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THE ROLE OF THE INCLUSION SURVEY CONTRACTOR IN THE URANIUM MILL TAILINGS REMEDIAL ACTION PROGRAM

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ABSTRACT

Twenty-four former uranium mills are involved in the Department of Energy's Uranium Mill Tailings Remedial Action Program (UMTRAP). The Radiological Survey Activities (RASA) project at Oak Ridge National Laboratory (ORNL) serves as the Inclusion Survey Contractor (ISC) in the UMTRA program. Responsibilities of the ISC are: (1) to identify potentially contaminated sites in the vicinity of these former uranium mills; (2) conduct radiological surveys to assess whether the property is contaminated with material originating from the mill in excess of Environmental Protection Agency (EPA) criteria formulated specifically for the UMTRA program (40 CFR 192); and (3) provide recommendations to DOE regarding remedial action.

Properties are identified by the ISC using historical information, aerial and ground-level gamma scanning, and surveying erosional pathways (wind and water movement of contamination from primary sources). Currently, over 8,000 vicinity properties have been identified that warrant further investigation. Once identified, an "inclusion" survey is conducted to assess whether a property is sufficiently contaminated to warrant inclusion into the UMTRA program. The inclusion survey includes a complete gamma scan of the surfaces of the property outdoors and the lowest habitable level indoors, and collection of soil samples outdoors and/or radon daughter samples indoors if required. Survey methods are described.

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INTRODUCTION

From the early 1940's through 1970, the Manhattan Engineer District (MED) and U.S. Atomic Energy Commission (AEC) contracted private companies to process uranium ore.[1] The by-product residues of uranium

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milling (tailings) were left in piles, and, during subsequent years, the tailings were relocated by erosion (wind and water) and by human intervention (i.e. hauled from the mill site for use in construction). On November 8, 1978, the Uranium Mill Tailings Radiation Control Act (UMTRCA, Public Law 95-604) was passed by congress. The Act required the Federal government to perform remedial action on 24 former uranium mill sites that were once under contract with MED/AEC and any properties in the vicinity of these mill sites which had become contaminated with radioactive material originating from the milling operations.

The Radiological Survey Activities (RASA) Group of the Health and Safety Research Division (HASRD) at Oak Ridge National Laboratory (ORNL) presently participates in the Department of Energy's (DOE) Uranium Mill Tailings Remedial Action Project (UMTRAP) as the Inclusion Survey Contractor (ISC). The purpose of the ISC is to identify vicinity properties contaminated with radioactive material originating from the 24 inactive uranium mill sites in the UMTRA Project[4] and make recommendations as to whether the site should be included in or excluded from the UMTRA project. Recommendations are based on radiological surveys conducted at these sites to ascertain if sufficient radioactive material is present to exceed the Environmental Protection Agency (EPA) criteria[3] established for UMTRAP (40 CFR 192).

METHOD

The ISC has responsibility for a number of activities in the UMTRA project described in detail in this section. A general description of the ISC's responsibilities and survey methodology is given in other references.[5,6] Specific ISC responsibilities include: (1) identifying the vicinity properties to be surveyed; (2) acquiring approval from the property owners to conduct a radiological survey; (3) conducting an inclusion survey on a property; (4) reporting inclusion survey results to DOE; and (5) submitting to DOE and/or its contractors the inclusion survey report, inclusion/exclusion recommendation, and all pertinent records on each vicinity property.

Identification. Initial identification of a property that may require remedial action is made on the basis of three sources of information: (1) historical information obtained from the results of early (1970 to 1975) mobile and onsite surveys; (2) aerial radiological surveys; and (3) mobile gamma scanning surveys.[5] By this process, 8,156 properties were designated (i.e. formally identified by DOE as potential candidates for remedial action) on February 2, 1984.[2] As the UMTRA project progresses, the ISC will identify new sites as potentially contaminated and will recommend to the DOE Project Office (PO) that they be designated.

There are two methods of identification available to the ISC: information from knowledgable sources and data from mobile gamma scanning using the ORNL scanning van.

Properties potentially contaminated with uranium mill tailings or ore material may be identified by federal, state, or local officials who have a reasonable suspicion that contaminated material may exist on a property. Additionally, citizens of a community who can reliably recollect transport or placement of uranium ore or tailings material on a property are sufficient evidence to warrant a designation recommendation by the DOE UMTRA PO, thereby triggering an inclusion survey by the ISC.

