CHASE ENVIRONMENTAL GROUP, INC.
environmental engineering, remediation & consulting

FINAL STATUS SURVEY PLAN FOR PHASE III AREAS

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

License Number: SNM-928

Prepared for:

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Oklahoma City, Oklahoma

June 1997

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FINAL STATUS SURVEY PLAN FOR PHASE III AREAS

1.0 Purpose

This Phase III Plan is the third and final phase of the overall Final Status Survey Program being submitted by Cimarron Corporation (Cimarron) to the Nuclear Regulatory Commission (NRC). The purpose of this plan is to establish the requirements needed for the release of each area of the Cimarron site that has been previously remediated or surveyed and determined to be clean as part of the site decommissioning process. The results of the Phase III Final Status Survey will provide final survey data demonstrating that radiological parameters are satisfied for unrestricted release of all Cimarron site areas.

As described in the April 1995 Cimarron Decommissioning Plan, the Final Status Survey Plan for the Cimarron site was separated into three phases. The Phase I Plan titled "Final Status Survey Plan for Unaffected Areas" was submitted to and approved by the NRC. The Phase I Final Status Survey was completed and the Report submitted to the NRC on August 9, 1995. A license amendment, releasing this area from the site license (Amendment No. 13), was issued by the NRC on April 23, 1996. Phase I included only unaffected areas. This release reduced the acreage remaining under license from 840 acres to 152 acres.

The Phase II Final Status Survey Plan was submitted to the NRC in July 1995, and was approved by the NRC on March 14, 1997. The Phase II Plan included known affected and some contiguous unaffected areas of the Cimarron site. Cimarron has substantially completed the remediation of Phase II areas and has begun generating the final status survey data showing that requirements for unrestricted release of these areas from the license are met.

This Phase III Plan includes only affected areas, some of which have previously been released by the NRC. A description of those areas released is included with this Plan. Where required, this Phase III Plan provides a description of methodologies to be followed for additional surveying and sampling to be conducted on remediated Phase III areas. Existing characterization data and any new characterization data will be compiled into the Phase III Final Status Survey Report and submitted to the NRC. This Report will be submitted in support of a license amendment request for the unrestricted release of all Phase III areas from Cimarron License SNM-928. Upon submittal of this Phase III Report, final status surveys for the entire Cimarron site will have been completed.

2.0 Background

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

Decommissioning efforts at the MOFF Facility were completed in 1990 and Cimarron Corporation applied to the NRC on August 20, 1990[3], to terminate License SNM-1174. After confirmatory surveys by Oak Ridge Associated Universities (ORAU), the NRC terminated the MOFF Facility License, SNM-1174, on February 5, 1993[4]. The land surrounding the MOFF building remained under License SNM-928.

Decommissioning efforts involving characterization, decontamination, remediation, and surveying for the 840 acres licensed under SNM-928 were initiated in 1976 and are nearing completion. The goal of the decommissioning effort is to release the entire 840 acre site for unrestricted use. Kerr-McGee Chemical Corporation will continue to operate research and development activities at the site that do not require licensing by the NRC.

Based upon historic knowledge of site operations and characterization work completed, the Cimarron Radiological Characterization Report[5] was submitted in October 1994 to the NRC. As discussed in that report, the site was divided into affected and unaffected areas. Affected areas are areas in which residual radiological contamination has been identified or where historical information indicates the potential for radiological contamination. Unaffected areas are areas which are not expected to contain residual contamination. The affected and unaffected areas are shown on Drawing No. 95MOST-RF3. For the Final Survey Plan the entire 840 acre site has been divided into three major areas which contain both affected and unaffected areas. Each of these three major areas are also shown on Drawing No. 95MOST-RF3 and are designated by Roman Numerals I, II, and III (herein referenced as Phases I, II, and III). These three major areas were then further subdivided into smaller subsections (i.e. A, B, C, D, etc.).

In the Cimarron Decommissioning Plan[6], the Final Status Survey Plan (Phases I, II and III) was discussed in general terms, with the understanding that each of the three phases would be submitted to the NRC under separate cover for approval. The first of these three phases (Phase I[7]) was reviewed by the NRC

and the NRC submitted their comments to Cimarron Corporation on February 24, 1995[8]. The NRC's comments were addressed and incorporated into both the Phase I plan and the Phase II plan as applicable. The Phase I plan was approved by the NRC via letter dated May 1, 1995[9]. The surveys and soil sample analyses for Phase I were completed and the Final Status Survey Report for Phase I was submitted to the NRC on August 9, 1995[10]. Cimarron Corporation responded to the NRC's comments[11] on the Phase I Report by letter dated November 13, 1995[12]. Confirmatory sampling for the Phase I areas were completed by the Oak Ridge Institute for Science and Education (ORISE). The ORISE report was submitted to the NRC, and a license amendment releasing this area from License SNM-928 was issued by the NRC and sent to Cimarron Corporation on April 23, 1996[13]. The Phase I area represents approximately 688 acres of the original licensed 840 acre site. Approximately 152 acres remain under license SNW-928 and are addressed in Phase II and III.

The area designated as Phase II on Drawing No. 95MOST-RF3 contains both affected and unaffected areas. The Phase II Area includes Burial Area #1, which had materials excavated and shipped off-site for disposal. This Phase II Area was released by the NRC per License Amendment #9[14] for backfilling with clean soil in 1992. Also included in Phase II are the East and West Sanitary Lagoons (also released for backfilling per License Amendment #9), the MOFF Plant yard area, the Emergency Building, the Warehouse Building (Building #4) and surrounding yard, and numerous stormwater drainage areas. The Final Status Survey Plan for Phase II was submitted to the NRC in July 1995[15]. The Phase II Final Status Survey Plan was approved by the NRC on March 14, 1997[16]. Final status surveying and soil sampling are currently being conducted for Phase II by Cimarron personnel. This area represents approximately 122 acres of the 152 acres remaining after release of Phase I.

The Phase III area survey is the last phase for completing the final status survey for the entire Cimarron site. This area is designated as Phase III on Drawing No. 95MOST-RF3 and consists of approximately 30 acres. The Phase III area includes the Uranium Processing buildings and yard area, Burial Areas #2 and #3, the New Sanitary Lagoon, the NRC approved BTP Option #2 On-Site Disposal Cell (Burial Area #4), and the Five Former Waste Water Ponds consisting of the Uranium Waste Ponds #1 and #2, the Plutonium Waste Pond, the Uranium Emergency Pond, and the Plutonium Emergency Pond.

3.0 Site Description

The Cimarron Facility is located in Logan County, Oklahoma, on the south side of the Cimarron River approximately 0.5 miles north of the intersection of

Oklahoma State Highways #33 and #74. Figure 3.1 shows the site location. The 840 acre site is located in an area of low, rolling hills and incised drainages. Local elevations range from about 940 feet along the river to 1,010 feet Mean Sea Level at the plant. The county is primarily rural with an economy primarily based upon agriculture and ranching. The entire site is owned by Cimarron Corporation, a wholly owned subsidiary of Kerr-McGee Corporation.

