# ENVIRONMENTAL ASSESSMENT

# BY THE OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

# OF THE PROPOSED DECOMMISSIONING PLAN AND OTHER PROPOSALS

# RELATED TO THE

# CIMARRON CORPORATION

# FORMER FUEL FABRICATION FACILITY

# DOCKET NO. 70-0925

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# FOREWORD

This Environmental Assessment (EA) reviews the environmental impacts of certain decommissioning actions proposed by Cimarron Corporation (Cimarron) at its facility in Crescent, Oklahoma. In connection with the review of the proposed action, staff of the U.S. Nuclear Regulatory Commissioning is also preparing a Safety Evaluation Report (SER), which evaluates conformance of the proposed action with NRC regulations and regulatory guidance. The SER may conclude that Cimarron's proposed action should be modified in one or more respects to more fully comply with NRC regulation and guidance. Such modifications to the proposed plan, should they come about and be implemented, are unlikely to have a significant bearing on the overall environmental impact of the proposed decommissioning and are not likely to change the conclusions of this EA.

## SUMMARY AND CONCLUSIONS

This Environmental Assessment (EA) was prepared by the staff of the U.S. Nuclear Regulatory Commission (hereafter called "NRC staff"), Office of Nuclear Material Safety and Safeguards, and Region IV.

1. The proposed action is to approve plans by Cimarron Corporation (the licensee) to perform final decommissioning at its facility located in Crescent, Oklahoma. The proposed decommissioning is part of a Cimarron decommissioning program that would remediate uranium contamination in soils and buildings at the Cimarron site. The objective of the decommissioning actions is to terminate the license and release the former fuel fabrication facility for unrestricted use.

2. The proposed actions are also revisions to License SNM-928, changes to the "Radiation Protection Plan," and changes to Cimarron's organizational structure

3. This EA assesses the environmental impacts of the decommissioning proposed by the licensee. It also considers the no-action alternative to the licensee's proposal. This EA has been prepared and issued pursuant to the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51 of NRC's regulations.

4. NRC staff has reviewed the potential impacts of the proposed decommissioning, both beneficial and adverse. The staff's conclusions are summarized as follows:

   a. Radiation exposures of persons living or traveling near the site because of onsite operations and waste transportation will be well within limits contained in 10 CFR Part 20.

   b. The potential radiological impacts off-site of potential onsite accidents are well below the radiation dose limit of 1 mSv/yr (100 mrem/yr) to the public and the radiation dose limit of 50 mSv/yr (5 rem/yr) to workers in accordance with 10 CFR Part 20.

   c. The potential nonradiological impacts, such as socioeconomic, air quality, land and water use, etc., from decommissioning activities at Cimarron are negligible.

d. For conservatism, the site use is assumed to be equivalent to the resident farmer scenario described in PG-8-08. Under this scenario, the maximum radiation doses to a hypothetical resident-farmer, who might establish a residence on the site, grow and consume food from the site, and consume drinking water from an onsite groundwater well, more than a 1000 year period, were calculated assuming both with a cover and without a cover over the disposal cell. The predicted doses for both scenarios are less than 0.09 mSv/yr (9 mrem/yr), which is below NRC's 10 CFR Part 20 radiation dose for the public of 1 mSv/yr (100 mrem/yr).

e. Radiation doses to a remediation worker onsite from direct exposure are estimated to be less than 0.01 mSv (1 mrem) for a 2000-hour exposure period. Inhalation doses from a 2000-hour exposure would be less than 0.03 Sv (3 mrem). These predicted doses are substantially less than the occupation exposure limit of 50 mSv/yr (5 rem/yr) in 10 CFR Part 20.

f. The impacts from the transportation of radioactive materials are low and within NRC and Department of Transportation requirements. The potential consequences and probability of a transportation accident are low.

g. The licensee has a radiation protection program that will maintain radiation exposures and effluent releases within the limits of 10 CFR Part 20 and will maintain exposures as low as is reasonably achievable.

h. The population within a 6.5 km (4 mile) radius of the licensee facility has minority and senior citizen populations lower than the county and the State averages, and has a median household income above that of the county and the State. Based on these statistics, there are no significant minorities and low-income households that will be exposed to impacts from the proposed activities at Cimarron. Because there are no significant impacts from the proposed activities, there will be no environmental justice impacts.

i. No reasonably available alternative to the licensee's proposed plan is obviously superior.

5. On the basis of this EA, NRC staff has concluded that the proposed action would not have any significant effect on the quality of the human environment and does not warrant the preparation of an environmental impact statement. The action called for, under NEPA and 10 CFR Part 51, is the issuance of a license amendment authorizing the licensee to perform final remediation of the Cimarron site as proposed by the licensee.

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# 1. INTRODUCTION

U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Material Safety and Safeguards, and Region IV prepared this Environmental Assessment (EA).

This EA:

(1) Evaluates the acceptability of Cimarron Corporation's (Cimarron's) proposed decommissioning plan (DP) (Reference 1) for the Cimarron facility;

(2) Evaluates proposed revisions to License SNM-928 to establish a cleanup standard for the Cimarron site, better delineate the handling of various classifications of contaminated material at the site, and revise references to licensee commitments;

(3) Evaluates proposed changes to the "Radiation Protection Plan" (RPP) (Reference 2); and

(4) Evaluates proposed changes to Cimarron's organizational structure.

## 1.1 Background

The Kerr-McGee Corporation (KMC) operated two plants at the Cimarron facility between 1965 and 1975, each under its own separate Atomic Energy Commission license. Radioactive Materials License SNM-928 was issued under 10 CFR Part 70 for the Uranium Fuel Fabrication Facility, and Radioactive Materials License SNM-1174 was issued for the Mixed Oxide Fuel Fabrication (MOFF) Facility. In 1983, when KMC was divided into Sequoyah Fuels Corporation (SFC) and Quivera Mining Corporation, SFC became the owner of the Cimarron Facility. Subsequently, in 1988, Cimarron, a subsidiary of KMC, became responsible for the Cimarron Facility. Although the Cimarron facility poses no immediate threat to public health and safety, it is listed in the Site Decommissioning Management Plan (SDMP) to ensure timely decommissioning.

## 1.2 Purpose and Need for Proposed Actions

The proposed actions are necessary for Cimarron to complete the remaining decommissioning activities needed for NRC to release the Cimarron site for unrestricted use and to terminate Radioactive Materials License SNM-928. License termination is a separate action that requires an NRC finding that the premises are suitable for release.

## 1.3 Description of Proposed Actions

The objectives of the proposed actions are to decontaminate and decommission the Cimarron site to permit release for unrestricted use of the site and termination of Radioactive Materials License SNM-928. In accordance with 10 CFR 70.38(g) Cimarron submitted a proposed DP. In conjunction with this proposal, Cimarron has also proposed revisions to Radioactive Materials License SNM-928, changes to the RPP, and changes to its organizational structure. The details of these proposals are provided in the following subsections.

### 1.3.1 Decommissioning Plan

Cimarron submitted its DP on April 19, 1995 (Reference 1). Responses to NRC staff comments on the DP were submitted on September 9, 1996, and May 6, 1997, to clarify statements made in the DP. Decommissioning activities have been ongoing since 1976 when production activities were terminated. Many of the decommissioning activities at the site have been completed under existing license conditions. For example, the facilities and grounds were decontaminated under, License Condition 20 of the March 31, 1983, license renewal; contaminated solid waste was shipped to a licensed low-level radioactive waste (LLW) disposal site, under License Condition 18; and contaminated soil was disposed onsite under License Condition 23 (Amendment No. 10). Other activities were conducted pursuant to NRC staff's approval of Final Status Survey Plans (FSSPs). Based on historical knowledge of the site, the Cimarron site was divided into three major areas (phases) containing affected and unaffected areas. These major areas were then subdivided into subareas. The Phase I FSSP was approved by the staff's letter of May 1, 1995; the Phase II FSSP was approved by the staff's letter of March 14, 1997; and the Phase III FSSP was approved by the staff's letter of September 11, 1998. More discrete activities; such as the backfilling in Subarea L and the emplacement of ground-up asphalt into a disposal cell were approved by NRC letters dated November 8, 1996, and April 28, 1998, respectively.

On July 30, 1998, Cimarron submitted the "Decommissioning Plan Groundwater Evaluation Report" (hereafter "Groundwater Evaluation Report") for the Cimarron site. This report was required because Cimarron did not address groundwater concerns in its DP. Additional clarification of the "Groundwater Evaluation Report" was provided in Cimarron's March 4, 1999,letter. The results of staff's review of this document, was conducted in coordination with

the Oklahoma Department of Environmental Quality (ODEQ), are also discussed in this EA.

Decommissioning activities remaining to be performed at the Cimarron facility include: decontamination and decommissioning of facility structures; onsite disposal of contaminated soil meeting the Option 2 criteria of NRC's 1981 Branch Technical Position (BTP), "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (Reference 3); offsite disposal of soil or material exceeding the BTP Option 2 criteria; and groundwater remediation.

1.3.2 Revisions to License

On April 30, 1997, Cimarron requested an amendment to its license to add a new license condition specifically establishing the BTP (Reference 3) Option 1 unrestricted-use residual-contamination criteria as the cleanup standard for the Cimarron site.

In addition, on June 30, 1997, Cimarron submitted an amendment request to:

(1) Modify License Conditions 18 and 23 to better delineate the handling of various classifications of contaminated material at the site; and

(2) Revise references to other licensee commitments in License Condition 10.

In response to April 3, 1998, comments from NRC, additional revisions to both of these requests were proposed by letter of June 29, 1998.

1.3.3 Revisions to the RPP

The RPP was first approved on July 7, 1997 (License Amendment No. 14). While the NRC staff was completing its approval of the RPP, on June 30, 1997, Cimarron proposed additional revisions to the RPP (Reference 2). These are minor changes to clarify statements made in the RPP. The intent of these proposed revisions was to:

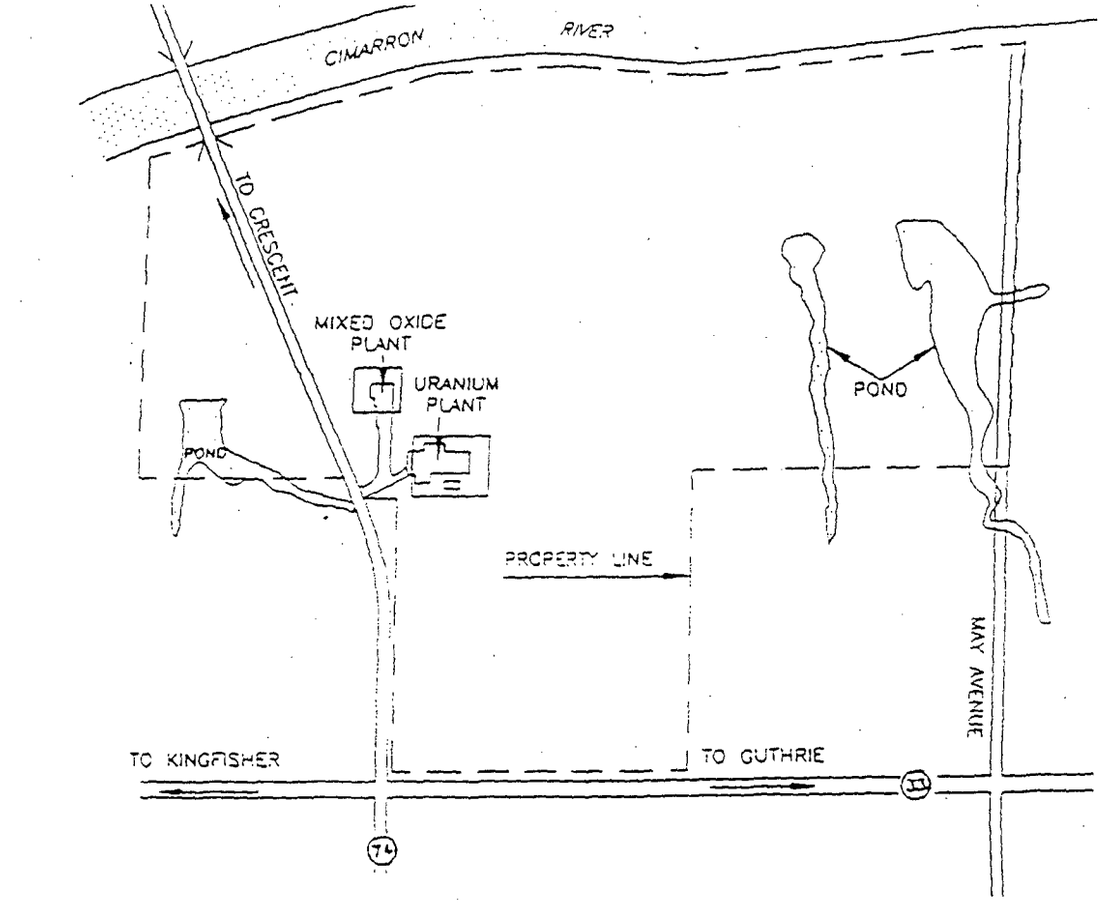
(1) Incorporate references to a Quality Assurance Plan; and

(2) Revise the Environmental Sampling Schedule.

