COTTER CANON CITY URANIUM MILL
1988 REMEDIAL ACTION PLAN
SUMMARY AND STATUS – AUGUST 2005

INTRODUCTION

The Colorado Department of Public Health and Environment (CDPHE) has received comments from interested citizens who have found it difficult to piece together information regarding the 1988 Remedial Action Plan (RAP) for the Cotter Canon City Uranium Mill. This document is intended to summarize the requirements of the RAP, and the status of Cotter's performance compared to these requirements.

The RAP was a document written for the purposes of settling state claims against Cotter under the Natural Resource Damage provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund). The legal parameters of that settlement are included in a document called the Consent Decree. The environmental characterization and cleanup actions that were required are contained in the RAP. The RAP focused on three major areas:

- eliminating exposure of residents to contaminants from the site,
- eliminating or controlling sources of contamination, and
- obtaining additional data to determine the nature and extent of contamination, and help determine any additional cleanup actions that might need to be taken.

The RAP reflected what the state felt needed to be accomplished at that time. Many RAP activities have been completed or constructed and are currently in operation and maintenance.

It should be noted that the requirements of the RAP are not necessarily all that will be required for final cleanup of the site. The Environmental Protection Agency (EPA) may require additional investigation and cleanup under Superfund, and CDPHE may require additional investigation and cleanup as part of decommissioning under the Radioactive Materials License.

The RAP is comprised of 32 sections, each dealing with a particular issue. This report is organized to follow that structure. It discusses the purpose of each section, the specific requirements of that section, and the status of activities required.

RAP Section 1 – Introduction

This section of the RAP provides a summary of the site history and operations. There are no requirements associated with this section.

STATUS: Not applicable.

FUTURE ACTIVITIES: None.

RAP Section 2 – Regional Setting and Site Features

This Section of the RAP describes the site geology, hydrology, vegetation and climate. There are no requirements associated with this section.

STATUS: Not applicable.

FUTURE ACTIVITIES: None.

RAP Section - 3.0 Scope of the Remedial Action Plan

This section of the RAP acts in part as an introduction to the various technical requirements of the document. In addition, there are several specific requirements related to sampling and reporting, as listed below.

3.1.1 Annual Report

Cotter is required to submit an Annual Report to the state by June 30 of each year. The report is to discuss the activities of the previous calendar year that were performed in compliance with the RAP. Specifically, this report is to include:

Operation of the groundwater withdrawal wells at the impoundments (Section 4.3)
Operation of the secondary impoundment (Section 5.3)
Operation of the water distribution pond (Section 6.3)
Acidity (pH) adjustment in the Main Impoundment (Section 7.3)
Operation of the Old Tailings Pond flushing system (Section 8.3)
Operation of the SCS Dam groundwater pump back system (Section 9.3)
Summary of the NE/NW Pathway investigations (Section 10.3)
Monitoring results report of the Wolf Park Mine Shaft (Section 11.4.7)
Operations of the SCS Dam to DeWeese Dye Ditch flush (Section 12.3)
Summary on the replacement of ground water supplies regarding the Lincoln Park Water Use Survey (Section 13.3)
Groundwater compliance well monitoring (Section 14.3)
Groundwater monitoring results (Section 15.3)

Control of wind dispersed particulates at the Main Impoundment (Section 16.3)
Control of wind dispersed particulates at the Old Tailings Ponds Area (Section 17.3)
Control of wind dispersed particulates at the ore stockpiles and ore handling areas (Section 18.3)
Control of wind dispersed particulates at the Yellowcake Dryer (Section 20.3)
Control of wind dispersed particulates from On-site Soils (Section 21.3)
Control of wind dispersed particulates from roads (Section 22.3)
Maintenance of fences to prevent grazing on Site Adjacent Soils (Section 24.3)
Activities summary for operations and maintenance of silt fences (Section 29.3)
Summary of the monitoring program for the Arkansas River (Section 30.3)

STATUS: Cotter has submitted all annual reports as required by the RAP. The Annual Report for 2004 was submitted July 14, 2005.

FUTURE ACTIVITIES**:** Cotter is to continue producing these reports annually.

This report has been consolidated with the Environmental and Occupational Performance Report and ALARA Review required by the license. In order to address citizen complaints, future reports will include the words "Remedial Action Plan" in the title, so that the report can be more easily found in a records search. 

3.1.2 Liquid Disposal Capacity

This section states that Cotter cannot claim that it cannot perform any requirement of the RAP due to a lack of liquid storage or treatment capacity.

STATUS: Cotter has not asked to be excused from any RAP requirement due to a lack of liquid storage or treatment capacity.

FUTURE ACTIVITIES: This requirement remains in effect.

3.1.3 Surface Water Releases

This section prohibits the release of any waters generated by remedial activities to the surface water system, unless such release is specifically approved by CDPHE and complies with all applicable laws and regulations.

STATUS: Cotter has not released any water to the surface water system. The facility operates as a non-discharge facility, with all remediation water being pumped to the impoundments for evaporation or recycling.

FUTURE ACTIVITIES: This requirement remains in effect.

3.2.1 Well Design

This section specifies the well designs that must be used for various types of wells on the site.

STATUS: All wells constructed pursuant to the RAP have met the specified criteria.

FUTURE ACTIVITIES: All future wells will be constructed according to specified criteria.

3.2.2 Quality Assurance / Quality Control (QA/QC)

This section requires Cotter to submit quality control plans to the state for certain remedial activities. It also outlines the requirements for these plans.

STATUS: Cotter has submitted all required QA/QC plans. The QA/QC program is discussed in the Annual Report.

FUTURE ACTIVITIES: Submit or revise QA/QC plans as necessary.

3.2.3 Soils and Sediment Analysis

This section specifies how soil samples will be analyzed.

STATUS: All soil samples analyzed pursuant to the RAP have met the specified criteria.

FUTURE ACTIVITIES: Any future soil sampling will follow prescribed protocols.

3.2.4 through 3.2.6 Background Data Set for Soils and Sediments

This section requires Cotter to perform a study to evaluate the background levels of certain elements in soils and sediments. The study was to measure uranium, molybdenum, radium and thorium. Specific design elements of the study were included, and a schedule for the final report was set.

STATUS: Cotter performed the study as required and submitted the report to CDPHE on September 11, 1989. Additional sampling was also performed. The background levels that were established as a result of that study and additional testing were:

TARGET ELEMENT	BACKGROUND MEAN	UPPER CONFIDENCE LIMIT
Uranium-soils, (ug/g)	2.1	2.9
Uranium-sediment, (ug/g)	2.0	3.4
Molybdenum-soils, (ug/g)	2.4	4.6
Molybdenum-sediment, (ug/g)	2.3	4.7
Radium-226-soils, pCi/g	1.3	1.9
Radium-226, sediment, pCi/g	1.1	1.7

Thorium 230-soils, (pCi/g)	1.8	3.2
Thorium-230-sediment, (pCi/g)	1.5	3.1
Gamma scintillometer - soils (µR/hr)	14.6	18.6
Waist level - unshielded		
Delta shielded – soils, (cpm)	2472.0	3208.0
Gamma scintillometer – sediment (µR/hr)	15.2	20.0
Waist level unshielded		
Delta shielded – sediments (cpm)	2406.0	3520.0

FUTURE ACTIVITIES: None.

