4.716E+00	4.798E+00	2.410E+00	1.452E-01	6.208E-06	1.425E-16	0.000E+00
Th-228	Th-228	1.000E+00	4.130E+00	2.874E+00	1.392E+00	1.100E-01	7.794E-05	7.231E-16	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	1.749E+00	1.748E+00	1.748E+00	1.745E+00	1.739E+00	1.717E+00	0.000E+00	0.000E+00
Th-232	Ra-228	1.000E+00	0.000E+00	4.591E-01	1.198E+00	2.582E+00	3.239E+00	2.878E+00	3.867E-07	2.890E-08
Th-232	Th-228	1.000E+00	0.000E+00	7.787E-02	5.053E-01	2.167E+00	3.379E+00	3.314E+00	8.028E-10	0.000E+00
Th-232	ΣDSR(j)		1.749E+00	2.285E+00	3.451E+00	6.494E+00	8.357E+00	7.910E+00	3.875E-07	2.890E-08

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 30 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	7.331E+00	6.361E+00	6.252E+00	1.245E+01	2.066E+02	4.832E+06	*2.726E+14	*2.726E+14
Th-228	7.264E+00	1.044E+01	2.155E+01	2.727E+02	3.849E+05	*8.192E+14	*8.192E+14	*8.192E+14
Th-232	1.716E+01	1.313E+01	8.694E+00	4.620E+00	3.590E+00	3.793E+00	*1.096E+05	*1.096E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ra-228	5.000E+00	2.070 ± 0.002	4.893E+00	6.132E+00	4.092E+00	7.331E+00
Th-228	5.000E+00	0.000E+00	4.130E+00	7.264E+00	4.130E+00	7.264E+00
Th-232	5.000E+00	36.29 ± 0.04	8.386E+00	3.577E+00	1.749E+00	1.716E+01

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated
DOSE(j,t), mrem/yr

Nuclide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	Ra-228	1.000E+00	2.046E+01	1.770E+01	1.325E+01	4.809E+00	2.654E-01	1.150E-05	7.114E-16	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	2.296E+00	5.988E+00	1.291E+01	1.620E+01	1.439E+01	1.934E-06	1.445E-07
Ra-228	ΣDOSE(j):		2.046E+01	2.000E+01	1.924E+01	1.772E+01	1.646E+01	1.439E+01	1.934E-06	1.445E-07
Th-228	Ra-228	1.000E+00	0.000E+00	5.878E+00	1.074E+01	7.239E+00	4.608E-01	1.954E-05	1.052E-18	0.000E+00
Th-228	Th-228	1.000E+00	2.065E+01	1.437E+01	6.960E+00	5.500E-01	3.897E-04	3.615E-15	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	3.894E-01	2.526E+00	1.084E+01	1.689E+01	1.657E+01	4.014E-09	0.000E+00
Th-228	ΣDOSE(j):		2.065E+01	2.064E+01	2.023E+01	1.862E+01	1.736E+01	1.657E+01	4.014E-09	0.000E+00
Th-232	Th-232	1.000E+00	8.743E+00	8.741E+00	8.738E+00	8.727E+00	8.696E+00	8.586E+00	0.000E+00	0.000E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated
S(j,t), pCi/g

Nuclide (j)	Parent (i),	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	Ra-228	1.000E+00	5.000E+00	4.333E+00	3.253E+00	1.193E+00	6.794E-02	2.994E-06	1.073E-18	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	5.615E-01	1.470E+00	3.202E+00	4.147E+00	4.196E+00	4.174E+00	4.097E+00
Ra-228	ΣS(j):		5.000E+00	4.894E+00	4.723E+00	4.395E+00	4.215E+00	4.196E+00	4.174E+00	4.097E+00
Th-228	Ra-228	1.000E+00	0.000E+00	1.410E+00	2.592E+00	1.753E+00	1.122E-01	4.951E-06	1.775E-18	0.000E+00
Th-228	Th-228	1.000E+00	5.000E+00	3.480E+00	1.686E+00	1.335E-01	9.507E-05	9.175E-16	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	9.251E-02	6.074E-01	2.619E+00	4.109E+00	4.196E+00	4.174E+00	4.097E+00
Th-228	ΣS(j):		5.000E+00	4.982E+00	4.885E+00	4.505E+00	4.222E+00	4.196E+00	4.174E+00	4.097E+00
Th-232	Th-232	1.000E+00	5.000E+00	5.000E+00	5.000E+00	4.999E+00	4.996E+00	4.987E+00	4.960E+00	4.869E+00

BRF(i) is the branch fraction of the parent nuclide.

Appendix II

of

APPENDIX II

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Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC30.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	1.380E-02	1.380E-02	DCF2(3)
B-1	Po-210	9.400E-03	9.400E-03	DCF2(4)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	U-234	1.320E-01	1.320E-01	DCF2(7)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	5.370E-03	5.370E-03	DCF3(3)
D-1	Po-210	1.900E-03	1.900E-03	DCF3(4)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	U-234	2.830E-04	2.830E-04	DCF3(7)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Po-210 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Po-210 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Po-210 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC30.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Po-210 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Po-210 , crustacea and mollusks	2.000E+04	2.000E+04	BIOFAC(4,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.048E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	2.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	5.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	9.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	2.370E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-235	5.000E-01	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-238	6.000E+00	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(9)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.630E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.130E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.130E-02	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.130E-02	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.790E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.130E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.568E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Po-210				
R016	Contaminated zone (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.546E-01	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.238E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.617E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R017	Inhalation rate (m**3/yr)	1.051E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Exposure duration	5.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	3.300E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.500E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.100E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.660E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.100E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.825E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.500E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.500E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed (time dependent)	DMFL
R021	Emanating power of Rn-222 gas	3.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	10000.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	5.256E+00	5.093E+00	4.780E+00	3.829E+00	2.034E+00	2.288E-01	8.960E+00	1.199E+01	1.260E+01	3.431E+00
M(t):	1.752E-01	1.698E-01	1.593E-01	1.276E-01	6.780E-02	7.627E-03	2.987E-01	3.997E-01	4.200E-01	1.144E-01

Maximum TDOSE(t): 1.260E+01 mrem/yr at t = 903.9 ± 0.9 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 903.9 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 903.9 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.842E+00	0.6224	4.114E-02	0.0033	4.486E-03	0.0004	1.540E+00	0.1222	8.265E-02	0.0066	1.701E-01	0.0135	9.680E+00	0.7683
U-235	5.746E-01	0.0456	2.323E-03	0.0002	0.000E+00	0.0000	1.130E-01	0.0090	1.409E-02	0.0011	3.545E-03	0.0003	7.076E-01	0.0562
U-238	1.802E+00	0.1430	1.345E-03	0.0001	1.557E-06	0.0000	3.545E-01	0.0281	1.372E-02	0.0011	3.993E-02	0.0032	2.212E+00	0.1755
Total	1.022E+01	0.8111	4.481E-02	0.0036	4.488E-03	0.0004	2.007E+00	0.1593	1.105E-01	0.0088	2.136E-01	0.0170	1.260E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	3.617E-03	0.0007	3.096E+00	0.5891	0.000E+00	0.0000	5.064E-01	0.0963	4.019E-02	0.0076	1.103E-01	0.0210	9.303E-02	0.0177
U-235	1.428E-01	0.0272	6.087E-02	0.0116	0.000E+00	0.0000	1.008E-02	0.0019	7.999E-04	0.0002	2.195E-03	0.0004	1.852E-03	0.0004
U-238	3.067E-01	0.0583	7.008E-01	0.1333	0.000E+00	0.0000	1.219E-01	0.0232	9.671E-03	0.0018	2.654E-02	0.0050	2.239E-02	0.0043
Total	4.531E-01	0.0862	3.858E+00	0.7340	0.000E+00	0.0000	6.384E-01	0.1214	5.066E-02	0.0096	1.390E-01	0.0264	1.173E-01	0.0223

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.850E+00	0.7324
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.186E-01	0.0416
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.188E+00	0.2260
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.256E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	3.506E-03	0.0007	3.001E+00	0.5893	3.303E-06	0.0000	4.892E-01	0.0961	3.894E-02	0.0076	1.069E-01	0.0210	9.016E-02	0.0177
U-235	1.384E-01	0.0272	5.901E-02	0.0116	0.000E+00	0.0000	9.771E-03	0.0019	7.877E-04	0.0002	2.127E-03	0.0004	1.796E-03	0.0004
U-238	2.972E-01	0.0584	6.792E-01	0.1334	7.876E-13	0.0000	1.177E-01	0.0231	9.370E-03	0.0018	2.571E-02	0.0050	2.170E-02	0.0043
Total	4.391E-01	0.0862	3.739E+00	0.7343	3.303E-06	0.0000	6.167E-01	0.1211	4.909E-02	0.0096	1.347E-01	0.0264	1.137E-01	0.0223

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.730E+00	0.7324
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.119E-01	0.0416
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.151E+00	0.2260
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.093E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	3.295E-03	0.0007	2.819E+00	0.5898	2.858E-05	0.0000	4.566E-01	0.0955	3.655E-02	0.0076	1.003E-01	0.0210	8.469E-02	0.0177
U-235	1.301E-01	0.0272	5.546E-02	0.0116	0.000E+00	0.0000	9.180E-03	0.0019	7.628E-04	0.0002	1.997E-03	0.0004	1.690E-03	0.0004
U-238	2.791E-01	0.0584	6.380E-01	0.1335	2.031E-11	0.0000	1.099E-01	0.0230	8.795E-03	0.0018	2.414E-02	0.0051	2.038E-02	0.0043
Total	4.125E-01	0.0863	3.512E+00	0.7348	2.858E-05	0.0000	5.756E-01	0.1204	4.611E-02	0.0096	1.265E-01	0.0265	1.068E-01	0.0223

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.500E+00	0.7323
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.991E-01	0.0417
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.080E+00	0.2260
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.780E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.662E-03	0.0007	2.265E+00	0.5914	2.771E-04	0.0001	3.583E-01	0.0936	2.929E-02	0.0076	8.042E-02	0.0210	6.804E-02	0.0178
U-235	1.045E-01	0.0273	4.467E-02	0.0117	0.000E+00	0.0000	7.380E-03	0.0019	6.769E-04	0.0002	1.601E-03	0.0004	1.367E-03	0.0004
U-238	2.241E-01	0.0585	5.124E-01	0.1338	6.410E-10	0.0000	8.622E-02	0.0225	7.048E-03	0.0018	1.935E-02	0.0051	1.637E-02	0.0043
Total	3.313E-01	0.0865	2.822E+00	0.7369	2.771E-04	0.0001	4.519E-01	0.1180	3.701E-02	0.0097	1.014E-01	0.0265	8.577E-02	0.0224

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.804E+00	0.7321
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.602E-01	0.0418
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.655E-01	0.2260
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.829E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.518E-03	0.0007	1.212E+00	0.5958	1.706E-03	0.0008	1.788E-01	0.0879	1.556E-02	0.0076	4.276E-02	0.0210	3.640E-02	0.0179
U-235	5.594E-02	0.0275	2.416E-02	0.0119	0.000E+00	0.0000	3.944E-03	0.0019	4.571E-04	0.0002	8.515E-04	0.0004	7.485E-04	0.0004
U-238	1.196E-01	0.0588	2.740E-01	0.1347	1.103E-08	0.0000	4.300E-02	0.0211	3.743E-03	0.0018	1.029E-02	0.0051	8.753E-03	0.0043
Total	1.771E-01	0.0871	1.510E+00	0.7424	1.706E-03	0.0008	2.257E-01	0.1110	1.976E-02	0.0097	5.390E-02	0.0265	4.590E-02	0.0226

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.489E+00	0.7318
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.610E-02	0.0423
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.594E-01	0.2259
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.034E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.450E-04	0.0024	1.374E-01	0.6004	5.593E-03	0.0244	1.516E-02	0.0662	1.719E-03	0.0075	4.694E-03	0.0205	4.120E-03	0.0180
U-235	6.248E-03	0.0273	2.827E-03	0.0124	0.000E+00	0.0000	4.084E-04	0.0018	8.461E-05	0.0004	9.346E-05	0.0004	9.107E-05	0.0004
U-238	1.311E-02	0.0573	3.063E-02	0.1339	9.168E-08	0.0000	3.593E-03	0.0157	4.085E-04	0.0018	1.128E-03	0.0049	9.786E-04	0.0043
Total	1.990E-02	0.0870	1.708E-01	0.7466	5.594E-03	0.0244	1.916E-02	0.0837	2.212E-03	0.0097	5.915E-03	0.0259	5.190E-03	0.0227

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.692E-01	0.7395
U-235	5.927E-06	0.0000	3.980E-08	0.0000	0.000E+00	0.0000	1.176E-06	0.0000	6.634E-09	0.0000	4.460E-09	0.0000	9.760E-03	0.0427
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.985E-02	0.2179
Total	5.927E-06	0.0000	3.980E-08	0.0000	0.000E+00	0.0000	1.176E-06	0.0000	6.634E-09	0.0000	4.460E-09	0.0000	2.288E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.388E-05	0.0000	7.806E-05	0.0000	2.808E-04	0.0000	8.405E-06	0.0000	1.081E-06	0.0000	7.101E-07	0.0000	2.234E-06	0.0000
U-235	1.715E-06	0.0000	1.951E-07	0.0000	0.000E+00	0.0000	2.844E-08	0.0000	1.072E-08	0.0000	5.648E-09	0.0000	6.861E-09	0.0000
U-238	3.488E-06	0.0000	1.875E-06	0.0000	6.395E-09	0.0000	1.618E-07	0.0000	2.453E-08	0.0000	6.789E-08	0.0000	5.988E-08	0.0000
Total	5.909E-05	0.0000	8.013E-05	0.0000	2.808E-04	0.0000	8.595E-06	0.0000	1.116E-06	0.0000	7.836E-07	0.0000	2.300E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.676E+00	0.6335	4.313E-03	0.0005	1.440E-05	0.0000	1.116E+00	0.1246	4.327E-02	0.0048	1.257E-01	0.0140	6.966E+00	0.7775
U-235	2.569E-01	0.0287	8.782E-04	0.0001	0.000E+00	0.0000	5.053E-02	0.0056	4.310E-03	0.0005	2.594E-03	0.0003	3.152E-01	0.0352
U-238	1.368E+00	0.1527	1.012E-03	0.0001	2.043E-08	0.0000	2.691E-01	0.0300	1.041E-02	0.0012	3.031E-02	0.0034	1.679E+00	0.1874
Total	7.301E+00	0.8148	6.203E-03	0.0007	1.442E-05	0.0000	1.436E+00	0.1603	5.799E-02	0.0065	1.586E-01	0.0177	8.960E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.537E+00	0.6286	1.277E-02	0.0011	9.249E-04	0.0001	1.482E+00	0.1236	6.204E-02	0.0052	1.663E-01	0.0139	9.261E+00	0.7724
U-235	4.239E-01	0.0354	1.593E-03	0.0001	0.000E+00	0.0000	8.338E-02	0.0070	8.473E-03	0.0007	3.461E-03	0.0003	5.208E-01	0.0434
U-238	1.800E+00	0.1501	1.334E-03	0.0001	3.452E-07	0.0000	3.540E-01	0.0295	1.370E-02	0.0011	3.988E-02	0.0033	2.209E+00	0.1842
Total	9.761E+00	0.8140	1.570E-02	0.0013	9.252E-04	0.0001	1.919E+00	0.1601	8.422E-02	0.0070	2.096E-01	0.0175	1.199E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 9.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 9.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.838E+00	0.6221	4.080E-02	0.0032	4.443E-03	0.0004	1.539E+00	0.1222	8.240E-02	0.0065	1.701E-01	0.0135	9.675E+00	0.7679
U-235	5.786E-01	0.0459	2.353E-03	0.0002	0.000E+00	0.0000	1.138E-01	0.0090	1.404E-02	0.0011	3.548E-03	0.0003	7.124E-01	0.0565
U-238	1.802E+00	0.1431	1.345E-03	0.0001	1.546E-06	0.0000	3.545E-01	0.0281	1.372E-02	0.0011	3.993E-02	0.0032	2.212E+00	0.1756
Total	1.022E+01	0.8111	4.450E-02	0.0035	4.445E-03	0.0004	2.007E+00	0.1593	1.102E-01	0.0087	2.135E-01	0.0169	1.260E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.217E+00	0.6462	4.553E-02	0.0133	5.562E-03	0.0016	4.330E-01	0.1262	4.539E-02	0.0132	4.463E-02	0.0130	2.791E+00	0.8135
U-235	1.011E-01	0.0295	3.064E-04	0.0001	0.000E+00	0.0000	1.989E-02	0.0058	3.565E-03	0.0010	7.982E-04	0.0002	1.256E-01	0.0366
U-238	4.190E-01	0.1221	3.244E-04	0.0001	1.861E-06	0.0000	8.241E-02	0.0240	3.198E-03	0.0009	9.282E-03	0.0027	5.142E-01	0.1499
Total	2.737E+00	0.7978	4.616E-02	0.0135	5.564E-03	0.0016	5.353E-01	0.1560	5.216E-02	0.0152	5.471E-02	0.0159	3.431E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction	t=	DSR(j,t) (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
U-234	U-234	1.000E+00		1.624E-01	1.574E-01	1.477E-01	1.183E-01	6.267E-02	6.785E-03	2.938E-01	3.861E-01	3.857E-01	8.960E-02
U-234	Th-230	1.000E+00		0.000E+00	3.102E-06	8.991E-06	2.690E-05	6.071E-05	9.409E-05	3.273E-06	1.229E-06	3.434E-06	3.833E-06
U-234	Ra-226	1.000E+00		0.000E+00	1.507E-07	1.304E-06	1.265E-05	7.796E-05	2.571E-04	1.993E-05	3.653E-04	1.755E-03	2.196E-03
U-234	Pb-210	1.000E+00		0.000E+00	5.245E-11	1.068E-09	2.968E-08	4.525E-07	2.887E-06	1.385E-05	8.806E-04	4.238E-03	5.305E-03
U-234	Po-210	1.000E+00		0.000E+00	2.579E-12	1.044E-10	3.962E-09	6.928E-08	5.374E-07	5.378E-05	3.389E-03	1.649E-02	2.068E-02
U-234	∑DSR(j)			1.624E-01	1.574E-01	1.477E-01	1.183E-01	6.281E-02	7.140E-03	2.939E-01	3.908E-01	4.082E-01	1.178E-01
U-235	U-235	1.000E+00		4.373E-01	4.237E-01	3.979E-01	3.193E-01	1.703E-01	1.879E-02	2.775E-01	3.648E-01	3.649E-01	8.477E-02
U-235	Pa-231	1.000E+00		0.000E+00	1.215E-04	3.394E-04	8.943E-04	1.375E-03	4.364E-04	7.936E-02	1.692E-01	2.981E-01	7.672E-02
U-235	Ac-227	1.000E+00		0.000E+00	2.884E-06	2.260E-05	1.690E-04	5.369E-04	2.888E-04	2.737E-01	5.076E-01	7.618E-01	8.978E-02
U-235	∑DSR(j)			4.373E-01	4.239E-01	3.983E-01	3.204E-01	1.722E-01	1.952E-02	6.305E-01	1.042E+00	1.425E+00	2.513E-01
U-238	U-238	1.000E+00		1.980E-01	1.918E-01	1.800E-01	1.443E-01	7.656E-02	8.306E-03	2.795E-01	3.676E-01	3.676E-01	8.541E-02
U-238	U-234	1.000E+00		0.000E+00	4.487E-07	1.259E-06	3.355E-06	5.331E-06	1.924E-06	2.667E-04	5.696E-04	1.007E-03	2.595E-04
U-238	Th-230	1.000E+00		0.000E+00	4.397E-12	3.770E-11	3.616E-10	2.184E-09	7.307E-09	4.025E-10	1.435E-09	6.041E-09	7.105E-09
U-238	Ra-226	1.000E+00		0.000E+00	1.419E-13	3.660E-12	1.156E-10	1.992E-09	1.665E-08	3.315E-08	5.385E-07	2.411E-06	2.902E-06
U-238	Pb-210	1.000E+00		0.000E+00	4.080E-17	2.358E-15	2.104E-13	9.243E-12	1.664E-10	7.527E-08	1.273E-06	5.701E-06	6.862E-06
U-238	Po-210	1.000E+00		0.000E+00	9.622E-19	2.075E-16	2.686E-14	1.392E-12	3.086E-11	3.476E-07	5.042E-06	2.226E-05	2.680E-05
U-238	∑DSR(j)			1.980E-01	1.918E-01	1.800E-01	1.443E-01	7.657E-02	8.308E-03	2.798E-01	3.681E-01	3.686E-01	8.570E-02

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 30 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 30 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
U-234		1.847E+02	1.906E+02	2.031E+02	2.536E+02	4.776E+02	4.202E+03	1.021E+02	7.677E+01	7.349E+01	2.547E+02
U-235		6.861E+01	7.078E+01	7.532E+01	9.363E+01	1.742E+02	1.537E+03	4.758E+01	2.880E+01	2.106E+01	1.194E+02
U-238		1.515E+02	1.564E+02	1.666E+02	2.080E+02	3.918E+02	3.611E+03	1.072E+02	8.149E+01	8.138E+01	3.500E+02

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 903.9 ± 0.9 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	2.370E+01	958.5 ± 1.0	4.115E-01	7.291E+01	4.084E-01	7.345E+01
U-235	5.000E-01	857.5 ± 0.9	1.465E+00	2.048E+01	1.415E+00	2.120E+01
U-238	6.000E+00	958.5 ± 1.0	3.687E-01	8.137E+01	3.686E-01	8.138E+01

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
U-234	U-234	1.000E+00	3.850E+00	3.730E+00	3.500E+00	2.803E+00	1.485E+00	1.608E-01	6.964E+00	9.151E+00	9.142E+00	2.123E+00
U-234	U-238	1.000E+00	0.000E+00	2.692E-06	7.551E-06	2.013E-05	3.199E-05	1.154E-05	1.600E-03	3.418E-03	6.044E-03	1.557E-03
U-234	∑DOSE(j):		3.850E+00	3.730E+00	3.500E+00	2.803E+00	1.485E+00	1.608E-01	6.965E+00	9.155E+00	9.148E+00	2.125E+00
Th-230	U-234	1.000E+00	0.000E+00	7.353E-05	2.131E-04	6.374E-04	1.439E-03	2.230E-03	7.758E-05	2.913E-05	8.139E-05	9.083E-05
Th-230	U-238	1.000E+00	0.000E+00	2.638E-11	2.262E-10	2.169E-09	1.310E-08	4.384E-08	2.415E-09	8.612E-09	3.625E-08	4.263E-08
Th-230	∑DOSE(j):		0.000E+00	7.353E-05	2.131E-04	6.374E-04	1.439E-03	2.230E-03	7.758E-05	2.914E-05	8.143E-05	9.088E-05
Ra-226	U-234	1.000E+00	0.000E+00	3.571E-06	3.091E-05	2.998E-04	1.848E-03	6.093E-03	4.723E-04	8.657E-03	4.159E-02	5.205E-02
Ra-226	U-238	1.000E+00	0.000E+00	8.516E-13	2.196E-11	6.934E-10	1.195E-08	9.988E-08	1.989E-07	3.231E-06	1.447E-05	1.741E-05
Ra-226	∑DOSE(j):		0.000E+00	3.571E-06	3.091E-05	2.998E-04	1.848E-03	6.094E-03	4.725E-04	8.660E-03	4.160E-02	5.207E-02
Pb-210	U-234	1.000E+00	0.000E+00	1.243E-09	2.532E-08	7.034E-07	1.072E-05	6.842E-05	3.283E-04	2.087E-02	1.004E-01	1.257E-01
Pb-210	U-238	1.000E+00	0.000E+00	2.448E-16	1.415E-14	1.263E-12	5.546E-11	9.985E-10	4.516E-07	7.636E-06	3.421E-05	4.117E-05
Pb-210	∑DOSE(j):		0.000E+00	1.243E-09	2.532E-08	7.034E-07	1.072E-05	6.842E-05	3.288E-04	2.088E-02	1.005E-01	1.258E-01
Po-210	U-234	1.000E+00	0.000E+00	6.112E-11	2.475E-09	9.391E-08	1.642E-06	1.274E-05	1.275E-03	8.033E-02	3.908E-01	4.901E-01
Po-210	U-238	1.000E+00	0.000E+00	5.773E-18	1.245E-15	1.611E-13	8.354E-12	1.851E-10	2.085E-06	3.025E-05	1.336E-04	1.608E-04
Po-210	∑DOSE(j):		0.000E+00	6.112E-11	2.475E-09	9.391E-08	1.642E-06	1.274E-05	1.277E-03	8.036E-02	3.910E-01	4.902E-01
U-235	U-235	1.000E+00	2.186E-01	2.119E-01	1.990E-01	1.597E-01	8.515E-02	9.397E-03	1.387E-01	1.824E-01	1.824E-01	4.239E-02
Pa-231	U-235	1.000E+00	0.000E+00	6.076E-05	1.697E-04	4.471E-04	6.877E-04	2.182E-04	3.968E-02	8.460E-02	1.491E-01	3.836E-02
Ac-227	U-235	1.000E+00	0.000E+00	1.442E-06	1.130E-05	8.451E-05	2.685E-04	1.444E-04	1.368E-01	2.538E-01	3.809E-01	4.489E-02
U-238	U-238	1.000E+00	1.188E+00	1.151E+00	1.080E+00	8.655E-01	4.594E-01	4.984E-02	1.677E+00	2.205E+00	2.206E+00	5.124E-01

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g									
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.370E+01	2.297E+01	2.158E+01	1.733E+01	9.265E+00	1.035E+00	1.976E-03	3.772E-06	1.374E-11	6.003E-13
U-234	U-238	1.000E+00	0.000E+00	1.649E-05	4.645E-05	1.244E-04	1.995E-04	7.432E-05	4.257E-07	1.355E-09	8.887E-15	4.315E-16
U-234	∑S(j):		2.370E+01	2.297E+01	2.158E+01	1.733E+01	9.265E+00	1.035E+00	1.977E-03	3.773E-06	1.375E-11	6.008E-13
Th-230	U-234	1.000E+00	0.000E+00	2.100E-04	6.109E-04	1.831E-03	4.148E-03	6.500E-03	6.750E-03	6.703E-03	6.610E-03	6.587E-03
Th-230	U-238	1.000E+00	0.000E+00	7.498E-11	6.474E-10	6.230E-09	3.778E-08	1.278E-07	1.548E-07	1.539E-07	1.517E-07	1.512E-07
Th-230	∑S(j):		0.000E+00	2.100E-04	6.109E-04	1.831E-03	4.148E-03	6.500E-03	6.750E-03	6.704E-03	6.610E-03	6.587E-03
Ra-226	U-234	1.000E+00	0.000E+00	4.539E-08	3.941E-07	3.866E-06	2.469E-05	9.570E-05	1.279E-04	1.275E-04	1.257E-04	1.253E-04
Ra-226	U-238	1.000E+00	0.000E+00	1.082E-14	2.800E-13	8.944E-12	1.597E-10	1.569E-09	2.913E-09	2.926E-09	2.886E-09	2.875E-09
Ra-226	∑S(j):		0.000E+00	4.539E-08	3.941E-07	3.866E-06	2.469E-05	9.570E-05	1.279E-04	1.275E-04	1.257E-04	1.253E-04
Pb-210	U-234	1.000E+00	0.000E+00	4.669E-10	1.199E-08	3.731E-07	6.225E-06	5.170E-05	8.481E-05	8.481E-05	8.363E-05	8.334E-05
Pb-210	U-238	1.000E+00	0.000E+00	8.367E-17	6.429E-15	6.608E-13	3.205E-11	7.538E-10	1.921E-09	1.946E-09	1.920E-09	1.913E-09
Pb-210	∑S(j):		0.000E+00	4.669E-10	1.199E-08	3.731E-07	6.225E-06	5.170E-05	8.481E-05	8.481E-05	8.363E-05	8.334E-05
Po-210	U-234	1.000E+00	0.000E+00	1.511E-10	7.096E-09	3.002E-07	5.522E-06	4.741E-05	7.820E-05	7.820E-05	7.712E-05	7.684E-05
Po-210	U-238	1.000E+00	0.000E+00	2.287E-17	3.415E-15	5.087E-13	2.800E-11	6.887E-10	1.771E-09	1.795E-09	1.770E-09	1.764E-09
Po-210	∑S(j):		0.000E+00	1.511E-10	7.096E-09	3.002E-07	5.523E-06	4.741E-05	7.820E-05	7.820E-05	7.712E-05	7.685E-05
U-235	U-235	1.000E+00	5.000E-01	4.846E-01	4.552E-01	3.656E-01	1.955E-01	2.185E-02	4.173E-05	7.969E-08	2.906E-13	1.270E-14
Pa-231	U-235	1.000E+00	0.000E+00	1.025E-05	2.889E-05	7.735E-05	1.240E-04	4.618E-05	2.640E-07	8.386E-10	5.482E-15	2.659E-16
Ac-227	U-235	1.000E+00	0.000E+00	1.590E-07	1.278E-06	9.637E-06	3.099E-05	1.636E-05	1.026E-07	3.317E-10	2.194E-15	1.066E-16
U-238	U-238	1.000E+00	6.000E+00	5.815E+00	5.462E+00	4.387E+00	2.346E+00	2.622E-01	5.007E-04	9.563E-07	3.488E-12	1.524E-13

BRF(i) is the branch fraction of the parent nuclide.