In response to April 3, 1998, comments from NRC, further revisions to this request were proposed by letter of June 29, 1998.

1.3.4 Revision of Organizational Structure

By letters dated January 23, 1998, June 29, 1998, October 26, 1998, and July 27, 1999, Cimarron proposed amending its license to incorporate changes in its organizational structure. These changes were necessitated by downsizing of staff at the Cimarron site as decommissioning activities were being completed.



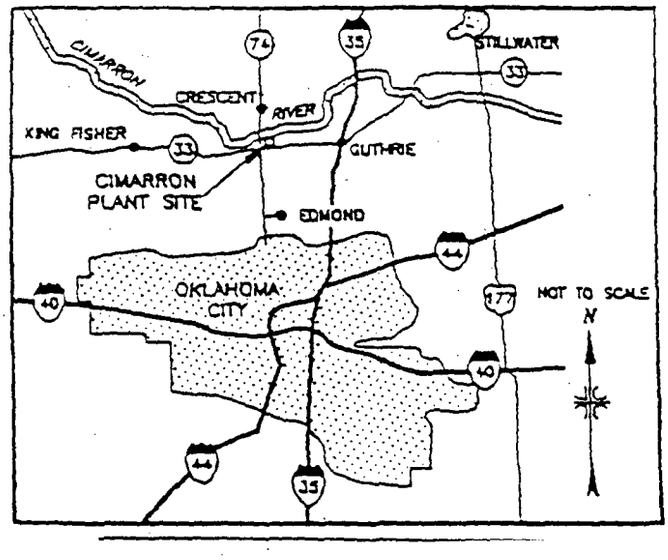




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Figure 2.1: Area Map

# 2. FACILITY DESCRIPTION

## 2.1 Site Locale and Physical Description

The Cimarron facility is located 8 km (5 miles) south of the city of Crescent, Oklahoma and approximately 0.8 km (0.5 miles) north of the intersection of Oklahoma State Highways Numbers 33 and 74 in Logan County, Oklahoma (Figure 2.1). The terrain of the region is rolling pasture land. Site elevation ranges from 286 to 309 meters (m) (938 to 1013 feet (ft)) above sea level. The entire Cimarron site encompasses approximately 3.4 x 10E6 $m^2$ (840 acres).

## 2.2 Description of Facilities

The process facilities included several one-story sheet metal buildings; five process-related collection ponds; two original sanitary lagoons; a newer sanitary lagoon; a waste incinerator, several uncovered storage areas; and three disposal areas. These process facilities are currently at differing stages of decommissioning. The site also includes the decommissioned MOFF building, the surrounding restricted area, and three reservoirs. The general site layout is shown in Figure 2.2. With the exception of Reservoirs 2 and 3, which were constructed for process make-up and potable water, all process facilities discussed above are considered affected areas. Included within these affected process facilities are several drainage areas and the site road to the old disposal area (Burial Area 1). The majority of the 3.4 x 10E6 $m^2$ (840 acres) licensed site was never used during nuclear fuel fabrication operations. Licensed material, including wastes generated from licensed activities, was never placed in or discharged to any of the designated unaffected areas.

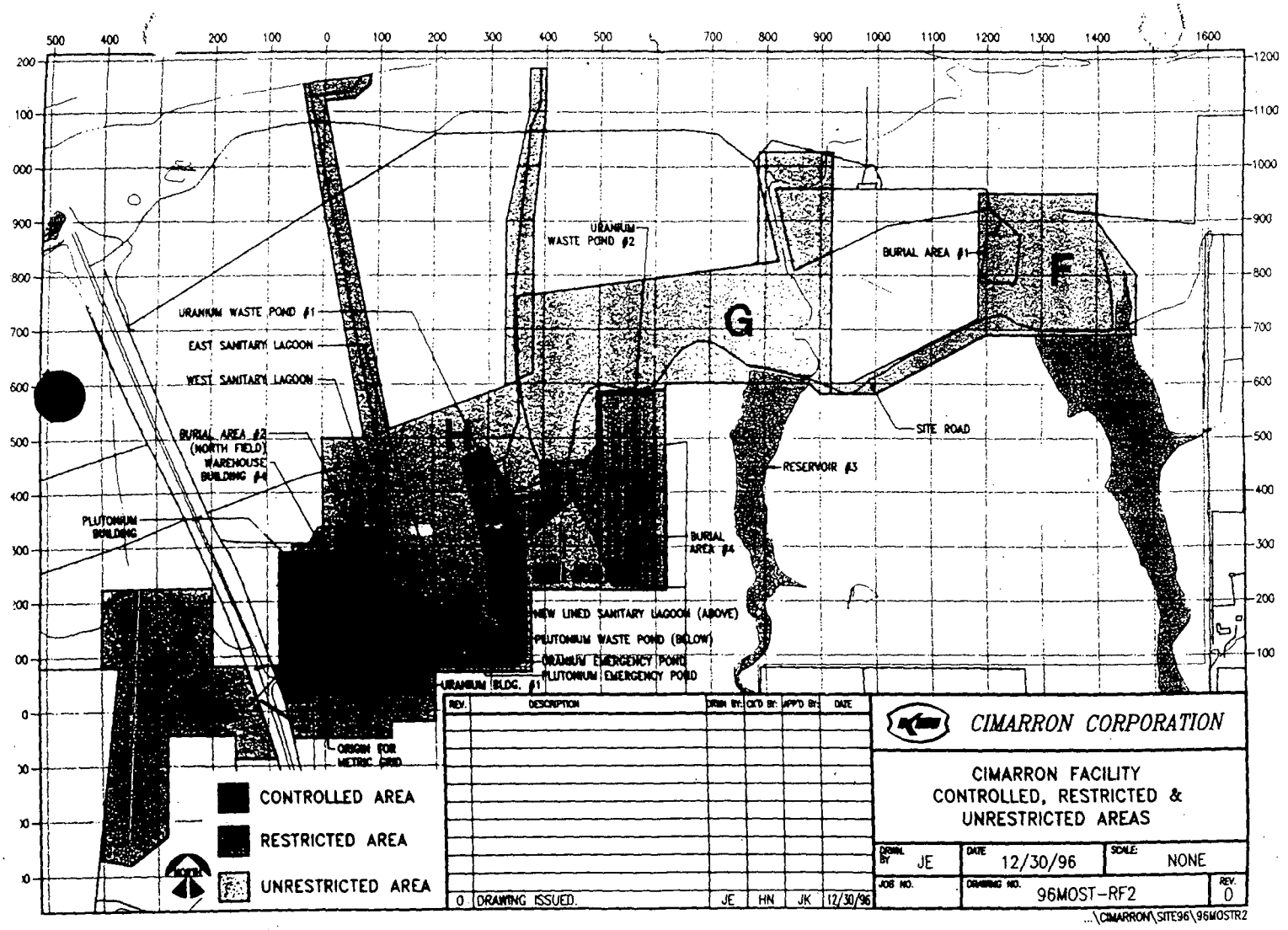


Figure 2.2: General Site Layout

## 3. RADIOLOGICAL STATUS OF THE FACILITY

Cimarron divided the site into subareas that are naturally distinguishable or have a common history of characterization and decommissioning activities. These subareas are indicated in Figure 2.2.

Under Phase I of its decommissioning activities, Cimarron identified as unaffected 2.81 x 10E6 $m^2$ (695 acres) of land that were never used for licensed activities and requested that this land be released for unrestricted use. As noted on Figure 2.2, the Phase 1 acreage is comprised of Subareas A, B, C, D, and E. Cimarron submitted final survey data for this area on October 20, 1994. Based on NRC staff review and follow-up confirmatory surveys, on April 4, 1996, the license was amended accordingly to release this area for unrestricted use (Amendment No. 13).

Phase II includes both affected and unaffected areas. As noted on Figure 2.2, the Phase II area is comprised of Subareas F, G, H, I, and J. In July 1995, Cimarron submitted an FSSP for Phase II. NRC staff approved the Phase II FSSP on March 14, 1995. Cimarron will be submitting FSSRs for Phase II subareas as decommissioning activities in these subareas are completed. To date, FSSRs have been submitted for Subarea F and J. Both are currently under NRC staff review.

Phase III contains affected areas only. As indicated on Figure 2.2, Phase III is comprised of Subareas K, L, M, N, and O. Cimarron submitted a Phase III FSSP in June 1997. In May 1996, Cimarron submitted an FSSR for Phase III Subarea L and requested NRC approval to backfill, grade, and seed the subarea, which was comprised of three former waste ponds and new lined sanitary lagoon areas. Based on its review of this FSSR, by letter of November 8, 1996, NRC staff approved Cimarron's request to backfill, grade, and seed this subarea. On July 27, 1998, Cimarron submitted its Phase III Subarea L FSSR and requested unrestricted release of this subarea from the license. NRC staff is currently reviewing this FSSR.

### 3.1 Radiological Status of all Structures and Systems

The radiological status of all structures and systems has been documented in the DP (Reference 1) and Cimarron's October 1994 "Radiological Characterization Report" (hereafter "Characterization Report") (Reference 4). The primary source of contamination was from the use of enriched uranium. When the "Characterization Report" was submitted, surface contamination of buildings and concrete areas described in Section 1.5 of the DP ranged from background to 40,000 disintegrations per minute (dpm) gross beta-gamma per

100-square centimeters ($cm^2$) (15.5-square inches ($in^2$)) and from background to 6000 dpm/100 $cm^2$ (6000 dpm/15.5 $in^2$) gross alpha. The highest surface contamination readings were observed on concrete rubble located in drainage ways in Phase II, Subarea F, that had been surveyed and released for unrestricted use based on gross alpha measurements taken in the late 1970s. However, the surface contamination release criteria in effect during the early phases of facility decommissioning were not as restrictive as those currently in place and the early surveys did not include beta-gamma activity before release, which is now the accepted practice for contaminants known or believed to be enriched uranium. Radiological exposure rate surveys performed in the areas described in Section 1.5 of the DP ranged from background of 1.8-2.6 pico Coulombs (pC) per kilogram (kg)) (7-10 micro-R ($\mu$R) per hour (hr)) to approximately 5.2 pC/kg (20 $\mu$R/hr).

Since submittal of the DP, the majority of the site areas have been decommissioned to meet the free release criteria of "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material" (Reference 5). Cimarron will be submitting FSSRs to demonstrate that all remaining site areas meet the BTP Option 1 criteria (less than 1.1 Becquerel per gram (Bq/g) (30 pico Curies per gram (pCi/g)) total uranium (Reference 3) or the guidance contained in the aforementioned guidelines for decontamination. Major areas of concern in regard to radiological status are summarized below.

Uranium Process Buildings and Equipment - Decontamination and decommissioning of the uranium processing equipment and buildings were initiated in 1977.

The Uranium Warehouse Building was released in 1980 for non-nuclear use as a coal liquification processing building. Additional surveys in 1993 showed elevated levels of beta activity which required decontamination. An alpha survey conducted at the same time, in 1993, showed a maximum fixed activity of 500 dpm/100 $cm^2$ (500 dpm/15.5 $in^2$) and an average of 200 dpm/100 $cm^2$ (200 dpm/ 15.5 $in^2$).

