UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

***

PANEL ON TRANSPORTATION & SYSTEMS:

SYSTEM SAFETY, HUMAN FACTORS, AND TRANSPORTATION

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Holiday Inn Arlington at Ballston
4610 North Fairfax Drive
Arlington, Virginia

Wednesday, June 14, 1995

The above-entitled matter came on for meeting, pursuant to notice, at 8:30 a.m.

BEFORE:

JOHN McKETTA,
Panel Chairman

C O N T E N T S

C O N T E N T S [continued]

P R O C E E D I N G S

[8:30 a.m.]

WELCOME AND OPENING REMARKS

JOHN J. McKETTA, NUCLEAR WASTE TECHNICAL REVIEW BOARD

DR. McKETTA: Good morning, ladies and gentlemen. Welcome to the meeting of the Nuclear Waste Technical Review Board, the Panel on Transportation and Systems.

My name is John McKetta. I am the panel chairman. I am the Joe C. Walter Professor of Chemical Engineering Emeritus at the University of Texas, and I would like to introduce other members of our Board and our staff.

Our leader is Dr. John Cantlon, who is chairman of the Board. He is Vice President Emeritus of Research and Graduate Studies at Michigan State University, and his field is in environmental biology.

Dr. Gary Brewer is professor of Resource Policy and Management at the University of Michigan. Dr. Brewer is also dean of the School of Natural Resources and Environment for 12 more days. He is going to be very lucky, and is promoted to being full professor at all times with no administrative work at the University of Michigan.

Dr. Dennis Price is professor of Industrial and Systems Engineering and director of the Safety Projects Office at the Virginia Polytechnic Institute and State University. Dr. Price is an expert in the disciplines of systems safety and human factors engineering. He was my predecessor as chairman of this panel until his term as a Board member expired in April of 1944.

[Laughter.]

DR. McKETTA: 1994. I had his birth date and his expiration date mixed here. I want to check my extemporaneous remarks to make sure.

It does say 1994. All right.

He has continued to provide the Board with his expertise by serving in a consulting capacity until a permanent appointment is made by the President and the new member joins our Board.

Dr. Ellis Verink is Distinguished Service Professor of Metallurgical Engineering Emeritus at the University of Florida. Dr. Verink served as chairman of the Board's panel on engineered barrier systems until his term as Board member expired in April of '94. Like Dr. Price, he also is serving as a consultant to the Board.

John Arendt is a chemical engineer and consultant, and he has retired after a long career at Oak Ridge National Laboratory as a senior engineer. He has been the leader in nuclear standards development, transportation, and other areas, and he is a new consultant to our Board.

Also with us today, we are fortunate to have Dr. Woody Chu, who is a Board professional staff member.

Woody, would you raise your hand?

Hiding in the audience somewhere is Dr. Carlos DiBella, who is also a Board professional staff member.

Our meeting today has two themes. One is the application of principles of system safety and human factors engineering. The second is the recent developments in transportation and related programs at the DOE. The second will be an update of what we heard a year ago when the Board devoted an entire day of its summer meeting to this subject of transportation.

The scope of that meeting was very broad. We were briefed by DOE at that time, and we were provided with prospectives of other organizations such as Department of Transportation and the Association of American Railroads.

We have a full program today. As always, however, we have provided time for comments from the audience at the end of the day.

Dennis Price will begin by giving an overview on system safety, and then after that, I will yield the chairmanship for the remainder of the program to Dr. Price.

Dennis, would you please start for us.

OVERVIEW OF SYSTEM SAFETY

DENNIS L. PRICE, NWTRB

DR. PRICE: Thank you, John.

Good morning. We are here; in part, anyway. The reason we are here is to address the system safety program in the Department of Energy's Office of Civilian Radioactive Waste Management.

The United States Nuclear Waste Technical Review Board has advocated from its first report to Congress in 1990, and since, that OCRWM establish and operate such a program. The DOE has agreed to the need for this program and has long indicated it will follow through on this recommendation.

These introductory remarks are to give an overview of what a system safety program involves. It might sound introductory, pedantic, and professorial to some. If it does, I do not apologize because I guess it is, and I am.

No reasonable person will argue that the radioactive waste management system should be unsafe. Those who work on and are dedicated to the Civilian Spent Fuel Management Program are dedicated to safety. However, the primary focus of each of their interests might be their own professional field, such as management and public policy, geochemistry, geohydrology, seismicity and tectonics, vulcanism, metallurgy, health physics, mining engineering, nuclear engineering, geology, civil and construction engineering, chemical engineering, physics, biology, the environment, and so forth. Many disciplines make up this program.

The system safety program should be staffed by persons who are safety professionals with an educational background and primary focus directed toward the accomplishment of safety of this complex system.

The first step in establishing a system safety program is in assigning such disciplined safety professionals to the program. Perhaps some might argue that the Nuclear Regulatory Commission provides the system safety program for OCRWM because they will not pass something that is unsafe. However, to meet NRC's requirements, all OCRWM must do is satisfy the regulations of the NRC, the EPA, the DOT, and any other pertinent regulator.

There is no doubt that the OCRWM program is aware of and addressing the regulations for spent fuel and high-level radioactive waste disposal. Whether or not this is adequate and sufficient depends upon the answer to this question: If all regulations are satisfied, could accidents still occur and undesired events nevertheless occur which will place in danger or at risk environment and human health and safety?

If the answer is yes, it is conceivable that dangerous events could still occur. Then simply satisfying the regulations is not enough. It is not enough because the standard of care for this kind of public concern and involvement must be high.

It is my opinion that the standard of care that should be required by the judicial system will certainly not be slight care, that degree of care less than that which a prudent person would exercise, nor do I think courts will accept as a standard of care, reasonable care, that degree of care exercised by a prudent person in observance of legal duties toward others.

