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August 10, 2005

Mr. Kenneth Kalman
Low-Level Waste & Decommissioning Projects Branch
Division of Waste Management
Office of Nuclear Materials Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Docket No. 70-925; License No. SNM-928
Site-Wide Groundwater Assessment Review

Dr. Mr. Kalman:

Cimarron Corporation (Cimarron) submits herein Site-Wide Groundwater Assessment Review for NRC and DEQ review and comment. This report provides:

1. A summary of the reports of past groundwater assessment activities conducted at the Cimarron site,
2. A discussion of Cimarron's efforts to identify potential sources of licensed materials and assess their impact to groundwater,
3. A description of the impact licensed materials has had on the groundwater in various portions of the site, and
4. A division of the site into areas based on the degree of groundwater impact and the amount of data available.

This report is submitted to provide NRC and DEQ an overview of Cimarron's knowledge and understanding of the need for groundwater assessment and remediation site-wide. Cimarron understands NRC's reluctance to approve assessment reports or remediation plans for individual areas without a better understanding of the affect of such approvals on the entire site.

It is our hope that, after reviewing the information presented herein, NRC will understand how the groundwater assessment reports and remediation plans previously submitted for individual areas fit into the "big picture". Cimarron maintains that:

1. No further groundwater assessment should be required for much of the site,
2. Several areas which contain groundwater exceeding license criteria must be addressed through remediation plans, and
3. Additional data is needed to conclude that the remaining areas comply with license criteria.

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Cimarron is submitting, under separate cover, a Conceptual Site Model essentially concurrently with this report. It is Cimarron's intent to schedule a meeting at Cimarron with NRC and DEQ to tour the site, discuss the content of these two reports, and agree on a path forward to complete groundwater decommissioning at the Site. If you have any questions or comments regarding the content of this report or the schedule for a meeting, please contact me at (405) 642-5152.

Sincerely,

Jeff Lux
Project Manager
Safety & Environmental Affairs Div.

xc: D. Blair Spitzberg, PhD. NRC Region IV
David Cates , ODEQ
Jerry Matthews, ODEQ

SITE-WIDE GROUNDWATER ASSESSMENT REVIEW

For

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

License Number: SNM-928

Cimarron Corporation
Crescent, OK

August 11, 2005

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PURPOSE

The purpose of this report is to provide the Nuclear Regulatory Commission (NRC) and Oklahoma Department of Environmental Quality (ODEQ) a summary of the historical groundwater site assessments that have been performed at the Cimarron site located near Crescent, Oklahoma. The report details the areas assessed and supports the position that all areas in which groundwater currently remains out of compliance with decommissioning criteria as specified in License SNM-928 have been identified.

In addition, the report will demonstrate how Cimarron has performed sufficient assessment to categorize different areas of the site into "Phase Areas". The concept of Phase Areas is similar to that which was used during decommissioning activities and for the Final Status Surveys. Four "Phase Areas" are proposed for the groundwater assessment activities that have been performed to date.

BACKGROUND

Cimarron Corporation operated a plant near Crescent, Oklahoma, for the manufacture of enriched uranium reactor fuels. The 840-acre Cimarron Facility is currently licensed under SNM License SNM-928, originally issued in 1965 for the operation of the Uranium Plant (U-Plant).

Decommissioning efforts at the Cimarron U-Plant Facility involving characterization, decontamination and remediation were initiated in 1976 and are nearing completion with the last remaining issue being the achievement of groundwater compliance with the criteria in the Decommissioning Plan.

Prior to 1985, monitor well installation information and records are limited. In February 1985, several monitor wells were installed in the vicinity of Uranium Pond #1 and Burial Area #1. The first comprehensive groundwater assessment was conducted in 1989. Several additional assessments have been carried out since that time.

During the 1989 assessment, potential groundwater impacts from former site operations were observed. At that time, the release criteria for total uranium was 30 pCi/l for total uranium. In the Decommissioning Plan Groundwater Evaluation Report (July 1998), Cimarron proposed a concentration-based criterion for uranium of 0.11 mg/l (180 pCi/l). By letter August 12, 1999, NRC issued Amendment 27(b) to License SNM-928. License Condition 27b specifically addresses a groundwater release criteria limit of 180 pCi/l total uranium. In addition to the alternative concentration, NRC also stipulated the license would

not be terminated until all wells are below the groundwater release criteria for eight consecutive quarterly samples (the past two years).

HISTORICAL ASSESSMENTS

Cimarron has assessed site-wide groundwater via several field studies since 1989. The following provides a brief description of the historical assessments performed as well as the results.

Site Investigation Report for the Cimarron Corporation Facility, Logan County, Oklahoma, James L. Grant & Associates, September 1989.

This report summarized geological and hydrogeological site investigations conducted at the Cimarron Facility and provided a basis for understanding the geological and hydrogeological controls on surface soil, bedrock, and aquifer (radiological) contamination and the potential movement of licensed materials in groundwater. The "Grant report" provided the first comprehensive conceptual site model and set the stage for determining which areas of the Cimarron site could have been affected radiologically by former site activities. This document contains:

- Characterization of the stratigraphy and lithology of the soils and bedrock at the site. The three sandstone unit designations are introduced and discussed (Sandstone A, Sandstone B, Sandstone C).

- Characterization of water-bearing unit properties including hydraulic conductivity, groundwater flow directions, and gradient.

- Characterization of groundwater quality and possible impacts from facility operations.

- Estimation of the mobility of radionuclides, particularly uranium, in the subsurface and the ability of subsurface materials to retard migration.

Cimarron Facility Closure Responses to NRC Questions, James L. Grant and Associates, Inc., May 1990.

In March 1990, the NRC requested additional information related to the Cimarron Site Investigation Report (1989 Grant Report), specifically related to the Onsite Disposal Cell. Cimarron collected and developed additional information to respond to the NRC requests. The information covered nine specific areas.

- Fracture flow was interpreted to be of minor importance to groundwater flow, as fractures are uncommon and the intergranular permeability of the upper sandstones is large. Also, no influence of jointing was noted in the shape of the shallow piezometric surface.