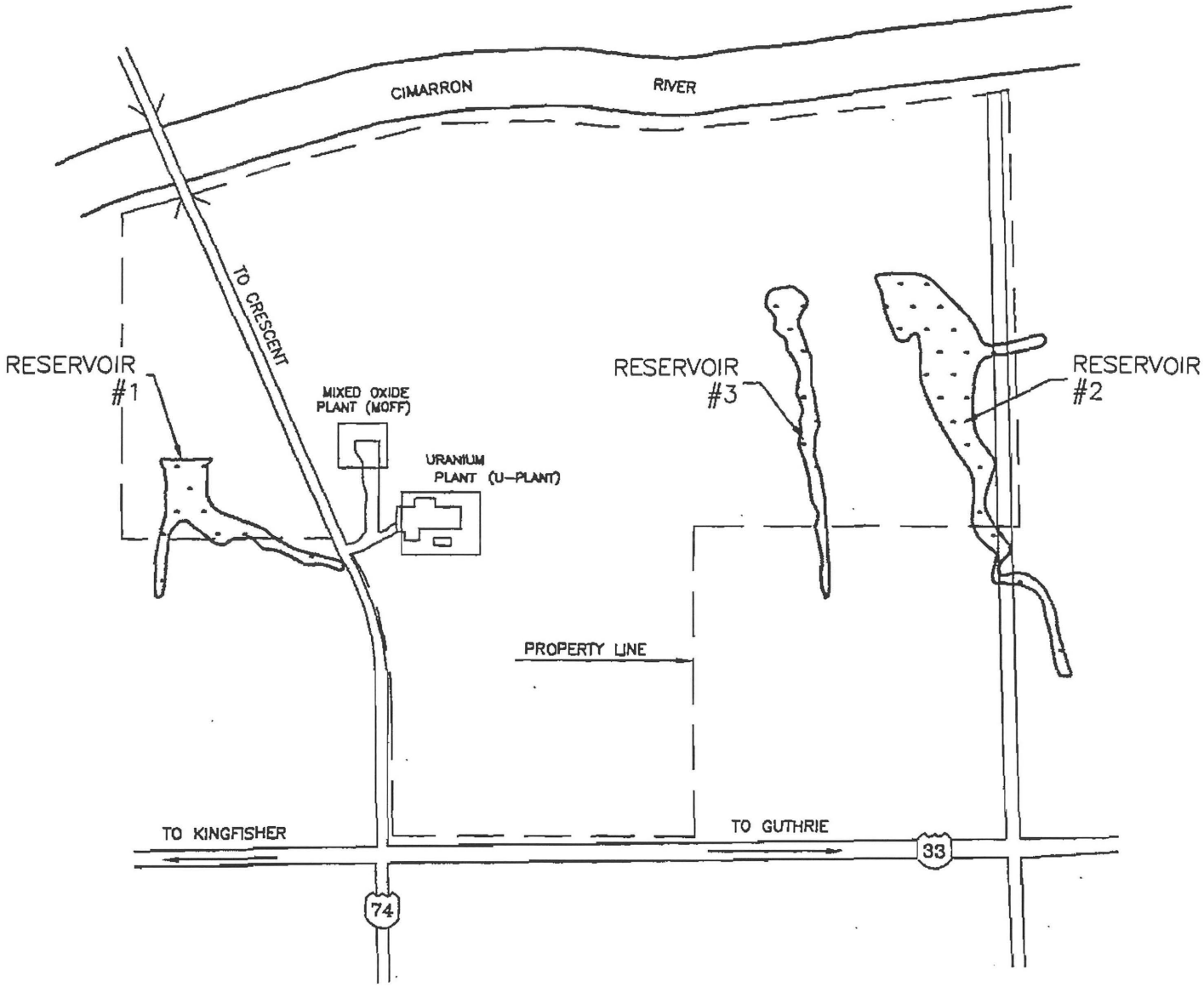
4.0 Facility Description

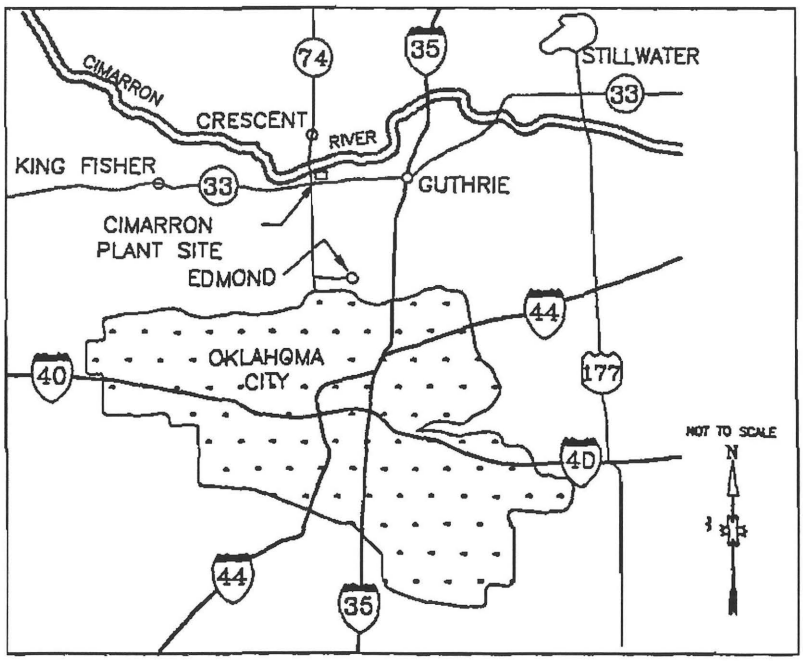
The U-Plant was constructed to be a complete nuclear fuel service facility. Operations provided for the production of UO_2, UF_4, uranium metal and the recovery of scrap materials. In 1968 the plant was expanded by increasing the UO_2 and Pellet facilities through the installation of another complete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

The process facilities included several one-story sheet metal exterior buildings (U-Plant), five process related collection ponds, two original sanitary lagoons, a newer synthetic-lined sanitary lagoon, a waste incinerator, several uncovered storage areas, and three burial areas. As discussed in this Plan, these areas (herein referred to as "units") are currently at differing stages of completion with respect to decommissioning. The general site layout is shown on Drawing No. 96MOST-RF15. Included within the affected areas are several drainage ways and the site road to the old burial area (Burial Area #1). Cimarron's site decommissioning efforts are discussed at length in both the Characterization Report[5] and the Decommissioning Plan[6].

5.0 History of Site Operations

The Cimarron Facility was originally licensed under two separate licenses. License SNM-928 was issued for the U-Plant Facility and License SNM-1174 was issued for the MOFF Facility. License SNM-928 was originally issued in 1965 to Kerr-McGee Nuclear Corporation for the manufacture of enriched uranium reactor fuels. Both facilities terminated production operations in 1975.





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Cimarron Corporation
Crescent Oklahoma Facility
Location Map
Figure 3.1

Decontamination and decommissioning of the MOFF Facility was completed by 1990, and the license was terminated by the NRC in 1993[4]. The U-Plant Facility decommissioning is nearing completion with several remaining locations in the final stages of remediation.

6.0 Final Status Survey Overview

The purpose of this section is to discuss briefly the status of the substantially completed Phase III remediation effort and to present the radiological criteria and guideline values utilized throughout this phase of the decommissioning process. The radiological criteria and guideline values for Phase III areas are identical to those utilized for both the Phase I and Phase II areas, except for the recent NRC guidance on subsurface volumetric averaging to be applied to Uranium Waste Ponds #1 and #2. Phase III contains only the affected areas which are shown on Drawing No. 95MOST-RF15. The status of this area is discussed in this section along with the additional sampling and survey requirements required to complete the Final Status Survey. The Phase III area has been divided into five sub-areas which are designated as K, L, M, N, and O.

In general, for Phase III areas, Cimarron Corporation has committed to follow the methodology prescribed in NUREG/CR-5849 for performing the Final Status Survey. The Final Status Survey will be conducted after fairly comprehensive efforts have been made to identify, evaluate, and if necessary remove any areas of residual activity exceeding the guideline value. The Final Status Survey Reports for this area will include all necessary (and in many instances much more) data to support the Final Status Survey and will also include an evaluation of the data presented.

6.1 Identification of Contaminants

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

Thorium contaminated materials from the Kerr-McGee Cushing Facility were disposed in Burial Area #1. Burial Area #1 is located within the Phase II area and is an affected area that was remediated between 1986 and 1988. ORAU[17] performed a confirmatory survey, and the NRC released this area for backfill in accordance with Amendment #9[14] to License SNM-928. Also, Burial Area #2, located within the Phase III Area contained slightly elevated thorium in a small amount of waste and soil. Although thorium (Th-232) is not considered to be a principle contaminant at the Cimarron site, samples collected from certain affected areas are analyzed for natural thorium to ensure complete and accurate characterization.

Cimarron notified the NRC on October 1996[18] that Tc-99 (Technetium-99) has been discovered at the Cimarron Site in several wells and seeps located downgradient from Uranium Waste Ponds #1 and #2. Cimarron Corporation discovered the presence of Tc-99 through an extensive investigation into a high gross beta to gross alpha ratio that was present in several of the 1996 environmental groundwater samples. On April 22, 1997[19], the NRC informed Cimarron that based on the information provided by the company regarding the origin and concentrations of Tc-99 at the Cimarron facility, there is no need to list Tc-99 on the license. However, Cimarron is continuing to perform annual environmental groundwater monitoring for Tc-99 for several wells with elevated gross beta to gross alpha ratios.

6.2 Site Background Levels

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

Cimarron personnel collected and analyzed 30 surface soil samples from the perimeter of the Cimarron site during the first quarter of 1995 to further validate background levels. These results are discussed in Cimarron Corporation's response to the NRC dated June 21, 1995[20], which was related to the release of the South U-Yard Area for backfill. Total uranium ranged from 2.3 pCi/g to 6.6 pCi/g, with the average being 4.0 ± 2.6 (2σ) pCi/g. These values were obtained using the

Cimarron on-site soil counter (Counter No. 1). This on-site soil counter is calibrated to assume an enrichment of 2.7 weight percent as this is the average enrichment of materials processed.

A correction factor (0.67/1.5) was then applied to these results to convert the values from an assumed 2.7 weight percent enrichment to a natural enrichment. The converted results ranged from 1.0 pCi/g to 2.9 pCi/g with an average of 1.8 ± 1.0 (2σ) pCi/g total uranium.

It can therefore be stated that measurements of background soils will be less than or equal to 2.8 pCi/g total uranium 95 percent of the time after application of the correction factor (0.67/1.5 converts values from 2.7 weight percent enrichment to natural enrichment). The 2.8 pCi/g total uranium concentration (natural enrichment) represents the upper 95 percent confidence interval for total uranium found in Cimarron site soils. In like manner, the inverse of the subject correction factor multiplied times the analytical results reported in terms of natural enrichment produces results in terms of 2.7 weight percent enrichment. For example, this correction factor (1.5/0.67) when applied to the value of 1.8 pCi/g (average total uranium concentration; natural enrichment), produces a value of 4.0 pCi/g (average total uranium concentration; 2.7 weight percent enrichment). When using the Cimarron Corporation on-site soil counter, the average background value of 4.0 pCi/g total uranium is used. The NRC released the South U-Yard Area for backfill and approved these background values by letter dated July 7, 1995[21].

In addition to analyzing for total uranium, the 30 samples collected from the site perimeter were analyzed for natural thorium. The discussion on background for thorium is included in Cimarron Corporation's response to the NRC dated November 13, 1995[22]. The natural thorium background concentration was determined to range from 0.7 to 1.7 pCi/g.

Background exposure rates have been established at the Cimarron site by taking micro-R readings at unaffected off-site sample locations and at Cimarron site areas which are unaffected by past operations. Site background exposure rates of approximately 7 μR/h have been observed in background areas by Cimarron personnel utilizing a Ludlum Micro-R survey meter. Site background exposure rates of approximately 7 μR/h have also been determined by ORISE personnel utilizing similar instrumentation. In addition, site background exposure rates have been determined by ORISE personnel utilizing a pressurized ion chamber (PIC)[23]. Based on the PIC measurements, the site background was determined to be approximately 10 μR/hr. Based upon these numerous

background assessments performed by both Cimarron and ORISE personnel, the background exposure rate at the Cimarron site has been determined to range from 7 to 10 μR/h. Cimarron conservatively uses 7 μR/h as a background exposure rate. This value will be utilized unless a different value is warranted due to changes in environmental variables (i.e., rock out-croppings).