The Uranium Building is a one-story metal building 49 m x 104 m (160 ft × 340 ft) which contained offices, laboratory, and change rooms plus the majority of the equipment used for uranium fuel processing. A general layout of the processing area is shown in Figure 3.1. Contamination levels on

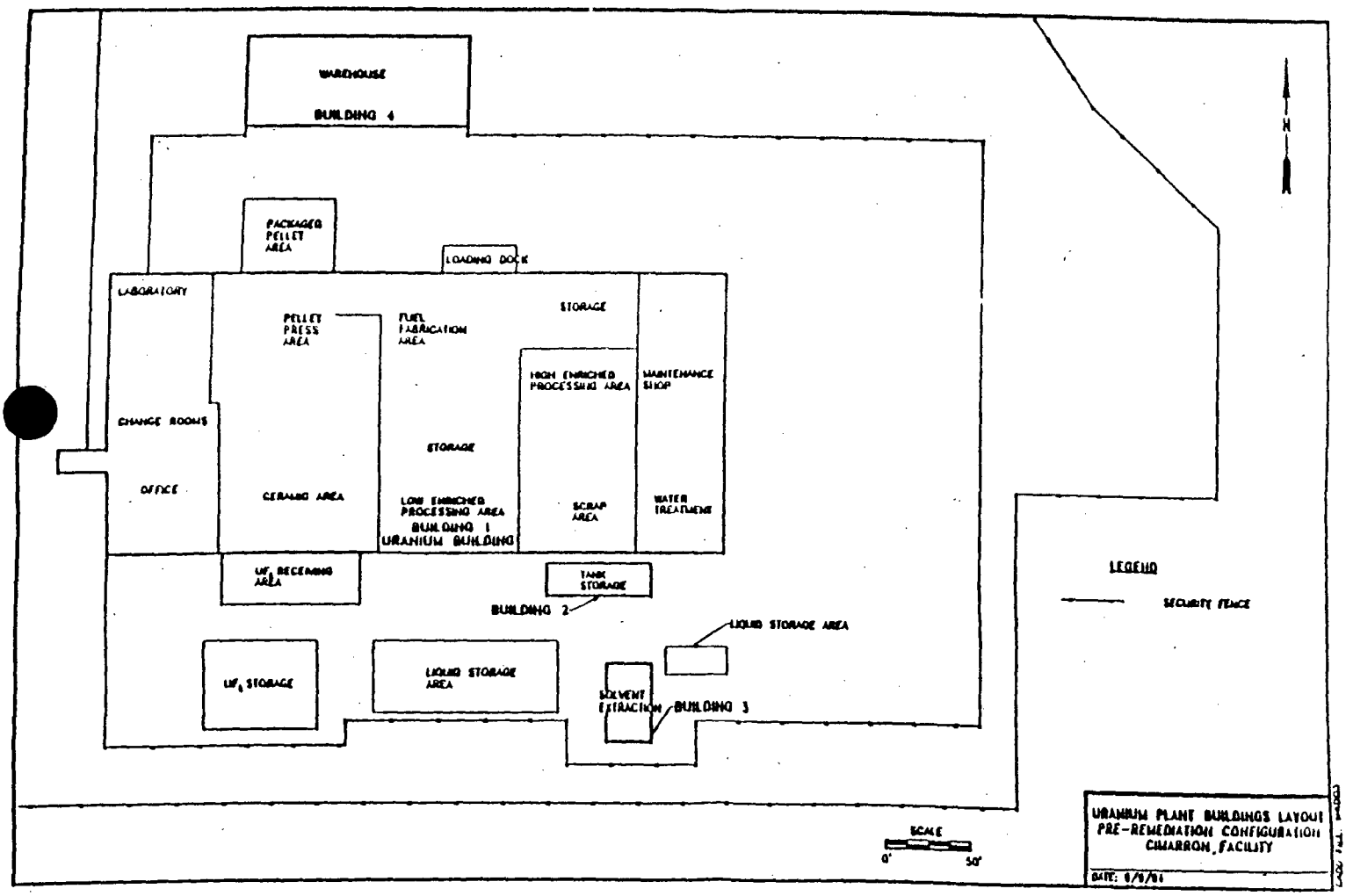


Figure 3.1: Uranium Building Processing Area

building surfaces, including the concrete floors, ranged from background to approximately 27,000 dpm/100 $cm^2$ (27,000 dpm/15.5 $in^2$) direct alpha and from background to approximately 10,000 dpm/100 $cm^2$ (10,000 dpm/15.5 $in^2$) smearable alpha. Process equipment within the buildings that was contaminated has been either decontaminated or removed. A number of the walls and floor sections have been removed and decontaminated or disposed of. Interior and exterior surfaces have been washed, scraped, chipped, or scabbled to remove surface contamination. Subfloor drains and the associated contaminated soils have also been excavated and removed. In 1997, the area formerly comprised of the laboratory, change rooms, office, pellet press area, and ceramic area was reconfigured into an area that is currently being used for storage of equipment and soil samples.

Trash Incinerator - This incinerator was used to incinerate non-radioactive waste materials released from restricted areas during site operations. The incinerator was located just east of the New Sanitary Lagoon. Because of the concentration of residual materials resulting from incineration, uranium concentrations above background levels were present in the ash. The incinerator was dismantled in 1992. Ash materials were surveyed, and if required, placed in drums and shipped offsite to a commercial LLW disposal facility. Five soil samples were taken from the area beneath the incinerator and counted onsite. The highest count for any of these samples was 0.48 Bq/g (13.07 pCi/g) total uranium, which is below the BTP Option 1 criteria for unrestricted release. Therefore, no further remediation is required for this area. This area will be included in the FSSR for Phase III Subarea M.

Drain Lines - The areas occupied by the former drain lines to the Sanitary Lagoons, Evaporation Ponds, Uranium Waste Ponds, and the two lines to the Cimarron River are considered part of the affected area. These drain lines have been removed and the areas were surveyed at the time of line removal or during subsequent characterization efforts. Before remediation, soil samples from areas surrounding the main drain line ranged from 0.1 Bq/g (3 pCi/g) to 122 Bq/g (3300 pCi/g) total uranium. The high count from this area was caused by a known break in this drain line. After remediation, soil samples were below the BTP Option 1 criteria (Reference 1) of 1.1 Bq/g (30 pCi/g). Other samples from a drain line from the Sanitary Lagoon to the Cimarron River averaged 0.32 Bq/g (8.7 pCi/g) total uranium. The decontamination and decommissioning of these drain lines are discussed in detail in Section 15.0 of the "Characterization Report" (Reference 4). The results of additional work on the drain lines will be reported in Phase II and Phase III FSSRs.

## 3.2 Radiological Status of Surface Soils and Subsurface Soils

The radiological status of all surface and subsurface soils has been documented in the DP and Cimarron's "Characterization Report" (Reference 4). The primary source of contamination was from the use of enriched uranium. The concentration range for surface soil was from background levels of 0.15 Bq/g (4 pCi/g) total uranium to isolated spots of 122 Bq/g (3300 pCi/g) total uranium. Cimarron intends to demonstrate, through the submittal of FSSRs, that all soils meet the BTP Option 1 criteria (less than 1.1 Bq/g (30 pCi/g) total uranium) (Reference 1). The only exception to this is the NRC-approved BTP Option 2 Disposal Cell where the average soil concentration is approximately 1.6 Bq/g (44 pCi/g) total uranium. Major areas of concern in regard to radiological status of soils are summarized below.

Burial Area 1 - This area was constructed in 1965 and was opened for disposal of radioactive waste in 1966, including thorium-contaminated waste from the Kerr-McGee Cushing Facility. Decontamination and decommissioning activities are further discussed in Section 7.0 of the "Characterization Report" (Reference 4). Burial Area 1 was closed and capped in 1970. However, based upon borehole sampling data, in 1986, Cimarron decided to excavate and remediate Burial Area 1. From 1986 through 1988 the trenches were excavated and 1840 $m^3$ (65,000 cubic feet ($ft^3$)) of waste exceeding BTP Option 2 criteria were shipped offsite for disposal at a licensed LLW disposal facility. Approximately 450 $m^3$ (16,000 $ft^3$) of BTP Option 2 waste from Burial Area 1 was disposed of at the onsite BTP Option 2 disposal cell. Based upon confirmatory surveys by Oak Ridge Associated Universities (ORAU) in December 1991, NRC released Burial Area 1 for backfilling with clean soil on December 28, 1992. At that time, Cimarron surveys showed samples with up to 0.85 Bq/g (23 pCi/g) total uranium and 0.2 Bq/g (5 pCi/g) total thorium. Final exposure rate surveys conducted in 1993 showed surface readings at 1 m (3.3 feet) above the surface in the 1.6-2.1 pC/kg (6-8 $\mu$R/hr) range with background included. This is well below the 1987 Guidelines (Reference 5) acceptance level of 2.6 pC/kg (10 $\mu$R/hr) above background at 1 m (3.3 ft) above the surface.

Uranium Plant Yard Areas - The restricted areas surrounding the Uranium Process Building and Warehouse Building have been extensively characterized and remediated. Decontamination and decommissioning activities are further discussed in Section 13.0 of the "Characterization Report" (Reference 4). Before remediation, the highest soil concentrations ranged from background to 59 Bq/g (1600 pCi/g) total uranium (average 37 Bq/g (1000 pCi/g)) in the Uranium Tank Storage Building, where there had been several spills when the uranium plant was in operation. Similarly, the Solvent Extraction Building had concentrations of up to 24 Bq/g (650 pCi/g) (average 13 Bq/g (350 pCi/g))

and the Vaporizer Room had concentrations up to 13.5 Bq/g (364 pCi/g) (average 1.5 Bq/g (41.7 pCi/g)).

Approximately 2300 $m^3$ (80,000 $ft^3$) of BTP Option 4 soil was shipped offsite to a licensed LLW disposal facility. The uranium plant yard areas also contained four stockpiles of BTP Option 2 material. To date, three of the stockpiles have been disposed of within the onsite disposal cell. The fourth stockpile, which is comprised of asphalt rubble that was ground into soil-like material in 1997, will be emplaced in the final lift of the third disposal cell. When this stockpile is removed, Cimarron will survey the underlying area and remediate as needed.

Burial Area 2 and North Field - This area was used in the 1970s for the disposal of industrial solid waste generated on the site. During an investigation of this area in 1990, contaminated materials were found in this disposal area. Soil sample concentrations within Burial Area 2 ranged from background to 46 Bq/g (154 pCi/g) total uranium and background to 5.5 Bq/g (150 pCi/g) total thorium. Decontamination and decommissioning of this area are discussed in detail in Section 8.0 of the "Characterization Report" (Reference 4). Remediation of this area began in 1991, with the removal of BTP Option 2 material. Several small areas in the North Field contained BTP Option 2 material that was removed. The final status survey for this area was submitted in Cimarron's May 1996 Phase III Subarea L FSSR. Based on its review of this FSSR, by letter of November 8, 1996, NRC staff approved Cimarron's request to backfill this subarea. An FSSR for the Subarea L surface area was submitted on July 27, 1998. NRC staff is currently reviewing this FSSR.

Burial Area 3 - This area was originally constructed for disposal of non-radioactive solid waste materials. However, the 1990 soil sampling program and gamma survey completed for this area identified five samples that exceeded the BTP Option 1 guideline value of 1.1 Bq/g (30 pCi/g). These samples ranged from 1.3 to 3.5 Bq/g (35 to 95 pCi/g). The initial 1990 survey led to a characterization of the area and the subsequent remediation. Decontamination and decommissioning of this area are discussed in detail in Section 9.0 of the "Characterization Report" (Reference 4). A final status survey of this area (Phase III Subarea M) will be conducted when remediation is complete.