The meeting of regulations will be necessary, but I think will not be sufficient. The standard of care which I think must be met in the management of radioactive waste is that of great care, that high degree of care that a very prudent and cautious person would undertake for the safety of others.

This standard of care will make it necessary that radioactive waste management demonstrate a vigorous program both to foresee hazards and to make a prudent effort to reduce them to an acceptable level.

The dual tests of foreseeability and prudence must be met. Great care must be taken to foresee the foreseeable hazards, and great prudence must be exercised to avoid or mitigate the foreseen hazards to an acceptable level. Great care is demonstrated by a reasonable, detailed, and rigorous system safety program faithfully exercised.

The question which the management of radioactive waste must inevitably address is: Was a reasonable effort made to anticipate and were programs in place to manage the potential for undesired events? The emphasis is on the word "reasonable."

Great care does not require crystal ball gazing, but does require the application of reason as the foundation for anticipation. No one can see into the future completely, but great care requires that that which can be foreseen be foreseen. Closely related to foreseeability is the concept of oversight. If it is determined that an undesirable event was foreseeable, but the program management failed to detect the undesirable event, that is an oversight. Oversight may entail culpability.

On the other hand, if the undesirable event is foreseen, then that event must be analyzed so that a prudent person can decide to accept the risk of that event or take actions to eliminate that potential or minimize the risk until it is acceptable.

Accepting risk may also entail culpability. While zero risk is unattainable in the real world, the role of radioactive waste management is to detect risks and to execute prudent and reasonable decisions about those risks. Thus, the twin tests of foreseeability and prudence are founded upon reason.

If the decision is that a given risk is acceptable and the undesired event, then, subsequently occurs, the effects of taking that risk can be defended on the basis of the careful reasons documented for that risk acceptance. Without careful prior documentation and reasoning, the judgment of management culpability is to be expected, given the occurrence of the undesired event.

What program and technology are there that management can utilize to provide satisfaction for the demand for at least reasonable care and, most probably, great care?

To address that question, let us examine the systematic approach to safety as found in the system safety discipline. This discipline is based upon analyses of existing or proposed complex systems. The analytic techniques are based upon reason and logic.

There are techniques which use inductive reasoning and techniques which use deductive reasoning. When it becomes necessary to demonstrate that great care has been exercised in foreseeing hazards in complex systems, such as the nuclear waste disposal systems, reason must be relied upon, and there are two kinds of reasoning, inductive and deductive.

System safety has developed techniques for safety analysis that use each kind of reasoning. The application of both inductive and deductive state-of-the-art approaches to safety analysis can be used to establish an argument for the standard of care given to safety.

A program management that uses both inductive and deductive techniques in a systematic approach to safety can proffer a strong defense that reason and prudence prevail and that great care was taken.

Let me give an example. The strength of this argument can be illustrated by the reasonable and prudent approach to hazard identification found in systems safety. The problem in hazard identification is to be sure that all hazards that reasonably can be foreseen are foreseen. A typical initial way of doing this is to get knowledgeable persons together to brainstorm on what hazards might exist and to come up with a documented preliminary hazard list.

This is an important and necessary first step. This step should be taken early in the conceptual stage of system development. However, as the stages of system development proceed, that is no longer enough to demonstrate that great care has been taken in hazard identification. This list must be revised, and revision can no longer be based upon brainstorming.

Suppose the informed management of a program acknowledges that as inherent hazards, it has inherent hazards which must be identified to the fullest extent possible and with the exercise of great care. That management must then institute an iterative approach that systematically revisits the hazard list and updates and refines that list.

To ensure that this iterative approach is thorough and reasonable, the manager employs two independent teams, each led by a knowledgeable safety professional. Each team is blind to the activities of the other. One team uses inductive system safety techniques exclusively; the other, deductive.

The inductive team, the techniques team, starts at the component level of the system and examines the failure modes to determine the undesirable end events that will occur. They use the bottom-up reasoning approach such as failure modes and effects analysis.

The deductive team starts with a listing of the top undesired events which conceivably could occur. It examines how each could occur by reasoning from the top down to the identification of the components, the failures of which could contribute to the top event, undesired event. They use techniques such as fault tree analysis.

Then the results of the two independent teams are compared. The end events of the inductive team should match the top undesired events listed initially by the deductive team. The component failures identified by the deductive team which contribute to the top events should each be found among the components listed initially by the inductive teams. Both teams utilized one of the two types of reasoning. Therefore, their efforts are reasonable.

If throughout the system life cycle these two types of reason are thoroughly and iteratively used until they complement each other by results which withstand the cross-check just described, a strong argument exists that great care has been taken in reasonable hazard identification.

Because one cannot completely determine future events, one cannot argue that all hazards have been identified. However, when a system safety approach to hazard identification is properly applied, one can argue that the effort was done with great care and was reasonable. That is clearly what is expected by the public and by the judicial system for nuclear waste management.

There is no place to hide. There is no hiding place in sayings such as "Accidents will happen," or "Accidents are random events," or "No one can see into the future," or "It was an act of God." I'm sure you have got some other sayings in the back of your head right now.

However, it is certain that everything is not foreseeable. Therefore, it is important to demonstrate in advance that great care has been exercised by establishing a program to reasonably identify and foresee that which is foreseeable and great care has been exercised also in prudent management of identified hazards and potential hazards.

How does management show that great care has been utilized in identifying and managing potential hazards? In my opinion, the answer is a state-of-the-art system safety program with its supportive technology conducted by dedicated knowledgeable safety professionals.

Let me say something about the system safety process itself. The system safety process is, as reported in the *System Safety Handbook*, 1993, "both deceptively simple and very difficult to implement."

Generally, it involves understanding the system, identifying potential hazards of the system, developing means to eliminate or sufficiently control the identified hazards, implementing those hazard controls, verifying the adequacy of implementation of controls, and iterating the process at various levels of detail.

