

conditioning. These uses are inappropriate, because the radioactive and toxic constituents of tailings may elevate indoor radon levels, expose people to gamma radiation, and leach into ground and surface waters.

Most of the mills are now inactive and many of the sites were abandoned. These abandoned sites are being remediated under Title I of UMTRCA. Congress designated 22 specific inactive sites in Title I of UMTRCA, and the DOE subsequently added two more. Most remaining uranium mill tailings sites are regulated by the NRC or States and will be reclaimed under Title II of UMTRCA. (DOE also owns one inactive site at Monticello, Utah, that is not included under UMTRCA). The Title I sites are located in the West, predominantly in arid areas, except for a single site at Canonsburg, Pennsylvania. Before disposal operations began, tailings piles at the inactive sites ranged in area from 5 to 150 acres and in height from only a few feet to as much as 230 feet. The amount at each site ranges from residual contamination to 2.7 million tons of tailings. The 24 designated Title I sites combined contain about 26 million tons of tailings covering a total of about 1000 acres.

Under the provisions of Title I of UMTRCA, the DOE is responsible for the disposal of tailings at these sites, which will then be licensed to DOE by NRC for long term surveillance and maintenance, following NRC approval of the remediation. In addition, tailings that were dispersed from the piles by natural forces or that have been removed for use in or around buildings or on land are being retrieved and replaced on the tailings piles prior to their disposal.

UMTRCA, as originally enacted, required that DOE complete all these remedial actions within 7 years of the effective date of EPA's standards, that is, by March 5, 1990. At the end of 1993 disposal actions had been completed at ten sites: Canonsburg, Pennsylvania, one of two sites in areas of high precipitation (Falls City, Texas is the other); Shiprock, New Mexico; Salt Lake City, Utah; Lakeview, Oregon; Green River, Utah; Spook and Riverton, Wyoming; Lowman, Idaho; Tuba City, Arizona; and Durango, Colorado. Disposal actions were well advanced at eight other sites: Rifle (two piles), Grand Junction, and Gunnison, Colorado; Monument Valley, Arizona; Mexican Hat, Utah; Falls City, Texas; and Ambrosia Lake, New Mexico. The remaining sites are in the advanced stages of planning and should be under construction within the next two years.

In view of the rate of progress with remedial work, Congress in 1988 extended the completion date for disposal and most cleanup activities until September 30, 1994, and provided further " * * * that the authority of the Secretary to perform groundwater restoration activities under this title is without limitation." (Uranium Mill Tailings Remedial Action Amendments Act of 1988, P.L. 100-616, November 5, 1988; 42 U.S.C. 7916). Section 1031 of the Energy Policy Act of 1992 further extended the completion date for UMTRCA surface stabilization (disposal) activities to September 30, 1996.

The most important hazardous constituent of uranium mill tailings is radium, which is radioactive. Other potentially hazardous substances in tailings piles include arsenic, molybdenum, selenium, uranium, and, usually in lesser amounts, a variety of other toxic substances. The concentrations of these materials in tailings vary from pile to pile, ranging from 2 to more than 100 times local background soil concentrations. A variety of organics is also known to have been used at these sites.

Exposure to radioactive and toxic substances may cause cancer and other diseases, as well as genetic damage and teratogenic effects. Tailings pose a risk to health because: (1) Radium in tailings decays into radon, a gaseous radioactive element which is easily transported in air and the radioactive decay products of which may lodge in the lungs; (2) individuals may be directly exposed to gamma radiation from the radioactivity in tailings; and (3) radioactive and toxic substances from tailings may leach into water and then be ingested with food or water, or inhaled following aeration. It is the last of these hazards that is primarily addressed here. (Although radon from radium in groundwater is unlikely to pose a substantial hazard at these locations, these standards also address that potential hazard.) The other hazards are covered by existing provisions of 40 CFR part 192.

EPA's technical analysis was based on detailed reports for 14 of the 24 inactive uranium mill tailings sites that had been developed by late 1988 for the Department of Energy by its contractors. Preliminary data for the balance of the sites were also examined. Those data showed that the volumes of contaminated water in aquifers at the 24 sites range from a few tens of millions of gallons to 4 billion gallons. In a few instances mill effluent was apparently the sole source of this groundwater. Each of the 14 sites examined in detail had at least some groundwater

contamination beneath and/or beyond the site. In some cases the groundwater upgradient of the pile already exceeded EPA drinking water standards for one or more contaminants due to mineralization sources or due to anthropogenic sources other than the uranium milling activities, thus making it unsuitable for use as drinking water without treatment and, in some extreme cases, for most other purposes before it was contaminated by effluent from the mill. Some contaminants from the tailings piles are moving offsite quickly and others are moving slowly. The time for natural flushing of the contaminated portions of these aquifers was estimated to vary from a couple of years to many hundreds of years. Active restoration was estimated to take from less than 5 years at most sites to approximately 50 years at one site.

DOE currently estimates that there is approximately 4.7 billion gallons of contaminated water, but this estimate does not include all sites. One site, Lowman, Idaho, shows no sign of contamination related to the processing activities, while the site with the largest amount of contamination, Monument Valley, Arizona, has an estimated 0.75 billion gallons of contaminated water. The DOE estimate does not include those sites where current assessments indicate that supplemental standards should be applied, because contamination at these sites has been hard to quantify.

Contaminants that have been identified in the groundwater downgradient from a majority of the sites include uranium, sulfate, iron, manganese, nitrate, chloride, molybdenum, selenium, and total dissolved solids. Radium, arsenic, fluoride, sulfide, chromium, cadmium, vanadium, lead, and copper have also been found in the groundwater at one or more sites.

UMTRCA requires that the standards established under Title I provide protection that is consistent, to the maximum extent practicable, with the requirements of RCRA. In this regard, regulations established by EPA for hazardous waste disposal sites under RCRA provide for the specification of a groundwater protection standard for each waste management area in the facility permit (see 40 CFR part 264, subpart F). The groundwater protection standard includes a list of specific hazardous constituents relevant to each waste management area, a concentration limit for each hazardous constituent, the point of compliance, and the compliance period. The subpart F regulations specify that the concentration limits may be set at