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Annual Meeting

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The U.S. Department of Energy Grand Junction Projects Office was pleased to host the 1987 Remedial Action Programs Annual Meeting and herein presents notes from that meeting as prepared (on relatively short notice) by participants. These notes are a summary of the information derived from the workshops, case studies, and ad hoc committee reports rather than formal proceedings. The order of the materials in this report follows the actual sequence of presentations during the annual meeting.

Should you wish further information concerning a specific topic, please contact the workshop leader, case study presenter or Ad Hoc Committee Chairman. An attendees mailing list is enclosed within this document.
Welcome Address For Remedial Action Programs Annual Meeting

Leo E. Little, Manager
Grand Junction Projects Office
April 1987

Good morning and welcome to the Grand Junction Projects Office and the Annual Remedial Action Conference, better known as the Jack Baublitz show. We like to think of ourselves as being the geoscience center of the Department of Energy.

Since I'm sure several here probably were wondering where Grand Junction is and what DOE does there, I would like to give you a very brief overview of our history.

Back during the early part of World War II, a young Second Lieutenant by the name of Frank Leahy was sent to Grand Junction with a set of sealed secret orders which he was to open after he had checked into a hotel in Grand Junction. I had the pleasure of meeting Frank at an AEC reunion we held here last fall. Over 600 old-time AECers came to the AEC/ERDA/DOE reunion.

When Frank opened his orders, his mission was to find uranium for the Manhattan Project. Frank's orders gave him the authority to go to any Base Commander in the U.S. and get their full support in anything he needed.

After World War II, the Colorado Raw Materials Office was established in 1947 to carry out the AEC's Domestic Uranium Program; and, exLt. Frank Leahy was the first manager of our Grand Junction Office.

During the 1950's, 1960's, and 1970's, many activities were carried out by this office covering R&D, exploration, building and operating pilot plant mills, and managing the AEC's Uranium Materials Program.

Numerous field camps in the boondocks were set up for exploration by over a hundred geologists, ore buying stations and mills were built, and by 1956 the peak complement of over 500 AEC employees were working at Grand Junction, Salt Lake City, Denver and in the field. By 1956 the AEC had purchased over 3 million tons of ore, producing over 20 million pounds of yellow cake.

Another major effort was establishing a leasing program, where public lands were withdrawn by the AEC and leased to private companies for exploration and mining. About $60 million in royalties have been collected from these leases.

Today, although uranium mining is no longer a viable enterprise due to the low price of uranium and foreign competition, we still have 30 active leases which have just been extended to the year 2004 with additional 10-year options. We hope this will help our domestic supply in case of an emergency.

The last major program from the old era of this Office was the NURE (National Uranium Resource Evaluation) Program launched in 1974 and completed in 1984. During this time the Grand Junction Projects Office was placed under the Idaho Operations Office. The extensive resulting geologic data base from this program can be of great value in future applications; e.g., we just this year produced a map for the National EPA Radon Study showing where radon is most likely to occur in the U.S., using the NURE data base.

Today, utilizing our geotechnical and geoscience expertise, complemented by project management capabilities, we are involved in several activities, the largest being remedial action projects for the Uranium Mill Tailings Remedial Action Program and the Surplus Facilities Management Program. In fact, one of our projects is to clean up our own facility here.

Also, using our geoscience base, we are working with the U.S. Army in Korea, and conducting geologic exploration and site characterization for our Kansas City site, Weldon Spring, SRPO, and BWIP of the CRWM Program. In addition we maintain a core repository, operate the largest radon chamber (only two in U.S.), operate our Chemistry, Petrology, and Electronics Labs and still provide support to the mining/exploration industry when needed.

I hope this brief history has given you some insight into the capabilities of the Grand Junction Office.
I am certainly pleased to be here in Grand Junction today and to have the opportunity to participate in the Remedial Action Annual Meeting. It is most fitting that the Grand Junction, Colorado, area was selected to host this meeting, since in 1966, the concern with high radon concentrations in structures in this area was recognized by the Colorado Department of Health and the Public Health Service. This concern gave rise to what we refer to today as "Remedial Action".

In response to these early concerns, a Departmental Remedial Action Program was set up to eliminate the potential hazards to the public and environment from radioactive contamination remaining at facilities and sites previously used by the Government in developing the Nation's atomic energy program.

Let us take a moment to reflect on the history, the need, and the scope of the program. In 1971 the subcommittee on Raw Materials of the Joint Committee on Atomic Energy held hearings to investigate the dangers presented by the use of uranium mill tailings for construction purposes. Testimony at those hearings lead to the passage of legislation in 1972 authorizing the Federal Government to enter into a cooperative program with the State of Colorado to provide a program of remedial action to remove tailings from sites and structures in Grand Junction where they constitute a threat to public health.

Concurrently, public and Federal attention began to focus on the regulation of the active commercial uranium milling industry. With the advent of the National Environmental Policy Act, more scrutiny was applied to licensing standards and requirements for the control and disposal of uranium mill tailings. As a result, in 1974 Congress requested the Energy Research and Development Administration to survey and assess the problem presented by the tailings located at 24 inactive uranium mill tailings sites. In 1978, on the basis of the resulting studies, Congress passed the Uranium Mill Tailings Radiation Control Act.

The original program for the development and use of atomic energy was established at various sites by the Manhattan Engineer District and was continued by its successor, the Atomic Energy Commission. The program involved the development of technology and production of nuclear materials for national defense and security. When the sites were no longer needed they were cleaned up according to the health and safety guidelines then in use. However, since that time the guidelines have become more restrictive. As a result, in 1974 the Formerly Utilized MED/AEC Sites Remedial Action Program was established to identify sites previously released for unrestricted use, to reevaluate the amounts of radioactivity present and to conduct further cleanup if warranted.

Many Government-owned nuclear facilities that were used throughout the early development of nuclear energy have no current use and have been retired. However, as you know, those facilities have residual radioactive contamination levels requiring controls. Under the authority of the Atomic Energy Act, as Amended, DOE established the Surplus Facilities Management Program to assure the safety, caretaking, and disposal of such facilities. About 500 facilities requiring remedial action have been identified and catalogued. The inventory of facilities includes reactors, fuel processing plants, laboratory facilities, tanks, pipelines, waste treatment systems, solid and liquid waste burial grounds, and storage areas with uranium and thorium residues. The goal is to reduce the current inventory of facilities awaiting disposition within the next 20 years by tackling the projects, one-by-one, as funding permits.
Today, we face challenges in the conduct of these programs:

- Public and political interest and participation.
- Funding during a period of fiscal constraint.
- Communications.

We in the Department recognize that success of the remedial action program depends on involving state and local governments, public interest groups, site-owner representatives, other Federal agencies, and Congressional representatives in planning, developing, and implementing these programs. Communication and coordination at all levels has become an increasingly significant part of the Remedial Action Program.

To this end, we provide numerous opportunities, including:

- National Environmental Policy Act related public forums.
- Congressional DOE budget cycle hearings.
- Technical meetings on waste management technology.
- Local public information meetings conducted by DOE with state and local government participation.
- Direct communication by the project and program offices.

This places an enormous burden on each of us that previously we may not have had to face. Nevertheless, we must provide public forums and take other affirmative actions necessary to inform the general public during both the early stages of a new remedial action and throughout the project. It is only through the development of sensitivity to the public relations needs of the communities in which we are involved will these programs be successful. This afternoon Karen Scotti and Peter Mygatt will be facilitating a public relations program workshop that will provide a forum for sharing of lessons learned and brainstorming for the future. In keeping the public informed about our activities and findings in a timely and complete manner, we need to do so in a manner that best meets our programmatic objectives. We have all seen well intentioned motives and plans that have ended up doing more harm than good.

I must add that the successes and accomplishments to date are the result of the cooperative, responsible, and professional manner in which you have managed and executed these programs.

With the above in mind, let us recall where we stand today. Remedial action is complete at:

- UMTRAP - Canonsburg, Pennsylvania; Shiprock, New Mexico.
- FUSRAP - Acid/Pueblo Canyon and Bayo Canyon, New Mexico; Middlesex Landfill and Kellex, New Jersey; University of California; University of Chicago, Illinois; and Niagara Falls Storage Site Vicinity Properties.

Remedial action efforts are under way at:

- UMTRAP - Salt Lake City, Utah; Durango, Colorado and Lakeview, Oregon. Later this year, site remedial action will begin here at Grand Junction, at Riverton, Wyoming, Ambrosia Lake, New Mexico, and Tuba City, Arizona. In total, nine sites will be in construction or completed by the end of this fiscal year.
- FUSRAP - Hazelwood, Missouri; Colonie, New York; Wayne and Maywood, New Jersey; Albany Research Center, Oregon; and the National Guard Armory, Illinois.
- SFMP - Major progress is being made in decommissioning the Shippingport Station in Pennsylvania. An international decommissioning symposium will be conducted in October of this year with tours of the Shippingport decommissioning project. The Weldon Spring, Missouri, Project Office was established last summer. A DEIS has been issued and a planning for remedial action is well underway.
- West Valley Demonstration Project - Numerous, highly contaminated, hot cells containing tons of vessels and miles of piping have been cleaned up, utility spent fuel has been returned to their owners, and construction for processing the supernatant portion of the liquid high-level waste is well under way, with non-radioactive operation to commence later this year.

Continued success depends on cooperation and team work not only within each of our organizations - program office, project office, and contractors. While there are times one may not recognize it as such, we are all a part of the same
team with the objective of getting the job done safely, in a technically sound manner, with minimal costs, and on a reasonable schedule.

The assignment sounds pretty straightforward to me, yet I am constantly amazed at the difficulty of its accomplishment. I am sure some of you have had the same experiences.

Each of us has a role to play to ensure the success of the programs and we must work together to achieve our goals. It is futile to spend time talking about who is responsible for what. It is necessary to remind ourselves that we are all working for the same boss and we have an obligation not only to the people of the communities and the taxpayers we serve, but also to ourselves to put the program ahead of self, parochial or provincial interests. I am calling for each of us to review our interactions and see what we can do to increase our coordination and communication that will lead to successful program implementation.

Successful implementation of our various programs is a key part of the Secretary's commitment to meeting environmental standards. We can expect that additional facilities and sites will be added to our scope. At the same time, we must be aware of the overall limitation on spending that impacts the Remedial Action and Waste Technology Program.

An objective of mutual interest to both Congress and the Administration is reducing the Federal budget deficit. Every week we hear of initiatives in this regard. Program activities are supported at all levels of the Department, the Administration, and the Congress; nevertheless, in the context of establishing national priorities and associated funding levels, it is subject to close scrutiny. Consequently, we cannot expect to receive a significant increase to our funding levels in the years ahead. The bottom line of which is that we are being asked to do our job, and then some, with the same amount of resources.

Accordingly, both the content and pace of each major element within the Remedial Action and Waste Technology Program is tempered by the overriding concern for fiscal restraint. This will have the impact of extending the completion dates for certain projects and, therefore, ultimately resulting in some increase in their total cost. Consistent with the guidance contained in House Appropriations Report Bill for FY 1987, we will again propose to extend the seven-year authorization period of the Uranium Mill Tailings Remedial Action Program through FY 1993. Likewise, other projects may see similar extensions.

It will also be necessary for each of us to hold or reduce costs. I am requesting each of the project offices, in concert with their respective program offices, to implement a cost reduction and productivity improvement program, the results of which would be presented by each project office at the next Remedial Action Conference. I know some offices in the past or currently have such programs in place. Additionally, Bill Jenkins and Gale Hovey facilitated a productivity improvement workshop this morning. We need an objective and fresh perspective taken with an aggressive follow-up and implementation campaign.

The management of nuclear facilities and wastes is an integral part of the national nuclear energy program. The Administration is strongly committed to ensuring that nuclear power can continue to be a vital contributor to the energy security of the Nation. Each of our major program areas - reactor development, space and defense, remedial action and waste technology, and uranium enrichment - is sharply focused on achieving this objective. Restoring public confidence in the safety and economics of nuclear power is essential to continuation and appropriate growth of this contribution. The Department must continue to pursue vigorously the resolution of significant institutional issues which affect the public perception of nuclear power. Through satisfactory resolution of these institutional issues, we would hope the nuclear industry once again will be judged fairly on its safety, economic and environmental merits.

A critical link to public confidence in the safety of nuclear power is the need for safe and efficient disposition of all categories of nuclear wastes. By demonstrating such disposition of wastes created by past nuclear development programs, our Remedial Action Program has made and will continue to make a strong contribution to restoration of the nuclear option to its proper place in the energy future of this country.

I am honored to be a part of the Remedial Action team and more specifically to have been asked to address this distinguished group. Thank you for your attention.
Introduction

Risk assessment is popular business these days. *Science* magazine devoted its April 17, 1987, issue to it. Much of that material is familiar, but it is worthwhile to examine it to put this paper in perspective. Perhaps most importantly, we need to agree on what is meant by the words "risk assessment (analysis)" and "risk management". In a perceptive article, William D. Ruckelshaus, twice Administrator of EPA, tried to separate risk assessment, which he viewed as a value-free scientific exercise, and risk management, which he viewed as the point at which value judgements and social and political considerations should be taken into account. As we shall see later, no such easy separation is possible. Ruckelshaus has defined risk assessment as an "attempt to quantify the degree of hazard that might result from human activities - for example, the risks to human health and the environment from industrial chemicals." He also points out that in cases where the data remain ambiguous, "risk assessment is something of an intellectual orphan," with many such studies based on assumptions that are scientifically untestable, (and) the method is too susceptible to manipulation for political ends...." Then, such studies encroach on socio-political judgments (i.e., the questions they raise cannot be answered by science) and have been labeled as trans-scientific by Alvin Weinberg. Ruckelshaus defines management as "adjusting our environmental policies to obtain the array of social goods—environmental, health-related, social, economic, and psychological—that forms our vision of how we want the world to be."

Though we, as scientists and engineers, might agree that risk is the quantification of hazards (consequences times probabilities), we need to recognize that, to many others, that is an incomplete set. Psychologists who have studied the problem of how the public perceives risk would hold that the degree that the hazards are, or are perceived to be (shown on the right-hand axis as Factor 1, shown in Figure 1), uncontrollable, dread, global catastrophic, consequences fatal, not equitable, high risk to future generations, not easily reduced, risk increasing and involuntary (all subsumed as "dread risk") and Factor 2, shown at the bottom of the figure, not observable, unknown to those exposed, effect delayed, new risk, and risks unknown to sciences (all subsumed under "unknown risk") increase the public's estimate of risk. It is therefore not strange that the public finds nuclear reactor accidents, nuclear weapons fallout and radioactive waste as the three most dread risks in the unknown risk quadrant and they are exceeded only by nuclear war, which has known consequences, shown in the lower right quadrant. Slovic holds that the public's "basic conceptualization of risk is much richer than that of the experts and reflects legitimate concerns that are typically omitted from expert risk assessments." Further, he notes, "Each side, expert and public, has something valid to contribute. Each side must respect the insight and intelligence of the other." We must recognize that in a democratic society the public is the final arbiter of acceptability of risk, even though it may be inconsistent, even within the same categories of insults. In addition, it is emphasized that many arguments about risk are not about risk at all, but reflect social and political concerns. Russell and Gruber indicate that the arguments about risk really arise from our society's conflicting desires for prosperity, justice, equality and environmental quality.

The necessity for defining what is meant by risk is emphasized by Russell and Gruber, who write "making decisions about risk in the absence of guidelines may lead to idiosyncratic decisions that cannot easily be explained or defended and that are subject both to accusations of capricious-
ness and to real or perceived manipulation in the service of political expediency.  

Finally, we need to recognize how uncertain are our knowledge base and models of fate and transport in the environment and effects on human health. Since we are particularly interested in mill tailings, we might look at the accuracy of EPA's generic model on radon flux from mill tailings piles. EPA used an emission rate of 1 Bq of $^{222}\text{Rn}$ per m$^2$-s for a concentration of 1 Bq of $^{226}\text{Ra}$ per gram in the tailings. Figure 2 compares measured radon fluxes with EPA's flux assumption.  

It can be seen that the assumption is not a particularly good one, though generally conservative (i.e., it overestimates the releases of radon per unit concentration of radium). Further, the uncertainty in the exposure-dose relationship is considerable. This is due to insufficient knowledge about deposition patterns in the lungs, clearance rates, source-target geometry, aerosol composition and size, concentration of unattached free ions, fraction of unattached $^{218}\text{Po}$, type, depth, and frequency of breathing, airway clearance rates, and personal factors such as age, sex, health and smoking. With these caveats in place, let us now look at three recent risk assessments and see what relevance it has for the Remedial Actions Program.

**Uranium Mill Tailings**

The most recent study of risks from mill tailings is that by a Panel of the Board of Radioactive Waste Management of the National Research Council. They found that dose is dependent upon a variety of factors, including concentration of radon during exposure period, degree of equilibrium between the parent radon-222 and its various daughters, aerosol composition and size, concentration of unattached free ions, fraction of unattached $^{218}\text{Po}$, type, depth, and frequency of breathing, airway clearance rates, and personal factors such as age, sex, health and smoking. They also published a table showing radon sources in the U.S. and the approximate dose to the lung from each of the sources. This is reproduced in Table 1. To put this in perspective, it should be noted that only four deaths out of 100 are due to lung cancer. It should also be noted that of the approximately 100,000 deaths per year due to lung cancer, it is calculated that 10,000-20,000 are due to indoor radon exposure. It can be seen from the table that uranium mining and milling are responsible for about 0.1 percent of all lung doses due to radon and its daughters.

Further the panel has computed that chances of getting a cancer from radon without the uranium piles is $1 \times 10^{-4}$ per year, whereas a person living right next to a mill tailings pile with an edge-of-pile concentration of 1 pCi/l would increase his risk by $7 \times 10^{-5}$ per year. This can be compared with the lung cancer risk per year from smoking of $1.2 \times 10^{-3}$. We can recall that one of the earliest studies of risk suggested that people ignore voluntary risks smaller that $10^{-3}$/yr and involuntary risks smaller than $10^{-6}$/yr. As alluded to earlier, this can only be categorized as acceptable or unacceptable, depending upon the definition of risk utilized.

In one of the earliest attempts to broaden the definition of risk and include concern about unknown and dread consequences, as defined previously, as well as the traditional benefits-minus-costs and public and worker death and morbidity, Fischoff, et. al., were able to show that the ranking of risk to human health of six energy technologies could be reversed depending upon the weight given to unknown risk and dread risk factors. The rankings are shown in Table 2a and the weights accorded to the risk attributes in Table 2b and the scoring by one expert in Table 2c. As shown in Table 2b, in Set A, the weights reflect traditional risk studies where equal weights are given to worker and public health and morbidity. In Set B, deaths to the public are given twice the weight of worker death and morbidity which is given twice the weight of unknown and dread risk. In Set C, public deaths and public fears are given the overwhelming weights, while worker health and morbidity are given minimal weight. Finally, in Set D, deaths are given practically no weight but present suffering due to morbidity and psychological fears is given the overwhelming weight. In Table 2a, one can see that by the traditional risk analysis, nuclear power generation has the lowest risk, whereas in Set C where public concerns are given the most weight, nuclear power has the highest risk.

In the Academy study, the alternative decision criteria that could have been used are shown in Table 3. Without explicitly making a choice that is economically, legally, administratively, and perhaps most important of all, politically acceptable among these criteria, scientific and socially consistent results may not follow. Because the EPA has not explicitly adopted any decision criteria and, in fact, appears to, at vari-
ous times, vacillate between them, it is not possible to determine the scientific adequacy and consistency of EPA's analysis. At the extremes, a rights-based criterion of no incremental risks due to the piles could be achieved only by excavating the piles and sending them off into space. At the opposite extreme, using a utility-based criterion, deterministic benefit minus costs, the cost of the corrective program has soared from $0.5 billion to $4 billion to save a projected 570 lives over 100 years of the projected 600 who would have died in that same time frame without remedial measures. The EPA rejected an earthen cover twice as thick to save an additional projected 27 lives, but that would cost an additional $250 million.

As those of you who have done such an analysis recognize, the difference between 570 and 597 is more apparent than real. Possibly more interesting is the rejection criterion of approximately $10 million per projected life saved, but acceptance at $1 million per projected life saved. Now that the costs have increased eight-fold, does this mean that the whole program should be abandoned since the costs now are approaching the $10 million per life saved that caused the additional cover to be rejected?

In addition, the regulations assume that remedial action is a one-time solution, but, in fact, we know that the radon covers will not last the 1000 years projected, never mind the half life of the parent thorium. Covers will require periodic maintenance, though those maintenance periods may be widely separated in time.

The NAS Panel also notes that "efforts to model flux based on measured concentrations of radionuclides in piles and efforts to estimate airborne concentrations in the vicinity of piles are both liable to be subject to error of up to several orders of magnitude. For any given site, the combined errors from adopting a modeling approach would thus be so large as to make the modeling results meaningless." This modeling approach to development of regulations is particularly unfortunate when means to measure integrated offsite concentrations accurately and economically are readily available. Despite all the misgivings about procedures, the NAS Panel was able to find that "viewed in the perspective of the wide variety of risks that face U.S. society, simple order-of-magnitude arguments and comparisons suggest that health risks posed by exposure to radon from uranium mill tailings piles are trivial for the average U.S. citizen and range from small to modest for most persons who live close to uncontrolled piles. However, if persons were to live right at the edge of a few uncontrolled piles that involve particularly unfavorable exposure conditions, their risk could be significant." (This would raise their annual incremental, lung-cancer risk by $8 \times 10^{-4}$, two thirds of the risk from smoking or three times the risk of a fatal automobile accident.)

At the same time as the Academy Panel was completing its study, a task committee of the American Society of Civil Engineers was also completing a study on Management of Inactive Uranium Mill Tailings. This review looked at the problem from a deterministic viewpoint and urged continuation of the cleanup with the objective of an ultimate solution by the removal of both the radium-226 and the thorium-230 for subsequent burial in a more secure fashion. No questions were raised about the validity of the process of setting the standards nor its appropriateness nor its feasibility.

**Thorium Tailings**

I have recently completed a risk-analysis study of a thorium tailings pile. While the location of the pile must remain confidential, I believe an analysis of the study will be illuminating. I should also add that I have changed the numbers to further disguise the location. The problem is what to do about an inactive thorium pile in a residential neighborhood. To make an informed decision, the alternatives to leaving and stabilizing it in place need to be evaluated so that one can at least see the tradeoffs. A group of experts brought together by the Nuclear Energy Agency has indicated how the problem might be structured. This is shown in Figure 3. This is a comprehensive outline that you might want to examine more leisurely. We might look at least at the second tier to areas of concern. The role of the ICRP in specifying the optimization of radiation protection, ALARA, should not be ignored. ICRP has recommended that the detriment of an action be computed by

$$Y = \alpha S + \beta \sum N_j \times f(H_j)$$

The two terms of this sum are generally called the "$\alpha$ term" and the "$\beta$ term", and their components have the following meaning:

- $S$ is the collective dose derived from a summation of all individual contributions in
the exposed population irrespective of the individual dose level or the time and location in which doses are received.

—α is the monetary cost attributed to a unit of collective dose, and is also independent of time, location and the level of the individual doses. However the value of α for a given practice may vary from country to country depending on local, socio-economical and other factors.

—The "β term" of the equation would take into account other components of the detriment which are not linearly related to the collective dose. This term is intended to take into account social and institutional factors. β is the monetary value that would be assigned to a unit of this component of the detriment: \( f(H_j) \) is a function of individual doses and would be used to give greater weight to higher individual doses, particularly those near the dose limits; \( H_j \) is the mean dose to the \( N_j \) individuals in the \( j \)th group.

That is, the α term is the collective dose multiplied by the monetary value assigned to the collective dose. This can vary from country to country. The beta term is related to other components which are not linearly related to the collective dose (i.e., individual dose) and takes into account social and institutional factors. This philosophy influenced my study of the thorium pile.