3.2.7 Steady State

This section required Cotter to analyze existing ground water data at the Lincoln Park compliance wells and sediment data from the silt fences in the adjacent drainage to determine whether uranium, molybdenum, radium and thorium were in steady state (e.g. neither increasing or decreasing). By utilizing statistical tools described in the RAP, concentrations are looked at over time. If it can be determined that no significant trends are occurring, then a steady state condition exists or has been achieved for that particular target element at that sampling location. If certain statistical conditions are met at the Lincoln Park Compliance Wells, then testing can be done to remove the hydrologic barrier at the SCS Dam (RAP Section 14.1.4.2). Also, if statistical data show that the silt fence sediments are in a steady state, the fences may be removed (RAP Section 29.2).

STATUS: Cotter continues to monitor water quality at the Lincoln Park compliance wells. The test of statistically meeting the groundwater cleanup goals has not been conducted because compliance objectives have not yet been met and trending has not suggested a steady state condition. The data indicate that contamination in the plume is decreasing over time, due to cleanup of contaminant sources on the mill site.

FUTURE ACTIVITIES**:** Continue to review data.

RAP Section 4.0 Main and Secondary Impoundments

Note: Back in 1988, what is now known as the Primary Impoundment was called the Main Impoundment. The term Main impoundment is used in this document, as it reports on the 1988 RAP and uses the terminology from the RAP.

In the 1988 Remedial Investigation report prepared by the state, there were questions regarding whether the impoundments were leaking. Water quality data in the liner sub drain, groundwater levels in the vicinity of the impoundments, and information regarding rock contacting the hypalon liner during construction lead to the possible conclusion that the impoundments could be leaking. The purpose of this section was to collect leakage, if any, from the main and secondary

impoundments, and to intercept, to the maximum extent reasonably achievable, ground water moving from the old tailings ponds area to the area beneath the new impoundments. Several specific actions were required.

4.2 through 4.4 Remedial Activities

Cotter was required to design, construct, and operate a groundwater withdrawal system along the toe of the impoundment embankments, using a series of wells. Cotter was also required to design and install a piezometer system to evaluate the performance of the withdrawal system. Data from the piezometers needed to show that a groundwater gradient towards the extraction wells was being maintained. Schedules were established for the submittal of design proposals.

The withdrawal wells must be operated until flushing of the Old Tailings Pond Areas is completed, free liquid in the Primary Impoundment has been removed, and closure of the Secondary Impoundment has begun. Cotter can petition the state to cease operation of any specific well if that well is dry for 5 consecutive calendar quarters.

STATUS: To investigate whether the impoundments were leaking, Cotter drilled several wells at the toe of the impoundment in 1989, in compliance with the plan that had been approved by CDPHE. These wells did not produce water in quantities that would allow the operation of the withdrawal system contemplated in Section 4 of the RAP. The system was modified from the original RAP requirements because of this lack of water. It was agreed to install a ground water injection/withdrawal system perpendicular to the flow of water near the toe of the impoundment dam. In order to achieve this, a line of three injection wells was constructed with withdrawal wells placed up gradient from the injection wells. Cotter constructed the well system and placed it in operation on September 9, 1989. This system was later tied into the 9/16 hydraulic barrier system to form a continuous injection and withdrawal system perpendicular to the direction of ground water flow. This system was shut down at the same time as the 9/16-barrier system (see RAP Section 8.0), because:

- it was not able to withdraw sufficient water
- gradient reversal was limited
- more water was injected than was withdrawn
- the system had little or no discernable effect on groundwater conditions

FUTURE ACTIVITIES: Cotter continues to monitor for leakage of the impoundment as discussed in RAP Section 7. These monitoring requirements have been enhanced in the 2004 license renewal.

RAP Section 5.0 Secondary Impoundment

The RAP required Cotter to operate the Secondary Impoundment as a means to manage the accumulation of liquid on the mill site; to reduce, to the extent feasible, the hydraulic head in the Main Impoundment; and, in conjunction with the other ground water remedial activities, to achieve the ground water quality objectives stated in RAP Section 14. An evaporation pond was

to be constructed within the secondary impoundment. The operation of the Secondary Impoundment in this manner was also designed to minimize windblown dust from this source. Cotter is required to keep a minimum of one foot of water on the secondary impoundment to control dust emissions.

STATUS: Cotter completed construction of the Secondary Impoundment November 1988 and flooded the Secondary Impoundment by the spring of 1989. Currently, the impoundment is in an operations and maintenance mode, where Cotter must maintain the minimum one-foot of water cover.

Historically, Cotter has done a good job at maintaining the required one-foot of water cover. However, on an inspection in 2002 during the drought, it was observed that the water level was below one foot. Cotter was told to raise the water level in the impoundment, which they did. During an inspection in 2003, it was observed that there was an island in the southeast corner of the impoundment. An investigation showed that the island consisted of crystals and not tailings. These crystalline materials were several feet thick and were not subject to particulate dispersion. Cotter has since installed a drip water feed system in the area, which appears to help prevent the formation of crystals.

FUTURE ACTIVITIES: Cotter is to maintain liquids in the Secondary Impoundment. In the current license renewal discussions, the possibility of closing the Secondary Impoundment is being considered.

P Section 6.0 Water Distribution Pond

Cotter was required to construct a surge pond in the area of Old Tailings Pond 7 to provide surge capacity for pump back water from the SCS hydrologic barrier; withdrawal wells; and/or the flushing extraction wells prior to distribution to the mill process, main impoundment, secondary impoundment, or reuse in remedial activities on site pursuant to appropriate restrictions.

STATUS: The Water Distribution Pond was completed in November 1988. The pond has been in operation since its completion.

In June of 2003, several large bubbles (more than 4 feet in diameter**)** were observed in the water distribution pond and reported to the state. Cotter performed an investigation and submitted a report on June 10, 2004. The report concluded that city water had been added to the water distribution pond by allowing it to cascade down the slope from a four-inch PVC pipe into the pond. The water traveled across a hole in the liner above the normal water line of the pond. The water displaced air in the compacted clay liner and forced it to accumulate under the synthetic liner near the center of the pond. As the clay liner became saturated, the displaced air created the air pockets that lifted the liner to the surface. The Division reviewed the report and the explanation for the bubbles was reasonable.

The presence of the air pockets under the liner and the absence of air bubbling to the surface indicated that the Hypalon liner was intact below the water line. Further investigation indicated

that the 24-inch clay liner was wet about 8 to 10 inches below the synthetic liner. Cotter repaired the liner and submitted a report on August 3, 2004.

FUTURE ACTIVITIES: Cotter will continue to use the system for water distribution and report on pond operation in the Annual Report.

RAP Section 7.0 Neutralization of the Primary Impoundment

The 1988 Remedial Investigation report raised questions regarding whether low pH (high acidity) in the Main Impoundment could impact the clay liner. It was stated that depending on the chemical processes that were dominant, the liner could become either more or less permeable. In addition, a design report by Wahler and Associates in 1979 recommended that the pH of liquids in the impoundment be maintained at 4.2 or higher**.** By adjusting tailings solutions into the pH 4 range, precipitation of secondary minerals will occur. These secondary minerals are insoluble in water and will plug seepage pathways, thus filling pores of tailings and soils making them more impermeable. Also, by these chemicals precipitating out of the liquids, the liquids contain fewer contaminants. Therefore, under this section Cotter was required to evaluate impacts, if any, of the acid impoundment tailings upon the clay liner, and to evaluate the technical feasibility of neutralization of the main impoundment. If the initial study showed that the liner could be adversely impacted by high acidity, Cotter was to design a strategy to minimize this impact. Schedules were prescribed for the submittal of these studies and plans.