Appendix III

of

APPENDIX II

RESRAD, version 5.70
Summary : PG-8-08 Default Parameters File: A:\SCEN#1A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	30.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	2.895E+00	2.806E+00	2.635E+00	2.117E+00	1.132E+00	1.276E-01	1.764E-01	2.357E-01	2.469E-01	6.623E-02
M(t):	9.650E-02	9.353E-02	8.785E-02	7.055E-02	3.772E-02	4.253E-03	5.879E-03	7.857E-03	8.229E-03	2.208E-03

Maximum TDOSE(t): 2.895E+00 mrem/yr at t = 0.000E+00 years

RESRAD, Version 5.7[illegible]
Summary : PG-8-08 Default Parameters File: A:\SCEN#2A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	300.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	4.033E+00	3.908E+00	3.670E+00	2.945E+00	1.572E+00	1.812E-01	1.858E+00	2.484E+00	2.602E+00	6.990E-01
M(t):	1.344E-01	1.303E-01	1.223E-01	9.817E-02	5.242E-02	6.040E-03	6.192E-02	8.279E-02	8.673E-02	2.330E-02

Maximum TDOSE(t): 4.033E+00 mrem/yr at t = 0.000E+00 years

Summary : PG-8-08 Default Parameters

File: A:\SCEN#3A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	225.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	3.893E+00	3.773E+00	3.543E+00	2.844E+00	1.520E+00	1.757E-01	1.374E+00	1.836E+00	1.924E+00	5.169E-01
M(t):	1.298E-01	1.258E-01	1.181E-01	9.481E-02	5.065E-02	5.856E-03	4.579E-02	6.121E-02	6.413E-02	1.723E-02

Maximum TDOSE(t): 3.893E+00 mrem/yr at t = 0.000E+00 years

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	250.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	3.943E+00	3.821E+00	3.588E+00	2.880E+00	1.539E+00	1.777E-01	1.534E+00	2.050E+00	2.148E+00	5.770E-01
M(t):	1.314E-01	1.274E-01	1.196E-01	9.601E-02	5.129E-02	5.923E-03	5.112E-02	6.834E-02	7.159E-02	1.923E-02

Maximum TDOSE(t): 3.943E+00 mrem/yr at t = 0.000E+00 years

RESRAD, Version 5.70 [illegible]
Summary : PG-8-08 Default Parameters File: A:\SCEN#4A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	900.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	4.743E+00	4.595E+00	4.313E+00	3.456E+00	1.836E+00	2.073E-01	6.202E+00	8.293E+00	8.687E+00	2.333E+00
M(t):	1.581E-01	1.532E-01	1.438E-01	1.152E-01	6.121E-02	6.909E-03	2.067E-01	2.764E-01	2.896E-01	7.776E-02

Maximum TDOSE(t): 8.687E+00 mrem/yr at t = 900.0 ± 0.9 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.0 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.0 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.643E+00	0.6497	3.672E-03	0.0004	3.199E-03	0.0004	9.973E-01	0.1148	5.339E-03	0.0006	1.102E-02	0.0013	6.664E+00	0.7672
U-235	4.166E-01	0.0480	2.118E-04	0.0000	0.000E+00	0.0000	7.376E-02	0.0085	9.098E-04	0.0001	2.299E-04	0.0000	4.917E-01	0.0566
U-238	1.298E+00	0.1494	1.211E-04	0.0000	1.113E-06	0.0000	2.297E-01	0.0264	8.893E-04	0.0001	2.587E-03	0.0003	1.531E+00	0.1762
Total	7.358E+00	0.8470	4.005E-03	0.0005	3.200E-03	0.0004	1.301E+00	0.1497	7.139E-03	0.0008	1.384E-02	0.0016	8.687E+00	1.0000

*Sum of all water independent and dependent pathways.

RESRAD, Version 5.70
Summary : PG-8-08 Default Parameters File: A:\SCEN#4B.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	1000.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	4.839E+00	4.688E+00	4.400E+00	3.525E+00	1.871E+00	2.106E-01	7.008E+00	9.370E+00	9.815E+00	2.636E+00
M(t):	1.613E-01	1.563E-01	1.467E-01	1.175E-01	6.238E-02	7.020E-03	2.336E-01	3.123E-01	3.272E-01	8.786E-02

Maximum TDOSE(t): 9.815E+00 mrem/yr at t = 900.9 ± 0.9 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.9 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.9 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	6.271E+00	0.6389	4.088E-03	0.0004	3.562E-03	0.0004	1.231E+00	0.1255	6.596E-03	0.0007	1.361E-02	0.0014	7.530E+00	0.7672
U-235	4.622E-01	0.0471	2.346E-04	0.0000	0.000E+00	0.0000	9.092E-02	0.0093	1.124E-03	0.0001	2.838E-04	0.0000	5.548E-01	0.0565
U-238	1.442E+00	0.1469	1.345E-04	0.0000	1.240E-06	0.0000	2.836E-01	0.0289	1.098E-03	0.0001	3.194E-03	0.0003	1.730E+00	0.1762
Total	8.175E+00	0.8329	4.457E-03	0.0005	3.564E-03	0.0004	1.606E+00	0.1636	8.819E-03	0.0009	1.708E-02	0.0017	9.815E+00	1.0000

*Sum of all water independent and dependent pathways.

RESRAD, Version 5.70 [illegible]
Summary : PG-8-08 Default Parameters File: A:\SCEN#5A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	3.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	1.561E+00	1.513E+00	1.421E+00	1.142E+00	6.105E-01	6.908E-02	1.758E-02	2.345E-02	2.456E-02	6.601E-03
M(t):	5.204E-02	5.043E-02	4.737E-02	3.805E-02	2.035E-02	2.303E-03	5.859E-04	7.816E-04	8.188E-04	2.200E-04

Maximum TDOSE(t): 1.561E+00 mrem/yr at t = 0.000E+00 years

Summary : PG-8-08 Default Parameters File: A:\SCEN#6A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	600.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	4.433E+00	4.295E+00	4.032E+00	3.233E+00	1.722E+00	1.962E-01	3.925E+00	5.248E+00	5.497E+00	1.477E+00
M(t):	1.478E-01	1.432E-01	1.344E-01	1.078E-01	5.740E-02	6.541E-03	1.308E-01	1.749E-01	1.832E-01	4.922E-02

Maximum TDOSE(t): 5.497E+00 mrem/yr at t = 900.0 ± 0.9 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.0 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.0 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	3.762E+00	0.6844	2.448E-03	0.0004	2.133E-03	0.0004	4.433E-01	0.0806	2.373E-03	0.0004	4.898E-03	0.0009	4.217E+00	0.7672
U-235	2.777E-01	0.0505	1.412E-04	0.0000	0.000E+00	0.0000	3.278E-02	0.0060	4.044E-04	0.0001	1.022E-04	0.0000	3.112E-01	0.0566
U-238	8.651E-01	0.1574	8.071E-05	0.0000	7.420E-07	0.0000	1.021E-01	0.0186	3.953E-04	0.0001	1.150E-03	0.0002	9.688E-01	0.1762
Total	4.905E+00	0.8923	2.670E-03	0.0005	2.134E-03	0.0004	5.781E-01	0.1052	3.173E-03	0.0006	6.150E-03	0.0011	5.497E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : PG-8-08 Default Parameters File: A:\SCEN#7A.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	1200.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	4.872E+00	4.720E+00	4.430E+00	3.548E+00	1.884E+00	2.120E-01	8.413E+00	1.125E+01	1.178E+01	3.165E+00
M(t):	1.624E-01	1.573E-01	1.477E-01	1.183E-01	6.280E-02	7.068E-03	2.804E-01	3.750E-01	3.928E-01	1.055E-01

Maximum TDOSE(t): 1.178E+01 mrem/yr at t = 900.9 ± 0.9 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.9 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 900.9 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.525E+00	0.6386	4.905E-03	0.0004	4.275E-03	0.0004	1.478E+00	0.1254	9.499E-03	0.0008	1.959E-02	0.0017	9.041E+00	0.7672
U-235	5.547E-01	0.0471	2.816E-04	0.0000	0.000E+00	0.0000	1.091E-01	0.0093	1.619E-03	0.0001	4.086E-04	0.0000	6.661E-01	0.0565
U-238	1.730E+00	0.1468	1.614E-04	0.0000	1.488E-06	0.0000	3.403E-01	0.0289	1.581E-03	0.0001	4.600E-03	0.0004	2.077E+00	0.1762
Total	9.810E+00	0.8325	5.348E-03	0.0005	4.276E-03	0.0004	1.927E+00	0.1635	1.270E-02	0.0011	2.460E-02	0.0021	1.178E+01	1.0000

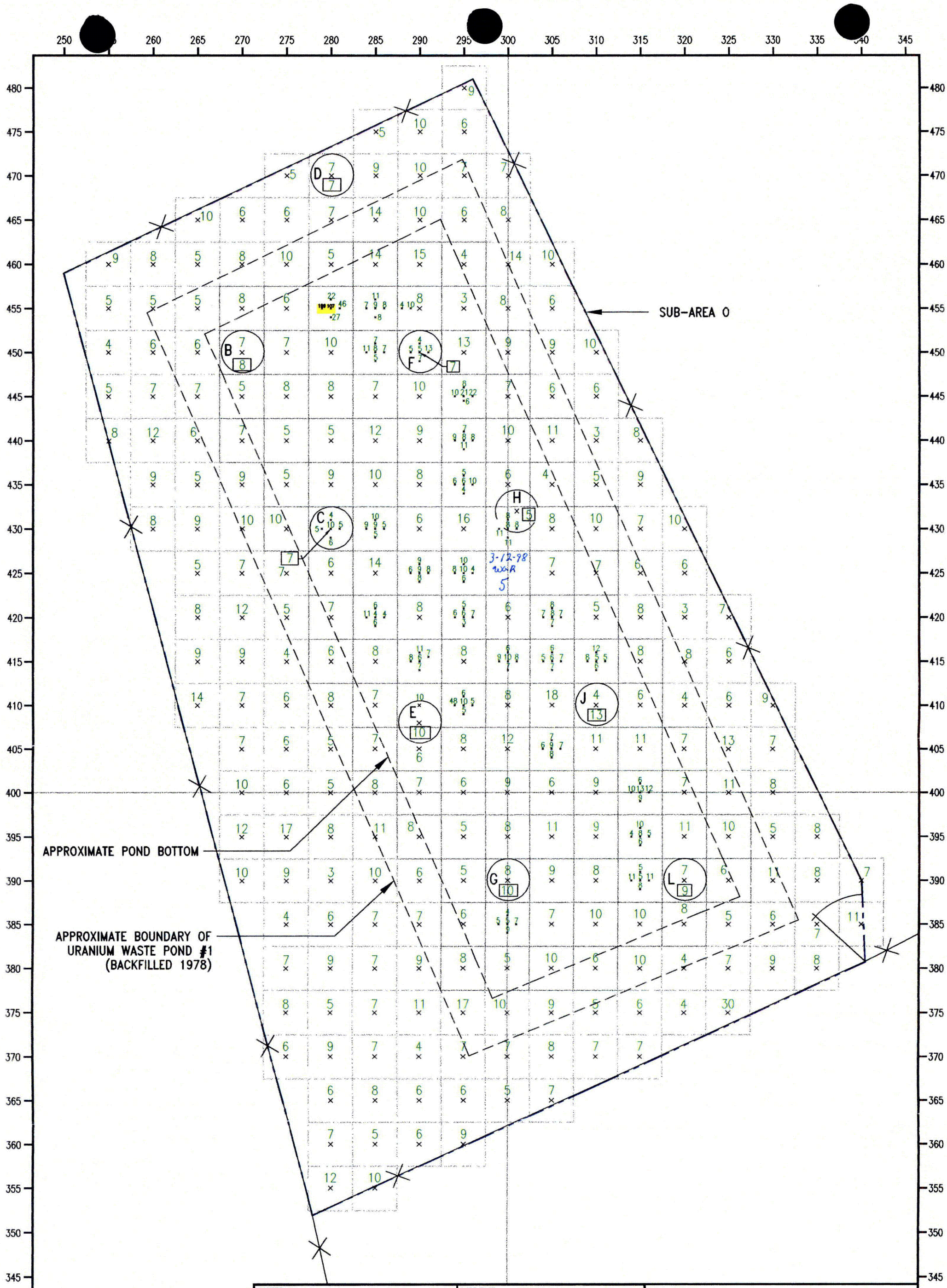
*Sum of all water independent and dependent pathways.

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	150.00 square meters	U-234	2.370E+01
Thickness:	0.30 meters	U-235	5.000E-01
Cover Depth:	0.00 meters	U-238	6.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	9.000E+02	1.000E+03
TDOSE(t):	3.702E+00	3.588E+00	3.370E+00	2.705E+00	1.447E+00	1.679E-01	9.028E-01	1.207E+00	1.264E+00	3.397E-01
M(t):	1.234E-01	1.196E-01	1.123E-01	9.018E-02	4.822E-02	5.596E-03	3.009E-02	4.023E-02	4.214E-02	1.132E-02

Maximum TDOSE(t): 3.702E+00 mrem/yr at t = 0.000E+00 years



NOTES
URANIUM (pCi/G U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.

SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.

ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
- URANIUM 1 – 94 pCi/g U
- URANIUM 95 – 219 pCi/g U
- URANIUM > 219 pCi/g U
- 1993 DEEP DRILLING SOIL SAMPLE RESULTS
- HIT ROCK– NO SAMPLE

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

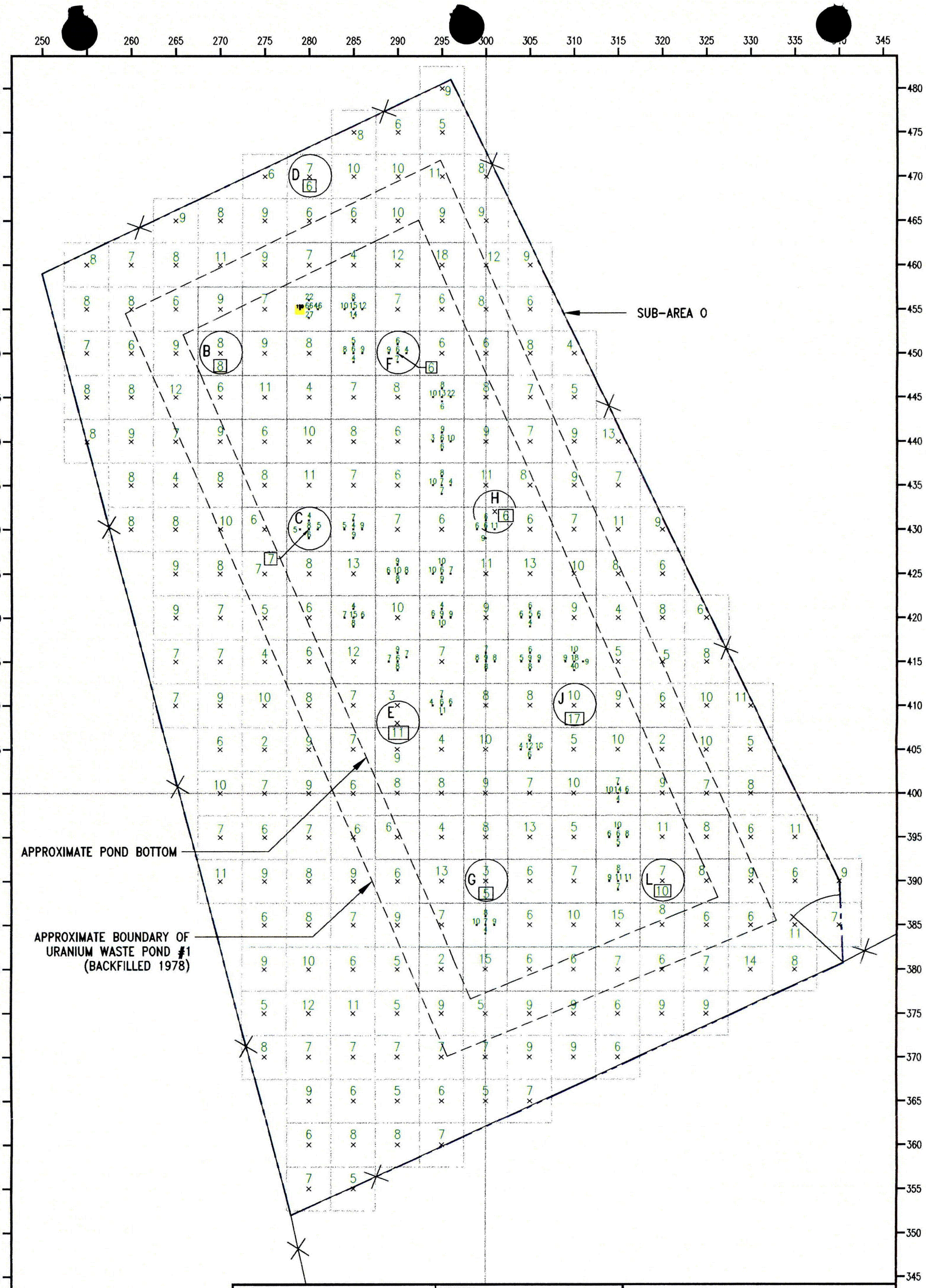
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 0 – 1'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP1SS-0	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
URANIUM 1 – 94 pCi/g U
URANIUM 95 – 219 pCi/g U
URANIUM > 219 pCi/g U
1993 DEEP DRILLING SOIL SAMPLE RESULTS
HIT ROCK– NO SAMPLE

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

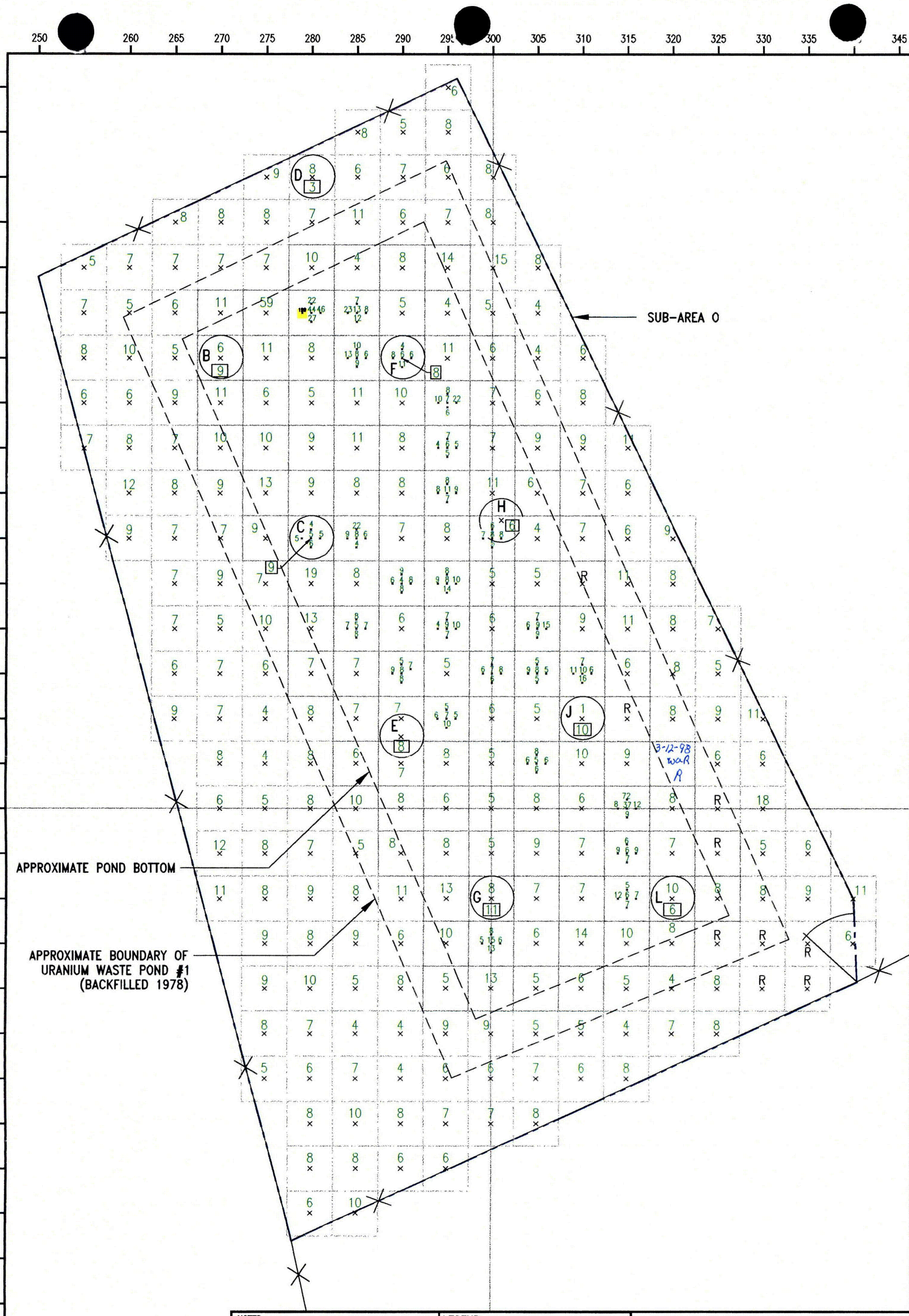
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 1' – 2'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP1SS-1	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
6 URANIUM 1 – 94 pCi/g U
120 URANIUM 95 – 219 pCi/g U
245 URANIUM > 219 pCi/g U
R HIT ROCK– NO SAMPLE
25 1993 DEEP DRILLING SOIL SAMPLE RESULTS

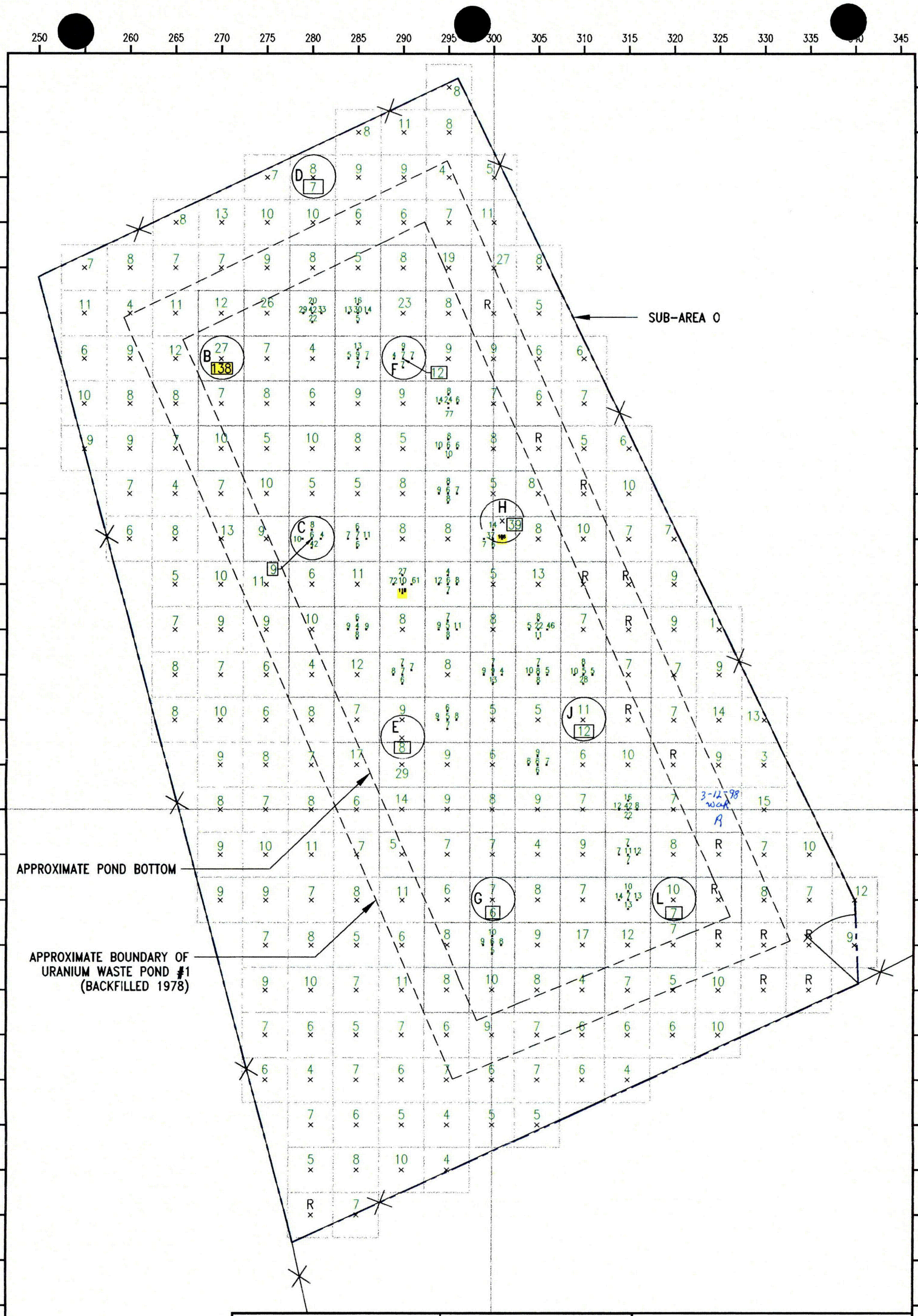
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 2' – 3'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP1SS-2	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES

URANIUM (pCi/G U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.

SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.

ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND

- URANIUM 1 – 94 pCi/g U
- URANIUM 95 – 219 pCi/g U
- URANIUM > 219 pCi/g U
- 1993 DEEP DRILLING SOIL SAMPLE RESULTS
- R HIT ROCK– NO SAMPLE

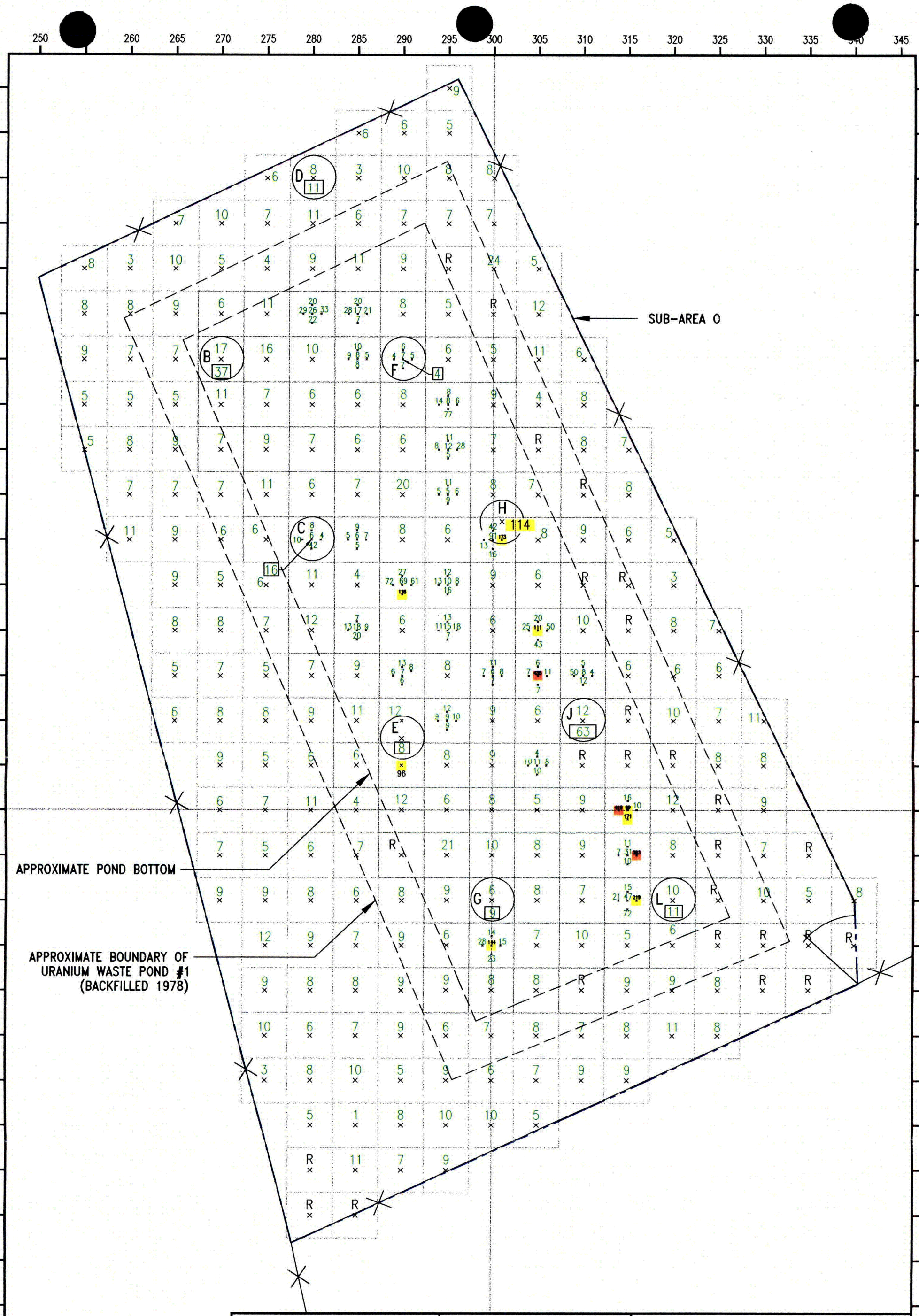
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 3' – 4'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP1SS–3	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES

URANIUM (pCi/G U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.

SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.

ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND

6 URANIUM 1 – 94 pCi/g U

120 URANIUM 95 – 219 pCi/g U

245 URANIUM > 219 pCi/g U

25 1993 DEEP DRILLING SOIL SAMPLE RESULTS

R HIT ROCK– NO SAMPLE

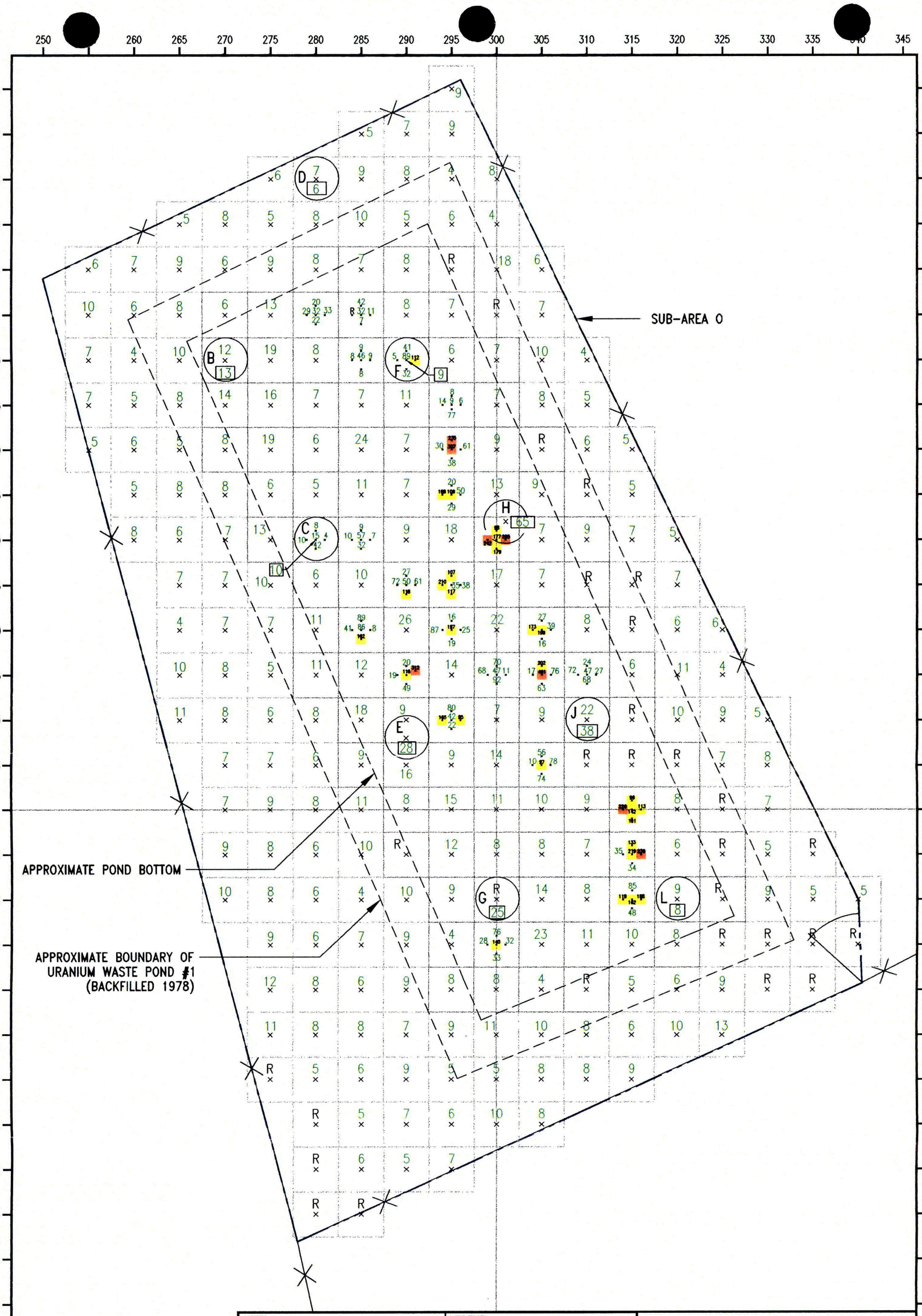
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA 0
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 4' – 5'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP1SS-4	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
6 URANIUM 1 – 94 pCi/g U
120 URANIUM 95 – 219 pCi/g U
245 URANIUM > 219 pCi/g U
25 1993 DEEP DRILLING SOIL SAMPLE RESULTS
B HIT ROCK– NO SAMPLE

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

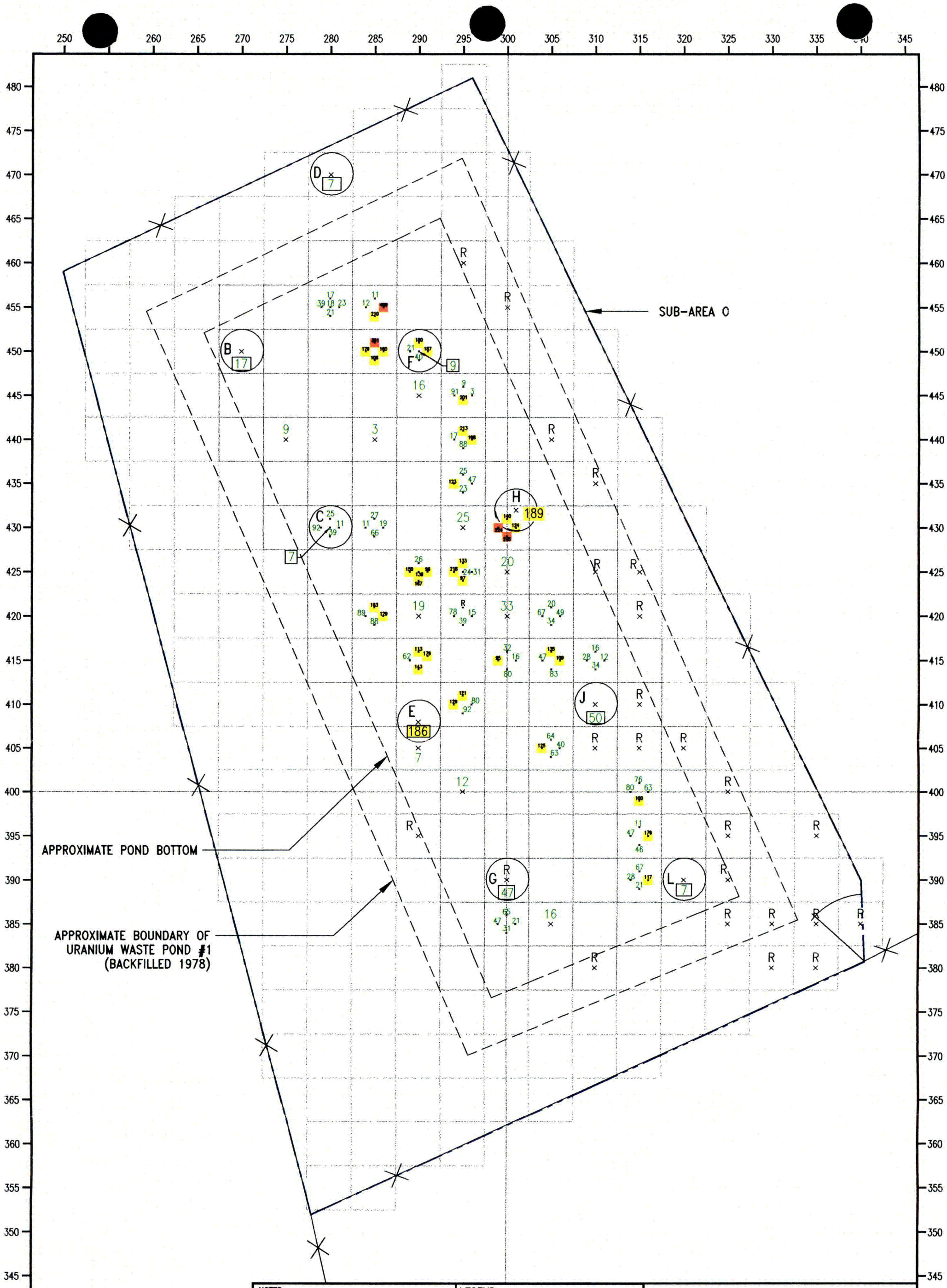
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 5' – 6'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP1SS-5	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
6 URANIUM 1 – 94 pCi/g U
120 URANIUM 95 – 219 pCi/g U
245 URANIUM > 219 pCi/g U
R HIT ROCK– NO SAMPLE
25 1993 DEEP DRILLING SOIL SAMPLE RESULTS

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

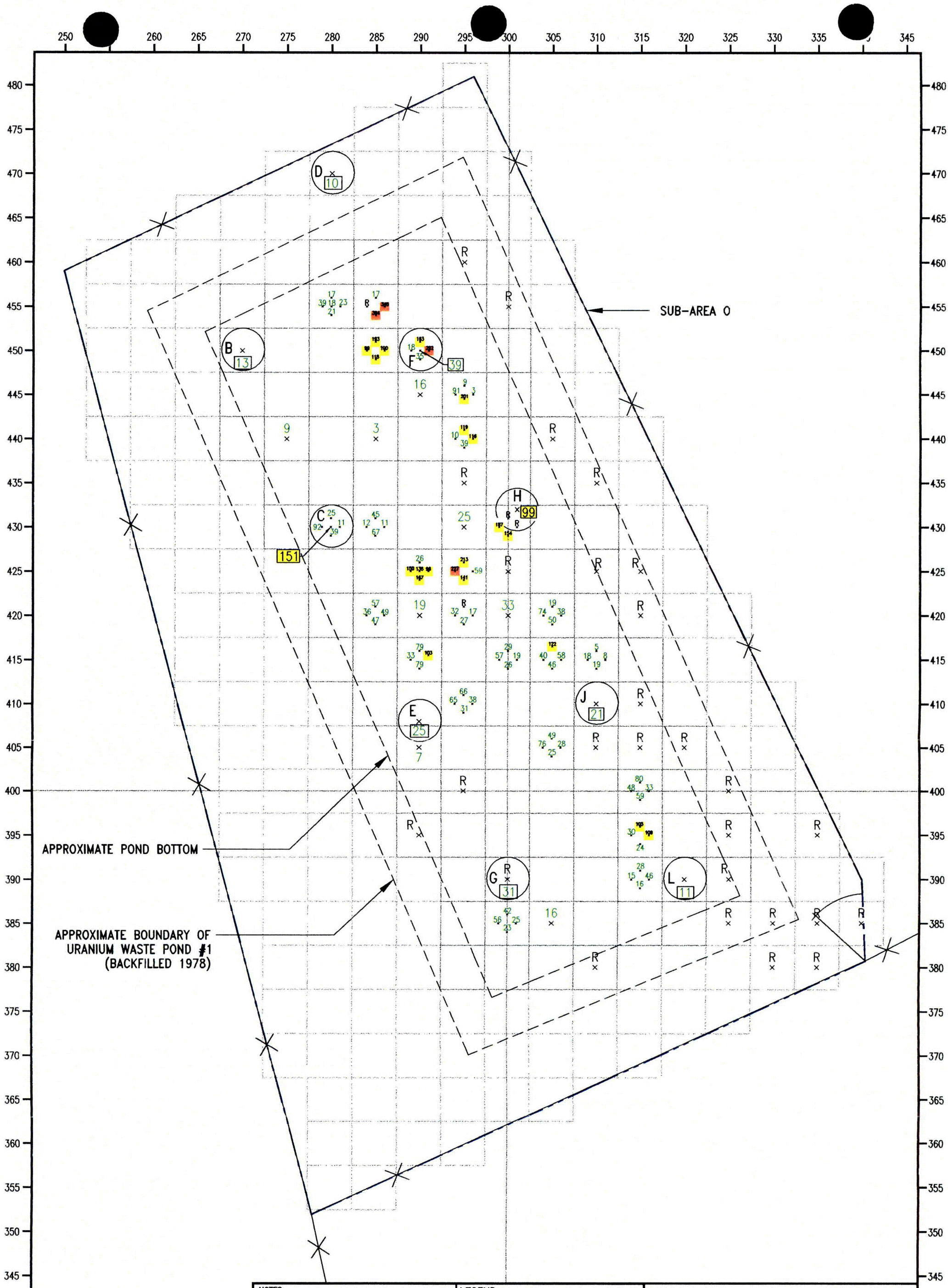
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 6' – 7'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP1SS-6	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
URANIUM 1 – 94 pCi/g U
URANIUM 95 – 219 pCi/g U
URANIUM > 219 pCi/g U
HIT ROCK– NO SAMPLE
1993 DEEP DRILLING SOIL SAMPLE RESULTS

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

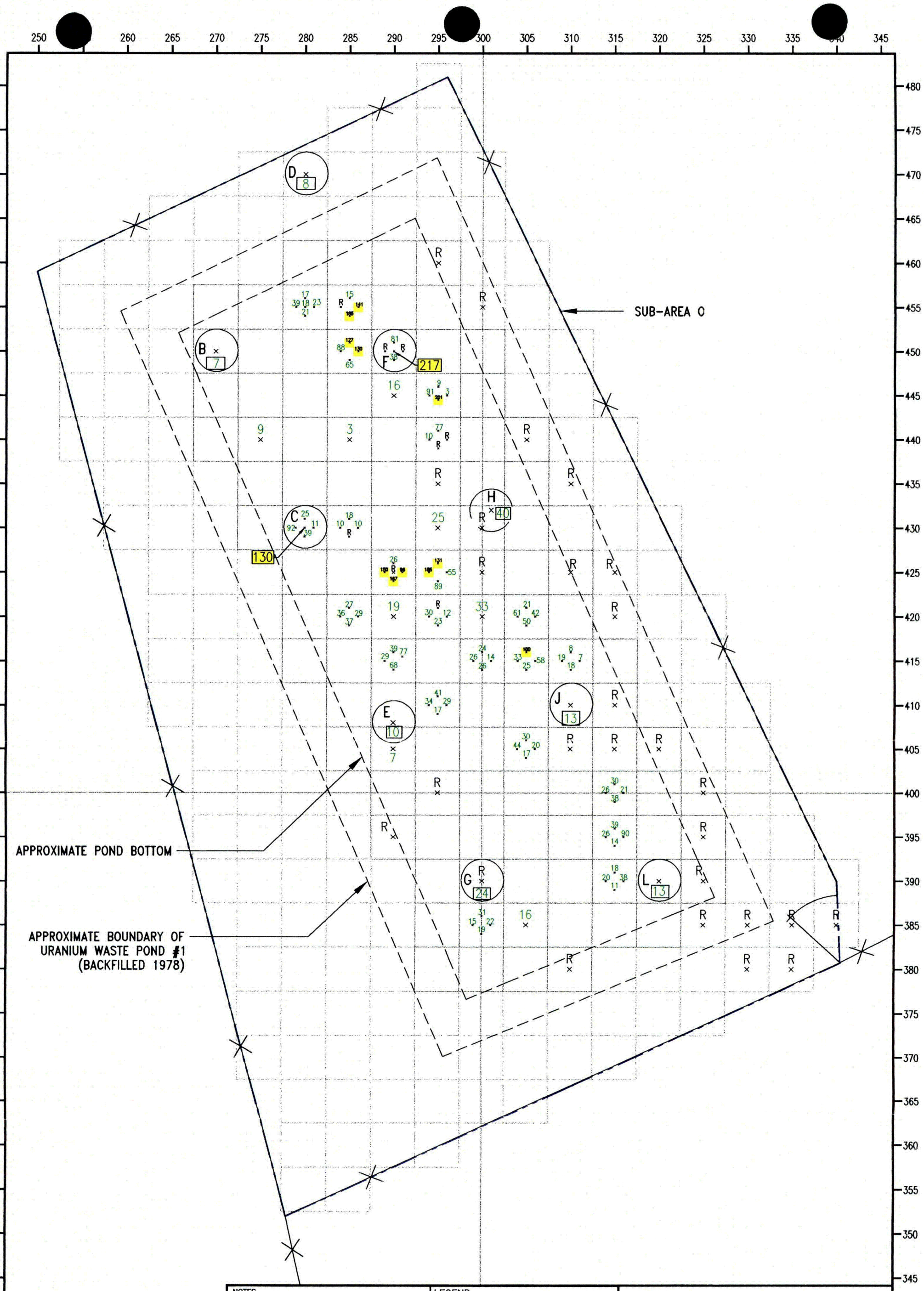
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 7' – 8'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP1SS-7	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
URANIUM 1 – 94 pCi/g U
URANIUM 95 – 219 pCi/g U
URANIUM > 219 pCi/g U
HIT ROCK– NO SAMPLE
1993 DEEP DRILLING SOIL SAMPLE RESULTS

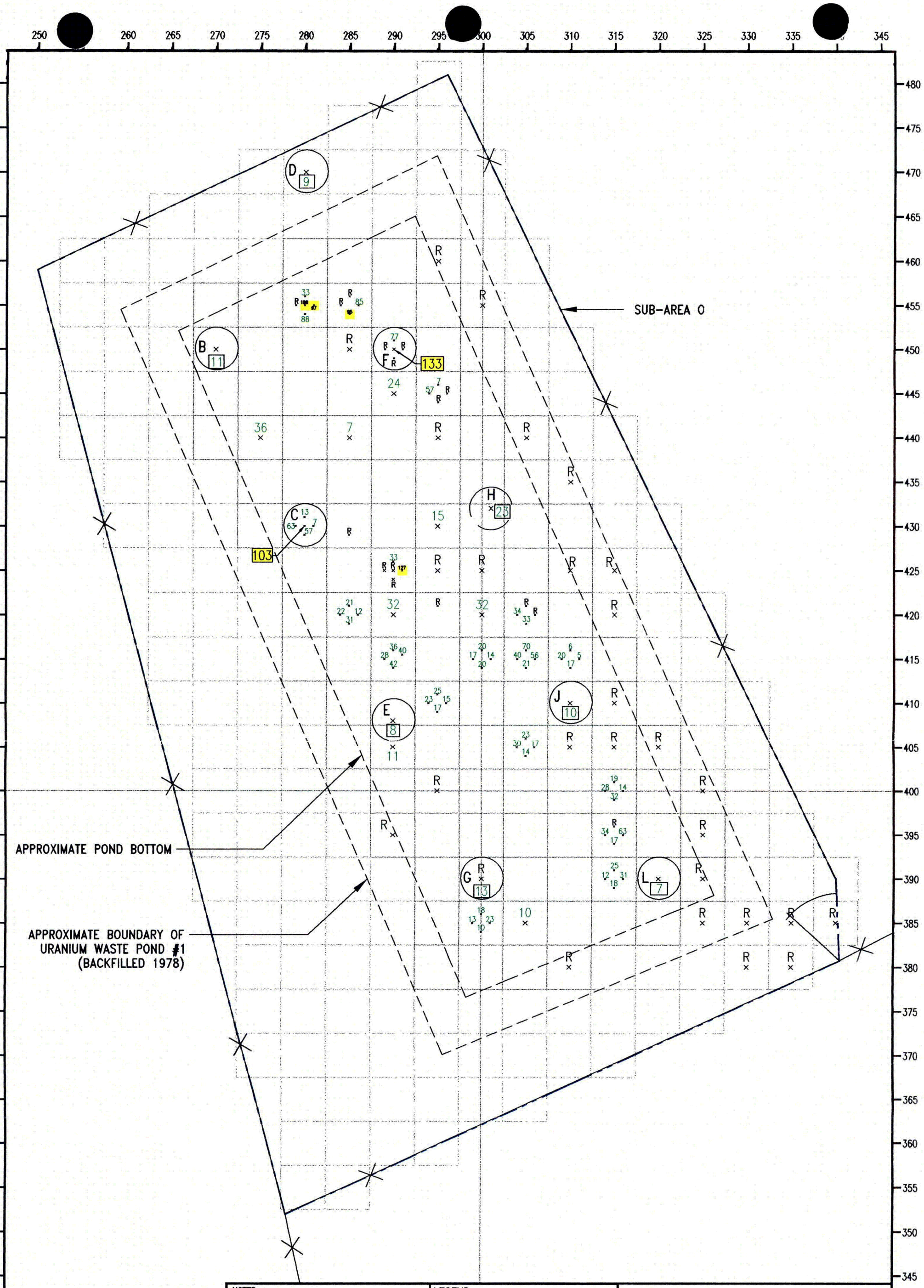
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 8' – 9'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP1SS-8	0

...\UPOND1\PRE-REM\97PRP1SS



NOTES
URANIUM (pCi/G U).
CIMARRON GAMMA SPEC SOIL COUNTER.
SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.
SAMPLES INCLUDE THOSE TAKEN ON A 5 METER X 5 METER GRID & THE OFFSET DATA.
ITEMS B, C, D, E, F, G, H, J AND L ARE DEEP DRILLING RESULTS

LEGEND
URANIUM 1 – 94 pCi/g U
URANIUM 95 – 219 pCi/g U
URANIUM > 219 pCi/g U
1993 DEEP DRILLING SOIL SAMPLE RESULTS
HIT ROCK– NO SAMPLE

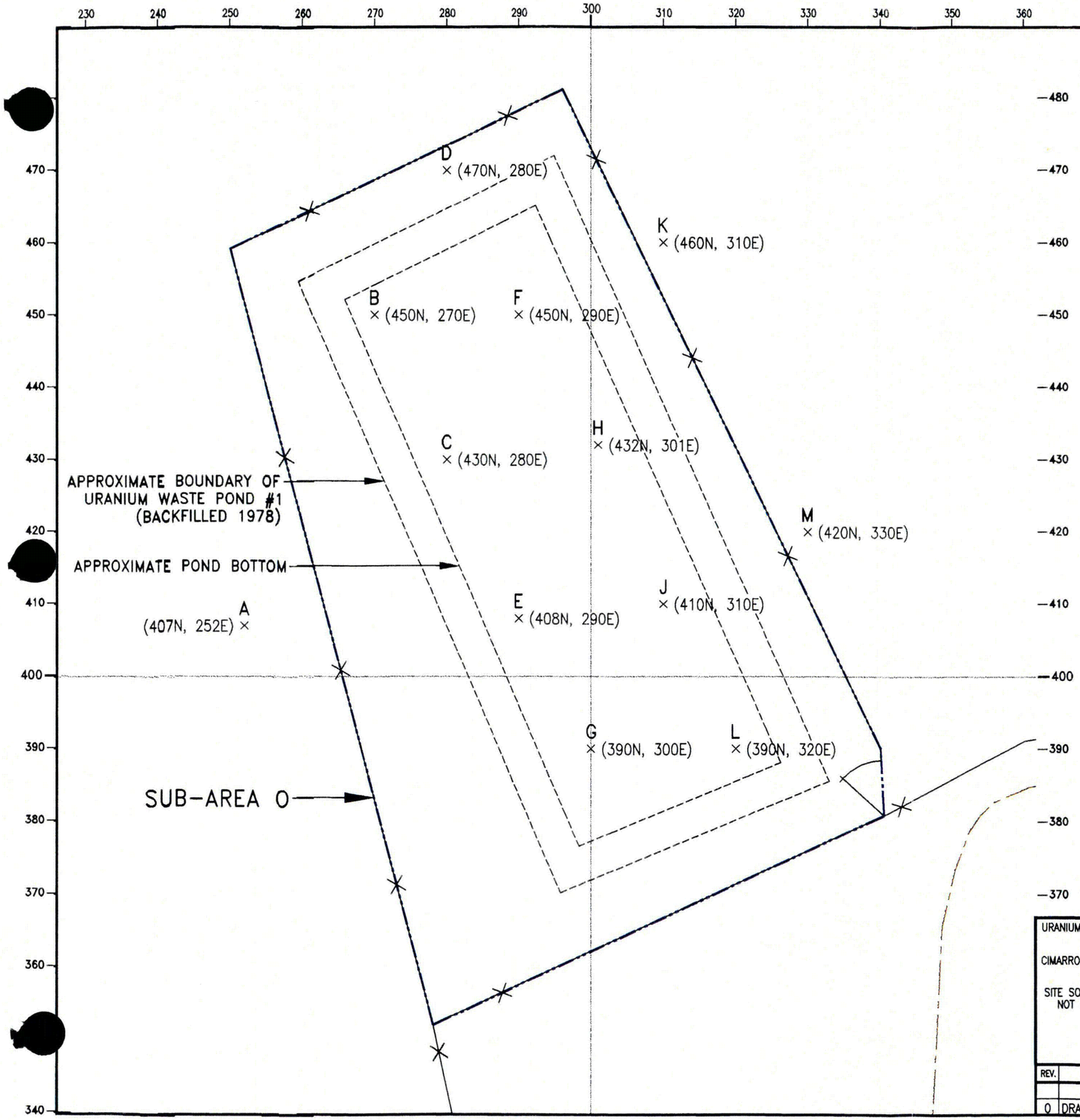
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #1
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 9' – 10'

DRWN. BY	DATE	SCALE:
JE	11/28/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP1SS-9	0

...\UPOND1\PRE-REM\97PRP1SS



SOIL SAMPLE ALIQUOT	A	B	C	D	E	F	G	H	J	K	L	M
0 – 1 Ft.	9	8	7	7	10	7	10	5	13	8	9	8
1 Ft. – 2 Ft.	12	8	7	6	11	6	5	6	17	10	10	7
2 Ft. – 3 Ft.	7	9	9	3	8	8	11	6	10	7	6	10
3 Ft. – 4 Ft.	9	138	9	7	8	12	6	39	12	7	7	6
4 Ft. – 5 Ft.	9	37	16	11	8	4	9	114	63	9	11	10
5 Ft. – 6 Ft.	12	13	10	6	28	9	25	65	38	8	8	5
6 Ft. – 7 Ft.	4	17	7	7	186	9	47	189	50	9	7	5
7 Ft. – 8 Ft.	10	13	151	10	25	39	31	99	21	6	11	6
8 Ft. – 9 Ft.	10	7	130	8	10	217	24	40	13	5	13	5
9 Ft. – 10 Ft.	10	11	103	9	8	133	13	23	10	7	7	5
10 Ft. – 11 Ft.	10	14	21	4	23	27	16	R	R	3	7	4
11 Ft. – 12 Ft.	13	7	17	5	9	20	R	R	R	6	R	7

15 0 15
SCALE IN METERS

NORTH

URANIUM (pCi/g U)

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.

