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February 14, 2013

Steve Tarlton
Radiation Management Unit
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South, Denver, CO 80246

Via email to: cdphe_tenormpolicyrevision@state.co.us, steve.tarlton@state.co.us, tony.waldron@state.co.us

Cc: Tony Waldron, Minerals Supervisor, Division of Reclamation, Mining and Safety

Re: Interim Policy and Guidance for Pending Rulemaking for Control and Disposition of Technologically-Enhanced Naturally Occurring Radioactive Materials in Colorado

Dear Mr Tarlton,

Thank you for the opportunity to submit these comments on the Department’s efforts to update its policies with regard to addressing technologically enhanced naturally occurring radioactive materials. We applaud the Department’s efforts to revise its TENORM guidance to help ensure that the public is protected from radioactive exposure beyond background levels for environmental radiation.

In its review of the findings made by the National Academy of Sciences regarding TENORM, the U.S. Environmental Protection Agency has clarified that “TENORM is material containing radionuclides that are present naturally in rocks, soils, water, and minerals and that have become concentrated and/or exposed to the accessible environment as a result of human activities such as manufacturing, water treatment, or mining operations.”\(^1\) EPA further confirmed the need to address this issue with respect to mining operations in recognizing that “large quantities of

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TENORM are currently undisposed and may be found in many of the thousands of abandoned mine sites around the nation.”

The Department has proposed establishing an annual exposure limit of 25 millirem to the public from radioactive materials. In 1997, EPA guidance established 15 millirem per year as a “protective and achievable” remediation standard suitable for CERCLA sites. The EPA’s recommendation should be incorporated into the Department’s TENORM guidance because it is more protective of public health and the environment.

In Colorado, mining operations and mined land reclamation activities are principally regulated by the Colorado Division of Reclamation, Mining and Safety. Despite this regulatory program, there is little evidence that protection against TENORM exposure is a focus of DRMS oversight of mined land reclamation activities. As such, to assist DRMS’ ongoing regulation of these mines until TENORM-specific regulations are adopted by EPA or Colorado, the Department should include mine wastes that contain radioactive materials under its TENORM guidance and should develop specific guidance for how TENORM in mining waste is handled, disposed and reclaimed.

Under current practices at state and federal levels, radioactive wastes generated from hardrock mining activities largely escape the oversight and attention of regulatory agencies and enjoy a general exemption from standards that would otherwise govern their handling and disposal. This issue is discussed in the EPA TENORM Report, in which EPA reiterates the finding of the National Academy of Sciences committee that “federal regulation of TENORM is fragmentary, and many potentially important sources of public exposure to TENORM are not regulated by any federal agency.” The Department’s guidance should identify existing authorities and develop specific mechanisms for how to address radiation protection requirements and prevent the migration of contaminants from mining sites that are specific to mining operations in Colorado.

Radioactive materials may be present in hardrock mining waste in any commodity, not just uranium. In Colorado, radioactive waste can potentially be generated by mining deposits of potash, phosphates, oil shale, nahcolite, gypsum, thorium, rare earths, copper and precious metals, among others, depending on the site-specific geology and location of the ore body. With the exception of thorium and phosphates, mining companies are currently engaged in the exploration, development, closure or reclamation of all these types of deposits in Colorado. (Coal deposits are also bear radionuclides.) In the future, any of these deposits could result in a mining

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2 Ibid, p. 5.


4 These activities are regulated under C.R.S. §§ 34-32-101, et seq. (Colorado Mined Land Reclamation Act).

operation that generates TENORM mining waste, despite the fact that the mine’s commodity might not be uranium and the radioactive waste material will be handled simply as hardrock mining waste.

In Colorado, the standard practice is to impound waste rock permanently at mining sites after closure, to recontour if necessary to stabilize the pile, to replace any reserved topsoil, and to revegetate the surface with native grasses and shrubs. However, these practices do not regularly account for radioactive TENORM contamination or exposure, even where the reclaimed lands are publicly accessible for such activities as camping, hiking, hunting or other public uses that may enable prolonged exposure to people.

As currently implemented under Colorado’s Mined Land Reclamation Act, a mining company is not explicitly required to document the baseline radiological conditions of a mine’s surface areas prior to mining. Nor is a company required to return the surface to baseline radioactivity once mining is finished, regardless of whether TENORM material is permanently buried on site. The Department’s guidance should identify ways this problem can be addressed within current statutes and permitting authority. The presence of TENORM in non-uranium mine wastes is not necessarily disclosed or addressed in permitting documents. As a result, the problems documented by the National Academy of Sciences and EPA is neither widely known nor understood by citizens and public officials.