STATUS: Evaluation of the effect of acid tailings on the clay liner was done on column tests in the laboratory. Results indicated that there was a potential for leakage, especially if the solution head on the clay sub liner was increased to 75 feet. The historical data as well as the column test work suggested that under a nominal solution head of less than 20 feet, the clay sub liner would continue as an effective geotechnical and geochemical barrier to seepage. However, because of concerns of possible leakage of liquids from the impoundments, it was agreed to modify operation of liquids in the impoundment, raise the pH of the liquid in the impoundment, and to implement a monitoring program to detect leakage from the impoundment.

Based on the above information it was decided to increase the pH in the impoundment to greater than 4.0. This partial neutralization of the freestanding pond fluids would:

1. Eliminate most of the free-acid and dissolved iron concentrations in the tailings solution;
2. Diminish the acid strength of the tailings solution stored in the impoundment;
3. Result in the precipitation of secondary minerals such as jarosite, that in effect would create another low-permeability zone above the tailings solids, earth cover, and Hypalon liner, and
4. Effect the precipitation of heavy metals, thereby rendering them immobile to transport along with tailings seepage.

It was agreed to keep the solution pool elevation below a tracking elevation of 5580 feet. This tracking level was based on the Primary Impoundment solution level that existed when alkaline process mill tailings discharge commenced in 1999. Solution levels have remained below the required elevation, and the average pH has remained above 4.0.

In addition, a water-monitoring plan was implemented to detect if liquids had permeated through the liner. This monitoring was incorporated into the license as RHS Procedure 3-10, *Impoundment Liner Breakthrough and Corrective Action*, during the 1995 license renewal. Since 1996 Cotter has been monitoring groundwater at locations up gradient and down gradient to determine if there has been any leakage from the Main Impoundment and also from sub drains under the liner. The locations used in the monitoring effort are 710, 711, 712, 325, 001, and 003. The basis of evaluation of the impoundment liner breakthrough is the Piper diagram. The Piper diagram characterizes water types by plotting major ion chemistry (using what is called a trilinear plot). Finding water in the wells and sub drains that have chemistry similar to that of the water in the impoundment would identify evidence of seepage from the main impoundment. It was determined through laboratory tests that magnesium would be a good chemical tracer to determine if the impoundments were leaking. A review of data submitted to date Annual Report shows that there are no magnesium shifts in Piper diagrams or major increases in magnesium content in the ground water, which indicates that the Main Impoundment is not leaking.

FUTURE ACTIVITIES: Cotter will continue to maintain the pH in the impoundments above 4.0, and monitor for liner breakthrough as required. These results will be reported in the Annual Report. Monitoring of the impoundments may change significantly as a result of the 2004 license renewal.

RAP Section 8.0 Old Tailings Ponds Area

Data from the remedial investigation indicated that the Old Tailings Ponds Area (OTPA) remained as a significant source of contamination, despite the removal of the old tailings. This section was designed to address residual soil and groundwater contamination in order to minimize the OTPA as a source of ground water impact. Several specific actions were required, as described below.

(1) Cotter was required to remove two feet of soil from the areas of old ponds 1,2 and 6. Cotter is required to remove an additional 6 feet of soil from the entire OTPA at the time of mill closure and decommissioning.

(2) Cotter was required to design a soil flushing system, and to test that system on a pilot scale. The pilot was to include groundwater flow modeling to help understand groundwater flow on site and maximize full-scale design effectiveness. Construction of a production scale system based on the pilot results was also required. This system was required to meet groundwater goals within 16 years.

(3) A hydraulic barrier utilizing injection wells was to be constructed along the common boundary of Sections 9 and 16 (9/16 Barrier). This barrier was designed to maintain a ground

water hydraulic gradient for flow from this barrier back to the Old Tailings Ponds Area. Piezometers were to be used to demonstrate the performance of the barrier.

STATUS: Removal of the two feet of soil as required by the RAP was completed in November 1988. The contaminated soil was placed in the Main Impoundment. In 1999 and 2000 an additional 87,600 cubic yards of soils were removed from two sites of the OTPA, which were considered to be the areas of highest residual soil contamination, based on low density soil borings (approximately 1 boring per acre) conducted to determine depth and width of contamination in the OTPA. These soils were used to construct the 20-acre evaporation ponds within the Primary Impoundment.

FUTURE ACTIVITIES: RAP Section 8.2.3.a states "An additional six (6) feet of soil shall be removed from the entire Old Tailings Ponds area at the time of mill closure and used as the lower strata of the tailings cover in conjunction with final reclamation of the main impoundment". This excavation depth may be modified on the basis of OTPA Feasibility Study findings. The Feasibility Study is undergoing Department review at this time (see below).

STATUS: Three pilot flushing systems were constructed and operated between 1990 and 1992. The final report was submitted on February 24, 1993. In summary, Cotter proposed to utilize the methodology of the third flushing system, which injects water under pressure into wells and recovers the water in trenches. The state determined this method to be unacceptable, because it did not meet the RAP requirement that " The amount of water injected should be less than the amount of water removed."

As part of the February 24, 1993, report mentioned above, a ground water model was also included. This model was also not accepted by the state. In dispute resolution it was decided that the United States Geological Survey (USGS) should perform independent modeling. In 1999, the USGS completed a Water Resources Investigations Report 98-4229 titled *Ground-Water Hydrology and Simulation of Five Remediation Alternatives For An Area Affected by Uranium-Mill Effluent Near Canon City, Colorado.* Digital groundwater flow and solute – transport models were developed to comparatively evaluate five remediation alternatives that have been proposed for the study area. A three-dimensional finite-difference model was developed to simulate flow in the ground-water system. A two-dimensional finite-element model representing the uppermost 100 feet of the ground-water system was developed to simulate the transport of uranium and molybdenum in the ground water system. This report presented a quantitative description of the ground-water bedrock of the mill facility and the Lincoln Park area. Based on the predicted concentrations for a simulation period of 50 years, the predicted effects of the five simulated (1993) remedial alternatives included short-term increases in concentrations and negligible to substantial long-term decreases in concentrations of dissolved uranium and molybdenum. This was further evidence that soil flushing was not feasible.

The State and Cotter proceeded with informal dispute resolution on the issue. This process led to an agreement to try an innovative technology called flush/fixation. Bench scale laboratory tests were conducted, field pilot studies were completed and a ten-acre field implementation project was constructed. City water was added in December 1996 for an initial flush. A

chemical fixant (calcium polysulfide) was added on June 3, 1997. The area was extensively monitored. Addition of liquid ceased in September 1998, but monitoring continued. On March 5, 1999, Cotter submitted an *Operations Addendum Report on the 10-acre Operable Unit.* The report concluded, "Using surface-cell infiltration to deliver reductant-treated solution to contaminated groundwater was demonstrated to be ineffective. For this reason, any expansion of the current treatment system into new areas of the Old Ponds Area is not recommended."

