

**FINAL CLOSE OUT REPORT**  
**Uravan Mill and Adjacent Areas**  
**Montrose County, Colorado**

**I. Introduction**

This Final Close Out Report documents that Umetco Minerals Corporation (Umetco) has completed all remedial actions at the Uravan Superfund Site (Uravan) in accordance with Close Out Procedures for National Priorities Sites (U.S. EPA, 2000). In December 1983, the State of Colorado filed a natural resources damages (NRD) claim in civil action 83-C-2384 against Union Carbide and Carbon (UCC) and Umetco under CERCLA. The State's 1983 NRD action was subsequently amended to include a CERCLA cost recovery claim in April, 1985. The site was proposed to the NPL in 1984 and finalized in 1986. Uravan is a 693 acre tract of land that includes the former Uravan Mill, Club Ranch Ponds, the Secure Tailing Repositories, and the Alternative Soil Standards areas. Residual waste in these areas will be managed under a long term surveillance program by the U.S. Department of Energy (DOE).

**II. Summary of Site Conditions**

**A. Background**

The Uravan Facility is located in Montrose County, Colorado approximately fifty (50) miles southwest of Grand Junction on State Highway 141, along the San Miguel River and on Club Mesa to the west of the San Miguel River. The site is characterized by an arid climate, sparse vegetation, and rugged topography. Topographic features at Uravan are dominated by broad mesas and incised canyons.

Mining operations in this area of Colorado began in the early 1900s. The Uravan Site was contaminated by radioactive residues resulting from the processing of vanadium- and uranium-containing ores from the early 1900's through the mid-1980's. From the time UCC/Umetco began operations at Uravan, in the 1920's, until it was shut down the mill processed over ten million tons of uranium-vanadium ore. During this time, operations produced in excess of ten million tons of tailing, 38 million gallons of waste liquid raffinate, raffinate crystal residue, and other milling wastes containing radioactive materials, metals and other inorganic contaminants.

In December 1983, the State of Colorado filed a natural resources damages claim in civil action 83-C-2384 against UCC and Umetco under CERCLA. The State's 1983 NRD action was subsequently amended to include a CERCLA cost recovery claim in April, 1985. UCC and Umetco have been identified as the sole Potentially Responsible Party (PRP) for the Uravan Site. The site was proposed to the NPL in 1984 and finalized in 1986.

**B. Remedial Investigation/Feasibility Study Results**

In 1985, Umetco and the State of Colorado began discussions concerning remedial action and cleanup of the site. A 1986 Memorandum of Agreement between EPA and CDPHE designated the State as the lead agency for discussions. EPA was consulted and provided technical support as needed. The result of these discussions was the preparation of a Consent Decree and a Remedial Action Plan (RAP) in 1986 that outlined the requirements for Umetco to remediate the site. This document is the functional equivalent of the EPA Remedial Investigation/Feasibility Study and Record of Decision. The United States District Court for the State of Colorado approved the Consent Decree and RAP on February 12, 1987.

A joint group consisting of Umetco, and the Colorado Department of Public Health and Environment (CDPHE) and their consultants, developed the RAP on the basis of previous site characterization work.

### C. Remedial Decision Findings

Solid wastes at Uranvan were comprised of milling and cleanup residues that included mill tailing; evaporation crystals and sludge; milling refuse; and mill debris. These wastes totaled over 10,000,000 cubic yards and contained radioactive elements, metals, and inorganic compounds. Liquid wastes from seepage collection and ground water extraction systems totaled over 350 million gallons at the end of 2004. These liquids also contained radioactive elements, metals and inorganic compounds.

Objectives of the remedial activities were to:

- Protect surface and ground water resources;
- Stabilize and control the tailing and other waste materials;
- Minimize radon emissions from the tailing and waste repositories; and
- Perform the remediation in a safe manner that minimizes impact on the environment and to the remediation personnel.

Meeting these objectives assured the protection of human health and the environment.