6.3 Characterization Data

As discussed earlier, the Cimarron site has been subdivided into survey units. These units are naturally distinguishable or have a common history of characterization and decommissioning activities. Throughout most of the decommissioning process at the Cimarron site, a unit was characterized, remediated (if required), and resurveyed. The description of the decommissioning activities and final survey data were then submitted to the NRC for review and approval. After review of the submittal, the NRC either released the unit and/or contracted with ORISE (previously ORAU) to perform a confirmatory survey. Based upon the ORISE confirmatory survey (if requested by the NRC), the NRC would either release the unit or require additional remediation. The units which have been released by the NRC and are contained in this Phase III Plan are addressed in this section. Cimarron personnel have substantially completed the remediation and are in the final phases of surveying the remaining units on site utilizing the same NRC-approved procedures.

6.3.1 Areas Released by the NRC

As discussed in Section 2.0, the Phase III area comprises only affected areas including several areas which have been previously released for backfilling by the NRC. The affected areas, which have been released by the NRC and are included within this Phase III Plan, are discussed briefly below.

- Five Former Waste Water Ponds - The Five Former Waste Water Ponds, discussed in this section, provided a method of liquid waste control during facility operations. These five ponds included Uranium Waste Ponds #1 and #2, the Plutonium Evaporation and Emergency Ponds and the Uranium Emergency Pond. By early 1977, these ponds contained no free-standing liquid. The sludge remaining in four of these ponds was removed, mixed with cement, and

shipped off site for disposal at a licensed LLRW burial site. The other pond, Uranium Waste Pond #2, did not contain any sludge.

After the sludge was removed, Cimarron staff, the Oklahoma State Department of Health (October 1977), and the NRC (November 1977), sampled the soils/liner materials from each of the five ponds. Based upon the analysis results, Cimarron Corporation received written permission from the Oklahoma State Department of Health to backfill and cover these ponds on March 2, 1978[23]. Cimarron Corporation received written authorization from the NRC to backfill and cover these ponds on July 10, 1978[24]. These five ponds were backfilled and covered between August 3, 1978 and November 1, 1978. An October 30, 1978, NRC inspection, which was documented via letter dated December 14, 1978[25], states that closure of the "five liquid effluent retention ponds was completed during the inspection". Initial seeding as well as fencing of the areas was performed between November 2, 1978, and March 20, 1979. Sprigging and fertilizing of the cap soil was performed from July 18, 1979, to October 30, 1979. Even though closed in accordance with "current guidelines" as stated in the NRC letter dated January 8, 1993[26], the NRC informed Cimarron Corporation that "the five former waste water ponds that were closed in 1978 must be addressed in detail". In response to this issue, additional characterization work was conducted by Cimarron Corporation in these pond areas and is discussed in detail in Section 12.0 of the Characterization Report. Recently, additional soil sample data was collected from Waste Ponds #1 and #2 to support the volumetric averaging methodology to be employed to demonstrate that soils within these two pond areas meet BTP Option #1 criteria. This methodology is discussed in Section 6.4.4.

- Uranium Plant Yard Area - The restricted area south of Uranium Building #1, (containing the UF_6 Receiving Area (Vaporizer Room), the Tank Storage Building (Building #2), the Solvent Extraction Building (Building #3), the Liquid Storage Areas and the UF_6 Storage Area have been extensively remediated. All structures south of Building #1 (see Figure 6.1) have been removed and the subsurface soil has been remediated. Decontamination and decommissioning activities are further discussed in Section 13.0 of the

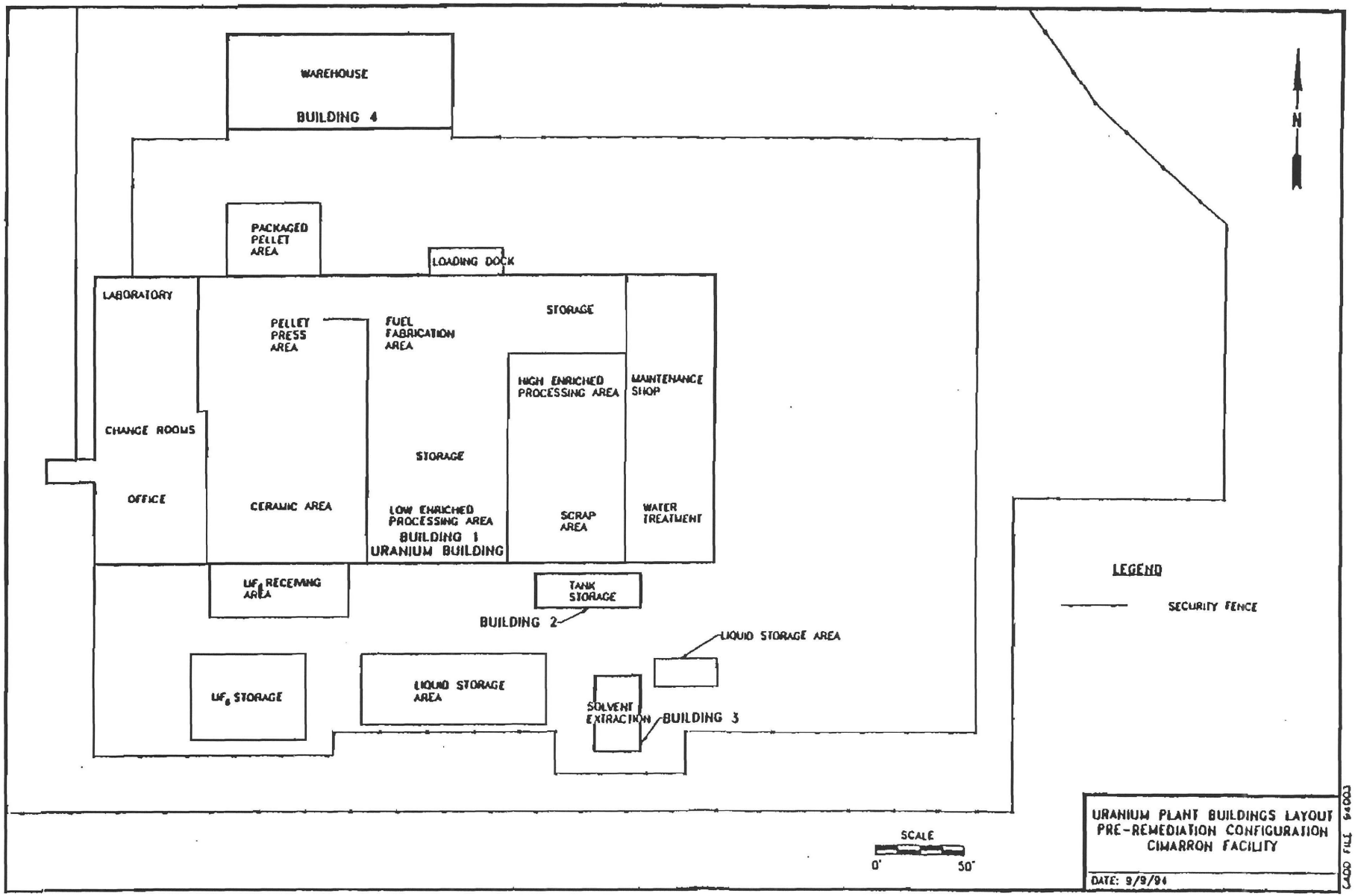
WAREHOUSE
BUILDING 4
PACKAGED PELLET AREA
LOADING DOCK
LABORATORY
PELLET PRESS AREA
FUEL FABRICATION AREA
STORAGE
HIGH ENRICHED PROCESSING AREA
MAINTENANCE SHOP
CHANGE ROOMS
STORAGE
OFFICE
CERAMIC AREA
LOW ENRICHED PROCESSING AREA
BUILDING 1
URANIUM BUILDING
SCRAP AREA
WATER TREATMENT
UF6 RECEIVING AREA
TANK STORAGE
BUILDING 2
LIQUID STORAGE AREA
UF6 STORAGE
LIQUID STORAGE AREA
SOLVENT EXTRACTION
BUILDING 3
N
LEGEND
SECURITY FENCE
SCALE
0'
50'
URANIUM PLANT BUILDINGS LAYOUT
PRE-REMEDIATION CONFIGURATION
CIMARRON FACILITY
DATE: 9/9/94

Figure 6.1

Characterization Report and also in the South U-Yard Remediation Report dated November 1994[28]. Based upon the results of the pre- and post-remediation characterization data presented in the South U-Yard Report and the November 1995 ORISE[29] confirmatory sampling results, the NRC released the area for backfilling and recontouring by letter dated July 7, 1995[30]. This area was backfilled, recontoured and seeded by December 15, 1995.

- Uranium Processing Building (Building #1) - In April 1977, Cimarron personnel initiated the characterization and decontamination of Building #1. The concrete floor in the Wet Ceramic Area has been removed. Option #4 soil located below the concrete floor was excavated and shipped off site for disposal. Option #2 soils were stockpiled on site waiting disposal in Burial Area #4. Follow-up soil sampling, completed in 1992, indicated that the soil remaining in this area met the BTP Option #1 guideline value for unrestricted release. At the request of the NRC, ORISE conducted an independent confirmatory survey on June 22, 1992[31]. Based upon this survey, the NRC released this area for backfill. The supporting data demonstrating that both the surface and subsurface areas meet the unrestricted release criteria along with the applicable ORISE references will be submitted as part of the Phase III Final Status Survey Report.

  The Scrap Recovery Area also required the removal of the concrete floor as well as contaminated soil located below the concrete. Confirmatory sampling was completed by Cimarron personnel in 1993, with sample results being submitted to the NRC that same year. Based upon a review of data by ORISE and the NRC, the NRC released this area for backfill in early 1994[32].

  The characterization and confirmatory sampling data, as well as a discussion of the decommissioning activities completed on Building #1, can be found in Section 14.0 of the Characterization Report[5].

