

This document constitutes a trip report by Tom Flemming and Roy E. Williams on a site visit to the Cotter Corporation uranium mill near Canon City, Colorado, during the second week of September 1981. Items discussed with Cotter include transfer of mill tailings produced by the now abandoned alkaline leach mill from their original tailings pond into the recently constructed lined secondary impoundment, alterations in the pump-back system since November 1980, efforts to determine background water qualities, efforts to delineate contaminated from the pump-back system on water quality data analysis and diversion of surface water out of the Sand Creek drainage basin.

# Water Quality Sampling Program

Under the direction of the Colorado Department of Health the company has altered considerably its water quality sampling and water quality reporting program since November of 1980. Considerable effort has been expended toward the objective of standardizing field collection procedures and sample preparation. Mechanisms for pumping wells prior to sampling so that at least one casing volume of fluid can now be removed from each well prior to sample collection. Standardized filtration and acidification procedures have been implemented. The company is in the process of organizing water quality data in a format which facilitates data storage on a computer. This move eventually should facilitate easy access to individual data points as well as make convenient the presentation of time dependent data in graphic form.

9110080603 810930 PDR WASTE WM-22 PDR In combination these changes should help alleviate some of the variability in data referred to in Roy E. Williams' report of November 6, 1980. However, some time will be required for the Cotter Corporation computer analyst to introduce all of the historic data into core storage. One individual has been put in charge of the water quality data collection and analysis program. This individual is Mr. Jim Cain, Cotter's Radiation Safety Officer. This move should improve greatly the reliability and validity of the data collection and analysis program over that of earlier years. A significant reduction in the time delay between time of sample collection and time of analysis should be one of the principal results of this new management practice. The company also is in the process of establishing a radiological analysis laboratory of its own.

## New Deep Well

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The Cotter Corporation has completed the drilling of a 1,054-foot deep well into the old Wolf Park Mine workings. This well was drilled approximately 200 feet north of the old Wolf Park Mine shaft. Considerable difficulty was experienced during the drilling of the well because of locations and elevations that had changed during the period since available maps were constructed and because of geologic conditions encountered near the bottom of the hole. Nevertheless the hole was completed in one of the openings of the abandoned drifts. Initial water quality data from the well revealed basic conditions. The initially alkaline environment at the bottom of the hole was probably the result of the influence of the drilling mud and/or grout. More recent data indicate acid conditions in the abandoned drift. The existence of acid conditions in the drift suggests that pyrite in the old workings may be reacting with oxygenated.

water that has moved down the old Wolf Park Mine shaft and seepage from tailings pond #1. However, this water should have been alkaline since tailings pond #1 received water from an alkaline leach mill. Apparently the supply of pyrite in the drift is sufficient to dominate the reaction of the acid water in the drift with the basic water that has moved down the Wolf Park Mine shaft. These two environments in combination will make difficult the interpretation of the chemistry of the water in the Wolf Park drifts and complicate the interpretation of the existence of a deep flow path at the site.

#### Pump-back System

The pump-back system at the Cotter site has been altered considerably since Roy E. Williams' report of November 1980. The Colorado Department of Health has assisted the company by encouraging these alterations. The central objective of the alterations has been to collect seepage from individual sources and direct it to a central pumping facility via which the collected seepage now enters the new lined primary tailings pond. This greatly improved pump-back system essentially eliminates the potential for the recycling of seepage referred to in the Williams' report of November 1980. In essence the Colorado Department of Health and the company have implemented virtually all of the suggestions made in the aforementioned report.

# Diversion of Surface Runoff Around the Sand Creek Drainage

The Cotter Corporation is considering six alternative diversion systems to eliminate or minimize the rate of inflow of surface water into the Sand Creek drainage. We are uncertain as to whether or not the company has formally proposed one. Any of the six alternatives is important

to the seepage recovery operation. Surface runoff moving down the Sand Creek basin is either collected in the Soil Conservation Reservoir or it recharges the shallow ground water flow system upgradient from the reservoir. In either case it merges with the existing mill tailings pond scepage and increases the volume that must be removed ultimately by the pump-back system. If the company nursued this division strategy, the ultimate success of the pump-back system should be enhanced and the volume of water introduced into the new lined primary impoundment will be reduced also. The latter effect should increase significantly the usable life of the primary impoundment for the purpose of mill tailings disposal (its primary purpose).