For the specific site, we need to look at the costs in terms of deaths, morbidity, radiation dose (sieverts), and health effects (from pollutants other than radiation) to the public and workers for each of the alternatives, as well as the incremental costs of each alternative from the base case. The alternatives calculated are a "secure" cell onsite and "secure" cells 50 and 200 miles offsite, whether it is possible to site such a facility or not. The processes required are the excavation of the waste at the site so as to be emplaced in a "secure" cell onsite or off, construction of the cell, transportation of the waste material to the cell, placement in the cell and maintenance of the cell. We recall that ICRP also says that in optimization studies, the calculations need only be carried out to the point where there is no difference between alternatives. Therefore, the maintenance costs and effects can be ignored, since they are the same for both onsite and offsite cells. More importantly, the vexing problem of how to treat very small doses in the far future can be finessed because they will be the same for all alternatives. To do the analysis, an engineering study was made for both onsite and offsite cells to determine the amount of material to be excavated, the manhours required to do so, the manhours to excavate and backfill the new cell, the manhours and truck miles to transport the materials to the site and the manhours required to place the material in the cell. For construction work, standard morbidity and mortality rates for heavy construction from non-radiological causes were taken from "Occupational Injuries and Illnesses in the U.S. by Industry, 1983" and found to be 4.5 x 10^-3 lost hours per hour worked and 1.2 x 10^-7 fatalities per hour worked. For non-radiological truck accidents and for routine and accidental radiation doses to the public, unit values were taken from Wolff's summary paper. He calculated that there were 8.2 x 10^-7 injuries per truck mile and 4.8 x 10^-8 deaths per truck mile. From calculations based on National Safety Council data, I found that there would be 1.6 x 10^-5 days lost due to injuries per truck mile traveled. Wolff also found that the various pollutants emitted, such as particulates, nitrogen oxides, sulfur oxides, hydro-carbons, carbon dioxide from combustion, particulates of fugitive dust from resuspended particulates from combustion, brake bands/pads, tire wear, and silt from windblown soil would cause 8.0 x 10^-9 health effects per mile. He further found that the radiological doses would be 3.2 x 10^-4, 4.8 x 10^-5 and 1.1 x 10^-5 person-rem per mile for incident-free transport to non-occupational and occupational and for non-occupational persons under accident conditions, respectively. The internal and external dose rates for workers at the site were measured values. These rates are all tabulated in Table 4. The results of all these calculations are shown in Table 5.

Recalling the difficulties in comparing risks, we can see that, in every category for workers and members of the public, moving the wastes offsite results in greater insults than leaving them onsite. If we try to put them in a common metric, dollars, then we can use a modified form of sensitivity analysis and allot $200,000 and $1,000,000 to a statistical human life. Then, the additional cost for worker deaths for moving offsite ranges from $42,000 to $210,000 at 50 miles to $164,000 to $820,000 at 200 miles. For public
deaths, similar calculations result in $5,400 to $27,000 at 50 miles and $19,400 to $97,000 at 200 miles. These values for public deaths could be multiplied by a factor of 2 to 10 to include the greater value placed on public deaths. For injuries, one might bound the costs with $10 to $25 per hour or cost per day of $80 to $200. For the 50-mile distance, the cost would range from $8,000 to $20,000 and for 200 miles, from $26,400 to $66,000.

For radiation dosage, we shall use the conversion factor of $2 \times 10^{-4}$ deaths per person-rem and the same $200,000 and $1,000,000 per human life. For workers, then, at 50 miles, the differential costs are $8,400 to $42,000 and at 200 miles $17,200 to $86,000. For members of the public, at 50 miles the differences are $54,800 to $274,000 and at 200 miles, $222,800 to $1,114,000. Summing these, we see the differential cost of moving the waste 50 or 200 miles offsite could range from $8,110,000 to $8,573,000 and $27,449,800 to $29,180,000, respectively. These dollar costs are dominated by the transportation costs. Even if one should value public insults at 10 times worker insults, the results would still be dominated by transportation costs. The only change would be to make the cost of moving off-site even greater.

However, if we recall that earlier we suggested that one should include in these kinds of evaluation public concerns, then we should look further. Putting dollar costs upon concerns is difficult. Therefore, we might look at how long it would take local residents to reach the same number of calculated deaths as would be received in the move 50 to 200 miles offsite. The effective population dose from an improved onsite disposal cell is 0.4 person-rem per year. Therefore, using the same conversion factors and assuming two years of lost time is equal to a death, approximately the increase in life expectancy if cancer should be eliminated, then 0.632 incremental deaths would occur due to the move to a site 50 miles away. The calculated death rate per year for a disposal cell on site is $(0.4 \times 2 \times 10^{-4} \text{ deaths/person-rem}) \times 8 \times 10^{-5} \text{ deaths/yr}$. Therefore, it would be 7900 years before the local population would receive doses that would cause the same number of deaths as a move 50 miles away. Similar calculations for the 200 mile distant site indicate it would take 41,000 years. This present-day dose can be compared with the concern of these local residents.

### Hazardous Chemical Wastes

The recent Ph.D. dissertation by Robert Broshears at Vanderbilt University looked at the risks presented by three hazardous chemical waste sites in Tennessee that are on the National Priority List. Broshears developed a risk algorithm, shown in Figure 4, to determine what degree of treatment or more accurate quantification of the parameters, if any, was required to meet ingestion standards. In some cases, none of the above would be sufficient and then institutional controls would be necessary. To illustrate the methodology, only the results of the groundwater pathway at the Velsicol Disposal site in Hardeman County, Tennessee, will be presented. From the mid-60s to the early 1970s, the corporation buried 300,000 drums of wastes from the manufacture of organochlorine pesticide wastes in near-surface trenches. The wastes included heptachlor, dieldrin, endrin, heptachlor epoxide, as well as other organic constituents, including carbon tetrachloride. Only the heptachlor analysis will be dealt with in this paper. For those interested, the hydraulic conductivity at the site was taken to be $1.2 \times 10^{-4}$ m/s, hydraulic gradient, 0.0034, dispersivity, 100 m, and porosity, 0.08. Using standard, simplified first-order deterministic models of degradation, solubilization, and leaching of the waste and dilution of the waste stream with groundwater and by advection, dispersion, retardation and degradation and ingestion of drinking water, maximum individual risks for worst case analysis at 1000 m for time of 100, 1000, and 10,000 years were greater than $10^{-6}$ per year, except for the risks at 100 years for hydraulic conductivities of $1.2 \times 10^{-4}$ and for 100 and 1000 years at hydraulic conductivities of $1.2 \times 10^{-5}$ m/s, where the plume had not yet reached the sampling point.

Therefore, a probabilistic risk analysis was carried out. The results are shown in Figures 5 and 6 for individual and collective risk, respectively. If one adopts the criterion that 95 percent of the maximum individual risk less than $10^{-6}$ is an acceptable risk and that a collective risk less than one is also acceptable, one can see that for individual risks, the 100 year calculation is acceptable, but the 1000 and 10,000 year risks are not. Then one goes back to the algorithm and sees that improved estimates of the solubility and partitioning coefficient by further experimentation would lead to the improved es-
Estimates shown in Figures 5d and 5e. One can see that the 1000 year estimate is satisfactory but that the 10,000 year estimate is not. Similarly, for the collective dose, one can see in Figure 6 that the 100 and 1000 year risks meet the criterion but the 10,000 year risk was exceeded until further refinement of the solubility and partitioning were made.

It can be seen from this study that, depending upon the time interval utilized and the accuracy of the input data and the criterion of acceptable risk utilized, the releases of heptachlor may or may not be acceptable. If institutional control of drinking water supplies can be maintained over a period of centuries, then the risks would meet the criteria.

Conclusions

From these three very disparate risk analysis studies, what can we conclude? First, we might note that by focusing on particular risks (radioactive and hazardous chemical wastes), we may be ignoring far greater risks, based upon a criterion of number of deaths. Chris Whipple has noted that, in this obsession, we frequently only transfer the risk to another source or group.17 Aaron Wildavsky has questioned this preoccupation: "How extraordinary! The richest, longest lived, best protected, most resourceful civilization, with the highest degree of insight into its own technology, is on its way to becoming the most frightened."18 Similarly, the editor of Science is shocked (tongue in cheek) to learn, based on television and newspaper reports, that "we are dying like flies from exposures to toxic chemicals, nuclear power stations, drunken drivers, and incompetent physicians."19

Second, we can see that risk assessment is like the Bible. We can find almost anything we want in it, or, as Mark Twain wrote many years ago, "There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact."20 or, as I like to put it, it is so soul satisfying.

Third, the definition of risk we are accustomed to using (probability of occurrence times consequences) is too restrictive. It must be broadened to accommodate the concerns of the public of unknown and dread risk or we shall continue to puzzle over our inability to convince the public of truths that are so obvious to us.

Fourth, risk analysis, properly done, can illuminate choices, consequences and tradeoffs.

Finally, we (with all these uncertainties and alternative interpretations) can see that, in addition to good science and engineering, it is the process that is important. It must be perceived to be open, transparent, and equitable, and deal with the public's concerns if we are to establish communication with a larger audience.
## Table 1. Radon Sources in the United States

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount Released PBq/y (Ci/y)</th>
<th>Approximate Percentage of Total U.S. Dosage to Lung from Rn + Daughters (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil</td>
<td>4400.000 (120,000,000)</td>
<td>40.00</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>330.000 (8,800,000)</td>
<td>3.00</td>
</tr>
<tr>
<td>Technology Enhanced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Interiors</td>
<td>1.000 (28,000)</td>
<td>55.00</td>
</tr>
<tr>
<td>Tillage of Soil</td>
<td>110.000 (3,100,000)</td>
<td>1.00</td>
</tr>
<tr>
<td>Natural Gas (industrial use)</td>
<td>0.410 (11,000)</td>
<td>1.00</td>
</tr>
<tr>
<td>Phosphate mines</td>
<td>2.000 (53,000)</td>
<td>0.02</td>
</tr>
<tr>
<td>Coal mines</td>
<td>0.520 (14,000)</td>
<td>0.005</td>
</tr>
<tr>
<td>Phosphate fertilizers</td>
<td>1.800 (48,000)</td>
<td>0.02</td>
</tr>
<tr>
<td>Geothermal power</td>
<td>0.021 (580)</td>
<td>0.20</td>
</tr>
<tr>
<td>Uranium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>7.400 (200,000)</td>
<td>0.07</td>
</tr>
<tr>
<td>Milling (active sites)</td>
<td>5.600 (150,000)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

* Volcanic eruptions, not included in this summary, could be a significant source. Certain granites and gneisses are also known to produce high levels, as, e.g., the Reading Prong in Pennsylvania.

Adapted from NRC, "Scientific Basis for Risk Assessment and Management of Uranium Mill Tailings," National Academy Press, 1986
### Table 2. The Risk-to-Human-Health Rankings of Six Technologies given Four Sets of Weights on One Set of Five Attributes and the Scores of One Expert

#### Set of Weights

<table>
<thead>
<tr>
<th>Rank</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Nuclear</td>
<td>Conservation</td>
<td>Conservation</td>
<td>Conservation</td>
</tr>
<tr>
<td>2</td>
<td>Hydro</td>
<td>Hydro</td>
<td>Small Wind</td>
<td>Hydro</td>
</tr>
<tr>
<td>3</td>
<td>Conservation</td>
<td>Nuclear</td>
<td>Hydro</td>
<td>Small Wind</td>
</tr>
<tr>
<td>4</td>
<td>Large Wind</td>
<td>Small Wind</td>
<td>Large Wind</td>
<td>Coal</td>
</tr>
<tr>
<td>5</td>
<td>Small Wind</td>
<td>Large Wind</td>
<td>Coal</td>
<td>Nuclear</td>
</tr>
<tr>
<td>Worst</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Coal</td>
<td>Coal</td>
<td>Nuclear</td>
<td>Large Wind</td>
</tr>
</tbody>
</table>

#### b. Four Possible Sets of Weights for Five Risk Attributes

<table>
<thead>
<tr>
<th>Attributes</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Public deaths</td>
<td>0.33</td>
<td>0.40</td>
<td>0.20</td>
<td>0.08</td>
</tr>
<tr>
<td>2. Occupational deaths</td>
<td>0.33</td>
<td>0.20</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>3. Morbidity</td>
<td>0.33</td>
<td>0.20</td>
<td>0.05</td>
<td>0.40</td>
</tr>
<tr>
<td>4. Unknown risk</td>
<td>0.00</td>
<td>0.10</td>
<td>0.30</td>
<td>0.24</td>
</tr>
<tr>
<td>5. Dread risk</td>
<td>0.00</td>
<td>0.10</td>
<td>0.40</td>
<td>0.24</td>
</tr>
<tr>
<td>Sum of Weights</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

#### c. The Score of Six Technologies of Five Risk Attributes by One Expert

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Coal</th>
<th>Hydro</th>
<th>Large Scale Wind</th>
<th>Small Scale Wind</th>
<th>Nuclear</th>
<th>Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Public deaths</td>
<td>80</td>
<td>10</td>
<td>20</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2. Occupational deaths</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>30</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>3. Morbidity</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td>50</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>4. Unknown risk</td>
<td>70</td>
<td>60</td>
<td>90</td>
<td>50</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>5. Dread risk</td>
<td>50</td>
<td>50</td>
<td>40</td>
<td>20</td>
<td>90</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 3. Examples of Some of the Alternative Decision Criteria that Might be Applied in Approaching a Risk-Management Decision on Uranium Mill Tailings

Utility Based Criteria

Deterministic Benefit-Cost: Estimate the benefits and costs of alternatives in economic terms, then choose the one with the highest net benefit (i.e., maximum benefit minus cost).

Probabilistic Benefit-Cost: Same as deterministic benefit-cost but use expected values of uncertain net benefit.

Cost Effectiveness: If total costs and benefits cannot be estimated, but regulation is deemed necessary, then a specific alternative may be chosen on the basis of minimizing the cost to achieve a given objective. Implicit in this approach is some assumption that the investments needed to get to the stated objective are worthwhile, but a formal cost-benefit criterion is not applied.

Bounded Cost: Sometimes also termed the "regulatory budget approach"; this strategy sets a maximum budget that society can afford to devote to risk management activity and then hopes that resources will be spent in such a way as to maximize the amount of risk reduction achieved within the budgetary constraint. To the extent that this hope is realized, this criterion is not logically different from the cost-effectiveness criterion.

Minimize Chance of Worst Possible Outcome...Maximize Chance of Best Possible Outcome: While these and similar criteria are utility based, they may not be stated in terms of utility maximization. Political and behavioral considerations frequently dictate the use of such criteria. Of course, this could be viewed as equivalent to maximizing a multiattribute utility, but operationally this is rarely done.

Rights-Based Criteria*

Zero Risk: Independent of what it costs, and how big the risks are, eliminate, or do not allow, the risk.

Bounded or Constrained Risk: Independent of the costs, constrain the level of risk so that it does not exceed a specific level, or more generally, so that it meets a set of specified criteria.

Approval/Compensation: Allow risks to be imposed only on people who have voluntarily given consent, perhaps after compensation.

Technology-Based Criteria

Best Available Technology: Do the best job of reducing the risk that is possible with current technological capability. In practice, this criterion is almost never applied as a pure strategy. Rather some "feasibility/affordability" criterion is added, making it a mixed criterion or perhaps even a pure cost-effectiveness criterion.

Hybrid Criteria

Often hybrids of utility and rights-based criteria are applied. For example, a bounded-risk criterion may be used to set an upper limit that, for ethical reasons, cannot be exceeded, and a benefit-cost criterion may be applied below that level. An example often employed in the context of radiological risk is ALARA (As Low as Reasonably Achievable), which combines a technology-based criterion with a fuzzily stated utility-based criteria.

*Strictly speaking all these criteria could be described by a utility function and thus could arguably be considered utility based. Nevertheless, in popular usage we believe the word "right*" better communicates the essence of these criteria.

From NAS, Risk Management
### Table 4. Rates for all Effects

#### Non-Radiological

<table>
<thead>
<tr>
<th>Category</th>
<th>Rate (unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Work</td>
<td></td>
</tr>
<tr>
<td>Lost hours/hours worked</td>
<td>$4.5 \times 10^{-3}$</td>
</tr>
<tr>
<td>Fatalities/hours worked</td>
<td>$1.2 \times 10^{-7}$</td>
</tr>
<tr>
<td>Truck Accidents</td>
<td></td>
</tr>
<tr>
<td>Days lost/mile</td>
<td>$1.6 \times 10^{-5}$</td>
</tr>
<tr>
<td>Deaths/mile</td>
<td>$4.8 \times 10^{-8}$</td>
</tr>
<tr>
<td>Pollutants emitted</td>
<td></td>
</tr>
<tr>
<td>Health effects/mile</td>
<td>$8 \times 10^{-9}$</td>
</tr>
</tbody>
</table>

#### Radiological

<table>
<thead>
<tr>
<th>Category</th>
<th>Rate (unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0.21$ mrem/hr - external</td>
</tr>
<tr>
<td></td>
<td>$0.10$ mrem/hr - internal</td>
</tr>
<tr>
<td>Truck transport</td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>$3.20 \times 10^{-4} + 1.1 \times 10^{-5}$ = $3.31 \times 10^{-4}$ person - rem/mile</td>
</tr>
<tr>
<td>Worker</td>
<td>$4.80 \times 10^{-5}$ person - rem/mile</td>
</tr>
<tr>
<td>Truck speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$47$ miles per hour</td>
</tr>
</tbody>
</table>

From Parker, 1986.
## Table 5. Comparative Effects of Onsite and Offsite Burial

<table>
<thead>
<tr>
<th></th>
<th>Onsite Burial</th>
<th>Offsite Burial</th>
<th>50 Miles</th>
<th>200 Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Worker</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health effects, deaths</td>
<td></td>
<td></td>
<td>0.0006</td>
<td>0.0008</td>
</tr>
<tr>
<td>Injuries, days lost</td>
<td></td>
<td></td>
<td>230.00</td>
<td>560.00</td>
</tr>
<tr>
<td>Dose, person-rem's</td>
<td></td>
<td></td>
<td>130.00</td>
<td>960.00</td>
</tr>
<tr>
<td><strong>Public</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health effects, deaths</td>
<td></td>
<td></td>
<td>0.0003</td>
<td>0.0010</td>
</tr>
<tr>
<td>Dose, person-rem's</td>
<td></td>
<td></td>
<td>120.00</td>
<td>5700.00</td>
</tr>
<tr>
<td><strong>Differential costs over on-site burial</strong></td>
<td>$8,000,000</td>
<td>$27,000,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From Parker, 1986
References

Figure 1. Location of 81 hazards on factors 1 and 2 derived from the relationships among 18 risk characteristics. Each factor is made up of a combination of characteristics.

Figure 2. Comparison of the reported range of measured radon flux from inactive uranium mill tailings piles with the EPA flux assumption.
Figure 3. From NEA, "Long-Term Radiation Protection Objectives for Radioactive Waste Disposal," 1984.
Figure 4. A risk assessment algorithm for hazardous waste sites.
Histogram for individual risk due to heptachlor for a 100-year time interval at the Velsicol Disposal Site.

Histogram for individual risk due to heptachlor for a 1,000-year time interval and improved parameter definition at Velsicol Disposal Site.

Histogram for individual risk due to heptachlor for a 10,000-year time interval at Velsicol Disposal Site.

Histogram for individual risk due to heptachlor for a 10,000-year time interval and improved parameter definition at Velsicol Disposal Site.

Histogram for individual risk due to heptachlor for a 100,000-year time interval at Velsicol Disposal Site.

Figure 5. Individual Risks.
Figure 6. Collective Risks

(a) Histogram for collective risk due to heptachlor for a 100-yr time interval at the Velsicol Disposal Site

(b) Histogram for collective risk due to heptachlor for a 1000-yr time interval at the Velsicol Disposal Site

(c) Histogram for collective risk due to heptachlor for a 10,000-yr time interval at the Velsicol Disposal Site

(d) Histogram for collective risk due to heptachlor for a 10,000-yr time interval at the Velsicol Disposal Site
Workshops
On April 29, 1987 an all day workshop was held on Hazardous and Mixed Waste Handling and Disposal. The workshop was part of the annual Remedial Action Programs Meeting held in Grand Junction, Colorado. It was co-facilitated by Gale P. Turi of the DOE and Kathleen L. Falconer of UNC Geotech.

The workshop was divided into a morning and an afternoon session. The morning session provided an overview of the requirements pertinent to the handling and disposal of hazardous and mixed waste. In the afternoon session the DOE's Headquarters' perspective of the applicable requirements was given along with the position of each of the Remedial Action Programs: the Uranium Mill Tailings Remedial Action Program (UMTRAP), the Formally Utilized Site Remedial Action Program (FUSRAP), and the Surplus Facilities Management Program (SFMP).

After a brief introduction of the workshop presenter, Kathleen Falconer of UNC Geotech began the morning session with a discussion of the Resource Conservation and Recovery Act of 1976 (RCRA) and the Hazardous and Solid Waste Disposal Act of 1984. In 1976 Congress passed RCRA thereby combining the Solid Waste Disposal Act of 1965 and the Resource Recovery Act of 1970. RCRA represented the first attempt at the federal level to manage solid waste in general and hazardous waste in particular. In its original form, RCRA provided for the "cradle-to-grave" management of hazardous waste by imposing requirements on generators, transporters and owners/operators of treatment, storage and disposal facilities (TSD's). EPA promulgated regulations pursuant to RCRA in May of 1980 (40 CFR Parts 260-270) setting into motion Congress' scheme for managing hazardous waste. In the same year Congress passed the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) to provide for the management of waste disposed of before 1980 and thus not covered by RCRA.

From 1980 to 1984 the DOE maintained that it was completely exempt from RCRA due to an exemption in the RCRA for source, special nuclear and by-product material as defined by the Atomic Energy Act of 1954. This position was supported by a Memorandum of Understanding between the Secretary of Energy and the EPA Administrator and was upheld until 1984 when it was overturned by a US Court of Appeals decision subjecting the Department of Energy to the full requirements of RCRA for the management of hazardous waste. The Department still maintained, however, that its mixed waste that was considered by-product material was exempt from regulation under RCRA.

On May 1, 1987, the DOE final rule clarifying DOE's obligations under RCRA was published in the Federal Register. The purpose of this final rule is to interpret the Atomic Energy Act (AEA) definition of the term "by-product material," set forth in Section II e (1) of that Act, as it applies to DOE owned or produced radioactive waste substances which are also "hazardous waste" within the meaning of RCRA. The effect of this rule is that all DOE radioactive waste which is hazardous under RCRA will be subject to regulations under both RCRA and the AEA. This rule does not effect materials that are defined as by-product material under section II e (2) of the AEA.

In November of 1984 Congress passed the Hazardous and Solid Waste Amendments to RCRA. These Amendments clearly expanded EPA's authority under RCRA to address past hazardous waste activities and federal facilities. In addition, it sets forth hammer provisions in a schedule for EPA to establish limits on the land disposal of specific hazardous wastes and provides for Research Development and Demonstration permits as an alternative to the full RCRA permitting in order to encourage the development of alternative waste treatment technologies.
Specific sections of the 1984 Amendments which could significantly impact Remedial Action Programs include Sections 3005 (e), 3004 (u), 3004 (c), (d), (e), and (g), 3007, 3016, 3002. Under Section 3005 (e), interim status on land disposal units terminated as of November 8, 1985 unless the owner or operator had submitted a Part B permit application for the unit, and a certification that the unit was in compliance with applicable ground water monitoring and financial responsibility requirements. The loss of interim status provides particular problems for DOE because it affects TSD units which were operated after 1980 under declared exemption to RCRA. These units are required to have Closure Plans implemented if the Part B Permits were not submitted. Another impact is also with the permitting process. Section 3004 (u) gives EPA the authority to deny or withhold permits until corrective actions or a compliance schedule have been accomplished for "all releases of hazardous waste or constituents from any solid waste management unit at a treatment storage, or disposal facility seeking a permit under this subtitle, regardless of the time the waste was placed in such unit." For DOE facilities seeking RCRA permits, this section has the effect of putting sites previously being handled under the DOE Order on CERCLA (5480.14) or other Remedial Action Programs under RCRA. Section 3004 (c), (d), (e), and (g) provides for restriction of land disposal of certain hazardous waste. It is important that these schedules be considered when planning for remedial action. Under section 3007 EPA or the authorized state is required to annually inspect all federal facilities. Section 3016 states in part:

Each Federal agency shall undertake a continuing program to compile, publish, and submit to the Administrator...an inventory of each site which the Federal agency owns or operates or has owned under section 3016 in January of 1986 with an update to be submitted in January of 1988. This information will be listed along with information submitted under RCRA section 3005 (Permits for Treatment, Storage, or Disposal), RCRA section 3010 (notification and effective dates, or CERCLA section 103 (Notices, Penalties) in a new Federal Agency Hazardous Waste Docket as provided under SARA.