Let me say something about the two major elements in the system safety program itself; that is, program plans and safety analysis.

After appropriate personnel are assigned to the system safety program, the next step is to draft the system safety program plans. These plans are integrated into a document which includes the entire system.

For example, for radioactive waste management, it will encompass the facility's equipment, operations, and procedures for the management of waste from its generation through its disposal. This document details the tasks and activities required to identify, evaluate, eliminate, or control hazards throughout the system life cycle. *The System Safety Handbook* makes this definition.

It also addresses planning for accomplishing the safety effort, including organization, responsibilities, tasks, schedules, methodologies, and management control means. These plans will detail the means for hazard tracking and responsibility for response in order to ensure that once a hazard is identified, it receives prudent action and resolution.

Second, safety analysis. The cornerstone of a system safety program is safety analysis. It results in a number of documents, and I will run very briefly through that.

Preliminary hazard list. The first analysis performed is typically the preliminary hazard list, referred to previously. It is derived from safety data from similar systems, mishap, incident logs, safety lessons learned, program safety requirements. The output is a list of potentially hazardous areas for future hazard analysis and the preliminary identification of additional safety design requirements.

The second document is the PHA, or preliminary hazard analysis. The PHL, preliminary hazard list, results are used to identify potential hazard areas. The output of the preliminary hazard analysis includes the identification of potential hazard areas, the ranking of hazards by severity and probability, operational constraints, recommended actions to eliminate or control the identified hazards, and the definition of new or additional safety design requirements. It is a living document requiring periodic updating and is a basic document for the program.

Next, the subsystem hazard analysis, or SSHA. The program plans will typically include analyses based on detail, subsystem design data, preliminary hazard analysis results, failure mode and effects analysis result, safety design requirements, and human engineering results. It will include failure modes that impact safety, recommend resolution actions for the failure modes, verification that safety design requirements are met, and verification that the subsystem design does not introduce any new hazards. The storage subsystems, transportation subsystems, geologic subsystem, and disposal operation subsystems are part of the overall system for waste management and subsystems to be covered under this analytic effort.

Next, system hazard analysis, or SHA. The system hazard analysis emphasizes the subsystem interface hazards.

It uses detailed system and subsystem design, data, the SSHA, the PHA, system safety design requirements, and environmental data results. The outputs are documents which verify compliance with safety requirements, recommendations to eliminate or control identified hazards, and verification of the total safe system design.

Next, operating and support hazard analysis, or O&SHA. As stated in the *System Safety Handbook* in 1993, "This is the key analysis for exploring the hazard relationships of people and the system." As its name implies, it emphasizes system use and examines procedurally controlled activities. It identified and evaluates hazards resulting from the implementation or improper implementation of operations or tasks performed by persons. It will utilize human factors engineering, data and reports, the PHA, the SSHA, and SHA reports. It is concerned with the adequacy of the design at the human equipment system interface. Its output will include analyses of hazardous activities, recommended control actions, including design changes, identification of safety training requirements, and an overall verification of compliance with systems safety requirements insofar as user personnel are concerned.

Finally, among those that I am listing for you this morning, health hazards analysis, or HHA. The HHA is an activity which results in a document which identifies potential toxic and physical agent exposure hazards, recommended actions to eliminate or control these hazards, and the means to verify that the system meets specified health hazard requirements.

Perhaps it should be pointed out that the system safety analytical techniques deal with potential or actual hazards and work in failure space first, then controls in design changes, and recommendations follow. This approach does not emphasize the oftentimes many ways a system can succeed, but is directed toward a frank analysis of the fewer ways a system can fail and do harm. It pulls out the dirty linen first, then looks for ways to clean it up. This approach may take institutional courage to implement in a sensitive and often controversial area such as radioactive waste management.

In conclusion, it should be evident from this, to me, brief overview of the need for system safety, the system safety process, the system safety program that if the DOE follows the Nuclear Waste Technical Review Board's recommendation for a system safety program, they will be able to present: (1) personnel whose profession and purpose is dedicated to system safety; (2) a clearly definable system safety process; (3) a system safety program, plans, document which demonstrates an organizational responsibility for system safety and a program with an iterative approach;

(4) a willingness to work in failure space -- I pause because that is important -- (5) a systematic means for hazard identification and documentation; (6) an adequate means for hazard tracking; (7) safety analysis using inductive and deductive techniques and system safety to produce documents of hazard identification, preliminary hazard analysis, subsystem hazard analysis, system hazard analysis, operating and support hazard analysis, and health hazard analysis; (8) prudent documented hazard management control and acceptance; and (9) an interactive integrated program for system safety that includes the entire radioactive waste system from waste generation through disposal.

Brian Moriarty, a TRW system safety professional located here in Washington, D.C., wrote the following in a textbook on a subject he co-authored with Harold Roland in 1990. "A modern poet put it very clearly. The road to wisdom? Well, it's plain and simple to express. Err and err and err again, but less and less and less. The concept of system safety advances one giant step from this concept. It stems from the logic of system functions and of preventing errors before they happen."

I wait with great interest for the presentations from the DOE this morning on system safety and other topics.

In that regard, it is now my opportunity, and I think even a little ahead of a time, to introduce to you James Carlson who will give the introduction of the topics this morning.

Jim?

INTRODUCTION OF TOPICS

JAMES CARLSON, DEPARTMENT OF ENERGY

MR. CARLSON: I thank you for the introduction. I think Dr. Price has indicated who I am. I will tell you a little bit about myself, a little bit about what I am going to cover. I will always say that Dr. Price is challenging to follow on any podium, and I appreciate the presentation.

I think what we have today for the Board will address a lot of these points. I think the program has made significant progress in this area over the last few years, particularly as the project office out at Yucca Mountain moves forward into the exploration of the site and the site suitability evaluations.