Mobile gamma scanning is conducted by the ISC in those areas identified by DOE UMTRAP PO. All accessible streets, alleys, and roadways are surveyed within the area. Detailed and specific methodology for performing this activity is described elsewhere.[8] Once the mobile gamma scan of the specified area is completed, all properties having anomalous gamma radiation levels relative to background radiation levels (using a ^{226}Ra-specific algorithm) are identified by location, assembled into a report, and submitted to the DOE UMTRAP PO. The DOE UMTRAP PO will designate the appropriate properties from this listing, and an inclusion survey will be conducted on those properties by the ISC.

Acquisition of Consent-for-Access. The ISC conducts radiological surveys at vicinity properties and recommends to the DOE that the properties be "included" into the UMTRA program, or that they be "excluded" from further consideration for remedial action based on the radiological condition of that property.

Prior to conducting a radiological survey, a signed consent-for-access agreement granting permission for the survey must be obtained from the property owner. This agreement also grants permission for the performance of an engineering assessment by the Remedial Action Contractor (RAC) if the property is "included" for remedial action.

The UMTRA project is a cooperative program between the Federal Government and the affected states and Indian tribes. The responsibility for acquiring consents-for-access, as well as the contents of the agreements, are determined by the individual states and tribes in cooperation with the DOE.

Each "designated" property has been assigned a location number by the DOE. The location number is a tracking number for a specific property and is used on all documents and reports pertaining to that property. The DOE Technical Assistance Contractor (TAC), Jacobs Engineering Group, Inc., maintains an UMTRA Vicinity Property computer data base, and is responsible for the control of location numbers. Assignment of location numbers to newly identified properties (such as those that are detected by the mobile van scan), as well as any changes in location numbers, must be coordinated with the TAC.

Consents-for-access generally are obtained in two ways: copies of the consent agreement are mailed to the property owner with a request that a signed copy be returned by mail, or the property owner is personally contacted. In most communities, a combination of the two methods is used.

The following steps are generally followed in obtaining consents-for access:

1. The current owner of a property is ascertained by searching ownership lists in the local Tax Assessor's Office. If the data is not current, then a personal visit to the property is made, telephone or personal contacts with neighbors are conducted, or other feasible avenues are used.

2. The consent-for-access package is prepared for mailing. Each such package consists of a transmittal letter, two copies of the access agreement, a stamped, self-addressed envelope, and a brochure describing the UMTRA program. The owner's name is typed as the inside address on the transmittal letter, and the property address is inserted in the letter as well. The location number and corresponding affected property address are typed on each copy of the consent-for-access agreement.

3. When the consent-for-access packages are ready for mailing, data for each property is entered into the ORNL computer data base, using the location number as the main tracking number.

4. If the owner does not respond, a second letter is sent out in about one month. If there is still no response, a personal contact (by telephone or in person) is made between an ISC representative and the owner. Negative responses are documented in the file folder for that property.

Inclusion Survey. Before an inclusion survey may be conducted, a scale-drawing of the location is produced for use by the radiological survey team. After determining the legal description of the location, the drafting coordinator or a subcontractor visits the property to take the necessary physical measurements to determine the placement of any structures on the property. No drawing of the interior of any structures is made prior to the inclusion survey.

The ISC field supervisor contacts the owner and any tenants to schedule the survey. When possible, scheduling accommodates the wishes of both owners and tenants. In the case of businesses, surveys may need to be scheduled during non-business hours or on weekends.

Estimates of the background of both gamma exposure rate and ^{226}Ra concentration in soil are determined for comparison with values measured during the survey. Background gamma exposure rates are measured on the uncontaminated portions of the property at ground level using both a pressurized ionization chamber (PIC)[7] and a gamma scintillator. Scintillator readings in counts per minute (cpm) are converted to μR/h based on the conversion factors determined by the PIC and the gamma scintillators.

The inclusion survey is a two-part process. A screening survey is conducted first to assess the presence or absence of radioactive material in excess of natural background levels. If elevated radiation levels are present on the property, but not to a degree that would automatically warrant "inclusion" into UMTRAP, then an extended survey is conducted.

Screening survey. The screening measurements consist of gamma scanning, with portable gamma scintillators, the ground surface of all accessible areas outdoors, and the floor surface of the lowest habitable level

indoors.

If radiation levels observed on the property are not significantly above background, no further measurements are required, and the property is recommended to be excluded from UMTRAP by the ISC. If elevated gamma radiation levels are observed, the location is noted on a drawing. Outdoors, regions averaging greater than 25 μR/h above background over 100 m^2 are eligible for inclusion with no further measurements reqnired. A drawing of the interior is made if indoor contamination is detected. Indoors, regions in excess of 100 m^2 which exceed the 20 μR/h above background criterion are grounds for immediate inclusion with no further measurements.

