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RESEARCH REPORT

Institutional Controls Case Study: Grand Junction

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INSTITUTIONAL CONTROLS CASE STUDY: GRAND JUNCTION

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Executive Summary

The Climax Uranium Company processed uranium ore on the banks of the Colorado River in Grand Junction, Colorado from 1951 until 1970. As a result of its operations, the mill produced 2.2 million tons of tailings, most of which were deposited in an on-site tailings pile that covered approximately 114 acres. Approximately 300,000 tons of tailings were, however, removed from the site and used as construction and fill material throughout the Grand Junction area. The City of Grand Junction used the tailings as fill when installing sewer and water lines, and businesses and homeowners used tailings as fill during construction. These, and other sites where tailings were used for construction or deposited through erosion, are known as vicinity properties (VPs). Uranium mill tailings emit radon gas, which presents a risk to human health.

Congress provided for the remediation of uranium mills and their associated tailings in the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978. The statute provides for certain institutional controls, including Department of Energy ownership and management of tailings disposal sites and annotation of land records or similar notification to prospective purchasers of mill sites. The statute also authorizes the U.S. Environmental Protection Agency to set standards to govern the cleanup of mill sites and the associated vicinity properties. These regulations include requirements for institutional controls if natural flushing is chosen as the remedy for contaminated groundwater.

Institutional controls have been part of the UMTRA program from the start, of which some are currently being implemented. The City of Grand Junction has worked with the Department of Energy and the Colorado Department of Public Health and Environment (CDPHE) to develop institutional controls to protect the health and safety of its workers who may encounter tailings that have been allowed to remain as fill associated with sewer, water and other utilities. The Department of Energy has created a database of all sites that were included in the UMTRA project in Grand Junction. The City is using information from this database in integrating its maps of utilities with maps showing the location of known tailings. The State has included restrictions, including restrictions on the use of groundwater, in the deed to the Climax Mill site that it has transferred to the City. Other institutional controls, particularly the statutory requirement of annotation of land records or other form of notice, have met resistance and have not yet been implemented.

The State, DOE, real estate professionals, lenders and property owners have opposed annotating land records of vicinity properties. They assert that annotating land records of properties that have been cleaned up to meet EPA's standards will unnecessarily and unfairly reduce property values without providing any benefit. The statute appears to not adequately distinguish between sites where institutional controls

are unnecessary because the hazardous substances have been removed and sites where institutional controls may be necessary to protect human health and the environment because radioactive materials that may present a risk have been left in place.

The voluntary nature of the UMTRA program has resulted in anomalous gaps in the protection against future risks provided by institutional controls. The database of vicinity properties prepared by DOE contains substantial information about any tailings left in place at sites cleaned up under the program. It contains no information, however, about tailings at properties whose owners refused to be evaluated or cleaned up under the program. This means that there will be no records to show where the potentially highest risks are located, while properties where no risk remains, because all tailings were removed, will be extensively documented.

The process for developing and implementing institutional controls has been ad hoc, with the groundwater and surface cleanup programs within the Grand Junction Office of DOE acting independently of each other and with little consultation with the other affected entities. Similarly, the State, NRC, and City of Grand Junction have, for the most part, developed policies internally, with relatively little interaction among themselves or with DOE. This uncoordinated process has resulted in uncertainty about what institutional controls would be implemented and by which entities. It has also precluded the development of a comprehensive program to implement appropriate institutional controls that will protect the public from risks where they remain. The public generally has not been concerned about the risks associated with tailings. As a result, public involvement in the UMTRA project, including development of institutional controls, has been low.

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Introduction

From the beginning of the Manhattan Project through the 1960s, much of the uranium ore mined in the United States was processed by private companies under contract to the federal government for use by the agencies responsible for manufacturing nuclear weapons. When government demand for uranium declined, the contracts terminated, and the uranium processing mills shut down, leaving large piles of uranium tailings at the mill sites. Tailings are a sand-like waste product of the uranium milling process, which contain 85 percent of the radioactivity present in unprocessed uranium ore. The principal health risk associated with tailings is exposure to radon gas, a radioactive decay product of radium that is naturally present in the tailings. There are about fifty of these uranium mill tailings sites in the country.

In 1978, Congress formally recognized the risks associated with closed uranium mill sites and their tailings by passing the Uranium Mill Tailings Radiation Control Act (UMTRCA) (Pub. L. 95-604). Title I of UMTRCA authorizes the U.S. Department of Energy (DOE) to clean up 24 of these sites to meet standards set by the U.S. Environmental Protection Agency (EPA) with the concurrence of the U.S. Nuclear Regulatory Commission (NRC). These Title I sites typically sold almost all of their uranium output to the U.S. government. The federal government provides 90 percent of the financing for these cleanups, with ten percent provided by the affected state, except that the federal government pays the entire cost of remediating four sites located on tribal lands. The cleanups are administered by the Uranium Mill Tailings Remedial Action (UMTRA) Project Office of the Department of Energy, located in Albuquerque, New Mexico. The UMTRCA was reauthorized and extended in 1996 by Pub. L. 104-0195.

Most of the remaining uranium mill sites are covered by Title II of UMTRCA and are being remediated by their private owners. Under Title X of the Energy Policy Act, the U.S. government also pays part of the cost of remediating Title II sites, in proportion to the percentage of their uranium output that was sold to the government. A few mills, such as one at Monticello, Utah, were owned by the federal government and are being remediated by the DOE as the owner, not as part of the UMTRA project.

Prior to the passage of UMTRCA, Congress authorized the more limited Grand Junction Remedial Action Program (GJRAP) (Pub. L. 92-314) to clean up 600 buildings and structures in Grand Junction. This limited cleanup program was administered by the Colorado Department of Public Health and Environment (CDPHE) from its

inception in 1972 until it ended on September 30, 1988. Sites that were remediated under GJRAP are not eligible for cleanup under the UMTRA Project.

This case study examines the use of institutional controls at the Grand Junction UMTRA Project site. It is part of a larger study of how the Department of Energy uses institutional controls in remediating sites contaminated with radioactive and other hazardous materials as part of the nuclear weapons program. Institutional controls are legal, administrative, or institutional mechanisms for managing risks to human health or the environment. Institutional controls are used in a variety of contexts to limit exposure to, rather than to eliminate, contaminants at contaminated sites. They include measures such as zoning, notices and warnings, easements, restrictive covenants, reversionary interests, restrictions on the use of specific resources such as soils or groundwater, records of hazards, trusts, and withholding insurance for certain uses of land. The Department of Energy uses institutional controls within its long-term stewardship program for contaminated sites. This study examines how the Grand Junction Project is using and planning to use institutional controls to protect human health and the environment according to standards set under the authority of UMTRCA. Other case studies in this series will examine the use of institutional controls at the Mound and Hanford DOE sites.