I believe the system safety program and the efforts there are moving along to address, I think, most, if not all, of the specific points that Dr. Price brought up in his presentation.

For those who have not met me before, I am Jim Carlson. I am the director of the Systems Engineering Division within the Headquarters Office of Program Management and Integration.

What I would like to do is explain a little bit about how the systems engineering and system safety as part of systems engineering functions within the Office of Civilian Radioactive Waste Management and some discussion of the breadth of the presentations today and the individuals who will be addressing the panel.

Within the office, the way that Dr. Dreyfus and Lake Barrett have set up the office, we have basically one headquarters program management or central organization that is responsible for the integration of the program. The general policy development within that office is the Planning Division, Program Management Division, which handles the project control or cost and schedule, Regulatory Integration Division which is liaison with the Nuclear Regulatory Division, my organization which does what I would call the technical management development or sets out the programs or the policies with regard to how we are going to do the engineering or the approach to the engineering and the integration across the programs.

We have also set up two, I believe we like to refer to them as, business enterprises, using some of the current jargon: the Yucca Mountain Site Characterization Office which is dedicated to the characterization, the NEPA compliance, and the recommendation if the site is found suitable; and the Office of Waste Acceptance Storage and

Transportation. We have individuals representing both business enterprises scheduled to speak today particularly with regard to the system safety within the exploratory studies work that is going on at the Yucca Mountain project.

As you can see, these are direct reports to the office director. Our involvement is generally doing policy development, developing the planning documents that integrate across the program and establish the system safety or the system engineering policy for the organization.

Within the individual projects or business enterprises, the project manager establishes his organization and implements the policies that flow down to the line organization. Basically, we have two line-implementing organizations and a headquarters staff function, human resources, quality assurance which under the NRC requirements reports independently to the director.

The first presentation you will hear will be by Dr. Smith who is within the Systems Engineering Group within TRW. I will sort of shift over to this organization which tends to parallel in some ways and mirror the DOE organization in that there are two TRW groups which report the business enterprises and the project organizations.

The program integration organization supports my boss or his counterpart, to Ron Milner who is headed by Colin Heath, and Greg Smith works within that organization in the Systems Engineering Group, and his specialty is system safety and human factors. He is the one who works in the development of our system safety plans and our human factors plans. He will be giving us an update on the status and where we are planning to go with the systems engineering management within the program, and he is also going to talk a little bit about a white paper he pulled together on working on thermally hot environments. I believe that was specifically requested.

The second area will be presented by individuals who work out in the Yucca Mountain Site Characterization Project, and this will be with Lewie Booth and Les Eisler. They are going to talk about the system safety work that is being done on the site characterization activities. They are going to be introduced by Dennis Royer who is part of the Yucca Mountain Site Characterization Office.

I will switch back to our organization.

Dennis works within the office or the organization of the Assistant Manager for Suitability and Licensing. He is the team leader for Systems Engineering within that office, and he has the DOE oversight of this Systems Engineering activities within the site characterization project.

The gentleman from TRW is going to talk about the actual implementation and activities, who reports through

Bob Sandifer's organization up through the assistant general manager for TRW's operations out at Yucca Mountain.

The next presentation where we are going to be giving status reports in the transportation waste acceptance area will be dealing with activities under Sam Rousso's organization and the implementation of the planning for waste acceptance, transportation, and storage, if there is a storage facility.

The MPC development, the MPC procurement status will be presented by Jeff Williams who is the director of the Engineering Division and Jim Clark who is with the TRW organization. He works for E.R. Johnson Associates, part of the M&O team. They will give you a status on the procurement and the information that they can of what is nonproprietary and available to present to the Board with regard to the MPC proposals.

I will say that they have to coordinate this because the awards have been challenged by some who did not receive awards, so that some of the discussions have all been cleared with the attorneys and everybody else, but we may find ourselves tied up with the litigation or the challenges to the procurement.

Also, within that same organization, we are going to get an update of the GA-4/9, the truck cask development activities that have been going on. We are before the NRC for certification. Don Nolan is going to give a presentation that is fairly detailed on that project, where it stands and what it looks like. Also, T.C. Smith, who has been overseeing the tractor trailer testing, the light-weight rig that is used to haul this truck, is going to give us a status report on that and some of the results of the ongoing testing. The third presentation in this area is on the risk management/risk communication planning that has gone on with regard to transportation.

Then there is going to a brief presentation as we shift back to the Nevada work, and this has been a system studies looking at alternative rail or heavy haul routes, should there be a requirement to ship early and also provide input into the NEPA process, and this is an update of work that was performed several years ago, and Rick Memory will present some of the results of that study.

The last set of presentations will be from personnel in the Operations and Environmental Division and contractors with our technical support contractor. Bob Rooney, who is with Weston, is a former railroad employee, and he will talk about the recent panel discussion on rail issues at the Transportation Coordinating Group meeting that was held in Baltimore while these gentlemen were out in Idaho.

The general update of transportation plans will be presented by Linda Desell who is the division director in the environmental and operational part of the WAST organization, and Markus Popa will talk about routing policy development that has been going on, involving both our office and the Environmental Management Office within DOE.

It is a very full agenda. We certainly appreciate the opportunity to bring the Board and the panel up to date on the activities in this area, and I am particularly pleased to have the opportunity to present to Dr. Price some of the progress has been made in the system safety area out with the Yucca Mountain site project.

At this point, I will introduce Dennis Royer who will introduce the speakers and the topics with regard to the Yucca Mountain Site Characterization Project.

Thank you.

I'm sorry. Greg Smith is the next presenter. I didn't have my agenda here. Greg is going to give us an update on the systems engineering at the program level.

MR. PRICE: If they could both go at the same time, it would be real interesting.

[Laughter.]