East & West Sanitary Lagoon - These ponds received all liquid process waste from the Uranium Plant from 1966 through 1970. In 1970, all liquid process wastes from the Uranium Plant were diverted to other lined uranium evaporation ponds located onsite. From 1970 until 1985, the MOFF Plant septic tank, the Uranium Plant septic tank, the Uranium Plant laundry, the Uranium Plant lab,

the Uranium Plant dock drain, and numerous floor drains in the Uranium Plant discharged into the East and West Sanitary Lagoons. In early 1986, both the East and West Sanitary Lagoons were removed from service. Both lagoons had been previously isolated to prevent discharge to the Cimarron River in 1977. These lagoons were remediated in 1986, with final surveys conducted by Cimarron personnel in September 1990. All results showed concentrations to be within the BTP Option 1 guideline value of 1.1 Bq/g (30 pCi/g) (Reference 3). ORAU conducted confirmatory surveys and soil sampling in November 1990. NRC authorized backfilling of the East and West Sanitary Lagoons under Amendment No. 9 of License SNM-928, issued in December 1992. Cimarron considered that decontamination and decommissioning of this area complete and discussed this matter in Section 11.0 of the "Characterization Report" (Reference 4). This area will be included in the Phase II Subarea H FSSR.

New Sanitary Lagoon - This lagoon is hypalon-lined and was installed in January 1986 to replace the East and West Sanitary Lagoons. The New Sanitary Lagoon was used from early 1986 to October 1992. Soil sample concentrations noted in Cimarron's characterization report ranged from 0.81 to 0.96 Bq/g (22 to 26 pCi/g) total uranium. The final status survey data for this area were submitted in Cimarron's May 1996 Phase III Subarea L FSSR. Based on its review of this FSSR, by letter of November 8, 1996, NRC staff approved Cimarron's request to backfill this subarea. NRC will require a final status survey before NRC staff can consider releasing this subarea from the license.

Five Former Waste Water Ponds - The five former waste water ponds (Waste Ponds 1 and 2, the Plutonium Evaporation and Emergency Ponds, and the Uranium Emergency Pond), were all closed by the end of 1979. The sludge within the ponds was treated, packaged, and transported to a commercial LLW disposal facility. On March 2, 1978, Cimarron received written permission from the Oklahoma State Department of Health to cover the five former waste water ponds. On July 10, 1978, Cimarron received written permission from NRC to backfill and cover the five former waste water ponds. More recently, NRC staff has raised concerns about uranium contamination in the areas of Waste Ponds 1 and 2. As noted in the "Characterization Report" (Reference 4), several soil sample locations exceeded the 1987 BTP Option 1 criteria (Reference 3). Soil samples from Waste Pond 1 showed concentrations up to 6.1 Bq/g (167 pCi/g) total uranium and soil samples from Waste Pond 2 showed concentrations up to 9 Bq/g (243 pCi/g) total uranium.

Reservoir No. 1 and Drainage Area - This reservoir received run-off from the Uranium Plant restricted area and is included in the environmental sampling program for the site. This area is discussed further in Section 16.0 of the "Characterization Report" (Reference 4). In 1991, the drainage area leading

to the reservoir was characterized and remediated. Soil concentrations, before remediation, ranged up to 2.6 Bq/g (70 pCi/g) total uranium. In September 1997, Cimarron submitted an FSSR for this area (Phase II Subarea J). NRC staff has reviewed the report and conducted a confirmatory survey of the area. The staff is currently in the process of making a finding.

Drainage Areas - Several drainage areas are also included in the affected areas as they either received drainage from a process area or had concrete rubble, placed in these areas for erosion control, that was previously surveyed and released from the Uranium Plant. Radiation surveys indicated that some pieces of concrete in the drainage areas exceeded 15,000 dpm/100 $cm^2$ (15,000 dpm/15.5 $in^2$) fixed beta/gamma acceptable surface contamination levels stated in the NRC's 1987 Guidelines (Reference 5). The maximum reading was 40,000 dpm/100 $cm^2$ (40,000 dpm/15.5 $in^2$). The decontamination and decommissioning of these areas will be performed in accordance with the NRC 1987 Guidelines (Reference 5) as discussed in Section 1.4 of the DP (Reference 1). These areas are also discussed further in Section 16.0 of the "Characterization Report" (Reference 4). These drainage areas will be included in the final status survey. The concrete rubble was surveyed and released to drainage areas for erosion control and it is unlikely that it will be moved in the future. This is discussed in Section 2.3 of the DP.

MOFF Plant and yard - This facility was licensed under SNM-1174, which NRC terminated in February 1993 (letter included as Attachment I-1 of the DP) after being surveyed for plutonium. The termination of SNM-1174 did not alter License No. SNM-928. Because the land formerly licensed under SNM-1174 is contained within the bounds of SNM-928, the area has been included within the affected area for uranium contamination only. Several borehole samples in this area ranged from 1.34 to 1.39 Bq/g (36.3 to 37.6 pCi/g) total uranium. However, other samples are much lower and it is expected that average levels will be below the 1.1 Bq/g (30 pCi/g) 1981 BTP Option 1 criteria for unrestricted release. This area, including the exterior surfaces of the MOFF building, will be included in the final status survey and will be decontaminated and decommissioned in accordance with the criteria discussed in Section 1.4 of the DP. This area is discussed further in Section 17.0 of the "Characterization Report" (Reference 4).

Onsite Roads - The roads from the Uranium Plant restricted area to the former Burial Ground 1 area were used for the transport of waste materials. Therefore, these roads have been included in the affected area and will be surveyed as such during the final status survey. The roads have not been surveyed. However, the plans for a survey of these roads are included in Cimarron's FSSPs for Phases II and III. The decontamination and

decommissioning of the onsite roads will be performed in accordance with the criteria discussed in Section 1.4 of the DP.

## 3.3 Radiological Status of Ground and Surface Water

As noted in Cimarron's "Groundwater Evaluation Report" uranium concentrations in the groundwater range from background to 74 Bq/liter (l) (2000 pCi/l) total uranium and exceed the U.S. Environmental Protection Agency (EPA) proposed groundwater standard of 1.1 Bq/l (30 pCi/l). The highest concentrations are in the vicinity of Burial Area 1. Well 1315 peaked in March 1990 at 300 Bq/l (8080 pCi/l) total uranium. By September 1990, concentrations at this well had decreased to 88 Bq/l (2386 pCi/l) total uranium. Concentrations at Well 1315 decreased to 81 Bq/l (2200 pCi/l) in March 1998. Supplemental information provided by Cimarron's letter of March 4, 1999, indicated that concentrations had dropped further to 21.3 Bq/l (580 pCi/l) by September 1998.

Data presented in Cimarron's "Groundwater Evaluation Report" indicates a decreasing trend in groundwater concentrations over time. Other areas where uranium concentrations have exceeded the 1.1 Bq/l (30 pCi/l) groundwater standard include Waste Pond 1, where Well 1312 ranged from approximately 2.2 Bq/l (60 pCi/l) total uranium, in 1988, to under 0.7 Bq/l (20 pCi/l) in 1997, and Well 1313 ranged from approximately 7.4 Bq/l (200 pCi/l) in 1988 to 0.9 Bq/l (25 pCi/l) in 1997. Likewise, at Waste Pond 2, the total uranium concentration ranged from approximately 3 Bq/l (80 pCi/l), in 1988, to approximately 1.2 Bq/l (32 pCi/l) in 1997. A seep down gradient from Waste Pond 2 has also been monitored, showing a decreasing trend from 11.2 Bq/l (303 pCi/l), in 1993, to 1.8 Bq/l (48.4) pCi/l, in March 1998.

In October 1996, Cimarron first reported the occurrence of technetium-99 contamination in a groundwater monitoring well and a seep in a cliff, both situated down gradient of Waste Pond 2. At that time, technetium-99 concentrations were as high as 176 Bq/l (4760 pCi/l) which equates to slightly more than the 0.04 mSv/yr (4 mrem/yr) total effective dose equivalent (TEDE) allowed by the EPA "National Primary Drinking Water Regulations" (40 CFR Part 141) for beta emitters. This EPA regulation is referenced in the SDMP Action plan as one of the cleanup criteria. However, data reported in Cimarron's groundwater evaluation report demonstrated a decreasing trend in technetium-99 concentrations to 68.74 Bq/l (1856 pCi/l) in Well No. 1312 and 20.8 Bq/l (562 pCi/l) in Well No. 1313. These concentrations equate to a dose well below the EPA 0.04 mSv/yr (4 mrem/yr) standard.

# 4. ALTERNATIVES TO THE PROPOSED ACTIONS

## 4.1 Proposed Action

The proposed action is to decontaminate and decommission the Cimarron site to permit release for unrestricted use of the site and termination of Radioactive Materials License SNM-928. License termination is a separate action that requires an NRC finding that these premises are suitable for release. The licensee proposed to decommission the site in accordance with its DP (Reference 1), submitted on April 19, 1995, and supplemented with responses to NRC staff comments in letters dated September 9, 1996, May 6, 1997, and July 30, 1998.

In conjunction with this proposal, Cimarron has also proposed revisions to Radioactive Materials License SNM-928. The proposed action adds a new license condition specifically establishing the 1981 BTP (Reference 3) Option 1 unrestricted-use residual-contamination criteria as the cleanup standard for the Cimarron site. The proposed action also modifies License Conditions 18 and 23 to better delineate the handling of various classifications of contaminated material at the site and revises references to the licensee's commitments contained in License Condition 10.

In addition, Cimarron has proposed minor changes to clarify statements made in the RPP (Reference 2) and to incorporate changes in its organizational structure.

## 4.2 Alternatives Considered and Decision Rationale

The only alternative considered in this EA is the no-action alternative. No action would mean that: (1) the site would not be approved to remediate now; (2) obsolete license conditions would continue to be in License SNM-928; (3) changes to the RPP that summarizes the overall radiation protection program for the Cimarron facility would not be effective; and (4) Cimarron's organizational structure would be outdated.

NRC staff has evaluated the no-action alternative and determined that the no-action alternative would conflict with NRC's requirement, in 10 CFR 70-38, for timely remediation at sites that have ceased operation. Although there is no immediate threat to the public health and safety from this site, not undertaking remediation at this time does not solve the regulatory and potential long-term health and safety problems associated with storing this waste. No action now would delay remediation until some time in the future,

when costs could be much higher than they are today. It is even possible that no disposal option will be available in the future if the current LLW disposal facilities are closed and no new ones are opened. Therefore, the no-action alternative is not acceptable.

The proposed actions are necessary to allow Cimarron to complete the remainder of decommissioning activities needed to allow for release for unrestricted use of the Cimarron site and termination of Radioactive Materials License SNM-928. The proposed actions also permit revisions to License SNM-928, changes to its RPP, and changes to its organizational structure.

## 5. RADIATION PROTECTION PROGRAM

### 5.1 Radioactive Waste Management Program

In accordance with the established limits for BTP Option 1 material (Reference 3), Cimarron is proposing to leave in-place, soils with concentrations up to 1.1 Bq/g (30 pCi/g) total uranium and up to 0.4 Bq/g (10 pCi/g) total thorium. Cimarron is also proposing in the DP (Reference 1), release limits for contamination on buildings and equipment to comply with NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material" (Reference 5).

On November 4, 1994, Cimarron's license was amended (Amendment No. 10, License Condition 23) to allow for the onsite disposal of BTP Option 2 material. Under the BTP Option 2 criteria, the average concentration of radioactive material that may be disposed of onsite is 3.7 Bq/g (100 pCi/g) total uranium above background (this assumes that the uranium is 100 percent soluble) and up to 9.3 Bq/g (250 pCi/g) for insoluble uranium. The average concentrations of thorium and plutonium in the soil will not exceed 0.4 Bq/g (10 pCi/g) and 0.04 Bq/g (1 pCi/g), respectively. Soils meeting the BTP Option 2 limits are proposed for disposal in the onsite disposal cell. Under Cimarron's License Condition 18, wastes that exceed the BTP Option 2 limits will be shipped offsite to a licensed LLW disposal site.

Most of the radioactive waste at the site has already been characterized and disposed of in accordance with the BTP. Under License Amendment 10, Cimarron was authorized to dispose of up to 1400 $m^3$ (500,000 $ft^3$)of BTP Option 2 radioactive waste. As of March 1998, approximately 9,910 to 11,326 $m^3$ (350,000 to 400,000 $ft^3$) have been emplaced in the onsite BTP Option 2 disposal cell. By letter dated April 17, 1998, Cimarron estimated that a

total 13,000 $m^3$ (450,000 $ft^3$) of soil will be disposed of in the onsite disposal cell.

