

PLANNING FOR THE OFFSITE DISPOSAL OF WASTE GENERATED IN THE REMEDIATION OF THE DENVER RADIUM SUPERFUND SITE

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ABSTRACT

In this paper, plans for the offsite disposal of waste from the Denver Radium Superfund Site will be discussed. The Denver Radium Site consists of over forty radium contaminated properties in Metropolitan Denver. These properties were contaminated from the production of radium during the early twentieth century. The properties have housed a variety of activities, and uses now vary from empty land to warehouses to retail and manufacturing facilities. The remedial action project currently under way at the Denver Radium Site is one of the largest in the United States where the selected remedy is offsite disposal.

The Department of Energy's Grand Junction Projects Office and its contractor, UNC Geotech, are performing remedial action on these properties under an Interagency Agreement with the EPA. One of the major challenges of the remedial action is planning for the offsite disposal of over 250,000 cubic yards of contaminated soils and building materials that are being excavated during the remedial process. This a significant challenge because of the lack of specific requirements regarding the disposal of this material, the quantity of the material, possible presence of RCRA or TSCA materials, and public concern over the shipment across public highways.

The waste generated from this remedial action is classified by the EPA and the Utah Department of Health as Naturally Occurring Radioactive Material (NORM). However, the Rocky Mountain Low-Level Radioactive Waste Compact and the Colorado Department of Health consider the material to be low-level radioactive waste. There is at least one facility which has a state license for disposal of NORM wastes and a second facility may become available.

The volume of waste material to be removed from the Denver Radium Site is approximately two and one half times the volume of low-level waste generated in the United States annually and over twenty times that generated in the Rocky Mountain Compact annually. Because of the tremendous volume of waste being generated in this remedial action, a plan for cost effectively handling this material is essential. In addition, concern over the use of public transportation routes must be addressed.

It is not anticipated that a site will be found that can receive both NORM waste and waste generated under RCRA. Therefore, it is necessary to develop a waste certification plan that ensures that each shipment meets the waste acceptance criteria for the facility that it will be shipped to. In addition, it is necessary to develop plans for managing waste that does not meet the waste acceptance criteria of the primary disposal facility.

In summary, planning for the offsite disposal of waste from the Denver Radium Site is a significant challenge that is of great interest to the waste management community at large and those that are involved with remedial action at radioactive waste sites in particular.

INTRODUCTION

Waste excavated from the Denver Radium Superfund Site will be shipped to a licensed disposal site. The transportation and disposal issues are proving to be more complicated than the remedial actions which are generating the waste. More time, money, and goodwill will be expended on the transportation and disposal than on any other phase of the Denver Radium Site cleanup. This paper

discusses the planning concerns of the transportation and disposal phase of the project.

BACKGROUND

The widespread use of radium in the treatment of cancer in the early 1900s created a strong demand for the element in the United States and Europe. In response to this demand and to a growing concern over the war in Europe, the United States government founded the National Radium Institute to eliminate the necessity of having to ship radium-bearing ores to France, which had priorly monopolized the production of radium. The National Radium Institute (NRI) was established in Denver in 1913 to

determine the best production techniques for radium, uranium, and vanadium and to study methodologies for the mining and concentration of their ores. The NRI successfully demonstrated that radium could be economically produced in the United States and began commercial operation of a radium recovery plant using a nitric acid leaching process. Other radium processors were also active in the Denver area in the 1920s; their refining processes included leaching with hydrochloric or sulfuric acid and sodium carbonate fusion. Recovery of uranium and radium by these methods being incomplete, process residues contained radioactive materials. These residues were generally discarded or left on site and as property ownership and use changed through the decades, they were often used as fill or cover or mixed with foundation or paving materials.