In conjunction with the current license renewal, Cotter submitted a *Feasibility Study for the Old Ponds Area* on September 9, 2004. This included six alternatives for remediation of the Old Ponds Area.

FUTURE ACTIVITIES: The Feasibility Study has been made available to the public and is being evaluated by CDPHE. Future activities in the OTPA will be based on the final outcome of that review.

STATUS: The 9/16 hydraulic barrier was to be constructed in conjunction with the Old Tailings Ponds Area (OTPA) flush system in order to intercept ground water from the flushing operation. The barrier was constructed with Cotter anticipating construction of the OTPA flush and placed it in operation on October 1, 1990. The system was modified from the original RAP proposed design because of site geology, hydrology and topography. In order to achieve a reverse gradient ground water flow back towards the OTPA, a line of injection wells were constructed with withdrawal wells placed up gradient from the injection wells. In a few locations, a reverse gradient was unachievable, even with the addition of more and deeper wells. In general, much more water was being injected than was withdrawn, when the requirement was to withdraw more than was injected. In December 1999, the representatives from Cotter, the Colorado Geological Survey, and the EPA agreed that the 9/16 barrier served no useful function since it did not operate as intended and was not very efficient. It was stated that the SCS barrier was intended to capture the contaminants moving in the shallow ground water and cessation of the 9/16 barrier would not effect the SCS operation. CDPHE agreed to shut off the withdrawal wells, but wanted to keep the injection wells working. It was agreed to keep injecting water for another 6 months. Operating the injection wells during this period had no impact on down gradient ground quality as observed in groundwater monitoring well locations. The system was shut off in 2000.

FUTURE ACTIVITIES: None.

RAP Section 9.0 Hydrologic Barrier

The Soil **C**onservation Service Dam, constructed in 1971, effectively stopped the flow of surface water and sediments off of the mill site. However, the shallow groundwater pathway that also followed Sand Creek was not addressed. This section required Cotter to construct a clay barrier / groundwater cutoff wall, to stop the flow of contaminated groundwater into Lincoln Park. The barrier system was to also include groundwater extraction upstream of the barrier, with the extracted groundwater pumped to the Secondary Impoundment or the water distribution pond. A specific water level was to be maintained via pumping.

STATUS: The clay barrier and pump back system were constructed and placed in operation in November 1988. The amount of water recovered varies with annual precipitation. In 2002, 2.9 million gallons of water was recovered. In 2001 the quantity was 15.7 million gallons. It is estimated that the barrier is effective in stopping approximately 90 percent of the shallow groundwater from entering Lincoln Park (estimated at approximately 30 gallons per minute). In 2001 another control structure (a Permeable Reactive Treatment Wall) was constructed down gradient of the SCS dam to treat any water passing the SCS barrier. Water entering this structure is currently being captured and returned to the site through the SCS barrier pump back system. An investigation is ongoing to determine whether the operational problems with the Reactive Treatment Wall can be mitigated (chemical reactions have caused plugging of the wall, so that it impounds water rather than treating it – see Section 12 below).

FUTURE ACTIVITIES: Continue system operation

RAP Section 10.0 Northeast / Northwest Shallow Groundwater Pathways

Based on an examination of hydrologic and geologic data, the 1988 Remedial Investigation speculated that there might be additional groundwater pathways other than the Sand Creek alluvial channel. The purpose of this section was to determine whether either or both of these pathways of shallow ground water flow to the northwest and northeast exist, and to mitigate these pathways as routes of shallow ground water flow if necessary. Cotter was required to develop a monitoring plan to determine whether these pathways existed.

STATUS: Required monitoring wells and piezometers were constructed by September 17,1990. These are monitored as required by RAP Section 15. A written annual summary is included with the annual report. Review of wells classified as the NE/NW pathway wells indicates that a hydrologic divide exists to the northwest and northeast of the Old Pond area. The existence of ground water divides on both sides of Sand Creek means that most of the shallow ground water from the Cotter Mill is moving down the Sand Creek drainage. This RAP section calls for the determination of the concentrations of dissolved molybdenum at locations 009, 014, 016, and 017 and the statistical analysis of that data. Molybdenum is a key indicator of ground water contamination from the mill area. After collecting 12 years of groundwater quality data at these locations a determination was made that the concentration of molybdenum at these locations was below the detection limit of 0.005 mg/l. Based on this data, monitoring of groundwater quality at these locations was discontinued in 2000.

FUTURE ACTIVITIES: None.

RAP Section 11.0 - Wolf Park Mine Shaft

The 1998 Remedial Investigation could not come to a conclusion regarding whether the Wolf Park Mine was a conduit for contaminated groundwater to reach deeper aquifers. There had been measurements in the shaft that showed some contamination, however, data from a well completed in the workings did not show contamination. Historically, the mine was known to "make water" from overlying strata, indicating a possible pathway. The purpose of this section was to further investigate the Wolf Park mineshaft as a pathway of flow to deep ground water. Cotter was required to drill a new well within 25 feet of the shaft (which had been backfilled by this time) and monitor monthly for a year. The well was to have a sampling interval between one hundred and forty (140) feet and one hundred and seventy (170) feet below the ground surface. This screen interval was selected because the water level previously reported in the shaft was 150 feet below the ground surface and Well 339, which had been completed into the mine shaft, to a depth of 1158 feet had a water elevation of 135 feet below the ground surface. If well data exceeded background, Cotter was required to construct a concrete grout plug in the shaft.

STATUS: Monitoring well 018 was constructed as required in August 1990. The well was screened in a low permeability zone and flow of water into the well is minimal (less than 0.5 ft per year. The well has not been properly developed because of the limited entry of water and was never sampled.

Backfilling operations at the Wolf Park Mine Shaft began on May 25, 1978 and were completed on August 11, 1978. Approximately 8,450 tons of crushed rock and sandy gravel were used to backfill the mineshaft. A bentonite layer was placed on top of the sandy gravel and 55 feet of sandy gravel mixed with 20% bentonite by weight was placed above the bentonite. This was later capped with clay soil and gravel to the surface.

The United States Geological Survey in Water Resources Investigations Report 98-4228 titled "Migration and Geochemical Evolution of Ground Water Affected by Uranium-Mill Effluent Near Canon City, Colorado" indicated that the deep migration path through the coal mines was unlikely. This is because reducing conditions from the presence of pyrite and coal would not be conducive to transport of either dissolved uranium or dissolved molybdenum. In addition, interbedded shales in the Poison Canon Formation would limit downward flow of water through that formation. This conclusion is supported by historical water quality data from several clustered wells that are down gradient from the Old Tailings Ponds and are screened a varying depths. The inability of Well 018 to make water also is an indication that a relatively impervious layer underlies the old tailings ponds area.

FUTURE ACTIVITIES: CDPHE has had two additional groundwater specialists review the historic record regarding this issue. They agree with the USGS that reducing conditions in the mine would inhibit contaminant movement into deeper aquifers. No further investigation is contemplated at this time.