Radioactive waste exceeding BTP Option 2 criteria have been shipped to licensed LLW disposal facilities at Sheffield, Illinois; Beatty, Nevada; Barnwell, South Carolina; Richland, Washington; and Clive, Utah. As noted in a letter from Cimarron dated September 4, 1998, a final total of 7417 $m^3$ (261,945 $ft^3$) of material exceeding BTP Option 2 criteria had been shipped offsite. The most recent shipments went to the Envirocare LLW disposal facility in Clive, Utah. If additional material exceeding BTP Option 2 criteria are found at the site, it will also be shipped to the Envirocare LLW disposal facility in Clive, Utah. The State of Utah licenses the Envirocare site for LLW disposal. Disposals will be made in compliance with 10 CFR Part 20 and State of Utah requirements. The shipments to the disposal facility will comply with NRC and U.S. Department of Transportation (DOT) packaging and shipping requirements.

NRC staff finds that Cimarron's radioactive material management activities and practices are being conducted in accordance with pertinent guidance and requirements. To date, more than 75 percent of the material designated for the onsite BTP Option 2 disposal cell has been emplaced in the cell and all known material exceeding BTP Option 2 criteria have been shipped offsite to a licensed LLW disposal facility. The staff does not anticipate Cimarron exceeding the limit on BTP Option 2 material that can be placed in the cell and has confirmed that Cimarron has made arrangement for the proper disposal of any additional material, found at the site, that exceeds BTP Option 2 criteria.

## 5.2 Environmental Specifications

Environmental specifications to be implemented include specifications limiting effluent releases to the environment and radiation exposure to workers and the public. An environmental monitoring program will be implemented as an additional safeguard. The environmental specifications are described in Cimarron's DP (Reference 1) and RPP, as supplemented (Reference 2). Cimarron has committed to perform environmental monitoring at the controlled area boundary and at various locations outside of the restricted area to ensure compliance with conditions of its license and all applicable regulations.

### 5.2.1 Effluent Release Specifications and Environmental Monitoring

Environmental air samples will be collected on a weekly basis at three locations and will be analyzed for gross alpha and gross beta activity.

Releases will meet 10 CFR Part 20 Appendix B airborne effluent release limits. Environmental Thermoluminescent Dosimeters are placed at 14 locations throughout the facility and at the perimeters of the facility, and will be assayed on a quarterly basis. The action level per quarter is 0.2 mSv (20 mrem) above background.

Liquid effluents will meet 10 CFR Part 20 liquid effluent requirements before release. Surface-water and groundwater samples will be taken annually at the site. Cimarron will collect grab surface samples at seven places across the site and in the Cimarron River, and will collect groundwater samples from 24 sampling locations on the site. The licensee will measure for fluoride, nitrate, gross alpha, gross beta, and total uranium in each of the samples. The action level to notify the Radiation Safety Officer (RSO), for the groundwater samples, is 50 percent of the limit of 10 CFR Part 20, Appendix B.

Cimarron will also collect soil samples and vegetation samples annually as part of its environmental monitoring program. The licensee will collect soil samples at 11 places and vegetation samples at three locations surrounding the site. The licensee will then measure for total uranium in each of the samples. The action level for total uranium in soils is 0.43 Bq/g (11.5 pCi/g) and the action level for total uranium in vegetation is 0.02 $\mu$g/$\mu$g vegetation.

NRC staff finds the effluent release specifications to be adequate for the decommissioning activities at Cimarron.

5.2.2 Worker Radiological Control Specifications

The radiation protection program will be implemented by qualified staff under the direction of the RSO. The goal of the radiation protection program is to ensure that remediation activities are conducted in full compliance with all NRC regulations, and that all occupational radiation exposures are within the limits of 10 CFR Part 20 and are reduced to levels as low as is reasonably achievable (ALARA). The radiation protection program is described in the RPP, as supplemented.

To control occupational exposures, restricted areas will be identified and posted, and access to them will be controlled. In addition, Cimarron uses administrative limits to control occupational exposures for the whole body, skin, eye lens, and extremities. They are established at 80 percent of the occupational dose limits of 10 CFR 20.1201. Specific annual administrative limits are, therefore, as follows:

Whole Body - The more limiting of the TEDE equal to 40 mSv (4 rem) or the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the eye lens being equal to 0.4 Sv (40 rem).

Skin - Shallow dose equivalent of 0.4 Sv (40 rem)

Eye lenses - Eye dose equivalent of 0.12 Sv (12 rem)

Extremities - Shallow dose equivalent of 0.4 Sv (40 rem)

Also to control occupational exposures, a special work permit (SWP) will be used to ensure workers understand: the tasks they are assigned; the equipment needed to perform the task; the task procedures; the radiation hazards in the work area; and the monitoring and personnel protection requirements for the task. The RSO or a designee will approve all SWPs before they are implemented.

Personnel external monitoring will be accomplished through the use of individual monitoring devices, film badges, and radiation surveys. The film badges will be processed for dose reading by a laboratory or vendor accredited under the National Voluntary Laboratory Accreditation Program. Personnel surveys will be performed before exiting radiologically controlled areas.

Personnel internal monitoring will be accomplished through the air monitoring program, and in-vivo or in-vitro bioassay sampling. Bioassay sampling will be performed at the direction of the RSO and whenever a calculated intake of 40 Derived air concentration (DAC)-hours may have occurred in any one incident, based on air sampling data, accident conditions, equipment failure, external contamination, or other conditions.

Respiratory protection equipment will be available and will be used in compliance with Subpart H, "Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas." Cimarron's Respiratory Protection Program plans to use elements from NUREG-0041, "Manual of Respiratory Protection Against Airborne Radioactive Material" (Reference 7).

A contamination control program will be implemented to minimize the spread of contamination. The limit for the restricted areas of the facility is 5000 dpm/100 $cm^2$ (5000 dpm/15.5 $in^2$) removable alpha. The licensee will designate Contaminated Area Control for areas that exceed the 1000 dpm/100 $cm^2$ (1000 dpm/15.5 $in^2$) removable alpha limit. ALARA will be a consideration when selecting decontamination methods.

An ALARA program will be implemented to ensure that exposures are reduced to ALARA levels. This program will encompass work task preparation and planning, engineering controls, personnel, design, equipment, monitoring devices, controls, and training. The licensee will have an ALARA Committee that will ensure that ALARA policy, philosophy, commitments, and regulatory requirements are integrated into all appropriate work activities.

NRC staffs finds the dose limits stated in the RPP, along with additional clarification regarding these limits as provided in submittals dated May 16, 1997, and June 30, 1997, are in accordance with 10 CFR Part 20 and are acceptable.

5.2.3 Unrestricted-Use Specifications

The licensee proposed to use the unrestricted-use criteria listed in the 1987 NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, source or Special Nuclear Material" (Reference 5) for surfaces of buildings and equipment, and the BTP (Reference 3) for soils. Specific values follow:

Surfaces of buildings and equipment -

5000 dpm alpha/100 $cm^2$ (5000 dpm/15.5 $in^2$), averaged more than 1 $m^2$ (10.8 $ft^2$);
5000 dpm beta-gamma/100 $cm^2$ (5000 dpm/15.5 $in^2$), averaged more than 1 $m^2$ (10.8 $ft^2$);
15,000 dpm alpha/100 $cm^2$ (15,000 dpm/15.5 $in^2$), maximum 1 $m^2$ (10.8 $ft^2$);
15,000 dpm beta-gamma/100 $cm^2$ (15,000 dpm/15.5 $in^2$), maximum over 1 $m^2$ (10.8 $ft^2$);
1000 dpm alpha/100 $cm^2$ (1000 dpm/15.5 $in^2$), removable;
1000 dpm beta-gamma/100 $cm^2$ (1000 dpm/15.5 $in^2$), removable

Soils -

| | |
|---|---|
| Natural uranium | 0.37 Bq/g (10 pCi/g) |
| Enriched uranium | 1.1 Bq/g (30 pCi/g) |
| Depleted uranium | 1.3 Bq/g (35 pCi/g) |
| Natural thorium | 0.37 Bq/g (10 pCi/g) |

Exposure rates are as follow:

Surfaces of buildings and equipments -

1.3 pC/kg (5 $\mu$R/hr) above background at 1 m (3.3 ft)

Soils -

2.6 pC/kg (10 $\mu$R/hr) average above background at 1 m (3.3 ft)
5.2 pC/kg (20 $\mu$R/hr) maximum above background at 1 m (3.3 ft)

Section 13 of the RPP describes Cimarron's program for surveying materials for unconditional release as well as calibration of the survey equipment and radiological analysis and characterization to be used. Radiological surveys will be performed in accordance with NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination" (Reference 8). Final radiation surveys will be performed to ensure that radioactive material meets the averaging criteria in NUREG/CR-5849. The objective of these procedures is to demonstrate, with a 95 percent confidence level, that there are no radioactive hot spots having levels that exceed the averaging criteria in NUREG/CR-5849. These criteria address averaging concentrations over any 100 $m^2$ (1076 $ft^2$) area (A) using the $(100/A)^{½}$ elevated area criteria. Material

that exceeds the averaging criteria in NUREG/CR-5849 will be removed and shipped offsite to a licensed LLW disposal site.

Cimarron proposed the use of alternative methodologies for volumetric averaging of Waste Ponds 1 and 2 in Phase III Subarea O, and concrete rubble in Phase II Subarea F.

By letter of July 1, 1997, NRC staff noted its concern with high levels of uranium in Waste Ponds 1 and 2. In response, by letter of August 26, 1997, Cimarron agreed to re-enter and decommission the two waste ponds in accordance with the BTP Option 1 criteria as identified in NRC's February 25, 1997, letter.

Cimarron proposed using the NRC guidance, "Method for Surveying and Averaging Concentrations of Thorium and Subsurface Soil" for evaluating soil concentrations. This method applies an averaging protocol to volumetrically contaminated material to minimize overall doses to an intruder. Although this guidance focused on thorium, the NRC letter noted that it could be applied to uranium.

Similarly, Cimarron proposed the use of alternative methodology for volumetric averaging of the concrete rubble in Subarea F. Surveys that were conducted at Subarea F used criteria that differed from those in NUREG/CR-5849 and indicated values that exceed the surface contamination criteria listed above. To demonstrate that this concrete rubble meets the BTP Option 1 criteria for free release (1.1 Bq/g (30 pCi/g) total uranium), Cimarron proposed the use of a risk-based dose assessment.

To determine the acceptability of the residual radioactivity on the concrete, the licensee evaluated the levels of surface contamination on the concrete and converted the surface contamination to an effective volumetric concentration. The resulting effective volumetric concentration ranged from 0.03 to 0.27 Bq/g (0.8 to 7.4 pCi/g) total uranium. This is below the BTP Option 1 limit of 1.1 Bq/g (30 pCi/g) total uranium. The total inventory of uranium in the concrete was calculated to be 1.7E-08 Bq (4.7E-03 Ci). In addition to the direct comparison to the 1.1 Bq/g (30 pCi/g) limit, the licensee performed dose assessments using the U.S. Department of Energy (DOE) RESRAD pathway analysis/dose assessment code and the resident farmer scenario. The maximum dose was estimated to be approximately 0.01 mSv/yr (1 mrem/yr) after 900 years.

The overall average exposure rate at 1 m (3.3 ft) from the concrete surface was 1.8 pC/kg (7 $\mu$R/hr), with a maximum exposure rate of 2.6 pC/kg (10 $\mu$R/hr). A background exposure rate was not subtracted from these values. The exposure rates are well below the SDMP Action Plan criteria of 2.6 pC/kg (10 $\mu$R/hr), above background at 1 meter (3.3 ft). In addition, the sediment downstream of the concrete was sampled and no contamination above background was identified.