### D. Cleanup Activities Performed

The general site remedies chosen to achieve the remedial objectives included:

- Removal and cleanup of dispersed materials and contaminated soil from approximately 400 acres;
- Relocation of more than 3 million cubic yards of mill wastes and contaminated materials to secure repositories on Club Mesa;
- Construction of waste and tailing repository covers, liquid evaporation and retention ponds, and permanent runoff control structures – utilizing more than 1.7 million cubic yards of earthen materials;
- Construction of 5 double-lined ponds (totaling 40 acres) for the evaporation of hillside seepage, tailing pile seepage and extracted ground water;
- Construction and utilization of a new repository in the B-Plant area capable of disposing in excess of 1.8 million cubic yards of evaporative pond demolition debris and radioactive waste;
- Demolition and removal of about 50 major mill facility structures and buildings, including the process systems and circuits, and removal of over 260 buildings in the town of Uranvan;
- Collection of over 70 million gallons of hillside and tailing seepage, containing approximately 6,000 tons of contaminated inorganic compounds. Hillside and tailing seepage that was collected was transferred to Club Ranch ponds for management by evaporation;
- Extraction of approximately 245 million gallons of contaminated liquids from the ground water with the removal of approximately 14,500 tons of contaminated inorganic compounds. Contaminated ground water that was collected was transferred to Club Ranch Ponds for management by evaporation, and,
- Removal of contaminated materials from the Old and New Town Dumps with placement into the Club Mesa Tailing repository.

From 1987 through 2004, remedial work included the excavation and consolidation of the vast majority of contaminants from the San Miguel River Valley and Club Mesa, decommissioning and demolition of the mill facility complex, installation and operation of the ground water withdrawal system and the removal of dispersed contaminated soil and debris from the UraVan site and nearby locations.

Throughout the remediation of the UraVan site there have been numerous facility inspections conducted by the Colorado Department of Public Health and Environment (CDPHE), EPA and Nuclear Regulatory Commission (NRC) to document that Union Carbide Corporation/Umetco Minerals Corporation (UCC/Umetco) has performed the remedial activities in accordance with the requirements in the Consent Decree and RAP. The CDPHE has at a minimum conducted annual site inspections of the work as well as end of project segment verification inspections. As required by CERCLA section 121(c), 42 U.S.C. 9621(c), the EPA has completed Five-Year Reviews of the progress at the UraVan site. Although not required, since the State of Colorado is an agreement state and is the lead agency in regard to licensing, the NRC has made several visits to the UraVan site to observe the progress made toward completion of the remedial action.

#### E. Community Involvement

Throughout the process from development of the Consent Decree to completion of the Remedial Activities, all phases of the UraVan remediation have been an open process with input from Federal and State Regulators, Montrose County Government and members of the public. Over the life of the project there have been numerous public comment periods and hearings to ensure that the local residents were able to contribute to the process and express their opinions.

Public involvement has been sought either by UCC/Umetco, CDPHE or EPA for many remediation and operation documents including the Consent Decree, RAP, the Colorado Radioactive Material Licenses and renewal of those licenses, License Amendments, and EPA Five-Year Reviews.

#### F. Redevelopment

Umetco has donated an office building used during remediation of UraVan and a piece of property immediately adjacent to the site to the Rimrocker Historical Society. This local organization will use the donation to develop a museum memorializing the history of uranium mining in western Colorado.

Remediation at UraVan included a portion of State Highway 141. The land underlying the highway and within the easement is now available for unrestricted use and unlimited exposure. Following the removal of radioactive tailing from within the road bed, EPA deleted that portion of the road from the National Priorities List (NPL) on September 4, 2007.

In addition to the deletion of State Highway 141, EPA deleted 9.84 acres, including two historic structures, from the site on February 18, 2005. The structures, which included the Boarding House and the Community Center, were originally planned for use as a museum by the Rimrocker Historical Society. The Boarding House and the Community Center were demolished in 2007, with approval from CDPHE, after determining that they were not structurally salvageable.

County Road Y-11 was also remediated as part of the UraVan cleanup. While there is some residual contamination beneath County Road Y-11, institutional controls have been implemented and the road will remain in use allowing public access across the site.

The remainder of the site will most likely revert to open space; DOE will manage use of the property in the future through their legacy management program.

### **III. Quality Assurance and Quality Control (QA/QC)**

#### **A. QA/QC Protocol**

Final Remediation Activities as specified in the RAP were completed under direction of the 1987 Quality Plans and Addendum to Quality Plans, which provided quality assurance and quality control requirements and set forth site specific mechanisms to evaluate the performance of the remedial activities.