LEGEND

- 6 × URANIUM 1 – 94 pCi/g U
- 120 × URANIUM 95 – 219 pCi/g U
- 245 × URANIUM > 219 pCi/g U
- R × HIT ROCK NO SAMPLE

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	3/2/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA 0
URANIUM DEEP DRILLING
SOIL SAMPLE RESULTS

DRWN. BY	DATE	SCALE:
JE	9/26/96	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	96PRP1DD-0	0

...\DEEPDRL\96PRP1DD

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1

GRID LOCATION : 255E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U
1	255	E	-	440	N	8	8	7	9	5	5			
2	255	E	-	445	N	5	8	6	10	5	7			
3	255	E	-	450	N	4	7	8	6	9	7			
4	255	E	-	455	N	5	8	7	11	8	10			
5	255	E	-	460	N	9	8	5	7	8	6			
6	260	E	-	430	N	8	8	9	6	11	8			
7	260	E	-	435	N	9	8	12	7	7	5			
8	260	E	-	440	N	12	9	8	9	8	6			
9	260	E	-	445	N	7	8	6	8	5	5			
10	260	E	-	450	N	6	6	10	9	7	4			
11	260	E	-	455	N	5	8	5	4	8	6			
12	260	E	-	460	N	8	7	7	8	3	7			
13	265	E	-	410	N	14	7	9	8	6	11			
14	265	E	-	415	N	9	7	6	8	5	10			
15	265	E	-	420	N	8	9	7	7	8	4			
16	265	E	-	425	N	5	9	7	5	9	7			
17	265	E	-	430	N	9	8	7	8	9	6			
18	265	E	-	435	N	5	4	8	4	7	8			
19	265	E	-	440	N	6	7	7	7	9	5			
20	265	E	-	445	N	7	12	9	8	5	8			
21	265	E	-	450	N	6	9	5	12	7	10			
22	265	E	-	455	N	5	6	6	11	9	8			
23	265	E	-	460	N	5	8	7	7	10	9			
24	265	E	-	465	N	10	9	8	8	7	5			
25														

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 1
FILE: WP1AOCSSR

W. A. Rogers

DATE: 3-11-98

CIMARRON CO[illegible]RATION
CIMARRON F[illegible]ILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 270E

DATE: 3/9/98

LN #	GRID NUMBE					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	270	E	-	390	N	10	11	11	9	9	10				
2	270	E	-	395	N	12	7	12	9	7	9				
3	270	E	-	400	N	10	10	6	8	6	7				
4	270	E	-	405	N	7	6	8	9	9	7				
5	270	E	-	410	N	7	9	7	10	8	8				
6	270	E	-	415	N	9	7	7	7	7	8				
7	270	E	-	420	N	12	7	5	9	8	7				
8	270	E	-	425	N	7	8	9	10	5	7				
9	270	E	-	430	N	10	10	7	13	6	7				
10	270	E	-	435	N	9	8	9	7	7	8				
11	270	E	-	440	N	7	9	10	10	7	8				
12	270	E	-	445	N	5	6	11	7	11	14				
13	270	E	-	450	N	8	8	9	27	37	13	17	13	7	11
14	270	E	-	455	N	8	9	11	12	6	6				
15	270	E	-	460	N	8	11	7	7	5	6				
16	270	E	-	465	N	6	8	8	13	10	8				
17		E	-		N										
18		E	-		N										
19		E	-		N										
20		E	-		N										
21		E	-		N										
22		E	-		N										
23		E	-		N										
24		E	-		N										
25															

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 2
FILE: WP1AOCSSR

W. A. Rogers

DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 275E

DATE: 3/9/98

LN #	GRID NUMBE					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	275	E	-	370	N	6	8	5	6	3	R				
2	275	E	-	375	N	8	5	8	7	10	11				
3	275	E	-	380	N	7	9	9	9	9	12				
4	275	E	-	385	N	4	6	9	7	12	9				
5	275	E	-	390	N	9	9	8	9	9	8				
6	275	E	-	395	N	17	6	8	10	5	8				
7	275	E	-	400	N	6	7	5	7	7	9				
8	275	E	-	405	N	6	2	4	8	5	7				
9	275	E	-	410	N	6	10	4	6	8	6				
10	275	E	-	415	N	4	4	6	6	5	5				
11	275	E	-	420	N	5	5	10	9	7	7				
12	275	E	-	425	N	7	7	7	11	6	10				
13	275	E	-	430	N	10	6	9	9	6	13				
14	275	E	-	435	N	5	8	13	10	11	6				
15	275	E	-	440	N	5	6	10	5	9	19	9	9	9	36
16	275	E	-	445	N	8	11	6	8	7	16				
17	275	E	-	450	N	7	9	11	7	16	19				
18	275	E	-	455	N	6	7	59	26	11	13				
19	275	E	-	460	N	10	9	7	9	4	9				
20	275	E	-	465	N	6	9	8	10	7	5				
21	275	E	-	470	N	5	6	9	7	6	6				
22	279	E	-	430	N	5	5	5	10	10	10	92	92	92	63
23	279	E	-	455	N	199	199	199	29	29	29	39	39	39	R
24		E	-		N										
25															

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	**MDA**
Total U 4	10
Th (Nat) 1.5	1

PAGE 3
FILE: WP1AOCSSR

W. A. Rogers

DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 280E

DATE: 3/9/98

LN #	GRID NUMBE					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	280	E	-	355	N	12	7	6	R	R	R				
2	280	E	-	360	N	7	6	8	5	R	R				
3	280	E	-	365	N	6	9	8	7	5	R				
4	280	E	-	370	N	9	7	6	4	8	5				
5	280	E	-	375	N	5	12	7	6	6	8				
6	280	E	-	380	N	9	10	10	10	8	8				
7	280	E	-	385	N	6	8	8	8	9	6				
8	280	E	-	390	N	3	8	9	7	8	6				
9	280	E	-	395	N	8	7	7	11	6	6				
10	280	E	-	400	N	5	9	8	8	11	8				
11	280	E	-	405	N	5	9	8	7	6	6				
12	280	E	-	410	N	8	8	8	8	9	8				
13	280	E	-	415	N	6	6	7	4	7	11				
14	280	E	-	420	N	7	6	13	10	12	11				
15	280	E	-	425	N	6	8	19	6	11	6				
16	280	E	-	429	N	6	6	6	42	42	42	39	39	39	57
17	280	E	-	430	N	7	7	9	9	6	15	7	151	130	103
18	280	E	-	431	N	4	4	4	8	8	8	25	25	25	13
19	280	E	-	435	N	9	11	9	5	6	5				
20	280	E	-	440	N	5	10	9	10	7	6				
21	280	E	-	445	N	8	4	5	6	6	7				
22	280	E	-	450	N	10	8	8	4	10	8				
23	280	E	-	454	N	27	27	27	22	22	22	21	21	21	88
24	280	E	-	455	N	107	66	44	42	26	32	18	18	18	188
25	280	E	-	456	N	22	22	22	20	20	20	17	17	17	33

INSTRUMENTS:

	BACKGROUND	**MDA**
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTO	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

PAGE 4
FILE: WP1AOCSSR

W. A. Rogers

DATE: 3-11-98

CIMARRON CORPORATION

CIMARRON FACILITY

PHASE III, SUB-AREA "O"

WASTE POND NO. 1

CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1

GRID LOCATION : 280E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	280	E	-	460	N	5	7	10	8	9	8				
2	280	E	-	465	N	7	6	7	10	11	8				
3	280	E	-	470	N	7	7	8	8	8	7	7	10	8	9
4	281	E	-	430	N	5	5	5	4	4	4	11	11	11	7
5	281	E	-	455	N	46	46	46	33	33	33	23	23	23	97
6	284	E	-	420	N	11	7	7	9	13	41	89	36	36	22
7	284	E	-	430	N	9	5	9	7	5	10	11	12	10	
8	284	E	-	450	N	11	8	13	5	9	8	179	99	88	
9	284	E	-	455	N	7	10	23	13	28	R	R	R	R	R
10	285	E	-	355	N	10	5	10	7	R	R				
11	285	E	-	360	N	5	8	8	8	11	6				
12	285	E	-	365	N	8	6	10	6	1	5				
13	285	E	-	370	N	7	7	7	7	10	6				
14	285	E	-	375	N	7	11	4	5	7	8				
15	285	E	-	380	N	7	6	5	7	8	6				
16	285	E	-	385	N	7	7	9	5	7	7				
17	285	E	-	390	N	10	9	8	8	6	4				
18	285	E	-	395	N	11	6	5	7	7	10				
19	285	E	-	400	N	8	6	10	6	4	11				
20	285	E	-	405	N	7	7	6	17	6	9				
21	285	E	-	410	N	7	7	7	7	11	18				
22	285	E	-	415	N	8	12	7	12	9	12				
23	285	E	-	419	N	6	8	8	8	20	162	88	47	37	31
24	285	E	-	420	N	4	15	5	4	18	86				
25	285	E	-	421	N	6	4	8	6	7	89	163	57	27	
26	285	E	-	425	N	14	13	8	11	4	10				

INSTRUMENTS:

CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 4A

FILE: WP1AOCSSR

W. A. Rogers DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 285E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	285	E	-	425	N	14	13	8	11	4	10				
2	285	E	-	429	N	5	9	4	6	5	32	66	67	R	R
3	285	E	-	430	N	9	4	8	7	6	57				
4	285	E	-	431	N	10	7	22	6	9	9	27	45	18	
5	285	E	-	435	N	10	7	8	5	7	11				
6	285	E	-	440	N	12	8	11	8	6	24	3	3	3	7
7	285	E	-	445	N	7	7	11	9	6	7				
8	285	E	-	449	N	5	4	9	7	8	8	106	118	65	
9	285	E	-	450	N	8	6	8	9	8	46	R			
10	285	E	-	451	N	7	5	10	13	10	9	391	193	127	
11	285	E	-	454	N	8	14	12	5	7	7	210	384	185	95
12	285	E	-	455	N	9	15	13	30	17	32				
13	285	E	-	456	N	11	8	7	16	20	42	11	17	15	R
14	285	E	-	460	N	14	4	4	5	11	7				
15	285	E	-	465	N	14	6	11	6	6	10				
16	285	E	-	470	N	9	10	6	9	3	9				
17	285	E	-	475	N	5	8	8	8	6	5				
18	286	E	-	420	N	4	6	7	9	9	8	129	49	29	12
19	286	E	-	430	N	5	9	6	11	7	7	19	11	10	
20	286	E	-	450	N	7	9	6	7	5	9	160	190	130	
21	286	E	-	455	N	8	12	8	14	21	11	499	345	141	85
22	288	E	-	455	N	4									
23		E	-		N										
24		E	-		N										
25		E	-		N										

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR
BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 5
FILE: WP1AOCSSR

W. A. Rogers

DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 289E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g									
						0 - 1'	1' - 2'	2' - 3'	3' - 4'	4' - 5'	5' - 6'	6' - 7'	7' - 8'	8' - 9'	9' - 10'
						Total-U	Total-U	Total-U	Total-U	Total-U	Total-U	Total-U	Total-U	Total-U	Total-U
1	289	E	-	415	N	8	7	9	8	6	19	62	33	29	28
2	289	E	-	425	N	6	6	6	72	72	72	150	150	150	R
3	289	E	-	450	N	5	9	8	4	4	5	21	18	R	R
4	290	E	-	360	N	6	8	6	10	7	5				
5	290	E	-	365	N	6	5	8	5	8	7				
6	290	E	-	370	N	4	7	4	6	5	9				
7	290	E	-	375	N	11	5	4	7	9	7				
8	290	E	-	380	N	9	5	8	11	9	9				
9	290	E	-	385	N	7	9	6	6	9	9				
10	290	E	-	390	N	6	6	11	11	8	10				
11	290	E	-	395	N	8	6	8	5	R	R	R	R	R	R
12	290	E	-	400	N	7	8	8	14	12	8				
13	290	E	-	405	N	6	9	7	29	96	16	7	7	7	11
14	290	E	-	408	N	10	11	8	8	8	28	186	25	10	8
15	290	E	-	410	N	10	3	7	9	12	9				
16	290	E	-	414	N	7	8	8	6	6	49	143	79	68	42
17	290	E	-	415	N	6	6	8	7	7	116				
18	290	E	-	416	N	11	9	5	7	13	20	113	79	39	36
19	290	E	-	420	N	8	10	6	8	6	26	19	19	19	32
20	290	E	-	424	N	8	8	8	118	118	118	167	167	167	R
21	290	E	-	425	N	9	10	4	10	69	50	136	136	R	R
22	290	E	-	426	N	9	9	9	27	27	27	26	26	26	33
23	290	E	-	430	N	6	7	7	8	8	9				
24	290	E	-	435	N	8	6	8	8	20	7				
25		E	-		N										

INSTRUMENTS:

CIMMARON SOIL COUNTER 4" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 5A

W. A. Rogers DATE: 3-11-98

FILE: WP1AOCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 290E
DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	290	E	-	440	N	9	6	8	5	6	7				
2	290	E	-	445	N	10	8	10	9	8	11	16	16	16	24
3	290	E	-	449	N	7	7	11	7	7	32	40	35	38	R
4	290	E	-	450	N	7	6	8	7	7	9	9	39	217	133
5	290	E	-	451	N	4	6	4	9	6	41	180	163	81	77
6	290	E	-	455	N	8	7	5	23	8	8				
7	290	E	-	460	N	15	12	8	8	9	8				
8	290	E	-	465	N	10	10	6	6	7	5				
9	290	E	-	470	N	10	10	7	9	10	8				
10	290	E	-	475	N	10	6	5	11	6	7				
11	291	E	-	415.5	N	7	7	7	7	8	312	176	103	77	40
12	291	E	-	425	N	8	8	8	61	61	61	96	96	96	127
13	291	E	-	450	N	13	4	6	7	5	112	187	292	R	R
14	294	E	-	410	N	48	4	6	9	9	165	129	65	34	23
15	294	E	-	420	N	6	6	4	9	11	87	78	32	30	
16	294	E	-	425	N	8	10	9	12	13	210	218	227	186	
17	294	E	-	435	N	6	10	8	9	5	168	123			
18	294	E	-	440	N	9	3	4	10	8	30	17	10	10	
19	294	E	-	445	N	10	10	10	14	14	14	91	91	91	57
20		E	-		N										
21		E	-		N										
22		E	-		N										
23		E	-		N										
24		E	-		N										
25		E	-		N										10

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 6

W. A. Rogers DATE: 3-11-98

FILE: WP1AOCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 295E

DATE: 3/9/98

LN #	GRID NUMBE					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	295	E	-	360	N	9	7	6	4	9	7				
2	295	E	-	365	N	6	6	7	4	10	6				
3	295	E	-	370	N	7	7	6	7	9	5				
4	295	E	-	375	N	17	9	9	6	6	9				
5	295	E	-	380	N	8	2	5	8	9	8				
6	295	E	-	385	N	6	7	10	8	6	4				
7	295	E	-	390	N	5	13	13	6	9	9				
8	295	E	-	395	N	5	4	8	7	21	12				
9	295	E	-	400	N	6	8	6	9	6	15	12	R	R	R
10	295	E	-	405	N	8	4	8	9	8	9				
11	295	E	-	409	N	5	11	10	7	9	22	92	31	17	17
12	295	E	-	410	N	10	6	7	5	9	42				
13	295	E	-	411	N	6	7	5	6	12	80	121	66	41	25
14	295	E	-	415	N	8	7	5	8	8	14				
15	295	E	-	419	N	3	10	7	8	7	19	39	27	23	
16	295	E	-	420	N	6	9	9	5	15	197				
17	295	E	-	421	N	5	4	7	7	13	16	R	R	R	R
18	295	E	-	424	N	6	9	14	7	16	117	97	141	89	
19	295	E	-	425	N	10	6	8	6	10	35	24	R		
20	295	E	-	426	N	10	10	8	4	12	107	133	213	131	
21	295	E	-	430	N	16	6	8	8	6	18	25	25	25	15
22	295	E	-	434	N	4	7	7	8	9	29	23			
23	295	E	-	435	N	6	7	11	6	5	109	R	R		
24	295	E	-	436	N	5	8	8	8	11	20	25			
25	295	E	-	439	N	11	6	5	10	5	38	88	39	R	

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR
BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 7
FILE: WP1AOCSSR

W. A. Rogers

DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 295E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	295	E	-	440	N	8	6	6	6	12	307	R			
2	295	E	-	441	N	7	9	7	8	11	235	213	119	77	
3	295	E	-	444.5	N	6	6	6	77	77	77	201	201	201	
4	295	E	-	445	N	21	13	7	24	8	9				
5	295	E	-	446	N	8	8	8	8	8	8	9	9	9	7
6	295	E	-	450	N	13	6	11	9	6	6				
7	295	E	-	455	N	3	6	4	8	5	7				
8	295	E	-	460	N	4	18	14	19	R	R	R	R	R	R
9	295	E	-	465	N	6	9	7	7	7	6				
10	295	E	-	470	N	7	11	6	4	8	4				
11	295	E	-	475	N	6	5	8	8	5	9				
12	295	E	-	480	N	9	9	6	8	9	9				
13	296	E	-	410	N	5	6	5	8	10	95	80	38	29	15
14	296	E	-	420	N	7	9	10	11	18	25	15	17	12	
15	296	E	-	425	N	4	7	10	8	8	38	31	59	55	
16	296	E	-	435	N	10	4	9	7	6	50	47			
17	296	E	-	440	N	8	10	5	6	28	61	198	116	R	
18	296	E	-	445	N	22	22	22	6	6	6	3	3	3	R
19	299	E	-	385	N	5	10	5	9	28	28	47	56	15	13
20	299	E	-	415	N	9	8	6	9	7	68	95	57	26	17
21	299	E	-	430	N	11	6	7	7	13	242	224	187		
22		E	-		N										
23		E	-		N										
24		E	-		N										
25		E	-		N										

INSTRUMENTS:

BACKGROUND	**MDA**
Total U 4	10
Th (Nat) 1.5	1

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTO
BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 300E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	300	E	-	365	N	5	5	7	5	10	10				
2	300	E	-	370	N	7	7	6	6	6	5				
3	300	E	-	375	N	10	5	9	9	7	11				
4	300	E	-	380	N	5	15	13	10	8	8				
5	300	E	-	384	N	9	4	13	5	23	33	31	23	19	10
6	300	E	-	385	N	5	7	15	6	144	140				
7	300	E	-	386	N	4	8	8	10	14	76	65	42	31	18
8	300	E	-	390	N	8	5	8	7	9	25	47	31	24	13
9	300	E	-	395	N	8	8	5	7	10	8				
10	300	E	-	400	N	9	9	5	8	8	11				
11	300	E	-	405	N	12	10	5	6	9	14				
12	300	E	-	410	N	8	8	6	5	9	7				
13	300	E	-	414	N	7	8	6	13	7	92	80	26	26	20
14	300	E	-	415	N	10	9	7	9	6	47				
15	300	E	-	416	N	6	7	7	7	11	70	32	29	24	20
16	300	E	-	420	N	6	9	6	8	6	22	33	33	33	32
17	300	E	-	425	N	5	11	5	5	9	17	20	R	R	R
18	300	E	-	429	N	11	9	5	6	16	179	245	154		
19	300	E	-	430	N	8	6	8	37	91	177	R			
20	300	E	-	431	N	8	6	6	14	42	98	140	R		
21	300	E	-	435	N	6	11	11	5	8	13				
22	300	E	-	440	N	10	9	7	8	7	9				
23	300	E	-	445	N	7	8	7	7	9	7				
24	300	E	-	450	N	9	6	6	9	5	7				
25	300	E	-	455	N	8	8	5	R	R	R	R	R	R	R

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 9
FILE: WP1AOCSSR

W. G. Rogers

DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 300E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	300	E	-	460	N	14	12	15	27	24	18				
2	300	E	-	465	N	8	9	8	11	7	4				
3	300	E	-	470	N	7	8	8	5	8	8				
4	301	E	-	385	N	7	9	6	8	15	32	21	25	22	23
5	301	E	-	415	N	8	8	8	4	8	11	16	19	14	14
6	301	E	-	430	N	8	11	8	166	173	285	124	R		
7	301	E	-	432	N	5	6	6	39	114	65	189	99	40	23
8	304	E	-	405	N	6	4	6	8	10	10	125	76	44	30
9	304	E	-	415	N	5	5	9	10	7	17	47	40	33	40
10	304	E	-	420	N	7	6	6	5	25	173	67	74	61	34
11	305	E	-	365	N	7	7	8	5	5	8				
12	305	E	-	370	N	8	9	7	7	7	8				
13	305	E	-	375	N	9	9	5	7	8	10				
14	305	E	-	380	N	10	6	5	8	8	4				
15	305	E	-	385	N	7	6	6	9	7	23	16	16	16	10
16	305	E	-	390	N	9	6	7	8	8	14				
17	305	E	-	395	N	11	13	9	4	8	8				
18	305	E	-	400	N	6	7	8	9	5	10				
19	305	E	-	404	N	8	6	6	6	10	74	63	25	17	14
20	305	E	-	405	N	9	12	5	8	11	97				
21	305	E	-	406	N	7	9	8	9	4	56	64	49	30	23
22	305	E	-	410	N	18	8	5	5	6	9				
23	305	E	-	414	N	7	8	5	8	7	63	83	46	25	21
24	305	E	-	415	N	6	9	8	8	435	461				
25	305	E	-	416	N	6	6	5	7	6	202	135	122	100	70
26	305	E	-	419	N	7	4	9	11	43	16	34	50	50	33

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 10

W. Q. Rogers DATE: 3-11-98

FILE: WP1AOCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 305E
DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	305	E	-	420	N	8	5	9	22	111	199				
2	305	E	-	421	N	8	6	7	8	20	27	20	19	21	R
3	305	E	-	425	N	7	13	5	13	6	7				
4	305	E	-	430	N	8	6	4	8	8	7				
5	305	E	-	435	N	4	8	6	8	7	9				
6	305	E	-	440	N	11	7	9	R	R	R	R	R	R	R
7	305	E	-	445	N	6	7	6	6	4	8				
8	305	E	-	450	N	9	8	4	6	11	10				
9	305	E	-	455	N	6	6	4	5	12	7				
10	305	E	-	460	N	10	9	8	8	5	6				
11	306	E	-	405	N	7	10	6	7	8	78	40	28	20	17
12	306	E	-	415	N	7	9	5	5	11	76	109	58	58	56
13	306	E	-	420	N	7	6	15	46	50	39	49	38	42	R
14	309	E	-	415	N	8	9	11	10	50	72	28	18	19	20
15		E	-		N										
16		E	-		N										
17		E	-		N										
18		E	-		N										
19		E	-		N										
20		E	-		N										
21		E	-		N										
22		E	-		N										
23		E	-		N										
24		E	-		N										
25		E	-		N										

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

PAGE 11
FILE: WP1AOCSSR

W.A. Rogers DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 310E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	310	E	-	370	N	7	9	6	6	9	8				
2	310	E	-	375	N	5	9	5	6	7	8				
3	310	E	-	380	N	6	6	6	4	R	R	R	R	R	R
4	310	E	-	385	N	10	10	14	17	10	11				
5	310	E	-	390	N	8	7	7	7	7	8				
6	310	E	-	395	N	9	5	7	9	9	7				
7	310	E	-	400	N	9	10	6	7	9	9				
8	310	E	-	405	N	11	5	10	6	R	R	R	R	R	R
9	310	E	-	410	N	4	17	10	12	63	38	50	21	13	10
10	310	E	-	414	N	6	40	16	28	12	68	34	19	18	17
11	310	E	-	415	N	5	18	10	5	8	47				
12	310	E	-	416	N	12	10	7	8	5	24	16	5	8	6
13	310	E	-	420	N	5	9	9	7	10	8				
14	310	E	-	425	N	7	10	R	R	R	R	R	R	R	R
15	310	E	-	430	N	10	7	7	10	9	9				
16	310	E	-	435	N	5	9	7	R	R	R	R	R	R	R
17	310	E	-	440	N	3	9	9	5	8	6				
18	310	E	-	445	N	6	5	8	7	8	5				
19	310	E	-	450	N	10	4	6	6	6	4				
20	311	E	-	415	N	5	9	6	5	4	27	12	8	7	5
21	314	E	-	390	N	11	9	12	14	21	119	28	15	20	12
22	314	E	-	395	N	4	6	9	7	7	35	47	30	26	34
23	314	E	-	400	N	10	10	8	12	419	226	80	48	26	28
24		E	-		N										
25		E	-		N										