Contamination associated with the NRI's former location in Denver was discovered in 1979 by the Environmental Protection Agency (EPA). Subsequent surveys by the EPA and the State of Colorado identified 31 properties in the Denver metropolitan area having low-level radioactive contamination thought to result from radium residues. Collectively known as the Denver Radium Site, the properties were listed on the interim EPA National Priorities List (NPL) in October 1981 and placed on the final NPL on September 8, 1983. The addition of other properties adjacent to the original locations have brought the total number of Denver Radium properties to 44. These properties have housed a variety of industrial activities through the years, among them radioactive ore processing (pitchblende and carnotite), ore smelting and assaying, metal fabrication, metal scrapping, stone cutting, paint manufacturing, paper manufacturing, brick manufacturing, chemical production, and cotton milling.

Remedial Investigation/Feasibility Studies (RI/FSs) were completed for the Denver Radium Site in 1986. A master RI summarized the investigative work conducted at all properties. Individual FSs were prepared for each of the eleven Operable Units within the Denver Radium Site which described possible alternatives for correcting contamination problems. An operable unit is a number of properties which have been conveniently grouped together. Seven separate Records of Decision (ROD) were obtained by the EPA for the ten Operable Units where remedies have been selected. These were issued by the end of 1987. In a series of Interagency Agreements (IAG) with the Department of Energy (DOE), EPA acquired the expertise of DOE's Grand Junction Projects Office to conduct remedial design and remedial action at the Denver Radium Site. Remedial design was begun in 1987 and remedial action was initiated in May 1988. Transportation and disposal of the contaminated materials are scheduled to begin in May 1989. UNC Geotech (UNC), as the prime contractor to the DOE, Grand Junction Projects Office is carrying out the remedial design and remedial action work at the Denver Radium Site. UNC has extensive experience in the waste management field and is currently doing similar work at several Uranium Mill Tailings Remedial Action (UMTRA) sites in Colorado and South Dakota. The EPA has, through another IAG, acquired services of the Bureau of Reclamation (BOR) to

contract for, administer, and manage the transportation and disposal of the wastes.

WASTE COMPOSITION

Radium-contaminated waste at several Operable Units is now part of the soils, gravels and building foundations. Radium levels in the soils range from about 15 to over 100 pCi/g. Contaminated construction debris including concrete and asphalt make up a significant portion of the material to be excavated and disposed of.

Other radioactive materials have been found on one or more of the Denver Radium Site properties. Thorium-230 and uranium were contained in the carnotite ore but were not usually recovered. Because these radionuclides are no longer in equilibrium with the radium due to the processing, it is difficult to estimate the degree of overall contamination when just the radium concentration is known.

The radioactive portion of the waste has been variously classified. The EPA and the Utah Department of Health use the term Naturally Occurring Radioactive Material (NORM) because the radioactive species are left over from ore processing and are not reactor-produced. The Rocky Mountain Low-Level Radioactive Waste Compact and the Colorado Health Department consider this waste in the category of low-level radioactive waste although it is not regulated as such by the Nuclear Regulatory Commission. The Department of Transportation (DOT) considers the material Below Regulatory Concern (BRC). Wastes which contain elevated amounts of nonradioactive compounds are to be classified on a case-by-case basis.

Hazardous or toxic contaminants may also occur at several properties and may be commingled with radioactive constituents. Lead, cadmium, selenium, arsenic, and barium have been detected at levels which could cause the samples to fail the Resource Conservation and Recovery Act (RCRA) EP toxicity test. These metals are sometimes commingled with the radioactive waste. Organic solvents such as benzene, toluene, and xylene are present in soils at some properties. Asbestos is present in soils and buildings, and is a concern in several areas.

Total waste requiring disposal from all properties is currently estimated at over 250,000 cubic yards. This total has been revised upward from the original 87,000 cubic yard estimate contained in the Denver Radium Site RI. Individual properties have quantities of a few hundred to several thousand cubic yards.