- Burial Area #2 and North Field Drainage Area - Burial Area #2 was intended to be utilized in the 1970's for the disposal of on-site generated industrial solid waste. During an investigation of this area in 1990, it was discovered that radioactive waste materials were present in the buried waste. Remediation of this area was initiated in 1991. Both Option

#4 and Option #2 soils have been removed from this area and separated from the industrial waste (i.e. metal, piping, etc.). Option #2 soils were stockpiled for confirmatory analysis prior to being placed in the on-site disposal cell. Option #4 soil has been packaged for transportation and disposal off site. The industrial waste, presently stockpiled, is being packaged and transported off site for disposal at a LLRW facility.

A final survey of the excavated area has been completed on a 5 m x 5 m grid. The characterization data for this unit can be found in the Final Status Survey Report, Phase III, Subarea L[33]. The Phase III, Subarea L Final Status Survey Report was submitted prior to the submittal of this Phase III Plan due to the urgency of backfilling this area prior to significant erosion occurring. Based upon the Survey Report, and additional Cimarron clarification and sampling, the NRC approved the backfilling of Subarea L[34] on November 8, 1996. The Subarea L surface area is still included in the license and will be addressed in the final status survey for Phase III areas.

- New Sanitary Lagoon - This lagoon was Hypalon-lined and was constructed in January 1986 to replace the East and West Sanitary Lagoons. The New Sanitary Lagoon was utilized from early 1986 to October 1992. The decommissioning of this area was accomplished in accordance with Section 2.2 of the Decommissioning Plan[6]. This Lagoon was included in Subarea L and was backfilled and graded per NRC approval[34] (Subarea L Subsurface).

6.3.2 Other Areas Within Phase III

Cimarron personnel have substantially completed the remediation and/or survey of the remaining units (areas) on site. The remaining Phase III units that have been remediated or are in the final process of being remediated are discussed briefly below. The final status survey data for these units will be included in the Phase III final status survey report.

- Burial Area #3 - This area was intended to be utilized for the disposal of non-radioactive solid waste materials. In 1990 the soil sampling and 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 removal of approximately 100 ft^3 of waste. This waste was packaged and shipped to a commercial LLRW disposal facility.

To verify that only materials meeting the BTP Option #1 limit were present, Cimarron recently completed the excavation of all Burial Area #3 trenches. Industrial solid waste and soils were surveyed during the excavation and any radioactive materials/soils above the BTP Option #1 guideline were separated for either disposal in the On-Site Burial Cell or packaged for disposal off site. Initial characterization data for this area can be found in Section 9.0 of the Characterization Report. Remediation of this area is complete and its final status survey data will be included in the Phase III Final Survey Report.

- Trash Incinerator - This incinerator was utilized to incinerate non-radioactive waste materials released from restricted areas during site operations. The incinerator was located just east of the New Sanitary Lagoon. Due to the concentration of residual materials resulting from incineration, uranium concentrations above background levels were discovered in the ash. The incinerator was dismantled in 1992. Ash materials were surveyed, and if required, placed in drums and shipped off site to a commercial LLRW disposal facility. No further remediation is required for this area.

- On-Site Roads - The road from the Uranium Plant to Burial Area #4 is being utilized for the transport of Option #2 waste materials. Therefore, this road has been included in the Phase III affected area and will be surveyed as such during the final status survey. The decontamination (if required) of this area and final survey will be performed when all Option #2 materials from other areas of the facility have been disposed.

- Burial Area #4 (Option #2 On-Site Disposal Cell) - On November 4, 1994, the NRC issued Amendment #10[35] to License SNM-928 which approved on-site disposal of up to 500,000 ft^3 of Option #2 waste materials at the location shown on Drawing No. 95MOST-RF15. The Option #2 stockpiles, which were located east and northeast of Building #1, have been placed in the on-site disposal cell. These materials were disposed with NRC approval after

characterization of the soil was completed by Cimarron and confirmed by ORISE. The on-site disposal cell is comprised of three pits (Pit #1, #2, and #3). Pits #1 and #2 have been filled and capped. Additional Option #2 materials are being placed in Pit #3 for final disposal. A final survey of this area will be completed in accordance with this plan once all Option #2 materials have been placed in Burial Area #4 and the cell is capped.

- Building #1 - The decontamination and decommissioning of this building is almost complete including the removal of walls, floors, and structural supports. As discussed in Section 6.3.1 of this plan and in Section 14.0 of the Characterization Report[5], two areas (i.e., scrap and ceramic areas) have been excavated, surveyed and released for backfill by the NRC.

  The office area, which is located at the west end of this building, will be surveyed for final release. Additionally, the western bay of the original process area will be surveyed and further decontaminated, if required for final release. These building spaces are to be retained throughout the final survey period or until replaced by portable offices, storage and maintenance trailers. All other walls, roof and structural support components are being removed, surveyed and decontaminated (if required) for free release. Approximately 80% of this building has been removed.

- Uranium Plant Yard Area - The restricted area east and northeast of Building #1 contained the Option #2 stockpiles prior to their disposal in the on-site disposal cell. Four of these stockpiles (DAP's #1, #2, #3 and #4) were characterized and placed in the on-site disposal cell. Option #4 soils and the industrial solid waste stockpiles are presently being placed in packages for transportation off-site to an approved LLRW disposal facility. The areas located beneath these stockpiles are being characterized and remediated (if required) in order to meet the Option #1 guideline value. A final survey of this area will be performed when all remediation has been completed. Excavated Option #2 materials are now being placed directly in the on-site disposal cell as approved by NRC on June 10, 1996[36].

- Drain Lines - The Phase III area includes several areas occupied by former drain lines to the Sanitary Lagoons, Evaporation Ponds and Uranium Waste Ponds. These drain

lines have been removed and the areas were surveyed at the time of line removal or during subsequent characterization and remediation efforts. One small section of an out of service sanitary drain line is still located beneath Building #1. A temporary change room and laboratory facility has been connected to the existing site sanitary drain line and septic drain field. The location of these drain lines and an explanation of remediation activities completed is included in Section 15.0 of the Characterization Report.

6.3.3 Environmental Monitoring

Several of the areas addressed under Phase III include locations where environmental monitoring is performed. Environmental samples are collected from locations within the Phase III Areas in accordance with the Cimarron environmental sampling program and submitted to off-site laboratories for independent analysis. In addition to annual environmental reports which are submitted to the NRC by Cimarron Corporation, a description of the environmental monitoring program and summary of results were incorporated into the Characterization Report[5]. Additionally, the Groundwater Report[37] submitted to the NRC in December 1966, contained an evaluation of the 1996 annual environmental monitoring program results for groundwater and surface water and a summary of the previous annual data. A second document[38], which included a site recharge and groundwater quality study, was also submitted in December 1996.

The environmental monitoring locations within the Phase III area include 12 environmental monitoring wells, two surface water sampling locations, one soil sampling location and two vegetation sampling locations. Cimarron Corporation will continue to perform environmental sampling in accordance with the facility's environmental monitoring program and until such time as the Facility License SNM-928 is terminated or NRC approval is granted to suspend monitoring.

The Groundwater Report[37] discusses those areas onsite where groundwater has been impacted by past site operations. Cimarron recently responded[39] to the NRC's March 13[40] questions on the two December 1996 Groundwater Reports. As discussed in Cimarron's responses, the company believes that the groundwater onsite is not a viable source of drinking water due to

alternate sources of better water and site use control. Cimarron is working with the State Oklahoma Department of Water Quality (ODEQ) concerning aquifer classification. Cimarron believes that with source removal and low aquifer transmissivity, active restoration of the groundwater is not justified and reliance on natural process is appropriate.

6.4 Survey Objective

The purpose of this section is to discuss the methodology to be utilized during the generation of additional survey and soil sampling data to supplement existing survey data for the Phase III area. The guidance promulgated in NUREG/CR-5849[41] will be utilized throughout the conduct of the Final Status Survey. The Final Status Survey Report for Phase III will present data necessary to demonstrate that all applicable radiological parameters are satisfied for unrestricted release. This report will be submitted to the NRC in conjunction with a license amendment request to terminate the Facility License SNM-928, due to the fact that this is the final phase of the overall Cimarron Facility Final Status Survey Plan.

The radiological parameters for surveys and soil sampling will be compared to the criteria described below:

6.4.1 Buildings and Equipment

Release limits for contamination on all buildings and equipment will comply with Facility License SNM-928 and are identical to the limits specified in Table 1 of the NRC's 1987 guidance[42] for decommissioning of facilities and equipment prior to release for unrestricted use. Those limits are reproduced in Table 6.1.

Surface contamination on a building interior surface which is between 1 and 3 times the stated average limit is acceptable, provided that the weighted average radioactivity within a 1 m^2 area containing the elevated activity is within the stated limit.

6.4.2 Surface Soil Activity

For an affected area, the guideline value for residual concentrations of uranium which may remain in soil is specified

TABLE 6.1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b,c,f]	MAXIMUM[b,d,f]	REMOVABLE[b,e,f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228,Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/cm^2	20 dpm/100 cm^2
Th-nat, Th-232m, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table dpm (disintegration per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent level should be reduced proportionally and the entire surface should be wiped.

[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber..

as Option #1 material (for enriched uranium, this is up to 30 pCi/g total uranium, excluding background) in Table 2 of the BTP[43]. Systematic soil sampling will be performed on each 100 m^2 grid area to determine the average value for residual activity. This systematic sampling will equate to four samples (5 m x 5 m grid) per 100 m^2 area. The average will then be compared to the guideline value. Hot-spot averaging will be performed for all locations, within 100 m^2 grid areas, which contain average soil concentrations in excess of 30 pCi/g total uranium above background as described in NUREG/CR-5849. Areas of elevated activity will be determined based upon discrete sampling within the grid or will be assumed to have a constant value (e.g., 25 m^2 based upon 5 m x 5 m grid sampling frequency). The maximum enriched uranium soil concentration within a 100 m^2 grid area may not exceed three times the BTP Option #1 limit (90 pCi/g total uranium above background).