RAP Section 12.0 SCS Dam to the DeWeese Dye Ditch

The purpose of this section was to flush groundwater in the Sand Creek Channel between the SCS Dam and the DeWeese Dye Ditch, in order to accelerate groundwater cleanup in that area. Cotter was required to inject clean water into the ground down gradient of the SCS Dam. The system was to be operated at a flow rate of not more than 100 gallons per minute, and only seasonally during periods when the ditch was flowing. The system was to operate until either the groundwater goals in Lincoln Park were met, or the SCS dam barrier was decommissioned. There is also a separate requirement for Cotter to test whether groundwater goals can be met following decommissioning of the SCS dam barrier, by injecting upgradient water below the dam (prior to decommissioning the barrier).

STATUS: The flushing system was constructed and placed in operation in March 1990. It was operated seasonally while the DeWeese Dye Ditch was flowing. Approximately 30 gpm of water was injected. This flushing caused some well concentrations in Lincoln Park to increase, as more highly contaminated water near the SCS dam was flushed out. Although this was not unexpected, citizen's concerns over this issue caused the flushing to be stopped in 1996.

In March 1999, the USGS submitted a report called *Migration and Geochemical Evolution of Ground water Affected by Uranium-Mill Effluent Near Canon City, Colorado.* The report indicated that ground water was moving through the surface alluvium down gradient of the SCS dam. In June Cotter excavated a trench in the area of the previous dam-to-ditch flush and confirmed the location of the shallow groundwater flow path. Alternatives to address this flow were investigated, and Cotter agreed to install a permeable reactive treatment wall (PRTW) system to treat the one to three gpm encountered below the dam. This PRTW is a passive remediation system that chemically reduces concentrations of contaminants as they pass through a reactive material.

After review and comments from CDPHE, the Colorado Geological Survey, and EPA, Cotter completed construction of the PRTW in June 2000. The PRTW was installed north of the SCS dam in the area of the Dam-to-DeWeese Dye Ditch flush. This PRTW was comprised of a Zero Valent Iron (ZVI) gate with ground water funneled to pass through the gate for removal of natural uranium and molybdenum. Initially, the system reduced concentrations of the uranium in the ground water by approximately 95 % and for molybdenum by approximately 50%. However, in late 2002 it was observed that the efficiency of reduction was decreasing. In 2003, it was observed that the water level in the upgradient sand was increasing, while the water level in the ZVI and downgradient sand was not changing. This indicated clogging of the PRTW and provided a possible explanation of the observed decreasing efficiency of the system.

In January 2004, Cotter performed a pump test to evaluate the ground water conditions in the PRTW and the adjacent area. Indications were that very little groundwater was passing through the gate. There was concern that the buildup of ground water behind the gate would eventually overtop the system. In February 2004, Cotter started to pump ground water from the upstream sand of the gate over the SCS dam to a sump, where water is then pumped to the Main Impoundment. In October 2004 Cotter excavated portions of the wall, and verified cementation (clogging) of the zero valent iron.

FUTURE ACTIVITIES: Cotter, CDPHE and EPA continue to evaluate the results of the pump test, and possible ways to restore the permeability of the wall. Cotter will continue to pump the water accumulating at the wall back to the impoundments to insure that no contaminated groundwater enters Lincoln Park. This pumping will continue for the foreseeable future.

RAP Section 13.0 - Lincoln Park Water Use

The purpose of this section is to determine the extent of ground water use by Lincoln Park residents, to connect any unconnected drinking water users in the Lincoln Park water use survey area to the Canon City water supply, to develop guidelines for the use of the ground water for irrigation and stock watering and, as appropriate, to protect agricultural ground water uses. Cotter was required to perform water use survey, and to arrange for the connection of well users to the city water supply.

STATUS**:** The Lincoln Park water use survey and water hook-ups were completed by September 1990. In addition, Cotter has continuing obligations to connect (new) properties that meet certain criteria, as specified in the RAP. There have been occasions involving either new development or change in ownership on properties that originally refused hookups, where Cotter's responsibilities under the RAP have gone to dispute resolution.

Cotter continues to review the State Engineer's office records semi-annually to determine if any new well permits have been issued in the area of Lincoln Park. This information is reported to CDPHE. The results of the water use survey have been discussed at the numerous public meetings that have been held in the Lincoln Park area over the past 16 years.

The human health and ecological risk assessments performed for the site indicated the agricultural use of the water did not pose a significant risk.

FUTURE ACTIVITIES: Cotter will continue to hook up newly developed properties that meet the criteria specified in the RAP.

RAP Section 14.0 - Ground Water Compliance

This section describes how attainment of the ground water quality objectives will be determined, and how alternate concentration limits (ACL's) will be established. The ground water quality objectives in the RAP focused on compliance wells in Lincoln Park. Section 14.1.5 also requires the compliance wells to meet standards for other chemicals as set forth in 40 CFR 192 Part D. The goals were set at 0.035 mg/liter for uranium and 0.1 mg/liter for molybdenum. Cotter cannot attempt to demonstrate compliance until the Old Tailings Pond area flushing is completed, the SCS dam barrier is decommissioned, and sufficient transit time is allowed for the impact of those actions to reach the compliance wells. This section allows Cotter to petition for Alternate Concentration Limits as set forth in federal regulation.

STATUS: The Lincoln Park compliance monitoring wells (019 and 020) were constructed and first sampled in February 1989. These wells were sampled monthly until the second quarter of 2000 and the results are reported in the Annual Report. The wells are currently sampled quarterly. In 1996, Cotter installed on-site compliance wells down gradient of the OTPA and Milling Facility and a background well west of the mill.

Review of the data shows downward trends for molybdenum and uranium in the Lincoln Park compliance wells and in other contaminated wells in the area.

FUTURE ACTIVITIES: The RAP cleanup objective is 0.035 mg/l uranium for Lincoln Park. The State of Colorado is expected to promulgate a groundwater standard of .030 mg/l uranium in 2008, to comply with the existing EPA standard.

RAP Section 15.0 - Ground Water Monitoring

This section sets the well monitoring locations and frequencies for the site. The purpose of monitoring is to provide information (1) on which to base decisions regarding changes to remedial activities, (2) with which to verify if performance criteria are being met, (3) with which to measure the effectiveness of remediation, (4) with which to determine if regulatory requirements are being met, and (5) to meet regulatory requirements pertaining to monitoring; specifically to satisfy the ground water monitoring requirements of RAP Section 14.

STATUS: New RAP-required wells were constructed, developed and sampled by February 1989. The ground water monitoring program in the RAP was modified as part of the 1995 license renewal and is incorporated into the Cotter license as Radiological Health and Safety Procedure 3-4. This procedure modified the sampling frequency, added (the new on-site compliance and background wells) and deleted (duplicative) wells and sample constituents such as selenium (added), vanadium (deleted). Review of the data indicates that the ground water quality is improving, both on and off site.

In 1999, Cotter met with representatives from EPA and the state to review the ground water monitoring program and improve our ability to delineate the contaminated plume. Wells that were located close to one another were considered redundant, in which case one well was deleted and the well with the longer history was retained in that area. In addition, wells located outside the plume description were eliminated, and some wells were added in areas to fill data gaps in order to better define the plume

FUTURE ACTIVITIES: Cotter continues to monitor and sample the wells as required. Required ground water monitoring results are reported in the Annual Report. CDPHE continues to split ground-water samples with Cotter. Test results from the Cotter Laboratory and the CDPHE State Laboratory are similar.

