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MASTER

SANDIA'S ACTIVITIES IN URANIUM MILL TAILINGS REMEDIAL ACTION

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The Uranium Mill Tailings Radiation Control Act of 1978 requires that remedial action be taken at over 20 inactive uranium mill tailings sites in the United States. Standards promulgated by the EPA under this act are to be the operative standards for this activity. Proposed standards were released this spring. They must still undergo internal review, public comment, and receive Nuclear Regulatory Commission concurrence before being finalized. The proposed standards, however, do give us a general idea of what will be required.

Briefly reviewed, the standards deal separately with new disposal sites (Part A) and cleanup of soil and contaminated structures at existing locations (Part B). In several cases, the present sites are felt to be too close to human habitations or to be otherwise unacceptably located. These tailings will probably be relocated. New disposal sites for relocated tailings must satisfy certain standards. The salient features of these standards (Part A) are summarized below. The flux of radon-222 from new disposal sites may not exceed 2 pCi/m^2-sec. Limits are placed on the concentrations of certain tailings-derived substances in underground drinking-water sources (see Table 1). For already-contaminated sources, no further degradation is permitted. The drinking-water standards apply at (1) distances more than 1.0 km from inactive (old) processing sites; and (2) distances more than 100 meters from new disposal sites. Any mixing of tailings-derived materials with surface waters used by the public is prohibited. Public use includes traversing and entering or use as a food source, e.g., fishing.

There should be a reasonable expectation that the standards will hold for at least 1000 years.

The second part (Part B), which deals with cleanup of open lands and contaminated structures, imposes the following limits.

a. The average concentration of radium-226 attributable to residual radioactive material in any 5-cm thickness of soil within one foot of the surface, or in any 15-cm thickness below one foot, shall not exceed 5 pCi/gm.

b. The levels of radioactivity in any occupied or occupiable building shall not exceed specified values (Table 2).

c. The cumulative lifetime radiation-dose-equivalent to any body organ of a maximally exposed individual resulting from residual radioactive materials shall not exceed the maximum dose which could occur from Ra-226 and its decay products under a. and b. above.

Criteria for exceptions are also discussed (part C). Of special interest to this workshop is the fact that these include circumstances where there may be an unfavorable balance between the environmental harm resulting from attempts to satisfy cleanup requirements and the environmental and health benefits that would result from implementing the standards.

Sandia National Laboratories in Albuquerque, New Mexico has, at the request of the Department of Energy (DOE), initiated work on engineering and environmental aspects of the clean-up effort. This program, part of the Uranium Mill Tailings Remedial Action Program (UMTRAP), is administered by DOE's Albuquerque Operations Office in liaison with technical personnel from Sandia.

Any proposed actions under the UMTRAP must satisfy the EPA standards; they also must conform to the requirements of the National Environmental Policy Act (NEPA). Actual work may not be initiated, however, until interim standards at least are promulgated in the Federal Register. Only Parts B and C of the proposed standards have been elevated to the status of interim standards by publication in the Federal Register on April 22 of this year. Presumably, Part A will receive similar recognition in the near future.

Because UMTRAP is in its formative stages, this workshop is most timely since it provides us with an early opportunity to explore those areas in which FWS involvement can aid this program.

The inactive tailings sites are scattered across nine western states and Pennsylvania. Site-specific factors require that each be considered separately. Preliminary environmental assessments are available for all but three sites. One of these, Belfield, ND, is no longer being considered.

The highest priority has been assigned to the following sites: Durango, Colorado; Salt Lake City, Utah; Shiprock, New Mexico; and Canonsburg, Pennsylvania. They are unacceptably close to human dwellings or are located in areas with undesirable geophysical or hydrological characteristics. These tailings must be moved to new locations. The tailings will be stabilized in place at most of the remaining sites.

Where tailings must be relocated, the candidate alternate sites must satisfy certain geophysical, hydrological, and meteorological criteria. For example, alternate sites should be in areas of low seismicity and low flood potential. It is necessary but not sufficient for an alternate site to be geologically suitable.

Environmental impact studies at these sites must consider not only the direct impacts of relocation efforts at present and proposed sites, but also land-use policies, socio-economics factors, the impacts of borrow pit and roadway construction , etc.

A vital part of these studies, of course, is consideration of potential effects on fish and wildlife and mitigating actions to restore or improve unavoidably affected habitats.

Obviously, the presence of rare, threatened, or endangered species or critical habitats is a factor in the site-selection process. The FWS should be consulted as early as possible in order to minimize the amount of time and money spent on site characterization at locations that turn out to be unsuitable because critical populations or habitats would be affected. Nearby sites for borrow pits, sources of rip-rap, and roadways should be screened in a similar manner. We realize that some areas, particularly at the more remote locations, are not well mapped in terms of wildlife resources. Input from FWS as to what areas in their judgment require more detailed data than are now available would be a valuable aid to expediting this program.