6.4.3 Volumetric Activity for On-site Disposal

On-site disposal of BTP Option #2 material in a designated earthen cell was approved by the NRC through the issuance of Amendment #10 to License SNM-928[35]. Current authorization is for the burial of 500,000 ft^3 of Option #2 materials. The average concentration of radioactive material that may be buried on site (Burial Area #4) is 100 pCi/g total uranium above background (this assumes that the uranium is 100% soluble), and up to 250 pCi/g total uranium above background for insoluble uranium. The average concentrations of thorium and plutonium in the soil earmarked for disposal cannot exceed 10 pCi/g and 1 pCi/g, respectively. Hot-spot averaging can be applied to any location within a 100 m^2 grid area which contains soil concentrations in excess of the limits stated above. The maximum total uranium soil concentration for any "hot spot" location within a 100 m^2 grid area may not exceed three times the BTP Option #2 limit for 100% soluble or insoluble uranium.

6.4.4 Averaging Methodology for Subsurface Residual Activity

The NRC guidance[44] for volumetric averaging of subsurface soil containing residual contamination will be followed for demonstrating compliance with BTP Option #1 criteria. This guidance was prepared for a NRC licensee with thorium

contamination. Per the NRC, this guidance can be applied to a site containing residual uranium contamination as long as the methodology is similar. Based upon the NRC's methodology, the soil concentration guideline values to meet the Option #1 criteria will be determined for comparison to residual activity remaining below grade.

These guideline values will be applied to Uranium Waste Ponds #1 and #2 to demonstrate that subsurface soils meet the Option #1 average concentration guidelines and can be left in place.

6.4.5 Gamma Surface Survey (Open Land Areas)

On occasion, Cimarron personnel utilize a shielded or unshielded 3" X 0.5" sodium iodide (NaI) detector as an additional screening device for qualitative identification of residual contamination in soil. This type of detector has been utilized primarily in affected areas to assist in remediation activities.

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

Paved and/or concrete surfaces will be scanned at the same frequency and for the stated limits discussed herein for open land areas. Surface contamination on an exterior surface which is greater than twice background is used as an indication that further investigation is required.

6.4.6 Exposure Rate Survey (Open Land Areas)

All open land areas contained within Phase III will be 100% scanned as part of the final status survey procedure. For affected areas, the average exposure rate may not exceed 10 μR/hr above background, at 1 meter above the surface. Exposure rates may be averaged over a 100 m^2 grid area as described in NUREG/CR-5849. The maximum exposure rate at any discrete location within a 100 m^2 grid area cannot exceed 20 μR/hr above

background. Any areas with average exposure rates greater than 10 μR/hr above background and any discrete locations within a 100 m^2 grid area with exposure rates greater than 20 μR/hr above background will be delineated and remediated if required. As stated in Section 6.2, Cimarron conservatively uses 7 μR/hr as a background exposure rate.

Paved surfaces will be surveyed for exposure rates at the same frequency and for the stated limits discussed herein for open land areas.

7.0 Administration

The current organizational structure is expected to remain in place throughout the duration of the decommissioning process. Personnel may change but the structure will remain the same. The Cimarron site RSO/Health Physics Supervisor, QA/QC Manager, Project Manager and other support personnel report directly to the Site Manager. The Site Manager reports directly to the Vice President of Cimarron Corporation.

7.1 Organization

The final survey of the Phase III affected areas will be performed by a final survey team consisting of qualified personnel from the Cimarron site. Contractor assistance may be utilized if required. The final survey team will operate under the general direction of the Cimarron Site Manager who reports directly to the Vice President of Cimarron Corporation. The Vice President will have the authority to make appropriate changes to the final status survey plan as the survey progresses.

The selection of field measurement equipment and sample collection techniques will be under the direction of the RSO/Health Physics Supervisor who reports to the Cimarron Site Manager. Actual field measurements and sample collection will be under the direction of the Project Manager. Additionally, the Project Manager will also oversee the field activities of any contractor support personnel.

Cimarron site laboratory activities will be under the direction of the RSO/Health Physics Supervisor. The RSO/Health Physics Supervisor will provide oversight for any contract laboratory assistance. All

activities required under the Final Status Survey Plan will be performed in accordance with the Cimarron Radiation Protection Program.

7.2 Training

Cimarron Corporation provides continuing training for Cimarron personnel and any other personnel (i.e., contractors, visitors, etc.) who are allowed access to the site. All members of the final survey team will attend an in-house training session prior to commencement of work under the Phase III Final Status Survey Plan. All survey procedures and quality assurance requirements will be reviewed during this training session.

7.3 Radiation Protection Program

Cimarron Corporation maintains a radiation protection program which meets and/or exceeds all of the applicable regulatory requirements associated with activities conducted under Special Nuclear Materials License SNM-928[1] and By-Product License 35-12636-02[45]. The Cimarron Radiation Protection Program currently in place for all decommissioning activities is administered through the use of the following documents:

- License SNM-928 Amendment #13
- Cimarron Radiation Protection Procedures
- Cimarron Site Health and Safety Plan
- Cimarron Quality Assurance Plan and Procedures
- Cimarron Emergency Plan

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

Independent Kerr-McGee Corporate audits for regulatory and internal requirements are conducted on a periodic basis and include the review of the Cimarron Decommissioning Program and the associated elements. Assessments of program effectiveness are also performed and documented periodically by the Cimarron RSO/Health Physics Supervisor. Additionally, the program is inspected for compliance with

applicable rules and regulations by the Oklahoma Department of Health, NRC Region IV, ORISE and NRC Headquarters staff.

7.4 Cimarron Quality Assurance Program

The Cimarron Corporation Quality Assurance Plan and Procedures are an integral part of the Cimarron Radiation Protection Program. A principal component of this Program is the affirmation of the quality of project work performed during decommissioning by assuring that all tasks are performed in a quality manner by qualified personnel. The Program ensures that all characterization and final status survey samples are collected, controlled and analyzed in accordance with all applicable quality assurance requirements such that the resulting data accuracy and validity are verifiable. Such quality controls allows independent, third party review of analytical results.

The Cimarron Quality Assurance Program is implemented and maintained in accordance with written policies, procedures, and instructions. This Program is administered under the direction of the Quality Assurance Manager. Periodic audits and reviews are conducted to ensure that all aspects of the Program are addressed. The Cimarron Quality Assurance Program satisfies all of the applicable requirements of ASME NQA-1[46].

Written procedures, designated as Special Work Permits (SWP's), are prepared, reviewed and approved for activities involved in carrying out the decommissioning process. A SWP is a document or series of documents prepared by the Project Manager and the Health Physics Department to inform individuals of the conditions that exist in the work area and the radiological and non-radiological job safety requirements. Additionally, a work plan will be prepared when necessary to provide procedural guidance to workers. The work plan designates the type of surveys to be performed, samples to be collected, frequency of sample collection, number of samples to be split with an off-site independent laboratory and the type of field instrumentation required for the tasks required.

The facility performs its own radiological soil analysis in accordance with written procedures and QA/QC protocols. Field data are gathered and maintained in field logs for all samples in accordance with the Cimarron Quality Assurance Program. Necessary data are transferred to the on-site laboratory sample log when the sample is brought to the on-site laboratory for analysis. The sample logs provide a record of sample

collection and transport (chain of custody) and are incorporated into the facility quality assurance files.

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

Numerous confirmatory samplings by the NRC and ORISE have confirmed the precision of the Cimarron on-site counter. On May 4 and 5, 1995, ORISE, while on site, selected six soil samples from Cimarron's sample archives for confirmatory analysis. The basis for selection of the samples was to establish a broad range of activity concentrations for total uranium. Analytical results for these samples were compared to those reported by the licensee. The results of this comparison, as a whole, confirmed that ORISE[28] and Cimarron's analytical results are statistically identical.

Sample and survey data are reviewed by the Health Physics Department for accuracy, consistency, and for comparison to the guideline values. Reviews are performed on a regular basis. Investigation and correction of recognized deficiencies are performed immediately upon identification.

8.0 Phase III Final Status Survey

Existing characterization survey and soil sampling data will be utilized when available from past characterization efforts. This existing characterization data will be reviewed in light of the guidance contained in NUREG/CR-5849 to determine applicability. Existing characterization data utilized in the Final Status Survey Plan (Phase III) will either be sufficient to meet the criteria contained in NUREG/CR-5849 or will have a technical justification explaining why the data is determined to be adequate. Areas identified as not having adequate characterization data, based upon the review of the existing characterization data, will be characterized in accordance with NUREG/CR-5849. The following sections describe the general approach to be taken in completing the Final Survey for Phase III areas.

8.1 General

Cimarron Corporation has divided the entire 840 acre site into three major areas which contain both affected and unaffected areas. Each of these three areas are shown on Drawing No. 95MOST-RF15 and are designated by Roman Numerals I, II, and III (herein referenced as Phases I, II, and III). This plan is for the Phase III area only; and is the third and final phase which will complete the Final Status Survey for the entire Cimarron site.

8.2 Existing Characterization Data

The Phase III area contains only affected areas which consisted of the Uranium Processing Buildings and yard areas, Burial Areas #2 and #3, the On-Site Disposal Area (Burial Area #4), the New Sanitary Lagoon, the five former waste water ponds, and portions of the on-site road and pipeline runs. These areas are further discussed in Section 6.3 as well as in the Facility Characterization Report[5] and Decommissioning Plan[6].