RAP Section 16.0 - Main Impoundment

The purpose of this section is to effectively mitigate the Main Impoundment as a source of wind dispersed particulates. Under this section, Cotter was required to minimize the area of the tailings beaches and to control the drying of the tailings beaches.

STATUS: Cotter Corporation tracks pool elevation in the primary impoundment monthly. Cotter continues to cover exposed beaches with clean soils and use dust control sprays on exposed beaches when the liquid level in the primary impoundment falls.

As an element of the 1995 license renewal process Cotter developed a performance objective to maintain the liquid in the primary impoundment to a maximum elevation of 5580 feet above mean sea level (amsl). The original design was 5598 feet amsl. To compensate for this decrease in capacity, Cotter agreed to construct 20 acres of evaporation ponds or cells in the west and south areas of the primary impoundment. Cotter used materials from the Old Tailings Ponds to construct the cells. These evaporation ponds were completed in 2002 and were filled with liquid.

FUTURE ACTIVITIES: Cotter continues to monitor the Main Impoundment and applies dust control when needed. Dust observations are generally reported at each location three times each day, once per shift. This results in 270 observations per area per quarter. Exposed beaches continued to be covered with soil material or sprayed with a dust control agent.

The 2004 license renewal requires Cotter to begin dewatering the impoundment, dewater (new) tailings prior to disposal, and update dust control plans accordingly.

RAP Section 17.0 - Old Tailings Ponds Area

The purpose of this section is to effectively mitigate the Old Tailings Ponds area as a source of wind dispersed particulates. Under this section Cotter was required to revegetate the Old Tailings Ponds area after removing the required 2 feet of soils (RAP Section 8).

STATUS: Cotter has removed additional soils from the Old Ponds Area to construct the evaporation ponds in the Primary Impoundment. These areas were revegetated using a seed mix recommended by the U.S. Soil Conservation Service. The Soil Conservation Service reviewed the status of revegetation and made no other recommendations.

Dust observations are generally reported at each location three times each day, once per shift. This results in 270 observations per area per quarter (1080 per year).

FUTURE ACTIVITIES Cotter is to evaluate the revegetation each year and report results in the Annual Report.

RAP Section 18.0 - Ore Handling and Ore Stockpiles

The purpose of this section is to effectively mitigate the uranium ore stockpiles and handling areas as potential sources of wind dispersed particulates and potential ground water and surface impacts. Cotter was required to construct lined ore pads with runoff controls, and to mist the piles as necessary to control dust.

STATUS: The ore handling and stockpile areas were constructed with modifications. The final construction report was submitted with revisions on November 17, 1989. Cotter is presently using the ore pads to stockpile ore from the Western Slope.

FUTURE ACTIVITIES: Cotter continues to monitor these areas as part of their O&M and inspection program. Dust observations are generally reported at each location three times each day, once per shift. This results in 270 observations per area per quarter. The ore stockpiles are treated with a dust control agent, and stockpile berms are maintained. The berms help to control the dispersal of ore particles by rainfall run-off to other areas of the site, as well as providing gamma radiation shielding for the protection of workers and the public. The 2004 license renewal requires Cotter to assess whether additional measures to reduce exposures from this area should be implemented, and includes more specific dust control procedures.

RAP Section 19.0 - Catalyst Pile

At the time of the RAP, Cotter had approximately 500 tons of catalyst material stored on a Hypalon liner. Cotter was required to dispose of this material at a permitted hazardous waste facility and verify that the soil beneath the liner was clean.

STATUS: Cotter submitted a proposal to treat the catalyst pile on-site after it was determined that the pile was a mixed waste. This proposal was reviewed and approved with a Consent Agreement No.95-01-04-01 by personnel in the Hazardous Materials and Waste Management Division on January 4, 1995. The material was solidified to remove the hazardous waste characteristic for cadmium and placed onsite in the solid waste disposal area in 1996. Soil verification below the liner showed that cleanup criteria for this area had been met.

FUTURE ACTIVITIES: None.

RAP Section 20.0 - Yellowcake Dryer

The purpose of this section is to effectively mitigate the yellowcake dryer stack as a potential source of wind dispersed particulates. Cotter was required to demonstrate that they were using "best available technology" to control stack emissions

STATUS: In 1989, Cotter hired Behrent Engineering Company to evaluate the yellowcake dryer. They determined that by optimizing the pressure drop across the existing yellowcake venturi scrubber equipment and by performing other modifications with regards to the system such as adding an additional blower and increasing the gas flow, they could achieve the desired results. Cotter submitted the final construction report for the yellowcake dryer modification to the State on July 29, 1992. The Air Pollution Control Division reviewed the report. The state accepted the report on November 4, 1992. When Cotter started to produce yellowcake, they

were to evaluate the efficiency of the modifications. When the yellowcake dryer stack operated in 1999- 2002, Cotter performed an evaluation of the efficiency of the system and it met air pollution control limits.

FUTURE ACTIVITIES: When the mill is operating, Cotter is to evaluate the yellowcake dryer (also called the uranium oxide venturi scrubber) as part of its performance objectives and report the results in their Semiannual Report of Performance Objectives and also in the RAP Annual Report. The 2004 license renewal requires Cotter to evaluate whether other systems could be implemented and eliminate the yellowcake stack.

RAP Section 21.0 - On-site Soils

The purpose of this section is to effectively mitigate the soils on the mill site as a potential secondary source of wind dispersed particulates and to provide for soil cleanup at mill closure. Cotter was required to maintain adequate vegetative cover on all mill site soils, or to use other dust control methods where vegetation could not be maintained. Upon closure, Cotter is required to survey/sample all soils, and perform cleanup based on radium and molybdenum levels. Soils that need to be excavated are to be disposed of in the main or Secondary Impoundment.

STATUS: Cotter has an on-site dust control program, which includes revegetation and using dust-suppressing agents when appropriate.

FUTURE ACTIVITIES: This is a continuing O&M program. The results are included in the Annual Report. Dust observations are generally reported at each location three times each day, once per shift. This results in 270 observations per area per quarter

On July 5, 2002, a dirt berm was constructed around the zirconium/uranium ore pile to help reduce the gamma radiation levels to the Main Office and Security Station. The 2004 license renewal requires Cotter to re-evaluate control measures at the ore pile to resource on-0site and off-site exposures.

RAP Section 22.0 - Roads

Under this section, Cotter is required to effectively mitigate the roads as a potential source of wind blown particulates.

STATUS: To achieve this requirement Cotter regularly waters the roads and has placed gravel in areas of high road traffic.

FUTURE ACTIVITIES: Cotter will continue dust control activities on roads. Dust observations are generally reported at fourteen locations three times each day, once per shift. This results in 270 observations per area per quarter. The 2004 license renewal requires Cotter to re-evaluate dust suppression measures.

RAP Section 23.0 - Air Monitoring

This section requires Cotter to perform air quality monitoring to evaluate the effectiveness of dust control activities. The section specified the monitoring locations and procedures.

STATUS: All air radionuclide concentrations remain well below the regulatory dose limit.

As a requirement of this RAP Section, Cotter also operated "event actuated" (high wind only) air monitors for three years. Although these monitors showed higher sample concentrations than other site monitors, the results were well below standards. In accordance with the RAP, after three years the utility of these monitors was evaluated, and they were discontinued. Cotter has also added a monitor north of the mill between the mill property and the golf course, and one near the entrance to the golf course. New houses are being constructed in this area.