MR. CARLSON: We have the dual viewgraphs. We could probably try it.

SYSTEMS ENGINEERING

GREGORY SMITH, TRW ENVIRONMENTAL SAFETY SYSTEMS

MANAGEMENT AND OPERATING CONTRACTOR

DR. SMITH: Good morning. As Mr. Carlson has indicated, I am Greg Smith, and I am a human factors engineer in the M&O Systems Engineering organization.

I will be talking on two topics this morning, updates to the systems engineering management plan, or the SEMP, and working in thermally hot environments.

As Dr. Price mentioned this morning, there is the need to identify, early on, potential hazards, and particularly in the repository, and this paper was written to provide those designers that may not be familiar with the human limits of working in thermally hot environments.

In the Systems Engineering group, we are responsible for developing the systems engineering management plan, or the SEMP, and this is our document hierarchy. I realize you can't see it very well up here.

On the left of the document hierarchy in yellow are the program and the project management documents and to the right is primarily the technical baseline or the program and the project requirements.

Of interest today is the SEMP, and the SEMP is our top-level management document. Its purpose is to prescribe how the Systems Engineering process will be implemented in managing development for the civilian radioactive waste management system, including the management responsibilities assigned to the M&O and to the elements of OCRWM.

Systems Engineering is being used to specify, evaluate, integrate, and document all aspects of the technical development of the waste management system and its system elements to ensure that the program and the project requirements are met in the operational system.

The SEMP calls for, among other things, a test and evaluation master plan and development of the Project SEMP. Disposing of nuclear waste is a unique undertaking, and this SEMP is a unique undertaking.

As various aspects of the program change, the SEMP is updated to reflect that. Once we find better processes to follow, we document that in the SEMP.

Through a series of meetings with the program- and the project-level engineers, one of the findings to make it a better SEMP was to make it more specific and more detailed.

Also, the SEMP is being updated to reflect the summer 1994 reorganization and the new program approach.

On this chart, the first bullet represents the new program approach, and the second, third, and fourth bullets represent some additional information that has been added to the SEMP.

Also, the SEMP was updated by adding three specialty engineering program plans to it. The Human

Factors Engineering Program Plan was already in the SEMP. We have added the System Safety Program Plan, the Integrated Logistics Support Program Plan; the Reliability, Availability and Maintainability, or RAM Program Plan. These documents are appendices to the SEMP.

The revisions to the SEMP are not complete. Not all issues have been resolved. So it is still in a draft stage for this particular iteration.

Next, I will cover some of these bullets, some of these topics that have been added to the SEMP.

The updated SEMP discusses the development of the MPC, or the multi-purpose canister. It also describes at a high level the activities within the five stages of acquisition of the MPC. It also identifies the minimum inputs and outputs for each MPC acquisition phase. That includes a technical baseline and related documents such sa reports and analyses. Finally, it specifies the reviews.

Later today, Mr. Jeff Williams and Mr. Jim Clark will give you a much more detailed briefing on development of the MPC program.

The updated SEMP also provides for the minimum acceptable inputs and outputs for each traditional acquisition phase. It includes requirements, baseline plans, analyses, reports, design packages, and so on.

Here is one example where, through the various phases, in the first column we specify the documents at the start of that phase. For example, in the conceptual phase, we would start with the OCRWM requirements document, and at the end of that phase, the requirements in that document have been allocated to the OCRWM elements and to the system requirements documents. We had also produced the various plans; for example, the Human Factors and the System Safety Program Plan.

In the preliminary design phase, you take the system requirements documents, and those are developed into much more detailed requirements documents. Also, we would have the results of various analyses at that point.

In the detailed phase, as the output of that phase, we would have our design packages and, again, various hazard analyses.

At the end of the fabrication construction phase, we have the as-built design packages and manuals, and of course, we use the manuals to begin operations. So those are just some examples that are in the SEMP.

The updated SEMP lists all the technical reviews through FY 1996. For each technical review, the affected element or segment, the type of technical review -- for example, an in-process versus a design review -- and the proposed date of the review are listed in the SEMP.

The updated SEMP requires the projects to determine the technical cost, schedule, and programmatic risk associated with proceeding with to-be-verified and to-be-determined requirements.

As I mentioned, we have the program plans which are now appendices to the SEMP, and the Human Factors Engineering Program Plan that lists the various activities that can be expected in each phase, providing inputs to the operational concept, providing functional allocation between people and machines, and conducting task analyses.

The specialty engineering program plans provide general guidance to the projects, and the projects must tailor this guidance to their unique needs, and that would be reflected in their project plans.

As I mentioned, the systems safety program plan was added in addition to discussing the various activities and phases, as did Dr. Price this morning. It talks about the various analyses that are performed, the need for a systems safety working group, and the need for a hazard tracking and risk resolution database.

Following my presentation will be Mr. Lewie Booth and Mr. Leslie Eisler, and they will be addressing the human factors engineering and the system safety activities in Las Vegas.

We have added the integrated logistics system program plan. It calls for a logistics support analysis for providing a maintenance concept, provisioning concept, and having the need for a failure reporting analysis and corrective action system.

The RAM plan calls for program liability requirements, the allocation of the RAM performance requirements, and performing tradeoff studies and analyses to achieve those requirements.

The second topic is working in hot environments. I will discuss why the topic is important, the components of heat gain and loss, the types of heat stresses, the need for a thermal design requirement. I will talk about two heat stress measures and finally talk about some repository temperatures.

As I have already mentioned, the topics for this briefing and for the paper that I provided was primarily for the repository. The role that heat plays on human and equipment performance must be understood when evaluating the various design alternatives.

The paper, "Working in Hot Environments," was written to provide background information for an operational upper limit for normal operations without thermal protection and to provide input to the concept of operations for how long people can work under various environmental conditions.