- Shallow mudstones act as aquitards and influence the direction of movement of infiltrating water, Cimarron utilized this property and revised the cell design to limit seepage.

- The disposal cell is located on the spine of a north-south trending topographic ridge. Consequently, groundwater will tend to flow downgradient primarily to the east and west, away from the disposal cell area.

- The erosional stability of the cell was modeled for long-term and extreme conditions.

- In order to facilitate independent review by NRC staff, copies of data files used by Cimarron were submitted to the agency.

- Additional information regarding uranium migration was collected and computer modeling was performed to better understand the chemical behavior of uranium. It was also determined that only soil contaminated with uranium that has been sorbed onto the soil matrix would be placed in the Option 2 disposal cell.

- Future land and water use scenarios were analyzed. Little population increase was projected as well as unlikely changes in future uses of land and water.

- Radionuclide exposure pathways were analyzed and potential impacts to human health and the environment were found to be negligible.

- Additional radiological data were studied to refine the volume estimate of soil to remain at the facility under the provisions of Option 2 of the Branch Technical Position Paper.

Radiological Characterization Report for Cimarron Corporation's Nuclear Fuel Fabrication Facility, Crescent, Oklahoma, Chase Environmental Group (Grant Environmental), 1994.
This report presented the results of field radiological investigations at the Cimarron site and facilitated the subsequent decommissioning of areas potentially affected by previous site activities. The report also summarized the site operational history and the decommissioning activities, such as removal of contaminated waste and soil that had been conducted up to 1994 at the Cimarron site.

- This Radiological Characterization Report included a combination of scoping surveys, characterization surveys, remediation control surveys, pre-remediation surveys, post-remediation surveys, final surveys, and confirmatory surveys (ORISE and NRC confirmatory survey results are

included for some areas, and in some cases, survey results are included for areas which have already been released by the NRC).

- No radionuclides other than uranium in its chemically separated forms were involved in the production processes at the Cimarron site under License SNM-928. The concentration of daughter radionuclides was negligible. Radium and thorium detected in groundwater and soil samples are at natural background levels and thus are not due to the effects of facility operations.

Groundwater and Surface Water Assessment for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma, December, Chase Environmental Group, Inc., 1996.
This report reviewed background water quality; summarized historic and current groundwater data to determine impacts from past operations; and determine changes to groundwater quality since issuance of reports prepared by James L. Grant and Associates in 1989 and 1994. This report also reviewed existing surface and groundwater data, including data from a comprehensive sampling event performed in 1996. The conclusions of this report were:

- Background, near surface groundwater quality is hard to very hard, and contains elevated concentrations of dissolved solids, chlorides, sulfates and nitrates, thus limiting its potential for usage as a potable water supply.

- The geology of the aquifers limits the groundwater available for withdrawal for beneficial usage to approximately one gallon per minute or less of sustained pumping.

- Shallow groundwater, which is found in Sandstones A and B, flows north-northwest until it is discharged to either the ground surface as seeps along low-lying bluffs and cliffs or to the Cimarron River alluvium.

- With source removal and further remediation, substantial improvements in localized groundwater quality have been realized. Groundwater testing indicates that past operations may have affected the groundwater quality adjacent to one or two former waste management units.

- Only one groundwater sample (Well 1315) exceeded the 10 CFR 20 uranium effluent concentration (EC) of 300 pCi/l. Well 1315, located between trenches within Burial Area #1, exhibited a total uranium concentration which was twice the EC limit in 1996. However, the 1996 sampling results reflect a substantial reduction in concentration from the 1990 level of 27 times the EC limit. In general, similar downward (improving quality) trends were observed in other wells with slightly elevated uranium. Groundwater impacts were contained totally on-site.

- The deeper wells, located in Sandstone C, have not shown any effect from past operations.

Cimarron Decommissioning Plan Groundwater Evaluation Report for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma, July, 1998

This report provided information regarding groundwater at the Cimarron Facility for inclusion in the Cimarron Decommissioning Plan. It also addressed the geology/hydrogeology of the vicinity and site, provided a summary of closure activities for facility areas with groundwater contamination, discussed background and affected area groundwater quality and, the trending of environmental data for affected areas as well as proposed additional work at Burial Area #1. The conclusions of this report were:

- There are effective confining mudstone strata between each of the groundwater zones of Sandstones A, B, and C found onsite. These mudstones influence the lateral flow of groundwater and retard the potential downward migration of shallow groundwater between the three sandstone units.

- The bluffs overlooking the Cimarron River represent a very large discharge zone that continually drains the upper sandstones due to the northward flow of groundwater toward the bluffs.

- The historical and more recent groundwater and surface water investigations clearly show that groundwater radionuclide impacts continue their decreasing trends from those levels presented in the 1989 "Grant Report".

- Shallow groundwater in the Sandstones A and B generally discharges to the incised drainage pathways and seeps found in the low-lying bluffs and cliffs that border the floodplain of the Cimarron River.

- Deeper groundwater in both Sandstones B and C discharges to the alluvial deposits that underlie and comprise the Cimarron River bottom and the adjoining floodplain.

- Cimarron will continue to monitor Former Burial Area #1 (BA #1) groundwater on a quarterly basis. Although Cimarron is confident that groundwater concentrations would continue to decrease, it agreed to conduct additional studies for the purpose of understanding the attenuation mechanisms of radionuclide movement. These studies were to include additional site-wide hydrogeologic evaluations.

- Cimarron would retain ownership of the formerly licensed properties under SNM-928 until the proposed groundwater criteria are met. In the unlikely

event that the uranium concentrations did not decline sufficiently during the monitoring period, Cimarron is committed to additional alternative corrective actions.

- Cimarron proposed release criteria for total uranium and Tc-99 of 180 pCi/L (0.11 mg/L) and 3,790 pCi/L, respectively.