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

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FILE: WP1AOCSSR

W. A. Rogers DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1

GRID LOCATION : 315E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	315	E	-	370	N	7	6	8	4	9	9				
2	315	E	-	375	N	6	6	4	6	8	6				
3	315	E	-	380	N	10	7	5	7	9	5				
4	315	E	-	385	N	10	15	10	12	5	10				
5	315	E	-	389	N	8	7	7	13	72	48	21	16	11	18
6	315	E	-	390	N	5	11	6	7	47	162				
7	315	E	-	391	N	5	8	5	10	15	85	67	28	18	25
8	315	E	-	394	N	6	5	7	7	10	34	46	24	14	17
9	315	E	-	395	N	8	6	6	11	31	219				
10	315	E	-	396	N	10	10	6	7	11	133	11	103	39	R
11	315	E	-	399	N	9	4	9	22	171	191	100	59	38	32
12	315	E	-	400	N	13	14	37	42	99	142				
13	315	E	-	401	N	6	7	72	16	16	96	76	80	30	19
14	315	E	-	405	N	11	10	9	10	R	R	R	R	R	R
15	315	E	-	410	N	6	9	R	R	R	R	R	R	R	R
16	315	E	-	415	N	8	5	6	7	6	6				
17	315	E	-	420	N	8	4	11	R	R	R	R	R	R	R
18	315	E	-	425	N	6	8	11	R	R	R	R	R	R	R
19	315	E	-	430	N	7	11	6	7	6	7				
20	315	E	-	435	N	9	7	6	10	8	5				
21	315	E	-	440	N	8	13	11	6	7	5				
22	316	E	-	390	N	11	11	7	13	219	188	117	46	38	31
23	316	E	-	395	N	5	8	9	12	383	239	176	109	90	63
24	316	E	-	400	N	12	6	12	8	10	113	63	33	21	14
25		E	-		N										

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

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W. A. Rogers DATE: 3-11-98

FILE: WP1AOCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 320E
DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	320	E	-	375	N	4	9	7	6	11	10				
2	320	E	-	380	N	4	6	4	5	9	6				
3	320	E	-	385	N	8	8	8	7	6	8				
4	320	E	-	390	N	9	7	6	7	11	9	7	11	13	7
5	320	E	-	395	N	11	11	7	8	8	6				
6	320	E	-	400	N	7	9	8	7	12	8				
7	320	E	-	405	N	7	2	R	R	R	R	R	R	R	R
8	320	E	-	410	N	4	6	8	7	10	10				
9	320	E	-	415	N	8	5	8	7	6	11				
10	320	E	-	420	N	3	8	8	9	8	6				
11	320	E	-	425	N	6	6	8	9	3	7				
12	320	E	-	430	N	10	9	9	7	5	5				
13	325	E	-	375	N	30	9	8	10	8	13				
14	325	E	-	380	N	7	7	8	10	8	9				
15	325	E	-	385	N	5	6	R	R	R	R	R	R	R	R
16	325	E	-	390	N	6	8	8	R	R	R	R	R	R	R
17	325	E	-	395	N	10	8	R	R	R	R	R	R	R	R
18	325	E	-	400	N	11	7	R	R	R	R	R	R	R	R
19	325	E	-	405	N	13	10	6	9	8	7				
20	325	E	-	410	N	6	10	9	14	7	9				
21	325	E	-	415	N	6	8	5	9	6	4				
22	325	E	-	420	N	7	6	7	1	7	6				
23		E	-		N										
24		E	-		N										
25		E	-		N										

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND
Total U 4
Th (Nat) 1.5

MDA
10
1

BACKGROUND NOT SUBTRACTED

PAGE 14
FILE: WP1AOCSSR

W. A. Rogers DATE: 3-11-98

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 1
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION : WASTE POND NO. 1
GRID LOCATION : 330E

DATE: 3/9/98

LN #	GRID NUMBER					pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U	6' - 7' Total-U	7' - 8' Total-U	8' - 9' Total-U	9' - 10' Total-U
1	330	E	-	380	N	9	14	R	R	R	R	R	R	R	R
2	330	E	-	385	N	6	6	R	R	R	R	R	R	R	R
3	330	E	-	390	N	11	9	8	8	10	9				
4	330	E	-	395	N	5	6	5	7	7	5				
5	330	E	-	400	N	8	8	18	15	9	7				
6	330	E	-	405	N	7	5	6	3	8	8				
7	330	E	-	410	N	9	11	11	13	11	5				
8	335	E	-	380	N	8	8	R	R	R	R	R	R	R	R
9	335	E	-	385	N	7	11	R	R	R	R	R	R	R	R
10	335	E	-	390	N	8	6	9	7	5	5				
11	335	E	-	395	N	8	11	6	10	R	R	R	R	R	R
12	340	E	-	385	N	11	7	6	9	R	R	R	R	R	R
13	340	E	-	390	N	7	9	11	12	8					
14		E	-		N										
15		E	-		N										
16		E	-		N										
17		E	-		N										
18		E	-		N										
19		E	-		N										
20		E	-		N										
21		E	-		N										
22		E	-		N										
23		E	-		N										
24		E	-		N										
25		E	-		N										

INSTRUMENTS:

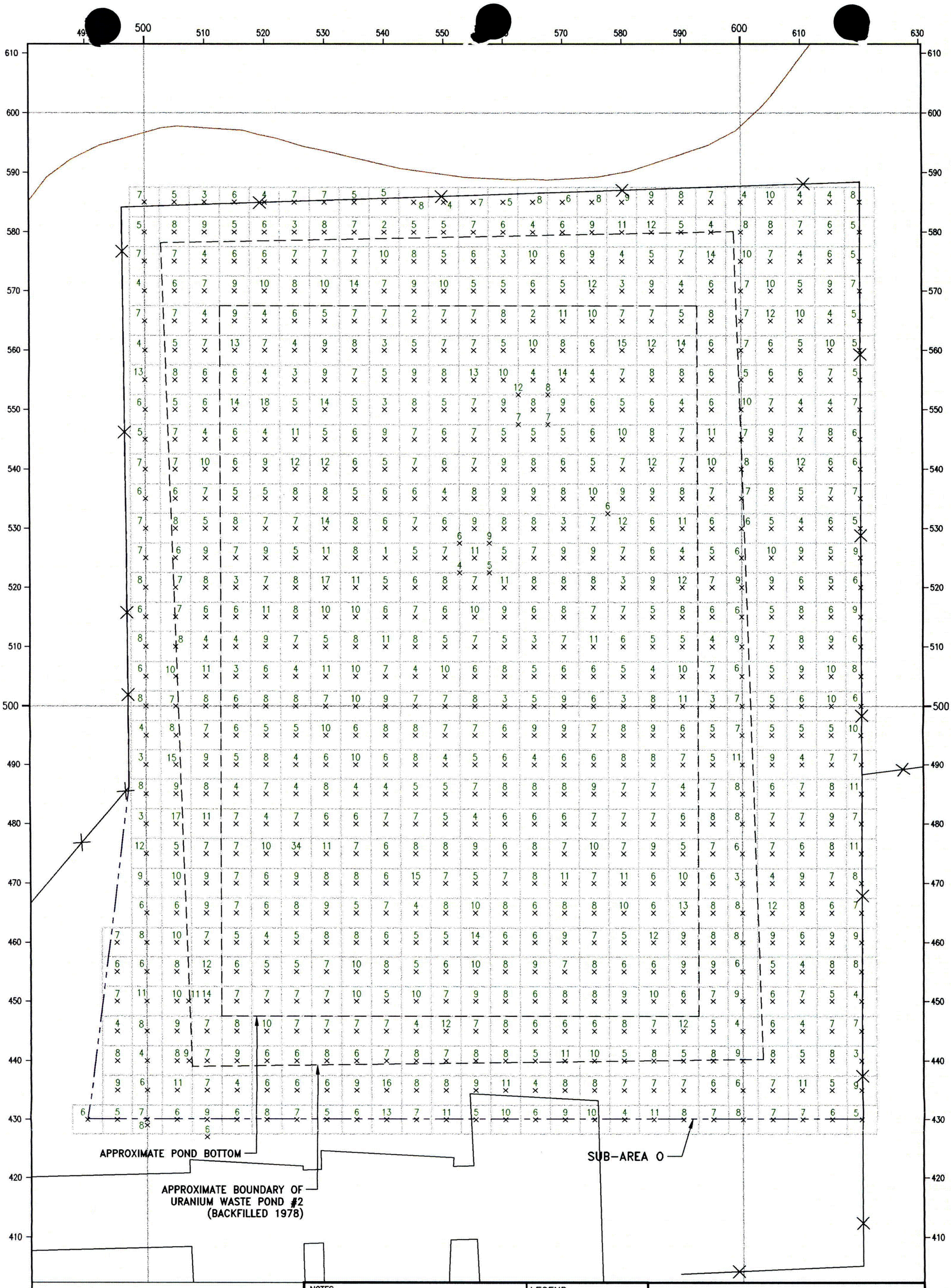
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	**MDA**
Total U 4	10
Th (Nat) 1.5	1

PAGE 15
FILE: WP1AOCSSR

W.A. Rogers DATE: 3-11-98



NORTH

15 0 15

SCALE IN METERS

NOTES
URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED

LEGEND
- 6 URANIUM 1 – 94 pCi/g U
- 120 URANIUM 95 – 219 pCi/g U
- 245 URANIUM > 219 pCi/g U
- R HIT ROCK– NO SAMPLE

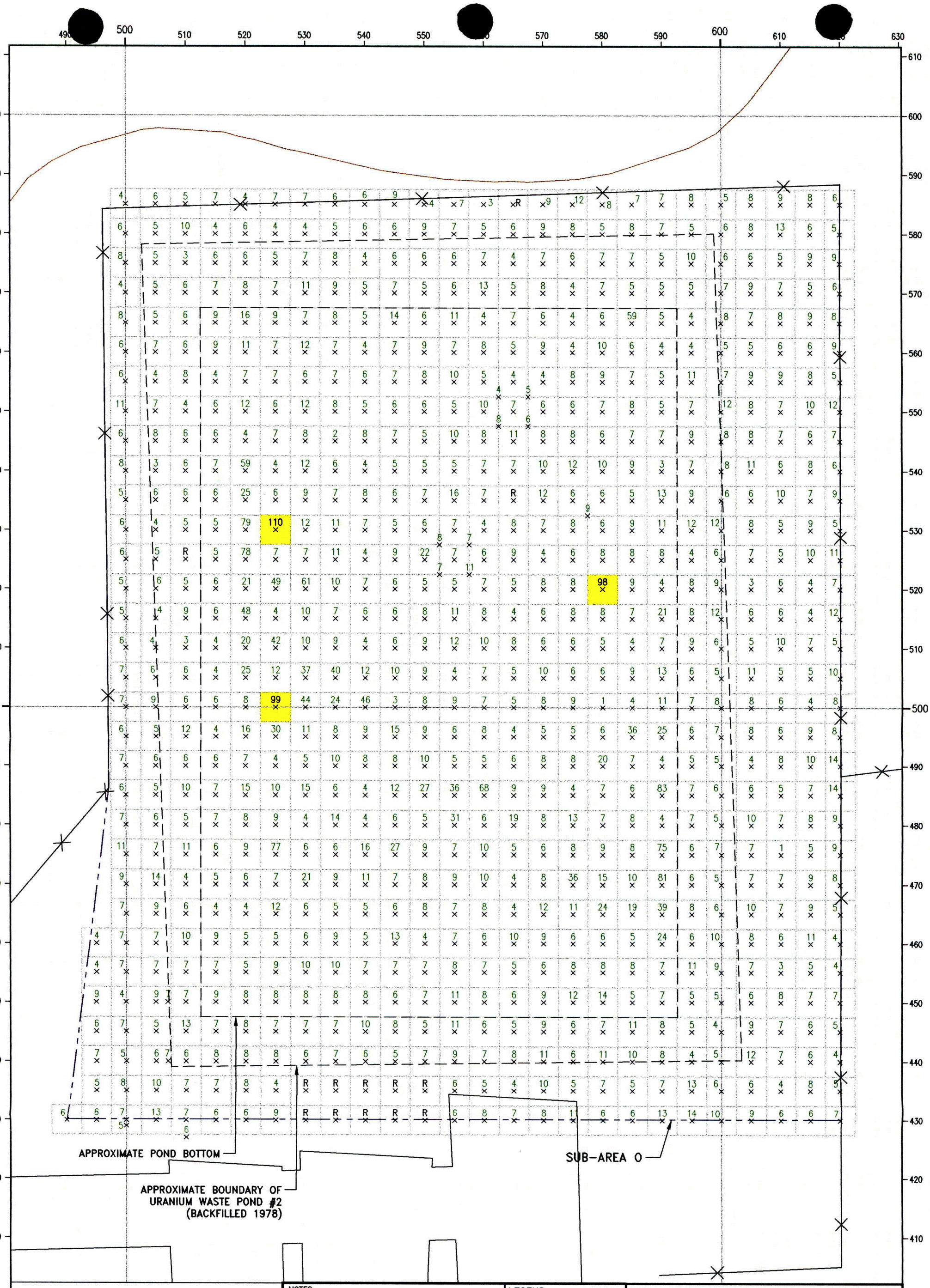
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #2
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 0 – 1'

DRWN. BY	DATE	SCALE:
JE	10/2/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP2SS-0	0

...\UPOND2\PRE-REM\97PRP2SB



NOTES

URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED

LEGEND

- 6 URANIUM 1 – 94 pCi/g U
- 120 URANIUM 95 – 219 pCi/g U
- 245 URANIUM > 219 pCi/g U
- R HIT ROCK– NO SAMPLE

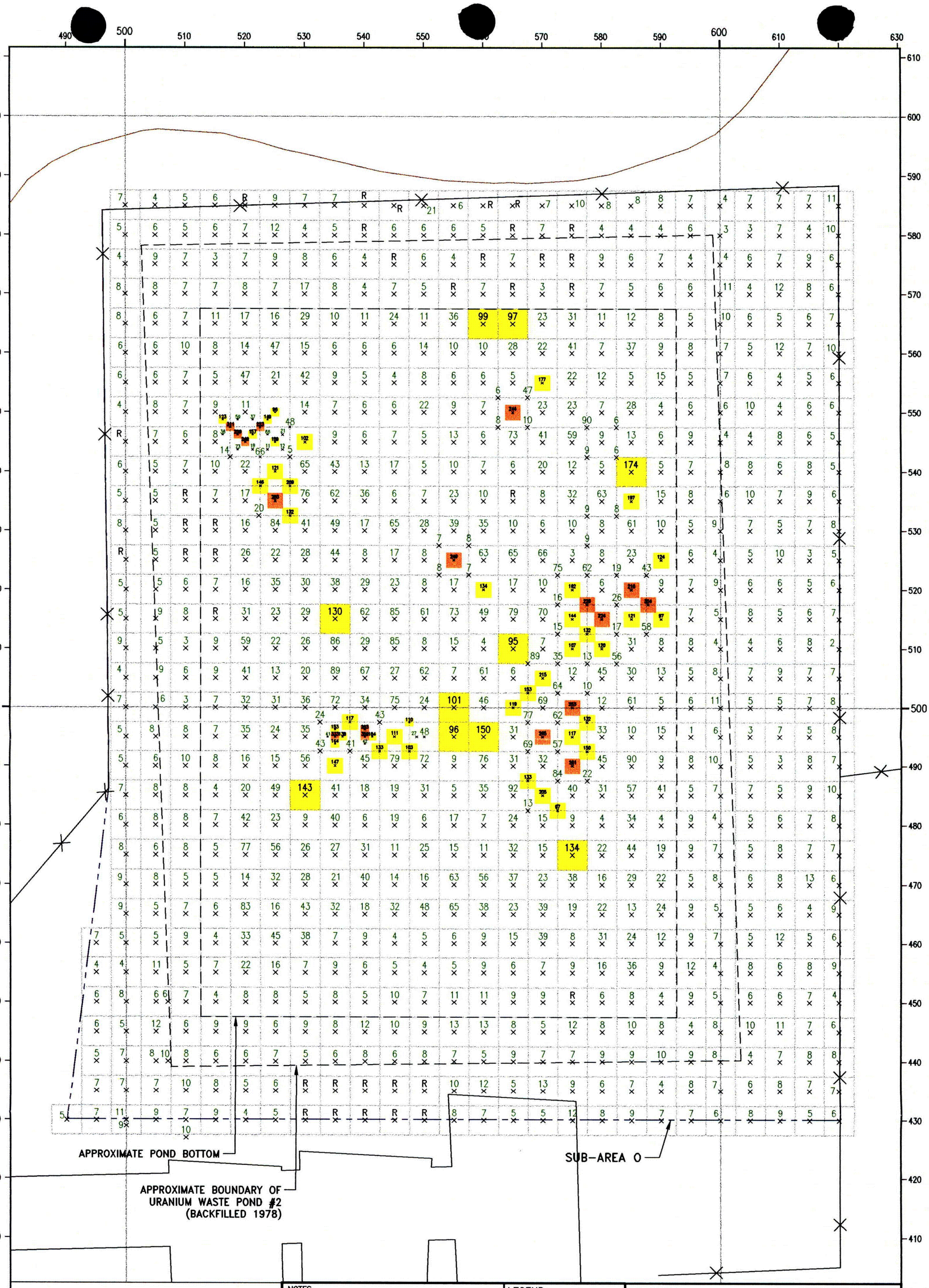
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #2
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 1' – 2'

DRWN. BY	DATE	SCALE:
JE	10/2/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP2SS-1	0

...\UPOND2\PRE-REM\97PRP2SB



NORTH

15 0 15

SCALE IN METERS

NOTES
URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED

LEGEND
- 6 URANIUM 1 – 94 pCi/g U
- 120 URANIUM 95 – 219 pCi/g U
- 245 URANIUM > 219 pCi/g U
- R HIT ROCK– NO SAMPLE

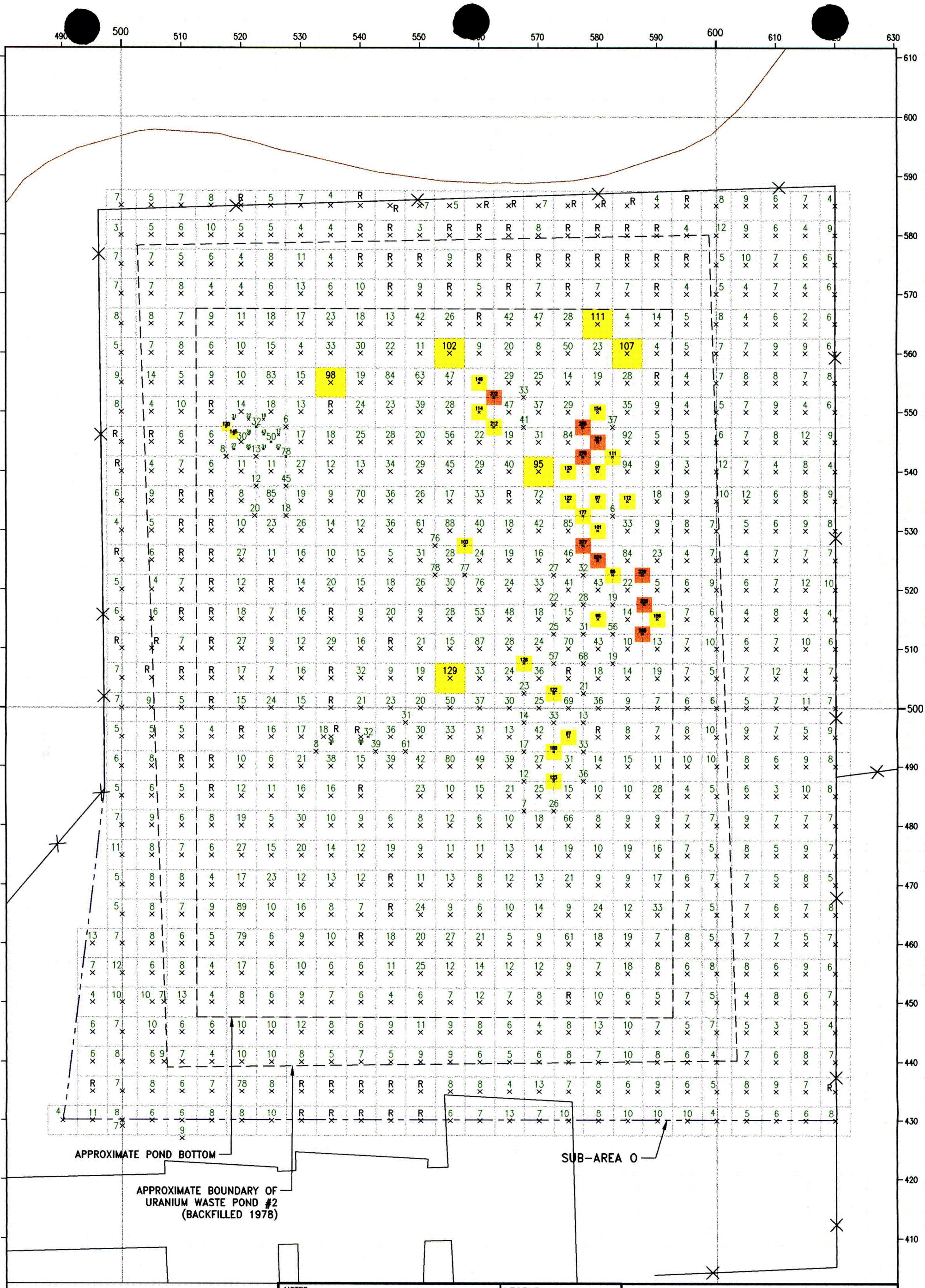
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #2
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 2' – 3'

DRWN. BY	DATE	SCALE:
JE	10/2/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP2SS-2	0

...\UPOND2\PRE-REM\97PRP2SB



NORTH

15 0 15

SCALE IN METERS

NOTES
URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED

LEGEND
- URANIUM 1 – 94 pCi/g U
- URANIUM 95 – 219 pCi/g U
- URANIUM > 219 pCi/g U
- R HIT ROCK– NO SAMPLE

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #2
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 3' – 4'

DRWN. BY	DATE	SCALE:
JE	10/2/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP2SS-3	0

...\UPOND2\PRE-REM\97PRP2SB

APPROXIMATE POND BOTTOM

APPROXIMATE BOUNDARY OF URANIUM WASTE POND #2 (BACKFILLED 1978)

SUB-AREA O

NORTH

15 0 15

SCALE IN METERS

NOTES

URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED

LEGEND

- URANIUM 1 – 94 pCi/g U
- URANIUM 95 – 219 pCi/g U
- URANIUM > 219 pCi/g U
- HIT ROCK– NO SAMPLE

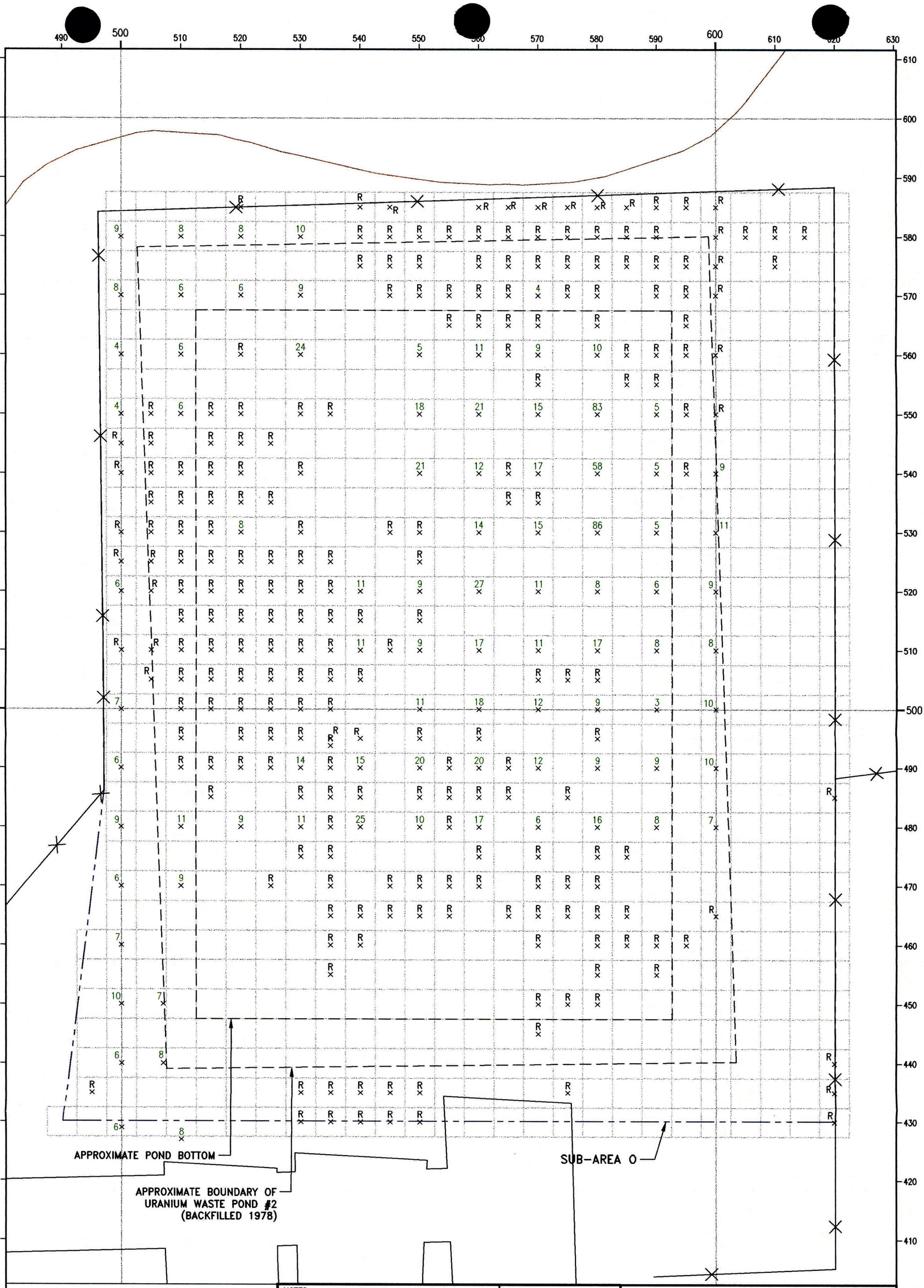
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #2
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 4' – 5'

DRWN. BY	DATE	SCALE:
JE	10/2/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP2SS-4	0