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Site Conditions

In 1951, Climax Uranium Company, a division of what is now AMAX Inc., began milling operations on the site of a former sugar beet refinery on the north bank of the Colorado River in Grand Junction, Colorado. The mill was shut down in 1970, after having produced 2.2 million tons of tailings, most of which were deposited in an on-site tailings pile that covered approximately 114 acres. Approximately 300,000 tons of tailings were, however, removed from the site. Until the mid-1960s, tailings were widely used as construction and fill material because they were sandy and acidic, in contrast to the clayey, alkali local soils. The City of Grand Junction used the tailings as fill when installing sewer and water lines, businesses and homeowners used tailings as fill during construction, and even the National Park Service used tailings in the concrete slab for an outdoor amphitheater at the Colorado National Monument near Grand Junction. These and other sites where tailings were used for construction, or deposited through erosion, are known as vicinity properties (VPs).

Although the program of actively distributing tailings from the mill site was discontinued in approximately 1964-65, tailings continued to be redistributed around the City and County by natural forces, contractors, and property owners. No law or regulation governs the use or disposal of tailings by private citizens. Property owners are free to take tailings off their property and give them away or dispose of them as and where they choose.

The UMTRA Project Remedial Action Plan for the Grand Junction site (which includes the Climax Mill site and approximately 5,000 vicinity properties in Grand Junction and Mesa County) involves removing tailings, or "residual radioactive materials" (RRM), and disposing of them at a managed disposal cell near Cheney Reservoir, approximately 17 miles from Grand Junction. Tailings were transported by truck and train from the Climax Mill site to the Cheney disposal cell from 1991 through 1993. Through 1993, tailings from vicinity properties were brought to the mill site for storage until it could be taken to Cheney. In 1994, the Climax site was backfilled with uncontaminated soil, graded to promote drainage, and revegetated. Since then, the City has established a storage facility in a clarifier formerly used by its sewage treatment works. This facility is used to store tailings from VPs until they can be transported to the Cheney disposal cell. The UMTRA cleanup program has spent $500 million to date on the Grand Junction cleanup.

Most of the VP sites are residential and small business, but they also include a country club, the city police building and jail, and the airport. The sidewalk along Main

Street in downtown Grand Junction, for example, was removed along with 92,000 tons of contaminated material. This project was conducted entirely at night as part of the effort to minimize the disruption to the 93 separate businesses affected. A primary goal throughout the VP project was to minimize disruption to property owners and to restore the property to the state it was in prior to the remedial work. DOE and its contractors attempted to accommodate the schedules of property owners, including home sellers who wanted cleanup as soon as possible.

In a few instances, DOE was unable meet an owner's needs. In one instance a company wanted DOE to remove tailings from under an asphalt tank that it wanted to replace. When the cleanup contractor could not clean it up in time to satisfy the company, it just paved over the area and built the new tank on top of the paved tailings pile.

As of April 1997, 25 VPs had yet to be cleaned up, along with 40 sites where DOE planned to do "simple fixes." Simple fixes generally involve installing ducts from a radon vent to a wind turbine or insulating and ventilating a crawl space and caulking. This work is performed at properties that exceed the goal for radon set by EPA at 0.02 working levels. EPA's regulations provide that a "reasonable effort" must be made to achieve 0.02 working levels, but that in no case may radon exceed 0.03 working levels. What constitutes reasonable effort has been the subject of discussions between the DOE and the Colorado Department of Public Health and Environment (CDPHE). Initially, DOE did not install vents because it assumed the cost of doing so was prohibitive given the existing risk. After discussing the issues, DOE and CDPHE agreed that installing vent systems would meet the standard. Vents were installed where DOE left tailings in place or was unable to locate the source of radon that exceeded the goal. DOE tended to leave tailings in place when removing them might disturb the foundations of a house, which often causes cracking, settling and other damage to the house. Vents are, however, a less permanent solution than complete removal of the tailings because residents may block or turn off the vents in order to save on heating costs.

In a number of other situations DOE has elected to leave tailings in place. CDPHE and DOE have different philosophies about leaving residual contamination. CDPHE preferred to remove all tailings, if possible, in order to remove all risk from the tailings. Leaving tailings in place allowed potential health risks to owners and users of the property to remain, which CDPHE preferred to avoid. DOE was willing to allow some residual risk to users in order to reduce initial costs, and was willing to revisit a site later, potentially many times, to reduce the risk to meet standards. CDPHE thought that returning to sites would be inefficient and that leaving tailings in place could necessitate implementing institutional controls to reduce the risk to future owners and users.

This issue was significant in dealing with the tailings underlying roads and utilities. According to one rough estimate, 70 miles of streets and utilities might have been affected and removing all the tailings would have cost $100 million. The DOE project manager sent the State a letter stating that DOE would consider removing all the tailings under the streets and utilities if the State would commit to its share of the cost. But the State did not have $10 million in its budget for its share of the cost for this cleanup. The State ultimately agreed to apply supplemental standards, which allow tailings to remain in place based on evaluations of likely exposure and reliance on institutional controls, because it could not commit enough money.

A similar result was achieved in the residential cleanups where a tree or other valuable element might have been affected by excavation. In a situation where DOE decided to not disturb such an element, it justified leaving RRM by "area averaging." Although the EPA standard is 5/15 picocuries over 100 m^2, area averaging allowed DOE to leave a hot spot as long as the level over the entire plot met the standard. Similarly, DOE would leave spillover material if it could be averaged. The CDPHE was concerned that shielding by soils would lead to future risk if the shielding soils were removed.

As part of the extension to UMTRCA, Congress created the Long Term Radon Management Program, which includes keeping the Cheney disposal site open for 25 more years, or until it reaches its design capacity, whichever comes first. In part, this was done to allay the City's fears that it would have no place to send the tailings that it would encounter during maintenance and repair of its roads and utilities. In fact, any state or community will be allowed to send tailings to Cheney for disposal, free of charge for the disposal, but the states will need to pay for their own excavation and hauling.

Groundwater

Groundwater at the Climax Mill site also has been contaminated and must be remediated to meet EPA standards, which were designed to protect human health and the environment. In general, the predominant choice of remedial action for groundwater contamination at milling sites has been natural flushing, with institutional controls on the use of the groundwater. As of April, 1997, two or three sites were being actively remediated, but Grand Junction was not one of them. This was considered to be acceptable because no one in Grand Junction uses wells for drinking water. A staff person with CDPHE noted that groundwater contaminants at the Climax Mill site are decreasing as predicted, as shown by the wells on the southwest (downgradient) corner of site. Groundwater is moving from the northeast to the southwest corner, and intersects the Colorado River. Thus, the contaminant plume is in communication with the river.

The UMTRA groundwater remediation program, managed separately from the surface program, is at a more rudimentary stage than the surface cleanup. The entire UMTRA groundwater program is managed as a whole rather than as separate geographical units, as the tailings removal program has been managed. Each program, therefore, has its own approach to institutional controls and has independently developed policies and procedures for implementing institutional controls.