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, Nuclear Regulatory Commission Office of Nuclear Material Safety and Safeguards, 1999

This Environmental Assessment (EA) assessed the environmental impact of the decommissioning proposed by Cimarron Corporation. It also considered the no-action alternative to the licensee's proposal. This EA was prepared and issued pursuant to the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51 of the NRC's regulations.

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

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

- Cimarron has proposed a groundwater standard of 6.7 Bq/l (180 pCi/L) for total uranium. This equates to the allowable 0.25 mSv/yr (25 mrem/year) TEDE to a hypothetical individual drinking the water. NRC staff found 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 was well below the 0.1 mSv/yr (100 mrem/yr) limit in 10 CFR 20.1301 for individual members of the public. In addition, the likelihood of this groundwater ever being used for domestic or agricultural purposes was considered to be low.

On the basis of this EA, NRC staff concluded that the proposed action would not have any significant effect on the environment and would not warrant the preparation of an environmental impact statement.

Burial Area #1 Groundwater Assessment Report for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Cimarron Corporation, January 2003.

This document detailed the comprehensive investigation of the uranium plume in groundwater identified in BA #1. The conclusions reached as a result of the BA #1 Groundwater Assessment Report include:

- The geology of the area has been adequately characterized and geotechnical properties of subsurface materials have been quantified.
- The upland area is characterized by Mudstone A overlying Sandstone B, with a buried escarpment covered by alluvial materials.
- The source of the licensed material in former Burial Area #1 has been removed.
- The former burial trenches extended through the low-permeability materials that covered Sandstone B and the more permeable alluvial material.
- The shallow groundwater shows a steep gradient in the bedrock area, and flattens considerably as groundwater discharges into the alluvium.
- Uranium concentrations in Sandstone C ranged from 6 to 34 pCi/L for the locations monitored, which is consistent with background levels of Sandstone C.
- None of the soils within the groundwater plume exceed the Option 1 criteria for unrestricted release (30 picocuries per gram (pCi/g) above background) in the NRC Branch Technical Position (BTP), "Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations."
- There is a transition zone characterized by low-permeability material (clay and clayey silts) with depth in the alluvial channel.
- The alluvium typically consists of a layer of fine, well rounded sands overlain by silts and clays. In a small portion of the alluvium, the sand extends to the surface.
- A clay/mudstone lithologic unit underlies a significant portion of the uranium plume.
- The assessment delineated the extent of the plume that exceeds 180 pCi/l total uranium.

Justification for Utilization of Fully Penetrating Groundwater Monitoring Wells in Shallow Alluvial Aquifer at the Cimarron Facility, Chase Environmental, January 2003

This document presented both hydrogeological and future land use information that explained the rationale behind Cimarron's decision to screen monitoring wells across the full saturated thickness of the shallow alluvial aquifer. The report addressed the nature of the alluvial aquifer and explained why potential future users of groundwater would install wells screened through the entire saturated thickness.

This technical assessment report concluded that the shallow alluvial aquifer downgradient from BA #1 consists of a vertically undifferentiated and unconfined hydrogeologic unit that is formed by a complex mixture of mostly sand with laterally discontinuous alluvial deposits of clay, silt and gravel.

The relatively thin and unconfined water-bearing zone of the alluvial deposits cannot practically or geologically be divided into an upper and/or lower zone for vertical differentiation of the uranium plume.

By letter on March 18, 2003, NRC notified Cimarron of their agreement regarding justification of utilizing fully screened wells in the alluvial aquifer.

Assessment Report for Well 1319 Area for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Cimarron Corporation, December 2003.
This report summarized the groundwater evaluation of licensed material in the area of the former Uranium Plant yard near Well 1319. The report concluded that:

- Licensed material in the Well 1319 Area is limited to groundwater in Sandstones B and C.

- Sandstone A is unimpacted because the former well 1319 was not perforated through the Sandstone A interval.

- Sandstone B and Sandstone C were locally impacted apparently due to solubilized uranium leaching from the sediments found at the bottom of the former well 1319, which subsequently enter Sandstones B and C through their respective perforated intervals.

- Groundwater in Sandstone B and C exceeding the limit of 180 pCi/l was restricted to a very small area downgradient of the former well 1319

Technetium – 99 Groundwater Assessment Report for Cimarron Corporation's Former Nuclear Fuel Fabrication Facility, Crescent, Oklahoma, December 2003.
This report presented the results of the Technetium-99 (Tc-99) groundwater assessment performed for the Cimarron Site. This assessment was performed in response to the NRC's March 12, 2002 letter requesting further evaluation of the presence of Tc-99 in groundwater at the Cimarron Site.

In the third quarter of 1996, Cimarron began an extensive investigation into the potential causes for the disproportionate gross beta to gross alpha ratios observed in several site monitor wells. Preliminary analytical results indicated the presence of Technetium. Additional information regarding Tc-99 contamination can be found in the Technetium-99 Site Impact Evaluation and Proposed Groundwater Assessment Workplan, September, 2002.

The source of the Tc-99, a fission product, was determined to be a contaminant present in the Atomic Energy Commission (AEC) supplied UF6 feed material shipped to the Cimarron facility. The results of this 2003 investigation were:

- Shallow groundwater within Sandstones A and B downgradient from U-Pond #2 has been impacted by prior site operations and showed elevated concentrations of Tc-99.

- Seep 1208 was the only sampling location that yielded Tc-99 concentrations 3,790 pCi/L[1]. In May 2003, analysis of Seep 1208 water detected Tc-99 concentrations at 5300 pCi/l.

- Since the original source (i.e., U-Ponds #1and #2) had been removed, concentrations of Tc-99 in groundwater in the alluvium and at the discharge zones would continue to decrease.

This characterization demonstrated that elevated levels of Tc-99 were present downgradient from the two former waste management areas of U-Pond #1 and U-Pond #2 within Sandstone A and at the seep outcrops.

GEOLOGY / HYDROGEOLOGY

To some degree, most of the reports listed above discuss the regional and site geology/hydrogeology of the Cimarron site. The most all-inclusive related document produced by Cimarron is the recently submitted (August 2005) Comprehensive Site Model (CSM) report prepared by ENSR (2005). In addition, discussions of local climate, surface water, groundwater, and groundwater flow is included in Sections 2.0 and 3.0 of the CSM.