If gamma radiation levels are between background and the screening inclusion criteria, then extended measurements are required on that property.

Extended survey. "Extensive" measurements outdoors constitute measurements in excess of simple gamma scanning. Such measurements may take two forms: (1) boring of holes to make subsurface gamma exposure measurements, or (2) removal of surface or subsurface soil samples to ascertain the ^{226}Ra concentration in the soil.

To investigate the possibility of subsurface activity sufficient to include a property, subsurface gamma measurements may be performed. Near or beyond the edge of any deposit located during the gamma screening measurements, a series of holes is made with a posthole digger. The purpose of these measurements is to ascertain whether or not the buried deposit has portions that are shielded by the soil to such an extent that those portions are undetectable from the surface. Once the top 15 cm of soil has been removed, an increase in gamma exposure count rate in excess of the 20% expected from geometry alone is taken as evidence that additional contamination exists further below the surface. Such a result indicates the need for a deeper hole and further gamma measurements or soil samples. If no increase in gamma count rate is observed in the hole, the ISC field supervisor may presume that the deposit detected from the surface measurements does not exist beyond the limit implied by those surface measurements.

Surface (0-15 cm) and subsurface soil samples are taken at the discretion of the field supervisor at locations identified during gamma screening as being elevated above background radiation levels, but which clearly do not exceed the gamma screening inclusion criterion of 25 μR/h above background averaged over 100 m^2. Surface and subsurface soil samples taken at the location specified are obtained in the following manner: once the sod plug (if any) is removed from the top of the hole, all the remaining soil down to the depth to be sampled is removed and placed on a sheet of plastic adjacent to the hole. This soil is mixed on the plastic sheet and an aliquot of about 500 g collected, bagged, labelled, and transported to the laboratory for analysis.

Assembly of Survey Data. Once the inclusion survey has been completed, the following steps are taken to assemble the survey data: (1) any soil samples taken are analyzed; (2) gamma exposure rate data is converted; and (3) a final drawing is prepared.

Soil samples are analyzed for their ^{226}Ra content using a 6 x 9-in. NaI(Tl) crystal with a 3-in. well. After the soil sample has been dried and left for the radon daughters to equilibrate within the sample (at least 10 to 24 days), the sample is analyzed using a technique previously described.[1]

Field gamma exposure rate data is converted to μR/h using factors determined in the field by a NBS-traceable PIC. Conversion factors are derived from an empirical linear relationship of μR/h and cpm measurements made in each community. From the calculated standard error of the prediction, the 95% confidence interval of the estimate is calculated for each scintillator reading.

A final property drawing is prepared. Contaminated regions are shaded and identified by letter, size, and gamma exposure rate. Other features of radiologic interest, such as soil sample locations, are also identified on the drawing.

Inclusion Survey Report. Once all radiological survey data are prepared and assembled, an inclusion survey report is prepared. The report consists of text, tables, inclusion/exclusion recommendations, and supporting graphics. The text or body of the report provides a thorough

property description with references to the graphics, a citation of the methodology employed in the survey, and the specific radiological results (outdoor, indoor, and extended masurements) obtained. In particular, the outdoor/indoor background ranges, any elevated gamma exposure rate ranges with the point of highest outdoor/indoor gamma, total estimated area of contamination, and the ^{226}Ra concentrations in the soil samples are given. The radiological results are summarized in the Significance of Findings section as well as any explanations, observations, or insights about the referenced contamination. The summary closes by stating a basis for including or excluding the location from the UMTRA project, using specific EPA criteria established for UMTRAP.

The draft report is reviewed for accuracy, and undergoes a technical review. Revisions are completed, and the report is finalized. A final package is submitted to DOE/UMTRAP from the ISC. This includes: (1) a signed consent form from the property owner; (2) a scale drawing of the property; (3) available information on the property; (4) original photographs of the property; (5) the final inclusion survey report; and (6) a letter prepared by the ISC recommending that the property be included or excluded from the UMTRA project.

SUMMARY

Because the ISC is the initial institution in the UMTRA remedial action program, the success of the vicinity properties portion of UMTRA is tied to the ISC success. Over 500 properties have been investigated by ORNL, and over 7,500 properties have yet to be surveyed between 1985 and 1990. This effort clearly depends on well-defined procedures; close communication with federal, state, local authorities, and the general public; and a heavy reliance on computers to automate many phases of the inclusion survey process.

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