...\UPOND2\PRE-REM\97PRP2SB



NOTES
URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED

LEGEND
- 6 URANIUM 1 – 94 pCi/g U
- 120 URANIUM 95 – 219 pCi/g U
- 245 URANIUM > 219 pCi/g U
- R HIT ROCK– NO SAMPLE

NORTH

15 0 15

SCALE IN METERS

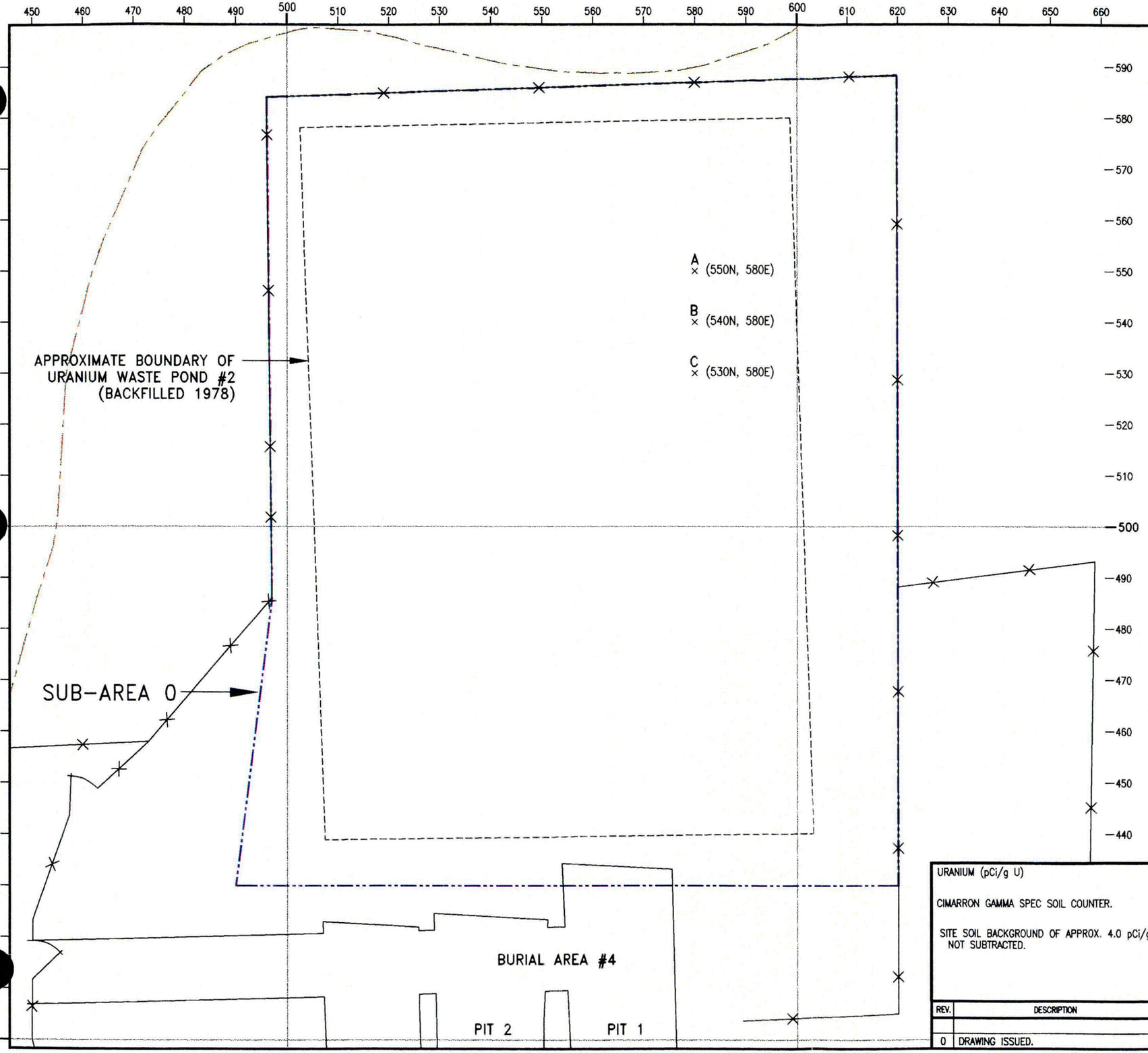
REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA O
URANIUM WASTE POND #2
CHARACTERIZATION SOIL SAMPLE RESULTS
SOIL SAMPLE ALIQUOT: 5' – 6'

DRWN. BY	DATE	SCALE:
JE	10/2/97	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	97PRP2SS-5	0

...\UPOND2\PRE-REM\97PRP2SB



SOIL SAMPLE ALIQUOT	A	B	C
0 – 1 Ft.	8	11	10
1 Ft. – 2 Ft.	6	5	9
2 Ft. – 3 Ft.	6	9	6
3 Ft. – 4 Ft.	12	12	11
4 Ft. – 5 Ft.	100	382	260
5 Ft. – 6 Ft.	17	67	91
6 Ft. – 7 Ft.	15	41	101
7 Ft. – 8 Ft.	17	5	140
8 Ft. – 9 Ft.	5	9	39
9 Ft. – 10 Ft.	5	6	14
10 Ft. – 11 Ft.	6	10	7
11 Ft. – 12 Ft.	11	8	9

20 0 20
SCALE IN METERS

NORTH

URANIUM (pCi/g U)

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROX. 4.0 pCi/g U, NOT SUBTRACTED.

LEGEND

- 6 — URANIUM 1 – 94 pCi/g U
- 120 — URANIUM 95 -- 219 pCi/g U
- 240 — URANIUM > 219 pCi/g U

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA 0
URANIUM DEEP DRILLING
SOIL SAMPLE RESULTS

DRWN. BY	DATE	SCALE:
JE	9/26/96	AS SHOWN
JOB NO.	DRAWING NO.	REV.
	96PRP2DD-0	0

...\UPOND2\DEEP-DRL\96PRP2DD

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION **490E & 495E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	490E-430N	6	6	5	4	7
2	495E-430N	5	6	7	11	5
3	495E-435N	9	5	7	ROCK	
4	495E-440N	8	7	5	6	5
5	495E-445N	4	6	6	6	7
6	495E-450N	7	9	6	4	8
7	495E-455N	6	4	4	7	7
8	495E-460N	7	4	7	13	10

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W.A. Rogers DATE: 9-16-97

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CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 500E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g					
		0 - 1'	1' - 2'	2' - 3'	3' - 4'	4' - 5'	5' - 6'
		Total-U	Total-U	Total-U	Total-U	Total-U	Total-U
1	500E-429N	8	5	9	7	10	6
2	500E-430N	7	7	11	8	8	
3	500E-435N	6	8	7	7	5	
4	500E-440N	4	5	7	8	9	6
5	500E-445N	8	7	5	7	6	
6	500E-450N	11	4	8	10	7	10
7	500E-455N	6	7	4	12	7	
8	500E-460N	8	7	5	7	9	7
9	500E-465N	6	7	9	5	4	
10	500E-470N	9	9	9	5	5	6
11	500E-475N	12	11	8	11	5	
12	500E-480N	3	7	6	7	8	9
13	500E-485N	8	6	7	5	8	
14	500E-490N	3	7	5	6	6	6
15	500E-495N	4	6	5	5	7	
16	500E-500N	8	7	7	7	5	7
17	500E-505N	6	7	4	7	5	
18	500E-510N	8	6	9	ROCK		
19	500E-515N	6	5	5	6	6	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 500E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	500E-520N	8	5	5	5	9	6
2	500E-525N	7	6	ROCK			
3	500E-530N	7	6	8	4	3	ROCK
4	500E-535N	6	5	5	6	4	
5	500E-540N	7	8	6	ROCK		
6	500E-545N	5	6	ROCK			
7	500E-550N	6	11	4	8	4	4
8	500E-555N	13	6	6	9	9	
9	500E-560N	4	6	6	5	5	4
10	500E-565N	7	8	8	8	8	
11	500E-570N	4	4	8	7	8	8
12	500E-575N	7	8	4	7	10	
13	500E-580N	5	6	5	3	7	9
14	500E-585N	7	4	7	7	5	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 500E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	505E-430N	6	13	9	6	11
2	505E-435N	11	10	7	8	7
3	505E-440N	8	6	8	6	9
4	505E-445N	9	5	12	10	9
5	505E-450N	10	9	6	10	7
6	505E-455N	8	7	11	6	10
7	505E-460N	10	7	5	8	3
8	505E-465N	6	9	5	8	9
9	505E-470N	10	14	8	8	5
10	505E-475N	5	7	6	8	8
11	505E-480N	17	6	8	9	6
12	505E-485N	9	5	8	6	6
13	505E-490N	15	6	6	8	5
14	505E-495N	8	5	8	5	4
15	505E-500N	7	9	6	9	6
16	505E-505N	10	6	9	ROCK	
17	505E-510N	8	4	5	ROCK	
18	505E-515N	7	4	9	6	11

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTO	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

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FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **505E - 507E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	505E-520N	7	6	5	4	ROCK	
2	505E-525N	6	5	5	6	ROCK	
3	505E-530N	8	4	5	5	ROCK	
4	505E-535N	6	6	5	9	ROCK	
5	505E-540N	7	3	5	4	ROCK	
6	505E-545N	7	8	7	ROCK		
7	505E-550N	5	7	8	4	ROCK	
8	505E-555N	8	4	6	14	3	
9	505E-560N	5	7	6	7	5	
10	505E-565N	7	5	6	8	5	
11	505E-570N	6	5	8	7	9	
12	505E-575N	7	5	9	7	5	
13	505E-580N	8	5	6	5	8	
14	505E-585N	5	6	4	5	7	
15	507E-440N	9	7	10	9	8	8
16	507E-450N	11	7	6	7	6	7

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 510E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	510E-427N	6	6	10	9	6	8
2	510E-430N	9	7	7	6	11	
3	510E-435N	7	7	10	6	5	
4	510E-440N	7	6	8	7	10	
5	510E-445N	7	13	6	6	8	
6	510E-450N	14	7	7	13	7	
7	510E-455N	12	7	5	8	8	
8	510E-460N	7	10	9	6	4	
9	510E-465N	9	6	7	7	6	
10	510E-470N	9	4	5	8	5	9
11	510E-475N	7	11	8	7	7	
12	510E-480N	11	5	8	6	8	11
13	510E-485N	8	10	8	5	5	
14	510E-490N	9	6	10	ROCK		
15	510E-495N	7	12	8	5	ROCK	
16	510E-500N	8	6	3	5	ROCK	
17	510E-505N	11	6	6	ROCK		
18	510E-510N	4	3	3	7	ROCK	
19	510E-515N	6	9	8	ROCK		

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **510E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	510E-520N	8	5	6	7	ROCK	
2	510E-525N	9	ROCK				
3	510E-530N	5	5	ROCK			
4	510E-535N	7	6	ROCK			
5	510E-540N	10	6	7	7	5	ROCK
6	510E-545N	4	6	6	6	6	
7	510E-550N	6	4	7	10	9	6
8	510E-555N	6	8	7	5	4	
9	510E-560N	7	6	10	8	6	6
10	510E-565N	4	6	7	7	7	
11	510E-570N	7	6	7	8	9	6
12	510E-575N	4	3	7	5	6	
13	510E-580N	9	10	5	6	5	8
14	510E-585N	3	5	5	7	5	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **515E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	515E-430N	6	6	9	8	6
2	515E-435N	4	7	8	7	8
3	515E-440N	9	8	6	4	7
4	515E-445N	8	7	9	6	5
5	515E-450N	7	9	4	4	10
6	515E-455N	6	7	7	4	7
7	515E-460N	5	9	4	5	5
8	515E-465N	7	4	6	9	6
9	515E-470N	7	5	5	4	6
10	515E-475N	7	6	5	6	6
11	515E-480N	7	7	7	8	6
12	515E-485N	4	7	4	ROCK	
13	515E-490N	5	6	8	ROCK	
14	515E-495N	6	4	7	4	4
15	515E-500N	6	6	7	ROCK	
16	515E-505N	3	4	9	ROCK	
17	515E-510N	4	4	9	ROCK	
18	515E-515N	6	6	ROCK		

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTO	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **515E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	515E-520N	3	6	7	ROCK	
2	515E-525N	7	5	ROCK		
3	515E-530N	8	5	ROCK		
4	515E-535N	5	6	7	ROCK	
5	515E-540N	6	7	10	6	ROCK
6	515E-545N	6	6	8	6	ROCK
7	515E-550N	14	6	9	ROCK	
8	515E-555N	6	4	5	9	6
9	515E-560N	13	9	8	6	7
10	515E-565N	9	9	11	9	6
11	515E-570N	9	7	7	4	8
12	515E-575N	6	6	3	6	9
13	515E-580N	5	4	6	10	5
14	515E-585N	6	7	6	8	4

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. G. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **516E - 520E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g					
		0 - 1'	1' - 2'	2' - 3'	3' - 4'	4' - 5'	5' - 6'
		Total-U	Total-U	Total-U	Total-U	Total-U	Total-U
1	516.25E-546.25N			36			
2	516.25E-548.75			123			
3	517.5E-542.5N			14	8		
4	517.5E-547.5N			311	130		
5	518.75E-543.75N			73	27		
6	518.75E-546.25			259	145		
7	518.75E-548.75N			59	31		
8	520E-430N	8	6	4	8	7	
9	520E-435N	6	8	5	78	4	
10	520E-440N	6	8	6	10	6	
11	520E-445N	10	8	9	10	5	
12	520E-450N	7	8	8	8	5	
13	520E-455N	5	5	22	17	13	
14	520E-460N	4	5	33	79	22	
15	520E-465N	6	4	83	89	25	
16	520E-470N	6	6	14	17	19	
17	520E-475N	10	9	77	27	8	
18	520E-480N	4	8	42	19	18	9

INSTRUMENTS	RESULTS IN	BACKGROUND	MDA
		Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR		Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 520E

DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	520E-485N	7	15	20	12	5	
2	520E-490N	8	7	16	10	6	ROCK
3	520E-495N	5	16	35	ROCK		
4	520E-500N	8	8	32	15	ROCK	
5	520E-505N	6	25	41	17	ROCK	
6	520E-510N	9	20	59	27	ROCK	
7	520E-515N	11	48	31	18	ROCK	
8	520E-520N	7	21	16	12	ROCK	
9	520E-525N	9	78	26	27	ROCK	
10	520E-530N	7	79	16	10	8	8
11	520E-535N	5	25	17	8	ROCK	
12	520E-540N	9	59	22	11	10	ROCK
13	520E-545N	4	4	249	30	ROCK	
14	520E-550N	18	12	11	14	11	ROCK
15	520E-555N	4	7	47	10	12	
16	520E-560N	7	11	14	10	12	ROCK
17	520E-565N	4	16	17	11	7	
18	520E-570N	10	8	8	4	8	6

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR

BACKGROUND

Total U 4
Th (Nat) 1.5

MDA

10
1

BACKGROUND NOT SUBTRACTED

W.a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **520E - 523E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g					
		0 - 1'	1' - 2'	2' - 3'	3' - 4'	4' - 5'	5' - 6'
		Total-U	Total-U	Total-U	Total-U	Total-U	Total-U
1	520E-575N	6	6	7	4	8	
2	520E-580N	6	6	7	5	7	8
3	520E-585N	4	4	ROCK			
4	521.25E-543.75			19	85		
5	521.25E-546.25N			157	36		
6	521.25E-548.75			37	22		
7	522.25E-532.5N			20	20		
8	522.5E-537.5N			146	12		
9	522.5E-542.5N			66	13		
10	522.5E-547.5N			223	32		
11	523.75E-543.75N			11	31		
12	523.75E-546.25N			66	43		
13	523.75E-548.75N			149	18		

INSTRUMENTS	RESULTS IN	BACKGROUND	MDA
		Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR		Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 525E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	525E-430N	7	9	5	10	8
2	525E-435N	6	4	6	8	9
3	525E-440N	6	8	7	10	3
4	525E-445N	7	7	6	10	7
5	525E-450N	7	8	8	6	7
6	525E-455N	5	9	16	6	7
7	525E-460N	5	5	45	6	10
8	525E-465N	8	12	16	10	7
9	525E-470N	9	7	32	23	ROCK
10	525E-475N	34	77	56	15	12
11	525E-480N	7	9	23	5	6
12	525E-485N	4	10	49	11	9
13	525E-490N	4	4	15	6	ROCK
14	525E-495N	5	30	24	16	ROCK
15	525E-500N	8	99	31	24	ROCK
16	525E-505N	4	12	13	7	ROCK
17	525E-510N	7	42	22	9	ROCK
18	525E-515N	8	4	23	7	ROCK

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECT	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 525E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	525E-520N	8	49	35	ROCK	
2	525E-525N	5	7	22	11	ROCK
3	525E-530N	7	110	84	23	23
4	525E-535N	8	6	280	85	ROCK
5	525E-540N	12	4	121	11	8
6	525E-545N	11	7	189	50	ROCK
7	525E-550N	5	6	96	18	8
8	525E-555N	3	7	21	83	24
9	525E-560N	4	7	47	15	5
10	525E-565N	6	9	16	18	21
11	525E-570N	8	7	7	6	4
12	525E-575N	7	5	9	8	7
13	525E-580N	3	4	12	5	7
14	525E-585N	7	7	9	5	5

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

QAQC-158-A
REV.1

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 526E - 530E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	526.25E-543.75N			12	57		
2	526.25E-546.25N			21	17		
3	527.5E-532.5N			132	18		
4	527.5E-537.5N			209	45		
5	527.5E-542.5N			5	78		
6	527.5E-547.5N			48	6		
7	530E-430N	5	ROCK				
8	530E-435N	6	ROCK				
9	530E-440N	8	6	5	8	8	
10	530E-445N	7	7	9	12	8	
11	530E-450N	7	8	5	9	5	
12	530E-455N	7	10	7	10	6	
13	530E-460N	8	6	38	9	6	
14	530E-465N	9	6	43	16	15	
15	530E-470N	8	21	28	12	13	
16	530E-475N	11	6	26	20	ROCK	
17	530E-480N	6	4	9	30	17	11
18	530E-485N	8	15	143	16	ROCK	
19	530E-490N	6	5	56	21	12	14
20	530E-495N	10	11	35	17	ROCK	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 530E - 533E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g					
		0 - 1'	1' - 2'	2' - 3'	3' - 4'	4' - 5'	5' - 6'
		Total-U	Total-U	Total-U	Total-U	Total-U	Total-U
1	530E-500N	7	44	36	15	19	ROCK
2	530E-505N	11	37	20	16	ROCK	
3	530E-510N	5	10	26	12	5	ROCK
4	530E-515N	10	10	29	16	ROCK	
5	530E-520N	17	61	30	14	ROCK	
6	530E-525N	11	7	28	16	ROCK	
7	530E-530N	14	12	41	26	18	ROCK
8	530E-535N	8	9	76	19	13	
9	530E-540N	12	12	65	27	20	ROCK
10	530E-545N	5	8	102	17	12	
11	530E-550N	14	12	14	13	15	ROCK
12	530E-555N	9	6	42	15	9	
13	530E-560N	9	12	15	4	35	24
14	530E-565N	5	7	29	17	24	
15	530E-570N	10	11	17	13	7	9
16	530E-575N	7	7	8	11	9	
17	530E-580N	8	4	4	4	8	10
18	530E-585N	7	7	7	7	6	
19	532.5E-492.5N			43	8		
20	532.5E-497.5N			24			
21	533.75E-495N			41	18		

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 535E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	535E-430N	6	ROCK			
2	535E-435N	9	ROCK			
3	535E-440N	6	7	6	5	8
4	535E-445N	7	7	8	8	7
5	535E-450N	10	8	8	7	8
6	535E-455N	10	10	9	6	ROCK
7	535E-460N	8	9	7	10	ROCK
8	535E-465N	5	5	32	8	ROCK
9	535E-470N	8	9	21	13	ROCK
10	535E-475N	7	6	27	14	ROCK
11	535E-480N	6	14	40	10	ROCK
12	535E-485N	4	6	41	16	ROCK
13	535E-490N	10	10	147	38	ROCK
14	535E-493.75			144	38	
15	535E-495N	6	8	333	ROCK	
16	535E-496.25N			153		
17	535E-500N	10	24	72	ROCK	
18	535E-505N	10	40	89	ROCK	
19	535E-510N	8	9	86	29	ROCK
20	535E-515N	10	7	130	ROCK	
21	535E-520N	11	10	38	20	ROCK
22	535E-525N	8	11	44	10	ROCK

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTO	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

PHASE III, SUB-AREA "O"
COVERED WASTE POND NO. 2
PRE-REMEDIATION SOIL SAMPLES

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 535E - 537E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	535E-530N	8	11	49	14	13
2	535E-535N	5	7	62	9	10
3	535E-540N	6	6	43	12	7
4	535E-545N	6	2	9	18	8
5	535E-550N	5	8	7	ROCK	
6	535E-555N	7	7	9	98	20
7	535E-560N	8	7	6	33	11
8	535E-565N	7	8	10	23	56
9	535E-570N	14	9	8	6	4
10	535E-575N	7	8	6	4	7
11	535E-580N	7	5	5	4	6
12	535E-585N	5	6	7	4	
13	536.25E-495N			138		
14	537.5E-492.5N			41		
15	537.5E-497.5N			117		

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 540E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	540E-430N	13	ROCK				
2	540E-435N	16	ROCK				
3	540E-440N	7	6	8	7	7	
4	540E-445N	7	10	12	6	7	
5	540E-450N	5	8	5	6	8	
6	540E-455N	8	7	6	6	11	
7	540E-460N	6	5	9	ROCK		
8	540E-465N	7	5	18	7	ROCK	
9	540E-470N	6	11	40	12	14	
10	540E-475N	6	16	31	12	16	
11	540E-480N	7	4	6	9	35	25
12	540E-485N	4	4	18	ROCK		
13	540E-490N	6	8	45	15	14	15
14	540E-493.75N			42	88		
15	540E-495N	8	9	359	ROCK		
16	540E-496.25N			263			
17	540E-500N	9	46	34	21	18	
18	540E-505N	7	12	67	32	ROCK	
19	540E-510N	11	4	29	16	12	11
20	540E-515N	6	6	62	9	ROCK	
21	540E-520N	5	7	29	15	10	11
22	540E-525N	1	4	8	15	5	

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND

Total U 4
Th (Nat) 1.5

MDA

10
1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **540E - 542E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	540E-530N	6	7	17	12	12	
2	540E-535N	6	8	36	70	12	
3	540E-540N	5	4	13	13	8	
4	540E-545N	9	8	6	25	12	
5	540E-550N	3	5	6	24	18	
6	540E-555N	5	6	5	19	7	
7	540E-560N	3	4	6	30	16	
8	540E-565N	7	5	11	18	25	
9	540E-570N	7	5	4	10	6	
10	540E-575N	10	4	4	ROCK		
11	540E-580N	2	6	ROCK			
12	540E-585N	5	6	ROCK			
13	541.25E-495N			184	32		
14	542.5E-492.5N			133	39		
15	542.5E-497.5N			43			

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **545E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	545E-430N	7	ROCK			
2	545E-435N	8	ROCK			
3	545E-440N	8	5	6	5	6
4	545E-445N	4	8	10	9	8
5	545E-450N	10	6	10	4	7
6	545E-455N	5	7	5	11	9
7	545E-460N	5	13	4	18	
8	545E-465N	4	6	32	ROCK	
9	545E-470N	15	7	14	ROCK	
10	545E-475N	8	27	11	19	15
11	545E-480N	7	6	19	6	
12	545E-485N	5	12	19		
13	545E-490N	8	8	79	39	
14	545E-495N	8	15	111	36	
15	545E-500N	7	3	75	23	
16	545E-505N	4	10	27	9	
17	545E-510N	8	6	85	ROCK	
18	545E-515N	7	6	85	20	30
19	545E-520N	6	6	23	18	
20	545E-525N	5	9	17	5	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W.a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **545E - 548E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	545E-530N	7	5	65	36	ROCK
2	545E-535N	6	6	6	36	17
3	545E-540N	7	5	17	34	24
4	545E-545N	7	7	7	28	14
5	545E-550N	8	6	6	23	15
6	545E-555N	9	7	4	84	14
7	545E-560N	5	7	6	22	14
8	545E-565N	2	14	24	13	22
9	545E-570N	9	7	7	ROCK	
10	545E-575N	8	6	ROCK		
11	545E-580N	5	6	6	ROCK	
12	545E-585N	8	9	ROCK		
13	547.5E-492.5N			103	61	
14	547.5E-497.5N			110	31	
15	548.75E-495N			27		

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTO	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **550E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	550E-430N	11	ROCK				
2	550E-435N	8	ROCK				
3	550E-440N	7	7	8	9	9	
4	550E-445N	12	5	9	11	6	
5	550E-450N	7	7	7	6	7	
6	550E-455N	6	7	4	25	13	
7	550E-460N	5	4	5	20	9	
8	550E-465N	8	8	48	24	ROCK	
9	550E-470N	7	8	16	11	ROCK	
10	550E-475N	8	9	25	9	18	
11	550E-480N	5	5	6	8	8	10
12	550E-485N	5	27	31	23	ROCK	
13	550E-490N	4	10	72	42	21	20
14	550E-495N	7	9	48	30	ROCK	
15	550E-500N	7	8	24	20	10	11
16	550E-505N	10	9	62	19	12	
17	550E-510N	5	9	8	21	7	9
18	550E-515N	6	8	61	9	ROCK	
19	550E-520N	8	5	8	26	18	9
20	550E-525N	7	22	8	31	ROCK	

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND	MDA
Total U 4	10
Th (Nat) 1.5	1

W. a. Rogers DATE: 9-17-97

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FILE: AOPRCSSR

QAQC-158-A
REV.1

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 550E - 552E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	550E-530N	6	6	28	61	37	ROCK
2	550E-535N	4	7	7	26	11	
3	550E-540N	6	5	5	29	24	21
4	550E-545N	6	5	5	20	8	
5	550E-550N	5	6	22	39	30	18
6	550E-555N	8	8	8	63	17	
7	550E-560N	7	9	14	11	13	5
8	550E-565N	7	6	11	42	20	
9	550E-570N	10	5	5	9	12	ROCK
10	550E-575N	5	6	6	ROCK		
11	550E-580N	5	9	6	3	ROCK	
12	550E-585N	4	4	21	7		
13	552.5E-522.5N	4	7	8	78	14	
14	552.5E-527.5N	6	8	7	76	27	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

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FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 555E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	555E-430N	5	6	8	6	7
2	555E-435N	9	6	10	8	6
3	555E-440N	8	9	7	9	10
4	555E-445N	7	11	13	9	8
5	555E-450N	9	11	11	7	6
6	555E-455N	10	8	5	12	6
7	555E-460N	14	7	6	27	17
8	555E-465N	10	7	65	9	ROCK
9	555E-470N	5	9	63	13	ROCK
10	555E-475N	9	7	15	11	11
11	555E-480N	4	31	17	12	ROCK
12	555E-485N	7	36	5	10	ROCK
13	555E-490N	5	5	9	80	ROCK
14	555E-495N	7	6	96	33	37
15	555E-500N	8	9	101	50	42
16	555E-505N	6	4	7	129	26
17	555E-510N	7	12	15	15	11
18	555E-515N	10	11	73	28	15

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECT	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 555E - 557E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	555E-520N	7	5	17	30	10
2	555E-525N	11	7	249	28	24
3	555E-530N	9	7	39	88	64
4	555E-535N	8	16	23	17	14
5	555E-540N	7	5	10	45	9
6	555E-545N	7	10	13	56	7
7	555E-550N	7	5	9	28	19
8	555E-555N	13	10	6	47	20
9	555E-560N	7	7	10	102	31
10	555E-565N	7	11	36	26	ROCK
11	555E-570N	5	6	ROCK		
12	555E-575N	6	6	4	9	7
13	555E-580N	7	7	6	ROCK	
14	555E-585N	7	7	6	5	9
15	557.5E-522.5N	5	11	7	77	35
16	557.5E-527.5N	9	7	8	103	42