The large undeveloped areas of the Cimarron site to the south and east are also discussed in the CSM. These large grass-covered areas are hydrologically upgradient of all former site operations and have always been utilized for purposes unrelated to the Cimarron facility. All former site operations were

[1] Seep 1208 is surface water and therefore the effluent concentrations in Appendix B to 10 CFR 20 apply. The comparison to the guideline of 3,790 pCi/L is not meant to imply that the seep is subject to the criteria, since seeps generally do not reflect groundwater concentrations due to effects of evaporation, pooling, precipitation, biological activity, and sampling processes.

conducted in downgradient locations and totally unrelated to these larger regions of the Cimarron facility.

EVALUATION OF POTENTIAL SOURCES OF GROUNDWATER IMPACT

As previously stated, Cimarron has submitted numerous reports which focus their discussion on groundwater and surface water impacts from former facility operations.

As directed by management, an October 2002 meeting was held at Cimarron to discuss historical and potential sources of known impact to groundwater. At that time, the discussion held that only a few areas of possible concern remained. The specific areas included the Seep 1206 area, Burial Area #3 (includes the closed incinerator), the area near Well 1331 (Burial Area #2), Sandstone B in the former process area (most of the wells were completed in Sandstone A or Sandstone C), and the former Uranium Emergency Pond. From that meeting, the need for additional assessment in certain areas moved forward.

The following is an update to the monitoring effectiveness and adequacy of the areas that were considered to be potential sources of groundwater impact from former facility operations. The grouping is similar to that used in most of the previous reports. These areas include the following (Plate 1):

Plutonium emergency pond	Plutonium waste pond
Uranium emergency pond	Uranium pond #1
Uranium pond #2	
East and West Sanitary Lagoon	New lined sanitary lagoon
Burial Area #1	Burial Area #2
Burial Area #3	Onsite disposal cell (BA #4)

Former Uranium Processing Building and Yard Area

Pipelines

Drain Lines

Incinerator

A discussion of the source identification and potential downgradient movement of impacted groundwater is presented as well as the disposition of potential sources. Water samples have historically been collected and analyzed for specific parameters which are related to past facility production and decommissioning

activities. Sample analyses include total uranium, Tc-99, nitrate/nitrite (as N), fluoride, gross alpha, and gross beta. The gross alpha and gross beta results serve as good indicator parameters of potential impact. Uranium isotopic analyses are also performed and serve as to better quantify potential impacts. The facility fuel fabrication process utilized uranium in solid and gaseous form as well as solutions containing ammonia, nitrate, and fluoride species. These constituents formed the basis for environmental monitoring.

Source Identification – Former Ponds

During active facility operations, liquid waste control was controlled in part by disposal to Uranium Pond #1 (lined), Uranium Pond #2 (unlined), the Uranium Emergency Pond (unlined), the Plutonium Emergency Pond (unlined), and the Plutonium Evaporation Pond (lined). Originally, each pond held only specific waste, but during decommissioning liquids were transferred from one pond to another to facilitate decommissioning. Approximately six months following suspension of production operations, the ponds were essentially dry except for occasional ponding of rainfall.

Subsequently, the remaining sludge was removed, mixed with cement in drums and shipped off site for disposal at a commercial low level radioactive waste (LLRW) disposal facility. The Oklahoma Department of Environmental Quality and NRC both collected soil samples which were analyzed for residual activity. Cimarron received approval from the Oklahoma Department of Environmental Quality and NRC to close the ponds in place. Clean fill soil was added as necessary for surface contouring, and the areas were reseeded with native grasses.

Although closed in accordance with then "current guidelines", NRC informed Cimarron by letter in January 1993 that the five former waste ponds that were closed in 1978 must be addressed in detail. In response to this letter, additional characterization work was conducted in these areas and was discussed in detail in Section 12.0 of the 1994 Characterization Report and Section 2.0 of the 1995 Cimarron Decommissioning Plan. The secondary characterization required additional remediation of one small area and the addition of a few feet of soil cover to U-Pond #2.

Potential Impact to Groundwater – Former Ponds

Monitor wells 1348, 1349, and 1353 (all Sandstone A wells) have been placed in the vicinity of the former Plutonium Waste Pond, the former Plutonium Emergency Pond, and the Uranium Emergency Pond. Wells 1348 and 1349 were installed in 2003 to monitor the area near the Uranium Emergency Pond and Uranium Pond #1, respectively. These monitor wells are positioned to detect potential elevations in uranium activity but as historical records indicate, total uranium activity in this area consistently remains well below the groundwater release criteria of 180 pCi/l. Well 1334 has greater than eight sets of data indicating background

levels of total uranium while wells 1348 and 1349 do not yet have eight sets of data. Cimarron contends that the former ponds in this area are not potential sources of impact as shown by historical data meeting the groundwater criteria.

A review of historical records indicates groundwater in the vicinity of Uranium Pond #1 has shown impact from prior site operations, specifically for Tc-99. Prior to 1997, groundwater was not tested for Tc-99. Until that time, monitor wells 1312 and 1313 (both Sandstone A wells) provided down gradient monitoring for U-Pond #1. Monitor well 1311 (completed in Sandstone A) is upgradient of the former pond. In 1997, wells 1340 and 1341 (completed in Sandstones A and B, respectively) were installed downgradient and east of U-Pond #1. New downgradient monitor well 1345 (Sandstone B) was installed in 2003.

Five new wells, T-57, T-58, T-62, T-63, and T-65 were installed in 2003 in the alluvium north of the U-Pond #1 area as part of the Tc-99 assessment. These wells were placed at the base of the sandstone bluff, downgradient from U-Pond #1, to monitor groundwater moving from the sandstone into the alluvium. Well T-63 was the only well to exhibit elevated levels of Tc-99, in the range of 1600 pCi/l, considerably below the groundwater release criteria for Tc-99 of 3,790 pCi/l.