WASTE CLEANUP AND TRANSPORTATION

Transportation of the Denver Radium Site waste, like the remedial action of the Denver Radium Site, is a complicated project. Waste is to be removed from properties having such diverse present uses as restaurants, warehouses, brick plants, scrap metal dealers, and streets. Owners' attitudes toward the cleanup activities also vary. Some owners are supportive and only wish the work could be finished so that they can go on about their business. Others are defensive because of possible problems that may be unearthed during the remedial design and action. Hostile feelings can be expected because of disruptions caused

by construction and transportation work. Maintaining reasonable relationships with operating businesses while still proceeding with the excavation has been and will continue to require major efforts.

Waste loading tonnages from individual properties will be driven by the schedule of the remedial action contractor and by the nature of the waste deposit. Wastes which have been stockpiled or are found in open lots will be less difficult to load and ship. However, material from several locations, such as in building crawl spaces and below foundations, will be less accessible and more difficult to remove.

Loading rates will also be affected by the time required for decontamination procedures. Every vehicle and container will be "frisked" and cleaned before leaving a property. Decontamination is required by the DOT and assures that radioactive material will not be deposited on streets and highways en route to the disposal facility.

Transportation of Denver Radium Site waste is expected to begin in May 1989 and continue through mid 1992. Peak shipping rates of about 1500 tons/day will occur during 1989 and 1990. Completion of the work may be delayed if disposal or treatment facilities for commingled wastes do not become available. A lack of continued government funding might also slow the program.

PROCUREMENT

As manager of the procurement of the transportation and disposal services for the Denver Radium Site waste, the BOR is using the Government's Commerce Business Daily (CBD) system, which results in the procurement schedule shown in Table 1.

TABLE I

Transportation and Disposal Services Procurement Schedule	
	Day
Issue CBD Notice	0
Issue Solicitation	15
Receive Proposals	75
Complete Technical Evaluation	90
Complete Cost Evaluation	97
Hold Negotiations with Bidders in Competitive Range	112
Receive Best and Final Offers	133
Complete Technical Evaluation	147
Complete Price Analyses	150
Obtain Reviews	157
Obtain Equal Employment Opportunity Clearance	164
Award Contract (estimated to be in 4/89)	175

This schedule does not include the time required to prepare the solicitation, nor does it take into account delays

caused by amendments, and contractor mobilization. Nonetheless, waste shipments are expected to begin in May 1989.

The procurement of the transportation and disposal services has been complicated by changes in quantity estimates. Remedial design activities and field experience has tripled the quantities reported in the RI for the Denver Radium Site. Close estimates cannot be made at many properties until the remedial designs are complete.

Waste disposal has also been made more difficult by the discovery of nonradioactive contaminants. Soils containing commingled RCRA or Toxic Substance Control Act (TSCA) and radioactive wastes cannot be transported from the Denver Radium Site because no permitted commercial disposal facility is available for such wastes. Therefore, the BOR's pending procurement does not require acceptance of wastes exceeding regulatory limits under RCRA or TSCA.

Because of the uncertainties in waste quantities and compositions, the contract was bid on a unit price basis with a wide range of possible shipping rates. The transportation contractors were initially required to match the production of the remedial action contractor. Because this requirement resulted in high daily and monthly shipping maxima, remedial actions were rescheduled to reduce the peak shipping rates to 1500 tons/day.

The Denver Radium Site waste is considered BRC under the DOT's definition in 49 CFR 173.403(y). However, the wastes are similar to materials classified in 49 CFR 173 as Low Specific Activity (LSA) wastes, including uranium and thorium ores and physical or chemical concentrates of those ores (49 CFR 173.403(n)) or material in which activity is essentially uniformly distributed and the concentration does not exceed 0.001 mCi/g. As specified in 49 CFR 173.425, LSA materials may be shipped in "strong tight containers" or, under certain conditions, they may be shipped in bulk form. When LSA materials are shipped in bulk form, they must be handled only in "exclusive use, closed transport vehicles." Furthermore, materials must be transported to the disposal facility in the original containers or transport vehicles; that is, the waste cannot be removed from a property in a dump truck and then emptied into a railroad hopper car. The solicitation requires bidders to describe the types of containers and vehicles which they plan to use.