Although TENORM in mining wastes are not exclusive to uranium mining, the continued lack of attention to the problem of the permanent disposal of radioactive wastes at uranium mine sites should be of significant concern in the Department’s review of its guidance. The unmitigated presence of radioactive waste at existing uranium mines remains an outstanding problem of public concern. A preliminary release of a Department of Energy inventory of uranium mines in Colorado that were connected to the federal government’s nuclear development program identifies at least 1,518 uranium mines in the state, the highest number in the nation. A 2006 inventory conducted by EPA identified a state database listing 3,491 uranium-related sites in Colorado. In 2007, EPA also compiled an estimate of the number of people who live in close proximity to uranium mines and bear the highest risk for prolonged exposure to offsite radionuclide migration. The more conservative of these population estimates counted 33,191 Coloradans living in a one-mile radius of a uranium mine and 518,357 Coloradans living within five miles of a uranium mine.

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The vast majority of these mines have never been reclaimed under any standards and exhibit exposed piles of radioactive waste rock on site. Collectively, these uranium mines represent a significant impact to the watersheds where they are located and can be expected to routinely generate radioactive airborne dust pollution, create groundwater contamination risks, and generate the migration of radionuclides from surface water flows and erosion. For example, Colorado has documented 56 abandoned uranium mines in Fremont County; nearly all are open pits with typical features such as overburden piles that contain TENORM. As many as a thousand abandoned uranium mines are concentrated in the Dolores-San Miguel watershed, where a commonplace mining technique attributable to the area’s geologic features was to dump spoils in long tails from the “rimrock” directly into the creek canyons below, dispersing waste broadly and permanently leaving it behind. Other concentrated areas with abandoned uranium mines include Jefferson, Gunnison, Boulder, Clear Creek, Saguache and Moffat counties.

A number of these sites continue to be the subject of economic speculation by mining companies and periodically are targeted for redevelopment and renewed mining activities, at which time, new permit areas are specifically drawn to exclude waste rock piles deposited on site during earlier periods of mining. These waste rock piles bear uranium and radioactive daughter products but, because of permit boundary gerrymandering, are often allowed to remain untouched as new mining operations spring up beside them. As a result, workers face higher levels of radon gas and alpha-radiation on the surface, where their exposure is not routinely measured and is not adequately regulated as an occupational safety hazard. In fact, DRMS is currently reviewing a mining permit application that includes this exact situation at the Liberty Mine in Mesa County, where the proposed boundary permits for reopening what was previously an abandoned uranium mine have specifically been drawn to exclude pre-existing mining features and where elevated radioactivity on the site’s surface have been recorded.10

In addition to the problem of disposing of TENORM waste in widely dispersed, unregulated and permanent surface waste piles, it is the practice at some uranium mines on the Western Slope to gob the waste rock back into the underground workings once mining is completed.11 This results in the permanent placement of TENORM waste material into exposed geologic areas underground that have the potential to contaminate ground water supplies. This waste disposal method can provide some benefit by reducing the amount of radioactive waste on the surface but experiences little scrutiny or regulatory oversight in practice, despite the questionable outcomes for water quality. Once the mine workings are filled and closed, it is impossible to accurately monitor the condition of the waste material, and current regulatory practices do not require ongoing ground water monitoring to confirm whether or not the mine wastes are stable or have mobilized after being deposited underground.

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10 Pending Liberty Mine 110-d limited impact mine application, submitted by Liberty Mining LLC. DRMS Permit No. M-2013-70. Mine file is accessible online at http://drmsweblink.state.co.us/drmsweblink/search.aspx?dbid=0.

11 Underground waste rock at mining operations is identified as TENORM by EPA in the EPA TENORM Report, p. 2-7.
Likewise, the handling of uranium-bearing waste rock at mining sites is also done without special regard for the radioactive nature of the material. It was the custom for decades to simply dump it on the ground and leave it in place, resulting in the downgradient infiltration of radionuclides — especially uranium, radium, and thorium — from the waste into ground and surface waters. EPA studies of waste pile samples from uranium mines demonstrated higher levels of radium closer to the tops of piles, suggesting that uranium migrates toward the bottom and increases the risk of groundwater contamination.\textsuperscript{12} Such conditions persist unmonitored and unregulated at hundreds of uranium mining sites in Colorado.

The guidance should identify existing mechanisms to address these unmitigated wastes. A couple examples illuminate this problem:

As mine permits for current, existing uranium mines are slowly updated and amended, new waste rock piles are sometimes designed to be placed on a thin clay pad. Over time, a waste rock pile over 10,000 tons for even a small uranium mine will develop on top of the pad, posing longterm concern for water quality. The pile will release airborne radioactive particles and precipitation will erode materials from the surface. Once the pile is revegetated during final closure of the mine, its radioactivity is unregulated into the future, despite the fact that it may have levels of radioactivity far above the background or original levels of the unmined site. The guidance should identify opportunities for DRMS to update these mine permits and require increased protections for the environment.