Section 3002 requires hazardous waste generators to have a program for waste minimization and to certify on the manifest required for off-site shipment that they have such a program in place. Since in the process of performing remedial action hazardous wastes are often encountered that must be disposed of under RCRA, waste minimization requirements must be addressed.

In the second presentation of the morning session, Harry Williams of UNC Geotech outlined a case study of efforts to remediate under RCRA a Department of Defense Site contaminated with dioxins. With respect to the RCRA requirements, Mr. Williams described the site, its history, and the magnitude of the characterization effort. He then described the efforts to demonstrate cleanup technologies on site under TOSCA and prior to the 1984 Amendments. Permitting for this effort took two (2) months. After the 1984 Amendments were in effect, a technology previously demonstrated was again taken to a site in the Pacific Ocean. This Research Development and Demonstration (RD&D) permit (Section 214 of the 1984 Amendments) was issued by Region XI, San Francisco, Ca., and took thirteen (13) months to obtain at a cost of $160,000. The actual demonstration was completed in five (5) weeks. A separate technology was a demonstration at a site under the jurisdiction of Region IV, Atlanta, Ga. The RD&D permit was obtained in six (6) months at a cost of $80,000, but subsequent concerns by Region IV and the issuance of the November 1986 Land Disposal Bill prevented the demonstration from taking place until May 1987, seventeen months after submittal of the permit application and a total cost of $1,000,000. In summary, the permitting process is costly and time consuming. It can be further complicated with changing regulations and program planning must allow for these changes.

In the third workshop presentation, Timothy Harms of the DOE's Division of Environmental Guidance discussed the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). CERCLA was intended to provide for liability, compensation, cleanup and emergency response for hazardous substances released into the environment and to provide for the cleanup of inactive hazardous waste disposal sites. It provides for reporting of a release when it occurs and any place where hazardous
materials have been treated, stored or disposed of, within 180 days of enactment of CERCLA. The Act gives the President the authority, which he delegated to the Administrator of the Environmental Protection Agency, to respond to releases of hazardous substances. A response is defined as a removal or a remedial action and may involve action by EPA to clean up a site, using money from the Superfund. EPA may issue an administrative order requiring cleanup under section 106. Section 107 (a) authorizes cause of action against any of the following parties who are jointly and severally liable: owners/operators of treatment, storage or disposal facilities, generators of hazardous substances, transporters of hazardous substances, and landowners, including previous owners, when disposal occurred during their tenure of ownership. Natural resource damages are addressed in section 107 (f) which authorizes a cause of action for natural resource damages. The actual Superfund was established under section 111 of the Act; however, money from the fund is not available for use on federal land except for emergencies and, to a limited extent, natural resource damages. Congress allowed for prioritization of sites involving releases in section 105 of the Act which is the basis of the National Priorities List (NPL).

CERCLA was amended by Congress in 1986 in the Superfund Amendments and Reauthorization Act (SARA). The Amendments were intended to resolve a number of issues that had arisen in the first several years of experience under CERCLA. Although SARA creates some new authorities, many of its provisions can best be understood in light of the history of CERCLA implementation. CERCLA was supposed to apply to federal facilities "in the same manner and to the same extent" as to private persons. This was actually impossible since use of the Superfund was a key element of CERCLA. SARA section 120 was intended to resolve federal facilities issues. Another limitation of CERCLA was that it provided no standards for cleanup. Section 121 of SARA is intended to provide the analytical methodology for choosing cleanup standards on a site-by-site basis through the identification of applicable or relevant and appropriate requirements (ARARS). EPA required under CERCLA that a party commit to at least 80% of the cleanup cost of a site before it would agree to a settlement. Section 122 provides a procedure for settling cases. EPA was criticized for acting too slow under CERCLA. Schedules for all cleanups are provided under section 116 and for federal facilities under section 120. Section 105 requires EPA to study and revise the much criticized HRS. SARA also provides for contractor indemnification and judicial review.

On October 22, 1986 a memorandum on SARA was issued from the Assistant Secretary of Environment, Safety and Health, Mary Walker. This memorandum which was discussed by Mr. Harm is included as an attachment.

The identification of hazardous and mixed waste as contained in 40 CFR Part 261 was presented by John Englert of Dames and Moore with the West Valley Project. Hazardous waste is waste which meets the definition of a solid waste and exhibits one of the characteristics of a hazardous waste or is listed as a hazardous waste. Hazardous waste characteristics defined in 40 CFR Part 261 include ignitability, corrosivity, reactivity, and toxicity. Waste which displays one or more of these characteristics must be managed as hazardous waste. Lists of hazardous waste are also included in 40 CFR Part 261. Because mill tailings are specifically listed in the Atomic Energy Act under Section II e as by-product material they are clearly excluded from regulation under Subtitle C of RCRA and have not been a subject of the by-product/mixed waste debate.

In the last presentation of the morning, Jerry Lyons, MK Ferguson, UMTRAP, discussed safety considerations in waste site investigations. Mr. Lyons emphasized that we are often-times working with unknown hazards and highlighted what additional precautions are necessary to compensate for these unknowns. A specific concern that was described was silica dust. Mr. Lyons calculated how easy it was to exceed the TLV given the silica content of many of the materials that are being handled as part of Remedial Action Programs.

Steve Miller, DOE Office of General Counsel, began the afternoon session with a discussion of the applicability of RCRA/SARA to radioactive materials and to the remedial action hazardous waste. Radionuclides are included under the Clean Air Act and thus are hazardous materials under CERCLA/SARA. CERCLA/SARA does apply to radioactive material with the exception of those covered by an exclusion, for section 104 of the Act only, of 1) commercial facilities
having nuclear incidents involving source, special nuclear and by-product material, 2) those sites dedicated for cleanup under Title I and II of the Uranium Mill Tailings Act and 3) Federally permitted releases of source, special nuclear and by-product material. Thus CERCLA/SARA apply to SFMP and FUSRAP without exception and to UMTRAP with limited exception (section 104). Mr. Miller also provided an update on the By-Product Rule.

Jack Hammond of MK Ferguson, Weldon Spring Remedial Action Project, followed with a discussion of the SFMP position on handling and disposal of hazardous and mixed waste. Using Canonsburg and Weldon Spring as examples, Mr. Hammond said that UMTRAP and SFMP work closely with EPA and the states with respect to the handling of these wastes. Hazardous waste being disposed of in compliance with the applicable requirements while the disposition of mixed waste, when encountered, is negotiated with the appropriate regulatory authorities.

David Sheffy of DOE’s Oak Ridge Operations Office discussed the FUSRAP position as being essentially the same as UMTRAP and SFMP. Mr. Sheffy mentioned specific mixed wastes whose ultimate disposition is yet to be determined, highlighting the need for the resolution of the mixed waste issue and for facilities for the management of mixed waste.

The UMTRAP position was presented by Richard Richey of DOE’s Albuquerque Operation Office. Mr. Richey said that the UMTRA Program has a small quantity of mill tailings that are mixed with hazardous waste. Current plans are to keep this material segregated from materials that are pure tailings while an agreement for its ultimate disposition is negotiated.

The workshop closed with a briefing on Maxey Flats from Steven Woodbury of DOE headquarters. Maxey Flats was a commercially operated, low-level waste disposal site that was shut down in the mid-1970s after it began to exhibit what is known as the “bathtub effect,” i.e., leachate overflowing from the trenches. Currently ownership of the site rests with the State of Kentucky. In 1985 Maxey Flats was listed on the NPL and in late 1986 the DOE along with many of its contractors was named a Potentially Responsible Party. DOE met with the other parties, both public and private; it was decided to have the private Potentially Responsible Parties (PRPs) complete the Remedial Investigation/Feasibility Study as allowed under the law in lieu of EPA and its contractors, with joint government and private party funding.

The participation of the workshop attendees indicates that hazardous and mixed waste issues are of considerable interest to the Remedial Action Program. Since approaches for handling the waste are evolving, we recommend that this topic be included for consideration at the next Remedial Action Program meeting.
Summary
Performance Measurement Systems Workshop

Co-Facilitators:
K. T. Dziedzic, DOE-Oak Ridge Operations Office
Jim Fulton, UNC Geotech
April 28, 1987

The performance Measurement Systems Workshop discussed the application of performance measurement systems for planning and controlling remedial action projects. The workshop consisted of six major presentations which prompted open forum discussions on shared experiences and lessons learned. The topics included were:

1. "Life Cycle Planning and Reporting Requirements and Fiscal Year Planning and Reporting Requirements" presented by Mike Mitchell of MK Ferguson.
6. "DOE-HQ Perspectives of Performance Measurements" co-presented by Jim Fiore and Bob Gallagher of DOE-HQ

Each of the workshop presentations and related discussions are summarized to document major observations and lessons learned. These summarizations are not meant to include entire presentations on the above topics. If the reader desires additional information which is not included in the following summaries, written requests can be made to the individual presenter or UNC Geotech.
Session I: "Life Cycle Planning and Reporting Requirements and Fiscal Year Planning and Reporting Requirements."

- Most remedial action programs are required to plan, authorize, and control work in accordance with annual fiscal year funding appropriations. This emphasis on fiscal year funding can, and has in some programs, reduced the emphasis of life cycle planning and reporting.

- The planning and controlling of remedial action work on a fiscal year basis is necessary and appropriate. However, performance measurement systems are designed to measure baseline performance over the entire life cycle of a project, and the importance of using current fiscal year performance data to predict long-term or at-completion impacts against predetermined baselines should not be compromised.

- Most remedial action programs have established life cycle baselines and utilize current fiscal year performance data to monitor progress towards the achievement of baseline objectives. For those programs where this dual emphasis is not appropriately balanced, a review of their planning and reporting requirements is recommended and, where appropriate, corrective action taken.

Session II: "Remedial Action Cost Estimating."

- Estimating remedial action costs continues to be a difficult process because no industry established performance data base is available. Oftentimes the ability to estimate the cost of remedial action work is inhibited by the lack of, or inability to gather, appropriate characterizations data.

- Effectively estimating remedial action costs follows many of the same approaches developed in estimating costs for construction projects. Typically, most remedial action cost estimates are developed and refined in phases which approximate the amount of engineering design or characterization data available. When the scope of work is initially determined, remedial action cost estimates are usually rough order of magnitude or conceptual in nature. As the contractor is better able to define the scope of work, the cost estimate is refined accordingly, and the confidence factor in the estimate increases.

- Some construction industry based cost guides are helpful in estimating costs of remedial action work. However, much of the remedial action work involves radioactive contamination or hazardous chemicals which complicates the scope of work and escalates costs. Many remedial action projects require the development of a cost data base while the work is progressing. This data is then used to refine cost estimates for work to be completed.

- Remedial action cost estimates should contain sufficient contingency funding requirements to cover the risk of the remedial action work. In initial estimates where the scope of work is not well defined, the contingency requirement may be quite high. As the work scope becomes better defined, the risks associated with completing the work decrease, and need for contingency funding accordingly decreases. Since the risks associated with the remedial action work are usually higher than the risks associated with construction work, the guidelines used for establishing contingency requirements on construction projects may be helpful but are often insufficient for appropriate risk protection on remedial action work.

- The uncertainties and risks associated with estimating costs on remedial action work complicate processes for forecasting the funding that will be required to complete undefined work scheduled to be completed in the future. An effective remedial action cost estimating system must be able to relate current cost information to work scheduled to be completed and evaluate potential impacts on the total cost baseline.

Session III: "Program Integration."

- Most remedial action projects involve a number of performing organizations whose individual objectives and performance must be integrated to effectively plan and control remedial action projects. The application of DOE's Cost Schedule Control System criteria to remedial action projects has provided a common framework around which integration of
contractor supplied data can be successfully achieved.

- Project integration is necessary to develop common and consistent objectives which can effectively be communicated to all levels of participants on the project. Whenever remedial action work involves a number of performing organizations, DOE has often selected a single contractor to provide integration services for the project. The services most often provided by the integrating contractor include:
  - Long-range planning and budgeting.
  - Program objectives and work scope definition.
  - Schedule coordination.
  - Fiscal planning and budgeting.
  - Funds management.
  - Performance assessment and reporting.
  - Project baseline change control.

- Several keys to successful program integration include:
  - Early development of a comprehensive work breakdown structure which encompasses the project from start to finish.
  - Multi-contractor participation and input to the planning and goal-setting process.
  - An effective management information system which is capable of manipulating the project data base.
  - Common performance measurement and reporting system requirements.
  - Common contractual philosophies which incorporate pass-through requirements for each of the performing organizations.

Session IV: "Hardware and Software Requirements to Support Project Management Information Systems."

- A computerized data processing and management system is an important tool in effectively managing remedial action work. This discussion presented some of the approaches used to select the appropriate hardware and software systems to support the planning, control, and performance measurement aspects of remedial action work and is best summarized through a review of the lessons learned:
  - Define your user requirements and document them thoroughly.
  - Assure that the systems selected can be supported by the vendor, and obtain a written agreement for the support to be provided prior to final selection.

Session V: "Cost Schedule Control System Validation Process."

This discussion group was presented in two parts. Part I presented a historical background of the DOE Cost Schedule Control System criteria and reviewed some of the lessons learned in validated applications. Part II discussed the validation review process in the context of lessons learned by Westinghouse during their demonstration review on the West Valley Demonstration Project. Individual summaries follow for each of these discussion.

Part I: "History of DOE's Policy, Procedure, and Practice of Implementing CSCS."

- Basic DOE Cost Schedule Control System philosophy and policy for implementation has been:
  - Minimize changes to contractors' existing systems.
  - Cost schedule control system should be the only internal management and government reporting system.
  - DOE has avoided imposition of specific systems and allowed the contractor to select those internal management systems they will use to meet the requirements of DOE's CSCS.

- DOE adopted the CSCS to:
  - Ensure contractors have sound management and control systems.
  - Ensure the contractors' systems provide necessary management data to properly relate cost, schedule, and technical performance and that the data provided by the contractor was valid, timely, and auditable.

- DOE's application of the criteria has met with some resistance from contractors in the following areas:
  - Misunderstanding of criteria requirements.
  - Micro management by the DOE.
—Cost of implementation.
—Performance data will be used against the contractor.
—Poor implementation support by the customer.

• DOE has initiated improvements in their implementation policies to enhance contractor acceptance and understanding of criteria requirements. The end result has been the continued and expanded use of DOE's CSCS which has consistently been demonstrated as a superior technique for the planning and control of major projects.

Part II: "Lessons Learned in Implementing a Validated CSCS Management Control System on the West Valley Demonstration Project."

• In order to successfully conduct a CSCS demonstration review at the West Valley Demonstration Project, a plan for success was established. The plan included provisions for:
  —Administrative policy and procedure development which embodied the principles of CSCS.
  —Comprehensive training programs.
  —Frequent customer contacts and dialogue.
  —Provisions for testing the system prior to construction.
  —Accurate, traceable records and logs.
  —Internal compliance audits.
  —Mock validation review.
  —Development and use of storyboards to enhance validation review team’s familiarity with system and documentation.

• Difficulties during system development and implementation included:
  —Minor resistance from some participants.
  —Problems in bringing major software package on line and operating.
  —Comprehension and understanding of performance reports.

• Major lessons learned were:
  —Development of a well-defined end project WBS is essential.
  —Don’t underestimate the time, training, and learning curve necessary to software implementation and data collection.
  —Initially design your management system around CSCS rather than retrofit.

  —Extensive training and preparation needed for validation including dry runs, mock audits, and remedial training.
  —Compliance with the criteria does not assure success. You have to read and evaluate performance data.

Session VI: "DOE-HQ Perspectives of Performance Measurements."

This session was co-presented in two parts. Part I discussed the status of performance measurement in the remedial action program. Part II discussed performance measurement indicators other than those provided by CSCS. Individual summaries for each of these discussions follow.


• CSCS implementations are continuing on remedial action programs as follows:

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<tr>
<th>Project</th>
<th>Contractors</th>
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<tr>
<td>FUSRAP</td>
<td>Bechtel National</td>
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<td>UMTRAP</td>
<td>Jacobs Engineering Group</td>
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<td>UNC Geotech</td>
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<td>Weldon Spring</td>
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• CSCS implementation issues continue to include:
  —Inadequate or poorly developed work breakdown structures.
  —Confusion over the definition and use of management reserve and contingencies.
  —Effective techniques to rebaseline or replan project work as a result of operating and annual funding problems while maintaining visibility and relevancy.
  —Project baseline performance measurement versus contract life.

• DOE-HQ is upgrading guides and policies, and some new things to look for are:
  —Improved PMAS for analyzing contractor performance data.
Part II: "Performance Measurement Indicators CSCS and Others."

• Key DOE-HQ questions on performance measurements:
  —Is the work getting done on schedule and within cost?
    -CSCS provides some excellent indicators.
  —Are the managers performing well?
    -CSCS provides some indicators.
    -Other important indicators aren't included in CSCS.

• DOE's view of performance measurement:
  For a job to be well managed, there must be both performance and accurate measurement of it.
  —Performance without measurement:
    -Fairly common, particularly with solid scientific or engineering people with limited project management experience.
  —Measurement without performance:
    -Less common, but does occur when manager fails to analyze CSCS.

• DOE-HQ evaluation of common errors in the use of CSCS:
  —Too much emphasis on numbers.
  —Too few deliverables.
  —Inadequate up-front planning.
  —Information isn't timely.
  —Inconsistencies in numbers.

• The performance of a project manager can be evaluated in terms of:
  —Control.
  —Consultation.
  —Cooperation.
  —Confidence.
  —Comprehensiveness.

• A project manager exhibits control when:
  —He has control of cost and schedule performance. In other words, he knows how to effectively use CSCS.

  —He is aware of what is happening on his project and controls the important items.

  —He delegates responsibilities appropriately.

• A project manager consults appropriately when:
  —The project office and HQ discuss options and strategies prior to implementation. This doesn't change who is responsible for a decision.
  —He draws on expertise of his staff and HQ staff.

• A project manager cooperates when:
  —He cooperates with HQ even when he questions the wisdom of the HQ decision.
  —He works toward HQ and field office being a team.
  —He works with HQ, not against it.
  —He cooperates with external groups as appropriate.

• A project manager exhibits confidence when:
  —He is confident of his own knowledge and skills.
  —He has confidence to admit when he is wrong.
  —He generates a sense of confidence in his staff that the job will be done well.

• A project manager exhibits comprehensiveness when:
  —He is given a task, it is done completely.
  —Strategies or options are proposed, they reflect a lot of thought.
  —There are few surprises for HQ because of forward thinking.
  —Contingency plans are developed to handle any possible perturbations.

• In summary:
  —CSCS can help measure project performance if it is done right.
  —Good project managers must do more than just implement CSCS.
Summary
Verification Measurements Workshop

Co-Facilitators:
Andy Wallo, DOE-Headquarters, NE-23
Michael K. Tucker, DOE-GJPD
John R. Duray, UNC Geotech
April 28, 1987

The Verification Measurements Workshop concentrated on three principal topics: measurements and their use in the verification/certification process, the application of supplemental standards, and independent verification. These topics are covered in four major sections and concluded with the fifth section on recommendations and concerns.

Measurements

New methods for estimating the indoor average radon-daughter concentration.

Abbreviated RPISU method—The abbreviated radon progeny integrating sampling unit (RPISU) method has been recently approved for use in Grand Junction vicinity property verifications. The method uses two or more bimonthly RPISU results according to a prescribed algorithm to determine if the EPA standard will be exceeded. Typically, fewer than six bimonthly RPISU measurements are necessary using this method. There are, however, certain conditions that govern the application of the method. The method has been validated in a recent Technical Measurement Center report. [Validation of the Abbreviated Radon Progeny Integrating Sampling Unit (RPISU) Method for Mesa County; Colorado, G.H. Largner, Jr., UNC/GJ-34(TMC)].

RTRAK system—The RTRAK system is a vehicular ground survey system intended for 100 percent coverage of large areas. The system is not yet built; it will be patterned after an operational system (MSCM) deployed at the Hanford site. The RTRAK system will consist of a number of gamma-ray detectors mounted on a vehicle and is designed to detect radium-226 at 5 pCi/g. The system will feature a position-location capability and data storage and plotting.

Ultrasonic ranging and data system (USRADS)

This system is intended for use in vicinity property surveys. The USRADS is a combination of ultrasonic ranging and radio-frequency transmission of survey data. The ranging and data handling is managed by a dedicated microcomputer.

Experience with Terradex Track EtchR monitors

Long term storage of Track EtchR monitors—Experience with long term storage of exposed monitors was presented for the benefit of all users. Exposed monitors were stored in their original mylar package. Folding the mylar package a few times did not seal the already exposed monitor from further radon exposure. Also, it was discovered that Terradex had shipped fresh monitors in mylar packages that were not completely sealed. Both problems have now been eliminated.

Variation between different detector-material batches—A series of controlled environmental measurements revealed that
detector-material batch response ranged from 70 to 140 percent of the actual radon concentration.

**Sensitivity variation within a detector batch**—Unexplained variation of sensitivity within some detector-material batches was also discovered in the controlled chamber exposures conducted by the Technical Measurements Center. For some batches, the spread of monitor results about the mean value was observed to be greater than expected (based on counting statistics).

**Use of Measurements in Verification/Certification**

**Implementation of clean-up standards.**

From the discussion, it was clear that there is a need for a common interpretation on the method to implement standards for designation, remediation, and certification and verification among the UMTRA contractors. One area of concern expressed during the workshop was the application of outdoor standards on foundations. It was suggested that a benefit basis and a cost value be established in order to arrive at a cost-benefit criterion that could be used in deciding whether or not to pursue or continue a remedial action.

There appears to be better coordination between the inclusion, remedial action, and verification contractors in FUSRAP/SFMP than among the UMTRA contractors. The FUSRAP/SFMP contractors hold monthly meetings to discuss interpretation of clean-up standards. Some in UMTRA have met only a few times.

Differences in adherence to the standards during cleanup were also noted. UMTRA/ALO cleans designated properties to external gamma-ray levels of 30 percent above background within (and contiguous to) 10 feet of the structure and to the EPA standard beyond that area. UMTRA/GJPO also cleans to 30 percent above background near structures but cleans to approximately two-times background outside of that area. FUSRAP/SFMP clean to their adopted standard plus ALARA; there is also a hot-spot limit. There was no consensus opinion regarding the significance of these differences. In terms of residual soil concentrations, radium concentrations in remediated soil from a UMTRA/GJPO action would be a minimum of approximately 1 to 2 pCi/g while for FUSRAP/SFMP the minimum level would be 5 pCi/g.

Currently all programs use soil sampling for certification of cleanup. UMTRA studies indicate that at 2 pCi/g average concentrations, 5 or 6 samples could provide 95 percent confidence that the site is clean. This could represent a significant savings in sampling costs from the 20 or so samples currently being composited for each 100 square-meter area. UMTRA personnel felt that it was possible to certify on gamma measurements only and it was suggested that this approach be considered along with some limited verification using soil sampling. FUSRAP/SFMP use external gamma-ray measurements for excavation control but use soil sampling for certification. A total of approximately 25 samples per 100 square meters are collected and composited. FUSRAP experience indicates that certification using only gamma-ray measurements is not acceptable.