The Rifle and Riverton sites, not Grand Junction, are furthest along in the groundwater remediation process. This case study includes a cursory examination of the Rifle and Riverton sites because DOE plans to use methods and institutional controls similar to the ones used at those sites in remediating the groundwater at Grand Junction. The Indian Health Service and DOE reached an agreement to implement institutional controls as the principal remedy at Riverton. Among the institutional controls being used is a moratorium on domestic wells in the DOE project area. The tribes agreed to put a moratorium on drilling wells if DOE would provide a separate water supply. The water from existing wells will still be available for irrigation. DOE will then apply to the Nuclear Regulatory Commission (NRC) for its concurrence with this approach to groundwater remediation (see Regulatory Authority below for a description of NRC's role). The DOE project manager is convinced that DOE can achieve the groundwater standard, but that it will take decades and therefore they will need an institutional control in the interim. As it stands, the finalized groundwater project relies on receiving the approval of the NRC.

The DOE project manager acknowledges that DOE needs a long-term surveillance and monitoring plan (LTSP) that it can use at each site where it is relying on natural flushing to ensure that flushing is in fact occurring. The current DOE plan is to monitor for the purpose of determining if the data continues to verify the model used to justify reliance on natural flushing. If the initial monitoring accords with the model, then DOE will monitor once every two years. Eventually, the frequency will drop to once every five years.

A substantial unresolved regulatory issue remains: DOE's preferred remedy for groundwater contamination at most sites, including the Climax Mill site, is natural flushing, which is allowed under the EPA regulations if it will not exceed 100 years to achieve the standards (40 CFR 192.12 (c)(2)). However, DOE's groundwater model predicts that natural flushing at Climax Mill will take longer than 100 years to reach the health-based standard. The regulations also require implementation of institutional controls that "will effectively protect public health and the environment" during the period of natural flushing (40 CFR 192.12 (c)(2)(i)(B)) and that the groundwater not be the source for a public water system. The DOE groundwater program is operating on the assumption that if the model is verifiable and residents have an alternate supply of potable water, then the length of time to achieve the health-based standard should be irrelevant. DOE managers note that the water supply condition is satisfied in Grand

Junction because the city provides water service to all residents and businesses from uncontaminated sources and that no one relies on private wells for drinking water. As such, DOE staff are moving forward with the groundwater program, assuming that the NRC will accept natural flushing as the remedy even if it does not meet the time limit established in the regulations. The CDPHE does not agree that natural flushing is acceptable if it will take longer than 100 years.

Another issue for the groundwater program is that DOE cannot allow owners to "opt out" as was permitted in the surface program. Also, because groundwater flows, contamination is likely to spread to properties that had no surface contamination. Thus, DOE is anticipating that some owners may seek compensation for damage to their property due to the migration of the contaminated groundwater.

Public Involvement

Public perception can be important to the effective implementation of institutional controls; where the public perceives there to be a substantial residual risk, there is increased acceptance of, and cooperation in implementing, institutional controls. The UMTRA Project has been a major presence in Grand Junction for much of the 1980s and 1990s. Despite this, the public apparently has not been convinced that the extensive tailings removal was necessary to reduce risks to human health. Civic leaders, city officials, and project managers generally agree that the public does not perceive the tailings on public or private property to be a significant health risk. A typical homeowner's response was said to be, "I don't care if there's radon in my house until I go to sell it." Reportedly, most people's concerns were economic, not health-based. Nevertheless, the existence or non-existence of tailings is not expected to influence the housing market substantially.

The co-chair of the Riverfront Commission, which was heavily involved in determining the land uses for the mill site and vicinity properties located along the river, reported that the public perception is that the cleanup was driven by the federal government, that the process was wasteful, and that the lag time for cleanup probably caused more exposure than if they had thrown the tailings in trucks and taken it to the Cheney disposal cell as quickly as possible. The Director of Public Works and Utilities for the City of Grand Junction confirmed that the cleanup had not been an important public issue, and that residents thought that the mill site cleanup was a boondoggle.

In a few cases, property owners did not allow the VP project to determine if tailings were present on their property, perhaps for some of the reasons described above. To the extent that some of those unsurveyed properties contain tailings, a risk to human health will remain. Furthermore, the current widespread knowledge and understanding about the potential for contamination due to tailings can be expected to

diminish as a generation unfamiliar with the uranium mines, tailings and the removal program replaces the current one. The risk due to the unidentified, and consequently unremediated, tailings will be exacerbated as owners, users and uses of those properties change. Finally, the sites where owners refused to be surveyed will not be included in the DOE database, and thus there will be no record of the potential of these sites to contain tailings.

Site Procedure

DOE used a variety of techniques to identify the potentially contaminated properties that required further evaluation to determine if they should be included in the UMTRA vicinity property program. These techniques included reviewing records from the State and the Climax Uranium Company, aerial surveys, mobile van surveys, and requests from property owners. Approximately 11,000 properties were evaluated for inclusion in the vicinity properties program. Of these, approximately 5,000 were determined to be eligible for cleanup.

One of the defining aspects of the vicinity properties cleanup program was the fact that it was a volunteer program. Property owners could ask that their property be surveyed to determine if tailings existed on the property, but had to submit these requests by February 28, 1997. Property owners also could refuse to be included at any stage of the process. In fact, some people declined to continue participating at each stage. Initially, Oak Ridge National Laboratory, the "inclusion survey" contractor, conducted a survey based on existing data. Oak Ridge also advertised the survey program, used vans equipped with gamma radiation detectors to scan properties in "drive-by" surveys, and contacted property owners on a designated property list. Of those on the list, 200 refused to be surveyed. Of the remaining approximately 10,000 properties to be surveyed, 59 backed out once they were included in the DOE program.

DOE developed a standard procedure to try to convince non-participants to agree to have their property surveyed to determine if it was contaminated with tailings. After asking the property owner three times to agree to be included, a formal final letter was sent explaining that the owner's refusal to be surveyed precluded their inclusion in the cleanup program. One local attorney said that this process was perceived as requiring a property owner "to sign her life away" if she chose not to enter the program. On the other hand, as the VP program was ending, a few property owners asked to be added to the program. These included some owners who inherited property from someone who had refused to be included.

A variety of reasons have been given for such refusals. Some did not want to be bothered, others did not like or trust the federal government, while still others did not like the process. Some former uranium miners who had hauled, inhaled, ingested, and

lived with uranium all their lives did not want any part of the cleanup program. The refusals were not all by individuals; some were businesses, including one bank. Thus, the voluntary nature of the vicinity properties project did not result in cleanup of all properties contaminated with tailings from the Climax Mill site.

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Institutional Issues

Ownership

None of the vicinity properties are or were owned by DOE. This distinguishes the UMTRA cleanup program from other DOE cleanups, where it owns or has had control of the land in the past. The Climax Mill site was privately owned during production, but was acquired by the State of Colorado in order to facilitate the cleanup. The mill site has been transferred to the City of Grand Junction through a process that required approval by the City, the Colorado Attorney General, the CDPHE and DOE.