This information has been used as input to the concept of operations, and the concept of operations for the repository is a work in progress and will be going on for quite some time.

One of our efforts during the design process will be to determine whether there is going to be a heat gain or a heat loss to the workers. This is a function of how hard the person is working and an environment in which that person is working.

As indicated on the chart, it is the sum of four variables, the first being metabolism. Metabolism is always positive, and the level of metabolism, of course, is determined by how hard that person is working.

We also will be looking at the working environment to determine whether there will be a gain or a loss by convection or heat radiation.

We would look at the expected humidity to determine how much heat loss is possible by evaporation, and of course, evaporation always results in a heat loss.

Conduction, the other method of heat gain or heat loss, is considered to be so negligible in this case that it is not being considered.

How heat is lost or gained is dependent upon the environmental conditions. This chart shows what percent of heat is lost from the human to the environment by convection, radiation, evaporation, giving differing air and tunnel temperatures shown at the bottom of the figure.

At the lower levels where, let's say, the air is 63 and the walls of the tunnels are 66, a person can lose heat to the environment by all three methods.

As we begin to heat up the air, then the walls, there is a loss of the ability to lose heat by radiation.

Finally, when the air and the wall becomes warmer than the skin temperature, the only way a person can lose heat to the environment is through evaporation, and we would look at the humidity levels to determine how effective evaporation would be.

A human cannot lose heat to the environment. Heat stress increases. The three stages of the heat stress and their symptoms are shown on the viewgraph.

What is important here is that for continued normal body functioning, the deep core body temperature must stay within a range of 98.6, plus or minus, 1.8 degrees Fahrenheit. There aren't many people, like most people, who can tolerate high temperatures.

There are numerous ways to measure heat stress. There have been two measures that have been used in studies. One is called effective temperature. The other one, I will discuss in a moment.

Effective temperature is not simply a single value, but a range of values. You can see the increasing dry bulb temperature at the bottom, relative humidity measures here.

We have increasing dry bulb temperature, increasing levels of relative humidity, and the effective temperature is defined as a given dry bulb temperature at 50 percent humidity. So the green line represents the 50 percent humidity. So that, an effective temperature of 85 degrees would be 85 degrees at 50 percent humidity. So 85 effective temperature is anywhere along this line. That is what I mean, it is a range of values.

At 85 effective temperature, if you decrease the humidity, you can tolerate higher and higher temperatures. If you increase the humidity, you can tolerate lower temperatures here. So it is a range of values.

This is an artist's rendition. It is not exactly correct, but an 85 effective temperature is the same comfort level as 85.5 degrees Fahrenheit at 90 percent relative humidity or 91 degrees Fahrenheit at 10 percent humidity. That is one measure of heat stress.

Another is the wet bulb globe temperature, and the wet bulb globe temperature takes into account the dry bulb temperature, humidity levels, wind velocity for evaporation, and radiant heat, and it is all combined into a single score.

NIOSH, the National Institute of Occupational Safety and Health, has provided guidelines for working at various levels here at the bottom. You have increasing work activity, and 100 kilocalories per hour is resting or very light work, 300 is medium-level work, and 4 and 500 is extremely heavy work.

So, given how hard the person is working, they provide information guidelines where they should be working 60, 45, 30, 15 minutes, or the maximum under any circumstances, across the various levels. It gives you a recommended range in the wet bulb globe temperature of 77 up to 86, and that is another measure we will be looking at to help us in our concept of operations.

So we are aware of the importance of taking heat into account in the design of the repository. Of interest to me as a human factors engineer are the temperatures displayed here. I would be interested in the various locations where people will be working, and they may not be working in all these places, that by location and by phase through operation, placement, care-taker, and backfilling, what can we expect those temperatures to be.

Once those are calculated, we can iterate on the design, do some tradeoff studies to see if we would like to have them lower or higher, depending upon what the final concept of operations is, whether people are going to be working in closed cabs or whether they will be working without thermal protection.

Most of these values are to be determined, for the most part, but when they are known, we will incorporate them into the concept of operations.

The location by phase temperatures will be a function of the thermal loading strategy, ventilation design, waste package offset, and other factors.

I understand that the Board has a scheduled presentation to them next month from Salt Lake City on ventilation design. I would defer any questions to then, but I did say that I would be happy to take any questions today, now, or after we are done today and relay that information, those questions, to those responsible so that they could be more ready to answer your questions.

That concludes my presentation for today.

QUESTIONS/COMMENTS

DR. PRICE: Are there questions?

John Cantlon.

DR. CANTLON: I guess as a biologist, I am surprised you didn't have air velocity in there as an important variable.

DR. SMITH: The wet bulb globe temperature takes wind velocity into account.

DR. CANTLON: As an integrator.

DR. SMITH: Yes.

On the effective temperature chart that I showed you, that was effective temperature given a wind velocity. If you change the wind velocity, you would have to have multiple charts.

DR. PRICE: Could you discuss the two types of wet bulb globe temperatures that NIOSH uses and which one you think will be applicable?

DR. SMITH: I am not familiar that there is more than one wet bulb globe temperature. I know that there are numerous effective temperatures that have been used, and I would have to go to the literature to tell you exactly what are the strengths and weaknesses of each because there are strengths and weaknesses of any stress index measure that has been developed.

DR. PRICE: There are two. One is indoor. One is called outdoor. There is a little bit of misnomer, and they are .7, .2, .1 breakout and .7, .3 breakout.

DR. SMITH: Right. I didn't realize that is what you were asking.

Yes. I am familiar with that one. It takes into account solar load. The other one does not take into account solar load. Obviously, in the repository, you would not have the solar load.

DR. PRICE: Of course, it isn't really truly solar load. It is radiant heat load.

DR. SMITH: Radiant heat.

DR. PRICE: You could have a radiant heat load in sun.

DR. SMITH: Yes.