As discussed in Section 6.3.1, Cimarron has gathered additional surface and subsurface soil data from Waste Ponds #1 and #2 areas. This data will be evaluated utilizing the recently issued NRC guidance[44] for averaging subsurface soil contamination. This guidance was prepared for a NRC licensee with thorium contamination. Per the NRC, this guidance can be applied to a site containing residual uranium contamination as long as the methodology is similar. Cimarron will follow this methodology for averaging concentrations of uranium in subsurface soils to demonstrate that the unrestricted use criteria is being met. Cimarron will develop average uranium activity concentrations for the scenarios evaluated in the NRC guidance and compare these values to the soil data available for the two Waste Ponds. Soils not meeting the guidelines will be remediated. Final characterization data, including the subsurface averaging data, will be included in a separate submittal to the NRC and only summarized in the Phase III Final Status Survey Report.

8.3 Survey Plan Grid Areas

For purposes of identification, the Phase III area is shown on Drawing No. 95MOST-RF15. The Phase III area has been further divided into sub-areas for data tracking and are shown on this drawing as K, L, M, N, and O. The grid system shown on these drawings is utilized for locating soil sampling and survey points. Cimarron employs a Ground Positioning Survey (GPS) unit to check pre-established grid points and to

accurately locate sample collection and survey positions in the field. This unit is accurate to less than ± 1 m. The 0.0 grid point is located just south and slightly west of the main Uranium Building as shown on Drawing No. 95MOST-RF15. This grid point will be tied into a permanent marker for future reference.

8.4 Surveys (Open Land Areas)

In general, the affected areas will be 100% surveyed. The specific instruments to be used will be selected by the RSO/Health Physics Supervisor. The instrumentation available for use by site personnel and the minimum detectable activity (MDA) for those instruments available for use by Cimarron personnel are listed in Table 8.1. Where possible, in selecting an instrument for scanning, the MDA for the instrument should be ≤25% of the guideline value.

Where possible, 5 m x 5 m grids will be established and areas will be surveyed by traversing back and forth within the grid area. In some cases, areas to be surveyed may be less than five (5) meters in width. Each traverse performed by the technician covers an area of approximately 2 meters in width. For areas less than 5 meters, the technician may elect to survey the length of the grid area without traversing. The highest reading found within each approximate five (5) meter length or 5 m x 5 m grid area will be recorded. Survey performance, documentation, and record retention will be in accordance with the Cimarron Radiation Protection Program and Quality Assurance Program. In the event that any of these survey readings exceed the limits described in Section 6.4.3, their location will be flagged for additional surveys and/or soil sampling. The specific work to be performed in the Phase III areas will be specified in SWPs.

8.5 Soil Sample Locations

The systematic soil sampling frequency for each sub-area will be specified in the SWPs. Where practicable, soil samples will be collected at the 5 meter grid intersects throughout each of the five sub-areas contained in Phase III. The 5 m x 5 m grid sampling frequency is equivalent to the guidance in NUREG/CR-5849 which recommends four samples at locations equidistant between the center and each corner of a 10 m x 10 m grid. The actual soil sample locations may vary slightly

TABLE 8.1

RADIATION MONITORING INSTRUMENTS

INSTRUMENT TYPE	NUMBER AVAILABLE	RADIATION DETECTED	SCALE RANGE	BKG	TYPICAL MDA 95% CONFIDENCE LEVEL
Scintillation (Ludlum 2224) Scaler/Ratemeter	2	Alpha Beta	0-500,000 cpm	< 10 cpm < 300 cpm	100 dpm/100 cm² 500 dpm/100cm²
Micro-R Meter (Ludlum) 1" x 1" Nal Detector	1	Gamma	0 - 5,000 µR/h	7 µR/h	7 uR/h
Ion Chamber (Victoreen)	2	Gamma	0.1 - 300 mR/h	<.0 1 mR/h	<0.2 mR/h
3" x 1/2" Nal Scintillation Detector Digital Scaler	3	Gamma	0 - 500,000 cpm	3,000 cpm avg shielded 9,000 cpm avg unshielded	250 cpm 500 cpm
100 cm² gas flow (43-68) Digital Scaler	1	Alpha	0 - 500,000 cpm	<10 cpm	100 dpm/100 cm²
60 cm² gas flow (43-4) Digital Scaler	1	Alpha	0 - 500,000 cpm	<10 cpm	200 dpm/100 cm²
60 cm² Count Rate Meter (PRM-6)	6	Alpha	0 - 500,000 cpm	<100 cpm	350 dpm/100 cm²
50 cm² Personnel Room Monitor (Ludlum 177)	3	Alpha	0 - 500,000 cpm	<100 cpm	500 dpm/100 cm²
5" Slide-Drawer Counter	1	Alpha	0 - 500,000 cpm	<0.3 cpm	2 dpm
Eberline 2" GM Tube (Pancake)	1	Beta, Gamma	0 - 500,000 cpm 720 cpm = 0.2 mR/h	<200 cpm	70 cpm
Ludlum 2" GM Tube (Pancake)	2	Alpha, Beta, Gamma	0 - 500,000 cpm 720 cpm = 0.2 mR/h	<200 cpm	70 cpm
Tennelec LB5100 Computer Based Auto Sample Counter	1	Alpha Beta	0 - 99,999,999 cpm	<0.3 cpm 1.5 cpm	0.4 dpm 1.5 dpm
Soil Counter - Computer Linked 4" x 4" x16" Nal (T1) Detector	1	Gamma	---	4 pCi/g Total U 1.5 pCi/g Th (Nat)	10 pCi/g U (5 minute count) 4 pCi/g U (30 minute count) .25 pCi/g Th (Nat)
100 cm² Gas Flow Digital Scaler	2	Beta, Gamma	0 - 10,000 cpm	<300 cpm	600 dpm/100 cm²

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from the designated 5 meter grid intersects due to obstructions located in the field. All soil samples collected will be analyzed for total uranium using the on-site soil counter. Additional soil sampling at various locations or depths may be required based upon previous sampling results or the surface soil sample analysis results generated under this plan.

Cimarron has collected surface and subsurface samples at numerous open land area locations within Phase III. For those locations where subsurface sampling has been performed, Cimarron has collected and composited these subsurface samples, at one foot intervals, down to a maximum depth of 4 feet (or rock) prior to analyses. For areas where there is no reason to believe that residual subsurface contamination is present, only surface sampling at the 5 m grid interval will be performed. However, subsurface samples will be collected at a frequency of one out of every twenty (20) 5 m x 5 m grids located within these Phase III open land areas not previously sampled below grade. One sample location out of every twenty (20) 5 m x 5 m grid areas equates to one (1) sample location for every 500 square meters (to be located approximately in the mid-point of each 500 square meter area as some areas may not conform to this configuration). Therefore, a total of twenty (20) locations would be sampled for a 10,000 (100 m x 100 m) square meter open land area (i.e., 20 sample locations with 4, one foot composite soil samples per location), for a total of 80 soil samples.

Roads located in open land affected areas will be surface sampled at 5 meter intervals along their length when the width of such affected areas are less than 5 meters. For areas greater than 5 m in width, a 5 m x 5 m grid will be established. Additionally, subsurface soil samples will be collected on a maximum frequency of 1 sample location per each 100 meters in length, and will include a total of 4 samples down to a maximum of 4 feet or rock for each 100 meter interval. As stated above, Cimarron does not intend to sample to depth all Phase III open land areas which have previously been sampled in accordance with NUREG/CR-5849.

For former pipeline locations, surface and subsurface soil samples will be collected at 5 meter intervals along their length. The subsurface samples will be collected to a depth of 4 feet or rock and include four one foot composite samples per sample location.

For each of the five designated sub-areas, four soil samples (for a total of twenty) will be split for submittal to an off-site independent laboratory for confirmatory analysis. Additionally, ten quarterly split samples will

be collected for soil counter quality assurance purposes and will include soil samples from the designated Phase III sub-areas where practicable.

Systematic exposure rates measurements using a Micro-R meter, will be recorded for each soil sample location at the surface and at 1 m above the surface. All areas with elevated exposure rates (greater than 10 μR/hr above background) will be investigated further.

8.6 Building/Surface Surveys

The survey measurements for surface activity will consist of a combination of surface scans, direct measurements and measurements of removable activity.

The maximum radioactive contamination on interior surfaces of buildings on the Cimarron site which may be released without restriction is based upon the NRC guidelines[42] for decontamination of facilities and equipment prior to release for unrestricted use which is discussed in Section 6.4.1.

The decontamination and decommissioning of the uranium processing equipment and buildings began in 1977. Almost all equipment has either been decontaminated and/or removed from the site. Building #1 is the only building still remaining within the Phase III area. A number of the exterior and interior walls, roof and floor sections have been removed. The walls, roof, and support steels are also being removed. Surfaces have been washed, scraped, chipped and/or scabbled to remove surface contamination as required. Subfloor drains and contaminated soils have also been excavated and removed. Two Building #1 subsurface areas have been released by the NRC for backfill. The western end of this building still houses the Cimarron Corporation Administrative Offices. The office areas, which have been remediated, may be retained or replaced with temporary building/offices.

The Liquid Storage Building (Building #2) has been dismantled and removed. The Solvent Extraction Building (Building #3) and the Vaporizer Room have also been dismantled and removed, including their concrete floors and foundations. The decommissioning of the process buildings is further discussed in Section 14.0 of the Characterization Report[5].

The remaining portions of Building #1 will be final surveyed, in general, per NUREG/CR-5849 and as discussed below. Where appropriate, a

reference grid will be established prior to conducting the initial survey. Scans of 100% of affected area floors and lower wall surfaces will be performed for alpha and beta/gamma. The surveys of the upper walls, ceilings, and support structures will be dependent upon the contamination potential for these surfaces. The survey coverage will be specified by the SWPs developed for this area.

Areas of elevated activity noted during the scan will be identified and direct measurements taken. The limit for activity on a building or structure surface for residual activity is three times the guideline value. Areas that exceed this limit will be remediated or removed and follow-up surveys will be performed. Areas of elevated activity between one and three times the guideline value will be tested to assure that the average surface activity level within any contiguous 1 m^2 area containing the elevated area is less than the guideline value. The guidelines for release of interior building surfaces are discussed in Section 6.4.1.