Regulatory Authority

The NRC, EPA, and CDPHE each have authority to regulate aspects of the Grand Junction cleanup. EPA was required by UMTRCA to set the standards for cleanup, which it did in March 1983 (40 CFR Part 192). These regulations cover control of tailings piles at the mill sites, as well as cleanups of buildings and other lands as part of the vicinity properties program. EPA's regulations also cover institutional controls as an element of groundwater remediation (40 CFR 192.12 (c)(2) and permitting of completed sites. The regulations do not define institutional controls but do require them to meet the following general performance standard: "[have] a high degree of permanence and which will effectively protect public health and the environment and satisfy beneficial uses of groundwater during the extended period [for natural flushing] and which is enforceable by the administrative or judicial branches of government entities, is instituted and maintained, as part of the remedial action, . . . wherever contamination by listed constituents from residual radioactive materials is found in groundwater, or is projected to be found." (40 CFR 192.12 (c)(2)(i)(B).

The statute requires the NRC to concur in the remedial action decisions of the DOE. This includes selection of disposal sites, engineering design, construction monitoring, certification, and long-term surveillance and monitoring. Each repository of RRM, or disposal site, also must be licensed by the NRC at the completion of remedial action. As a condition of licensing, the NRC requires continual groundwater monitoring, by which it means yearly samples for the first five years. The NRC signed a Memorandum of Understanding with DOE granting concurrence for all vicinity property remedial actions taken in accordance with EPA standards. Separate concurrence is required, however, for any vicinity property where DOE proposes to invoke supplemental standards.

Within CDPHE, the Hazardous Materials Waste Management Division (HMWMD) carries out the State's responsibility to participate fully in the UMTRA cleanup program. The Department acts pursuant to its general authority to protect public health, which explains its focus on health risks and its general reluctance to accept supplemental standards. The State has signed a cooperative agreement with the NRC that authorizes it to license sites instead of the NRC.

The Grand Junction office of HMWMD will decrease from four staff full time equivalents (FTE) to two FTE as the level of activity related to the cleanup program lessens. The State funds have been drawn from the energy impact fund, of which $60 million has been spent. Approximately $11-13 million remained in the fund in April 1997, and $7-11 million was expected to remain after the end of fiscal year 1997. The surplus from the UMTRA Trust Fund will be deposited in the Local Government Severance Tax Fund. CDPHE will apply for grants from this fund to pay for its post-UMTRA monitoring and other activities. The HMWMD staff estimated that $100,000-200,000 per year would be needed to pay for two staff in Grand Junction to be available to conduct property surveys, outreach and oversee any additional cleanup work. The City would also be able to apply to the fund for reimbursement for maintenance of the interim storage facility (*i.e.* the former clarifier). The HMWMD staff are attempting to facilitate the post-UMTRA monitoring and implementation and to make the Cheney disposal facility easily accessible.

Other Institutions

Local Government

The City of Grand Junction, principally through the Department of Public Works and Utilities, is trying to ensure there is a program in place to deal with the tailings over the long term. The Director of Public Works and Utilities acknowledges that the City knew little about the long-term effects of tailings left in place (RRM) until seven or eight years ago. DOE's position was that it would leave RRM in place only when there was little risk, it was not easily accessible, or it was prohibitively expensive to remove. City officials responded that this was unfair to city taxpayers, particularly after closure of the Cheney disposal site, which was expected to be shortly after completion of the VP cleanup program. DOE staff asserted that those issues were outside the scope of its authority under UMTRCA. This led the City to work with its congressional representatives and the CDPHE to introduce the provision in the UMTRCA extension bill requiring the Cheney disposal facility to remain open for 25 years, or until it reaches capacity, whichever comes first.

City officials also decided that the City should become more actively involved in the ongoing program, volunteering an unused clarifier from the sewage treatment facility as the location for the Interim Storage Facility (ISF). Nevertheless, the City has

no plan for storing tailings after Cheney is closed. The current strategy is to see how the program works. If the data demonstrates that it is a viable long-term program, then the City will try to extend the time the disposal cell remains open and may become involved with the long-term surveillance and monitoring (LTSM) program. The City also wants to work out a management plan with the State, relying on the State to take the lead with its expertise in the issue. The State is drafting a guide to long-term management of tailings and planned to distribute it to all Colorado UMTRA communities in the fall of 1998. Among the issues that the City is interested in are:

- possibly leasing the ISF to CDPHE, which would then manage inputs and outputs; and
- funding the operation of the ISF (the City wants to use the balance/interest of the trust fund for FTEs at CDPHE, to pay the costs of maintenance of the ISF, and to transport tailings to Cheney).

The City's Parks and Recreation Department will manage the former mill site. Department officials have expressed frustration over the fact that, except with respect to the use of groundwater, DOE has provided no formal guidelines regarding restrictions on use of the former mill site. Parks officials were aware that the State would impose restrictions on the use of the mill site when it transferred the property to the City, but were frustrated about not being told what those restrictions would be early enough to take them into account during their planning process for the site. CDPHE, on the other hand, asserted that other than putting out a guidance on the types of restrictions that would apply at a mill site, neither it nor DOE should be involved in land use decisions, that those were the prerogative of the local government.

Even with respect to the groundwater, Parks officials expressed frustration at not receiving as much guidance as they would have liked. The Department was installing piers to support a bridge connecting the mill site to a neighborhood park on the opposite bank of the river. The excavations for the piers intersect the groundwater and could lead to problems, but Parks managers were not satisfied with responses from DOE about the issue.

For approximately 25 years, the City and County each have required a Building Permit Survey (BPS) before they will issue a building permit. The BPS includes a search of the CDPHE records for information about tailings on the property and adjacent properties. Neither the City nor the County will issue a building permit unless the owner removes any existing tailings. City officials think this program has worked well over the years even though no law specifically authorizes the participation or actions of any of the governmental entities. The City and County are aware and concerned that they have nothing to rely on if a citizen sues over these requirements, but it has not happened in 25 years. State staff noted that other counties that have similar problems with tailings have not required such surveys.

DOE staff assert that these building permit requirements are causing the perverse result of wasting some of the disposal capacity of the Cheney site. They claim that owners whose property has been remediated to meet the UMTRA standards, but where small amounts of tailings were left in place, have been required to remove those tailings in order to receive a building permit. The process of removing tailings generally requires the removal of large amounts of soil surrounding the tailings, all of which ultimately is sent to the Cheney disposal cell. DOE measures the radium concentration of material entering the facility in order to determine how much radon gas is being released to the atmosphere. These measurements showed that more than one third of the shipments of vicinity property material (9 of 28, after shipments from the mill site ceased) were below the surface cleanup standard of 5 picocuries per gram of radium and thus met the standard to be left in the owner's yard (40 CFR 192.12 (a)(1)). Four shipments actually had radium concentrations in the normal background range. DOE staff conclude that a substantial fraction of the remaining disposal capacity at Cheney is being wasted by filling it with ordinary soil.