DR. PRICE: So that is why I was curious as to how you saw which one you might be using.

Let me shift over to your program plans. Those program plans, you indicated -- by just generally what is in the program plans, we certainly have not, as yet, seen the program plans, particularly the ones of the topic today, human factors and system safety.

You indicated activities by phase and so forth. My impression is, generally, things were pretty general, generally --

DR. SMITH: Yes.

DR. PRICE: -- and not very specific nor very definitely applied to the project we are working on here.

DR. SMITH: They were made general because the different projects have different specific needs. So we are saying that this was the intent. This is the guidance we are providing, and tailor this guidance to your own specific needs of the project.

So, at the project level, they should have very detailed and specific plans.

DR. PRICE: Is what is in the human factors engineering program just a general statement? Then the idea is to give it to each project? I am not sure what you mean by projects. Then they actually are supposed to fulfill that? So there is a plethora of these program plans?

DR. SMITH: The SEMP is the system engineering management plan. It is the overall guidance that gives direction as to what needs to be developed at the program level and the project level, the idea being that if it is not required by the SEMP, then it is not done. So we use the SEMP as a way of indicating what we expect to be done at the program and the project level.

DR. PRICE: How detailed is that since we don't have the information here? How detailed is the information you are giving to them?

As you pass it on, there are not human factors professionals all throughout the levels in the various projects, are there? There are not system safety professional people throughout all of the levels that are fully equipped to be able to write these plans.

DR. SMITH: I reside at the program-level plan, and Les Eisler and Lewie Booth are at the project level.

MR. BOOTH: Dr. Price, you have kind of taken away part of my briefing, but let me see if I can help.

DR. PRICE: Okay.

[Laughter.]

MR. BOOTH: We will do that after Greg is done.

I am a human engineer in Las Vegas on the Yucca Mountain project. What Greg has described is true. He has written an overall program plan, and I am currently developing the human factors engineering project plan, and that plan will be specific concerning the phases and the activities we propose to execute.

That is currently under development. That is one of the things we are presently doing, which I was going to tell you later, but here it is.

DR. PRICE: Good. I don't mean to jumping out of order and preempting.

MR. BOOTH: That's fine.

DR. PRICE: The only thing we haven't seen is the appendices that you are talking about. So it is a little difficult to be sure what really it is that you are presenting to us this morning. That really, basically, was my problem there.

It didn't seem to me like there was enough detail. To bullet activities per phase doesn't do a whole lot for me specifically as to what is in these plans.

DR. SMITH: I did not want to take up time to describe those for each of the program plans, but they are in the program plans of SEMP. As I have indicated, it is in draft form, and it has not been approved. So I am not sure what the date for distribution is or the target date is for the SEMP.

MR. CARLSON: The target dates, I believe, are within the next couple of months. We hope to have this go before the Program Board for approval, but we would be pleased to share the draft plans with you in regard to the specialty engineering areas.

DR. PRICE: Any other questions?

[No response.]

DR. PRICE: I don't know if the Board can tolerate running ahead of schedule like this.

[Laughter.]

DR. PRICE: Dr. Chu suggested that I find a story to fill in time. Thank you very much.

I think we are a few minutes ahead of time. Suppose we take our break at this time. It is 9:45 instead of 9:55, and we were scheduled back at 10:10. So we will just do it at 9:45 and come back at 10:00.

[Recess.]

DR. PRICE: Let's begin. We will continue on. I guess you can't begin and continue on at the same time. Let's continue on to the second page of our outline for this morning's activities with Dennis Royer.

SYSTEM SAFETY AND HUMAN FACTORS ENGINEERING FOR

SITE CHARACTERIZATION

DENNIS ROYER, DOE

LEWIE BOOTH AND LESLIE EISLER, TRW - M&O

MR. ROYER: Good morning. I am Dennis Royer. My nickname is "Dan." So don't let that confuse you.

I am the Systems Team Leader at the Yucca Mountain Project for DOE. I would like to thank Dr. Cantlon and Dr. Chu and the rest of the Board for inviting me this morning to provide the presentations on these very important topics.

DR. PRICE: Excuse me. I forgot something that I should have done. I was asked to remind everyone to speak directly into the microphone, those at the table and at the podium as well.

I am not saying that you were not. I just forgot to say that.

MR. ROYER: I would like to explain the responsibility of assignments at Yucca Mountain. I know there is some question on where the safety is aligned, and system safety is certainly a part of this.

Many of you have seen this Yucca Mountain organizational chart before. I have focussed mainly on the assistant manager portion of the organization. You can see the assistant manager for Environmental Safety and Health, basically the five branches.

Now it is broken down as far as how the assignments are, as far as systems engineering and specialty engineering are allocated. The project manager is the yellow highlights. Then it goes through system management for suitability and licensing, which is Dr. Brocum's group. I am a direct report to Dr. Brocum as a systems engineering lead, and then on the M&O side, we have our equal counterparts, and they are responsible for our requirements, determination of importance evaluations, and also this is where our specialty engineer lives.

The topic today is system safety and human factors, and also some of our systems analysis modeling, you will see later on today and anything else that falls under systems engineering.

I would like to introduce Mr. Lewie Booth and Mr. Les Eisler. They are providing our briefings this morning on the topics on system human factors and also failure reporting analysis and corrective action system, otherwise known as FRACAS.

Mr. Booth has a bachelor of science in mechanical engineering. He is a registered professional safety engineer and is certified in reliability engineering. He has over 20 years of experience in nuclear and non-nuclear safety as applied to both DOE and commercial nuclear powerplants and chemical processing facilities.

Mr. Eisler holds a master of science degree in industrial psychology. He has applied human engineering criteria to design of user work spaces and work station designs, facility configurations, and equipment selection for user populations, display formats, and input/output dialogues, and data entry techniques.