CDPHE audits the air monitoring program annually to insure it is being properly implemented.

FUTURE ACTIVITIES: This activity is ongoing and the results are reported in the Annual Report.

RAP Section 24.0 - Site Adjacent Soils

Adjacent soils have been contaminated by wind-blown particulates from the mill site. The purpose of this section is to effectively mitigate the adjacent soils as a potential secondary source of wind dispersed particulates and of surface water sediment transport, to restrict access to impacted soils, and to reduce constituent concentrations in soils to background range. Cotter was required to perform a survey of soils outside the restricted area, evaluate grazing uses in relation to contaminated soils, and construct fences to restrict grazing where necessary. Under this section, Cotter is also required to conduct additional off-site soil surveys as part of mill closure activities, and remediate soils above background for radium and molybdenum.

STATUS: Cotter has completed the required soils survey and has determined an area east of the restricted area has elevated radium-226 readings when compared to the soils and sediment background study, which was completed in 1990. Cotter installed grazing fences during the spring of 1993. The construction report was submitted on June 15, 1993, and accepted by the state on June 30,1993. Cotter regularly inspects their fencing. Cotter has not allowed grazing on their property adjacent to the mill in the past several years.

FUTURE ACTIVITIES: Cotter is to continue monitoring the fence for the restricted and unrestricted areas. In addition the 2004 license amendment requires Cotter to produce and implement a plan to update off-site soil characterization data.

RAP Section 25.0 - Lincoln Park Soils

The purpose of this section was to evaluate whether soils in Lincoln Park had been contaminated by windblown and waterborne contaminants from the mill. Cotter was required to conduct a gamma scintillometer survey in Lincoln Park and to report the results.

STATUS: The Lincoln Park soil survey was completed in December 1988. The gamma survey showed no elevated gamma in Lincoln Park. The state accepted the report in February 1989. No further action was required after the report was given to the health risk assessment panel.

FUTURE ACTIVITIES: None.

RAP Section 26.0 - Willow Lakes

The purpose of this section was to evaluate whether Willow Lakes had been contaminated by groundwater from the mill. Cotter was required to sample the ground and surface water quality, fish, sediments and water uses in the Willow Lakes and feeder springs, and to report the survey results.

STATUS: Cotter submitted their final report of their study of the Willow Lakes and three comparison lakes in April 1991. Ecosystems that were sampled included the following: (1) water, (2) lake sediments, (3) autotrophs [algae], (4) primary consumers or detrivores [tadpoles, macroinvertebrates], and (5) carnivores [fishes]. The three comparison sites were sampled for all of the ecosystem components listed above for the Willow Lakes. The ecosystems were tested for uranium and molybdenum, the primary constituents of concern from the Cotter Mill. Radium was also tested in the lakes. The data showed no indication of radium enrichment in the Willow Lakes.

The report indicated that the Willow Lakes contained higher concentrations of molybdenum in sediment and water than in the comparison lakes. One of the Willow Lakes approached the RAP ground water standard and EPA ground water standard of 0.1 mg/l for the mean concentration of molybdenum, but was below it. Molybdenum in fish was highest in one of the control lakes. The same control lake had significantly higher uranium than the other lakes in algae.

One of the control lakes had significantly higher uranium than did the Willow Lakes for water, sediment, and algae. The mean uranium concentrations in all of the lakes were below the RAP ground water objective and EPA's groundwater objective of 0.03 mg/l. The uranium standard for the state is related to protection of aquatic life. The report indicates that the acute protection limit would be 7.5 mg/l and the chronic standard would be 4.7 mg/l for the Willow Lakes.

In aggregate, this information demonstrates that the mill has not contaminated Willow Lakes, and no cleanup actions are required.

FUTURE ACTIVITIES: None.

RAP Section 27.0 - Ephemeral Streams and the Fremont Ditch

Prior to construction of the SCS dam, storm events carried contaminated sediments from the mill site down the Sand Creek drainage. The purpose of this section was to evaluate and mitigate any impacts from these sediments in Sand Creek and the Fremont Ditch (which could have potentially received sediment from Sand Creek). Cotter was required to conduct a gamma survey of the dry beds of Sand Creek and the Freemont Ditch, and to remove all sediments that exceeded the radium standard set forth in federal regulation (40CFR 192). The goal of the cleanup was to reduce radium-226 concentrations to background range.

STATUS: The Sand Creek Cleanup project involved removal of approximately 2800 cubic yards of contaminated tailings, soils, and sediment from 1.25 miles along the ephemeral portion of Sand Creek. The cleanup objective was to remediate the creek to allow the unrestricted use of the area. To achieve this objective, the cleanup standard was set at 4 picocuries per gram

("pCi/g") for radium-226 as well as for thorium-230. All tailings, soils, and sediment containing levels of radium-226 or thorium-230 above 4 pCi/g were removed and disposed on the Cotter mill site. Confirmation sampling by Cotter and the state was completed. Cotter backfilled the excavated areas with clean soils as required by the Army Corps of Engineers.

Cotter sampled sediment in Fremont Ditch from its head gate near Sand Creek to where it is channeled in concrete about a quarter mile downstream. Cotter submitted the results of the study in the "Fremont Ditch Assessment Report – June 2000," which showed radium-226 averaged 1.86 pCi/g with thorium in-growth. This was below the cleanup standard of 4 pCi/g. The concentrations of gross alpha concentration (3.8 pCi/g), uranium (6.6 ug/g) and molybdenum (2.2 ug/g) were all low. The results of the assessment effort confirmed that the sediments in the Fremont Ditch did not require remediation. The State concurred.

FUTURE ACTIVITIES: None.

RAP Section 28.0 - Perennial Streams

The purpose of this section is to survey the molybdenum and radium-226 concentrations in sediments in the perennial stream segments of Sand and Willow (Plum) Creeks to determine whether these stream reaches had been impacted by the mill. If necessary, contaminated sediments were to be removed and properly disposed of. The goal of sediment removal is to reduce molybdenum and radium-226 concentrations to background range.

STATUS: The survey required under this RAP Section is not scheduled until mill closure. It should be noted that during the ecological risk study, sediments were sampled west of Ash and where Sand Creek enters the Arkansas River. Sample analysis indicated that sediments were at background levels.

FUTURE ACTIVITIES: Cotter will need to perform this survey and remediate contaminated sediments, if any, at the time of mill closure.

RAP Section 29.0 - Pathway Management

The purpose of this section is to evaluate the runoff of contamination from off-site soils into ephemeral drainages, including Sand Creek, Willow Creek, Forked Gulch, Wolf Park and Chandler Creek, and to mitigate the concentrations of molybdenum, radium-226, and thorium-230 in these drainages. Cotter was required to survey and sample soils in these sub-basins. For any soils exceeding background, Cotter was required to either remove those soils, or construct (and maintain) silt fences to prevent contaminated sediments from entering stream channels. Criteria for when the silt fences can be removed are included in this section.