It is expected that the waste will be shipped by a combination of truck and rail from Denver to the disposal facility. The exact transportation mode will not be known until the contract is awarded in the second quarter of 1989. Several of the larger properties have rail spurs which may allow direct loading from the excavations or stockpiles into rail cars. Other properties do not have access to rail lines or have too little waste as to make rail car loading practical. Waste from these properties will be loaded into bins, dumpsters, or some other approved container for transport to the disposal facility.

WASTE CERTIFICATION

The contents of every container or vehicle leaving the Denver Radium Site must be known to certify that the material meets transportation and disposal requirements. A waste certification plan has been written to meet this objective. This plan is needed to ensure that regulatory requirements are met and to eliminate the possibility of having to excavate the contents of even a few containers at the disposal site and deal with the returned material. Containers with waste contaminated at levels below cleanup standards may be emptied rather than transported to the disposal facility. Containers whose contents include commingled waste will not be shipped to the disposal facility.

Collecting and analyzing representative samples from thousands of rail cars and dumpsters will be time consuming and expensive. Each container will be sampled in Denver using a hydraulically driven auger mounted on a boom. Samples from three or more auger holes will be composited and split to obtain a representative sample for each container. The composite sample will be analyzed for radium-226 as well as other contaminants. Typical analytes will be those RCRA or TSCA constituents which are suspected of being present at the source property. Sample analyses will be expedited to reduce the time containers and vehicles are staged prior to shipment.

The solicitation requires the transportation and disposal contractor to either accept the analyses provided by the remedial action contractor or to analyze a sample split at their own cost. The government and the transportation and disposal contractor must agree on the acceptability of the material before each container is released for transport from Denver. The containers or vehicles will be shipped directly to the disposal facility; no material may be added. No additional sampling will take place prior to disposal.

DISPOSAL FACILITIES

Prospective disposal facilities for NORM wastes are currently limited to a site in western Utah and a proposed site in western Colorado. Disposal facilities for NORM wastes are licensed by the states and do not require federal permits. However, design guidelines for disposal sites are provided in 40 CFR 192(a). The Utah facility is in operation and has a license, while the Colorado facility is attempting to obtain a license specifically to dispose of the Denver Radium Site waste. Additional sites may become available but they must also meet the stringent requirements of the solicitation.

Disposal charges will constitute the largest portion of the Denver Radium Site cleanup costs. For example, local disposal fees for NORM wastes are comparable to the remedial action construction subcontract cost.

SOLICITATION EVALUATION

The proposals will be evaluated on a 60% technical merit/40% cost basis. The solicitation package includes a

statement of work which describes the material, specifies where it is located, and when it is to be shipped.

Technical merit will be judged by a BOR Technical Proposal Evaluation Committee. Cost/price data will not be considered during the technical evaluation. Technical evaluation criteria as presented in the solicitation are summarized below in order of decreasing importance.

- a. Qualifications. Offeror must demonstrate management and technical experience in completing projects of similar complexity.
- b. Discussion of the Work. Offeror must demonstrate thorough knowledge of the project.
- c. Disposal Facility. Offeror must completely describe the facility.
- d. Health and Safety Plan. Offeror must show compliance with all applicable federal, state and local regulations.
- e. Project Plan. Offeror must divide the transportation and disposal plan into discrete tasks covering the required work.
- f. Project Schedule. Offeror must detail by phase the entire project and identify major milestones.
- g. Project Organization. Offeror must show key personnel and their functions.
- h. Quality Assurance Plan. Offeror must describe the methods and techniques to be used to ensure overall quality of the work.
 - i. Tracking/Reporting. Offeror must show ability to track waste containers at all times.
 - j. Subcontracting. Offeror must identify subcontracting firms and their function(s).
 - k. Other Information. Offeror must provide all information which is pertinent in evaluating the proposal.