Another example of the unmitigated radiological impacts of mining activities is disclosed in gamma surveys of three reclaimed uranium mines operated by the Cotter Corporation. The surveys were submitted to DRMS by the company during the updating of the mines’ environmental protection plans as a means to document current site conditions and establish the existing baseline (not background) radioactivity. All three of the mines are considered to be fully “reclaimed,” with work completed at the mines a decade ago. The reclamation plans in place for the mines required that the mine portals be closed with gates that allow bats to enter and that the waste piles be stabilized and revegetated on site.

Approximately 10 years after the reclamation work was completed, however, each site exhibits elevated gamma radioactivity, an indication of elevated levels of radium in the soil. At the SR-13A site, readings were recorded up to 287 microrem per hour; at the LP-21 site, readings showed 316 microrem per hour; and at the CM-25 site, readings were recorded at 531 microrem per hour. [Please see attached survey documents.] Lower radioactivity readings were recorded on public access roads into the reclaimed mine sites, which are located on public lands. Notably, each gamma survey clearly shows the offsite migration of radioactive materials beyond the mine’s formal permit boundaries. Even though these mines are jointly regulated by DRMS, the Bureau of Land Management and the Department of Energy, none of these agencies is requiring

\textsuperscript{12} EPA TENORM Report, p. 3-22.
that any mitigation actions be taken to return the sites to their natural condition, with normal background levels of radioactivity. The documented radioactive contamination at these sites is attributable to the presence of unregulated TENORM mining wastes disposed on site. Colorado’s mining law requires that once mining is done, the land be reclaimed and returned to “beneficial public use,” yet that is not what occurs in practice.

EPA’s standards provide a helpful place to start in considering how to address unregulated TENORM waste at mining sites. EPA guidance establishes an action level of 5 picocuries per gram above background for the presence of radium in soil at decommissioning uranium mills. The Department’s new guidance should provide similar action levels for the DRMS to carry out under its existing authorities to better ensure protection of public health and environment. Because the 5 pC/g standard is set for uranium processing sites, where higher radioactive levels at decommissioned sites are not as easily mitigated as they are at mining sites, a lower soil standard for radium should be developed for mines, regardless of commodity. The goal should be to return surface conditions to background radiation levels once mining is complete, and in many cases, this is easily achievable with improved reclamation standards and effective guidance that addresses TENORM waste.

Although actual, enforceable TENORM regulations would address the problem better than non-binding guidance and informal consultation between staff, these comments are limited to the Department’s proposal to adopt new guidance. Similarly, by taking a case-by-case approach outlined in the guidance, there is a risk that the Department’s budget and fee collection from licensees will not provide sufficient staff resources to consult with DRMS during permitting, and with federal agencies preparing NEPA analyses. Where the Department has previously reported inadequate staff to address its existing oversight of radiation licensing, there is a danger that sufficient staff resources will not exist to address TENORM issues on a case-by-case basis.

When considering the appropriate levels to which TENORM and radioactive mining wastes should be regulated, the Department should incorporate as policy current legal requirements, including the Mined Land Reclamation Act’s intent that mined lands can and must be returned to their background radiation levels by means of adequate reclamation requirements.

Generic guidance sought by the regulated industries hides current knowledge and work on TENORM regulation. Known problems require guidance that focuses on specific processes, industries and specific types of waste. A specific, mining-focused guidance is in line with the recommendation of the National Academy of Sciences committee and EPA recommendations of creating specific arenas for regulatory oversight, due to the difficulties of comprehensively addressing all TENORM issues on a national scale. The safest choice for both public health and the environment is to require reclamation standards that fully mitigate increased radioactivity at mining sites and return them to background levels. There is no such explicit requirement currently in place. The guidance should identify opportunities to move toward the goal of reclamation that not only returns native vegetation and contours that existed before mining, but that also removes radiological contamination that did not exist before mining.
We look forward to the opportunity to discuss these comments with the Department and DRMS in the future.

Respectfully submitted,

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Respectfully,

The number shown below, if you have any questions or concerns regarding the information submitted, please call me.

The highest reading noted in reviewing the radiometric scan data was 316 Bq/m³.

Altered are two copies of Colorado Corporation (N.S.L.)'s Revised Radiometric Survey.

Mr. Cagle.

RE: LP-21 Response to Radiometric Survey Changes

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Grand Junction Field Office
Colorado Division of Radiation Protection and Safety

May 1, 2013

RECEIVED