#### **B. Sampling and Analysis Protocol**

After completion of an individual construction segment the QC Officer verified that the tasks were performed in compliance with the final plans and specifications and then provided a Compliance Report (similar to a Remedial Action Report) detailing the applicable points from the Quality Plans for approval by the Site Manager and the CDPHE On-Site Coordinator.

The Quality Control (QC) activities implemented used standardized QC procedures and provided the necessary tests and observations for the construction, sampling and monitoring process at the Uravan site. Quality Assurance audits and reviews provided the needed oversight of the QC Activities. In addition, for each project the respective quality plan required a Compliance Report at the successful completion of a Construction Segment.

#### **C. Results of On-Site Inspections**

After the completion of a construction segment the QC Officer verified that the construction tasks were in compliance with the final plans and specifications and then wrote a Compliance Report detailing the applicable points from the quality plan for approval by the Site Manager and the CDPHE On-Site Coordinator.

### **IV. Monitoring Results**

The Uravan RAP, the Soil Cleanup Methodology, and Uravan Alternate Concentration Limits (ACL) Application, detail the sampling and analysis program for the Uravan remedial action. The sampling program was bifurcated. The first program specified site monitoring for the health protection of the site workers and members of the public, and the second program addressed verification of compliance with remedial objectives.

#### **A. Monitoring for Protection of Human Health of Site Workers and the Public**

The RAP and Colorado Radioactive Materials License 660-02 detailed a rigorous sampling and analysis program for protection of health for onsite workers and off-site members of the public.

The sampling program included:

- Daily perimeter air monitoring for total particulates and radionuclides;
- Daily personnel air sampling of exclusion-zone workers for radionuclides;
- External exposure using dosimeters;
- Internal exposure calculation from air monitoring data and Breathing Zone data.

Specifics of the program are detailed in the Policies and Procedures manual for Uravan.

The Uravan License required that the Radiation Safety Officer (RSO) audit annually the site inspection logs, reports and monitoring data for adherence to operating procedures, license requirements, and safety practices affecting radiological safety. The license further required an annual independent audit of these programs, the results of which were reported with the RSO audit in the Uravan Annual Reports submitted for approval to the Colorado Department of Public Health and Environment.

#### B. Monitoring for Verification of Attainment of Remedial Objectives.

Requirements for verification of the remedial activities are outlined in the Remedial Action Plan, individual Quality Plans by project number, the Soil Cleanup Methodology Manual and the Uravan ACL Application.

The sampling program included:

- Exposure surveys
- Confirmatory soil sample(s) for all site contaminants, wherever contamination was suspected or known to occur;
- Complete sampling of borrow materials for all site contaminants; and
- Groundwater and surface water sampling for site contaminants.

Monitoring results have been documented by individual project area as the segments were completed.

The Uravan Site has been cleaned up to the criteria specified in the RAP and the Soil Cleanup Methodology Manual. The clean-up criteria in the Soil Cleanup Methodology Manual are similar to the State of Colorado's *Soil Remediation Objectives Policy Document*, EPA Region III's Risk-Based Concentration (RBC) Table, and EPA's *Soil Screening Guidance*.

Alternative soil standards have been requested for four locations in the Uravan area where Radium-226 is in excess of the Soil Cleanup Criteria. The alternative standards areas are within the area to be transferred to the DOE for long-term surveillance activities and are termed the Mill Hillside, A-Plant North, River Ponds, and County Road Y-11 areas. The Alternative Soil Standards Application contains a description of the alternative standard areas and information to support the application for alternative soil standards in the subject areas. Development of the application utilized the DOE's Supplemental Standards Justification Checklist (1992). This application is currently under review by the NRC with an anticipated Fall 2008 approval.

As previously described, Compliance reports detailing the applicable points from the quality plan were approved by the Site Manager and the CDPHE On-Site Coordinator. These compliance reports are available in the Administrative Record for the Site.