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W.A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **560E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	560E-430N	10	8	7	7	13	
2	560E-435N	11	5	12	8	9	
3	560E-440N	8	7	5	6	9	
4	560E-445N	8	6	13	8	9	
5	560E-450N	8	8	11	12	9	
6	560E-455N	8	7	9	14	6	
7	560E-460N	6	6	9	21	14	
8	560E-465N	8	8	38	6	4	
9	560E-470N	7	10	56	8	ROCK	
10	560E-475N	6	10	11	11	ROCK	
11	560E-480N	6	6	7	6	29	17
12	560E-485N	8	68	35	15	ROCK	
13	560E-490N	6	5	76	49	29	20
14	560E-495N	6	8	150	31	ROCK	
15	560E-500N	3	7	46	37	27	18
16	560E-505N	8	7	61	33	17	
17	560E-510N	5	10	4	87	49	17
18	560E-515N	9	8	49	53	17	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W.A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 560E - 562E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	560E-520N	11	7	134	76	35	27
2	560E-525N	5	6	63	24	9	
3	560E-530N	8	4	35	40	21	14
4	560E-535N	9	7	10	33	19	
5	560E-540N	9	7	7	29	25	12
6	560E-545N	5	8	6	22	10	
7	560E-550N	9	10	7	114	38	21
8	560E-555N	10	5	6	146	18	
9	560E-560N	5	8	10	9	8	11
10	560E-565N	8	4	99	ROCK		
11	560E-570N	5	13	7	5	ROCK	
12	560E-575N	3	7	ROCK			
13	560E-580N	6	5	5	ROCK		
14	560E-585N	5	3	ROCK			
15	562.5E-547.5N	7	8	8	212	64	
16	562.5E-552.5N	12	4	6	372	76	

INSTRUMENTS:	BACKGROUND	MDA
	Total U 4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat) 1.5	1

BACKGROUND NOT SUBTRACTED

W.a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **565E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	565E-430N	6	7	5	13	5
2	565E-435N	4	4	5	4	7
3	565E-440N	5	8	9	5	12
4	565E-445N	6	5	8	6	6
5	565E-450N	6	6	9	7	7
6	565E-455N	9	5	6	12	4
7	565E-460N	6	10	15	5	10
8	565E-465N	6	4	23	10	ROCK
9	565E-470N	8	4	37	12	13
10	565E-475N	8	5	32	13	12
11	565E-480N	6	19	24	10	7
12	565E-485N	8	9	92	21	ROCK
13	565E-490N	4	6	31	39	ROCK
14	565E-495N	9	4	31	13	7
15	565E-500N	5	5	119	30	16
16	565E-505N	5	5	6	24	19
17	565E-510N	3	8	95	28	12
18	565E-515N	6	4	79	48	19

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTO	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W.a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **565E - 567E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	565E-520N	8	5	17	24	17
2	565E-525N	7	9	65	19	17
3	565E-530N	8	8	10	18	12
4	565E-535N	9	ROCK			
5	565E-540N	8	7	6	40	ROCK
6	565E-545N	5	11	73	19	7
7	565E-550N	8	7	244	47	31
8	565E-555N	4	4	5	29	17
9	565E-560N	10	5	28	20	ROCK
10	565E-565N	2	7	97	42	ROCK
11	565E-570N	6	5	ROCK		
12	565E-575N	10	4	7	ROCK	
13	565E-580N	4	6	ROCK		
14	565E-585N	8	ROCK			
15	567.5E-482.5N			13	7	8
16	567.5E-487.5N			133	12	10
17	567.5E-492.5N			69	17	4
18	567.5E-497.5N			77	14	9
19	567.5E-502.5N			153	23	14
20	567.5E-507.5N			89	128	13
21	567.5E-547.5N	7	6	10	41	5
22	567.5E-552.5N	8	5	47	33	13

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. E. Rogers DATE: 9-17-97

PAGE: 30

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **570E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	570E-430N	9	8	5	7	10	
2	570E-435N	8	10	13	13	9	
3	570E-440N	11	11	7	6	7	
4	570E-445N	6	9	5	4	ROCK	
5	570E-450N	8	9	9	8	ROCK	
6	570E-455N	7	6	7	12	7	
7	570E-460N	9	9	39	9	ROCK	
8	570E-465N	8	12	39	14	ROCK	
9	570E-470N	11	8	23	13	ROCK	
10	570E-475N	7	6	15	14	ROCK	
11	570E-480N	6	8	15	18	10	6
12	570E-485N	8	9	205	25	7	
13	570E-490N	6	8	32	27	14	12
14	570E-495N	9	5	265	42	64	
15	570E-500N	9	8	69	25	21	12
16	570E-505N	6	10	215	36	ROCK	
17	570E-510N	7	6	7	24	14	11
18	570E-515N	8	6	70	18	20	

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

BACKGROUND		MDA
Total U	4	10
Th (Nat)	1.5	1

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 570E - 572.5E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g					
		0 - 1'	1' - 2'	2' - 3'	3' - 4'	4' - 5'	5' - 6'
		Total-U	Total-U	Total-U	Total-U	Total-U	Total-U
1	570E-520N	8	8	10	33	14	11
2	570E-525N	9	4	66	16	40	
3	570E-530N	3	7	6	42	12	15
4	570E-535N	8	12	8	72	ROCK	
5	570E-540N	6	10	20	95	9	17
6	570E-545N	5	8	41	31	14	
7	570E-550N	9	6	23	37	24	15
8	570E-555N	14	4	177	25	ROCK	
9	570E-560N	8	9	22	8	6	9
10	570E-565N	11	6	23	47	ROCK	
11	570E-570N	5	8	3	7	8	4
12	570E-575N	6	7	ROCK			
13	570E-580N	6	9	7	8	ROCK	
14	570E-585N	6	9	7	7	ROCK	
15	572.5E-482.5N			97	26	7	
16	572.5E-487.5N			84	123	29	
17	572.5E-492.5N			57	180	36	
18	572.5E-497.5N			62	33	14	
19	572.5E-502.5N			64	122	19	
20	572.5E-507.5N			35	57	12	
21	572.5E-512.5N			15	25	5	
22	572.5E-517.5N			16	22	18	
23	572.5E-522.5N			75	27	6	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 575E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	575E-430N	10	11	12	10	10
2	575E-435N	8	5	9	7	ROCK
3	575E-440N	10	6	7	8	7
4	575E-445N	6	6	12	8	9
5	575E-450N	8	12	ROCK		
6	575E-455N	8	8	9	9	15
7	575E-460N	7	6	8	61	16
8	575E-465N	8	11	19	9	ROCK
9	575E-470N	7	36	38	21	ROCK
10	575E-475N	10	8	134	19	9
11	575E-480N	7	13	9	66	20
12	575E-485N	9	4	40	15	ROCK
13	575E-490N	6	8	281	31	14
14	575E-495N	7	5	117	97	40
15	575E-500N	6	9	253	69	21
16	575E-505N	6	6	12	ROCK	
17	575E-510N	11	6	107	70	29
18	575E-515N	7	8	144	15	10

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECT	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **575E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	575E-520N	8	8	162	41	12
2	575E-525N	9	6	3	46	10
3	575E-530N	7	8	10	85	37
4	575E-535N	10	6	32	122	64
5	575E-540N	5	12	12	133	70
6	575E-545N	6	8	59	84	23
7	575E-550N	6	6	23	29	15
8	575E-555N	4	8	22	14	8
9	575E-560N	6	4	41	50	25
10	575E-565N	10	4	31	28	15
11	575E-570N	12	4	ROCK		
12	575E-575N	9	6	ROCK		
13	575E-580N	9	8	ROCK		
14	575E-585N	8	12	10	ROCK	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **577E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	577.5E-487.5N			22	36	6
2	577.5E-492.5N			150	33	26
3	577.5E-497.5N			132	13	9
4	577.5E-502.5N			10	21	8
5	577.5E-507.5N			13	68	10
6	577.5E-512.5N			132	31	10
7	577.5E-517.5N			228	28	12
8	577.5E-522.5N			62	32	16
9	577.5E-527.5N			9	377	164
10	577.5E-532.5N	6	9	9	177	24
11	577.5E-542.5N			9	276	158
12	577.5E-547.5N			90	255	86

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTO	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **580E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	580E-430N	4	6	8	8	9	
2	580E-435N	7	7	6	8	11	
3	580E-440N	5	11	9	7	7	
4	580E-445N	8	7	8	13	10	
5	580E-450N	9	14	6	10	ROCK	
6	580E-455N	6	8	16	7	ROCK	
7	580E-460N	5	6	31	18	ROCK	
8	580E-465N	10	24	22	24	ROCK	
9	580E-470N	11	15	16	9	ROCK	
10	580E-475N	7	9	22	10	ROCK	
11	580E-480N	7	7	4	8	25	16
12	580E-485N	7	7	31	10	5	
13	580E-490N	8	20	45	14	17	9
14	580E-495N	8	6	33	ROCK		
15	580E-500N	3	1	12	36	17	9
16	580E-505N	5	6	45	18	ROCK	
17	580E-510N	6	5	120	43	27	17
18	580E-515N	7	8	224	98	34	

INSTRUMENTS:

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND

Total U 4
Th (Nat) 1.5

MDA

10
1

BACKGROUND NOT SUBTRACTED

W.a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 580E - 582.5E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	580E-520N	3	98	6	43	7	8
2	580E-525N	7	8	8	524	36	
3	580E-530N	12	6	8	101	267	86
4	580E-535N	9	6	63	97	97	
5	580E-540N	7	10	5	97	189	58
6	580E-545N	10	6	9	321	65	
7	580E-550N	5	7	7	154	41	83
8	580E-555N	7	9	12	19	16	
9	580E-560N	15	10	7	23	13	10
10	580E-565N	7	6	11	111	ROCK	
11	580E-570N	3	7	7	7	ROCK	
12	580E-575N	4	7	9	ROCK		
13	580E-580N	11	5	4	ROCK		
14	580E-585N	9	8	8	ROCK		
15	582.5E-507.5N			56	19	6	
16	582.5E-512.5N			17	56	17	
17	582.5E-517.5N			26	19	6	
18	582.5E-522.5N			19	96	32	
19	582.5E-532.5N			8	6	28	
20	582.5E-542.5N			6	111	28	
21	582.5E-547.5N			6	37	8	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **585E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	585E-430N	11	6	9	10	4
2	585E-435N	7	5	7	6	4
3	585E-440N	8	10	9	10	4
4	585E-445N	7	11	10	10	7
5	585E-450N	10	5	8	6	8
6	585E-455N	6	8	36	18	16
7	585E-460N	12	5	24	19	ROCK
8	585E-465N	6	19	13	12	ROCK
9	585E-470N	6	10	29	9	13
10	585E-475N	9	8	44	19	ROCK
11	585E-480N	7	8	34	9	7
12	585E-485N	7	6	57	10	10
13	585E-490N	8	7	90	15	8
14	585E-495N	9	36	10	8	6
15	585E-500N	8	4	61	9	13
16	585E-505N	4	9	30	14	8
17	585E-510N	5	4	31	10	9
18	585E-515N	5	7	121	14	5

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **585E - 587E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	585E-520N	9	9	216	22	7
2	585E-525N	6	8	23	84	36
3	585E-530N	6	9	61	33	13
4	585E-535N	9	5	197	112	24
5	585E-540N	12	9	174	94	28
6	585E-545N	8	7	13	92	19
7	585E-550N	6	8	28	35	17
8	585E-555N	8	7	5	28	ROCK
9	585E-560N	12	6	37	107	ROCK
10	585E-565N	7	59	12	4	26
11	585E-570N	9	5	5	7	5
12	585E-575N	5	7	6	ROCK	
13	585E-580N	12	8	4	ROCK	
14	585E-585N	9	7	8	ROCK	
15	587.5E-512.5N			58	266	198
16	587.5E-517.5N			354	326	182
17	587.5E-522.5N			43	229	152

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 590E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	590E-430N	8	13	7	10	10	
2	590E-435N	7	7	4	9	6	
3	590E-440N	5	8	10	8	7	
4	590E-445N	12	8	8	7	10	
5	590E-450N	6	7	4	5	7	
6	590E-455N	9	7	9	8	ROCK	
7	590E-460N	9	24	12	7	ROCK	
8	590E-465N	13	39	24	33	34	
9	590E-470N	10	81	22	17	19	
10	590E-475N	5	75	19	16	14	
11	590E-480N	6	4	4	9	18	8
12	590E-485N	4	83	41	28	23	
13	590E-490N	7	4	9	11	8	9
14	590E-495N	6	25	15	7	9	
15	590E-500N	11	11	5	7	5	3
16	590E-505N	10	13	13	19	7	
17	590E-510N	5	7	8	13	6	8
18	590E-515N	8	21	97	156	44	

INSTRUMENTS:

BACKGROUND

Total U 4
Th (Nat) 1.5

MDA

10
1

CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR

BACKGROUND NOT SUBTRACTED

W.A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **590E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	590E-520N	12	4	9	5	6	6
2	590E-525N	4	8	124	23	15	
3	590E-530N	11	11	10	9	7	5
4	590E-535N	8	13	15	18	45	
5	590E-540N	7	3	5	9	4	5
6	590E-545N	7	7	6	5	15	
7	590E-550N	4	5	4	9	10	5
8	590E-555N	8	5	15	ROCK		
9	590E-560N	14	4	9	4	ROCK	
10	590E-565N	5	5	8	14	8	
11	590E-570N	4	5	6	ROCK		
12	590E-575N	7	5	7	ROCK		
13	590E-580N	5	7	4	ROCK		
14	590E-585N	8	7	8	4	ROCK	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **595E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	595E-430N	7	14	7	10	6
2	595E-435N	6	13	8	6	6
3	595E-440N	8	4	9	6	9
4	595E-445N	5	5	4	5	7
5	595R-450N	7	5	9	7	8
6	595E-455N	9	11	12	6	8
7	595E-460N	8	6	9	8	ROCK
8	595E-465N	8	8	9	7	7
9	595E-470N	6	6	5	6	8
10	595E-475N	7	6	9	7	8
11	595E-480N	8	7	9	7	48
12	595E-485N	7	7	5	4	3
13	595E-490N	5	5	8	10	4
14	595E-495N	5	6	1	8	7
15	595E-500N	3	7	6	6	9
16	595E-505N	7	6	5	7	9
17	595E-510N	4	9	8	7	5
18	595E-515N	6	8	7	7	10

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 595E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	595E-520N	7	8	7	6	8
2	595E-525N	5	4	6	4	9
3	595E-530N	6	12	5	8	6
4	595E-535N	7	9	8	9	6
5	595E-540N	10	7	7	3	ROCK
6	595E-545N	11	9	9	5	5
7	595E-550N	6	7	6	4	ROCK
8	595E-555N	6	11	5	4	7
9	595E-560N	6	4	8	5	ROCK
10	595E-565N	8	4	5	5	ROCK
11	595E-570N	6	5	6	4	ROCK
12	595E-575N	14	10	4	ROCK	
13	595E-580N	4	5	6	4	3
14	595E-585N	7	8	7	ROCK	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTO	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 600E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	600E-430N	8	10	6	4	6	
2	600E-435N	6	6	7	5	4	
3	600E-440N	9	5	8	4	6	
4	600E-445N	4	4	8	7	6	
5	600E-450N	9	5	5	5	6	
6	600E-455N	6	9	4	8	7	
7	600E-460N	8	10	7	5	4	
8	600E-465N	8	6	5	5	ROCK	
9	600E-470N	3	5	8	7	5	
10	600E-475N	6	7	7	5	6	
11	600E-480N	8	5	4	7	4	7
12	600E-485N	8	6	7	5	7	
13	600E-490N	11	5	10	10	4	10
14	600E-495N	7	7	6	10	10	
15	600E-500N	7	8	11	6	12	10
16	600E-505N	6	5	8	5	10	
17	600E-510N	9	6	4	10	9	8
18	600E-515N	6	12	5	6	8	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

GRID LOCATION 600E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U	5' - 6' Total-U
1	600E-520N	9	9	9	9	7	9
2	600E-525N	6	6	4	7	6	
3	600E-530N	6	12	9	7	11	11
4	600E-535N	7	6	6	10	5	
5	600E-540N	8	8	8	12	11	9
6	600E-545N	7	8	4	6	6	
7	600E-550N	10	12	6	5	4	ROCK
8	600E-555N	5	7	7	7	3	
9	600E-560N	7	5	7	7	11	ROCK
10	600E-565N	7	8	10	8	5	
11	600E-570N	7	7	11	5	7	ROCK
12	600E-575N	10	6	4	5	ROCK	
13	600E-580N	8	6	3	12	ROCK	
14	600E-585N	4	5	4	8	ROCK	

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **605E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	605E-430N	7	9	8	5	5
2	605E-435N	7	6	6	8	10
3	605E-440N	8	12	4	7	7
4	605E-445N	6	9	10	5	5
5	605E-450N	6	6	6	4	7
6	605E-455N	5	7	8	8	8
7	605E-460N	9	8	5	7	7
8	605E-465N	12	10	5	7	6
9	605E-470N	4	7	6	7	7
10	605E-475N	7	7	5	8	5
11	605E-480N	7	10	5	9	6
12	605E-485N	6	6	7	6	8
13	605E-490N	9	4	5	8	5
14	605E-495N	5	8	3	9	8
15	605E-500N	5	8	5	5	7
16	605E-505N	5	11	7	7	4
17	605E-510N	7	5	4	6	8
18	605E-515N	5	6	8	4	5

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACIILTY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **605E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	605E-520N	9	3	6	6	7
2	605E-525N	10	7	5	4	9
3	605E-530N	5	8	7	5	7
4	605E-535N	8	6	10	12	6
5	605E-540N	6	11	8	7	11
6	605E-545N	9	8	4	7	9
7	605E-550N	7	8	10	7	6
8	605E-555N	6	9	6	8	5
9	605E-560N	6	5	5	7	8
10	605E-565N	12	7	6	4	5
11	605E-570N	10	9	4	4	6
12	605E-575N	7	6	6	10	5
13	605E-580N	8	8	3	9	ROCK
14	605E-585N	10	8	7	9	6

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W.A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **610E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	610E-430N	7	6	9	6	4
2	610E-435N	11	4	8	9	8
3	610E-440N	5	7	7	6	6
4	610E-445N	4	7	11	3	8
5	610E-450N	7	8	6	8	4
6	610E-455N	4	3	6	6	4
7	610E-460N	6	6	12	7	5
8	610E-465N	8	7	6	6	6
9	610E-470N	9	7	8	5	9
10	610E-475N	6	1	8	5	8
11	610E-480N	7	7	6	7	6
12	610E-485N	7	5	5	3	7
13	610E-490N	4	8	3	6	6
14	610E-495N	5	6	7	7	2
15	610E-500N	6	6	5	7	7
16	610E-505N	9	5	9	12	6
17	610E-510N	8	10	6	7	10
18	610E-515N	8	6	5	8	5

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **610E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	610E-520N	6	6	6	7	3
2	610E-525N	9	5	10	7	4
3	610E-530N	4	5	5	6	6
4	610E-535N	5	10	7	6	5
5	610E-540N	12	6	6	4	2
6	610E-545N	7	7	8	8	4
7	610E-550N	4	7	4	9	4
8	610E-555N	6	9	4	8	8
9	610E-560N	5	6	12	9	5
10	610E-565N	10	8	5	6	5
11	610E-570N	5	7	12	7	4
12	610E-575N	4	5	7	7	ROCK
13	610E-580N	7	13	7	6	ROCK
14	610E-585N	4	9	7	6	4

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. C. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **615E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	615N-430N	6	6	5	6	5
2	615E-435N	5	8	7	7	6
3	615E-440N	8	6	8	8	5
4	615E-445N	7	6	7	5	7
5	615E-450N	5	7	7	6	11
6	615E-455N	8	5	8	9	5
7	615E-460N	9	11	5	5	7
8	615E-465N	6	9	4	7	6
9	615E-470N	7	9	13	8	3
10	615E-475N	8	5	7	9	3
11	615E-480N	9	8	7	7	6
12	615E-485N	8	7	9	10	6
13	615E-490N	7	10	8	9	11
14	615E-495N	5	9	5	5	7
15	615E-500N	10	4	7	11	6
16	615N-505N	10	5	7	4	7
17	615E-510N	9	7	8	10	8
18	615E-515N	6	4	6	4	6

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **615E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	615E-520N	5	4	5	12	6
2	615E-525N	5	10	3	7	6
3	615E-530N	6	9	7	9	7
4	615E-535N	7	7	9	8	8
5	615E-540N	6	8	8	8	7
6	615E-545N	8	6	6	12	8
7	615E-550N	4	10	6	4	5
8	615E-555N	7	8	5	7	9
9	615E-560N	10	6	7	9	9
10	615E-565N	4	9	6	2	5
11	615E-570N	9	5	8	4	4
12	615E-575N	6	9	9	6	6
13	615E-580N	6	6	4	4	ROCK
14	615E-585N	4	8	7	7	11

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. G. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION **WASTE POND NO. 2**

GRID LOCATION **620E** DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	620E-430N	5	7	6	8	ROCK
2	620E-435N	9	5	7	ROCK	
3	620E-440N	3	4	8	7	ROCK
4	620E-445N	7	5	6	4	7
5	620E-450N	4	7	4	7	6
6	620E-455N	8	4	9	6	9
7	620E-460N	9	4	6	7	6
8	620E-465N	7	5	9	8	8
9	620E-470N	8	8	6	5	4
10	620E-475N	11	9	7	7	7
11	620E-480N	7	9	8	7	6
12	620E-485N	11	14	10	8	ROCK
13	620E-490N	7	14	7	8	8
14	620E-495N	10	8	8	9	9
15	620E-500N	6	8	8	7	8
16	620E-505N	8	10	7	7	7
17	620E-510N	6	5	2	6	5
18	620E-515N	9	12	7	4	10

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" NaI DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED

W. A. Rogers DATE: 9-17-97

FILE: AOPRCSSR

CIMARRON CORPORATION
CIMARRON FACILITY
PHASE III, SUB-AREA "O"
WASTE POND NO. 2
CHARACTERIZATION SOIL SAMPLE RESULTS

SAMPLE LOCATION WASTE POND NO. 2

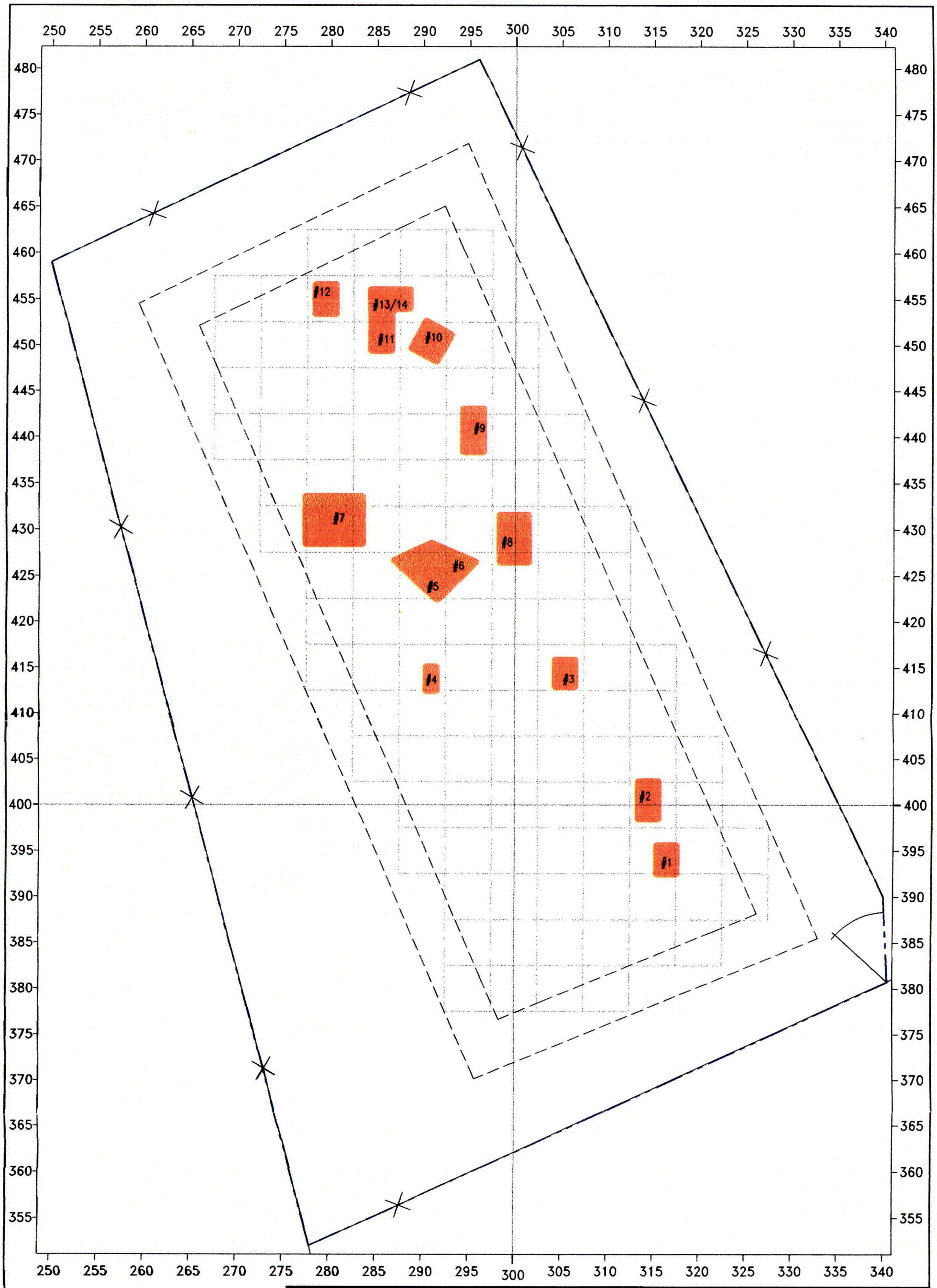
GRID LOCATION 620E DATE: 9/1/97

LN #	GRID NUMBER	pCi/g 0 - 1' Total-U	1' - 2' Total-U	2' - 3' Total-U	3' - 4' Total-U	4' - 5' Total-U
1	620E-520N	6	7	6	10	7
2	620E-525N	9	11	5	7	6
3	620E-530N	5	5	8	8	3
4	620E-535N	7	9	6	9	10
5	620E-540N	6	6	5	4	3
6	620E-545N	6	7	5	9	5
7	620E-550N	7	12	6	6	7
8	620E-555N	5	5	6	8	8
9	620E-560N	5	9	10	6	7
10	620E-565N	5	8	7	6	7
11	620E-570N	7	6	6	6	5
12	620E-575N	5	9	6	6	6
13	620E-580N	5	5	10	9	6
14	620E-585N	8	6	11	4	5

