THE USDOE ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT PROGRAM

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ABSTRACT

The Department of Energy (DOE) is faced with the largest environmental cleanup task ever to confront the United States. As a result of over 40 years of defense production activities throughout the U. S., numerous toxic, radioactive, and mixed waste problems exist at DOE sites.

This paper describes the scope of the DOE problems, ranging from managing newly generated wastes to remediating previous disposal or operating facilities which do not meet current environmental standards. This paper also describes specific activities which DOE is undertaking to ensure an efficient program which will give the American taxpayer a cost-effective return on their tax dollars; discusses the findings of the recently released Office of Technology Assessment report "Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production"; and delineates specific actions which DOE is taking to educate and train students to ensure the workers will be available when needed to accomplish the DOE's 30 year cleanup goal.

INTRODUCTION

The Department of Energy (DOE) appreciates this opportunity to discuss the Environmental Restoration and Waste Management Program. The DOE is faced with the largest environmental cleanup task ever to confront the United States. As a result of over 40 years of defense production activities throughout the U. S., numerous toxic, radioactive and mixed waste problems exist at DOE sites. In November, 1989, the Office of Environmental Restoration and Waste Management (EM) was established to manage the expected 30-year cleanup program, and Leo Duffy was named as its Director.

And more recently, on December 28, 1990, Admiral Watkins issued a memo which realigned the Field to Headquarters reporting relationships by specifying that each Field Office report to a single Program Secretarial Officer (such as an Office Director or Assistant Secretary). This memo specifically assigned responsibility for all Hanford operations to the EM organization. And for the other Field Offices where EM has programs, an Assistant Manager reports directly to the EM Director. You can see by these organizational realignments that the Secretary and Leo Duffy, as well as the other Program Secretarial Program Officer, take Departmental environmental responsibilities very seriously.

The Departments success depends on accurate and efficient planning procedures, on developing knowledge of the problems confronting it, and on conducting the program in an efficient and cost-effective manner. DOE is doing everything possible to conduct the program using realistic assessments of risk to the public and to the environment. The pace of the clean-up must be based on the capacity of the program's infrastructure, the availability of funds, and the present state of technology. EM tries not to force solutions on problems that cannot be effectively resolved using present technology, but rather is committed to and is looking to environmental research for ultimate solutions, while relying on waste stabilization in the interim. (There will be more about this later.) Finally, DOE's program is striving to achieve the new public interactive philosophy that Admiral Watkins is pursuing with the Department. Environmental problems will no longer be hidden behind the cloak of national security.

EM provides centralized management and planning of projects contained in DOE Five-Year Plan. The Five-Year Plan is the central, annually updated strategic planning document. It serves as the cornerstone for DOE's program and contains the framework for DOE to characterize, prioritize, and consolidate cleanup activities at every site. It outlines the specific actions DOE intends to undertake over the next 5 years to achieve compliance with this Nation's environmental laws, but it is not a budget document. The third Five-Year Plan is to be published in June 1991 and by the time the 1993 plan is published, it should contain sufficient detail to be of budget quality.

The Five Year Plan contains the framework for DOE to characterize, prioritize, and consolidate cleanup activities at every site. Immediate problems will be confined and corrected. The priorities of a 30-year cleanup effort will be based on credible science and technology, and, hopefully, on new national standards that finally resolve the dilemma DOE faces today regarding "how clean is clean?". DOE's already hard at work with States and the Environmental Protection Agency. We believe this process will help to re-establish DOE's credibility with Congress, the American public, and regulatory bodies at both the Federal and State level. But even working with these agencies and the public will not necessarily allow DOE to achieve the 30 year cleanup goal without some sort of definition of "how clean is clean?". (This point will also be addressed later in this paper.)

In preparing and issuing the Five Year Plan, the Department worked with representatives from a number of groups--States, Indian Tribes, Governmental organizations, public interest groups, and others. A session on the com-

promises which these groups and the Department made to develop and publish the Five Year Plan will be discussed in detail in Session V of this meeting, which will be held this afternoon.