None of the upland wells in the vicinity of U-Pond #1 were above criteria limits for Tc-99 except well 1312. For several years prior to 2003, the Tc-99 values in well 1312 were trending downward but in the later 2003 and early 2004, levels were once again above 3,790 pCi/l. Since that time, Tc-99 activity has been steadily decreasing.

Initially, well 1336 (Sandstone A) and Seep 1208 monitored the groundwater from former Uranium Pond #2. In 1994, well 1336 was replaced with 1336A. Water quality data for 1336 and 1336A indicate an overall decreasing trend for Tc-99. Seep 1208 trends appear to vary, with values ranging from 3320 pCi/l in August 2004 to 4020 pCi/l in September 2003.

In early 1997, two additional wells were installed in the U-Pond #2 area. Well 1337 (Sandstone A) and 1338 (Sandstone B) were installed to verify the existence of Mudstone A, a semi-confining layer between Sandstone A and Sandstone B, as well as to demonstrate that groundwater in both Sandstone A and Sandstone B in the area is unimpacted. Analytical results indicate background levels for both uranium and Tc-99 in both wells.

In early 2003, two more additional upland wells were installed as part of the Tc-99 assessment. Wells 1346 (Sandstone B) and 1347 (Sandstone

A) were drilled to monitor groundwater quality directly downgradient of U-Pond #2 in both Sandstone A and Sandstone B. Wells 1346 and 1347 have consistently indicated low values for Tc-99, with the most recent analysis in September 2003 showing 84 and 66 pCi/l, respectively. Also, alluvial wells T-54, T-55, T-56 were installed adjacent to the bluff to monitor for Tc-99. T-56 has exhibited very low levels of Tc-99 while T-54 and T-55 are noted to have maximum levels at 1480 and 1590 pCi/l, respectively, with a trend toward diminishing concentrations in both.

Source Identification – East and West Sanitary Lagoons, New Sanitary Lagoon

The East and West Sanitary Lagoons initially received liquids from the Uranium Plant from 1966 to 1970. In 1970, liquid waste from the Uranium (U) Plant was diverted to the (then) newly constructed U-Ponds #1 and #2. From 1970 to 1985, the Mixed Oxide Fuel Facility (MOFF) septic tanks, the U-Plant septic tank, the U-Plant laundry, the MOFF laboratory, the U-Plant laboratory, the U-Plant dock drain, and numerous floor drains in the U-Plant discharged into the East and West Sanitary Lagoons. In 1985, both lagoons were isolated from the facilities in anticipation of closure. In January 1986, the remaining water in the East and West Sanitary Lagoons was pumped to the (then) New Sanitary Lagoon.

Initial soil removal and packaging of contaminated soil from the Sanitary Lagoons was performed from January to October 1986. Approximately 55,000 cubic feet of waste was shipped off-site to a LLRW disposal facility. Final clean up and survey work was performed during September 1990. Confirmatory radiological surveys and soil sampling was conducted by an NRC contractor in November 1990. NRC approved the backfilling of the East and West Sanitary Lagoons in December 1992, with backfilling of the lagoons completed by July 1993.

In January 1986, a New Sanitary Lagoon was installed to replace the East and West Sanitary Lagoons that were being remediated and closed out. The New Sanitary Lagoon was Hypalon–lined and located directly atop the previously closed Plutonium Evaporation Pond and a portion of the closed Plutonium Emergency Pond. Prior to construction of the New Sanitary Lagoon, a french drain, composed of gravels and drain pipe, was installed to divert water that accumulated beneath the lagoon into the drainage channel adjacent to the New Sanitary Lagoon.

All liquids from the East and West Sanitary Lagoons were pumped to the New Sanitary Lagoon prior to their remediation. In addition, waste water from the ion exchange system and the U-Building drains was released to the New Sanitary Lagoon. The New Sanitary Lagoon was utilized from early 1986 to October 1992.

When the New Sanitary Lagoon was decommissioned, the liner and the drain piping were removed except for the french drain discharge pipe. The gravels were left in place and continue to allow groundwater to collect. The groundwater collected by the french drain system monitors the area of the former ponds and

remains consistently near background total uranium concentrations. In November 1996, Cimarron received NRC approval to backfill the New Sanitary Lagoon.

Potential Impact to Groundwater – East and West Sanitary Lagoons
Groundwater monitoring wells within this area are placed to detect impacts from the East and West Sanitary Lagoons as well as the New Sanitary Lagoon. These wells include 1322 (Sandstone A), 1332 (Sandstone C), 1333 (Sandstone A), 1334 (Sandstone A), and 1349 (Sandstone A, a new well completed in April 2003). None of these wells exhibit radiological activity above background. Therefore, Cimarron holds that this area remains unimpacted by former plant operations.

Source Identification - Burial Area #1
Burial Area #1 (BA #1) was constructed in 1965 and used to bury both radioactive and non-radioactive waste in a series of trenches. BA #1 was closed in 1970.

Soil settlement in the trenches resulted in the initiation of an investigation in 1984 to establish an appropriate response. In February 1985, several monitoring wells were installed in the vicinity of BA #1 (i.e. monitoring wells 1314 through 1317). Subsequent sampling and analyses of groundwater samples from these four wells yielded elevated concentrations of total uranium. These wells continued to be monitored during and after excavation and closure of the trenches.

Based on the monitoring well data and the continued settling of the trenches, the decision was made in 1986 to excavate the buried waste materials contained within BA #1. By 1988, all waste materials had been removed. Approximately 65,000 cubic feet of material was shipped off-site to a LLRW disposal facility.

The excavation remained open from 1988 until 1993 awaiting NRC confirmatory surveys and authorization for backfill. During the time the excavation was open, NRC's contractor (ORISE) conducted an initial confirmatory survey. This confirmatory survey resulted in the identification of several areas containing contaminated soils which were subsequently excavated and shipped off-site for disposal. In 1991, ORISE conducted a second confirmatory survey and provided a report to the NRC that documented BA #1 was decommissioned in accordance with the release criteria. NRC subsequently released this area for backfill in late 1992.