INSTRUMENTS:	BACKGROUND		MDA
	Total U	4	10
CIMMARON SOIL COUNTER X" X 4" X 16" Nal DETECTOR	Th (Nat)	1.5	1

BACKGROUND NOT SUBTRACTED W. a. Rogers DATE: 9-17-97

FILE: AOPRCSSR



NORTH

10 0 10

SCALE IN METERS

NOTES

LEGEND

REMEDIATED AREA

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	RS	JL	2/16/98

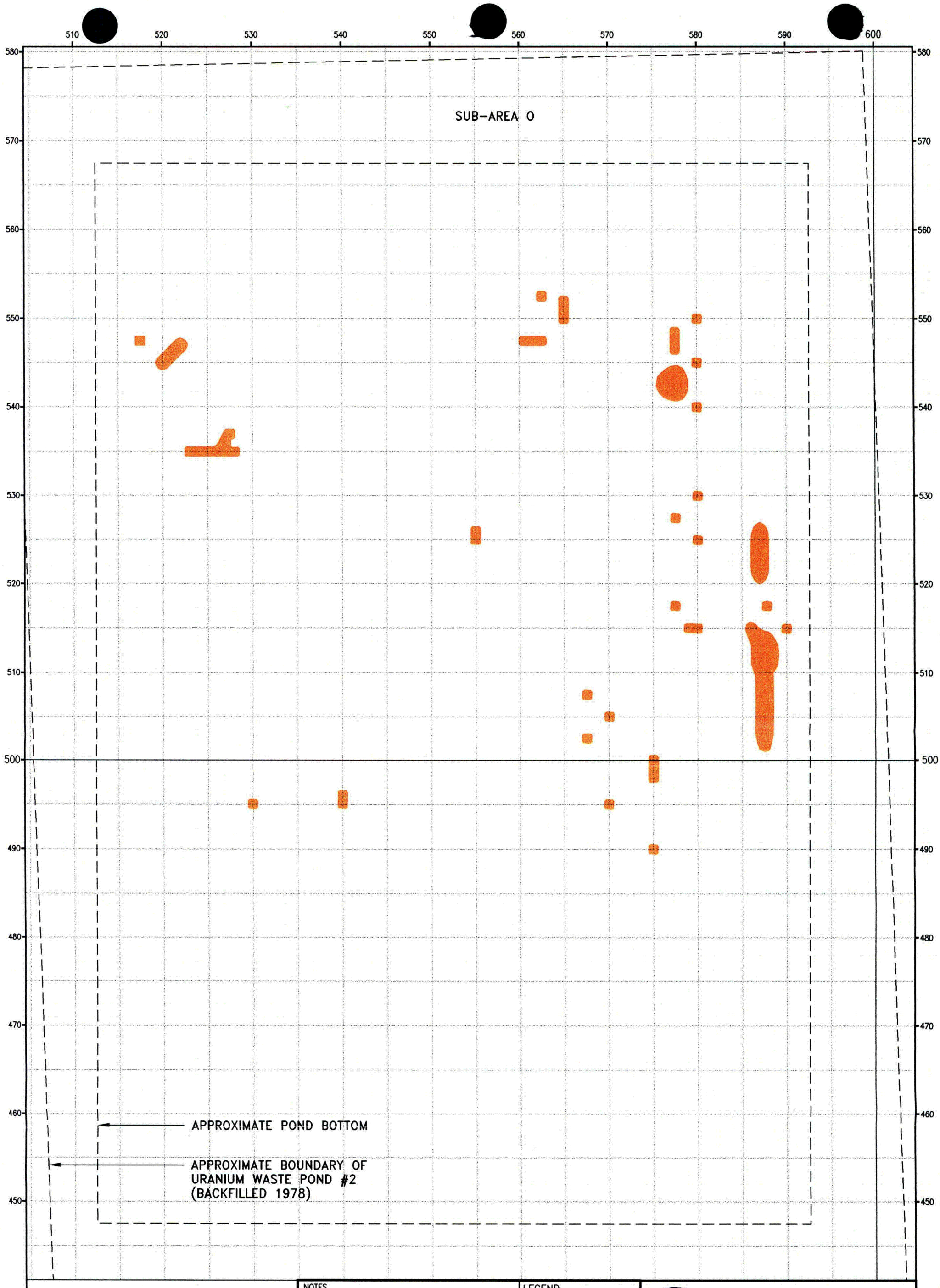
CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA 0
URANIUM WASTE POND #1
REMEDIATED AREAS

DRWN. BY	DATE	SCALE:
JE	1/1/98	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP1RB-0	0

...\UPOND1\POST-REM\97PRP1RB



NORTH

10 0 10

SCALE IN METERS

NOTES

LEGEND

REMEDIATED AREA

REV.	DESCRIPTION	DRWN BY:	CK'D BY:	APP'D BY:	DATE
0	DRAWING ISSUED.	JE	WR	JL	2/16/98

CIMARRON CORPORATION

CIMARRON FACILITY
PHASE III – SUB-AREA 0
URANIUM WASTE POND #2
REMEDIATED AREAS

DRWN. BY	DATE	SCALE:
JE	10/4/97	AS SHOWN

JOB NO.	DRAWING NO.	REV.
	97PRP2RB-0	0

...\UPOND2\97PRP2RB

CIMARRON SOIL COUNT SYSTEMS
EXAMPLE OF TYPICAL EFFICIENCY AND MDA CALCULATIONS

Gamma Spectrum Analysis Programs

The Cimarron Soil Count System utilities the lease-squares resolution of gamma-ray spectra in environmental samples (U.S. Department of Commerce, National Technical Information Service PB 280237 August, 1977). Soil Counter #1 uses the Alpha M program only. Soil Counter #2 uses the Alpha M program with Ortec software Model A65-BI version 3.06. Maestro for Windows 3.0.

The Alpha M program used to analyze soil samples at the Cimarron Facility assumes that the sample spectrum can be described by a linear combination of the gamma spectra of each component obtained separately. This allows the problem to be treated as a curve fitting problem by using least-squares techniques. The isotopes assumed to be present in the sample are U-238, U-235, Natural thorium, Ra-226 (in equilibrium), and background.

Standard spectra for these components are obtained by taking long counts on standards of known concentration with a geometrical configuration and size similar to a nominal unknown sample. The spectrum used contains the gamma energies from ≈ 26 Kev to 2.7 Mev. The background spectrum is developed by taking a long term count of the detector with no sample present. Data from all channels is used in the analysis.

Calibration Standards prepared by Kerr-McGee Technical Center (G.E. Van De Steeg)

The three standards listed below were constructed by the Technical Center with NIST traceable source material. The Th-232 source material certificate is dated October 1963 (Th-232 & Th-238 are in equalibrium). The standard construction and source material certificates are contained in the Chemical Research & Development Division Report TR-94034.

1. U-235 300 pCi/g 693.4 grams

   300 pCi/g x 693.4 grams x 2.22 dpm/pCi = 461,804.4 dpm

2. U-238 300 pCi/g 691.2 grams

   300 pCi/g x 691.2 grams x 2.22 dpm/pCi = 460,339.2 dpm

3. Th-232 300 pCi/g 693.3 grams

   300 pCi/g x 693.3 grams x 2* x 2.22 dpm/pCi = 923,475.6 dpm

   *Multiply by 2 to convert to Th(Nat)

Soil Counter #1 vs. #2 Comparison Counts

Cimarron has employed two counting systems for on site analysis of total Uranium and Thorium. Presently, counting system #2 is the primary system utilized with Counter #1 a back up. A comparison of the two systems is provided below:

	Soil Counter #1		Soil Counter #2
1.	Assumes 2.7% enrichment	1.	Makes no assumptions on enrichment
2.	Uses U-235 data to calculate Total-U	2.	Uses U-235 data, and U-238 data and calculates the U-234 as follows - U-234 = 21.4 x U-235 value Or U-234 = U-238 value whichever is largest 21.4 = ratio U-234/U235 Natural U in equilibrium
3.	Same background subtracted for each count.	3.	Background determined subtracted from each count.

Standard responses in Designated Areas of Interest (Net Count per Minute):

		Soil Counter #1 October 1996	Soil Counter #2 August 1997
1.	U-235 std.	55,690.7 Net cpm	55,477.1 Net cpm
2.	U-238 std.	Data not used in Total-U analysis	2886.1 Net cpm
3.	Th-(Nat) std.	140,867.5 Net cpm	140,365.4 Net cpm

Background in Areas of Interest

		Soil Counter #1 October 1996	Soil Counter #2 August 1997
1.	U-235 std.	1360.0 cpm	1332.4 cpm
2.	U-238 std.	Data not used in Total-U analysis	686.5 cpm
3.	Th(Nat) std.	7949.5 cpm	6005.6 cpm

Efficiency Soil Counter #1

The purpose of this presentation is to calculate the efficiency of Counter #1 and to determine the multiplier used for converting from U-235 measurement to total Uranium in the soil sample. The program assumes 2.7% enrichment; and the efficiency is calculated as follows:

1. $\frac{55{,}690.7 \text{ net cpm}}{461{,}804.4 \text{ dpm}} = .1205937 =$ 12.1 % efficiency for U-235

2. $\frac{140{,}867.5 \text{ net cpm}}{923{,}475.6 \text{ dpm}} = 0.1525406 =$ 15.25% efficiency for Th(Nat)

The multiplier is determined based upon the following assumption and calculations.

1. Standard U-1-2 = 28.66 pCi/g Total-U (Refer to Sub-Area "O" Report Table 7-2 page 23) is used and represents an average concentration from two independent laboratories.

   U-1-2 counted value 9.563×10^2 pCi-U-235

   Standard weight = 750 grams

   $\frac{9.563 \times 10^2 \text{ pCi-U-235}}{750 \text{ grams}} = 1.275$ pCi/g U-235

   1.275 x Multiplier = 28.66 pCi/g Total-U

   Multiplier = 23.0

   Thus Total U = $\frac{\text{U-235 counted value x 23}}{\text{sample weight}}$

MDA Calculation NUREG/CR-5849 (Page 5.9)

The guideline in NUREG/CR-5849 is followed in determining the MDA for Counter #1. The MDA determined is on a 5 minute count time.

MDA Calculation for Total U

1. $$MDA = \frac{2.71 + 4.65\sqrt{Bkg.} \times \text{count time}}{\text{count time} \times \text{efficiency} \times \text{sample weight} \times 2.22\ \text{dpm/pCi}}$$

$$MDA = \frac{2.71 + 4.65\sqrt{1360} \times 5}{5 \times 0.12 \times 750 \times 2.22}$$

$$MDA = \frac{386.158}{1003.95} = 0.385 = 0.385\ \text{pCi/g U-235}$$

Multiplier x 0.385 = MDA for Total-U 5 (minute count)

MDA = 23 x .0385 = 8.855 pCi/g Total-U 5 (minute count)

MDA Calculation for Th (Nat)

2. $$MDA = \frac{2.71 + 4.65\sqrt{7949.5} \times 5}{5 \times 0.15 \times 750 \times 2.22}$$

$$MDA = \frac{929.77}{1269.90} = 0.73216 = 0.73\ \text{pCi/g Th(Nat) (5 minute count time)}$$

Efficiency Soil Counter #2

1. U-235

$$\frac{55,477.1\ \text{cpm}}{461,804.4\ \text{dpm}} = 0.1201312 = 12.01\%\ \text{efficiency}$$

2. U-238

$$\frac{2886.1\ \text{cpm}}{460339.2\ \text{dpm}} = 0.006269507 = 0.63\%\ \text{efficiency}$$

3. Th(Nat)

$$\frac{140,365.4\ \text{cpm}}{923,475.6\ \text{dpm}} = .1519969 = 15.2\%\ \text{efficiency}$$

Soil Counter #2 5 minute Count Time

1. **U-235**

$$MDA = \frac{2.71 + 4.65\sqrt{\text{Bkg. x count time}}}{\text{Count Time x Efficiency x sample weight x 2.22 dpm/pCi}}$$

$$MDA = \frac{2.71 + 4.65\sqrt{1332.4 \times 5}}{5 \times 0.12 \times 750 \times 2.22}$$

$$MDA = \frac{382.248}{1000.09}$$

MDA = 0.38 = 0.38 pCi/g U-235

2. **U-238**

$$MDA = \frac{2.71 + 4.65\sqrt{686.5 \text{ X } 5}}{5 \times 0.00627 \times 750 \times 2.22}$$

$$MDA = \frac{275.142}{52.194}$$

MDA = 5.272 = 5.27 pCi/g U-238

3. **Th(Nat)**

$$MDA = \frac{2.71 + 4.65\sqrt{6005.6 \text{ X } 5}}{5 \times 0.152 \times 750 \times 2.22}$$

$$MDA = \frac{808.489}{1265.374}$$

MDA = 0.639 = 0.64 pCi/g Th-(Nat)

4. **Total - U** (assumes a calculated ratio of U-234:U-235 of 21.4:1)

$$MDA = \frac{2.71 + 4.65\sqrt{(\text{U-238 Bkg x Count Time}) + (\text{U-235 Bkg x Count Time}) + (\text{U-235 Bkg x 21.4 x Count Time})}}{\text{Count Time x Average Efficiency x sample weight x dpm/pCi}}$$

$$MDA = \frac{2.71 + 4.65\sqrt{(686.5 \times 5) + (1332.4 \times 5) + (1332.4 \times 21.4 \times 5)}}{5 \times \frac{(0.120 + 0.00627)}{3} \times 750 \times 2.22}$$

$$MDA = \frac{2.74 + 4.65\sqrt{152,661.3}}{5 \times 0.042 \times 750 \times 2.22}$$

$$MDA = \frac{1819.55}{350.762}$$

MDA = 5.187 = 5.2 pCi/g Total - U for 5 minute count

William A. Rogers

W.A. Rogers 3-3-98

EXPLANATION OF CALCULATION METHODS

The following is a discussion of the methodology used in calculating the average uranium concentrations for all subsurface soils within the perimeter of U-Ponds # 1 and #2. The concentration averages were evaluated against the subsurface volumetric averaging criteria (guideline values) determined per the NRC guidance. The final status survey data was evaluated as described below:

- Data within each 5 m x 5 m by 1 foot in depth block of soil were averaged by assigning a weight factor to each sample location. These soil volumes were assigned a representative value of 7.5 m^3.
- The 7.5 m^3 soil volumes were then averaged in one meter depth at the soil depth increments of 0-1 m, 1-2 m and 2-3 m. It should be noted that the data was collected in 1' increments. The soil depths are 3 or 4 foot averages represent one meter.
- Next, the one meter averages for the 5 m x 5 m blocks are averaged from zero to two meters and zero to three meters depths for comparison to guideline values;
- Next, the 0-1 m, 0-2 m, and 0-3 m soil average concentrations are further averaged in 100 m^3, 200 m^3, and 300 m^3 soil volumes for comparison to the guideline values.

Typically the data were averaged using the weighting factors illustrated in the Figures on Pages 4 and 5. These figures represent soil grids with typical layout showing sample locations and assigned weighting factors. If a grid contained areas requiring extensive remediation, then actual areas remediated were used for determining grid area weighting factors. Five example calculations are included to demonstrate the methods used in calculating the subsurface volumetric averages.

Example One (See Calculations Provided)

This calculation is based upon Figure 1. A single data point was reported in each 5 m x 5 m block. For depths zero to four feet, the data points were the same, i.e. the entire layer had the same measurement. The 0-1 meter grid average (representing 25 m^3 of soil) was the same for each 5 m x 5 m block (i.e., 7.0 pCi/g). Therefore, the 10 m x 10 m x 1 m grid average (representing 100 m^3 of soil) was the same as the 5 m x 5 m x 1 m grid average (i.e., 7.0 pCi/g).

For the 1-2 meter depth calculations, the data varies beginning at a depth of 4 feet. The 5 m x 5 m x 1 m average is calculated from the average concentration recorded for the 3'-4', 4'-5' and 5'-6' measurements. For block 580E-560N, this average is 7.3 pCi/g. The four 5 m x 5 m x 1 m block averages (7.3, 7.3, 16.0 and 25.3 pCi/g) were averaged to determine the 10 m x 10 m x 1 m average for the 0-1 meter depth (i.e., 14.0 pCi/g). This procedure was followed for the 2-3 meter soil depth calculations.

For determining the 0-2 meter average concentrations for each 5 m x 5 m grid, the 5 m x 5 m values for 0-1 meter and 1-2 meter were averaged. For example, in block 580E-560N, 7.0 and 7.3 pCi/g are averaged. The four 0-2 m average for 5 m x 5 m grid block values (7.2, 7.2, 11.5 and 16.2 pCi/g) are averaged to determine the 10 m x10 m 0-2 meter depth average (i.e., 10.5 pCi/g). This procedure is repeated for the 0-3 meter averages.

Example Two (See Calculations Provided):

This calculation is represented by Figure 1 and Figure 2. A single data point was reported in each 5 m x 5 m block for depths zero to four feet, the data points were the same, i.e. the entire layer had the same measurement. The 0-1 meter grid average was the same for each 5 m x 5 m block (i.e., 7.0 pCi/g). Therefore, the 10 m x 10 m x 1 m grid average concentration was the same as the 5 m x 5 m x 1 m grid average (i.e., 7.0 pCi/g).

For the 1-2 meter depth calculations, the data is represented by Figure 2 beginning at a depth of 4 feet. The 5 m x 5 m x 1 m average concentration was calculated by taking each data point in a grid block and multiplying a fraction of the grid block's area by each data point concentration. The fractions are illustrated by Figure 2. For example, in evaluating grid block 575E-535N, the data point 9.0 pCi/g is located in the southwest corner of the block and data point 6.0 pCi/g is located in the center. Using Figure 2, 9 is multiplied by 1/8, and 6 is multiplied by 7/8, and then the two concentrations are summed. This results in an average value of 6.4 pCi/g for the block.

In block 580E-540N, data points 8 and 5 pCi/g are averaged and then multiplied by 1/8, since they are both located in the northwest corner of the grid.

For determining the 100 m^3, the four 5 m x 5 m x 1 m average concentrations representing 25 m^3 each (13.5, 9.0, 20.2, and 20.9 pCi/g) were averaged to determine the 10 m x 10 m x 1 m average concentration for the 1-2 meter depth (i.e., 15.9 pCi/g). This procedure was followed for the 2-3 meter depth calculations.

For the 0-2 meter calculations, the 5 m x 5 m concentrations for 0-1 meter and 1-2 meter are averaged for determining the 50 m^3 soil averages. For example, in block 575E-535N, 7.0 and 13.5 pCi/g are averaged. Then, for determining the 200 m^3 average the four 0-2 m average concentrations for the four 50 m^3 volumes (10.3, 8.0, 13.6, and 14.0 pCi/g) are averaged to determine the 10 m x 10 m x 0-2 meter depth average (i.e., 11.5 pCi/g). This procedure is repeated for the 0-3 meter averages for both the 75 m^3 and 300 m^3 soil volumes.

Example Three (See Calculation Attached):

This calculation is represented by Figures 1 and Figure 2 and is similar to Example Two.

Example Four (See Calculation Attached):

This calculation, in general, is represented by Figure 4 and Figure 5, except for grids where extensive excavation was performed.

For the 5 m x 5 m x 1 foot soil volumes, representing 7.5 m^3, the averages were determined utilizing the weighting method illustrated in Figure 4 and Figure 5 and by assigning a percentage of the total block area (25 m^2) to each data point, depending on the sampling point location. The 5 m x 5 m grid containing five data points will be weighted as shown in Figure 4. One point will be weighted with 1/25 of the total grid area and the remaining four points will each be weighted with 6/25 of the total grid area. The 5 m x 5 m grids containing two or three points will be weighted based on the physical location of the sampling point, as shown on Figure 5. For gird block 290E-425N the area remediated was determined to be 21 m^2 out of a possible 25 m^2 for the entire grid. Thus, the backfill soil was assigned a weighting factor of 21/25 for this 5 meter x 5 meter grid.

The 5 m x 5 m x 1 m grid average concentrations, the 10 m x 10 m x 1 m grid averages, and the 10 m x 10 m grid averages for the 0-2 m and 0-3 m soil depths were calculated as described above.

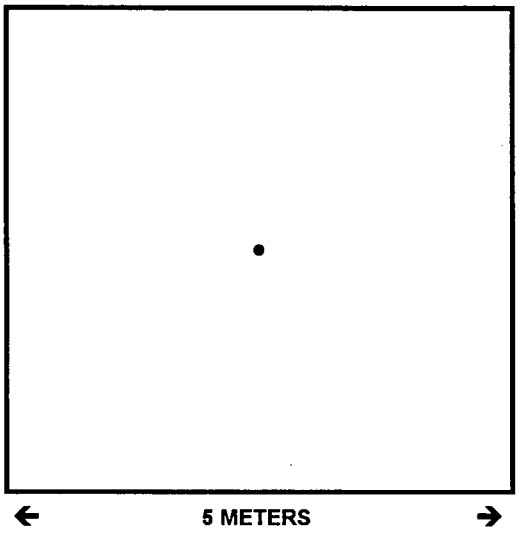
Example Five (See Calculation Attached):

For the 5m x 5m x 1 foot soil volumes, the averages were determined using weighting factor determined from the actual sample locations relative to excavated areas. For example, the remediated area was assigned an area equal to the area remediated and a concentration representative of the backfill soil. This weighting method was utilized in all the areas which were remediated. For example, in block 290E-430N, 0-1 foot depth, the distance between the data point 6.0 pCi/g located in the center and data point 7 pCi/g, located in the southwest portion of the grid block was divided in half as shown by the dashed line (Reference Figure 6). The area above the dashed line (15 m^2) is multiplied by 6, then divided by 25. The area excavated in this block was determined to be 4.25 m^2. This area is multiplied by 7 pCi/g, then divided by 25. The rest of the area of the block (5.75 m^2) is multiplied by 7 pCi/g, then divided by 25. The sum of these three weighted values is reported as the average concentration for the 7.5 m^3 soil volume.

The 5 m x 5 m x 1 m grid averages, the 10 m x 10 m x 1 m grid averages, and the 10 m x 10 m grid averages for 0-2 m and 0-3 m are calculated as described above.

TYPICAL EXAMPLES OF (5 METER X 5 METER) GRIDS ILLUSTRATING THE WEIGHTING FACTORS ASSIGNED TO A SAMPLE LOCATION

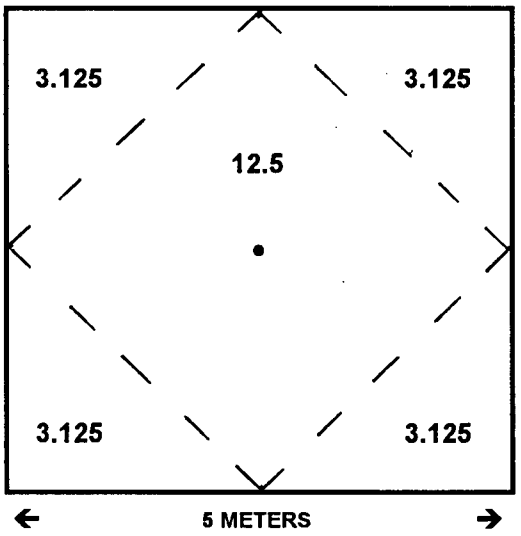
FIGURE - 1



A SINGLE DATA POINT

25 SQUARED METERS (25 m²)

FIGURE - 2

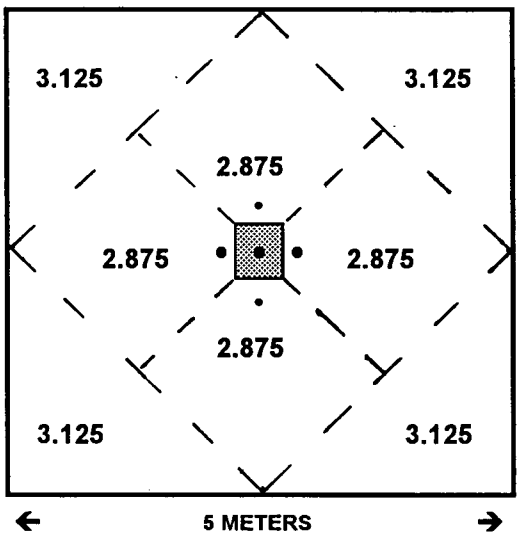


3.125 m² (1 / 8 OF THE AREA)

12.5 m² (4 / 8 OR 1 / 2 OF THE AREA)

3.125	m²
3.125	m²
3.125	m²
3.125	m²
12.500	m²
25	m²

FIGURE - 3

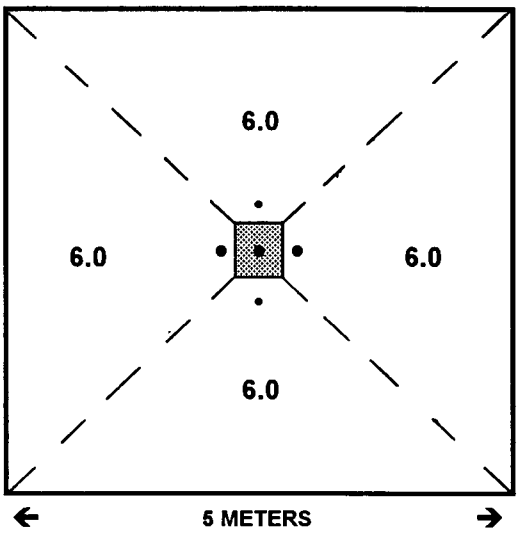


SHADED BLOCK (1 m²)

1.000	m²
3.125	m²
3.125	m²
3.125	m²
3.125	m²
2.875	m²
2.875	m²
2.875	m²
2.875	m²
25	m²

TYPICAL EXAMPLES OF (5 METER X 5 METER) GRIDS ILLUSTRATING THE WEIGHTING FACTORS ASSIGNED TO A SAMPLE LOCATION

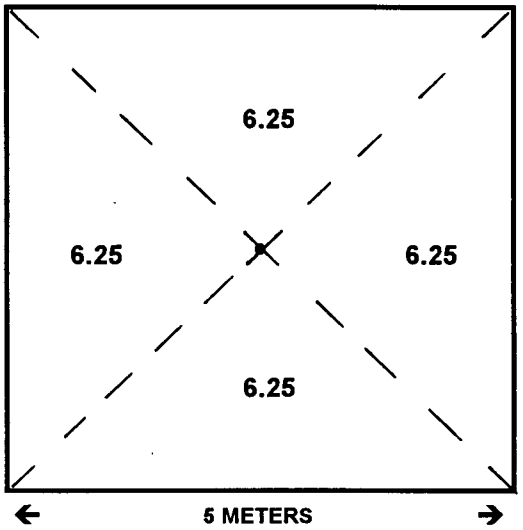
FIGURE - 4



SHADED BLOCK (1 m²)

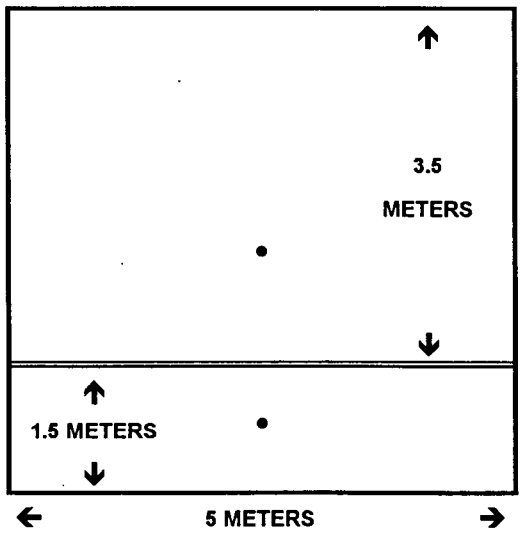
1.0	m²
6.0	m²
6.0	m²
6.0	m²
6.0	m²
25	m²

FIGURE - 5



6.25	m²
6.25	m²
6.25	m²
6.25	m²
25	m²

FIGURE - 6



VARIABLE AREA ASSIGNED BASED ON SAMPLE LOCATIONS