Another major EM initiative is called roadmaps. EM has developed the roadmap methodology to identify: 1) key issues at the installation level that need to be addressed to assure that sites meet compliance and clean-up goals, and 2) actions that must be taken if those goals are to be met. Basically, roadmaps are a planning tool, which, when coupled with DOE's strategic plans, will identify a method to get from here to there. For this year, roadmaps are being developed at four critical sites or programs: Rocky Flats, the Feed Materials Production Center, the single-shell tanks at Hanford, and the Idaho Buried Waste Program.

The charge to EM in living up to its goals, both programmatic and ideological, is immense, but some headway has been made. The office has made progress in building the infrastructure and necessary management procedures needed to carry out its responsibilities. The number of compliance agreements with EPA and State regulators, which obligate the Department to meet specific milestones to bring DOE activities into regulatory compliance, will increase from 59 at the end of FY 1990 to 82 at the end of FY 1991 with even more anticipated by FY 1992. Many assessments and characterizations have been completed. The 54% increase in the budget of the Environmental Restoration program reflects the continuing transition from the investigating and feasibility studies under CERCLA and RCRA to actual remediation projects.

It is important to note that we are trying to focus DOE's resources (people and dollars) on problems which require solutions--in other words, clean up those sites where risk is posed by contamination, and do not focus on "blind compliance" where there is no reduction of risk.

One of EM's major achievements in the last year deals with the geological disposal of nuclear wastes. This project demonstrate both DOE's commitment to the use of advanced technology and the problems it encounters in pursuing this course. The Waste Isolation Pilot Project, or WIPP, near Carlsbad, New Mexico, has been designed for the long-term disposal of transuranic waste. Construction of WIPP has been completed, and it is anticipated that in the very near future WIPP will start receiving limited quantities of TRU Waste. This will signal the start of the important test phase of the WIPP program. The Interior Department issued its modified public land order on January 22, 1991. This may be the first step in determining if WIPP is satisfactory for long-term disposal of TRU wastes; however, there are many people who are concerned that this land order is the desired way to achieve land withdrawal. The Secretary is one, but DOE is rapidly coming to the "Fish-or-cut-bait" decision. WIPP will complete its operational readiness review by the end of February and the first shipment could be received as early as next June, if extended review, legislation to counteract the *public land order*, and litigation for any reason, do not overtake the technical performance assessment.

Although the construction of WIPP is essentially completed, DOE recognize that the hard work is just beginning. DOE must evaluate and prove the long-term capability of the facility to isolate TRU waste in accordance with applicable federal regulations -- in particular, 40 CFR 191. Once this is accomplished, WIPP can function as the final resting place for the TRU waste that has been generated in this country.

This will not be an easy task. New scientific techniques had to be developed to get this far, and new methods will have to continue to be developed in order to complete performance assessments which will determine performance evaluations of WIPP for the next 10,000 years. New techniques had to be developed and used to measure host rock properties both in the area of hydrology and radionuclide migration. A few of the unique achievements DOE has made are discussed below.

The permeability and pore pressure of the repository's host rock had to be characterized for performance assessment model validation. Typical oil reservoir permeabilities are measured in the millidarcy (10^{-3}) to darcy range and tight gas sands permeabilities are measured in the microdarcy (10^{-6}) range. However, WIPP host rock permeabilities are in the nanodarcy (10^{-9}) range which is 3 to 9 orders of magnitude lower than what commercially available equipment is designed for. Similarly, pore pressure gradients are as high as 40 psi/foot. In order to achieve the necessary resolution for permeability and pore pressure measurements in the WIPP host rock, DOE had to test for longer periods of time; a measurement that may take a day in an oil field can take 6 to 12 months to complete at WIPP. Permeabilities are measured in conjunction with porosity; at WIPP, porosities of the host rock are on the order of 0.1 to 1 percent. In contrast, porosities of oil fields are in to 10 to 30 percent range.