**Natural source involvement in remedial actions.**

The difference in the levels to which remedial actions were done was used to crudely estimate the natural source involvement at UMTRA sites. Chem-Nuclear cleans to the EPA standard and UNC cleans to within two-times background away from structures. Chem-Nuclear found 10 to 15 percent of properties they cleaned had low indoor gamma yet had an indoor radon-daughter concentration (RDC) that exceeded the standard. Chem-Nuclear attributed these properties to be elevated from natural sources. UNC found "no surprises" in the indoor RDC result after remedial action. By comparison of Chem-Nuclear and UNC results, 10 to 15 percent of the properties may have natural source involvement along with the uranium residue contamination. The next version of the Vicinity Property Management Implementation Manual contains a procedure for a reasonable series of measurements on those properties that have had remedial action yet exceed the indoor RDC standard. The cost of this remeasurement procedure is a rough estimate of the effort expended on natural source involvement when there is no residual contamination.

**Thorium-230 monitoring and personnel protection.**

UMTRA experience at some sites suggests that thorium-230 may be a problem. The problem relates in the difficulty of identifying the presence of thorium-230 (when it is not in equilibrium with radium) and monitoring it to be sure no workers are being significantly exposed. FISRAP experience did not suggest any concentrations of thorium-230 for personnel safety. Although con-
Centrations of thorium-230 are higher at FUSRAP sites that handled pitchblende ores and uranium residues than at UMTRA sites, the moisture conditions at these sites reduce the risk of exposure significantly. FUSRAP air monitors rarely reach 10 percent of the derived concentration guide. UMTRA measurements resulted in higher values.

Application of Supplemental Standards

Nuclear Regulatory Commission (NRC) perspective.

Supplemental standards should only be applied when absolutely necessary, and furthermore, all supplemental standard applications should consider ALARA.

NRC would consider accepting a verification measurement method that may give results that are less precise than the lab analysis of soil samples as long as there was a random soil sampling and lab analysis for QC purposes.

The NRC (reviewer of UMTRA supplemental limits) and DOE Headquarters (reviewer of FUSRAP/SFMP supplemental limits and exceptions) emphasized that the supplement application must demonstrate that the ALARA philosophy is followed and that the supplement provisions are being used because of absolute necessity.

The application of supplemental standards.

It appeared that the application of supplemental standards by FUSRAP/SFMP and UMTRA was similar although there were some differences in the process. There was a difference in the permitted whole body dose: 100 mrem for FUSRAP/SFMP (per DOE/EH guidance) and 500 mrem used by some in UMTRA. The 100 mrem value will prevail when DOE Order 5480.xx is implemented but will not supersede the related EPA standards for indoor exposure rate.

Independent Verification Process

The process of independent verification in FUSRAP/SFMP was presented. The plan for independent verification in UMTRA vicinity properties was outlined.

Independent verification in the FUSRAP includes 100 percent paper review of all site reports by the independent verification contractor and DOE Headquarters. Depending on site complexities and past experiences with spot checks and paper reviews, 10 to 100 percent onsite verification is conducted.

False exclusions.

There is no independent verification of false exclusions. The recommendation not to include (or designate) a property is in effect a kind of certification. Many felt that the observations of the Inspector General were based on a misinterpretation of the data. Following the recommendations of the Inspector General will weaken the bases for exclusion and may increase the false exclusion rate. No estimate was made for the present false exclusion rate.

Recommendations and Concerns

- Review the different implementation policies for the remedial action standards under the different programs to determine if the differences are necessary and if the associated costs or benefits warrant consideration to change selected practices. The ad hoc verification and certification committee may be the best mechanism to assess this issue.
- UMTRA should implement frequent, periodic, working meetings among the various contractors working on the same projects/sites to ensure common interpretation of the EPA standards.
- Alternative certification procedures should be examined to see if they are adequate and more cost effective than current procedures.
- The ad hoc verification and certification committee should review the need for examining the current inclusion process to determine if the false exclusion rate is acceptable. Currently, there is no information on the false exclusion rate.
- Although non-radiologic contaminants were not extensively discussed during the workshop sessions, concern was expressed regarding the need for verification of sites for hazardous materials.
• Alternative certification procedures should be examined to see if they are adequate and more cost effective than current procedures.
• The ad hoc verification and certification committee should review the need for examining the current inclusion process to determine if the false exclusion rate is acceptable. Currently, there is no information on the false exclusion rate.
• Although non-radiologic contaminants were not extensively discussed during the workshop sessions, concern was expressed regarding the need for verification of sites for hazardous materials.
Summary
Public Relations Programs Workshop
Tuesday, April 28, 1987

Co-facilitators:
Peter Mygatt, DOE-Idaho, Director of Office of External Affairs
Karen Scotti, UNC Geotech, Public Relations Manager

The workshop attendance included contractor representatives from the UMTRA, FUSRAP and WSSRAP programs as well as DOE representatives from Idaho, Oak Ridge, and Headquarters.

Guidelines and Regulations

Discussions began with a look at the impact that various guidelines and regulations have on the development of a public relations/community relations program. Of particular interest are the increasing public outreach activities being required by the implementation of environmental legislation such as the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

While much of the remedial action work involving uranium mill sites and mill tailings removal are exempted from the requirements of CERCLA/SARA, some of the work being done under the Surplus Facilities Management Program (SFMP) will need to follow public information activities as outlined by the Environmental Protection Agency (EPA) document "Community Relations in Superfund: A Handbook" prepared for the Office of Emergency and Remedial Response, EPA, March 1986 edition. This handbook is quite detailed and is of beneficial use to any who are involved in remedial action work but who do not have a public affairs professional on staff.

Additionally, the group looked at the needs and requirements of the various states that are involved in remedial action work and how state involvement impacts the design of a viable information plan. Overall, the first step in designing a plan is: determination of applicable DOE orders and policies; followed by consideration and inclusion of any pertinent requirements from EPA and/or the Nuclear Regulatory Commission (NRC); and finally, incorporation of any requirements from the specific state in which the work is being done. Fortunately, the information activity requirements from these regulatory bodies tend to follow the same philosophy and form—basically, to provide adequate opportunities for the affected community to comment on the remedial action work as it is being proposed and conducted.

Elements of a Viable Outreach Program

The UNC Geotech PR Manager began the discussion of this segment by providing a verbal outline and brief description of the public/community relations (Outreach) program requirements required by CERCLA. Those elements include the following:

Pre-Remedial Investigation Stage
Community Interviews—Personal interviews with environmental and community organizations, local residents and officials to determine citizen concerns, information needs, and how and when citizens would like to be involved in the remedial action process.

Community Relations Plan—Prepared prior to the start of field activities by a public relations professional in tandem with the technical team.

Feasibility Study (FS) Stage
Information Repository—Contains basic public documents such as: the community relations plan, the environmental assessment, environmental impact statement, fact sheets supporting general technical information, etc.
located in a central location such as a public library or city hall for small communities. 

Notification of public comment period (minimum 3 weeks)—Broad advertising within affected community of availability of the FS and the opportunity (including time period) for public comment.

Public comment/public meetings—Purpose is to get public input to the draft EA or EIS and to identify all public concerns before selection of the preferred remedial action alternative.

Fact sheet of feasibility study—Sent with notice specifying the alternatives, which alternatives attain or exceed public health and environmental standards, etc.

Responsiveness summary—Summary of community concerns prepared and submitted with the Record of Decision.

Public notice and fact sheets after selection of alternative—Covering selected method of remedial action. Similar method of broad advertising within the affected community and provision of fact sheets are selected distribution points.

Revision of the community relations plan—Revised to account for any citizen concerns that might affect the remedial design and construction phases.

Design/Action Stage

Public Notice & Fact Sheet—Provision of information through broad community distribution method that advises public of pertinent activities and milestones during the design and remediation phases. Preparation and distribution of general information fact sheets to interested or affected community groups during the design/remediation phases. Provision of materials on on-going basis to Information Repository.

Finally, a general outline for an Outreach (Community Relations Plan) consistent with DOE and EPA requirements was reviewed. That outline includes the following sections and attachments:

- Community Relations Plan Outline
  - Section 1: Overview of Community Relations Plan
  - Section 2: Capsule Site Description
  - Section 3: Community Background
  - Section 4: Highlights of Community Relations Plan

Section 5 Community RelationsActivities

Attachment A - Mailing List of Key Contacts & Interested Parties
Attachment B - Suggested Locations for Meetings & Information Repository

Tools of the Trade

There was a general discussion covering the purpose and variety of outreach activities that may be used to provide public information. Those "tools of the trade" include:

- Briefings—Purpose: to inform key officials and citizens about recent developments at the site, to provide them with background materials on technical studies, results of field investigations, and engineering design, and to report on remedial action planning and progress.
- Community interviews—Purpose: to obtain first-hand information about the community; to gain an understanding of the site's history, the community's involvement with the site, and the political climate of the area. To identify credible sources and disseminators of information. To learn how the community would like to be involved in the remedial action process, and to lay the groundwork for an effective community relations plan for the site.
- Contact person—Purpose: to help build trust between the agency and citizens. To establish a single point of contact - preferably a public relations professional.
- Exhibits—Purpose: to illustrate issues and proposed cleanup actions associated with the project in a creative and informative display. To make technical information more accessible and understandable to the general public.
- Fact sheets—Purpose: to ensure the public is kept informed of the status and findings of remedial activities; and to ensure that citizens have an understanding of the issues associated with the remedial action program.
- Formal public hearings—Purpose: to provide an opportunity for formal contact and testimony on proposed actions. All testimony becomes part of the public record.

Information Repository—Purpose: To allow free and convenient access to information on the nature of site problems and remedial action activities. An information repository enables citizens to review all site-related documents approved by DOE or the State for public disclosure.
**News Conferences**—Purpose: To provide media with accurate information concerning important developments before, during and after remedial action. To announce plans for any future actions at the site.

**News Releases**—Purpose: To make official statements on the proposed course of action or key milestones.

**Tours/open houses**—Purpose: To provide citizens with an opportunity to view the site, ask questions and express their concerns. To enable media, local officials and citizens to better understand the nature of the problem and the remedial action proposed or under way.

**Presentations/speakers bureau**—Purpose: To improve the public's understanding of the remedial action program. To explain how the process works and how the work will be accomplished.

**Public comment period**—Purpose: To provide an opportunity for citizen review and comment on the proposed course of remedial action.

**Public meetings**—Purpose: To inform citizens of planned and/or ongoing remedial actions and to discuss and receive feedback on the proposed course of action.

**Responsiveness summaries**—Purpose: To document for the public record any public concerns and issues expressed during the remedial planning and how DOW or the State responded to these concerns and issues.

**Revision of community relations plans**—Purpose: To ensure that the community relations program remains sensitive to citizen concerns through the final phases of remedial action. To evaluate which community relations activities were or are effective and which were ineffective.

**Case Studies**

This portion of the workshop gave participants the opportunity to bring up special site-specific problems and to highlight activities that have been tried with either great success or no success. Among the topics discussed were:

**How do you deal with a hostile community?**—Suggestions included use of a citizen's advisory task force when the community perceives the government agency and its contractor as "the enemy". This has worked successfully at some of the mill site communities where public opinion on the remedial action has been widely divergent. The citizen group served to provide the "opinion leader" focus many of the divided community organizations needed and worked successfully to bring all of the differing groups to a consensus that was supportive of the selected action. Care needs to be exercised that the citizen group is not perceived as being hand-picked or in the pocket of the government. In the case of a unified, hostile community, the suggestion was made that a respected but independent group - perhaps recruited from a local or state university - be used to provide the communications bridge between the remedial action program and the community.

**How do you explain the low-level health risks associated with radon without connecting the issue to other forms of radiation exposure?**—The participants agreed that this is a difficult and unresolved area. The general public has received a certain level of "education" from the media mostly connected to high-level waste issues or related to nuclear power/nuclear weapons. The consensus was that more work still needs to be done, with public relations and health physics professionals working together, on developing some information materials that puts radiation information into terms that the average person can understand. Pico-curies per liter data is still meaningless to most people.

**How do you put together a community relations plan if you don't have the luxury of a PR professional on staff?**—The ideal, of course, is to have that PR professional on the team. And in keeping with the overall theme of the annual meeting, it is cost-effective in the long-run to have that professional on board. Without one, however, you need to look for the technical management person on staff who can work comfortably with the general public and community groups. You can also always enlist the guidance and support of the DOE field office public affairs officer.

**Owner Relations**

This segment covered a description of the Owner Relations programs as they are being applied in the Uranium Mill Tailings Remedial Action (UMTRA) Project. Overall the discussion related to the importance of a more personalized program - preferably a system that will assign someone from the remedial action contractor company to serve as a point-of-contact with the property owner from inclusion into the program to
completion/certification. Because this phase of the UMTRA Project deals with individual property owners, a personalized program is essential to successful completion. Information is readily available from both UNC Geotech and Jacobs Engineering to help others start such a program if applicable.

Crisis Management/Response Team Planning

The final topic discussed was the importance of having a crisis management/emergency response plan in place. Peter Mygatt outlined the brief-but-intense media interest in a single vehicle (truck) accident that resulted in uranium billets being spilled into the Snake River in Idaho. Considerable effort was expended by DOE-Idaho in handling the media interest and in reassuring the local population that no environmental hazard resulted from the accident. Most of the workshop participants had prior experience planning for and working with emergency preparedness plans for facilities with the potential for on or offsite radiation releases. Consideration must also be given to potential accidents that could be related to the remedial action program activities. These tend to fall into the areas of transportation accidents, industrial (construction-related) events, or potential chemical spills. Because of the sensitivity of the public to any type of event, no matter how loosely connected, involving radiation or radioactive materials, an emergency preparedness plan is essential for assuring prompt, accurate information is provided to the appropriate state and local agencies and the general public.
Case Studies
Case Study: UMTRAP Millsites
Lakeview Tailings Site

Richard Sena, DOE-UMTRA Project Office
April 29, 1987
# Summary of EPA Standards

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standard</th>
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</thead>
<tbody>
<tr>
<td><strong>Control Of Tailings Piles</strong></td>
<td></td>
</tr>
<tr>
<td>— Longevity</td>
<td>200-1000 years</td>
</tr>
<tr>
<td>— Radon emissions</td>
<td>20 pCi/m²s; or 0.5 pCi/L</td>
</tr>
<tr>
<td>— Water protection</td>
<td>No limit, site specific judgment</td>
</tr>
<tr>
<td>• Clean-up of buildings</td>
<td></td>
</tr>
<tr>
<td>— Indoor radon decay products</td>
<td>0.02-0.03 w/l max.</td>
</tr>
<tr>
<td>— Indoor gamma radiation</td>
<td>20 micro R/hr above background</td>
</tr>
<tr>
<td>• Clean-up of Land</td>
<td></td>
</tr>
<tr>
<td>— Surface</td>
<td>5 pCi/s above background averaged over 15 cm.</td>
</tr>
<tr>
<td>— Buried</td>
<td>15 pCi/s above background averaged over any 15 cm.</td>
</tr>
<tr>
<td>— Buried layer</td>
<td></td>
</tr>
<tr>
<td>— Supplemental standards</td>
<td>Supplemental standards</td>
</tr>
<tr>
<td>— Procedure</td>
<td>Health, safety, costs, small</td>
</tr>
<tr>
<td>— Applicability</td>
<td>quantity and inaccessible tailings</td>
</tr>
</tbody>
</table>


Lakeview Geothermal Activity

- Seven Active Faults Or Fault Zones Potentially Impacting Site.

- Three Hot Springs Plus 40 Geothermal Wells In The Lakeview Known Geothermal Resource Area.
  - Many wells within 1 1/2 miles of site.
  - Hunter Hot Springs 0.4 miles NW of tailings pile.

- Geothermal Changes From Seismic Activity Documented.
  - Seismic activity can affect thermal and flow characteristics.
  - Activity can cause formation of new springs.

- Distinct Geothermal Hazard.

Desirable Characteristics for Alternate Area

- Geotechnical
  - Distance from active fault
  - Potential for liquefaction
  - Slope stability
  - Erosion Potential

- Hydrological
  - Minimal drainage area
  - Away from terraces
  - Depth to groundwater
  - Floodplains
  - Towards top of watershed unit

- Engineering
  - Distance from existing tailings
  - Proximity of borrow materials
  - Transportation network
  - Terrain

- Environmental
  - Away from critical habitats
  - Proximity to state and national parks
  - Distance to wildlife refuges
  - Location away from wilderness and national parks
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Criteria Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifers</td>
<td>Principal recharge areas for sole source aquifers or other significant aquifers.</td>
</tr>
<tr>
<td>Surface drinking water supplies</td>
<td>Areas within 1 mile of surface drinking water supplies.</td>
</tr>
<tr>
<td>Communities</td>
<td>Areas within 1 mile of community limits (legal boundary).</td>
</tr>
<tr>
<td>Mineral resources</td>
<td>Significant known recoverable resources of oil, gas, coal, and other minerals (except uranium and gravel).</td>
</tr>
<tr>
<td>Subsidence areas</td>
<td>Within 0.25 miles of areas susceptible to subsidence by natural or man-made causes.</td>
</tr>
<tr>
<td>Transportation corridors</td>
<td>Areas within the rights-of-way of state, Federal and county roads and Lake County Airport.</td>
</tr>
<tr>
<td>Archaeological &amp; historical resources</td>
<td>Within 100 feet of archaeological or historical districts and sites on the National Register of Historic Places.</td>
</tr>
<tr>
<td>Prime farmland</td>
<td>Areas designated by the Soil Conservation Service as being within the Class II soil capability classification.</td>
</tr>
<tr>
<td>State &amp; National Parks</td>
<td>Within 0.25 mile of Parks and Monuments under Federal, state or local jurisdiction.</td>
</tr>
<tr>
<td>Wilderness &amp; natural areas</td>
<td>Within 0.25 mile of Wilderness Areas, Wilderness Study Areas, Natural Areas, areas of critical environmental concern, and roadless areas as identified by the U.S. Forest Service, Bureau of Land Management, and the State of Oregon.</td>
</tr>
<tr>
<td>Wildlife refuges</td>
<td>Within 0.25 mile of wildlife refuges and disengaged migratory bird feeding areas.</td>
</tr>
<tr>
<td>Critical habitat</td>
<td>Within 0.25 mile of designated critical habitat for threatened or endangered species, fishery resource areas, and botanically and geologically sensitive areas; within 0.5 mile of known bald eagle or osprey nests and sage grouse strutting grounds.</td>
</tr>
</tbody>
</table>
## Attachment

### Exclusionary Criteria

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Criteria Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geological faults</td>
<td>Areas within 0.25 mile of Holocene or Recent faulting.</td>
</tr>
<tr>
<td>Liquefaction potential</td>
<td>Within 0.25 mile of areas having saturated loose sand or visible surface indications of disrupted drainage or broken ground.</td>
</tr>
<tr>
<td>Landslides</td>
<td>Areas within 0.25 mile of visible indications of slope instability.</td>
</tr>
<tr>
<td>Geothermal activity</td>
<td>Within 2 miles of Known Geothermal Resource Areas as identified by the Oregon Department of Geology &amp; Mineral Industries and other evidence of geothermal activity.</td>
</tr>
<tr>
<td>Volcanic activity</td>
<td>Areas within 2 miles of exposed Late Quaternary volcanic deposits.</td>
</tr>
<tr>
<td>Erosive soils</td>
<td>Areas of known highly erosive soils.</td>
</tr>
<tr>
<td>Slopes and escarpments</td>
<td>Slopes steeper than 33% grade; or areas from the top of an escarpment in excess of 10 feet in height established by the intersection of the ground surface with a plane inclined at a 20° angle from a horizontal plane passing through the toe of the escarpment, or 100 feet, whichever is greater.</td>
</tr>
<tr>
<td>Goose Lake</td>
<td>Areas lower in elevation than 5 feet above the historic high water level (4,721 feet).</td>
</tr>
<tr>
<td>Waterbodies</td>
<td>Lakes, ponds, reservoirs, rivers, or perennial streams.</td>
</tr>
<tr>
<td>Wetlands</td>
<td>Wetlands as defined by the Oregon Department of Fish &amp; Wildlife Habitat Protection Plan for Lake County.</td>
</tr>
<tr>
<td>Floodplains</td>
<td>100-year floodplains as defined by the U.S. Department of Housing &amp; Urban Development.</td>
</tr>
</tbody>
</table>
Impetus for Oregon Site Cleanup

• Concerns of Governor Atiyeh.
  —Delay in efforts at Lakeview.
  —Uncertainty of Federal Funding.

• Oregon Department of Energy.
  —Need for adequate site evaluation.
  —Agreed upon course of action.

• Recent findings on geothermal activity.
Figure 1. Final Condition-Collins Ranch Disposal Site
Figure 2. Collins Ranch Cover System-Topslopes
Figure 3. Collins Ranch Disposal Site Typical Cross-Section
Figure 4. Final Condition, Collins Ranch Disposal Site-Isometric

Figure 5. Existing Condition, Collins Ranch Disposal Site-Isometric
Figure 6. Flynn Ranch Alternate Disposal Site And Borrow Site
Figure 7. Collins Ranch Alternate Disposal Site and Borrow Site
Figure 9. Lakeview Mill Site
Figure 10. Lakeview Site Location
The following copies of photographs are presented for the purpose of reviewing the vicinity property case study as presented at the Annual Remedial Action Program Meeting held in Grand Junction, Colorado, on April 29, 1987. The slides were presented as a means of displaying the remedial actions performed on one vicinity property from the start of remedial actions to completion.

Originally, the case study was to display problems encountered during performance of remedial actions and unique solutions associated with these problems. However, after consideration was given to the vicinity property program in its entirety, it was decided to present the base case situation where major problems were not encountered. The majority of the vicinity properties remediated under the UMTRA Project are of this category.

The following photo copies display remedial action states associated with a Strabane, Pennsylvania, vicinity property located near the Canonsburg Uranium Mill Tailings Remedial Action (UMTRA) site. Two hundred and seventy-six cubic yards of residual radioactive materials were excavated, removed, and encapsulated within the Canonsburg disposal cell. Remedial action included exterior excavation covering approximately 70 percent of the outdoor surface area and a small amount of interior excavation within the basement.

This vicinity property was certified as having EPA standards on April 17, 1987.
Photo 1. Concrete being placed in East sidewalk, front porch landing prepared for concrete placement.

Photo 2. Concrete placement complete, new sod laid.
Photo 3. Eight inch drain clay pipe drain in front parking area surrounded with residual radioactive materials, six inch corrugated rubber flex hose replaced with eight inch clay pipe.

Photo 4. Same as No. 3.
Photo 5. Eight inch clay pipe prior to replacement.

Photo 6. Six inch corrugated rubber flex hose.
Photo 7. Backfilling with common fill post remedial action in front yard.

Photo 8. Spreading top soil along East side of property.
Photo 9. New sidewalk on East side of property looking Southwest.

Photo 10. Same view as picture No. 9 with new flowers.
Photo 11. West face of house where new sod was laid looking South.

Photo 12. Forming new back porch steps and placing structural fill for sidewalk on East side of property.
Photo 13. Excavation around storm drain on Southwest corner of house looking North.

Photo 15. Garbage can storage area in back yard looking East.

Photo 16. Garbage can storage area looking Southeast.
Photo 17. Excavation looking Northwest.

Photo 18. Placing concrete in East sidewalk looking North.


Photo 22. New sod being laid in back yard looking North.
Photo 23. Spreading top soil in back yard looking South.

Photo 24. Laying block border around garbage can slab looking NE.
Photo 25. Excavation in alley looking West.

Photo 26. Excavation in alley looking East, 24 inch storm drain in contaminated bedding.
Photo 27. Excavation around 24 inch storm drain looking Northeast.

Photo 28. Verification gamma measurements being performed around 24 inch storm drain.
Photo 29. Spreading top soil looking North.

Photo 30. Air conditioner unit reinstalled on new patio.
Photo 31. Existing crack between basement north foundation wall and bathroom wall.

Photo 32. Flooring removed in this area for excavation in basement.
Photo 33. Basement bathroom prior to remedial action.
Photo 34. Shower in basement bathroom prior to remedial action.

Photo 35. Removal of floor and cinders in basement bathroom.
Photo 36. New tiling in bathroom.