During the period March through July 1993, clean soil was placed in the excavated area. Final grading of BA #1 was completed in July 1993.

Potential Impact to Groundwater – Burial Area #1
As part of the 2002 BA #1 assessment, a total of 62 new monitor wells were installed in order to determine the extent of the uranium plume in

Sandstone B and alluvial aquifers. None of the soils within the plume were found to exceed the BTP Option 1 decommissioning criteria of 30 pCi/g above background. A clay/mudstone lithologic unit (Mudstone B) underlies a significant portion of the uranium plume. The hydraulic gradient in the upland Sandstone B aquifer is steep, whereas the gradient is nearly flat in the floodplain alluvium. Monitoring of the existing wells in the BA #1 area indicates that the plume has not migrated significantly nearer the Cimarron River during the three years since the comprehensive assessment. Remedial options for the groundwater plume continue to be studied.

Source Identification - Burial Area #2

Burial Area #2 (BA#2) was utilized in the early 1970's for the disposal of on-site generated industrial solid waste from plant activity. During a 1990 investigation, there were indications that radioactive waste materials were present in the waste material in BA#2. Remediation of BA#2 was initiated in 1991.

Later characterization and remediation efforts for BA#2 resulted in the excavation of all BTP Option 2 and Option 4 soils from BA#2 in 1996. Excavated Option 2 soils were stockpiled and sampled prior to being placed in the Onsite Disposal Cell. All Option 4 soils were packaged and shipped offsite for disposal at a LLRW disposal facility. Industrial waste containing residual activity was also removed from BA#2, packaged, and shipped offsite for disposal at a LLRW disposal facility.

Following excavation of affected soils and removal of waste, soil samples were collected to depths of six feet in some areas. Approximately 20,000 cubic feet of Option 4 waste was excavated and shipped offsite as a result of this effort. NRC staff supervised a confirmatory subsurface sampling effort in October 1996. Based on the results of the confirmatory sampling, the NRC approved backfilling of BA#2. In January 1997, the area was backfilled with clean soil. BA#2 was remediated such that all remaining soil was at or below the BTP Option 1 criteria except for two locations which were below the total uranium guideline value based on activity averaging over a 10m x 10m grid

Potential Impact to Groundwater – Burial Area #2

Burial Area #2 is monitored by well 1331, located downgradient as shown by potentiometric surface mapping. Historical records indicate groundwater in the area was impacted by former burial activities but over time, these impacts have diminished. Initially, total uranium in groundwater from well 1331 was noted as high as 388 pCi/l in mid 1990. The August 2004 groundwater sampling event recorded 82 pCi/l and has been below the release criteria for greater than eight sets of quarterly data. This decreasing trend in total uranium indicates that the remediation of former burial area #2 was successful and that the area is not a source of concern.

Source Identification - Burial Area #3

Burial Area #3 (BA#3) was intended to be utilized for the disposal of non-radioactive solid waste materials. In 1990, a soil sampling and a gamma survey indicated that radioactive materials were present in the buried waste. An in-depth characterization of this area, completed in 1992, resulted in the identification of several elevated areas and the removal of approximately 100 cubic feet of waste. Further investigations in 1993 and 1994 uncovered other areas of soil and materials requiring removal. Efforts were made to separate BTP Option 2 soils, BTP Option 4 soils and metal debris. The BTP Option 4 waste was packaged and shipped to a LLRW disposal facility. Metal wastes were either surveyed and released or packaged and shipped for disposal at a LLRW disposal facility. A total of 13,500 cubic feet of Option 4 soil and waste was packaged and shipped off site. BTP Option 2 soils were stockpiled for placement in the Onsite Disposal Cell.

Potential Impact to Groundwater – Burial Area #3

Prior to 2003, monitor well 1311 was the nearest location from which groundwater samples could be collected for BA#3. As part of an ongoing assessment to determine water quality in areas without an established monitoring network, several new wells were installed.

Eleven new wells were installed during the first half of 2003 in the BA#3 vicinity. Wells 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, and 1360 were all completed in the Sandstone A aquifer. Three of the eleven, 1351, 1352, and 1356, continue to yield groundwater with concentrations above the release criteria of 180 pCi/l. Well 1351 has shown only one analytical result greater than the limit and will be re-sampled to verify the impact. The impact to groundwater appears to be localized.

These wells, installed in 2003, are downgradient and to the northwest of the former burial area. Potentiometric surface mapping indicates the monitoring wells are placed in the optimum position to detect impacted groundwater as flow is to the northwest. Monitoring of groundwater will continue as some wells yield groundwater above the release criteria.

Source Identification – Onsite Disposal Cell

On September 4, 1987, Cimarron Corporation submitted a license amendment request to the NRC for on-site disposal of soils and incidental construction debris containing uranium and thorium meeting the NRC BTP Option 2 criteria. As part of the decommissioning process, Cimarron personnel excavated, sorted, and stockpiled Option 2 materials in anticipation of disposing of these materials onsite. On November 4, 1994, the NRC issued Amendment #10 to License SNM-928, approving on-site disposal of up to 500,000 cubic feet of Option 2 materials at the location described in Cimarron's October 1989 submittal. Materials that had been placed in three separate stockpiles were approved for disposal in the on-

site disposal cell. The areas beneath these stockpiles has also been characterized and remediated as required.

The average activity in the disposal cell, 41.7 pCi/g total uranium, is substantially below the 100 pCi/g Option 2 limit. Also, the volume of material placed into the Onsite Disposal Cell is below the 500,000 cubic feet authorized by the 1994 license amendment.

After placement and compaction of the final lift into each pit, the Option 2 material was covered with four feet of clean fill. The final cap was then contoured to achieve a slope ranging from 1.4 % to 2.5%. Markers have been installed at the four corners of the cell and its location recorded on the property deed filed with the County Recorder.

Potential Impact to Groundwater – Onsite Disposal Cell

Several monitor wells were installed in the vicinity of the Onsite Disposal Cell area (wells 1320, 1321, 1324, 1325, and 1335). These wells have been used to monitor the performance of the burial area before and after Option 2 soils were placed. More than eight sets of groundwater data from these wells are within background levels of activity.