Direct measurements will be performed at a spacing of 2 m or less when practical for both floors and lower walls. Upper walls, ceilings and overhead surfaces will be surveyed at a frequency similar to floors and lower walls if operating history and the initial scan indicate the presence of residual activity. Different survey coverages may be specified for different overhead areas depending upon the potential for suspected residual activity. The guidelines and coverage will be specified by the SWPs developed for the area.

Removable contamination measurements (smears) will be taken at each location when direct surface activity measurements are obtained. The guidelines for removable activity are discussed in Section 6.4.1.

Exposure rate measurements will also be taken at 1 m from the floor and lower wall surfaces at each direct measurement location. The exposure rate guideline for internal building surfaces will be 5 μR/hr above background.

8.7 Instrumentation

The instrumentation to be utilized to generate the characterization and final status survey data discussed above are calibrated and maintained in accordance with the Radiation Protection Program procedures. These procedures utilize the guidance contained in ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration". Specific requirements for instrumentation include traceability of calibrations to

NIST standards, field checks for operability, background radioactivity checks, operation of instruments within established environmental bounds (i.e. temperature and pressure), training of individuals, scheduled performance checks, calibration with isotopes of energies similar to those to be measured, quality assurance tests, data review, and recordkeeping.

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

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

As required by the Cimarron Quality Assurance Program, a SWP is written and approved prior to commencement of field work covered under the Final Status Survey Plan. The SWP for this project will specify the type of instrumentation to be utilized in performing the site surveys. Several of the instrumentation utilized by site personnel are discussed below.

The portable instrumentation available at Cimarron for use during this Final Status Survey are listed in Table 8.1 along with the detector sensitivities for the instrumentation (MDA).

8.7.1 Unshielded 3" x 0.5" NaI Gamma Detector

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

the window "out" mode, meaning that this instrument response is for the entire range of detectable energies.

8.7.2 Shielded 3" x 0.5" NaI Gamma Detector

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

8.7.3 Micro-R Survey Meter

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

8.7.4 Soil Counter (Gamma Spectroscopy)

The Cimarron Soil Counter consists of a 4" x 4" x 16" sodium iodide crystal housed in a shielded chamber which is computer linked to a multi-channel analyzer (MCA). Data from the MCA is processed through an analysis program which, in turn, determines uranium and thorium concentrations in soil samples.

Calibration of this counting system is performed annually and is traceable to NIST standards through contractor laboratory evaluations of the on-site standards. ORISE has been used by the NRC for verification of a majority of the decommissioning work completed to date at the Cimarron site. ORISE has conducted an evaluation of the Cimarron Soil Counting system's ability to accurately measure total uranium concentrations in soil samples. This was done by comparing ORISE sample analysis results obtained by alpha pulse height analysis and gamma spectroscopy with the results obtained from the use of the Cimarron Soil

Counter. ORISE and Cimarron analysis results compared favorably at levels above background as demonstrated by the most recent confirmatory analysis performed for the DAP-3 stockpile (NRC approval letter dated May 31, 1995)[47]. Additionally, the confirmatory analysis performed on select soil samples collected during ORISE's site visit to investigate the South U-Yard,[28] verified previously that Cimarron's on-site counter results are statistically identical to ORISE's results.

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

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

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

9.0 Data Validation

The recorded survey data and soil sample activity concentrations for each affected area will be reviewed and compared to the criteria discussed in Section 6.4. Items to be reviewed during the data validation process to ensure consistency and acceptability of the data are also discussed below.

9.1 Field Survey Data (Portable Instrumentation)

Instrument calibration, data entry records, and data calculations shall be verified by the Project Manager or designee to ensure that:

- Field survey results have been recorded, signed and dated. Any changes will be crossed out with a single line and initialed by the individual making the change.
- Background and source check readings were obtained each day on which surveys were performed. Calibration sources are traceable to National Institute of Standards and Technology (NIST) standards or some other nationally recognized standard.
- MDA for appropriate instruments shall be recorded.
- Individuals performing the survey have been trained under the Cimarron QA program.
- Statistical analysis has been performed in accordance with NUREG/CR-5849 or some other approved method to demonstrate that the data for the survey unit (i.e. group of contiguous grids or regions with the same classification of contamination potential) satisfy the guideline values addressed in Section 6.4.
- Required conversions/calculations have been verified.
- All required signatures and dates are in place.
- Instrumentation calibration records are current.

9.2 Laboratory Analytical Data (On-Site Soil Counter)

Instrument calibration, data entry records, and data calculations shall be verified by the Project Manager or designee to ensure that:

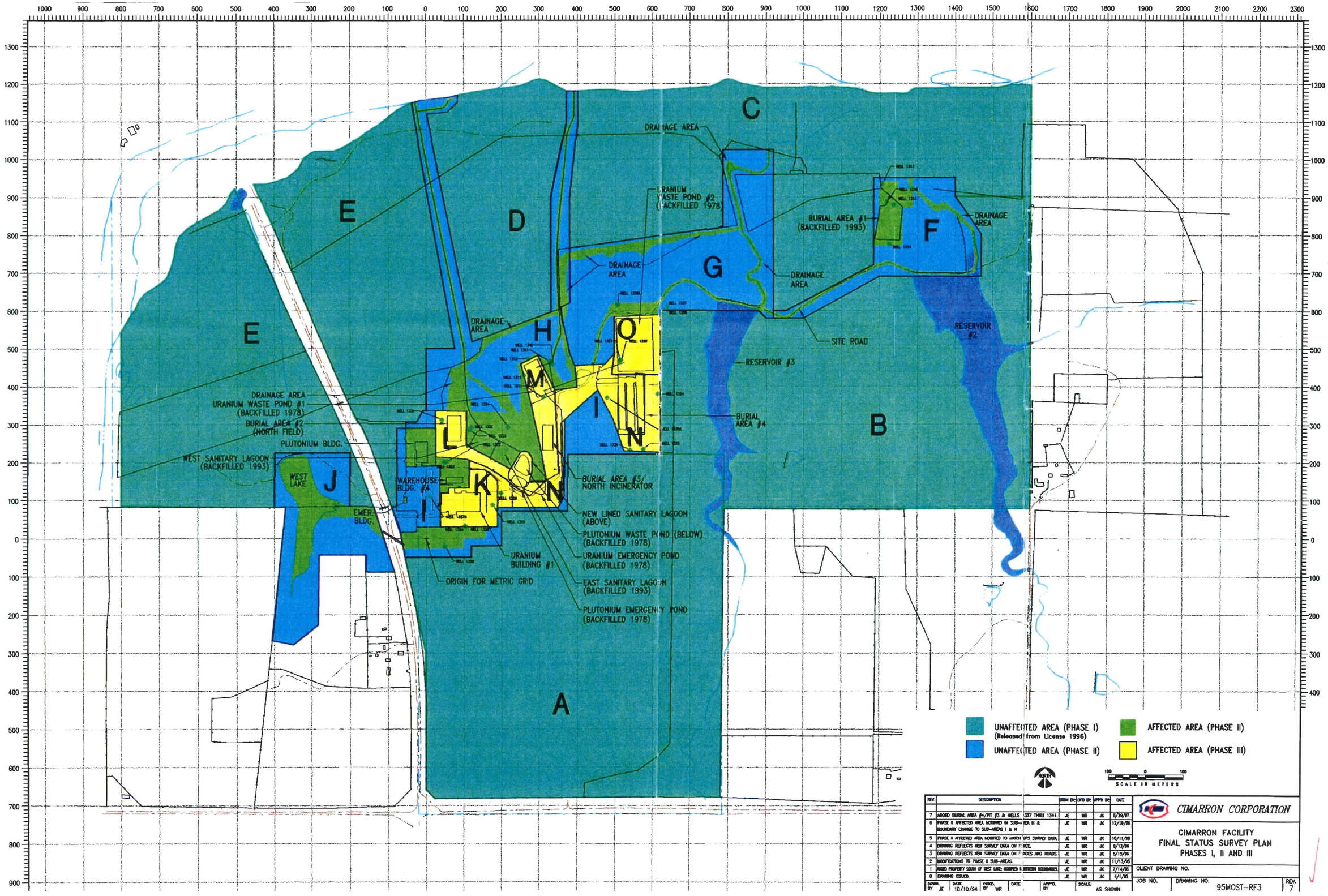
- Instrumentation calibration records are current. Calibration sources are traceable to NIST standards.
- Sampling tracking documentation is complete and records have been filed in the project file.
- Laboratory results have been accurately recorded on laboratory data entry records, and where required, correctly converted to the appropriate units.
- Individuals operating the laboratory equipment are trained under the Cimarron QA program.
- Statistical analysis has been performed in accordance with NUREG/CR-5849 or some other approved method to demonstrate that the data for the survey unit (i.e. group of contiguous grids or regions with the same classification of contamination potential) satisfy the guideline values addressed in Section 6.4.

- Required conversions/calculations have been verified.
- Split samplings (i.e. two identical samples; one sent to an independent laboratory for analysis and the other analyzed on-site) have been performed as required by the applicable Special Work Permit.
- Split sample analysis results have been evaluated and meet acceptance criteria.
- All required signatures and dates are in place.
- Chain of Custody forms are used for all off-site analysis.
- Off-site laboratories have in place a Quality Assurance Program and as part of their program participate in an intercomparison (cross check) program. Participation in the program is to provide an objective measure of the accuracy of the analyses traceable to the National Institute of Science and Technology (NIST).

Any discrepancies discovered during the data validation process described above will be resolved and the disposition will be noted in the affected record(s). The discrepancy disposition may include additional surveys, sampling, sample analysis/re-analysis and/or remediation. All records generated as a result of the data validation process will be retained in accordance with the Cimarron QA Program. The data validation is administered under the direction of the site RSO/Health Physics Supervisor.