Photo 37. Excavation in basement shower.
Photo 38. New tiling in basement shower.
The Remedial Action Graphics Management System (GMS)

UNC Geotech
M.E. Madson
GMS Objectives

Visual Display of Grand Junction Vicinity Properties Status to Provide Cost Effective Management of the UMTRA Work Process...

GMS Capabilities

- Fully Integrated with AutoCAD-Equipped PC Stations
- Linked with the GJ Vicinity Property Tracking Data Base Updated Weekly
- Linked with the Designated Property List (DPL) Maintained on the CDC CYBER-815 Mainframe
- Generation of Weekly Plot Maps at AutoCAD Stations at Various Scales
- Accessible by All Performing Organizations Within UMTRA
- Innovative Graphic Management Tool

GMS Developments

UNC-ORNL Effort in Digitizing 5596 Property Locations Within 155 One Mile Sections. Fourteen 7 1/2 Minute Quadrangle Maps Were Then Digitized to Translate the Coordinates of the Section Maps to a Fixed Coordinate System. The Property is Then Displayed on Various Media with the Location and its Status Within the UMTRA System.
Basemap from the State Line to Cameo Quad [14] Quad Maps Are Represented

The Grand Valley from 16.5 to 38 Road
Township 2945, Mesa County, Colorado
2945--2943 Boundaries

Section 14 With 2945
Section 14 With Properties

Section 14 Boundaries

North Ave.
Belford Ave.
Teller Ave.
Hill Ave.
Gunnison Ave.
Chipeta Ave.
Guray Ave.
Grand Ave.
White Ave.
Rood Ave.
Main Street
Colorado Ave.
Ute Ave.
Pitkin Ave.
South Ave.
Section 14 With Properties and Boundaries

Downtown Grand Junction—Main Street
## PROPERTY STATUS COLOR CHART

<table>
<thead>
<tr>
<th>COLOR</th>
<th>MILESTONE CODE</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>1 - Li Red</td>
<td>20 - 40</td>
<td>Land Survey Bucking</td>
</tr>
<tr>
<td>7 - White</td>
<td>40</td>
<td>Land Survey in Process</td>
</tr>
<tr>
<td>3 - Li Green</td>
<td>90</td>
<td>RAD in Process</td>
</tr>
<tr>
<td>10 - Brown</td>
<td>100</td>
<td>Engineering Bucking</td>
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<td>4 - Li Cyan</td>
<td>110</td>
<td>Engineering in Process</td>
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<tr>
<td>12 - Dk Cyan</td>
<td>410</td>
<td>First &amp; Final REA/RAA Submitted</td>
</tr>
<tr>
<td>8 - Dk Red</td>
<td>490</td>
<td>First &amp; Final REA/RAA DOE/CDH Approved</td>
</tr>
<tr>
<td>9 - Li Magenta</td>
<td>490</td>
<td>First &amp; Final REA/RAA Owner Approved</td>
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<tr>
<td>5 - Li Blue</td>
<td>1010</td>
<td>Engineering Package to Procurement</td>
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<tr>
<td>13 - Dr Blue</td>
<td>1290</td>
<td>Bid Package (Subcontract Awarded)</td>
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<tr>
<td>2 - Yellow</td>
<td>1140</td>
<td>Construction in Process</td>
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<tr>
<td>14 - Dk Magenta</td>
<td>1240</td>
<td>Construction Completed</td>
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<td>8 - Gray</td>
<td>1270</td>
<td>Final Completion Report Submitted</td>
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<tr>
<td>11 - Dk Green</td>
<td>1270</td>
<td>Property Certification</td>
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### DESIGNATED PROPERTY

![Ouryay Ave. Properties With Designated Property](image-url)
UMTRA WORK PROCESS

INCLUSIONS

LAND SURVEY

RADIOLOGIC SURVEY

ENGINEERING DESIGN

SUBCONTRACTS

CONSTRUCTION

COMPLETION/CERTIFICATION

UMTRA Work Process

GJ-10571

Designated Property
Designated Property Complete

Ultimate Goal—All Clean Properties
Case Study SFMP Weldon Spring Start-Up

Glen A. Newtown, DOE-Weldon Spring Site Office
Jack Hammond, MK Ferguson

Background of Weldon Site and Description of DOE Weldon Spring Project

The Weldon Spring Site is located in St. Charles County, Missouri, about 30 miles west of St. Louis, on land used from 1941-1944 by the Department of the Army (DA) as a trinitrotoluene (TNT) and dinitrotoluene (DNT) ordnance works. The site consists of a 3.4-hectare (9-acre) former limestone quarry; a 21-hectare (51-acre) raffinate disposal area and a 69.6-hectare (169-acre) mothballed uranium feed materials plant, and various vicinity properties that are contaminated as a result of past DA and Atomic Energy Commission (AEC) activities at the Site. A map of the St. Louis area is shown in Figure 1.

During the period 1943-1957, DA utilized the former limestone quarry about 4 miles from the ordnance works for disposal of rubble and soils contaminated with TNT and DNT, and later from 1959 through 1966, the AEC disposed of building rubble and soils contaminated with thorium, uranium, and decay products. The quarry contains about 99,400 cubic meters (130,000 cubic yards) of waste, including quarry materials contaminated by the presence of this radioactive waste. A map of the quarry area, including the nearby well field serving the County of St. Charles is shown in Figure 2. The well field serves approximately one-third of St. Charles County.

The feed materials plant was built during 1955-1957 by the AEC, predecessor agency to DOE, and operated by Mallinckrodt, Inc., for the AEC from 1957 to 1966. The plant processed uranium ore concentrates and recycled scrap to pure uranium trioxide, uranium tetrafluoride, and uranium metal. Thorium ore concentrates were also processed. The raffinate residues from this processing were disposed of in four large open pits. During operations of the plant, the buildings, the equipment, the immediate terrain, the process sewer system, and the drainage easement to the Missouri River became contaminated with uranium, thorium, and their decay products. A map of the Weldon Spring Site is presented in Figure 3.

In 1967, the feed materials plant site was selected for a herbicide production facility and except for the materials stored in the raffinate pits and quarry, the site was transferred back to the DA and renamed the Weldon Spring Chemical Plant (WSCP). The Army began a major effort to decontaminate three process buildings for herbicide production. During 1968, the DA deposited about 4,260 cubic meters (5,572 cubic yards) of contaminated material in the quarry. The cleanup was not totally successful, and subsequently reduced requirements for the herbicide and increased cleanup costs resulted in cancellation of the project in 1969.

Approximately 238,600 cubic meters (312,000 cubic yards) of contaminated soil, equipment, and buildings remaining on the WSCP site require cleanup to meet current guidelines for unrestricted use. In addition, surveys show that radioactive contamination of the surrounding vicinity properties which occurred during and subsequent to plant operation would require removal of about 20,800 cubic meters (27,200 cubic yards) of soil to meet current guidelines for unrestricted use.

The 21 hectares (51 acres) encompassing the raffinate pits site were transferred back to the AEC in 1971. The raffinate pits contain approximately 168,200 cubic meters (220,000 cubic yards) of uranium and thorium residues. In addition approximately 98,000 cubic meters (130,000 cubic yards) of soils underlying the raffinate pits are also contaminated and will require remedial action.

On October 15, 1985, the Environmental Protection Agency (EPA) proposed including the Weldon Spring Quarry (WSQ) on the National Priority List as called for in the National Contingency Plan which is the implementing regulation for the Compensation Act (CERCLA).
Thus the remedial actions to be carried out by DOE at the Weldon Spring Site are subject to EPA oversight under CERCLA. For this project, the oversight function will be performed by EPA Region VII. The EPA/DOE Federal Facility Agreement for the Weldon Spring Remedial Action Project was signed in August 1986. This agreement defines the procedures and actions that DOE and EPA must carry out in order to discharge the responsibilities placed upon them by CERCLA, NEPA, and the Atomic Energy Act. The agreement provides for exchange of information and expertise between EPA and DOE. The agreement also establishes a basis for delisting the Weldon Spring Site from the National Priorities List (if listed) at the completion of the project.

On November 27, 1984, the DOE was directed by the Office of Management and Budget to assume responsibility for the decontamination of the WSCP from the DA and to integrate that work with other DOE remedial actions proposed for the WSQ, the Weldon Spring Raffinate Pits (WSRP), and the Weldon Spring Vicinity Properties (WSVP). The DOE and DA will share the cost for the WSCP decontamination. A Memorandum of Understanding regarding the site and the cost sharing was approved on February 11, 1985. Transfer of custody and control of the WSCP to DOE was effected on October 1, 1985.

In February, 1985, the DOE established the Weldon Spring Site Remedial Action Project (WSSRAP) as a major project for DOE management purposes. Figure 4 provides a graphical representation of the project. The scope of the project is as follows:

- Maintenance and surveillance of the site as necessary to maintain public safety and reduce radiological impact to as low as reasonably achievable, in preparation for site disposition.
- Integrated planning, engineering, and technology development as necessary to support evaluation of long-range disposition alternatives.
- Complete the environmental impact assessment process.
- Plan and implement the remedial action program required to adequately clean up the site.

-Priority will be given to decontaminating the WSQ by treating and disposing of the contaminated water, remove as much of the waste materials as feasible, and transfer them to the main plant area, stabilize any remaining wastes at the WSQ, conduct ground water restoration, if needed, and restore the site as appropriate.

-At the WSRP/WSCP, treat and dispose of the contaminated water, stabilize the wastes, dismantle all structures, construct a disposal cell on site in accordance with the requirements of 40 CFR 192 (preferred alternative); alternatively, dispose of these wastes off site.

-For the vicinity properties, clean up these properties to release limits and restore the properties, to the extent feasible, to their original condition; dispose of the wastes in the on-site disposal cell (preferred alternative); alternatively, dispose of these wastes off site.
- Certify remedial actions have been conducted, cleanup standards have been met and release as much of the site as possible for unrestricted use.

**NEPA Process**

As part of its Surplus Facilities Management Program (SFMP), the U.S. Department of Energy (DOE) issued a Notice of Intent (NOI) in the Federal Register on March 2, 1984 (U.S. Dept. of Energy, 1984), to prepare an Environmental Impact Statement (EIS) to assess the environmental impacts of alternatives for the long-term management of existing radioactive materials at the Weldon Spring raffinate pits, vicinity properties, and quarry. In accordance with regulations of the Council on environmental Quality (CEQ) and DOE guidelines for implementing the National Environmental Policy Act (NEPA), the Department conducted a scoping process to determine the alternatives to be analyzed in the EIS, the significant issues to be analyzed in depth, and the issues to be eliminated from further detailed study.

Since issuance of the NOI and completion of the public scoping process, the U.S. Department of the Army transferred custody of and accountability for the chemical plant to the DOE. As a result, management of contaminated materials resulting from decontamination and decommissioning (D&D) of the chemical plant are included in the alternatives evaluated in the EIS. However, many of the issues associated
with D&D of the chemical plant are not yet ready for a decision. DOE therefore plans to prepare a later NEPA document specific to D&D of the chemical plant.

Public input to the scoping process included:
- Presentations by 27 individuals made at a public meeting held in the Francis Howell High School gymnasium, St. Charles, Missouri, on March 20, 1984.
- Letters received by DOE from 15 individuals regarding the scope of the EIS.

These inputs were received from private citizens; organized citizen action groups (particularly the St. Charles Countians Against Hazardous Waste); local, state, and national political representatives; and state government agencies.

Technical input to the scoping process included:
- Engineering evaluations by Bechtel National, Inc. (BNI), of several alternatives for disposition of the radioactive wastes at the Weldon Spring Site.
- Meetings and correspondence between ANL and the DOE operations office at Oak Ridge, Tennessee, regarding location and conceptual designs for long-term management of the radioactive wastes.
- Meetings, correspondence, and review of alternatives and issues by SFMP program managers at DOE Headquarters and DOE operations offices at Oak Ridge, Tennessee, and Richland, Washington.
- Preliminary evaluation by ANL and — in consultation with Missouri state agencies, local government representatives, and members of the St. Charles Countians Against Hazardous Waste — development of a conceptual design for an additional alternative of a new, above-grade disposal cell at Weldon Spring.
- Meetings with Missouri state agencies (e.g., Department of Natural Resources) and elected officials.
- Meetings with EPA Region VII.

During scoping, commenters most often raised the following issues for consideration in the EIS:
- Health risks to members of the general public.
- Chemical contamination (particularly the quarry and chemical plant) and associated potential health risks.
- Sc epage from the raffinate pits or quarry and potential contamination of drinking water.
- Above-grade containment of wastes.
- Inclusion of the chemical plant in the proposed actions.
- Relocation of wastes from the raffinate pits to another area on the DOE or Army properties.
- Separation/recovery of radioactive substances.
- Effects on residential and industrial development in the Weldon Spring area.
- Regional seismic conditions.

Other issues receiving emphasis in the EIS are chemical contamination (in addition to radiological) of groundwater and the impact of potential contamination of the St. Charles County well field on development in the county. These issues were included because the Weldon Spring quarry has been nominated to the National Priority List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and because there is evidence of hazardous wastes at the chemical plant.

The three basic alternatives given in the NOI are assessed in the EIS. However, they have been renumbered and reorganized to improve presentation.

Alternative 1 in the NOI is the no-action alternative, which is Alternative 4 in the EIS. Alternative 2 in the NOI has been divided into two alternatives in the EIS: Alternative 1, long-term management of the wastes in the existing raffinate pits with improved containment; and Alternative 2, long-term management of the wastes in the raffinate pits area in a new disposal cell. Alternative 2 has been divided into two sub-alternatives: Alternative 2a, partially above-grade disposal cell with a leachate monitoring system; and Alternative 2b, completely above-grade disposal cell with a layer of lead in the cover and a leachate monitoring system. Alternative 2b was added as a result of input received during the scoping process.

Alternative 3 in the NOI involved long-term management of some (or all) of the wastes at alternative sites. This alternative has been divided into three sub-alternatives in the EIS: Alternative 3a, transport to and management of all wastes at the Hanford site near Richland Washington; Alternative 3b, transport to and management of all wastes at a "Nearby Site" in Missouri within 160 km (100 miles) of the Weldon Spring Site; and Alternative 3c,
transport of the sludge from the raffinate pits and quarry to an existing uranium processing site for reprocessing and management of the remaining lower-activity wastes at the Weldon Spring Site. Alternative 3c was added as a result of input received during the scoping process.

Many other sub-alternatives could have been developed from combinations of the various options for long-term management sites, disposal cell designs, transportation modes, and so forth. Permutations of all options would have created an unwieldy set of alternatives for analysis and comparison; therefore, combinations of options covering the range of alternatives to be considered by the DOE decision-maker were selected for analysis.

DOE determined that the following issues were beyond the scope of the EIS.

1. Comparison of various regulations — As provided under the Atomic Energy Act (as amended), DOE is exempt from regulation by states and other federal agencies with respect to radiological aspects of DOE operations. DOE develops its own regulations ("Orders") for general application to DOE operations.

2. Psychological impacts — As a result of a U.S. Supreme Court case involving the proposed restart of one of the Three Mile Island reactors (Metropolitan Edison Company vs. People Against Nuclear Energy [PANE] 103 S. Ct. 1556 [1983]), DOE determined that analysis of indirect psychological impacts is beyond the scope of the EIS.

3. Impacts of past operations at the site — The impacts of the various alternatives on the existing environment will be assessed. In the above-mentioned Supreme Court decision, it was stated that "NEPA is not directed at the effects of past accidents and does not create a remedial scheme for past federal actions." Therefore, a detailed analysis of past operations, beyond that necessary to characterize the existing environment, is beyond the scope of the EIS.

4. Monitoring of health of students and staff at Francis Howell High School — No monitoring studies were performed as part of the EIS. However, health impacts on students and staff were considered.

5. Detailed assessment of the chemical plant cleanup — the impacts of specific alternatives for D&D of the chemical plant were not specifically assessed. These alternatives will be covered in a later NEPA document tiered to the EIS.

6. Disposal of Weldon Spring wastes at Callaway Nuclear Power Plant — the Callaway Nuclear Power Plant was not assessed as a long-term management site (see number 7); however, the impacts of disposal of the wastes at the "Nearby Site" within 160 km (100 miles) of the Weldon Spring Site are assessed. If management of the wastes at a "Nearby Site" is chosen, this EIS will serve as the programatic NEPA document on which assessment of impacts at a specific management site will be tiered.

7. Other management sites — Only DOE owned sites are currently available for management of wastes from DOE operations. Long-term management of the Weldon Spring wastes at non-DOE-owned sites is not an alternative reasonably available to the DOE decision-maker. Use of a non-DOE-owned site would involve a multistate compact or NRC licensing. No such site has been chosen or licensed, so the alternative could not be specifically assessed in the EIS. The Hanford site is the only existing DOE-owned site considered in this EIS because it is representative of alternative DOE sites.

8. Other radioactively contaminated sites in the St. Louis area — EPA Region VII proposed that DOE also consider the possibility of cumulative disposal at the Weldon Spring Site of the radioactive wastes currently stored at various locations in Missouri (Figure 5). These wastes and their locations are as follows:
   - St. Louis Airport Site (SLAPS) and SLAPS Ditches — Previously used for storing ore residues, scrap, and equipment from uranium-processing operations (Newtown and Coxon, 1985).
   - Hazelwood Site (9200 Latty Avenue) — Previously used for storing ore residues and wastes from uranium-processing operations (Newtown and Coxon, 1985).
   - Uranium Processing Facilities, St. Louis — Plant buildings and site previously used to process uranium ore or
concentrates to produce uranium dioxide, uranium trioxide, uranium tetrafluoride, and uranium metal; also previously used for other activities with uranium metal and for extractions and concentration of thorium-230 from pitchblende raffinates (Newtown and Coxon, 1985).

West Lake Landfill — Previously used for disposing of soil from the Hazelwood site (Booth et al., 1982).

The SLAPS, Hazelwood, and Uranium Processing Facilities sites are already included in the DOE Formerly Utilized Sites Remedial Action Program; the West Lake Landfill is under NRC cognizance. DOE was directed that the materials be disposed of locally by reacquiring, stabilizing, and using SLAPS in a manner acceptable to the city of St. Louis. Plans for disposal of wastes from the Uranium Processing Facilities in St. Louis have not yet been formulated. The proposal for collecting all these wastes at the Weldon Spring Site has been strongly opposed by local citizens; local, state, and national officials; and groups from the St. Louis area. DOE therefore did not address in the EIS the cumulative impacts from disposal of the wastes from other sites in the St. Louis area at the Weldon Spring Site.

Decision To Be Made

As specified in the regulations of the Council on Environmental Quality (CEQ) for implementation of the National Environmental Policy Act (NEPA), the EIS is being prepared early in DOE’s decision-making process for the Weldon Spring Site. In addition to engineering, cost, and other consideration, environmental impacts are being considered. The planned sequence of decisions is shown in Figure 6. DOE is taking the CEQ “tiered” approach, and this EIS is the document on which subsequent assessments will be tiered. The concept of tiering relates to the preparation of additional NEPA documentation on specific project actions not currently developed to a level of detail that would allow for their assessment in this EIS. Specific examples include NEPA documentation for (1) decommissioning of the chemical plant and (2) site-specific impacts of long-term management at another site in Missouri within 160 km (100 miles) of Weldon Spring if this alternative (Alternative 3b in this EIS) were selected. This concept is described in 40 CFR Part 1508.28. The set of tiered documents will constitute the complete environmental impact assessment for all actions at the Weldon Spring Site.

The EIS supports the major decisions on cleanup and long-term management of the contaminated materials from the four areas at the Weldon Spring Site: raffinate pits, chemical plant, quarry, and vicinity properties. However, many of the specific issues associated with decontamination and decommissioning (D&D) of the chemical plant are not yet ready for a decision.

Decontamination of the quarry is common to all action alternatives. After removal of the wastes from the quarry to a disposal cell, DOE will evaluate the need for any further action alternatives. If groundwater restoration is not needed at either area, a decision will be made regarding whether the quarry or portions of the raffinate pits area can be released for unrestricted use or whether appropriate restrictions must be imposed for a period of time. If groundwater restoration is needed at either or both areas, DOE will add it to the project as needed. After implementation of the groundwater restoration alternative, DOE will determine if the quarry area or portions of the raffinate pits area can be released for unrestricted or other appropriate use.

The phrase "long-term management" is used in the EIS because the parent radionuclides (i.e., uranium, thorium, and radium) in the Weldon Spring wastes have long half-lives, and the hazard will not diminish appreciably for thousands of years. The potential environmental impacts under conditions of continuing management (maintenance, monitoring, and corrective actions as necessary) and under conditions of potential loss of management are assessed in the EIS.

Comments received as a result of the public hearing, April 10, 1987, have been uniformly negative. Criticisms center on level of design included, adequacy of alternatives, and necessity for additional characterization. They call for a supplement or revised DEIS. However, the Department will not respond to this until all comments have been reviewed and evaluated.
References


Figure 1. St. Louis Area Map
Figure 2. Location of Weldon Spring Quarry Relative to Missouri River and Municipal Well Field
Figure 3. Weldon Spring Site Vicinity Map
Figure 4. Weldon Spring Site Remedial Action Project (WSSRAP)
Figure 5. Location of Radioactively Contaminated Sites in the St. Louis Area
Figure 6. DOE Decision-Making Process for the Weldon Spring Site
Weldon Spring Site Remedial Action
Project Startup
Project Management Contractor's Point of View

J.D. Hammond
MK Ferguson Company
The Biggest Favors DOE Can Do For Its Prime Contractors and Itself

- Make the R.F.P. proposal data directly relevant and usable for the project.
- Establish the basic control structure.
- Stick with and use the established contract basis for management.
- Keep your contractor involved and informed.

The Biggest Favors Contractors Can Do For DOE and Themselves

- Insist on a signed contract prior to startup.
- Set parameters for startup during negotiations.
- Ensure control framework is in place from day one.
- Be flexible but control to baseline and maintain the baseline.
- Keep your client involved and informed.
Strategy

- Mobilize
  Personnel, Facilities, Support
- Establish controls
  Management, cost/schedule, procurement, safety, quality
- Reassess priorities
  Health & safety, characterization, engineering, remediation
- Implement program
  Management, community relations, etc.
- Reassess Program
  Priorities, performance, near term vs. long term
## WSSRAP Chronology

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1941-1944</td>
<td>WSOW operated</td>
</tr>
<tr>
<td>1943-1957</td>
<td>WSQ disposal area operated</td>
</tr>
<tr>
<td>1955-1957</td>
<td>WSFMP constructed</td>
</tr>
<tr>
<td>1957-1966</td>
<td>WSFMP operated</td>
</tr>
<tr>
<td>1959-1966</td>
<td>WSQ disposal area operated</td>
</tr>
<tr>
<td>1967-1969</td>
<td>Partial decontamination and initiation of WSCP</td>
</tr>
<tr>
<td>1968</td>
<td>Last use of WSQ for disposal</td>
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<tr>
<td>1971-present</td>
<td>WSRP/WSQ in ERDA/DOE caretaker status</td>
</tr>
<tr>
<td>1982</td>
<td>WSS proposed as 'regional' waste facility - 2000 citizens object</td>
</tr>
<tr>
<td>1982-present</td>
<td>NEPA process</td>
</tr>
<tr>
<td>1984</td>
<td>OBM directs DOE to accept custody of WSCP from DA</td>
</tr>
<tr>
<td>Feb 1985</td>
<td>WSSRAP established as a major project MOU on cost sharing between DOE/DA signed</td>
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<td>Oct 1985</td>
<td>WSCP transferred to DOE /EPA proposed WSQ be included on NPL under CERCLA</td>
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<tr>
<td>June 1986</td>
<td>Project office established on site</td>
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<tr>
<td>Aug 1986</td>
<td>FFA between DOE/EPA signed</td>
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<tr>
<td>Feb 1987</td>
<td>DEIS issued</td>
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<td>Mar 1987</td>
<td>Public hearing on DEIS</td>
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<td>1100 citizens attended</td>
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WSSRAP Baseline Data
RFP/Project Budget Base (1987 Budget)

- 9 year effort (1987-1996)
- $357 million tec
- Critical path(s)
- NEPA process/characterization
- WSCP demolition/disposal cell

WSSRAP
NEPA Process

Notice of Intent March, 1984
Public scoping meetings March, 1984
August, 1984
PDEIS IV (to EPA) October, 1986
DEIS February, 1987
Public information meetings March 9, 10, 1987
Public hearing April 10, 1987
Close comment period June, 1987
Comment response (to EPA) October, 1987
PFEIS-II (to EPA) March, 1988
FEIS October, 1988
ROD November, 1988 - January, 1989
Project Organization
The WSSRAP organization is depicted on the following page. The DFSD of the U.S. Department of Energy Headquarters (DOE-HQ) will provide program direction of the project through DOE’s Oak Ridge Operations Office (DOE-OR). The DOE-OR has the delegated responsibility and authority as the WSSRAP Lead Operations Office to conduct the project in accordance with policy and guidance provided by DOE-HQ. Specific project management responsibility for DOE-OR will be provided by the WSSRAP site office. The WSSRAP PMC will be responsible for directing and monitoring the technical, cost, and schedule management of all activities to assure that end products meet project technical requirements, including Quality Assurance and Safety Considerations.
Project Organization

Weldon Spring Remedial Action Project

Figure 1. Project Organization Weldon Spring Remedial Action Project
DOE-ORO selected a prime contractor as a Project Management Contractor (PMC). The PMC is required to subcontract on a fixed-price competitive basis to the maximum extent possible the construction work for the remedial actions, and to comply with DOE policies for contracting with small and small disadvantaged businesses.