The Onsite Disposal Cell is constructed in a manner that will retard potential groundwater impact. The cell is located on the spine of a north-south trending topographic ridge and as such, shallow groundwater may flow either to the east or to the west. Additionally, the shallow mudstones act as aquitards and inhibit water infiltration. Evapotranspiration in the area is greater than precipitation providing assurance against the likelihood of generating a leachate.

The surface of the finished disposal cell is contoured to shed rainwater. An evaluation of potential cell cover erosion was analyzed utilizing methods described in the NRC Draft Technical Position Paper (1989), Nelson, et.al. (1986), and the U.S. Department of Agriculture computer model GLEAM. The study indicated even with the occurrence of a Probable Maximum Precipitation event, a worst-case scenario, the disposal cell soil cover would suffer little effect. All of the aforementioned precautionary specifications provide additional protection to the buried materials from groundwater saturation, justifying a relatively short post-closure period to monitor the cell as a permanent vegetative cover becomes established

Source Identification – Former Uranium Processing Building and Yard Area

The Former Uranium Processing Building and Yard Area underwent extensive decontamination. As reported in previous submittals, much of the contaminated equipment, structures, soil, and associated debris were shipped offsite to disposal facilities. Contaminated soil from the Building and Yard Area, as well as

stockpiled soil from other affected areas was temporarily place in the Yard Area for later disposal in the Onsite Disposal Cell. Following removal of the stockpiled soil, extensive excavation and grading was necessary to remove impacted soils which was either moved to the Onsite Disposal Cell as Option 2 material or shipped offsite as Option 4 material.

Potential Impact to Groundwater – Former Uranium Processing Building and Yard Area

Initially, the area around the Uranium Processing Building and Yard was monitored by six monitoring wells; including the now abandoned well 1319 which was constructed as a water production well rather than a monitor well. Wells 1326, 1327B, 1328, 1329, and 1330 were installed to monitor groundwater in this area. Groundwater flow in the shallow Sandstone A is in a westerly direction. None of these shallow wells indicate impact from former plant operations. Even the three new Sandstone A wells near the 1319 Area are significantly below the release criteria.

The 1319 Area Assessment identified localized impact to the groundwater in the Sandstone B and Sandstone C aquifers. Wells 1319 B-1 and 1319 C-1 both yielded groundwater with elevated uranium concentrations. Groundwater was pumped from both wells for a period of time to reduce the concentrations below the 180 pCi/l release criteria. In a January 2005 letter to NRC, Cimarron proposed a post-decommissioning groundwater monitoring program for the 1319 Area. Both wells were included in the proposed monitoring program. The collection of groundwater data for eight quarters below the release criteria is ongoing.

Source Identification – Drain Lines

Pipeline from Uranium Building to U-Pond #1 - A four-inch PVC discharge line extended easterly from the Uranium Building, approximately 1000 feet, then north to the Uranium Waste Pond #1. According to Section 15.0 of the 1994 Characterization Report, this line was reported to have leaked during the facility's operational period. Approximately 150 drums of contaminated soil were excavated and shipped offsite for disposal from a leak just south and east of U-Pond #1.

The drain line was excavated and removed in 1985. Several areas along the pipe trace were remediated. These locations are approximately adjacent to, and upgradient of the BA#3 vicinity. The impact to groundwater in this area has been addressed by remediation in the former Uranium Processing Building and Yard Area as well as Burial Area #3.

West Pipeline - A four-inch steel pipeline was used for liquid effluent discharges from the Sanitary Lagoons to the Cimarron River. The effluent was sampled prior to discharge to ensure that the effluent would meet Cimarron license criteria.

A weir box with a continuous sampler was used to collect a 24-hour composite sample which was analyzed daily.

This pipeline was excavated and removed in June 1985. The line trace was surveyed and sampled. Four sample locations were remediated that exceeded the 30 pCi/g Option 1 limit. These locations are part of the Western Alluvium assessment and are currently being monitored.

East Pipeline - A pipeline extending from U-Pond #1 to the Cimarron River was a six-inch PVC line installed for effluent discharges. Records indicate it was used only two times and that released liquids met the license criteria. A survey and soil sampling program following line excavation did not encounter soils greater than the 30 pCi/g total uranium criteria. No remediation was required. The risk of impact to groundwater is considered very slight as noted by analysis from monitor well T-53 exhibiting background levels of total uranium.

Transfer Line - A four-inch PVC transfer line extended from U-Pond #1 to U-Pond #2. When the line was excavated and removed, no contaminated soil was encountered. The risk of potential impact to groundwater is considered minor since neither line leaks nor contamination were encountered.

Uranium Building Drains - The Uranium Building was underlain with a series of drain lines to the Sanitary Lagoons. These lines extending from the west end of the building (Uranium Building laboratory and restrooms/change rooms), from the dock area on the north side of the building, and from the east end of the building to the Sanitary Lagoons.

All the lines that were removed were surveyed as well as the soil surrounding the lines. Soil samples were collected for analysis of uranium. Only one section of line under the lab/change room sanitary drain under Building #4, the former warehouse north of the Uranium Processing Building, was left in place. This section of line was decontaminated and surveyed for release. All drain line areas, including those leading to the sanitary lagoons, were included in confirmatory surveys performed by ORISE prior to backfilling.

Potential impact to groundwater from the drain lines and pipelines has been addressed by former and ongoing assessments, as well as nearby monitor wells, in the vicinity of the Uranium Building and Yard area.

Source Identification – Incinerator

The trash incinerator south of BA#3 was utilized for the incineration of non-radioactive materials during site operations. Due to the concentration of radionuclides in the residual ash materials, uranium concentrations above the BTP Option 1 levels were encountered. The ash materials were surveyed, removed and shipped offsite to a LLRW disposal facility. Soil samples were collected and found to be below the release criteria. Potential Impact to

groundwater is being addressed by downgradient well 1350. As of this report, groundwater data for four only quarters has been collected. Total Uranium concentrations are slightly above background but well below release criteria. Monitoring of the area will continue for at least eight quarters demonstrating less than 180 pCi/l.