10.0 Report

A report (or reports) will be prepared which describes the results of the Phase III Final Status Survey and demonstrates that the Phase III area meets all applicable regulatory requirements for free release. This report will be submitted to the NRC in conjunction with a license amendment request to release the Phase III areas from License SNM-928 and to terminate the License.



REV.	DESCRIPTION	DRAWN BY:	CK'D BY:	APP'D BY:	DATE
7	ADDED BURIAL AREA #4/PIT #3 & WELLS 1337 THRU 1341.	JE	WR	JK	5/29/97
6	PHASE II AFFECTED AREA MODIFIED IN SUB-AREA H & BOUNDARY CHANGE TO SUB-AREAS I & M	JE	WR	JK	12/19/96
5	PHASE II AFFECTED AREA MODIFIED TO MATCH GPS SURVEY DATA.	JE	WR	JK	10/11/96
4	DRAWING REFLECTS NEW SURVEY DATA ON FENCE.	JE	WR	JK	8/13/96
3	DRAWING REFLECTS NEW SURVEY DATA ON FENCES AND ROADS.	JE	WR	JK	5/15/96
2	MODIFICATIONS TO PHASE II SUB-AREAS.	JE	WR	JK	11/13/95
1	ADDED PROPERTY SOUTH OF WEST LAKE; MODIFIED NORTHERN BOUNDARIES.	JE	WR	JK	7/14/95
0	DRAWING ISSUED.	JE	WR	JK	4/1/95

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

CIMARRON CORPORATION

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

CLIENT DRAWING NO.

JOB NO.	DRAWING NO.	REV.
	95MOST-RF3	7

URANIUM WASTE POND #1 (BACKFILLED 1978)
EAST SANITARY LAGOON (BACKFILLED 1993)
WEST SANITARY LAGOON (BACKFILLED 1993)
BURIAL AREA #2 (NORTH FIELD)
WAREHOUSE BUILDING #4
PLUTONIUM BUILDING
WEST LAKE
EMERGENCY BUILDING
URANIUM BUILDING #1
ORIGIN FOR METRIC GRID
URANIUM WASTE POND #2 (BACKFILLED 1978)
BURIAL AREA #1
RESERVOIR #3
RESERVOIR #2
BURIAL AREA #4
NORTH INCINERATOR BURIAL AREA #3
NEW LINED SANITARY LAGOON (ABOVE) (BACKFILLED 1996)
PLUTONIUM WASTE POND (BELOW) (BACKFILLED 1978)
URANIUM EMERGENCY POND (BACKFILLED 1978)
PLUTONIUM EMERGENCY POND (BACKFILLED 1978)
O
M
N
N
L
N
K

NORTH
100 0 100
SCALE IN METERS

REV.	DESCRIPTION	DRWN BY	CK'D BY	APP'D BY	DATE
0	DRAWING ISSUED.	JE	RS	JK	5/29/97

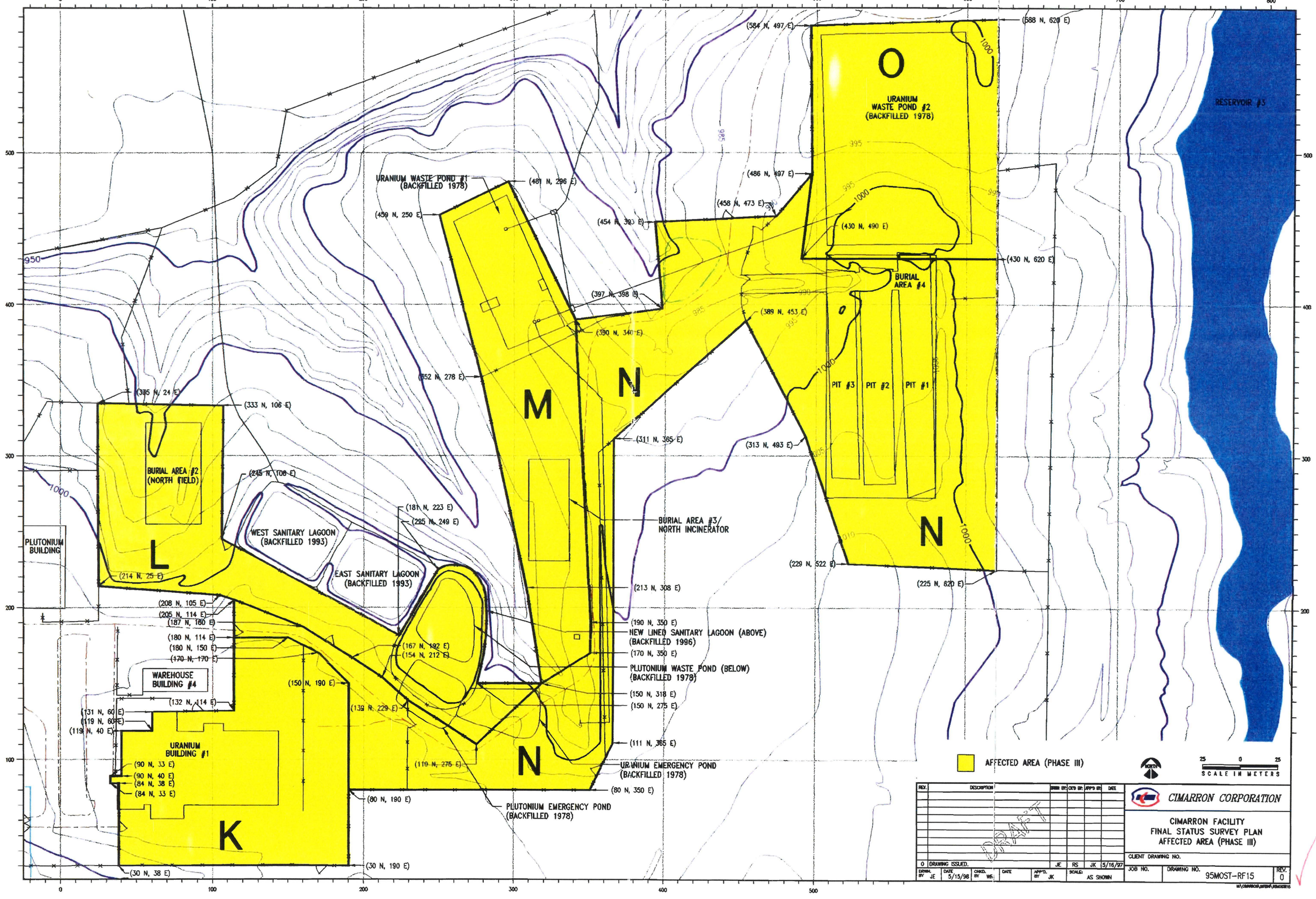
DRWN BY JF | DATE 4/15/96 | CHKD. BY WL | DATE | APP'D. BY | SCALE: AS SHOWN

CIMARRON CORPORATION

CIMARRON FACILITY
LOCATION OF PHASE III
AFFECTED AREAS

CLIENT DRAWING NO.

JOB NO. | DRAWING NO. 95MOST-RF14 | REV. 0


O
URANIUM
WASTE POND #2
(BACKFILLED 1978)
(584 N, 497 E)
(588 N, 620 E)
(486 N, 497 E)
(458 N, 473 E)
(454 N, 393 E)
(430 N, 490 E)
(430 N, 620 E)
URANIUM WASTE POND #1
(BACKFILLED 1978)
(481 N, 296 E)
(459 N, 250 E)
BURIAL
AREA #4
(397 N, 398 E)
(389 N, 453 E)
(390 N, 340 E)
(352 N, 278 E)
M
N
PIT #3
PIT #2
PIT #1
(335 N, 24 E)
(333 N, 106 E)
(311 N, 365 E)
(313 N, 493 E)
BURIAL AREA #2
(NORTH FIELD)
(245 N, 106 E)
(181 N, 223 E)
(295 N, 249 E)
BURIAL AREA #3/
NORTH INCINERATOR
RESERVOIR #3
PLUTONIUM
BUILDING
L
WEST SANITARY LAGOON
(BACKFILLED 1993)
EAST SANITARY LAGOON
(BACKFILLED 1993)
(214 N, 25 E)
(229 N, 522 E)
(225 N, 820 E)
(213 N, 308 E)
(208 N, 105 E)
(205 N, 114 E)
(187 N, 180 E)
(180 N, 114 E)
(180 N, 150 E)
(170 N, 170 E)
(190 N, 350 E)
NEW LINED SANITARY LAGOON (ABOVE)
(BACKFILLED 1996)
(167 N, 192 E)
(154 N, 212 E)
(170 N, 350 E)
PLUTONIUM WASTE POND (BELOW)
(BACKFILLED 1978)
WAREHOUSE
BUILDING #4
(150 N, 190 E)
(132 N, 114 E)
(150 N, 318 E)
(150 N, 275 E)
(139 N, 229 E)
(131 N, 60 E)
(119 N, 60 E)
(119 N, 40 E)
(111 N, 365 E)
URANIUM
BUILDING #1
(90 N, 33 E)
(90 N, 40 E)
(84 N, 38 E)
(84 N, 33 E)
(110 N, 275 E)
N
URANIUM EMERGENCY POND
(BACKFILLED 1978)
(80 N, 350 E)
(80 N, 190 E)
PLUTONIUM EMERGENCY POND
(BACKFILLED 1978)
K
(30 N, 190 E)
(30 N, 38 E)
AFFECTED AREA (PHASE III)
NORTH
25 0 25
SCALE IN METERS
DRAFT
CIMARRON CORPORATION
CIMARRON FACILITY
FINAL STATUS SURVEY PLAN
AFFECTED AREA (PHASE III)
CLIENT DRAWING NO.
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DRAWING NO. 95MOST-RF15
REV. 0
0 DRAWING ISSUED. JE RS JK 5/16/97
DRAWN BY JE DATE 5/15/98
CHKD. BY WR DATE
APP'D. BY JK
SCALED AS SHOWN