The project Management Contractor is responsible for the full range of activities including:

- General site management and administration functions.
- Support of project-related activities which include: long-term maintenance and surveillance plans for the disposal cell; coordination of project plans with NEPA activities; land access agreements and property disposal; medical services; budget preparation; legal services related to the PMC's role; public affairs; and interface with Federal, State, and local government agencies for local interest groups when appropriate.
- Support of project activities which include: detailed project planning; conceptual and final engineering design and cost estimating; implementation of remedial actions; construction management; reporting; monitoring; security; and related maintenance at the Weldon Spring Site, Missouri.
- Implementation and administration of programs and systems for Environmental, Safety and Health; Quality Assurance; Cost and Schedule Control; and Records Management.
- Maintenance, surveillance, and security operations.

In performance of work under this contract, the Contractor shall:

- Establish and maintain during the term of this contract an office at the project site in Weldon Spring, Missouri. It is expected that the Project Manager and other engineering and construction management and support staff will be located in the Weldon Spring Office.
- Conduct the project steps for which the Contractor is responsible with careful attention to public concerns and a willingness to inform and work closely with property owners, local and State governments, and Federal agencies regulating the various aspects of work encompassed in the various project steps.
- Maintain or have unimpeded access to expert familiarity and understanding of technological advancements in applicable aspects of fields of science and technology covered by project steps in question.
- Maintain well-trained and experienced staff to accomplish or to cause to be accomplished the key elements of the project.

DOE awarded a cost-plus-fixed fee contract for the Base Award and option. DOE has reserved the right to convert the total award, if option is exercised, to a cost-plus-award-fee contract. The proposed term of the contract will extend through the performance of the Statement of Work currently estimated to be nine (9) years with established option.
### WSSRAP
**PMC Award**

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<td>Preproposa! conference/site tour</td>
<td>August 14/15, 1985</td>
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<td>Proposals received</td>
<td>October 11, 1985</td>
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<td>Proposal Review</td>
<td>October, 1985-February, 1986</td>
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<td>PMC Selection</td>
<td>February 28, 1986</td>
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<td>Contract Award</td>
<td>May 12, 1986</td>
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VBS NO.

Activity

Site Characterizations (Pits, Quarry, & Vicinity Properties)
Preliminary Engineering Studies (Pits, Quarry, & Vicinity Properties)
Site Characterizations (Chem. Plant) Radiological
Geological, Hydrological, Chemical
NEPA Process
Pits, Quarry, Vicinity Properties
Chem. Plant (Tired EIS Supply)

1.1 Project Integration
1.2 Support Facilities
1.3 Quarry
1.4 Raffinate Pits
1.5 Chemical Plant
1.6 Vicinity Properties
1.7 Waste Disposal

Department/Program Milestones


W.S.S.R.A.P. Baseline Schedule
W.S.S.R.A.P. Base Line

Source: M.K. Ferguson
W.S.S.R.A.P. Budget Study Target
Figure 2. Water Isolation Areas Identified for Cutting and Capping of Lines
Figure 3. Monitoring wells to be sampled as part of the Environmental Monitoring Plan at the Chemical Plant/Raffinate Pit portion of the Weldon Spring Site

Source: M.K. Ferguson 1986
Figure 4. Ground water monitoring locations at the Weldon Spring Quarry for the Environmental Monitoring Plan.
Figure 5. Surface water sampling locations near the WSCP and WSRP areas of the Weldon Spring Site for the Environmental Monitoring Plan
Figure 6. Surface water sampling locations for the Environmental Monitoring Plan near the WSQ of the Weldon Spring Site (X monitoring wells from Figure 4)
Figure 7. Proposed NPDES surface water sampling points to be sampled monthly
Figure 8. Proposed radon-222 TLD measured locations at the Chemical Plant and Raffinate Pits portion of the Weldon Spring Site

Source: M.K. Ferguson 1986
Figure 10. Off-site radon and external gamma monitoring locations for the WSS
Figure 11. Airborne particle sampler locations, Weldon Spring Site Remedial Action Project
Figure 12. Area of nitrate contamination at the Weldon Spring Site (discovered early Spring '87, total extent as yet undefined)

Legend

- Area of Nitrate Contamination
- Monitoring Well Location

Source: M.K. Ferguson 1987
Figure 13. Area of 2,6-Dinitrotoluene (DNT) contamination at the Weldon Spring Site (discovered early Spring '87, total extent as yet undefined)

Source: M.K. Ferguson 1987
Project includes Site, Quarry and associated Vicinity Properties.
Quarry Pond and debris (extends 20 feet above water and 20 feet below water).

Close up of debris in the Quarry showing concrete, steel, barrels, etc.
Barrels scattered throughout the Quarry.

Water leaking from underground piping. Runoff (leakage) in excess of 200,000 gallons per day from more than ten (10) locations.
Closeup showing water fountain from underground piping.

Water leakage goes through "Frog Pond"; picks up contamination and runs offsite.
"Ash Pond" collects site runoff, adds contamination, and overflow goes offsite.

Imhoff Tank and Storm Sewer outfall; more contaminated water runoff.
Two 24" lines cut and ready for capping; capping successfully eliminated leakage and resultant offsite discharge.

Pit 4 contains more than Raffinates: debris from renovation of Process Facilities.
Closeup of debris in Pit 4.

Exterior insulated piping prevalent.
Insulation in generally poor repair.

Looks suspiciously like asbestos.
Some insulation is not staying in place.

Looks like asbestos falling to ground.
Sampling confirmed asbestos, but only 25% of linear footage.

Utility Building: Significant asbestos exposure potential; siding is Asbestos Transite; ducting, equipment, piping, all insulated with friable asbestos.
Close up showing deteriorated state of equipment and insulation.

More asbestos on the ground spells need for Remediation to place material under control.
General picture of interrelated considerations: asbestos, PCB's, overhead congestion, high structures, transite siding.

Transformer and switchgear showing deteriorated state.
More oil seeps.

Some transformers with exterior contamination.
Sampling confirmed some but not all transformers and switchgear contained PCB oil.

35% PCB Oil; inventory greater than 6,000 gallons.
Transformers and Switchgear: inactive, more than 40 on site, of a vintage expected to be PCB filled.

Process building interiors showing high work and structure density.
More piping, grating, and piping (asbestos).

Other typical potential hazards; chemical tanks.
Solvents stored on site.

Underground tanks (only ones known).
Equipment and debris.

Drums and scrap.
Head tank in middle of site; being used for county water distribution.

Particulate monitoring.
Finding the rest of the facts: ground water sampling.
The State of New Jersey brings to mind a number of images, most of which are associated with its proximity to New York City. It is not strictly, however, a state of big city problems and industrialization. Given the opportunity to see some of the state away from the big city, evidence can be readily found to warrant its being called "The Garden State." It is a state of striking contrasts, and in a similar way, the Formerly Utilized Sites Remedial Action Program (FUSRAP) in New Jersey is a program of contrasts. And, just as a garden is not without a few thorns, so the successes of the FUSRAP program in New Jersey are not without a few thorns.

FUSRAP in New Jersey consists of five sites, representing 17 percent of all sites in the FUSRAP program. Two of those sites, Kellex in Jersey City and Dupont in Deepwater, have not been included in recent program activities, and the case study will concentrate only on the other three; one in Middlesex, one in Wayne, and one in Maywood. Each of these is being used as an interim storage site for contaminated material from vicinity properties. They also represent three distinct stages of completion of interim remedial action also having been accomplished.

Contrasts range from drastically different attitudes in the public and local government sector to significant differences in quantities of contaminated materials, and the mechanisms by which they migrated to vicinity properties. And, in each case, the main concern on the part of the public is lack of a location for permanent disposal.

The history, objectives, and accomplishments for each site will be discussed; and, in keeping with the overall theme of the conference, those activities which were undertaken during FY1986 to enhance productivity at each of the sites will be addressed. Finally, project wide activities to facilitate productivity enhancement will be described and several areas demonstrating improved cost effectiveness will be discussed.
THREE CONTRASTING SITES

• MIDDLESEX SAMPLING PLANT

• RARE EARTHS, INC. / W.R. GRACE PLANT
  (NOW WAYNE INTERIM STORAGE SITE — WISS)

• MAYWOOD CHEMICAL WORKS
  (NOW STEPAN CO. AND MAYWOOD
  INTERIM STORAGE SITE — MISS)
FUSRAP SITES IN NEW JERSEY

WAYNE/PEQUANNOCK

MAYWOOD

MIDDLESEX - THE FORMER MIDDLESEX MUNICIPAL LANDFILL SITE - THE FORMER MIDDLESEX SAMPLING PLANT

OUTLINE

PER SITE
• SITE HISTORY
• REMEDIAL ACTION OBJECTIVES
• REMEDIAL ACTION ACCOMPLISHMENTS
• PRODUCTIVITY ENHANCEMENT

GENERAL
• PRODUCTIVITY ENHANCEMENT
• COST-EFFECTIVENESS
Middlesex Sampling Plant
Middlesex, New Jersey

SITE HISTORY
MIDDLESEX

1943   ESTABLISHED BY MED FOR SAMPLING AND STORAGE OF URANIUM, THORIUM, AND BERYLLIUM ORES

1967   OPERATIONS DISCONTINUED — SITE DECONTAMINATED AND RELEASED

1969—1979  U.S. MARINE CORPS RESERVE TRAINING CENTER

1980   RETURNED TO DOE CUSTODY
REMEDIAL ACTION OBJECTIVES
MIDDLESEX

- CLEAN UP 44 VICINITY PROPERTIES (66,100 yd$^3$)
- PROVIDE INTERIM STORAGE FOR MATERIALS FROM VICINITY PROPERTIES
- REMOVE STORED MATERIAL TO PERMANENT DISPOSAL SITE
- CLEAN UP SITE ITSELF (23,000 yd$^3$)

REMEDIAL ACTION ACCOMPLISHMENTS
MIDDLESEX

<table>
<thead>
<tr>
<th>YEAR</th>
<th>LOCATION</th>
<th>CUBIC YARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>15 RESIDENTIAL AND COMMERCIAL PROPERTIES</td>
<td>9,400</td>
</tr>
<tr>
<td>1981-1982</td>
<td>29 RESIDENTIAL AND COMMERCIAL PROPERTIES</td>
<td>25,700</td>
</tr>
<tr>
<td>1984</td>
<td>MIDDLESEX MUNICIPAL LANDFILL</td>
<td>15,000</td>
</tr>
<tr>
<td>1986</td>
<td>MIDDLESEX MUNICIPAL LANDFILL</td>
<td>16,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>TOTAL</strong></td>
<td><strong>66,100</strong></td>
</tr>
</tbody>
</table>
PRODUCTIVITY ENHANCEMENT
MIDDLESEX

- GOOD PUBLIC RELATIONS
- WATER CONTROL WITHIN EXCAVATION ZONE vs WATER DISPOSAL
- ONE-FOOT LIFT THICKNESS CONTROL
- CONTINUOUS MONITORING OF PLANNED vs ACTUAL PROGRESS IN EXCAVATION ZONE

MIDDLESEX LANDFILL CLEANUP

- TOTAL ESTIMATED EXCAVATION
- ACTUAL EXCAVATION (TOTAL)
- ACTUAL TRANSPORTED VOLUME
- CONTRACT TRANSPORT VOLUME

END OF PLANNED EXCAVATION

EAST COORDINATE OF EXCAVATION PROCESS

CUBIC YARDS

0 10,000 20,000 30,000 40,000 50,000

10,750 10,850 10,950 11,050 11,150 10,750 10,850 10,950 11,050

NORTH AREA SOUTH AREA
Rare Earths, INC./W.R. Grace Plant

(Wayne Interim Storage Site—Wiss)
Wayne, New Jersey

SITE HISTORY
WAYNE

1948  RARE EARTHS, INC. BEGAN EXTRACTING THORIUM
      AND RARE EARTHS FROM MONAZITE SANDS

1957  FACILITY ACQUIRED BY W.R. GRACE

1971  OPERATIONS DISCONTINUED

1974  SITE PARTIALLY DECONTAMINATED

1975  STORAGE LICENSE TERMINATED BY NRC

1981 – 1983  SEVEN SURVEYS OF SITE PERFORMED
             (ADDED TO NPL)

1984  ENERGY AND WATER APPROPRIATIONS ACT ADDED
      SITE TO FUSRAP – SITE ACQUIRED BY DOE AND
      PREPARED AS INTERIM STORAGE SITE
REMEDIAL ACTION OBJECTIVES
WAYNE

- PREPARE WISS AND CLEAN UP 16 VICINITY PROPERTIES (38,500 yd³)
- CLEAN UP POMPTON RIVER (DELETED AFTER CHARACTERIZATION IN 1986)
- PROVIDE INTERIM STORAGE FOR MATERIALS FROM VICINITY PROPERTIES
- REMOVE STORED MATERIAL TO PERMANENT DISPOSAL SITE
- CLEAN UP SITE AND RAILROAD SIDING IN PEQUANNOCK (70,000 yd³)

REMEDIAL ACTION ACCOMPLISHMENTS
WAYNE

<table>
<thead>
<tr>
<th>YEAR</th>
<th>LOCATION</th>
<th>CUBIC YARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>SITE DEVELOPMENT</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>WISS SCHOOL BUS FACILITY</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>TOWNSHIP PARK</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>SHEFFIELD BROOK</td>
<td>19,000</td>
</tr>
<tr>
<td>1987</td>
<td>SHEFFIELD BROOK (CONTINUED)</td>
<td>11,000 (EST)</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>34,000</td>
</tr>
</tbody>
</table>
PRODUCTIVITY ENHANCEMENT
WAYNE

- GOOD PUBLIC RELATIONS
- WELL POINTS FOR AREA DEWATERING
- ONE-FOOT LIFT THICKNESS CONTROL
- CONTINUOUS MONITORING OF PLANNED vs ACTUAL PROGRESS IN EXCAVATION ZONE
- WATER DISPOSAL BY SUBCONTRACT
- ENHANCED SAMPLING PROTOCOL
- CASH SETTLEMENTS FOR TREES AND SHRUBS

SHEFFIELD BROOK
FY 1986 EXCAVATION QUANTITIES

[Graph showing contract quantity vs actual excavation]
<table>
<thead>
<tr>
<th>OLD</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 DISCRETE SAMPLES</td>
<td>25 PLUGS COMPOSITED TO 1 DISCRETE SAMPLE</td>
</tr>
<tr>
<td>WET COUNT — 4 SAMPLES</td>
<td></td>
</tr>
<tr>
<td>DRY / PULVERIZE — 4 SAMPLES</td>
<td>1 EACH</td>
</tr>
<tr>
<td>DRY COUNT — 4 SAMPLES</td>
<td></td>
</tr>
<tr>
<td>ARCHIVE — 4 SAMPLES</td>
<td></td>
</tr>
<tr>
<td>AVERAGE 4 SAMPLES TO</td>
<td>DIRECT COMPARISON</td>
</tr>
<tr>
<td>COMPARE WITH GUIDELINES</td>
<td></td>
</tr>
<tr>
<td>FOR 100-m³ AREAS</td>
<td></td>
</tr>
</tbody>
</table>

LOWER < HOT SPOT SAMPLING PROBABILITY > GREATER
Maywood Chemical Works
(Stephan Co. and
Maywood Interim Storage Site—Miss)
Maywood, New Jersey.

SITE HISTORY
MAYWOOD

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1916</td>
<td>MAYWOOD CHEMICAL WORKS BEGAN EXTRACTING THORIUM FROM MONAZITE SANDS</td>
</tr>
<tr>
<td>1932</td>
<td>NJ ROUTE 17 BUILT THROUGH DISPOSAL AREA</td>
</tr>
<tr>
<td>1956</td>
<td>THORIUM EXTRACTION OPERATIONS DISCONTINUED</td>
</tr>
<tr>
<td>1959</td>
<td>BUSINESS SOLD TO STEPAN CO.</td>
</tr>
<tr>
<td>1963—1968</td>
<td>STEPAN CLEANUP OF SITE (40,000 yd³ IN THREE LICENSED BURIAL SITES)</td>
</tr>
<tr>
<td>1968</td>
<td>AEC SURVEY OF PORTION OF PROPERTY — PROPERTY SOLD TO PRIVATE CITIZEN, THEN TO BALLOD ASSOCIATES</td>
</tr>
<tr>
<td>1980—1983</td>
<td>ADDITIONAL INVESTIGATIONS (ADDED TO NPL)</td>
</tr>
<tr>
<td>1984</td>
<td>ENERGY AND WATER APPROPRIATIONS ACT ADDED SITE TO FUSRAP — LAND LEASED BY DOE FOR INTERIM STORAGE SITE</td>
</tr>
<tr>
<td>1985</td>
<td>PROPERTY ACQUIRED BY DOE</td>
</tr>
</tbody>
</table>
REMEDIAL ACTION OBJECTIVES
MAYWOOD

- CLEAN UP ?? VICINITY PROPERTIES IN THREE TOWNSHIPS (143,000 yd$^3$)
- PROVIDE INTERIM STORAGE FOR MATERIALS FROM VICINITY PROPERTIES
- REMOVE STORED MATERIAL TO PERMANENT DISPOSAL SITE
- CLEAN UP SITE ITSELF (127,000 yd$^3$)

REMEDIAL ACTION ACCOMPLISHMENTS
MAYWOOD

<table>
<thead>
<tr>
<th>YEAR</th>
<th>LOCATION</th>
<th>CUBIC YARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>17 RESIDENTIAL AND PART OF ONE COMMERCIAL PROPERTY</td>
<td>4,700</td>
</tr>
<tr>
<td>1985</td>
<td>EIGHT RESIDENTIAL AND REMAINDER OF ONE COMMERCIAL PROPERTY</td>
<td>30,200</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>34,900</td>
</tr>
</tbody>
</table>
PRODUCTIVITY ENHANCEMENT
MAYWOOD

- DAY RATE vs UNIT RATE FOR DRILLING
- CONTINUAL REFINEMENT OF CHARACTERIZATION PLAN
- DRILLING CREW ACCOMPANIED BY GEOLOGIST
- CHARACTERIZATION BEFORE FORMAL DESIGNATION

OPTIMIZATION OF CHARACTERIZATION BOREHOLES

<table>
<thead>
<tr>
<th>TYPE OF BOREHOLE</th>
<th>NUMBER</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PLANNED</td>
<td>ACTUAL</td>
</tr>
<tr>
<td>ANGLE</td>
<td>57</td>
<td>27</td>
</tr>
<tr>
<td>STRAIGHT</td>
<td>498</td>
<td>323</td>
</tr>
<tr>
<td>TOTAL</td>
<td>555</td>
<td>350</td>
</tr>
</tbody>
</table>
### CHARACTERIZATION RESULTS 1986

<table>
<thead>
<tr>
<th>TYPE OF PROPERTY</th>
<th>NUMBER PLANNED</th>
<th>NUMBER ACTUAL</th>
<th>ACRES PLANNED</th>
<th>ACRES ACTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>13.0</td>
<td>14.0</td>
<td>102.0</td>
<td>104.0</td>
</tr>
<tr>
<td>RESIDENTIAL</td>
<td>8.0</td>
<td>25.0</td>
<td>3.0</td>
<td>10.0</td>
</tr>
<tr>
<td>MUNICIPAL OR STATE</td>
<td>1.0</td>
<td>2.0</td>
<td>0.8</td>
<td>3.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22.0</td>
<td>41.0</td>
<td>~106.0</td>
<td>~118.0</td>
</tr>
</tbody>
</table>

PLUS 19 AD HOC SURVEYS

### PRODUCTIVITY OBSTACLES MAYWOOD

- MULTI - TOWN OPERATION
- LOCAL POLITICS
- VOCAL MINORITY OPPOSITION
- MONTCLAIR STIGMA
- LACK OF PERMANENT DISPOSAL SITE
FUTURE PLANS
NEW JERSEY

• CONTINUE SURVEILLANCE AND MAINTENANCE AT INTERIM STORAGE SITES

• RESOLVE OBSTACLES IN MAYWOOD AND COMPLETE INTERIM REMEDIAL ACTIONS

• DEVELOP A PERMANENT NEW JERSEY DISPOSAL SITE

• TRANSPORT STORED AND BURIED MATERIAL TO DISPOSAL SITE
  – MIDDLESEX = 89,000 yd³
  – WAYNE = 108,500 yd³
  – MAYWOOD = 270,000 yd³
  TOTAL = 467,500 yd³

• RELEASE INTERIM STORAGE SITES

PRODUCTIVITY ENHANCEMENT — GENERAL

• CONVERSION TO CADD IN 1 YEAR

• INCREASED UTILIZATION OF PCs

• CONVERSION TO PROJECT 2 SYSTEM FOR INTEGRATED COST / SCHEDULE CONTROL

• CONVERSION TO BAR CODING

• COMPUTERIZED DATA ENTRY
COMPARISON OF LEVEL THREE COSTS BY FISCAL YEAR

Level Three NBS
- Site Charac.
- Prelim. Engr.
- Design Engr.
- Remedial Action
- Waste Transport
- Site Surveillance
- Final Engr. Report
- Project Management
- Capital Equip.

SUBCONTRACT COST AS % OF TOTAL COST

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>0.41</td>
</tr>
<tr>
<td>83</td>
<td>0.42</td>
</tr>
<tr>
<td>84</td>
<td>0.45</td>
</tr>
<tr>
<td>85</td>
<td>0.59</td>
</tr>
<tr>
<td>86</td>
<td>0.50</td>
</tr>
</tbody>
</table>
ENGINEERING MANHOURS PER CUBIC YARDS EXCAVATED

Fiscal Year

LABOR COST PER MANHOUR

Fiscal Year

Adjusted for 5% average annual escalation
Case Study: West Valley - A Status Update

Eli Maestas, DOE-West Valley Project Office
April 29, 1987

The West Valley Demonstration Project, directed by the United States Department of Energy, is at the site of the only commercial nuclear fuel reprocessing facility to have operated in the United States. Operation of the plant ceased in the early 1970s. It was determined in 1980 that the facility provided a unique opportunity for demonstrating established high-level nuclear waste management technology. As mandated by Congress, the project's overall goal is to solidify approximately 600,000 gallons of high-level nuclear waste and prepare it for shipment to a federal repository.

The Department of Energy assumed control of the West Valley site in February, 1982. West Valley Nuclear Services Company, a division of Westinghouse Electric Corporation, was chosen as the site prime contractor.

Engineers, scientists, and innovative thinkers here are showing the world that nuclear waste can be safely cleaned up. The heart of the high-level waste solidification system has been designed, built, and installed. Engineering tests are currently underway. Additional processing and support systems will be added this year, followed by modifications and adaptations for remote operation.