PROPOSED PHASE AREAS

Decommissioning efforts involving characterization, decontamination and remediation of the Uranium Plant and Area were initiated in 1976. The only un-finished activities involve potential groundwater remediation of certain areas. Based on historic knowledge of site operations and the characterization work conducted prior to 1994, Cimarron proposed dividing the site into affected and unaffected areas. This concept was approved by NRC via NM-928 License Amendment #15.

Affected areas were areas where residual contaminations had been identified or where historical information indicated the potential for radioactive contamination. Other areas which were not expected to contain residual radioactivity were considered unaffected. The site was then divided into three major "Phase" areas and further divided into Sub-areas which contained both affected and unaffected areas.

Using a similar premise for grouping under current assessment requirements and current knowledge, Cimarron proposes using four "Phase Areas" to group areas as follows:

Phase I Areas - Areas for which no groundwater assessment should be required. Phase I areas are those that have been found to be "unaffected" or "unimpacted" by either assessment or by the fact that facility activities were never conducted in the vicinity. These areas were not used for processing or disposal, and are hydrologically isolated from "affected" or "impacted" areas. Plate 2 Illustrates the proposed Phase I areas located on the southern half of the Cimarron site in Sub-areas A and B.

Phase II Areas – Areas in which a potential for groundwater impact exists but areas downgradient from sources of existing groundwater impact have been found to be unimpacted as evidenced by groundwater monitoring. Much of Areas C, D, E, G, and J were outside of areas of delineation. Portions of Area I and H are also considered in the Phase II Area (Plate 2). No further monitoring is needed as shown by historical assessments and groundwater data.

Phase III (a) Areas - Areas in which groundwater assessment has been implemented and impact encountered above background levels but below the license release criteria. Monitor wells have been installed

downgradient from sources but not all wells may have eight consecutive periods of monitoring. Wells that have been monitored longer than eight consecutive intervals satisfy the intent of license condition 27 (b). No additional monitoring should be required.

Phase III (b) Areas - Areas in which groundwater assessment has been implemented. Impact may or may not have been detected above license criteria but the impact no longer exceeds the criteria. Some localized areas of impact may remain and will require ongoing monitoring until eight consecutive intervals of data below the criteria have been collected. In addition, analytical results must not demonstrate increasing trends in concentration.

Plate 2 illustrates the area in the vicinity of former well 1319. This area was initially discovered to have localized uranium impact in Sandstone B and Sandstone C. Following groundwater pumping from wells 1319 B-1 and 1319 C-1, groundwater has been remediated in the area. Groundwater monitoring of these two wells is ongoing.

Other areas in the proposed Phase III would be Sub-areas K, N, O, portions of G, H and L. Portions of the Phase III areas do have wells with more than 8 sets of data below the criteria to show monitoring is sufficient. Other wells above the criteria indicate ongoing monitoring must be continued.

Phase IV Areas – Areas where impact to groundwater was identified and continues to exceed license criteria and for which recommendations for groundwater remediation strategies will be proposed. Former Burial Areas #1 a nd #3 and the Western Alluvium Area are those areas in which additional groundwater remediation is anticipated (Plate 2).

The Phase Area Chart (Chart 1) illustrates the four Phases proposal in a diagrammatic format.

CONCLUSION

Cimarron Corporation has conducted a comprehensive review of historical data, reviewed assessment and characterization reports that have been prepared and submitted, and reviewed the historical and on-going collection of groundwater analytical data that has been assembled at the Cimarron site since 1977. From this review, Cimarron Corporation believes it has adequately assessed known and potential areas of groundwater impact on the entire 840-acre property, and that no further assessment activities are needed or warranted.

Areas that have the potential for groundwater impact are believed to have been located and assessed such that any remaining groundwater impact will be

remediated or shown to have no long term effects either to human health or the environment.

Coincident with this review is a proposal by Cimarron Corporation to divide the site into four "Phase" areas which would be similar in scope to that used for site soil areas and final status surveys. These four groups will promote a simplified focus on site groundwater issues as opposed to continuing the more complex Sub-areas tied to the final status survey grouping as noted by comparing Plate 1 with Plate 2.

Cimarron will, under separate cover, request a license amendment that will amend License Condition 27 b to:

- Plug and abandon wells in Phase I and Phase II areas.
- In Phase III areas, devise a monitoring program that will comply with the intent of License Condition 27 b.
- Reword License Condition 27 b to address Phase III areas for which groundwater monitoring is not yet complete as well as Phase IV areas for which remediation is not yet complete.

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Cimarron Facility
Proposed Phase Area Chart

Area		Need for Assessment	Need for Monitoring
1		No need for assessment because areas are hydrologically isolated from sources; in some areas limited data confirms no impact to groundwater	No monitoring is needed in Phase I areas. License condition 27(b) should not apply to these areas.
2		These areas have been assessed. Past assessment has demonstrated that these areas lie beyond the extent of impact, and groundwater concentrations are within the range of background.	No further monitoring is needed in Phase II areas. License condition 27(b) should not apply to these areas.
3	3a	These areas have been assessed. Past assessment has demonstrated that these areas are impacted above background, but below the license criteria.	Not all wells in these areas have been monitored for eight consecutive periods. Wells that have been monitored more than eight consecutive intervals satisfy the intent of license condition 27(b). No further monitoring should be required.
	3b	These areas have been assessed. These areas may or may not have been impacted above license criteria, but no longer exceed license criteria.	Select locations in these areas should be monitored until eight consecutive periodic yield data consistently below the license criteria and do not demonstrate an increasing trend in concentration.
4		These areas have been assessed. Groundwater concentrations in these areas exceed license criteria. Groundwater remediation methods are being evaluated.	Select locations in these areas will be monitored in accordance with approved groundwater remediation plans. Those plans will include post-decommissioning monitoring programs to demonstrate compliance with license condition 27(b).

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