In addition to time constraints, equipment design was a limiting factor in permeability testing at WIPP. In one instance, DOE found that the tubing of an instrument was more permeable than the rock being tested. The presence of high pore pressure gradients requires stronger equipment to hold pressure for the longer test duration during which corrosion of the anodized aluminum instrument housings has been a problem in the high saline test environment. Costs for specially designed test equipment are an order of magnitude or more higher than costs for off the shelf oil field testing equipment. In one case, the equipment cost was $100,000 versus $5,000.

Both brine and gas flow through the host rock, and there is potential for waste-generated gas to flow from storage rooms out into the formation. Mechanism of 2-phase flow in low permeability salt are not fully understood and DOE is developing models to predict flow behavior over long periods of time. Two-phase flow models require absolute and relative permeability, gas entry threshold pressure, porosity, and gas-brine capillary pressure measurements as inputs. These fundamental measurements demand state-of-the art equipment resolution limits. In addition, in order to model the flow of potentially contaminated brine through the host rock, the concept of a 2-phase flow model has been introduced. This requires baseline measurements of permeabilities of brine charged with gases. Since the mechanisms of 2-phase flow are not fully understood, introduction of this concept has significantly added to the research requirements of the program. Session XXXV at this meeting, which will be held on Thursday afternoon, will discuss WIPP issues in detail.

Significant challenges remain in this arena and some of you in the audience will be helping DOE to face them. Just this month the OTA came out with a report entitled "Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production". Quoting from the OTA report "Progress in cleanup the waste and contamination at the Complex is being hampered by a paucity of data and qualified personnel, lack of ready technical solutions, and public skepticism toward government agencies in general, and DOE in particular." "Technologies that could effectively remediate certain sites either are not available or cannot be applied with the resources now contemplated. It may be impossible with current technology to remove contaminants from certain groundwater plumes and deeply buried soil or, even if possible, it may be extremely expensive or require prolonged period of operation. The most promising new technologies will require many years of research, development, and testing at specific sites." (As an aside, Session 11, on Tuesday morning, will discuss the technologies which DOE is developing to address waste management and environmental restoration program needs.)

The report goes on to say "EPA is attempting to use the interagency agreements negotiated with individual States and the DOE facilities to resolve jurisdictional overlaps and disputes, and to serve as a timetable for cleanup actions. But acceptable cleanup levels have yet to be determined for many DOE weapons sites." It is important that we not underestimate the impact of the "how clean is clean" determination no be underestimated, not only on the types of technologies which DOE needs to develop and implement, but also on the budgets necessary to meet the 30 year goal or remediation at DOE sites.

The OTA report goes on to make specific policy recommendations which they believe are necessary for EM to meet the 30 year cleanup goal. Some of these are the same types of policies which the Department has tried to develop, and the Department is delighted to have OTA agree with our efforts. These include: [assuring] "that needed agency personnel are developed, standard setting is accelerated, and cleanup technology is developed." Also, [developing] "site-specific and national mechanisms for involving the public in decisions about waste management and environmental restoration objectives, priorities, and activities.".

As the OTA report stated, a significant problem facing DOE's EM is the shortage of people trained in the areas required for EM to fulfill its mission. The challenges associated with environmental restoration and waste management will require contributions from all "classical" science and engineering disciplines, as well as persons trained in the law, regulatory compliance, and economics. DOE is attempting to build a sound technical talent base for the future mainly through a series of new partnerships among DOE laboratories, universities, and industry. DOE has established as a top priority a program to train and motivate the next generation of scientists, engineers, and technicians who will be called upon to devote years to correcting DOE's present environmental situation. DOE plans to tap into the creativity fostered by our universities and laboratories.

The need to start with primary education is being addressed in a K-through-12 outreach program that focuses on teacher training and curriculum development. Curricula development and professorial internships will be the primary focus of the undergraduate training program, addressed through the formation of the DOE/university consortia. DOE will use this mechanism to exchange students, faculty, and staff between colleges and universities and DOE laboratories and to establish collaborative research projects that help address DOE needs.