The site is receiving international attention for its progress in the decontamination and decommissioning of this former nuclear fuel reprocessing facility. Miles of contaminated piping and dozens of large radioactive vessels have been removed. New handling, packaging, and disposal techniques have been developed to manage the low-level waste generated during cleanup.

Additionally, engineers have directed the safe return of over 600 spent nuclear fuel assemblies from storage at West Valley back to their utility owners. When all the fuel has been shipped, the underwater storage basis will be used to clean and cut up the large stainless steel tanks removed from the former nuclear fuel reprocessing plant.
Hazardous Waste Management at the WVDP

Several Streams Identified

• \( \text{No}_x \) scrubber bottoms (corrosive) (1000 GPD during melter runs)
• Degreasing solvents (listed) (approximately 100 gal/yr)
• Developer - fixer solution (E.P. Toxic) (1-2 GPD)
• Zinc Bromide - Purification sludges (corrosive) (17 drums)
• Zinc Bromide - Spill residual (corrosive) (18 drums)

Management Objectives

• Minimize hazardous waste volume
  – Neutralize corrosive streams
  – Substitute nonhazardous for hazardous materials
• Comply with generator requirements of 6NYCRR 372.2

Implementation

• Corrosive wastes neutralized on-site, disposed off-site or manifested off-site directly
• Listed wastes manifested off-site, use discontinued
• Other wastes manifested off-site
Mixed Waste Management at WVDP

Streams Identified

• Zinc bromide spill residual (corrosive) (7 drums)
• Extracted salt solution (E.P. toxic) (500,000 gal.)

Management Objectives

• Avoid generation of listed mixed waste
• Minimize generation of characteristic mixed waste
• Treat to eliminate hazardous characteristic
• Treatments exempted from permitting
  – neutralization
  – totally enclosed treatment
  – treatment in accumulation tanks or containers

Implementation

• Zinc bromide residue solidified in cement accumulation
• Containers stored as LLW pending disposal

• Solidify extracted salt solution in cement to render chromium non-leachable. TCLP testing of nonradioactive surrogates ongoing
Groundwater Monitoring at the WVDP

Program Expanded in 1986 To Provide Coverage Of Three Waste Management Units:

- Low-level radioactive waste lagoon system
- High-level radioactive waste tank complex
- NRC licensed disposal area (NDA)

Lagoon System And HLW Tanks In North Plateau Area Alluvial Fan And Glacio Fluvial Sand And Gravel Hydraulic Conductivity $1 \times 10^{-4} - 9 \times 10^{-3}$ cm/sec.

NDA In Glacial (Lavery) Till Comprised Primarily Of Clay And Silt Underlain By Lacustrine Unit (Containing Fine Sand Clay And Silt) And Kent Till.

- Hydraulic conductivity till approximately $3 \times 10^{-8}$ cm/sec (unweathered)
- Hydraulic conductivity till $\geq 3 \times 10^{-7}$ cm/sec (weathered)

Monitoring Network Comprised Of:

- RCRA monitoring program
  - 5 existing wells (installed by USGS)
  - 9 new wells
  - 1 seep
  - French drain outlet
- Radiological monitoring program
  - 32 additional wells sampled semiannually for gross alpha, beta, H-3 and pH.
Groundwater Monitoring at the WVDP (cont.)

Detection Monitoring Parameters Include:

- Groundwater Quality Parameters
  Cl, Mn, Na, SO$_4^{2-}$, Fe, Phenols
- pH
- Specific Conductance
- TOC
- NO$_3$  
- H-3
- Gross Alpha
- Gross Beta
- Specific Gamma emitters
- Drinking Water Metals (8)

Wells, Seep And French Drain Sampled:  Quarterly - 1st year  
Semiannually - thereafter  

1st Samples Collected December 1986
## Comparison of Hazardous Waste Requirements and HLW Management Practice at the WVDP

### Hazardous Waste Requirement (6NYCRR373)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>WVDP Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste analysis</td>
<td>Tank contents sampled and tested for vitrification system design data. Approval required before new material transferred to tanks.</td>
</tr>
<tr>
<td>Security</td>
<td>Tank farm is high-security area.</td>
</tr>
<tr>
<td>Personnel training</td>
<td>All operators trained at various levels, required to requalify annually.</td>
</tr>
<tr>
<td>Preparedness/prevention</td>
<td>— operations covered by procedures reviewed and approved by management (SOP, SIP, TOP, work order.)</td>
</tr>
<tr>
<td></td>
<td>— safety and radiological controls specified in RWP and IWP.</td>
</tr>
<tr>
<td></td>
<td>— safety analyses developed for nonroutine operations.</td>
</tr>
<tr>
<td></td>
<td>— facility equipped with communications systems, alarms, fire fighting brigade.</td>
</tr>
<tr>
<td></td>
<td>— equipment covered on preventive maintenance program</td>
</tr>
<tr>
<td>Contingency plan/Emergency procedure</td>
<td>— project has formal documented emergency plan and procedures.</td>
</tr>
<tr>
<td></td>
<td>— identifies emergency coordinators and reporting requirements.</td>
</tr>
<tr>
<td></td>
<td>— contains agreements and arrangements with off-site agencies.</td>
</tr>
<tr>
<td></td>
<td>— SPCC plan appended to plan</td>
</tr>
</tbody>
</table>
Comparison of Hazardous Waste Requirements and HLW Management Practice at the WVDP (cont.)

Hazardous Waste

<table>
<thead>
<tr>
<th>Requirement (6NYCRR373)</th>
<th>WVDP Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater monitoring</td>
<td>—program expanded to cover HLW tank farm, LLWT lagoons, NDA</td>
</tr>
<tr>
<td></td>
<td>—sampling and analyses patterned after detection monitoring program.</td>
</tr>
<tr>
<td>Tank management</td>
<td>—waste contained within multiple barriers-tanks, pan, vault.</td>
</tr>
<tr>
<td></td>
<td>—monitored for temp, pressure, level.</td>
</tr>
<tr>
<td></td>
<td>—annulus monitored and can be sampled</td>
</tr>
</tbody>
</table>

Air Discharge

• Non-radioactive:
  —Regulated by NYSDEC
  —Permits obtained
    Boilers (2)*
    Incinerator*
    LLWTF nitric acid tank vent*
    14D-1 nitric acid tank vent*
    Lief
    Vitrification off-gas
    Cement silo vent
    LLWTF vent system (2)**

• Radioactive:
  —Presently regulated by EPA (40CFR61)
  —Submitted application packages to DOE-ID for 15 release points
  —Total estimated dose to maximally exposed offsite individual 0.23 MREM
Aqueous Discharges

• Non-radioactive:
  — Regulated by NYSDEC via SPDES permit
  — Original permit transferred from NFS
    6 Outfalls
    Radioactive discharge monitoring
    Requirements and limits
  — Permit Renewal
    3 outfalls
    Flow weighted averages for nutrient
    Discharges
    Net limits for iron
    Radioactive monitoring & reporting deferred
    to DOE requirements
    Consent order to correct sewage treatment deficiencies
    Imposed intermittent stream discharge limits.

• Radioactive:
  — Regulated by DOE 5480.1
NFS Reached Agreement with AEC and New York State to Construct Reprocessing Plant

Construction Completed

NFS in Operation (~ 640 Metric Tons of Spent Fuel Reprocessed)

Plant Shut Down for Modifications

Received Spent Fuel in Preparation for Resuming Production
WEST VALLEY HISTORY (CONTINUED)

1976  NFS Decided to Withdraw From Reprocessing Business and Turn Over Responsibility to New York State

1978  DOE Study Resulted in Allocation of Responsibilities Between New York State and DOE

1980  Congress Authorized DOE to Carry Out High-Level Nuclear Waste Management Demonstration

1981  Westinghouse Selected as Operating Contractor of West Valley Demonstration Project

Feb. 25, 1982  DOE and WVNS Assumed Operational Control

WEST VALLEY DEMONSTRATION PROJECT

Objective
Demonstrate Solidification and Preparation of High-Level Waste for Permanent Disposal

Authority
Pub. L. 96-368, West Valley Demonstration Project Act

Scope
• Solidify Liquid High-Level Waste in a Form Suitable for Transportation and Disposal
• Develop Containers Suitable for Permanent Disposal
• Transport Solidified Waste to Federal Repository for Permanent Disposal
• Dispose of Low-Level and Transuranic Waste Produced
• Decontaminate and Decommission Tanks, Facilities, Material, and Hardware Used
WVDP WASTE MANAGEMENT STRATEGIES

- LLW
  - Minimize Generation
  - Provide Stabilized On-Site Disposal
  - DOE Regulated

- Hazardous Waste
  - Minimal Generation
  - Collect and Temporarily Store
  - Send to Commercial, EPA-Approved Treatment/Disposal Facility
  - EPA Regulated

- Mixed Waste
  - Characterizing Process Streams
  - Evaluating Treatment Alternatives
  - EPA Consulted
TRU
- No Generation
- Package Existing TRU
- Provide Engineered Interim Storage Area
- Package to WIPP-WAC
- Ship to DOE Repository

High-Level Waste
- Minimize Inventory
- Stored as Liquid and Sludge
- Solidify to Borosilicate Glass
- Interim Storage as Glass
- Begin Shipping to National HLW Repository in 2003 or Earlier

West Valley Demonstration Project
New Systems

High Level Waste
Vitrification System (VS)
- The VS will solidify into borosilicate glass the radioactive constituents of the high level waste (HLW).
- The component test stand was originally constructed to test the major components of the VS. It is currently undergoing conversion in preparation for radioactive operations.
- Approximately 300 carbon steel canisters will be filled with a mixture of concentrated waste and glass forming ingredients. Canisters will be cooled, decontaminated and stored in a sealed cell on site until a federal repository is available.

Supernatant Treatment System (STS)
- The primary objective of the STS is to reduce the volume of HLW.
- 90% of the Purex waste contained in tank BD2 is an alkaline liquid (supernatant).
- The STS will separate radionuclides, primarily cesium, from the nonradioactive salt solution using an ion exchange filter.
- Tank BD1, the spare tank, is being modified to house the ion exchange process components.

Low Level Waste
Liquid Waste Treatment System (LWTS)
- Process various plant liquid waste by evaporation, filtration, and ion exchange to minimize the volume for the Cement Solidification System.
- Decontaminate the wastes to be either recycled for reuse or released to the environment.
- Treat the decontaminated supernatant solution from the STS and other contaminated liquid wastes from the plant and decontamination and decommissioning operations.

Cement Solidification System (CSS)
- Encapsulate low level waste (Class B and C) into cement contained within steel drums.
- The high shear mixers are the heart of the system which encapsulate the waste into cement, automatic drum handling equipment caps, swipes and overpacks the drums.
- The system has three parts: waste encapsulation, cement storage, and drum handling.
TANK 8D-2 SLUDGE LAYERING SECTIONAL VIEW

RADWASTE TREATMENT SYSTEM (RTS) PROCESSING FLOW SHEET
LOW LEVEL WASTE PROCESSING

LWTS SYSTEM FUNCTION


- Decontaminate the Water Removed to Allow it to be Either Recycled for Reuse, or Released to the Environment.

- Treat the Decontaminated Supernatant Solution from the Supernatant Treatment System and Other Contaminated Liquid Wastes from the Plant and D/D Operations.
Remotely operated valves and associated instruments are located in the valve aisle which contains shield windows and manipulators to permit remote operations and replacement of components as necessary.

Concurrent with non-radioactive testing, a 4' thick concrete wall and remote operating equipment are being built to shield the glass making equipment.
CSS SYSTEM FUNCTION

- Encapsulate Low Level Waste (Class B and C) into Cement Contained Within Steel Drums.

- The Heart of the System is the High Shear Mixers Which Encapsulate the Waste into the Cement, and the Automatic Drum Handling Equipment Which Moves Caps, Swipes and Overpacks the Contaminated Drums.

- The System is Broken Into Three Sub Systems:
  - Waste Encapsulation System
  - Cement Storage and Transfer
  - Drum Handling System

CSS OPERATING CHARACTERISTICS

- Expected Production Rate of 6 Round Drums (4 Square Drums) per Hour.

- Variety of Mixes: Decontaminated Supernatant, Three Sludge Washes, Spent Organic Resins (LWTS), Spent Zeolite, Filter Backwash, Uranyl Nitrate.

- Radiation: Supernatant 400-500 MR/HR Content.

- Shielding: Walls 20' Thick Concrete.
RTS DRUM CELL

• Disposal for 21,000 Round Drums (55 Gallon)
  15,000 Square Drums (71 Gallon)

• Drums Handled Remotely with a Computerized Crane System

• Drums Stacked Horizontally

• 20-Inch Shield Wall Around Drums

• Heated Building During Winter Months for Drum Curing
RADIOACTIVITY OF HLW THROUGH 1984

<table>
<thead>
<tr>
<th>Site</th>
<th>Curies</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRP</td>
<td>7.96 x 10^8</td>
</tr>
<tr>
<td>ICPP</td>
<td>5.90 x 10^7</td>
</tr>
<tr>
<td>HANF</td>
<td>4.20 x 10^6</td>
</tr>
<tr>
<td>WVDP</td>
<td>3.24 x 10^7</td>
</tr>
<tr>
<td>Total</td>
<td>1.31 x 10^9</td>
</tr>
</tbody>
</table>

TOTAL FACILITY DECONTAMINATION STATUS

Total Calculated Square Footage Of Area-350,000 Square Feet

- Clean Area: 94%
- Working Area: 5%
- Remaining Area: 1%

FY82 WVNS Takeover
Status as of Oct. 1, 1986
Fuel Shipping Program

Original Spent Fuel Inventory 750 Assemblies
625 Assemblies Have Been Shipped Between 9/83 and 5/86

TRU WASTE

- Radioactive Waste Containing Alpha-Emitting Transuranic Radionuclides With Half Lives Greater than 5 Years and Concentrations Greater than 100 nCi/g

- All TRU Waste Currently Stored On-Site for Ultimate Shipment Off-Site for Disposal

- Working to WIPP WAC Criteria for TRU Waste Disposal
The working group on Hazardous and Mixed Waste Management was formed in December, 1986 to provide for increased transfer of experiences and issues among the Nuclear Energy remedial action programs. The following participants were selected to represent the various programs.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Remedial Action Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Englert</td>
<td>D&amp;M</td>
</tr>
<tr>
<td>Kathleen Falconer</td>
<td>UNC</td>
</tr>
<tr>
<td>Jack Hammond</td>
<td>MKF</td>
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<tr>
<td>Steven Liedle</td>
<td>BNI</td>
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<tr>
<td>Craig Little</td>
<td>ORNL</td>
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<tr>
<td>Jerry Lyons</td>
<td>MKF</td>
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<tr>
<td>Richard Richey</td>
<td>DOE</td>
</tr>
<tr>
<td>David Sheffey</td>
<td>DOE</td>
</tr>
<tr>
<td>Gale Turi</td>
<td>DOE</td>
</tr>
<tr>
<td>Lida Whitaker</td>
<td>DOE</td>
</tr>
</tbody>
</table>

The focus provided to the group was as follows: Review hazardous and mixed waste requirements, standards, disposal options, experiences, problems/issues, solutions, liability insurance issues, RCRA/CERCLA compliance, reporting requirements, permitting requirements, etc.

As can be seen, this covers a broad scope, so the first action of the group was to identify areas in the scope that were of particular concern to each of the remedial action programs. The following significant compliance issues were identified.

**Significant Compliance Issues**

- FUSRAP—CERCLA/SARA compliance
- West Valley—RCRA or CERCLA (whichever applies)
- UMTRAP—Hazardous and mixed waste (identification and management)
- SFMP—Applicability and implementation of SARA
- Grand Junction,—Disposition and handling of mixed waste

At the first meeting, we discussed the strategies being taken by the different programs for complying with Environmental Protection Agency regulations. In this context, the following items were discussed in some detail:

- West Valley solid waste management (RCRA) logic diagram
- By-product redefinition
- Concern for worker safety during remedial action
- Handling drums of unknown content, asbestos, and transformers
- Interactions with State and EPA
- Use of EPA, RCRA, and CERCLA hotlines
- RCRA (totally enclosed treatment exemption)
- Laboratories for characterizing mixed waste
- EPA federal facility agreements at remedial action sites
- State’s role under SARA
- Applicable or relevant and appropriate requirements (ARAR)
- General remedial action project compliance strategy

The second meeting was held at the Weldon Spring site and included a site tour and presentation of ongoing characterization activities. A representative from the Office of
Environmental Guidance and Compliance (Sheryl Katz) attended the meeting and provided an update on the Office of Environment, Safety, and Health activities with EPA, revisions to the National Contingency Plan (NCP), the by-product redefinition, and DOE orders. This was followed by a general discussion on mixed waste. It was noted that mixed waste is not subject to RCRA if RCRA and the AEA are inconsistent. At CERCLA sites such as Weldon Spring, no license is required for on-site disposal of the waste. The NCP as it is currently being revised will include a procedure for establishing ARARs. At Canonsburg the mixed waste disposal issue was successfully handled by reaching agreement with the State and NRC. The limited volume of mixed waste was disposed of in the tailings pile that was constructed to meet 40 CFR 192 standards. The Weldon Spring DOE/EPA Federal Facility Agreement calls for the disposal of mixed waste using the best technical available approach considering RCRA and 40 CFR 192 to assure maximum protection of public health and the environment. In all cases EH recommends close coordination with the EPA regional offices.

The next meeting is planned for June at the West Valley site. The topics for discussion will be SARA and hazardous waste.

What is apparent from the proceeding discussion is the benefits of the group. It provides for the exchange of practical information on environmental compliance and mixed and hazardous waste issues among the remedial action programs. It also highlights issues to the project and program offices and Office of Environment, Safety and Health for more timely resolution.

The consensus of the group, as well as outside observers, is that the Nuclear Energy remedial action programs are on the front side of the "remedial action implementation curve" relative to other State and Federal programs, as well as other programs within DOE. The regulatory questions relating to the programs are complex and there are few precedents and no easy answers. Consequently, on one hand there is little guidance available while on the other hand it presents opportunities to be innovative in working with EPA, NRC, and the States, and the public. It was noted that the level of involvement of EPA, the States, and the public is increasing and must be factored into schedules.

There is good news as well as bad news. The bad news is that regulatory compliance issues are complex and appear to be increasing. The good news is that the remedial action programs are moving ahead in spite of obstacles and sites are being completed with a commensurate increase in the protection of the public health and safety.
Report from
The Disposal Cell Design Committee

Chairman: John D'Antonio
April 30, 1987
The Big Picture
What Are The Factors Affecting Cell Design?

• Program Objectives

• Enabling Authority/Requirements

• Environmental Requirements

• Institutional Requirements

• Public Participation Requirements

• Project Management
  Design Development Approaches and Methodologies
  —Common design considerations
  —Open issues
  —Technology development

• The Bottom Line
Program Objectives

- Federal Recognition of Agency Needs
  - National security—Weapon Req'ts—Waste mgt. policy
- Industrial Needs
  - Energy requirements
  - Demonstration projects
- Public Interest
  - Identification/stabilization of radiological wastes
  - Long-term energy–related solutions

Enabling Authority/Requirements

- GJRAP 1972 PL-92-314 (ID/AL/UMTRA)
  - Authorized congressional funding (75/25) removal of tailings from structures in Grand Junction, Colorado
  - Criteria: U.S. Surgeon General guidelines/state initiatives
- FUSRAP 1974 (HQ/ORO/BNI)
  - Reevaluate radioactive status, conduct R/A at sites which exceed current guidelines
  - Assure safe caretaking and decommissioning
- UMTRA 1978 PL 95–604 (NE/AL/UMTRA–PO)
  - Cleanup of inactive mill tailing processing sites and vicinity properties under 90/10 cost–sharing with states
  - Criteria: 1983 EPA standards—NRC approval–state concurrence
Enabling Authority/Requirements Cont.

- WVDP PL 96–368 (ID/WVPO) Demonstration Project
  - High-level waste solidification–decommission facilities–low-level waste disposal
  - Criteria: DOE orders–10 CFR 61–10 CFR 20

- WSSRAP 1986 (SFMP/NE–23/OR)
  - On-site disposal of mixed wastes (explosives/PCB/asbestos)
  - Criteria: Not fully defined–DOE orders

Environmental Requirements
Confirmed On A Case–By–Case Basis

- EIS
- EA
- Action description memorandum
- And, in all cases, requires contacts with various publics

Institutional Requirements

- Other federal agencies
- States
- Local governments
- Reviews
  - Comments/inputs
  - Concurrence
  - Approvals
Public Participation
How much is enough?

• Involvement vs Participation
• Input vs Decision-Making Process
• Cost vs Cost Sharings

Design Development, Approaches And Methodologies
Common Design Considerations

• Pile Configuration
• Radon Covers
• Erosion Protection
• Site Characterization

• Pile Configuration
  —Optimization of size vs putting deeper earth cover
  —Settlement (total and differential)
  —Liquefaction
  —Fault study (seismicity)
  —Slope stability
  —Infiltration

• Radon Covers
  —Radon emission
  —Long-term moisture content
  —Sequence for placement of contaminated materials
  —Infiltration
Design Development, Approaches And Methodologies
Common Design Considerations (cont.)

• Erosion Protection
  — Design for PMP (where practical)
  — Use flat slope to minimize impact
  — Protect against gully intrusion (Western sites)
  — Rock with filter/bedding layer
  — Vegetative covers
    Eastern sites
    Title II sites (20 ft. of soil)

• Site Characterization
  — Rock sources for durability
  — Insitu material properties
  — Borrow material properties
  — Groundwater hydrology

Open Issues

• FUSRAP
  1. Siting Considerations:
     — Fed/Private
     — Incentives
  2. Leachate Collection and Detection Systems
  3. Secondary Containment
  4. Intrusion Barriers

• SFMP
  1. Varies With Project Type
  2. Weldon Spring:
     — Mixed wastes determinations—criteria TBD
Open Issues (cont.)