## Resistivity Surveys

The feasibility of ucilizing resistivity surveys for the purpose of delineating ground water with high total dissolved solids content was discussed among the Cotter Corporation, the Colorado Department of Health and Roy E. Williams in November of 1980. Since that time, the Cotter Corporation has experimented with the use of resistivity surveys as a mechanism for achieving such delineation. The processing of data has not yet been completed, but the company reports that the results appear to be encouraging. However, it is possible that a sufficiently large number of data points will be required for eff2ctiveness that the method will not be economically feasible. If the method does prove to be feasible, the company is considering using the results of the resistivity surveys as a guide to the location of additional recovery wells in order to speed up the withdrawal of the contaminated ground water.

## Tracer Studies

Tracer studies are being evaluated as a mechanism for id stifying specific sources of seepage that contribute to the ground water contamination problem. This action is being taken via a purchase order with hydrologists from the University of Arizona. Current efforts consist of the identification of a stable tracer that will be unique to the system. Bromine is being considered at the present time. This effort is in cooperation with the Colorado Department of Health.

## Maps of Old Mine Workings

W. A. Wahler and Associates, Inc., consultants to the Cotter Corporation, have obtained and/or prepared maps of the abandoned coal mine workings in the vicinity of the Cotter Mill. These maps should prove useful in delineating potertial flow paths along which seepage might be moving. These maps also may contribute to the eventual unraveling of the background water quality data in the area. It is clear that multiple sources of discolved constituents in the ground water exist at the site. The abandoned workings conceivably could act as preferential hydraulic connections among these sources. Such sources inevitably will make difficult the accurate determination of appropriate background concentrations for the various dissolved constituents in the ground water in the vicinity of the site. This problem is one that will not be resolved easily. It will require continuing work so that the proper definition of contamination eventually can be realized.

#### Transfer of Old Tailings

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The Colorado Department of Health consistently has been a strong proponent of the expeditious transfer of the tailings from the old mill into the new lined secondary impoundment area. This transfer currently is being implemented. Most of the problems anticipated prior to the initiation of the transfer have not materialized. This is primarily a consequence of the fact that the tailings constitute a much freer draining porous medium than was predicted. Water encountered during the excavation process by mechanical equipment is drained to one or more central sumps and pumped into the new primary lined impoundment. The mechanical excavation equipment is able to operate continually as the tailings drain into the collection sumps. So called "quick" conditions have not been encountered ubiquitously. The mechanical equipment employed consists of a variety of sizes of dozers, scrapers, backhoes and trucks. Some backhoes are wheel mounted and some are track mounted. Scrapers are used to remove the dryer portions of the tailings and backhoes are used to construct ditches and load trucks. Roughly speaking, the backhoes operate in the center of the old tailings pile and the scrapers operate around the periphery. Tailings are pushed toward the periphery of the tailings pile where they are collected by scrapers and transported to the new secondary impoundment. Trucks also haul tailings directly to the new secondary impoundment after being loaded by backhoes. Small dozers push tailings toward a large track mounted backhoe that is used to load the trucks. Dust does not appear to constitute a problem during the transfer process. The moisture content of the tailings is sufficiently high to preclude eolian erosion of the soda ash rich tailings. Suppression of soda ash

rich dust on haul roads is accomplished by watering trucks. The transfer operation appears to be proceeding efficiently and the contractor is approximately two months ahead of schedule.

The transferred tailings are being emplaced in a new secondary impoundment under what appears to be conditions of optimal or near optimal compaction. The transferred tailings are being emplaced in layers by the scrapers and by a D-8 dozer with a U-shaped blade. The dozer is used to spread the tailings that are transferred by truck. Compaction of the layers spread by the dozer is being achieved by the weight of the D-8 cat. Under these conditions we predict that the volume of the secondary impoundment utilized for transfer tailings emplacement will be less than anticipated. In summary, the tailings transfer operation, precipitated by the Colorado Department of Health, is proceeding much more efficiently and expeditiously than many experts predicted.

The transfer of the tailings apparently has not yet proceeded to the point where the rate of seepage production at collection points has been reduced. We anticipate that as the transfer continues, the rate of flow of seepage collection points will begin to be reduced. This reduction should begin to occur within the next two or three months provided no unusual ground water recharge event occurs in the Sand Creek drainage prior to the installation of a diversion ditch system.

This concludes our remarks with respect to the site visit.