#### C. Groundwater Monitoring

The Club Ranch Ponds (Ponds) were constructed in 1963 as a seepage and evaporation system to dispose of raffinate solutions from the mill. A contaminant plume developed beneath the Ponds due to seepage during the approximately 25 years of operations. In 1983, 14 monitoring wells were constructed to monitor the plume beneath the Ponds with another 4 wells added in 1986 for the same purpose. A groundwater model and remedial plan was developed by evaluating the hydrogeologic conditions in the Club Ranch Pond area. This study predicted future Total Dissolved Solid (TSD) concentrations in the Kayenta aquifer and identified optimal locations for extraction wells. The Uravan RAP, Section A5.4.3.3, required that the performance of the groundwater remedial system be optimized and addressed in a Performance Evaluation Report. Monitoring data was acquired in accordance with the CDPHE approved groundwater monitoring procedures.

In 1998, modification to the Ponds groundwater extraction program was developed in concert with the EPA, CDPHE, and the Colorado Geologic Survey. The objective of the program modification was to remove high TDS liquids from low permeability zones in the Kayenta Formation. The report recommended a change in remedial strategy from groundwater volume removal to mass contaminant

removal. Accomplishing this change in strategy involved installing new monitor and extraction wells in highly contaminated, low permeability areas.

The new extraction and monitoring wells in the low permeability zones in the Kayenta aquifer were added in 1998 by drilling eight boreholes. Four of the boreholes were completed as withdrawal wells; three were completed as monitoring wells; and one borehole was abandoned.

Throughout the life of the groundwater remedial action, the groundwater monitoring procedures were modified with CDPHE approval to ensure optimum performance of the extraction program and monitor compliance with groundwater protection standards.

The Kayenta aquifer had reached steady state conditions by 2002. The groundwater performance evaluations showed that future groundwater extraction would not significantly enhance aquifer restoration.

In 2003, a groundwater Alternative Concentration Limit (ACL) application was approved by CDPHE. ACLs were proposed for eleven (11) groundwater constituents at the Uravan site. The ACLs were developed using a Point of Exposure (POE) in the San Miguel River. ACLs were calculated using a mass balance approach for aquifer concentrations that did not exceed the surface water quality for the San Miguel River. Action levels well below the ACL values were established so that corrective actions could be identified and implemented prior to degradation of the river. The ACL Application implemented a monitoring program that consisted of quarterly monitoring with annual performance evaluations for a period of three years. After three years of monitoring and annual evaluations the program showed that there were no contaminants in the Kayenta Aquifer above the ACLs and the ACL monitoring program was terminated. Currently, as required by the ACL Application, groundwater is monitored in accordance with the anticipated DOE Long Term Monitoring for the Uravan Site.

The DOE's long term monitoring of groundwater will be implemented upon their assumption of ownership of the site and will be undertaken to ensure that the groundwater plume under the Club Ranch Ponds Area continues to dissipate in accordance with the groundwater mixing model and that the granted ACLs are not exceeded. The effectiveness of groundwater remediation will be assessed by the DOE in the future.

#### D. Surface Water Monitoring

The San Miguel River at Uravan has been monitored since the early 1960's at various times by the EPA, CDPHE and Umetco. Prior to and during the initial stages of site remedial activities in the 1980s, water quality standards were exceeded for some contaminants.

Water quality in the San Miguel River has been monitored on a quarterly basis since 1987 at six monitoring stations in accordance with the RAP section 5.1.1.4(6) and the Colorado Radioactive Materials License (RML) 660-02. The monitoring station locations were selected to monitor improvements in the San Miguel River as remedial actions were conducted.

As remedial actions progressed, exceedances of the San Miguel River water quality standards decreased. Remedial activities at Uravan resulted in a direct improvement in San Miguel River water quality through: (1) removal of tailing material from the flood plain of the San Miguel River; (2) construction of new, lined evaporation ponds; (3) removal of contaminated solids and liquids from the unlined Club Ranch Ponds; and through (4) extraction of and containment of contaminated groundwater from beneath the Club Ranch Ponds. For a ten year period from 1993 to 2003 there were no significant or consistent exceedances of surface water quality standards in the San Miguel River at Uravan.