• UMTRA
  1. Infiltration/Long-Term Moisture Content
  2. Groundwater Restoration

• UMTRA
• FUSRAP
• SFMP
• WVDP
• WSSRAP

Technology Development
Near Term And Beyond

1. TAC/UMTRA Finalizing 1-D Infiltration/Moisture Content Model
2. Test Embankment at Ambrosia Lake: To Determine Settlement Rates For Cover Placement
3. Test Plots For Permeability Field Verification
4. Geochemical Barriers
5. Organics/Limits Distribution
6. Bldg/Major Equipment Disposal
7. Vegetative Covers
8. Waste Water Treatment Plants
9. Groundwater Technology Transfer
10. Attendee Suggestions
The Bottom Line

• Step Back—Look At The Big Picture

• Attempt Advance Strategic Planning

• Existing Technologies Are Available

• Design Efficiencies Can Be Altered And Delayed By Admin Req'ts And Decisions Outside The Technical Arena

• This Committee Recommends Continuance
Ad Hoc Committee Report
Vicinity Property Remedial Action Standards, Verification, and Certification Committee

Co-Chairman: Rich Sena, DOE-UMTRAP
Co-Chairman: Mike Tucker, DOE-GJPO

John Pepin, MK-F (UMTRAP); Carol Moore, JEG (UMTRAP); Bill Borden, BNI (FUSRAP); Dick Murri, UNC (UMTRAP); Craig Little, ORNL (UMTRAP); Tei Tappen, ARIX (UMTRAP); Charles Young, Aerospace; Tony Brazley, NE-22; Andy Wallo, NE-23

April 30, 1987

Focus: Review procedures for conducting vicinity property remedial action and certification, verification, and documentation process. Identify areas of commonality and differences. Where differences exist, identify significance and explore adoption of common approach or explain continuation of differences. Identify any Office of Remedial Action and Waste Technology or project office issues or actions.
Federal Hierarchy

Directives - Regulations - Standards

Promulgation To Implementation

- International Community

Nuclear Regulatory Commission

National Level Guidelines, Standards & Criteria of General Application

Environmental Protection Agency

Department of Energy Implementation Directives & Instructions

Program Specific Application - Implementation

- GIRAP Surgeon General's Guidelines
- FUSRAP Program Specific Protocols
- UMTRAP EPA Standards for Remedial Action
### Supplemental Standards

<table>
<thead>
<tr>
<th>Topic</th>
<th>FUSRAP</th>
<th>UMTRA</th>
</tr>
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<tbody>
<tr>
<td>• Guidelines</td>
<td>EPA Standards</td>
<td>EPA Standards</td>
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<tr>
<td></td>
<td>40 CFR 192</td>
<td>40 CFR 192</td>
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<tr>
<td>• Owner Comments</td>
<td>As Required</td>
<td>Mandatory</td>
</tr>
<tr>
<td>• Approving Agencies</td>
<td>DOE-HQ</td>
<td>NRC</td>
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<td>State</td>
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### Verification

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<tr>
<th>Topic</th>
<th>FUSRAP</th>
<th>UMTRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Field Verification</td>
<td>10% - 100%</td>
<td>10%</td>
</tr>
<tr>
<td>• Paper Verification</td>
<td>100%—Formal Report</td>
<td>100% Checklist</td>
</tr>
<tr>
<td>Topic</td>
<td>Certification</td>
<td>FUSRAP</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>• Federal Register Notice</td>
<td>Notice for Each Docket</td>
<td>Notice When a Site is Totally Complete</td>
</tr>
<tr>
<td>• Owner Notification of Completion</td>
<td>Interim Letter to Owner Notifying Intent to Certify</td>
<td>Final Certification Letter</td>
</tr>
<tr>
<td>• Vicinity Property Certification</td>
<td>Group Report</td>
<td>Individual Reports</td>
</tr>
<tr>
<td>• Documentation of Land Records</td>
<td>As Required</td>
<td>Project Completion Report and Certification Letter Provided to State</td>
</tr>
</tbody>
</table>
Remedial Action Methods And Standards

- Land Survey and Mapping
- Radiation Assessment
- Engineering Design
- Radiologic Engineering Assessment
- Performance Contracting
- Excavation Monitoring and Sampling

Land Survey And Mapping

- GJRAP
  - Field technicians make physical measurements
  - Property mapped to line of occupation
  - Right-of-way spillover included
  - Hand-drawn maps

- GJPO/UMTRA
  - Simple properties use ISC map
  - Other properties surveyed by in-house professionals
  - Mapped to legal property lines showing line of occupation
  - Inclusion boundary is edge of curb to center of alley
  - AutoCAD produced maps

- ALO/UMTRA
  - Same as GJRAP

- FUSRAP
  - Land survey by subcontracted professional
  - AutoCAD produced
Radiation Assessment
GJRAP
Protocol
Indoor only = 0.017 WL residential and 0.037 WL commercial, 20 μR/h above background structure average
Practical
Inside or outside surface criteria => 17μR/h, annual average RDC using RPISU

Radiation Assessment
GJPO/UMTRA
Protocol
EPA Standard (40 CFR 192)
Practical
Indoor = 20μR/h above background in room-size area, abbreviated RPISU RDC measurement (grab sample RDC initiated April 1987)
Outdoor = 17 μR/h surface and 23 μR/h subsurface

Radiation Assessment
ALO/UMTRA
Protocol
EPA Standard (40 CFR 192)
Practical
Indoor = 20 μR/h above gamma background in room-size area, grab sample RDC, if greater than 0.01 WL alpha track film long-term
Outdoor = twice gamma background for surface and subsurface
Radiation Assessment
FUSRAP

Protocol

EPA Standard (40 CFR 192) plus surface contamination and 100 mRem/yr dose limit

Practical

Indoor and Outdoor = twice gamma background for surface and subsurface, Ra-226, limited indoor gamma exposure rate or RDC

Engineering Design

• GJRAP
  —Hand-drawn plans and details
  —Standard specifications
  —Cost estimates based on experience
  —Remedial-action performance bid package and instructions
  —Bid groups of 1 to 12 properties

• GIPO/UMTRA
  —AutoCAD plans and details
  —Remainder same as GJRAP

• ALO/UMTRA
  —Hand-drawn plans
  —Grouped by type of work required to accommodate local expertise
  —Remainder same as GJRAP

• FUSRAP
  —Same as GJRAP, AutoCAD plans, grouping not usually practical
Radiologic Engineering Assessment

• GJRAP
  — No formal report
  — Radiologic data technical review by client
  — Preliminary review of engineering design package
  — Final review of engineering design package

• GJPO/UMTRA
  — Formal report includes engineering design, remedial action recommendations, and radiologic assessment
  — Radiologic assessment is appendix to REA

• ALO/UMTRA
  — Radiologic assessment is chapter in REA

• FUSRAP
  — No REA report
  — Detailed assessment plan
  — Detailed site characterization report
Performance Contracting

• GJRAP
  —Lump-sum/unit-price contingency
  —20% change order experience

• GJPO/UMTRA
  —Basic order agreement for simple properties
  —Lump-sum/unit-price contingency (significant change order experience of about 50%)
  —Time and materials being explored

• ALO/UMTRA
  —Unit price/target quantity
  —Few change orders

• FUSRAP
  —Lump sum if well-defined
  —Unit price if not well-defined
  —Speciality (landscape, electrical, excavation) contractors on annual "call order" agreement
Excavation Monitoring And Sampling

GJRAP

• Scintillometers Issued to Contractors for Excavation Control

• Backfill Criteria = 17μR/h

• No Soil Samples

• Grab Radon Used for RDC Evaluation

• RPISU Method for Annual Average

GJPO/UMTRA

• Backfill Criteria = 17 μR/h within 10 feet of Structures or Contiguous Deposit and for All Surfaces, 23 μR/h for Subsurface

• Soil Samples
  —9 to 15 aliquots from 90 to 150 m²
  —small areas combined to equivalent of 100 m²
  —aliquots composited

• Abbreviated RPISU to Track Etch® RDC on All Properties

• Interior Exposure Rate for Each Room-Size Area

ALO/UMTRA

• Soil samples
  —each separate excavation
  —10-aliquot minimum if smaller than 100 m², 10 additional aliquots for next 100 m²

• Track Etch® RDC Only if Grab Sample Elevated

• RDC for Elevated Pre-Remedial or Remedial Action Within 10 Feet of Structure
Excavation Monitoring And Sampling (cont.)

FUSRAP

• Full-Time Monitoring
• Cone Shield Measurements, 13 per 100 m²
• Soil Samples
  —25 aliquots per 100 m²
  —aliquots composited
• Positively Cleaned, EPA Standards for Ra-226 in Soil
  —Hot-spot Criteria and Field ALARA Applied
• Area Averaging Routinely Used

Summary

• Primary Differences
  —Performance contracting
  —Excavation monitoring and sampling
• Conclusion
  —All methods and application of standards apparently achieve desired/required results
• Recommendations
  —Explore efficiencies that might be gained in areas of primary differences
Ad Hoc Committee Report
Disposal Site Long-Term Surveillance and Maintenance Committee

Facilitator: Mark Matthews, DOE-UMTRAPO
John Coleman, BNL (FUSRAP); Jack Caldwell, JEG (UMTRAP); Dave Lechel, Weston, (UMTRAP); Bill Knight, MK (WSSRAP); Paul Valenti, WVNS (WVDP); William Murphie, DOE-HQ, NE-23;
Jake Gatrell, DOE-HQ, NE-22
April 30, 1987

Focus: Review surveillance and maintenance requirements, standards, and practices and costs. Explain continuation of differences. Identify any Office of Remedial Action and Waste Technology or project office issues or actions.
Working Group on Long-Term Surveillance and Maintenance

Definition of S&M

Surveillance and Maintenance

Those activities, such as monitoring, maintenance and emergency measures, which are undertaken at a site after remedial actions are complete in order to protect the public health, safety and the environment; and these activities may be pursuant to a license from the Nuclear Regulatory Commission, or other agency, as appropriate.

Purpose Of Working Group

- Review Post-Closure S&M Requirements, Standards, Practices and Costs
- Identify and Explore Areas of Commonality and Differences;
- Make Recommendations for Projects; Policies and Actions

S & M Working Group Membership

- UMTRAP (D. Lechel, J. Caldwell, M. Matthews)
- FUSRAP (D. Glenn)
- Weldon Spring (B. Knight)
- West Valley (P. Valenti)
- Kansas City (L. Fleischhauer)
- HQS/NE (J. Gatrell)
Applicable Regulations

- 40 CFR 192 (UMTRCA)
  - Inactive site standards
  - Active site standards
- 40 CFR 264
  - Hazardous waste treatment, care, closure
- 10 CFR 161
  - NRC licensing requirements for radioactive waste disposal
- DOE Order 5480.2
  - Hazardous and radioactive mixed waste management
  - References 40 CFR 260-265, RCRA
- DOE Order 5820
  - Certifying and documenting of former federal nuclear sites

Comparison Of S&M Programs

Legal Basis

- UMTRAP
  - Requirement exists in PL95-604 (UMTRCA) for S&M pursuant to NRC license.
- FUSRAP
  - No statute requirement exists for S&M, but DOE has directed that 40 CFR 192, 40 CFR 264, and DOE Order 5480.2 be used as guidance.
- Weldon Spring
  - No licensing requirement for S&M, since the site is not licensed by NRC
Legal Basis (cont.)

- West Valley
  - Using DOE Order 5820 and 10 CFR 61
  - When the facility is shut down and final decommissioning and decontamination efforts are performed, it will be transferred to the state of New York, which will assume a NRC License for the site. Final S&M Program will not be established until final closure plan is accepted

- Kansas City
  - No S&M program, but using RCRA.

Comparison Of S&M Programs

Status Of S&M Programs

- UMTRAP
  - S&M Program established and in-place.
  - S&M started at Canonsburg, Shiprock.

- FUSRAP
  - S&M Program established at two sites (Niagara Falls, Colonie Interim Storage Site) and S&M activities initiated at eight interim storage sites.

- Weldon Spring
  - S&M Program has not been established yet since it is not required until 1996.

- West Valley
  - Final S&M Program not established, but performing interim S&M activities.

- Kansas City
  - No S&M Program, but Hydrogeologic Characterization Program in-place.
Components of S&M Programs

- **UMTRAP**
  - Drawings, photographs, maps showing post-closure condition
  - Monuments, markers, signs indicating UMTRAP Site
  - Erosion markers
  - Settlement plates
  - Monitor wells, which are sampled to establish baseline conditions and monitor changes
  - Annual walkover Phase I inspections
  - Phase II inspections to quantify problems noted during Phase I inspections
  - Contingency inspections
  - Custodial maintenance

- **FUSRAP**
  - Drawings, photographs, maps
  - Site markers and signs
  - Monitoring wells
  - Civil surveys for settlement detection
  - Regular inspections
  - Contingency inspections
  - Custodial maintenance

- **Weldon Spring**
  - Not developed at this time

- **West Valley**
  Final S&M Program not established, but currently program consists of:
  - Monitor wells
  - Surface water discharge analysis
  - Trench monitoring
  - Air monitoring

- **Kansas City**
  - No long-term, post-closure S&M Program, instead conducting a hydrogeologic site characterization of effects of discharges onto surfaces and underground.
Program Costs

- UMTRAP
  - Baseline fixed costs; $50,000 (at Canonsburg)
  - $100K for first year
  - $75K per year for next 5 years
  - $50K per year thereafter

- FUSRAP
  - $400K per site per year

- Weldon Spring
  - $290K per year for first 5 years
  - $50K per year for next 195 years

- West Valley
  - $250K per year for first 5 years
  - $500K per year thereafter
S&M Working Group Agreements And Future Actions

• Hold Meetings For Informational Exchange, Cross-Fertilization, Policy Development.

• Hold Next Meeting At FUSRAP Site (Niagara Falls).

• Investigate Adding Other Program Members To Working Group.

• Eliminate Kansas City Member From Group.

• At Next Meeting
  (A) Discuss in detail the S&M aspects at
    —Canonsburg (UMTRAP)
    —Niagara Falls (FUSRAP)
    —West Valley
    —Weldon Springs
  (B) Discuss organizational aspects of managing all S&M Programs at one project office.
  (C) Develop proposed DOE Policy Statement
    —Long-term S&M responsibilities
    —One S&M office
    —Contracts
    —Site-specific programs
    —Funding
Productivity
Quality
Improvement

at
UNC Geotech

William A. Jenkins
PQI Coordinator

Presented to
Productivity Improvement Systems Workshop
Remedial Action Programs Annuals Meeting
April 28, 1987
Grand Junction, Colorado

Bottom Line PQI Program Demands
Quantifiable Results

Elements are:

- CEO leadership and commitment
- Measurable improvements—preferably in dollars
- Specific annual goals
- System for sharing benefits of improvements
- Practical training in methods (e.g., work simplification, value analysis)
- Intent to institutionalize
Program Revolves Around Seven Key Factors

Leadership and Organization Reflects Long-Range Commitment

Managers Relate PQI Performance to Careers
Leadership & Organization

Steering Committee Establishes Policy and Guides Company-Wide Effort

- Integrates and coordinates key factors
- Provides strong senior management long-range commitment
- Ensures productivity planning and feedback systems
- Drives implementation

Leadership & Organization

Productivity Office is Needed to Coordinate and Focus Productivity Improvement Efforts

Responsibilities:
- Build awareness
- Disseminate guidelines
- Monitor progress and identify problem areas
- Serve as resource
- Provide gathering point for information on techniques

Tenure Should Be Limited
Incentive

Rationale for Program Must Be Related to Employee Self Interest

- Deeper motivation than benefit sharing is needed
- Relationship to Company mission and future should be clear
- Programs can satisfy employees' desire to participate in decision-making

Incentives

Incentives Are Tangible Evidence of Management Commitment

- Financial
  - % of $ value of P/Q improvement benefit
  - Merit increases — performance appraisals
- Recognition
  - Awards
  - Certificates
  - Publicity
Goals

Finite Goals Essential to Success

- Committee will set policy
- Managers will encourage employee participation
- Goals will be keyed to value of productivity/quality improvement

Thrust is Toward Process Change

Goals

Setting Organization Goals Requires Climate of Positive Reinforcement

- Employees should be involved in establishing goals
- Goal achievement cannot be seen threatening jobs
- Goal achievement competition should balance value and participation

\[ \text{Value} \quad \Delta \quad \text{Participation} \]
Productivity Measurement, Analysis, Reporting Must Meet Five Criteria

1. **Understandable** — Both data collection/analysis and resulting information

2. **Relevant** — Must have:
   - Predictive value — for planning
   - Feedback value — for monitoring/control
   - Timeliness — for decision making

3. **Reliable** — Data must be:
   - Valid — reflects true state
   - Unbiased — no statistical lying
   - Verifiable — measurement methods produce consistent data

4. **Acceptable** — Information must be reported and used in a manner acceptable to employees

5. **Cost Effective** — Reporting costs should not be perceived as counterproductive

---

**Measurement and Analysis Systems Are Vital to Implementation**

- Establish PQI form and procedure
- Establish labor, capital, material, energy measurement criteria
- Establish increased scope criteria and implementation process
Company Must Commit to Up Front Investment in Training

- Training in basic concepts required for all managers and employees
- Specialized skill development courses should be provided as needed
- Facilitators for basic activities should be trained

Packaged Courses Are Available

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Communication

Communication Among Managers and Later To Participants Must Be Well Managed

- Initial confusion is inherent — seek to mitigate
- Change is traumatic — seek to dispel threatening aspects
- Stay ahead of events — avoid surprises
- Emphasize face-to-face employee/manager communication — especially at onset

Communication

Strong Initial Awareness Thrust Needed Followed by Systematic Communication Program

- President talks to management and employee groups
- Rules and procedures explained by managers
- Productivity news media established
- Hoopla fostered — grass roots best
Employee Participation

PQI Form Should be Focus of Employee Participation

Ad Hoc Task Forces

Quality Circles

PQI Form

Individuals

Goal Achievement Linked to PQI Form

Summary

Aim to Institutionalize Bottom Line PQI Concept

- PQI system must be built into Company operation
- Managers must relate their careers to their productivity performance
- Employees must become sensitive to opportunities and practiced in developing them
- Top management commitment and support must continue

Productivity/Quality Improvement Can Become Part of the Culture
Conclusions and Recommendations

Technical Program

The Ad Hoc Committee reports were a pleasant surprise in that they represented a higher degree of program interaction than the workshops. Primarily this resulted from Ad Hoc Committees having already met two or three times at various pertinent locations around the country to exchange ideas from the different programs on a specific topic. We feel that the Workshop-Case Study format for the Annual Meeting has been valuable over the past two years. However, the focus should now be shifted to more specific problems addressed continually and cooperatively throughout the year by the Ad Hoc Committees. The Annual Meeting would then revolve around the reports from these several (perhaps 10) committees; attendance would emphasize those more directly involved in program activities addressed by the committees.

We recommend that this year’s practice of publishing meeting notes for attendees be continued next year. Pertinent content and format information should be provided to potential attendees early in the overall planning. The 1987 presenters have done a fine job of pulling together summary information after the fact, but the problem of a variety of presentation styles can be solved by earlier planning.

Logistics Planning

The only real logistics problem encountered during the 1987 meeting was a temperamental and generally unreliable hotel sound system used in the banquet area. It is worth any extra money to rent a decent system if your host facility is only adequate.

It will take at least six months to adequately prepare for the Annual Meeting. The last month prior to the actual meeting dates will be spent in intensive detail checking and last minute logistics and program agenda changes.

UNC Geotech will be glad to share our planning file information with the next host group. Our thanks to Bechtel National, especially Joe Nemec and John Schliatter, for giving us a ‘leg up’ this year.

— Karen S. Scotti, General Chairman
— David A. Emilia, Technical Coordinator
Agenda
REMEDIAL ACTION PROGRAMS ANNUAL MEETING
"Cost Effectiveness and Productivity Enhancement"
April 27-30, 1987
Grand Junction, Colorado

Monday, April 27, 1987
3:00-9:00 PM Registration at Hotel (Holiday Inn Holidome)

Tuesday, April 28, 1987
8:00-8:30 AM Registration continued outside of General Session Room - Mt. Garfield Room
8:30-9:00 AM OPENING SESSION - General Session Room (Welcome, general remarks, administrative information)
9:00-11:30 AM CONCURRENT WORKSHOPS BREAK 10-10:15 AM

Hazardous Waste Handling & Disposal (Full Day) - Mount Garfield Room
Co-Facilitators: Gale P. Turi, DOE-Headquarters, NE-23
Kathleen L. Falconer, UNC Geotech

Performance Measurement Systems (Full Day) - Monument Room (Includes Cost Estimating previously shown as separate 1/2 day session)
Co-Facilitators: K.T. Dziedzic, DOE-Oak Ridge Operations Office
Jim Fulton, UNC Geotech

Verification Measurements (Full Day) - Grand Mesa Room
Co-Facilitators: Andy Walla, DOE-Headquarters, NE-23
Michael K. Tucker, DOE-Grand Junction Projects Office
John R. Duray, UNC Geotech

Half-day Workshops

Morning Sessions - Productivity Improvement Systems - Escalante Room
Co-Facilitators: William A. Jenkins, UNC Geotech and Gale K. Hovey, Bechtel National, Inc.
Cancelled - special briefing held Apr. 30.

Procurement/Subcontracting - Dominguez Room
Co-Facilitators: Melvin L. Scott, UNC Geotech

Afternoon Sessions - Public Relations Programs - Dominguez Room
Co-Facilitators: Peter Mygatt, DOE-Idaho Operations Office
Karen S. Scotti, UNC Geotech

11:30AM-12 Noon OPEN
April 28, 1987
12 Noon - 1:30 PM
LUNCH - Holldome
Keynote Speaker: William R. Voigt, Jr.
Director, Office of Remedial Action and
Waste Technology, U.S. Department of Energy
Topic: "General Remedial Action Program
Direction and Congressional Climate".

1:30-4:30 PM
CONCURRENT WORKSHOPS continued
BREAK 2:45-3:00 PM

4:30-5:00 PM
OPEN

5:00-6:00 PM
SOCIAL HOUR - No host bar

Wednesday, April 29, 1987

8:30 AM -9:30 AM
GENERAL SESSION - Mt. Garfield
Case Study: UMTRA Millsites
"Lakeview Tailings Site"
Richard Sena, DOE-UMTRA Project Office

9:30-10:30 AM
GENERAL SESSION - Mt. Garfield
Case Study: UMTRA Vicinity Properties
Jolene Garcia, DOE-UMTRA Project Office
Michael Madson, UNC Geotech

10:30-10:45 AM
BREAK

10:45-11:45 AM
GENERAL SESSION - Mt. Garfield
Case Study: SFMP
"Weldon Spring Start-Up"
Glen A. Newtown, DOE-Weldon Spring Site Office
Jack Hammond, MK-Ferguson

11:45-12 Noon
OPEN

12 Noon-1:30 PM
LUNCH - Holldome - Guest Speaker
Dr. Frank L. Parker, Vanderbilt University,
Chairman, Board on Radioactive Waste Management
National Research Council.
Topic: Risk Analyses as Applied to Mill Tailings Piles
and Hazardous Wastes.
April 29, 1987
1:30-2:30 PM  GENERAL SESSION - Mt. Garfield Room
Case Study: FUSRAP
"FUSRAP in New Jersey"
Jim Kannard, Bechtel National, Inc.

2:30-2:45 PM  BREAK

2:45-3:45 PM  GENERAL SESSION - Mt. Garfield
Case Study: West Valley - A Status Update
Eli Maestas, DOE-West Valley Project Office

3:45-4:45 PM  GENERAL SESSION - Mt. Garfield -
Workshop Leader Reports:
   Procurement/Subcontracting
   Mel Scott, UNC Geotech

   Public Relations
   Peter Mygatt, DOE-Idaho

   Verification Measurements
   Jack Duray, UNC Geotech

4:45-5:00 PM  OPEN

5:00 PM - Conclusion  BARBEQUE - Colorado National Monument -
Guest Speaker: Grand Junction historian David Fishell
"Lost and Found Gold Mines in Colorado"

Thursday, April 30, 1987
8:30-9:30 AM  GENERAL SESSION - Mt. Garfield-
Workshop Leader Reports - Continued
   Performance Measurement Systems
   Ken Dziedzic, DOE-Oak Ridge Operations
   Jim Fulton, UNC Geotech

   Hazardous Waste Handling & Disposal Workshop
   Kathleen L. Falconer, UNC Geotech
   Gale P. Turi, DOE-Headquarters, NE-23

   Ad Hoc Committee Report - Hazardous and Mixed
   Waste Management
   Gale P. Turi, DOE-Headquarters, NE-23

9:30-9:45 AM  BREAK
GENERAL SESSION - Mt. Garfield
- Ad Hoc Committee Reports
  • Disposal Cell Design Committee
    Chairman: John D'Antonio - DOE-UMTRAPO
  • Vicinity Property Remedial Action Standards, Verification, and Certification Committee
    Co-Chairman: Rich Sena, DOE-UMTRAPO
  • Disposal Site Long-Term Surveillance and Maintenance Committee
    Chairman: Mark Matthews, DOE-UMTRAPO

Special Report -
Productivity Improvement Systems
William A. Jenkins, UNC Geotech

11:45 AM - 12 Noon
GENERAL SESSION - Mt. Garfield - Closing Remarks
John E. Baublitz
Deputy Director, Office of Remedial Action and Waste Technology
U.S. Department of Energy, NE-20

12 Noon - 1:00 PM
OPEN

1:00 - 4:00 PM
OPTIONAL TOURS - The DOE Grand Junction Projects
Office provided tours of its technical facilities and vicinity properties projects in progress.
List of Attendees
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<tr>
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<th>Lastname</th>
<th>Company or Govt Org</th>
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**Notes:**
- The table includes information such as first name, last name, company or government organization, street address, city, state, zip, and telephone number for attendees of the Remedial Action Program Annual Meeting in 1987.
- The data is presented in a tabular format with columns for Firstname, Lastname, Company or Govt Org, street address, city, state, zip, and Telephone.
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Special Report
Productivity/Quality Improvement Systems
Conclusions and Recommendations
Appendices
Guest Speakers