Real Estate Profession

After the risks associated with tailings became known, real estate professionals made it a common practice in Mesa County to investigate whether tailings had existed on a property before the property could be sold. This was done by checking with the County Health Department, which had maintained records about known tailings sites. The real estate profession was driven to adopt this practice by the need to avoid property risk. Some buyers resisted purchasing properties with known deposits of tailings, and values could be depressed where there was uncertainty about the issue. At one point, this practice became standard for the local Board of Realtors. Currently, real estate agents will reveal information about tailings to prospective buyers. Buyers who deal directly with the owner can obtain information from the county health department, CDPHE or DOE, if they know to ask. The Grand Junction area is becoming increasingly popular as a place to live and, therefore, the number of buyers from outside the county, who are less likely to know about the tailings issue, is increasing.

Department of Energy

DOE Planning and Budgeting

Funding for different activities is separated within the Department, with pre-licensing activities funded from one office and post-licensing (*i.e.*, long-term surveillance and monitoring (LTSM)), activities funded out of the Grand Junction Office under DOE's Assistant Secretary for Environmental Management (EM) . The Grand Junction Office (GJO) includes LTSM in its budget every year. Problems can arise when there is a transfer of responsibility from one office to another within DOE, even within the same Assistant Secretariat.

Institutional Knowledge

Transfer of responsibility within DOE also leads to loss of knowledge about the site. Offices within DOE are managed as distinct entities, causing relatively large losses of information when a site is transferred from one office to another. Grand Junction DOE staff anticipate that this could be a significant problem over the hundreds of years of LTSM that will be required, particularly for the Cheney disposal cell. GJO staff believe that DOE has a good system for record keeping, but acknowledge that formal records are not sufficient to pass on all of the experience and understanding gained by working with a site. One suggestion by DOE staff for transferring more of this knowledge, is for the former staff to conduct an informational walking tour of the site for new staff.

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Reuse Considerations

The GJO has discussed issues related to future land use with the NRC and the State. The three agencies have different opinions regarding how near-term land uses affect the remedy. The GJO recognizes that it is hard to predict if, when, or what kind of development may occur in five years, much less in 20 or 100 years. Nevertheless, the GJO prefers to make some assumptions about future use in deciding whether to remove tailings or leave them in place. For example, the GJO reasons that because most utilities run along the street, it is highly unlikely that anyone would build immediately next to the street, and thus it need not remove tailings in the roadbed. Project managers note, however, that shrewd property owners have said that they might want to build on top of a tailings site in order to force DOE to remove the tailings. This is no longer possible because the vicinity properties remediation project has been completed, and DOE staff doubt that anyone ever did so.

The reuse issues for the Climax Mill site differ somewhat from those for the vicinity properties because the groundwater at the mill site is known to be contaminated. Much less is known about groundwater contamination at VPs, but DOE assumes that groundwater will not be an issue at most VPs, particularly where tailings have already been removed. DOE is testing a few sites to verify this assumption.

Managers of the Grand Junction Parks and Recreation Department were concerned that they could not get DOE and CDPHE to commit to specific restrictions on reuse of the Climax site. They were frustrated that they had not received sufficient information about the restrictions, including types and how long they would last, in time for them to consider the restrictions in their planning process. The Parks managers were aware of the general nature of the restrictions on groundwater use or, more specifically, that reuse of the site could not impede groundwater flow or discharge, but wanted more specific information. They understood DOE and CDPHE to prefer to respond to the City's plan for the site. CDPHE did not agree that it had any obligation to provide more information than it had, noting that it had provided the City with a guide on the types of restrictions that would apply to transferred mill sites and that the City could use the property in any way that met the restrictions. Furthermore, State officials thought that to do more would be improper interference with local land use decisions.

At one point there were plans to turn the Climax Mill site into a State park, but those plans were abandoned. After it became clear that the site would be transferred to the City, the Parks department solicited proposals for a master plan for the site with one

stipulation, that the site must be used for recreational purposes. Suggested uses include:

- little league;
- skating rink;
- wetlands; and
- spawning grounds for endogenous species (proposed by U.S. Fish and Wildlife Service).

Reforestation also has been suggested, but since the soils are alkali with a high salt content, such an effort would be difficult and unlikely to succeed. Plans already exist to use part of the site near the river for a trail that eventually could link up with the Kokopelli trail that extends to Moab, Utah.

Some of the reuse options, such as a skating rink, could involve building a structure. Parks managers were concerned that the parks board would not know how to deal with tailings if they were encountered during construction, as they thought might happen if the structure required pilings. As State staff noted, however, this would be highly unlikely because all the tailings that exceeded standards had been removed from the mill site. The Parks department had not been told of any restrictions, such as capping or radon vents, that might be imposed on a structure. DOE project staff, however, stated unequivocally that such restrictions would be imposed if a structure were built. The fact that the Parks managers who would be directly responsible for managing the mill site did not understand two fundamental issues about the site is an indication that the process for transferring information about the site and its potential risks was not working as well as it should.

A co-chair of the Riverfront Commission, a local non-governmental organization, believes bureaucratic delays have caused the community to lose a significant opportunity to create a State park at the Climax Mill. According to this community leader, there was an early plan to transfer the mill site to Colorado's Parks and Recreation Department to build a State park. As time passed and the site was not ready to be reused, the State Parks Department came under pressure to generate revenue and it therefore changed its idea for the type of park and its location. The City then was asked to accept the site, but delayed action as it sought to clarify who would be responsible if contamination were found at a later date. During this period, the City Parks Department developed a long-term plan for parks, but failed to include the Climax Mill site in the plan. Also, during the interim, the City Parks Department acquired property next to the interstate highway and farther away from the downtown area, where it constructed baseball diamonds, soccer fields, and other recreational facilities. The civic leader's opinion is that these delays caused the children living in the poorer areas near the mill to lose an opportunity for accessible recreational facilities.

The issue of future land use at VPs is being handled in a different manner and by different parties. These differences stem from differences in the risks, number of properties, institutions, and types of people involved in the VP cleanup program. Residential and commercial property owners perceive that all tailings have been removed. Since in most cases this is correct, none of the agencies involved in the program have initiated discussions about future land use at the smaller VPs that contain RRM. Furthermore, conventional wisdom is that radon is a threat only in confined spaces with continued exposure. Groundwater contamination is also less likely at VPs.

Reuse has received greater attention at particular VPs, due to their size or location. One of these is the Jarvis property, formerly the American Auto Salvage facility. The size and riverfront location of this property has led to more extensive public consideration of options for its reuse. Much of the impetus for considering multiple options for reuse of this property came from the Riverfront Commission. Quarterly meetings held by the Riverfront Commission bring all agencies with business on the riverfront together. These meetings provide a rare opportunity for all of the parties involved in the cleanups and reuse of the mill and VPs to gather and discuss issues.