The proposals which are rated technically superior will be subjected to a cost analysis. The BOR will enter into negotiations with the respective offerors in order to resolve questions arising during the technical evaluations. A request for best and final proposals will be made and the firm offering the best combination of technical capability and low cost will be awarded the contract.

COMMUNITY RELATIONS

The identification of the Denver Radium Site properties in 1979 generated considerable media coverage and public interest. Both EPA and the Colorado Department of Health (CDH) received numerous inquiries concerning the locations of contaminated properties. However, the level of public interest and concern fell markedly after this initial phase.

From 1980 to 1983, CDH carried out community relations activities as part of its agreement with EPA to conduct the technical investigations. Efforts consisted mainly of making contact with affected property owners to arrange for access, to coordinate private-party cleanup activities, and to inform owners of CDH actions and findings. Press releases were issued, informational mailings were sent, media interviews and briefings were conducted, and

coordination with other agencies was maintained. At the conclusion of the CDH investigation, a public meeting was held to report the findings and to explain the transfer of the study effort from the CDH to the EPA.

After 1983, when the EPA assumed the lead on the Denver Radium RI/FS and Community Relations Program, there continued to be little public interest in the project except when EPA proposed to establish a waste consolidation and storage facility at one of the properties included in the site. Controversy about the proposal diminished when it became apparent that this could be avoided and since then most communications activity has focused on property owner contact and interagency coordination. Nonetheless, the RI/FS reports, RODs, supplemental data, and fact sheets were made available to the public, press releases were prepared, and announcements of all public comment periods were placed in newspapers. The local media announced the ground-breaking ceremony for the first of the Denver Radium Site properties in April 1988, and the EPA held a media briefing following the detection in October 1988 of possible heavy metal contamination at one of the properties.

Public interest in the transport and disposal of Denver Radium Site wastes has been considerable. The EPA has attended a number of public hearings held by the CDH regarding a proposed regional low-level radioactive waste disposal license for a site at Uravan, Colorado. In addition, the EPA has participated in public meetings relating to concerns about the transport of the Denver Radium Site wastes via rail or the public highway system and the potential effects of such transport on communities along the route. DOE and UNC have also supported the EPA in the community relations effort.

Concerns of the public regarding the transport of Denver Radium Site wastes have focused on a variety of issues. First, there is the question of the "fairness" of transporting Denver's wastes elsewhere. Second, there is concern about the winding nature of the proposed routes of transport (both train and truck) and the potential increase of accidents and congestion. Third, there is anxiety about the direct effects spills may have on communities and environments along the route and about the indirect effects of such

spills on community image. Fourth, there is concern about the effects that spills into waterways may have on irrigated crops and drinking water supplies downstream. Fifth, citizens question the adequacy of emergency response plans to deal with accidents effectively and thoroughly. For example, Montrose County Colorado, site of the proposed Western Colorado disposal facility, has no emergency response capability. Sixth, there is concern in western Colorado about the possibility of inadvertently "opening the door" for the transport of other states' NORM materials and/or materials more dangerous than the Denver Radium wastes.

Concerns of the public regarding the disposal facility for the Denver Radium Site wastes have been many, primarily regarding the establishment of the site in Colorado. Some people have expressed concern about the stigma associated with a community's housing of a waste site, and the potential adverse effects of such a stigma on tourism and economic development. In addition, the wastes are perceived to have the same health threats as those associated with more acutely hazardous materials. There is also a strong sentiment among some that providing for waste disposal discourages waste reduction efforts.

Successful transportation and disposal of the Denver Radium Site wastes will require a continuous effort by all parties to address these concerns. A sincere effort to address people's concerns by meeting with community representatives and incorporating their suggestions when possible is an important part of the program and essential to gaining acceptance of the remedial action program for the site.

SUMMARY

Transportation and disposal of Denver Radium Site waste will begin during 1989 despite numerous complications related to uncertainties in material quantities and compositions, transportation routes and destination, and public reaction. Thorough planning and a sincere commitment by all involved will allow the cleanup of the Denver Radium Site to proceed with minimal delays.