Borrow pits, other disturbed areas at the relocation sites, and the former tailings sites themselves must all be reclaimed after the relocation operations are completed. Again, input from the FWS as to revegetation options that could create beneficial habitats would be useful to our efforts.

Similar disturbances will occur at those tailings sites which will be stabilized in place. It is now planned that rip-rap rather than soil cover will be used. Because the proposed EPA standards require that site integrity be maintained for 1000 years, the use of soil cover was rejected. Deep-rooted plants such as mesquite that could become established on soil cover might penetrate to the level of the tailings in less than 1000 years and establish pathways through which radon could travel to the surface and cause higher than permissable rates of release. The use of rip-rap should reduce the chance of this sort of breach by making the establishment of vegetation difficult and should also minimize wind erosion. There will undoubtedly be soil deposition in the rip-rap and ultimate natural revegetation within the 1000-year period. It is expected, however, that plants with shallow root systems would predominate. The rip-rap itself should provide habitat for small mammals, lizards, and other reptiles. By increasing run-off to immediately adjacent soils, the rip-rap should have a highly localized perimeter effect on the surrounding vegetation.

Until in situ stabilization efforts are initiated, steps should be taken to prevent incursions by local wildlife in the interim. Ten tailings sites are presently unfenced, and none of the fenced locations effectively exclude many forms of wildlife. We feel that a primary area for FWS initiatives is the testing and/or development of wildlife-proof fences that could satisfy the need for interim site isolation. A related problem for which there is not at present a satisfactory solution is that of waterfowl and other birds visiting the ponds that form on or near many tailings piles.

The whole question of contamination of wildlife and domestic animals that have access to tailings is one for which few data are available. Conservative estimates would indicate that the overall problem is not severe. However, burrowing animals that establish themselves in or near tailings piles may be at higher risk than other wildlife. The potential exists among this group and their predators for the accumulation of toxic levels of tailings-derived heavy metals either directly or through the food chain. Given the relatively short life-spans of most small mammals and herptiles, nonradiological toxicity may be a more significant problem than that of radon inhalation or other radiation exposure. The chemical makeup of tailings varies from site to site according to the type of processing and chemical characteristics of the original ore-bearing rock. The FWS may be interested in initiating surveys at unfenced sites prior to their stabilization in order to establish a "worst-case" baseline. Such data could conceivably be useful to future monitoring efforts at active sites. For example, a study of deer mice (Perognathus manuculatus) and Ord's kangaroo rat (Didodomys ordii) living in dry radioactive leaching ponds at the Idaho National Engineering Laboratory in southeastern Idaho was conducted in 1978.[1] Captured animals were surgically implanted with lithium fluoride thermoluminescent dosimeter chips (TLD's) Approximately 65% were recaptured at an average of 11 days after release. Mean dose rates to the animals were significantly greater than dose rates to animals in control plots. Deer mice received higher doses than kangaroo rats: 160 ± 162 mrem/day (range 7-982) versus 6 ± 7 mrem/day (range 0-160). This was attributed to habitat preferences. Deer mice tended to prefer the gravelly pond bed, where the highest air-exposure rates (approximately 2050 mR/day) were measured. Kangaroo rats tended to remain near the more densely vegetated pond banks. Although dose rates to these animals were several times lower than air-exposure rates, further studies of possible physiological effects are being carried out. Similar studies at tailings sites are likely to yield equally interesting data.

[1]Halford, D. K. and O. D. Markham, 1978. Radiation Dosimetry of Small Mammals Inhabiting a Liquid Radioactive Waste Disposal Area. Ecology 59: 1047-1054.

Table 1

Permissible Concentrations of Tailings-Derived Substances

Arsenic	0.05	milligram/liter
Barium	1.0	milligram/liter
Cadmium	0.01	milligram/liter
Chromium	0.05	milligram/liter
Lead	0.05	milligram/liter
Mercury	0.002	milligram/liter
Molybdenum	0.05	milligram/liter
Nitrate nitrogen	10.0	milligram/liter
Selenium	0.01	milligram/liter
Silver	0.05	milligram/liter
Combined radium-226 and radium-228	5.0	pCi/liter
Gross alpha particle activity (including radium-226 but excluding radon and uranium	15.0	pCi/liter
Uranium	10.0	pCi/liter

Table 2

Average Annual Indoor Radon Decay Product Concentration (including background)	0.015 WL
Indoor Gamma Radiation (above background)	0.02 milliroentgens/hour