A major local recession in the mid-1980s prompted the Lions Club to raise money for a $250,000 challenge grant to encourage the City to purchase Watson Island, a dumping ground and an eyesore, and a VP. After the City, with substantial volunteer help, cleaned up Watson Island, the nearby Jarvis property became available. This property was the site of an automobile junkyard and it was also in the VP program. DOE planned to remove the cars, remove and dispose of the tailings and commingled waste, and then return the junked cars. The Commission and City convinced DOE to give the City the money it would have spent in returning the cars to the site. The City then used these funds, along with locally-generated funds, to buy the property as part of a plan to restore it to a condition capable of supporting public uses.

Final plans for reuse of the site are still uncertain, and City parks managers are not sure they need the Jarvis property, other than as a green belt. At a minimum, there is general agreement that the future use should include a riverside trail and that it should include mixed uses. City parks managers are considering a performing arts facility, such as an amphitheater. The U.S. Fish and Wildlife Service is also interested in using a pond near the river as a spawning ground. Among the projects being pursued are a pedestrian bridge across the river to be financed by the Colorado Department of Transportation, federal money from the Intermodal Surface Transportation Efficiency Act (ISTEA), and a foundation; a trail across the Climax Mill site linking the pedestrian bridge to Watson Island; and a trail from the bridge to the Jarvis property. The major objection to the process used at the Jarvis property has been that after it was acquired by the City it took more than three years before DOE began the cleanup work.

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Institutional Controls at the Site

What Institutional Controls are in place at this time?

Information Systems

DOE has created a database of the vicinity properties pursuant to an UMTRCA provision requiring documentation of properties included in the program. Records exist for more than 10,000 properties. The database was designed to provide information about the properties included in the VP cleanup program, as well as those assessed and found to need no further action. When the cleanup contractor completes action at a property a Completion Report is produced and submitted to DOE. DOE certifies that the action met the relevant standards and sends a copy of the certification to the owner. For properties where DOE met supplemental standards, the owners receive a document stating that the property meets the standards, but that some tailings remain. In addition, when the Completion Report is finished the information is entered into DOE's database, and both the State and the National Archives receive a copy. Information in the database is not identical to the Completion Reports, however. For example, information about small isolated deposits of tailings ("lens deposits") left in place would not be included in completion reports, but might be in the database.

Staff of the DOE Grand Junction and Albuquerque Offices describe the database as containing information on all sites, including streets and utilities that have supplemental standards. Notwithstanding these claims, there appear to be significant gaps in the database. For example, several important groups of sites are not included in the database, including those in which the owners refused to be included in the cleanup program. The GJO estimates that approximately 200 owners identified as candidates for screening opted out of the assessment process, and an additional 59 owners withdrew once the formal assessment process started. Because these properties are not included in the database, there is no permanent record of their location or of the information that suggested that they might contain tailings. The only way to identify these properties is to repeat the original process, starting with the CDPHE records that include properties that were thought to contain tailings.

The database also does not include sites where tailings are known to exist but where standards were met at the time of the initial assessment. This could cause problems when the land use changes, if the new use results in human exposure to radon. One relatively common example is where tailings were known to exist under a building. In that situation the applicable standard was the level of radon inside the

building. When that building eventually is razed there will be no record to warn people that tailings exist under the building. Thus, the tailings may be exposed, moved, incorporated into construction material, or otherwise allowed to recreate the original risk of human exposure to radon.

A similar possibility exists for the approximately 500 sites included in the first, State-run program (GJRAP) to clean up the worst structures. In some cases the remedial action was to seal the tailings in concrete, which reduced the radon to acceptable levels, but which might fail later when the concrete is breached, either naturally or anthropogenically. None of these sites are included in the database, although the deeds to 400 of these properties were annotated.

CDPHE also has microfiche records in its Grand Junction office containing full information on vicinity properties. DOE staff anticipate that the State will take over responsibility for the database in 1998. The HMWMD is trying to keep two employees involved in the continuing activities of the interim storage facility and to deal with requests for information and other related activities. State staff note that it would be highly desirable for the Grand Junction CDPHE office to retain these records and to stay open for at least the next 30 years, but that there is no guarantee of this. This will depend on the State legislature providing funding, which is uncertain.

The City also has a map of where tailings are or were located. Using a geographic information system (GIS), the City has keyed the database of vicinity property locations to its maps. The maps mark RRM with red lines. City staff are able to produce maps of a city block with this system. These maps are available for public inspection at the Department of Public Works and Utilities.

The City Department of Public Works and Utilities is in the preliminary stages of integrating maps from its GIS showing the locations of utilities with those showing the locations of tailings. By overlaying its GIS of water and sewer lines on the tailings maps, the Department is able to anticipate when work is likely to encounter tailings. It can then include in its contract specifications and work orders that the contractor is likely to encounter tailings and must, therefore, take certain precautions. Public Works employees and contractors are also trained to take extra precautions at water main breaks where tailings are known to exist. Utility workers in a trench would receive the highest exposures, so health assessments are based on how long the worker is in the trench, among other factors. Exposure to date has been very low, but still there exists a need for continued training of contractors and workers.

If tailings are present in the level to be excavated, the City will remove them; if tailings exist below that level, it will leave the tailings in place. Recently, the City has been trying to "surgically remove" tailings by being more careful in identifying tailings.

Public Works also is using a variety of techniques and new technologies to reduce the amount of tailings that it handles. These include pipe-bursting techniques for water lines and similar technologies for sewer lines that allow polyethylene pipe to be pulled through the old pipe. This reduces exposure to tailings since the workers do not have to excavate the entire trench. In addition, this will reduce the quantity of tailings the City will take to the Interim Storage Facility. The Department of Public Works and Utilities estimates that these measures will reduce the amount of tailings they excavate to 1,000 to 2,000 cubic yards per year. This would reduce the need to transport a load of tailings to the Cheney disposal cell to about once per year. Despite these measures some projects will require excavation and if the excavated material is suspect, the Department will haul it to the ISF, let the water drain out, and then ask the State to test it. To deal with such uncertainties, the City has designated one end of the ISF for suspect material, and the other end for known tailings.

Security Systems

DOE has asked the state police in each state that has a disposal site to report any vandalism of these sites to DOE. A similar request was made to the national weather service to report natural disasters in the areas of the disposal sites. Those agencies have agreed to the requests.

The Interim Storage Facility (ISF) is protected by several overlapping security measures. The gate on the clarifier (ISF) is locked during non-business hours, the State may be given control of the keys (though the City will probably keep a set of keys for emergencies, such as a burst pipe in the middle of the night causing the need to bring tailings), the City keeps a log of people entering the ISF, and city police fuel up in the area and the City has asked them to keep an eye on the ISF. Nevertheless, the City is concerned about a number of potential security problems, particularly that people will dump random, inappropriate waste in the ISF. One city official cited cases of people dumping explosives and barrels of unidentified material. The City also is worried about people mixing wastes, because then the City will be unable to dispose of it. The City wants to know what type of material enters the ISF, by logging it and being able to test it for "purity." The most challenging issue will be dealing with commingled waste.