As the average surface contamination levels exceed values of "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material" (Reference 5), the NRC staff requested an additional assessment to evaluate the potential dose from the resuspension of the surface contamination. The licensee performed dose calculations using two scenarios: 1) a resident farmer scenario, and 2) a trespasser dose assessment. The dose assessments were performed using conservative assumptions as to the amount of resuspended contamination. The resulting doses from the two scenarios were 0.002 mSv/yr (0.2 mrem/yr) and 0.0002 mSv/yr (0.02 mrem/yr), respectively.

NRC staff has reviewed the alternative methods that Cimarron proposed for the waste ponds in Subarea 0 and the concrete rubble in Subarea F and found them to be acceptable. Cimarron is following the NRC guidance provided for volumetric averaging in the waste ponds and volumetric concentration averaging for the concrete rubble.

Another area of concern was in regard to high concentrations of uranium in the groundwater. As previously noted, the EPA proposed groundwater standard for total uranium is 1.1 Bq/l (30 pCi/l) for community drinking water or individual household use. However, Cimarron maintains, and ODEQ agrees, that the naturally poor quality of groundwater and surface water at the Cimarron site, as well as the availability of other sources of water in the area, make it unlikely that the groundwater will ever be used for domestic or agricultural purposes. As a result, NRC staff finds it more appropriate to use the 0.1 mSv/yr (100 mrem/yr) dose limit of 10 CFR 20.1301 for individual members of the public for groundwater and all other exposure pathways at the Cimarron site.

Cimarron has proposed a groundwater standard of 6.7 Bq/l (180 pCi/l) for total uranium which it has demonstrated to equate to the allowable 0.25 mSv/yr (25 mrem/year TEDE to the hypothetical individual drinking the water. NRC staff finds the proposed groundwater standard of 6.7 Bq/l (180 pCi/l) for total uranium to be acceptable because the 0.025 mSv/yr (25 mrem/yr) dose

associated with that standard, when added to the negligible dose from all other pathways, is well below the 0.1 mSv/yr (100 mrem/yr) limit of 10 CFR 20.1301, for individual members of the public. In addition, likelihood of this groundwater ever being used for domestic or agricultural purposes is low.

Cimarron has proposed to take quarterly samples from the wells that currently exceed the proposed groundwater standard of 6.7 Bq/l (180 pCi/l) for total uranium until eight successive samples are below the standard. In addition, Cimarron's March 4, 1999, submittal included a contingency plan for dealing with wells that may unexpectedly exceed the proposed standard for a period of 1 year or more. It should be noted, that in consideration of past variability in groundwater monitoring results, NRC will not terminate Cimarron's license until it has been demonstrated that the concentrations in all wells have been below the proposed standard for eight consecutive samples (the past 2 years). Also, ODEQ may require continued groundwater monitoring of non-radioactive components under its authority.

In regard to the onsite disposal of BTP Option 2 material, Cimarron will comply with License Condition 23. Likewise, Cimarron will comply with License Condition 18 in disposing of radioactive material that exceeds BTP Option 2 criteria at a licensed LLW disposal facility. NRC staff therefore concludes that the proposed criteria are consistent with the 0.1 mSv/yr (100 mrem/yr) limit of 10 CFR 20.1301, for individual members of the public.

## 5.3 Radiological Accident Analysis

NRC staff reviewed the licensee's estimated potential consequences of postulated accidents, submitted in a letter dated July 1, 1998. The licensee evaluated two hypothetical worst-case accident scenarios--offsite spillage of a shipment of radioactive material during transport to a LLW disposal facility, and rupture and spillage of a drum on site. Two calculations, estimating TEDE to a cleanup worker and to a member of the public, were performed for the offsite spillage of a shipment of uranium soils and debris. A calculation to estimate the TEDE was also performed, for a radiation worker, from the potential onsite spillage of a drum containing uranium soils and debris.

The postulated offsite scenarios assumed that the transport vehicle is involved in an accident, and the entire shipment of fifty-eight 208 l (55 gallon) drums is breached. This volume is based on Cimarron's waste shipment No. 50 in June 1997. According to the licensee, this shipment is representative of the soil shipments from the Cimarron site, that exceeds the

BTP Option 2 limits. This was the last shipment from the Cimarron site. According to the licensee, the concentration of soil from waste shipment No. 50 is higher than average compared with other soil shipments in the previous year from the site.

In the accident scenario, the assumptions are: (1) the inhalation and direct exposures are the exposure pathways; (2) the time an individual is exposed cleaning up the spill is 24 hours; (3) the individual of interest is always downwind of the spill; (4) no atmospheric dispersion at right angles to the wind direction; (5) the dispersion of the spilled materials has a maximum height of 2 m (6.6 ft) the same as the breathing zone; (6) average total uranium concentration is 23 Bq/g (617 pCi/g), based on the activity of total uranium reported for Cimarron waste shipment No. 50; (7) the breathing rate is 1.2 $m^3$/hr (42.4 $ft^3$/hr); (8) the dose conversion factors, from EPA's Federal Guidance No. 11 (Reference 9), of all uranium isotopes are the same as those for uranium-235, which is the most conservative; and (9) there is no respiratory protection.

The cleanup worker is assumed to be at the spill location, whereas the member of the public is assumed to be 1 km (3048 feet) from the spill and is continuously in the plume centerline downwind in a very stable atmosphere. The maximum dose, to the clean up worker, from the offsite spillage of a shipment of uranium soils and debris, from both direct exposure and inhalation pathways is 0.062 mSv (6.2 mrem) TEDE. For comparison purposes, the 10 CFR Part 20 limit is 0.05 Sv/yr (5 rem/yr) for occupational exposure. The maximum dose to a member of the public from the same offsite spillage is 9E-5 mSv (0.009 mrem) TEDE. For comparison purposes, the 10 CFR Part 20 dose limit is 1 mSv/yr (100 mrem/yr) for members of the public.

The onsite scenario assumed that the drum containing 113 Bq/g (3054 pCi/g) is ruptured and the entire contents are spilled. 113 Bq/g (3054 pCi/g) is the highest concentration of total uranium based on the activity of total uranium reported for Cimarron waste shipment No. 50. In this case, the inhalation and direct exposures are the exposure pathways; the time used to clean up the spill is 4 hours; the worker is always downwind at the edge of the spill; there is no atmospheric dispersion at right angles to the wind direction; and the dispersion of the spilled materials has a maximum height of 2 meters (6.6 ft). The maximum dose to a radiation worker from the onsite spillage of a drum containing uranium soils and debris is 0.04 mSv (4 mrem) TEDE. For comparison purposes, the 10 CFR Part 20 limit is 0.05 Sv/yr (5 rem/yr) for occupational exposure.

NRC staff determined that these postulated accidents do not have the potential for onsite or offsite radiation doses that exceed the 10 CFR Part 20 limit of 1 mSV/yr (100 mrem/yr) for members of the public or of 0.05 Sv/yr (5 rem/yr) for workers. These postulated accidents will not result in any significant environmental impact, and are, therefore, acceptable.

# 6. ENVIRONMENTAL IMPACTS

## 6.1 Radiological Impacts on the Public and Workers

Radiological impacts on members of the public may result from inhalation or ingestion of releases of radioactivity in air and in water during the remediation operations, direct exposure to radiation from radioactive materials at the site during remediation operations, and from transport for disposal. The public will also be exposed to radiation as a result of onsite disposals. Decommissioning workers may receive doses primarily by inhalation and direct exposure during the remediation activities. The potential radiological impacts of accidents are considered in Section 5.3.

### 6.1.1 Radiological Impacts on the Public

Of the areas currently under Cimarron's license, the BTP Option 2 disposal cell located in Subarea N and the groundwater underneath the site have the greatest potential for radiological impact on the public under intruder or resident homeowner scenarios. The concentration of uranium in the BTP Option 2 disposal cell ranges from 1.56 to 1.67 Bq/g (42 to 45 pCi/g), based on sampling results of materials disposed of there so far. A value 1.67 Bq/g (45 pCi/g) of uranium was used to estimate a conservative dose to the public resulting from the potential radiological exposure from the soil in the disposal cell. In addition, Cimarron has requested the concentration of 6.7 Bq/l (180 pCi/l) of uranium as the release limit of the groundwater underneath the site. This value was used to estimate a conservative dose to the public resulting from the potential ingestion of groundwater. The contributions of total uranium activity of the various uranium isotopes were estimated for uranium-234 (U-234), uranium-235 (U-235), uranium-238 (U-238) to be about 79 percent, 1.7 percent, and 20 percent, respectively (Reference 10).

The resident-farmer scenario is more conservative, although less probable, than an intruder or a resident-homeowner scenario. For conservatism, the site use is assumed to be equivalent to the resident-farmer scenario described in PG-8-08 (Reference 11). Under this scenario, it is assumed that a farmer moves onto the site, builds a home, and raises crops and livestock for

consumption. This farmer represents the individual reasonably expected to be the most highly exposed to a radiological dose. Pathways through which the farmer could receive a radiological dose from the soil are: (1) direct radiation; (2) inhalation; (3) ingestion of plant foods grown on the contaminated soil; (4) ingestion of milk and meat from livestock raised and fed from the contaminated area; and (5) ingestion of fish raised in a nearby pond. In addition, the farmer ingests water from a nearby well that pumps water from the shallow aquifer underneath the Cimarron site. This well is assumed to contain the concentration of uranium that the licensee requested as the release limit, 6.7 Bq/l (180 pCi/l).

The DOE approach for implementing residual radioactive material guidelines was used to calculate the dose from soil contamination, and the dose assessments were performed using DOE's computer code RESRAD, Version 5.82 (Reference 12). NRC staff then performed an analysis to calculate the dose from groundwater contamination as a result of ingesting the water from the aquifer underneath the site.

The RESRAD dose assessments were performed by using site-specific source-term data provided by the licensee and also by using data taken from previous reports (References 4, 10, and 13). For parameters without any site-specific values, PG-8-08 (Reference 11) or the RESRAD defaults (Reference 14) were used.

The soil disposal cell for the BTP Option 2 waste is approximately 55 m (180 ft) wide by 163 m (535 ft) long (Reference 10). The maximum thickness of the disposal cell containing contaminated materials is 1.8 m (6 ft). Thus, the maximum volume is 16,137 $m^3$ (5.75E5 $ft^3$). The disposal cell has at least 1.2 m (4 ft) of clean soil covering the contaminated soil. The depth to the groundwater in the areas around the disposal cell is about 9.1 m (30 ft) below ground level (Reference 10). Thus, the average thickness of the unsaturated zone, which is between the bottom of the contaminated material and the top of groundwater, is 6.1 m (20 ft).

In the area around the disposal cell, there is a layer of resistant mudstone at a depth of about 1.8 to 2.1 m (6 to 7 ft), dipping to the east (Reference 10). After heavy rains, infiltrating water perches on this mudstone layer and continues to travel above this layer along the dip to the east. The mudstone layer directs seepage across the area of the disposal cell. As a result, the water is less likely to enter the disposal cell. For conservatism, no credit is given to this layer of mudstone.

The measurement of the distribution coefficient ($K_d$) value for uranium is based on five samples taken from around the Cimarron site, and the values ranged from 339 to 2829 ml/g (5.4E-3 to 4.5E-3 $ft^3/lb$)(Reference 10). For conservatism, the lowest measured $K_d$ value of 339 ml/g (5.4E-3 $ft^3/lb$) is used in this analysis. Also, the licensee performed a sheet erosion analysis that indicated approximately 0.69 m (27 in) of soil would be removed by sheet erosion in a 1000-year period (Reference 10). Thus, the erosion rate of 6.9E-4 m/yr (2.3E-3 ft/yr) is used for the cover soil and the contaminated material in this analysis.

The gradient of the shallow groundwater at the Cimarron site averages approximately 0.025 percent, except where it steepens as a result of proximity to discharge areas (Reference 10). A value of 2.5E-4 is used in this analysis. For additional conservatism, the water table drop rate is assumed to be zero. Also, according to Cimarron's Site Investigation Report, the measured hydraulic conductivity values of the shallow aquifer ranged from 76 m/yr (250 ft/yr) to 1798 m/yr (5900 ft/yr) (Reference 13), and the average hydraulic conductivity value measured in the wells near the disposal cell is 363 m/yr (1190 ft/yr). This value is used in the analysis.