In 2003, a groundwater Alternative Concentration Limit (ACL) application was approved by CDPHE. The ACLs were developed using a Point of Exposure (POE) in the San Miguel River. ACLs were calculated using a mass balance approach for aquifer concentrations that did not exceed the surface water quality for the San Miguel River. Action levels well below the ACL values were established so that corrective actions could be identified and implemented prior to degradation of the river. The ACL Application implemented a monitoring program that consisted of quarterly monitoring with annual performance evaluations for a period of three years. After three years of monitoring and annual evaluations the program showed that there have been no impacts to the San Miguel River from the Club Ranch Pond

ground water plume. The river monitoring data shows that human health and the environment is protected at the Point of Exposure established in the San Miguel River.

Currently, the San Miguel River is monitored on a semi-annual basis at three locations in accordance with the DOE's Long Term Surveillance Plan.

## **V. Summary of Operation and Maintenance (Long Term Surveillance)**

The clean up of the site complies with the requirements of CERCLA and Colorado Rules and Regulation Pertaining to Radiation Control, Part 18. The long term surveillance and maintenance for the site will be managed by the Department of Energy.

Funding for the long term surveillance and maintenance is to be provided by UCC/Umetco to the DOE at the termination of the State of Colorado Source Materials License 660-02 and transfer of ownership to the Federal Government. As-builts and other site specific documentation as requested by the DOE will be provided prior to the time of site transfer.

Section 300.425(e) of the National Contingency Plan provides that sites may be deleted from the NPL when no further response is appropriate.

The confirmation investigations, compliance reports, and other associated reports show that the site poses no significant threat to public health or the environment and, therefore, the taking of further remedial measures is not appropriate and the site is ready for deletion from the National Priorities List.

## **VI. Summary of Remediation Costs**

The original 1986 Uravan RAP total cost estimate for the remediation was \$40 million and did not include administrative costs, license renewal fees, the long term surveillance fund or state oversight costs. This estimate also excluded the costs associated with initial remediation designs and the tailing stabilization done prior to the Consent Decree and NPL listing. A total of \$127 million has been spent on the remediation of the Uravan site in the twenty-two years since approval of the Consent Decree and NPL listing.

Additionally, the PRP will provide \$750,000 to DOE to fund Long Term Surveillance of the Uravan Site.

## **VII. Protectiveness**

This site meets all the site completion requirements as specified in OSWER Directive 9320.2-09-A-P, Close-out Procedures for National Priorities List Sites.

All cleanup actions specified in the RAP have been implemented and the site has achieved the RAP cleanup objectives or been cleaned up to acceptable risk levels. Confirmatory sampling and backfilling of the various project areas with clean soil provides further assurance that the site no longer poses any threats to human health or the environment.

The one area of the site under management of the DOE that will remain open to members of the public is Montrose County Road Y-11 which passes through the site. The 1998 Risk analysis and 2004 As Low As Reasonably Achievable (ALARA) analysis showed that the calculated doses to hypothetical individual members of the public from the residual radioactivity above background on and along the Y-11 Road are all less than 10 percent of the decommissioning dose limit of 25 mrem/year .

As this is a county road, all maintenance of the road will be completed with the CDPHE Uranium Mill Tailing Management Plan (UMTMP) as the guiding document to ensure that worker contact with potentially present radioactive materials is kept ALARA. The UMTMP describes the responsibilities and procedures for managing uranium mill tailing encountered or disturbed during construction activities in Western Colorado.

Remaining O&M activities to be performed and the Uranium Mill Tailing Management Plan will ensure long term protectiveness to human health and the environment.

## **VIII. Five Year Review**

Waste will be left in place at the Uravan Site at levels that will not allow for unrestricted use and unlimited exposure. The site will be transferred to DOE to become part of that agency's legacy management program. DOE will be responsible for all future operation and maintenance, implementation of institutional controls, and ensuring that the remedy remains protective into the future.

A periodic review of the remedy is required by CERCLA. DOE will conduct these reviews at least every 5 years for approval by EPA. The reviews will determine whether the remedy at Uravan remains protective of human health and the environment, or if additional actions need to be taken by DOE.

The DOE's long term monitoring of groundwater will be implemented upon their assumption of ownership of the site. Monitoring will be undertaken to ensure that the groundwater plume under the Club Ranch



Ponds area continues to dissipate in accordance with the groundwater mixing model and that the granted ACLs are not exceeded (Stoller, 2007). The effectiveness of groundwater remediation will be assessed by the DOE in the future.

Approved By:



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Carol Rushin

Acting Regional Administrator



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Date