The City also has considered the issue of health risks to city employees who operate the ISF. The City plans to do risk assessments on the few people who have reason to be in the ISF, but also notes that they rarely enter it. The City also is concerned about the potential for wind-blown dust from the ISF. To prevent this, the tailings are watered down if they become dusty. A roof is not used for dust control because the radon gas released from the tailings could concentrate in an enclosed structure, increasing the health risk.

What Institutional Controls have been definitely selected for implementation in the future?

UMTRCA

The UMTRCA requires certain specific institutional controls, most of which are yet to be implemented at Grand Junction. First, the statute requires disposal sites, such as the Cheney disposal cell, to be transferred to DOE and prohibits the federal government from transferring title to disposal sites, except for subsurface mineral rights. DOE is required to maintain disposal sites so as to protect public health, safety and the environment. Disposal sites are therefore subject to the institutional control of direct ownership and control by the DOE. The statute also requires the NRC to license sites where RRM, defined to include tailings, is disposed. Further, the statute requires annotation of land records for processing sites, defined to include vicinity properties, with RRM. Although some DOE staff question whether this land annotation provision was intended to apply to all of the VPs, or only to the former uranium processing mills themselves, most parties assume that it applies to VPs and mill sites. The statute allows the former mill sites to be sold or retained for public purposes, as was done with the Climax Mill site, unless the site was used for the disposal of RRM. These provisions raise questions about how the statute is to be applied to sites where RRM in the form of tailings was allowed to remain in place.

The states, local governments, and real estate industry all objected to the land annotation requirement, fearing that it would stigmatize properties and decrease their values. The states did, however, want future owners to know about the risks associated with the property. Real estate and financial institutions, on the other hand, generally want to avoid any annotation of land records, even one stating that a site has been completely cleaned up. These parties combined to convince Congress to amend the land annotation provision as part of the 1996 extension of UMTRCA. The statute now requires states to notify prospective purchasers of property containing RRM. The states are allowed to do this either by "land annotation" or by developing a mechanism for notifying prospective purchasers. DOE is required to develop rules governing this notification process and to approve the states' programs.

For the most part, these statutorily mandated institutional controls have not yet been implemented. For example, although the NRC suggested that it might require licenses for all VPs where supplemental standards were used to justify allowing tailings to remain in place, it apparently has decided not to require licenses in such cases. Similarly, not a single deed has been annotated to date, though a private processing site in Utah where the owner is cooperative may soon be the first to be annotated under UMTRCA. The NRC has informed DOE staff that it wants the deed for the Utah site annotated before it certifies the cleanup as complete because the remedial action used

supplemental standards. On the other hand, the NRC has made progress in licensing the mill sites, having licensed approximately half of them by mid-1998.

Transfer of Processing Sites

Institutional controls for the mill sites have been under consideration by DOE for much of the time the UMTRA program has existed. According to DOE project managers, institutional controls start when DOE acquires a mill site or, in most cases, including Grand Junction, when the state acquires the site for DOE. The DOE project managers consider the first institutional control to be the approval from the regulators of the remedial design and construction plan, followed by their certification of the completed work. After the work is certified, the site will be available for reuse, although the title may not be transferred until the regulators give their approval.

In most cases, however, groundwater at the processing sites will not have been remediated to standards for unrestricted use. In fact, DOE predicts that natural flushing, meaning no active treatment, will be the remedial action for groundwater at most mill sites. EPA's amended standards allow natural flushing as long as institutional controls designed to restrict the use of the groundwater are used as an alternative method of reducing the risks to human health. Therefore, neither DOE nor the State may give a full release of the property until natural processes cause the groundwater to meet the standards. In most cases, DOE is relying on the State to impose and implement the restrictions on groundwater use. The State of Colorado, however, lacks authority to regulate the use of groundwater based on the quality of the water. Where the State is in the chain of title, as with the mill sites, then it could restrict groundwater use by including use restrictions in the deed transferring the property. This method was used for the Climax Mill site, but the State cautions that it has limited applicability.

In the short-term, DOE must have access to a site during construction of any groundwater remedy, including monitoring wells. DOE will also need continued access for monitoring, which might be necessary for 100 years. A provision allowing for access to three wells for as long as is needed for groundwater monitoring has been included in the transfer document for the Climax Mill site. In addition, based on its review of the monitoring data, the NRC can require DOE to install additional monitoring wells. The UMTRA project manager anticipates that the locations of the monitoring wells may make it more difficult for the City to find sufficient space to construct a building as part of the park. In addition, any building would need to be approved by DOE and CDPHE. Finally, a building will likely need to have a radon venting system.

DOE staff also view the remedial action agreements (RAAs) with the states as institutional controls because they establish the long-term institutional relationship between the state and DOE, including implementation of other institutional controls. These have been modified to show that groundwater action is still required, typically in

the form of restricted use. In some cases, DOE may also enter into a remedial action agreement with a local entity.

If the state owns the property, as was the case for the Climax Mill site, the state may transfer the land after obtaining approval from DOE and the NRC. The previous owner has a right of first refusal if the state sells the property, but not if it donates the property to a local government. The State may allow public use of the land by transferring it to a city or county, as was done in Grand Junction with the Climax Mill site. The trend, though in the early stages, appears to be for the State to transfer title with restrictions on how to use land. DOE anticipates that each deed will specify restrictions, including those on use of groundwater. DOE also expects that the restrictions could be removed if and when the groundwater meets the standards for unrestricted use.

Despite this planning and forethought about land use restrictions, DOE has provided no specific directions to the City of Grand Junction, or other local entities, about how they may use the land. Most of the communication with respect to planning and initial education has been between local governments and states. A DOE attorney has drafted a document describing what the institutional controls for the Climax Mill site should look like, including restrictions on groundwater use, but it has not yet been provided to the City.

The staff of DOE and the NRC disagree about the relative roles of the two entities in implementing controls over the long term. Some DOE project staff interpret the absence of specific provisions in UMTRCA requiring that DOE manage the sites over the long term to mean that DOE's role ends when clean up activities are completed. Therefore, they assert that the NRC has responsibility to manage the residual materials, including implementing institutional controls, particularly at VPs or processing sites that are not licensed. The CDPHE expects neither DOE nor NRC to take any active role at the Climax Mill site or the VPs after the UMTRA program is over. The State predicts that institutional controls will be left to the State and the local government to implement.

What Institutional Controls Are Under Consideration?

A significant unresolved issue is how to implement the statutory requirement for annotating land records or providing notice to prospective buyers of property covered by the program. The State and DOE are considering either allowing the County to annotate the land records, or including a notice on the tax bills for the property. The State, which has responsibility for this program, prefers including the notice in tax statements or some similar record.