The result of the calculation is shown in Figure 6.1. The dose was estimated for a time period of 1000 years. The maximum dose from soil contamination for the uranium concentration is estimated as 0.0086 mSv/yr (0.86 mrem/yr) at 1000 years. The dose is almost zero for several hundred years after the disposal cell is closed.

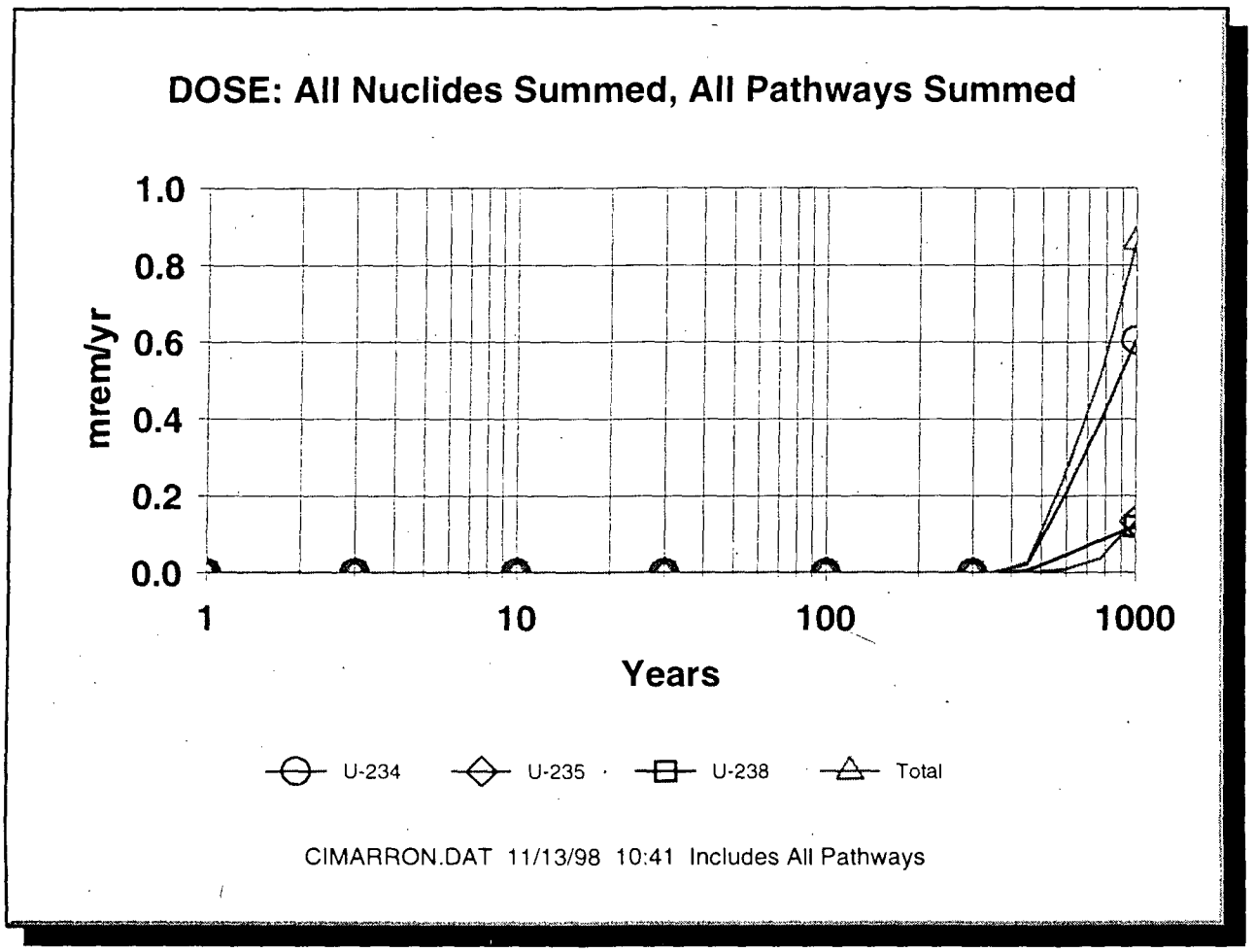


Figure 6.1: Resident-Farmer Scenario Doses for the Cimarron Disposal Cell With Cover

For comparison purposes, another dose assessment was performed assuming that no soil cover was over the contaminated material. The maximum dose from soil contamination is estimated as 0.049 mSv/yr (4.96 mrem/yr) at zero years, as shown in Figure 6.2.

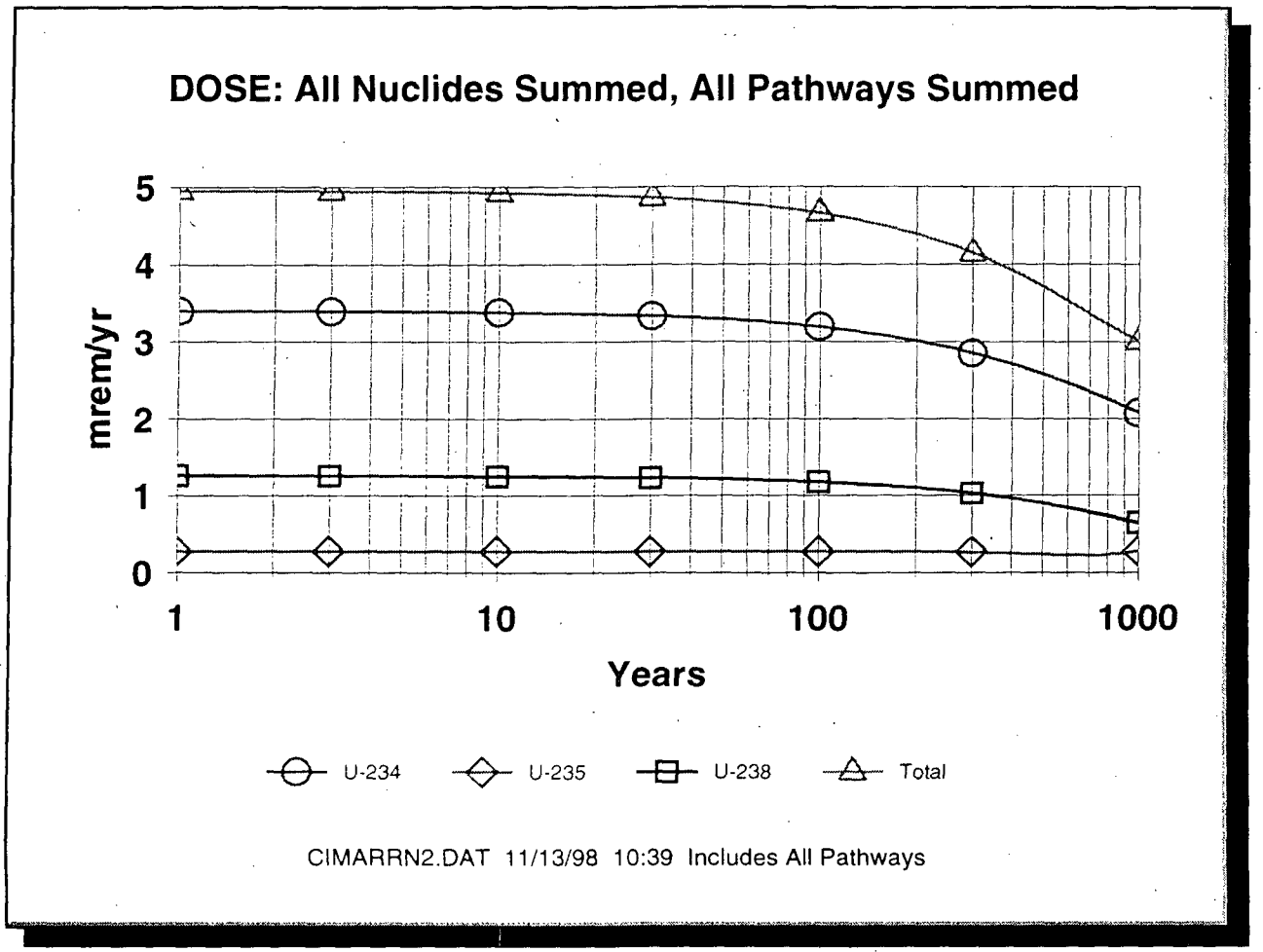


Figure 6.2: Resident-Farmer Scenario Doses for the Cimarron Disposal Cell With No Cover

In both the cover and no-cover cases, doses during the first 1000 years result from the groundwater independent pathways (inhalation, ingestion, and direct exposure). Figure 6.3 shows the water-independent and the water-dependent pathways for the no-cover, resident-farmer scenario.

NRC staff analyzed the dose to the resident farmer who ingests groundwater from a nearby well that pumps water from the shallow aquifer underneath the Cimarron site. This well is assumed to contain the concentration of uranium that the licensee requested as the release limit, 6.7 Bq/l (180 pCi/l).

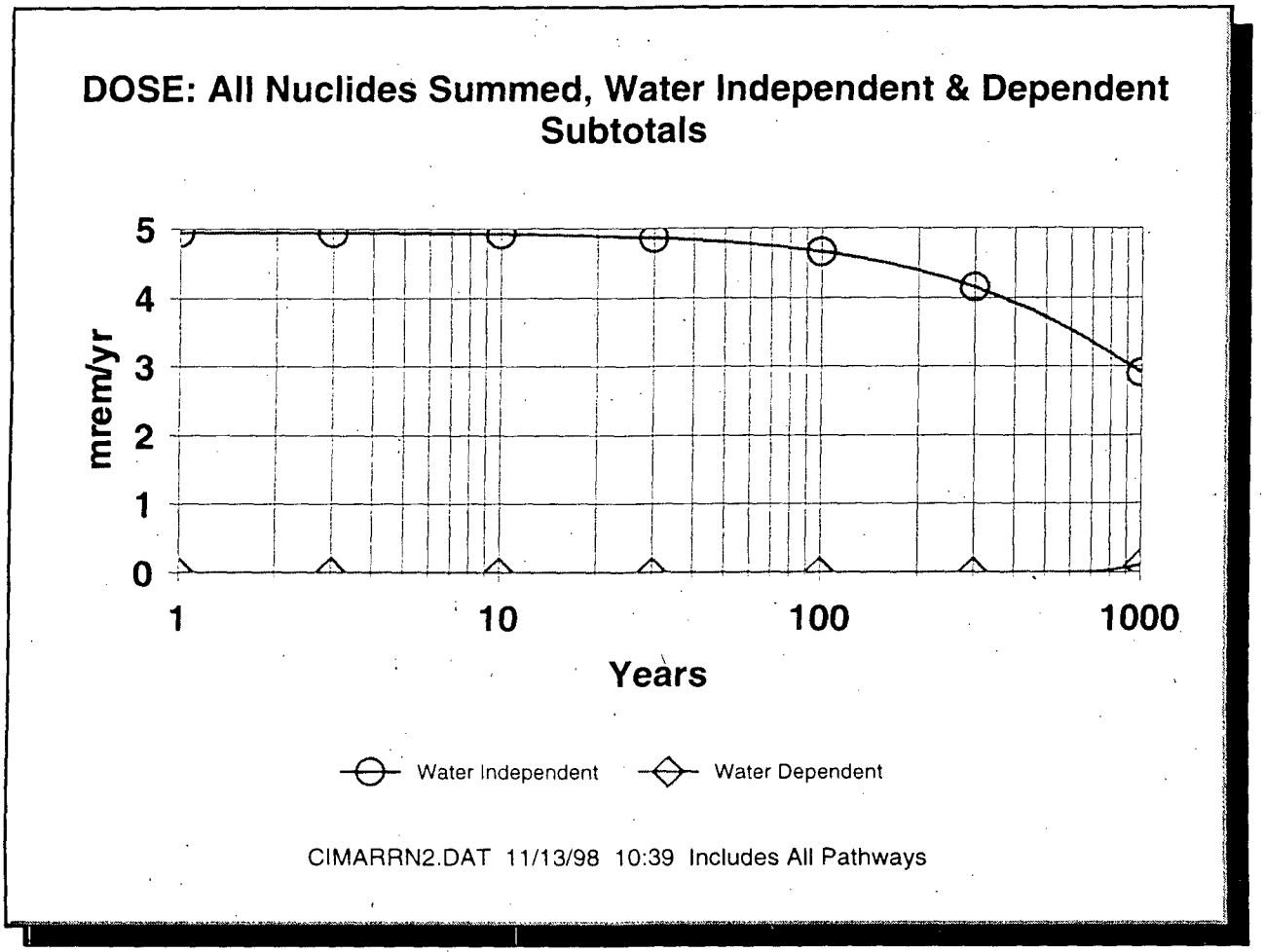


Figure 6.3: Doses from Water-Independent and Water-Dependent Pathways for the Cimarron Disposal Cell With No Cover

To calculate the potential ingestion dose to a resident farmer, Dose Conversion Factors (DCFs) were obtained from EPA's Federal Guidance No. 11 (Reference 9). The ingestion DCFs are 7.08 x $10^{6}$ Sv/Bq (2.62E-5 mrem/pCi), 7.22E-6 Sv/Bq (2.67E-5 mrem/pCi); and 6.43E-6 Sv/Bq (2.38E-5 mrem/pCi) for U-234, U-235, and U-238, respectively. The farmer is assumed to consume 730 l/yr (26 $ft^3$/yr) of water. This represents the 90$^{th}$ percentile daily drinking water ingestion rate as tap water, including uses in cooking and for beverages prepared using tap water. NRC staff computed the groundwater ingestion dose to be 0.032 mSv/yr (3.4 mrem/yr).