To date, EM Education activities have reached over 100,000 students; awarded 15 scholarships and fellowships at minority institutions; and awarded 25 scholarships, 20 fellowships, and 6 young faculty grants which were nationally competed. As an example, of program activities, at the Idaho National Engineering Laboratory, site the Science Education Outreach Program has implemented activities that will increase the exposure of rural students and their teachers to the world of science and math. Session XV, on the educational needs and initiatives in the waste management field will be presented on Tuesday afternoon.

On the "openness" front DOE is proceeding along the right track, as well. In 1990, 3,000 visitors toured the WIPP site, and 130 of these visitors were from Japan, the United Kingdom, France, Germany, Taiwan, and the Soviet Union. On February 7, EM finished the last of its twenty-three nation-wide Programmatic Environmental Impact Study scoping meetings. At these meetings, any party who wished to give testimony pertaining to DOE's Environmental Res-

toration and Waste Management program was allowed to do so. Senior executives attended these hearings and asked clarifying questions. The PEIS is expected to be available to the public in 1993 with comments being solicited all along the process. The PEIS will serve in large part as an additional environmental prioritization guide to the program.

Despite our efforts in the area of public interaction, there is still a small percentage of the public and scientific community that remains unconvinced that this nation can safely dispose of nuclear waste. A series of articles in the New York Times over the past several years tell story after story of postulated technical inadequacies in DOE's geological repository program. Most of these stories have been targeted more at Yucca Mountain rather than WIPP. The Department supports technically competent people questioning Departmental activities. In the long run, it adds to the overall credibility of the process of finding adequate solutions to DOE's technical problems.

For example, in one of the most recent New York Times articles published last November, one of DOE's own geologists is questioning certain assumptions about the nature of ground water behavior at the Yucca Mountain Site. This has become known as the "Szymanski Hypothesis." A recent U.S. geological survey report appears to contradict Szymanskis's view and was reported accordingly in the Las Vegas Review-Journal last December. As one might expect, Szymanski differed with USGS report and stated this in the article. So, the scientific debate rages in the newspapers about who's opinion is correct. The newspapers have a field day with this sort of thing -- so-called "experts" are rolled out to give their opinion on who is right and who is wrong. The only problem is that many of these "experts" are not qualified to speak with technical competence, and often their opinion is formed more by where they stand on the nuclear issue rather than scientific evidence. There must be a differentiation between hypothesis and fact, theory and measurements learned discussion and emotional reaction. Let me be clear here, the Department does not put Mr. Szymanski in this category. However, the debate should be waged in the laboratory, and more accurately covered in the media. A parallel would be to decide the Super Bowl Champion by public opinion polls or by a video game rather than on the field. It is an uphill battle; the only way to win is to demand equal time in the media and present arguments from both sides which are based on sound scientific arguments and not emotion.

In the new world order that President Bush has called for the U.S. must be prepared to set an example and take the environmental lead. The world, as yet, does not know the full extent of the environmental damage caused by the Gulf War, but surely environmental issues will play into the US's continuing policy in the region. As Eastern Europe continues to open up, previous environmental practices will undoubtedly prove more archaic than those strongly criticized in the U.S. At home and abroad, energy diversification, including nuclear power, is on the agenda, leading to cries for long term solutions to wastes. EM is preparing the base upon which it can meet all of these problems and to perform its role in finding their solutions.

DOE has had technological successes in developing long term storage with geological depositories and are slowly learning to work with the public to achieve their acceptance. There is still a lot of work to do, but planning procedures are in place, with the Five-Year Plan, roadmaps and the PEIS all going according to schedule. DOE, with its research facilities and its university and industry contacts, is ideally situated to foster the necessary research in environmental fields and is well on its way towards building the infrastructure needed to implement scientific findings. DOE's activities could go a long way toward determining the position of the U.S. in a new interdependent, environmentally conscious global village.