The real estate and financial professions resist most of the proposals for providing notice to prospective purchasers. They point to the paradox that properties

that were cleaned up have the most extensive documentation, but few or no records exist for properties that were kept out of the program due to owner refusals. Real estate professionals believe this will unfairly reduce the marketability of properties that were cleaned up because non-local banks and buyers will misunderstand the significance of the notice and think that annotated property is risky. They also fear that the notices will not distinguish the mill site from VPs. Another concern is that notices will be placed on property that had no tailings other than those associated with city sidewalks or utilities. Real estate professionals believe that annotating such properties unfairly encumbers property owners whose land is clean but is merely next to the sidewalk or utility.

State officials agree that VPs should be distinguished from the mill site. An HMWMD official testified before Congress that requiring annotation of VPs will unfairly reduce the value of properties that are now clean. The State, along with other States and DOE, has asked Congress to amend UMTRCA to clarify that VPs are not to be treated the same as mill sites. The State also characterizes the annotation requirement as punishing property owners who volunteered to participate in the UMTRA program, while ignoring the properties where owners refused to participate in the cleanup program and where tailings may be present.

The principal argument for why vicinity properties should not be annotated is that because they have been remediated, there is no need to inform potential purchasers that these properties contain no hazardous substances. But the premise that they contain no hazardous substances is not necessarily correct. All tailings were in fact removed from many VPs, but at some VPs sufficient amounts of tailings may have been left in place that they might present risks to future users if not handled properly. Therefore, it may not be appropriate to exempt all VPs from the annotation requirement, but instead to require annotation only for those where remaining tailings could present a risk if mishandled in the future.

Some confusion exists about which sites will be licensed and by whom. DOE and NRC staff assert that NRC will license the Climax Mill site, while the CDPHE asserts that as an Agreement State it has the authority to license sites in Colorado. The UMTRCA statute and NRC regulations provide that the disposal sites, including at least the Cheney site, will be licensed by NRC for DOE to provide long-term care (42 U.S.C. 7914(f)(2); 10 CFR 40.27(a)). DOE staff in Grand Junction have discussed licensing issues with NRC, but apparently not with the State. The NRC has told DOE staff that it has considered licensing every property on which tailings remain, including VPs. DOE project staff believe this is unlikely due to the NRC's lack of funding and staff. The NRC has not fully explained the goals such licensing would be intended to achieve or how the Commission would implement such licenses over the long term. CDPHE, however, states that it does not intend to license VP owners.

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Planning for Failure

The GJO and other DOE staff with UMTRCA responsibilities have been considering how the Department should deal with the possibility that institutional controls may fail. This planning for potential failures of institutional controls has not been coordinated among different offices nor has a comprehensive policy been developed. Instead, individual staff members or programs have been considering options relevant to the programs with which they are familiar.

Staff in the groundwater cleanup program, for example, have considered mechanisms by which DOE can assure that the legal authority to enforce or regulate institutional controls will be maintained. Staff believe that UMTRCA gives DOE sufficient statutory authority to require tribes, local governments and states to maintain institutional controls or to assure that others under their jurisdiction maintain the controls. They acknowledge the possibility of a weak link in monitoring compliance with institutional controls (on well drilling, for example), but note that at least some attention is being focused on the controls. Groundwater cleanup staff noted that in an extreme case of failure to implement institutional controls limiting new wells, DOE could take control of enforcing the restriction. This planning has not, however, gone beyond the conceptual stage. Specifically, DOE staff have not established a system for monitoring sites to determine if production wells are being installed or included such monitoring in plans for future activities to be conducted at the sites.

Some of the key institutional controls in the UMTRCA program depend on property owners continuing to implement the controls. Therefore, DOE staff have been concerned about the possibility of a "bad actor" owner and have considered options for dealing with owner refusals to comply with institutional controls. There has, in fact, been at least one known breakdown or failure of an institutional control in the UMTRCA program, involving an owner failing to comply. The original land owner had signed an RAA requiring the owner to notify DOE if the land was transferred. The owner also agreed to notify any purchaser that RRM remained on the property. The original owner sold the property without either informing DOE of the sale or notifying the purchaser of the RRM. Staff in the state environmental agency in Oregon, where this occurred, learned of the sale much later, and joined DOE in explaining the issues to the new owner and in finding the original owner. The new owner was willing to sign an RAA.

This situation raised questions for DOE staff about the enforceability of the RAA. One strategy that they developed for dealing with this particular form of failure is to give states responsibility for monitoring property owner compliance with, and implementation of, institutional controls. This can be implemented through the existing

cooperative agreements between DOE and the states. Another strategy, to be used if the owner is totally uncooperative, would be for DOE to start condemnation proceedings on the property.

Owner refusals to participate in the UMTRA program can be viewed as another failure of institutional controls. Although the UMTRA program considers such voluntary refusals to not be part of the program, the risk that the program was designed to eliminate remains at such properties. Depending on when the owner refused to participate the property may be known to have tailings or merely be suspected of having tailings on it. The UMTRA program fails to provide any institutional controls in either case, which in the former situation leaves future owners and the public with no protection against the risks associated with the tailings. The failure to implement institutional controls at all properties known to contain tailings is perhaps the most significant failure of the program.

Other relatively minor failures of institutional controls have also occurred, but the problems have been discovered and solved. Still, they demonstrate that institutional controls can fail, even when the cleanup program is still active and relatively fresh in the minds of the public. One such failure involved a company whose property contained a large volume of tailings but which, due to contractual obligations, could not shut down to allow the tailings to be removed. Thus heat pumps and a ventilation system were installed as an alternative method of reducing radon levels. The property was sold, and since the new owners were not told that the heat pumps were needed to maintain safe radon levels, they removed them. The property now has increased levels of radon.

Most of the remaining tailings are under city streets or under city or other utilities. Although the City is implementing a database and other institutional controls to assure that its work crews are aware of tailings when they begin to excavate a street or sewer line, other utilities such as natural gas, electricity, and telephone lines are not covered by this system. US West experienced a problem when it excavated tailings and, not knowing what they were, hauled them to Denver. After discovering what they were and that they could not be disposed of in Denver, the company brought the tailings back to Cheney for disposal. Where the responsibility lies for informing these utility companies of the location and proper handling of tailings is unclear. Some DOE staff think that it is the City's responsibility to continually educate potentially affected people that tailings remain.

The State is concerned about the small deposits that have been left behind at residential properties. CDPHE staff note that a tree or foundation may cover a cubic yard of tailings. Although they acknowledge that neither situation represents a large volume of covered tailings, they fear that in 20 - 50 years someone will cut down the tree or demolish the house, exposing the tailings without understanding what they are and how they should be handled. The same situation may occur at properties where the

owner refused to be included in the removal program, but the volume of tailings could be larger. However, this concern by CDPHE staff apparently does not lead the Department to conclude that such sites should be annotated to warn prospective purchasers of the potential risk. (See What Institutional Controls Are Under Consideration, above).

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