STATUS: Cotter has completed sampling the sub-basins. They found two impacted sub-basins located in Section 15 just east of the Cotter mill controlled area. The state had indicated that a third sub-basin north of these two sub basins in the same drainage should also be investigated. Cotter completed the study and did not find elevated levels of radium-226, molybdenum, or thorium. The State accepted Cotter's proposal to install silt fences in the two impacted sub-basins on October 22, 1992. The fences were installed in the spring of 1993. Another silt fence was added in 1997 at the northwest corner of the golf course near well 337. Results of

observations, repairs and soil sampling are included in the Annual Report. Silt fences are inspected on a weekly basis and after rainfall of 1/4 inch or more.

Sediment samples controlled by the silt fences indicate that thorium-230 concentrations at all locations are considerably higher than background range values. Radium-226 and molybdenum concentrations were all slightly greater than background range except for molybdenum at the north fence. The results are similar to sample results from prior years and are indicative of pockets of wind blown contamination and/or spillage that had been found during the RAP Section 24 and 29 gamma surveys and soil sampling efforts or during soil sampling along the Golf Course Land Exchange.

An inspection by CDPHE in 2004 indicated that the fences are starting to wear and should be repaired or replaced. The south fence will be extended for greater coverage.

FUTURE ACTIVITIES: Cotter continues to monitor the silt fences, remove sediments collected by the fences and reports the results in the Annual Report. Cotter has expressed the desire to reopen discussions on final soil cleanup levels based on the "benchmark dose" provisions in Part 18 of the Colorado Rules and Regulations Pertaining to Radiation Control.

RAP Section 30.0 - Arkansas River

The purpose of this study is to evaluate the adequacy of the on-going river monitoring program and its ability to measure the effectiveness of RAP activities. Cotter was required to design and implement a sampling study to answer this question.

STATUS: Cotter and their consultant, Western Environmental Analysts, implemented an Arkansas River sampling plan that was approved by the CDPHE Water Quality Control Division. It included bi-weekly sampling of the river at five locations:

1. Parkdale for background,
2. Grape Creek,
3. 1st Avenue-upstream of where Sand Creek entered the Arkansas River,
4. McKenzie Bridge-downstream from where sand Creek enters the Arkansas River, and
5. Where Highway 67 to Florence crosses the River.

This sampling began on April 28, 1989, and ended on June 20, 1990.

In addition, four synoptic sampling events, or sampling of water in-flows, from both sides of the river from all sources was done between the canyon mouth and Highway 67. The samples were analyzed for uranium, molybdenum, and specific conductance. The purpose of the synoptic sampling was to provide information on tributary flows that might reflect unusual sources of these substances. The synoptic sampling showed that other sources such as Fourmile Creek (located on the north bank of the Arkansas River) and return flow structures from irrigation contributed to increases in molybdenum and uranium as well as did Sand Creek and Plum Creek into the Arkansas River.

Ecosystems that were sampled included the following: (1) water, (2) river sediments, (3) autotrophs [algae], (4) primary consumers or detrivores [tadpoles, macroinvertebrates], and (5) carnivores [fishes]. Constituents tested included stream flow, molybdenum, uranium, radium-226 and thorium-230. The report states "Concentrations of molybdenum, radium, and thorium

show no statistical evidence of increase downstream on the Arkansas River based on bi-weekly samples over 14 months at four stations between Parkdale and Highway 67, but statistical comparisons are hampered by extremely low concentrations."

The lack of impact shown by this study is reflected in modifications to the sampling program that were accepted by the state in 1992. The new (and current) program calls for monthly sampling First Avenue Bridge and at McKenzie Bridge. Results are included in the Annual Report. Test data for 2003 indicates similar concentrations to prior years. Stream standards are not exceeded.

FUTURE ACTIVITIES: No additional work is required to validate the adequacy of the sampling program. Cotter continues to sample the Arkansas River in accordance with the approved sampling plan, and reports the results in the Annual Report.

RAP Section 31.0 - Minnequa and Pueblo Reservoirs

Based on the fact that the Arkansas River flows into these reservoirs, this section was designed to define the existing concentrations of specified elements in the sediments of the Minnequa Reservoir and the Pueblo Reservoir, to determine whether the mill has impacted them.

STATUS: These section gave the state the option to sample sediments in these reservoirs. The state has reviewed numerous reports regarding water quality and sediments in the Arkansas River, Fremont Ditch, and the Pueblo Reservoir. The United States Geological Survey completed surface water and sediment sampling programs in the Arkansas River and Pueblo Reservoir in 1991 and 1994. The studies had two major conclusions. First, because of contributions of radionuclides from other sources such as naturally occurring rocks, return water from irrigation waters and elevated radionuclide contaminants from perennial streams in the area, it would be difficult to isolate contributions from the Cotter Mill. Second, data shows that the sum of all contributions still results in sediment contamination levels that are not above a level of concern. Minnequa Reservoir was not directly sampled. However, sampling of Fremont ditch sediments, which are much closer to the mill site, did not show levels requiring any cleanup.

FUTURE ACTIVITIES: None. The state has decided not to conduct a sediment core-sampling program in these reservoirs based on review of available information

RAP Section 32.0 - Health Risk Assessment

The purpose of this section is to determine if the release of mill-derived constituents has an effect on human health. Cotter was required to design and conduct a comprehensive study to assess human health risks and impacts, if any, from the mill.

STATUS: Cotter submitted the health risk assessment final report in October 1991. After review by the state and EPA, the report was found to be unacceptable in May 1992, as several areas of concern were identified. These included chemicals evaluated, concentration values and use of standard Superfund methods. CDPHE required that a Supplemental Risk Assessment be performed for the site. The purpose of this Supplemental Risk Assessment was not to replace or repeat the efforts completed in 1991, but to focus on the specific concerns expressed by CDPHE, EPA, and area citizens.

The re-assessment of risks to citizens of Lincoln Park was based on environmental conditions in the 1988 time frame. That is when the Consent Decree was signed. This study was completed in 1996. An additional study considered risks to current and potential future residents in Lincoln Park and other areas in the vicinity of Lincoln Park mill site based on environmental conditions in the 1994-1996 time frame, after remedial activities required by the Consent Decree had been implemented. This study was completed in 1998.

The assessments evaluated the various chemicals for carcinogenic and non-carcinogenic adverse health risks. They looked at risks from ground water, air, soil, surface water and locally grown produce. The findings of the reports were consistent. Non-cancer risks may be in a range of potential concern for area residents who use ground water from wells located in the contaminated plume area along Sand Creek as a long – term source of drinking water. However, many wells within the Lincoln Park area would not pose risks greater than EPA's typical guidelines. Cancer risks to residents are dominated by radon in air and by radium in soil, both of which appear to be within the normal "background" range expected for the Lincoln Park area. Cancer and non-cancer risks to residents from eating vegetables and fruits are below a level of concern. 

An Ecological Risk Assessment (ERA) was completed in January 1999. The report determined that risks to animals and plants were low and, as such, no remedial actions were identified with regard to local ecological conditions.

FUTURE ACTIVITIES: No further action is required under the RAP. However, due to citizen concerns, CDPHE and EPA are working with ATSDR to determine whether any additional health studies are warranted for the area. It should be noted that CDPHE performed three cancer incidence studies that looked at cancer incidents in the area from 1979 to 1987, 1979 to 1990, and 1979 to 1995. These studies did not find any statistically significant increase in cancer in the vicinity of the mill site.