The dose from soil contamination to be a resident farmer, if no soil cover were over the contaminated material, would be about 0.05 mSv/yr (5 mrem/yr), as shown by the RESRAD analysis. The dose from groundwater contamination to the same resident farmer is about 0.034 mSv/yr (3.4 mrem/yr). The sum of the

doses is 0.084 mSv/yr (8.4 mrem/yr). Therefore, the total dose estimate confirms that the combined dose from the onsite BTP Option 2 disposal cell and the licensee's proposed groundwater release limit at the Cimarron site satisfy the requirements for unrestricted release.

6.1.2 Radiological Impacts on Workers

During the remediation of the contaminated materials, workers will receive doses from direct exposure and from the inhalation of dusts containing uranium. For conservatism, it is assumed that the workers will receive doses from activities immediately above an uncovered BTP Option 2 disposal cell in Subarea N. According to the licensee, the concentration of uranium in the BTP Option 2 disposal cell ranges from 1.56 to 1.67 Bq/g (42 to 45 pCi/g) based on sampling results of materials disposed there so far. The contributions of total uranium activity of the various uranium isotopes were estimated for U-234, U-235, U-238 to be about 79 percent, 1.7 percent and 20 percent, respectively (Reference 10). Assuming a total uranium concentration of 1.67 Bq/g (45 pCi/g), each radionuclide's concentration used in this analysis is 1.32 Bq/g (35.55 pCi/g) for U-234, is 0.03 Bq/g (0.765 pCi/g) for U-235, and is 0.33 Bq/g (9.0 pCi/g) for U-238.

To calculate the potential direct exposure dose to a worker, DCFs were obtained from EPA's Federal Guidance No. 11 (Reference 9). The external exposure DCFs for a uranium volume source with thickness of 15 cm (6 in) are 1.85E-16 Sv/d per Bq/$m^3$ (2.5E-7 r/yr/pCi/$cm^3$), 3.24E-13 Sv/d/Bq/$m^3$ (4.38E-4 r/yr/pCi/$cm^3$), and 4.76E-17 Sv/d/Bq/$m^3$ (6.43E-8 r/yr/pCi/$cm^3$) for U-234, U-235, and U-238, respectively. The soil density is assumed to be 1.625E6 g/$m^3$, (1.625 g/$cm^3$) and the worker is assumed to be performing decommissioning activity on the contaminated soil for 40 hrs/week (wk), 50 wks/yr (2000 hr/yr). NRC staff computed the direct exposure dose to be 0.0013 mSv/yr (0.13 mrem/yr) for a working-year exposure.

To calculate the potential inhalation dose to a worker, DCFs were obtained from EPA's Federal Guidance No. 11 (Reference 9). The inhalation DCFs are 0.035 Sv/Bq (0.13 mrem/pCi), 0.032 Sv/Bq (0.12 mrem/pCi), and 0.032 Sv/Bq (0.12 mrem/pCi) for U-234, U-235, and U-238, respectively. A worker is assumed to be performing decommissioning activity on the contaminated soil for 40 hrs/wk, 50 wks/yr (2000 hr/yr). Also, it is assumed a dust loading of 200 $\mu$g of soil per $m^3$ of air, and a respiratory rate of 1.2-$m^3$ (42.4 $ft^3$) of air/hr. NRC staff computed the inhalation dose to be 0.0278 mSv/yr (2.78 mrem/yr).

The sum of the doses from direct exposure and inhalation is 0.029 mSv/yr (2.9 mrem/yr). This dose is substantially below the 10 CFR Part 20 limit of 50 mSv/yr (5 rem/yr) for occupational exposure.

6.1.3 Waste Transportation Impacts

Most of the proposed decommissioning activities have been completed and the licensee does not expect to find any more wastes onsite above the BTP Option 2 limits. If it does, the wastes will be shipped in accordance with DOT and NRC requirements to the Envirocare facility in Utah. If 420-$m^3$ (15,000-$ft^3$) of waste is assumed to be shipped, then the shipment is estimated to produce less than 2.3E-4 occupational and less than 1.5E-3 public fatalities from traffic accidents and less than 4.1E-6 occupational and less than 1.4E-4 public fatalities from rail shipment accidents. These impacts are based on non-radiological rail and medium-to-heavy truck accident fatality risk data. These impacts are not significant relative to truck and rail shipments of other commodities.

The relatively small scale of the proposed activities will produce no significant impact on local traffic patterns and will not produce a significant noise impact. Thus, the impact from transporting the remaining waste from the licensee's site is insignificant.

6.1.4 Impacts on Low-Level Waste Disposal Site Operations

The licensee has shipped all of its radioactive waste above BTP Option 2 to LLW disposal facilities. However, the licensee may discover additional wastes that exceed the BTP Option 2 limit during the remaining decommissioning efforts at the site. If additional waste is found that exceeds the BTP Option 2 limit, the waste will be shipped to Envirocare in Clive, Utah.

The amount of waste that the licensee may discover represents a relatively small percentage of the total volume of wastes disposed of at that LLW disposal site. Radiological impacts on workers and the public from waste disposal operations are considered in the approvals for LLW disposal site licenses and will be consistent with the performance objectives in 10 CFR Part 61, Subpart C, and the applicable State regulations.

## 6.2 Non-Radiological Impacts

### 6.2.1 Socioeconomic Impacts

During operation, the licensee employed approximately 175 to 200 workers on the site. From 1975 to 1997, the licensee had approximately 20 to 25 of its employees on the site to perform decommissioning work. Most of these individuals had worked at Cimarron during operation. As activity decreased on site, the number of employees decreased. In 1998, there were about 11 employees at the Cimarron site, and the number was expected to decrease to four in 1999, and to remain at that afterwards. The decommissioning process is expected to have minimal impact on the local economy. The decrease in the number of employees at the site was gradual.

### 6.2.2 Air Quality Impacts

Air quality impacts will result from dust and equipment exhaust from construction and waste emplacement operations. These impacts will be of short duration and are expected to be minor. The licensee has submitted annual air, vegetation, and soil sampling results. The results from 1996 and 1997 were all within applicable regulatory limits in the BTP (Reference 3) and 10 CFR Part 20. The most conservative applicable regulatory limit for air was 22.2E-10 Bq/ml (5E-14 $\mu$Ci/ml) and the applicable regulatory limit for soil and vegetation was 11.11 $\mu$g/g.

### 6.2.3 Land and Water Use

No new land will be used to support decommissioning activities. The disposal cells are constructed on land that is currently contaminated. After the emplacement of the wastes and completion of the disposal cell, the licensee indicated that it will continue control and use of the facilities. A large area of land owned by KMC is currently used for agricultural purposes and for cattle grazing, and that area will continue to be used for that purpose after unrestricted release. A small area of the site will be used as a pilot plant for non-radiological research and development activities associated with KMC's Chemical Division.

Decommissioning operations may require the use of additional domestic water. This additional water use should be minimal and have no significant impact.

### 6.2.4 Impacts Associated with Revisions to the License, RPP, and Organizational Structure

The proposed revisions to the license, RPP, and organizational structure are intended to bring the license up to date in recognition of Cimarron's current status in the decommissioning process. The proposed revisions clarify licensee commitments for the duration of the decommissioning process and provide an organization to effectively complete this process. These proposed revisions are administrative and have no environmental impact.

6.2.5 Other Impacts

NRC staff checked the U.S. Fish and Wildlife Service (FWS) web site to determine whether any threatened or endangered species reside in the area of the Cimarron site. The web site indicated that three endangered species (Interior least tern, Peregrine falcon, and Whooping crane) and one threatened species (Piping plover) are listed in Logan County. During a June 16, 1999, telephone conversation with Mr. Ken Frazier, Senior Staff Biologist with FWS, Oklahoma Ecological Services Field Office, NRC staff was informed that only the Interior least tern was found in the vicinity of the Cimarron site. Mr. Frazier noted that decommissioning actions at the Cimarron site were unlikely to impact this endangered species or its nesting areas.

The downtown area of Guthrie, which is about 14 km (9 miles) east of the Cimarron site, is on the National Register of Historic Places. There are no other known historical or archeological sites at the Cimarron site or in the local area. There should be no impacts on Guthrie.

7. ENVIRONMENTAL JUSTICE

NRC staff evaluated the proposed activity's impacts on minority and low-income communities. The minority population within a 6.5-km (4-mile) radius of the Cimarron facility is lower than that of both Logan County and the State of Oklahoma. Within a 6.5-km (4-mile) radius, the population of African Americans (1.1 percent) is lower than that of the county (13.9 percent) and the State (7.4 percent). Within a 6.5 km (4 mile) radius, the population of Native Americans (5.2 percent) is lower than that of the State (8.0 percent) and is slightly higher than that of the county (3.2 percent).

The percentage of people above 65 years of age (senior citizens) within a 6.5 km (4 mile) radius is 13.2, which is slightly less than the average for Logan County (13.4 percent) and the State of Oklahoma (13.5 percent). The senior-citizen population in Crescent City, located just over 6.5-km (4-miles) from the licensee's site, is 25.1 percent, which is more than that of the county and the State.

The median household income ($28,342) within a 6.5-km (4-mile) radius of the licensee facility is higher than that of both Logan County ($24,050) and the State of Oklahoma ($23,577). The median income of Crescent City is $15,583, which is less than that of the county and the State.

The senior-citizen population and the median household incomes within a 6.5-km (4-mile) radius are more relevant than those in Crescent City for environmental justice purposes because the decommissioning of Cimarron will not directly affect Crescent City. The population within a 6.5-km (4-mile) radius of the licensee facility has minority and senior citizen populations lower than the county and the State averages, and has a median household income above that of the county and the State. Based on these statistics, there are no significant minorities and low-income households that will be exposed to impacts from the proposed activities at Cimarron. Because there are no significant impacts from the proposed activities, there will be no environmental justice impacts.

## 8. AGENCIES AND INDIVIDUALS CONSULTED, AND SOURCES USED

This EA was prepared entirely by NRC staff in consultation with the FWS and the ODEQ. Input from the Fish and Wildlife Service is discussed in Section 6.2.5 of this EA. Based on its review of a draft copy of this EA, by letter of June 24, 1999, ODEQ stated that if NRC releases the site for unrestricted use, ODEQ reserves the right to require Kerr-McGee to continue monitoring the site for non-radiological components. NRC incorporated this comment into Section 5.2.3 of this EA.

ODEQ also commented that it would like to continue to review the final remediation work plans and other items addressing the decommissioning and decontamination of the Cimarron facility. NRC staff agrees and will continue to coordinate with ODEQ staff.

No other sources were used beyond those referenced in this EA.

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5. U.S. Nuclear Regulatory Commission, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material," August 1987.

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