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SUBJECT: Review of the Ground Water Data for the Cotter Uranium Mill Site, Canon City, Colorado

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RCRA Corrective Action Program

TO: Terry Brown, Project Manger
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Per your request I have reviewed all available data and information gathered from the Colorado Department of Public Health and Environment (CDPHE) files pertaining to the ground water levels and contaminant and geochemistry for the wells in the vicinity of the Primary and Secondary Evaporation Impoundments at the Cotter facility. This evaluation was conducted as part of the RCRA Program's Off-Site Rule to determine if there was sufficient and adequate existing ground water data to make a determination that the impoundments have, or have not released contaminated liquids into the subsurface.

Comments:

The major result from the review of ground water data for the existing wells is that there are insufficient and inadequate data to make the determination that a release has or has not occurred at this point in time. Therefore, it is impossible to determine conclusively if a release has or has not occurred. There are four primary reasons for this conclusion.

First and foremost is that the existing down-gradient monitoring system is inadequate. The existing monitoring system does not contain a sufficient number wells, located in the appropriate locations, and screened at the appropriate depths to determine, with any degree of certainty that a release has or has not occurred. As stated in the May 3, 2005 Report from Cotter's consultants, (R^2 Inc.) page 17: "Cotter has established a point of compliance (Well 003) which is down-gradient of the impoundment and is currently monitoring the system in accordance with a State approved program." Page 20 goes on to state "The Part 18 Point of Compliance as approved was located down-gradient of the impoundment, completed in the uppermost aquifer of the Poison Canyon formation and Quaternary Alluvium – five wells include 371, 372, 003, 024, and 808." There are some inaccuracies with the statement that these wells are all down-gradient monitoring wells, located down-gradient of the impoundment. The location of well 024 is clearly up-gradient of the impoundments and thus should not be described, nor included as part of the down-gradient monitoring well network. Well 808 is

cross-gradient of the impoundments and thus should also not be considered a down-gradient monitoring well. Depending on the temporal variations in ground water flow direction, well 371 may be either cross-gradient or down-gradient, and thus should also not be considered a down-gradient well in all instances. Well 003 and 372 appear to be the only wells located in the down-gradient direction (as depicted on the Ground Water Potentiometric Map included in the March 2005 R^2 Inc. report). However, the locations of these wells pose a problem with regard to their distance from the impoundment. Well 003 is approximately 500 feet from the base of the toe of the Primary impoundment, well 372 is approximately 1000 feet away. In addition, well 371 is approximately 1200 feet away and is located in the area of the former ponds, where the subsurface was contaminated.

A typical monitoring system for an impoundment of this size (154 acres) would include a significantly greater number of monitoring wells located around the down-gradient perimeter of the unit, and screened at appropriate depths to take into consideration the temporal and spatial variations in ground water flow direction, both vertically and horizontally. Ground water monitoring systems must be designed with particular regard given to the site hydrogeology, contaminant characteristics, and the regulated unit size and design. The current monitoring system is comprised of only two, and possibly three down-gradient wells. For a 154 acre unit, that is an insufficient number of wells for an adequate monitoring system.

Another very important factor in designing a monitoring well network in this type of geologic environment is that the ground water flow may be predominantly through preferential flowpaths via fractures. Therefore, in addition to having wells screened in the unconsolidated material above the bedrock, monitoring well wells would need to be located and screened where the preferential pathways exist. The existing monitoring wells are screened only in the unconsolidated material and there is no indication that they were located with regard to any preferential flowpaths.

The second point is that, even though there are several wells located on the facility where ground water elevation data has been collected, and could have been used to collect long-term ground water elevation data, they have not been used in that capacity. Many of those wells were installed and monitored as part of projects designed to evaluate various remediation alternatives (soil flushing with injection and removal wells, infiltration galleries, gradient control methods, etc.). As such they were only operated for the duration of time needed to assess the efficacy of the technology, and the data was collected during the period of operation for those systems, does not represent steady-state equilibrium conditions with regard to the impoundments and thus is rendered inappropriate for the purpose of determining if a release has or has not occurred from the impoundments. Even though ground water elevation data were collected during the operational period for those projects, it can not be used to determine if a release has, or has not occurred from the impoundments due to the fact that during the time of operation, the natural ground water system was perturbed.

A third concern is that there has never been an adequate determination of the site-wide ground water flow patterns. Therefore, there is no historical database depicting the variation in temporal and spatial flow patterns across the entire facility. That information is needed in order

to determine how the ground water flow in the vicinity of the impoundments fits within the overall flow pattern(s) across the entire facility, and in order to assist in the development of an adequate ground water monitoring system.

The fourth point relates to the under-drains 710, 711, and 712, which were completed as french-drains to intercept and drain the "springs" that were encountered when the unconsolidated overburden was removed to bedrock, prior to installation of the clay liner, should not be considered as viable and appropriate monitoring points for determining if a release has, or has not occurred. While it is possible that they could yield valuable information to determine if a release has occurred, that would only be the case if the release occurred where it was intercepted by the french-drain. If the release occurred outside the zone of capture of the french-drain, then it would not be detected by it. In addition, since the french-drains theoretically intercept non-contaminated, "clean" ground water that migrates vertically upwards under artesian conditions, then it could dilute a release to such a degree to render it non-detectable at the point of sample collection (end of the discharge pipe). Monitoring the discharge points 710, 711, and 712 should continue, however, they should not be considered as reliable monitoring points for determining if a release has or has not occurred.

Current Activities:

In light of the deficiencies with the current ground water monitoring system around the impoundments, as well as site-wide, CDPHE has requested that Cotter implement a program to determine the ground water flow patterns across the entire site. This project includes the collection of ground water levels over a period of a year, collected quarterly from existing and recently installed wells. The first measurements were collected mid-summer 2005, with the second scheduled for fall 2005. Also at the request of CDPHE, Cotter is conducting a geophysical survey around the down-gradient perimeter of the Primary and Secondary Impoundments to determine the presence or absence of preferential flowpaths. The results of that survey will aid in determining where to install new ground water monitoring wells around the perimeter on the impoundments. The geophysical survey is scheduled to be completed in the fall 2005. These activities are necessary in order to obtain the data needed to design, install, and operate an adequate ground water monitoring system.

Conclusions and Recommendations:

At the present time, there are insufficient ground water monitoring data to determine if a release of liquids from the Primary and Secondary Impoundments has, or has not occurred. This is due to the inadequacy of the current monitoring well network. In order to rectify this problem, additional ground water monitoring wells must be installed, at the appropriate locations, and screened at the appropriate depths around the down-gradient perimeter of the impoundments so as to develop an adequate monitoring system. At the request of CDPHE, Cotter has begun the process of determining where those wells should be placed. Since it is impossible to make a determination if a release has, or has not occurred at this time, EPA will need to defer making this determination until an adequate ground water monitoring system has been installed around the impoundments.