Mr. Eisler has over 24 years of human engineering, system design, implementation, and project management experience.

Also, this afternoon you will hear from our systems studies direct report on the M&O side, Mr. Rick Memory. My report, J.C. de la Garsa will introduce those topics and address the systems study area later on this afternoon.

Here is Lewie. He is first up.

MR. BOOTH: I will try to speak up so that you can hear me a little better in the back. This should do it.

My name is Lewie Booth, and I specialize in the system safety. I would like to preface the presentation by thanking Dr. Price for the introductory remarks, which is a big help, because oftentimes when you come in for safety presentations, you don't have any introductory information, and this makes the job a little easier.

What we have done in our presentation is, not knowing the exact mix, we are trying to make it come across in a way that it can be understood by people who don't necessarily have system safety background, but there is enough information, we hope, to show those of you who have safety background where we have been going and what we have done to date.

The presentation is divided into two parts. First of all, the agenda is in two viewgraphs, but the first viewgraph here shows that we are going to talk about some system safety definitions to focus on the activities that we have been doing in the immediate past because we are going to show some examples of those.

Then we are going to talk about the extent to which system safety analysis is accomplished there within the context of those definitions.

The M&O is a mixture of several team mates, and there are other organizations that do have responsibilities for safety and health, industrial hygiene, and those sorts of things. We will try to show those as we go along and show where our activities focus and where their activities focus.

We will also give you a little bit of background information, which leads up to the YMP, the Yucca Mountain Project system safety analysis plan and the system safety analysis procedure.

I will continue on and give you a brief update on the hazard tracking and risk resolution database and conclude with a failure reporting analysis and corrective action system update.

At that point, Mr. Eisler will take over, and he will talk about the systems safety analysis examples, the analyses that we have done to date that will give you a better idea physically of what has been going on.

Then he will go on into the Yucca Mountain Project human factors engineering plan, and then we will conclude with some of the other activities we have been involved in.

So, from a standpoint of systems safety in our particular activities and particular in our systems effectiveness group, systems safety is an engineering discipline which is directly related to an integral part of design out there, and the systems safety analysis we have been involved in is a systematic process that identifies design-related hazards that can lead to accidents and its site-specific mitigation features that are intended to eliminate or mitigate those consequences.

The scope of our particular activities and what we will be talking about here is accident hazards resulting from equipment failure, design layout, or design-caused human error. We will show you a little bit later how that contrasts with some of the other activities.

One of the reasons there are other people involved -- and this helps illustrate that -- when we say systems safety analysis, we are referring to what Les and I and the group we are involved in, specialty engineering, what they have been doing. Specifically, we operate under DOE Order 5481.1B, and in that order, construction-related work activities that relate to safety are conducted by the construction organization safety.

Also, in the second bullet, we highlight the point that designs that are not under M&O control, such as off-the-shelf maintenance tools or construction equipment, is also handled by the construction organization safety group.

Furthermore, hazards resulting from operational and maintenance procedures are handled by the operating and maintenance contractors. They use the similar kinds of analyses that you find in the System Safety Society Handbook, namely job safety analyses, in order to disclose and provide mitigations for hazards.

There are other activities like the industrial hygiene-type activities where non-accident-related hazards, such as effluent releases and off-normal operation and out-of-tolerance conditions. That is the responsibility of the construction organization, but the safety and health organization has purview over that and does do inspections, and they do have an industrial hygiene expert out at the site covering those areas.

On this viewgraph, we thought we would give you a little bit of background as to how the safety analysis plan and procedure was developed.

One would normally expect in these activities to see a plan and procedure completely developed prior to doing analyses, but in our case, before 1992, when the M&O came into these activities, what was handed over to us was already established by the DOE, and it was called a preliminary safety analysis report. It was a format, and it is non-radiological.

By the way, for those of you who have particularly commercial nuclear power background, it is not the NRC safety analysis report. This, in particular, is a similar effort, but it is for non-radiological safety problems.

At that point, we were required to in that report include all design packages all in one report. The problem we ran into was even if you did a thorough safety analysis, the information didn't get disseminated as rapidly as we would like.

So, in '93, the specialty engineering group decided to start issuing the safety analysis reports on an individual design package basis. That way, those were stand-alone documents that could be reviewed. The mitigations could get into effect. Later on, it could be included in an overall report, but that way, we communicated better with designers, better with construction, better with the people involved in the day-to-day activities.

After that, in 1994, the DOE requested a system safety analysis plan and procedure on the project level, and that, of course, came out of the SEMP, also. The reason was that not just that it was a requirement, but they felt that they needed a better road map for those reviewing the documents who may not have been thoroughly familiar with the ins and outs of safety activities, and it provided them with a better way of providing inputs and interfacing, particularly with individuals who are working in the system safety working group which we will talk about a little later and the details on that.

I will just show a couple of viewgraphs on the system safety analysis plan, and the reason is that it is a more broad and general document, and it sets out why you are going about doing safety analysis and what the basis is. The purpose of the safety analysis plan is to address system safety issues that are mandated by DOE orders, of course, the general design criteria, and 5481.1B, which is the safety analysis and review systems, and of course, as we mentioned earlier, the OCRWM and the Yucca Mountain Project systems engineering management plan. They also set forth areas to cover. In that plan, we describe how to accomplish those objectives.

The next viewgraph shows the general approach in the plan. Just to make a long story short, so to speak, it is based on proven analytical approaches such as MIL-STD-882, which you will find referred to in the DOE Order 5481.1B, but we also rely heavily on the System Safety Society Handbook.

For one reason, it is a very good communication tool for those who are interfacing with us who are not familiar with safety techniques. It provides them with the advantages, disadvantages, most trouble in applications of these techniques. It provides a very good cross-reference, and of course, it is a nice clean reference to be used in any one of these particular techniques that we included in our analyses. They can easily go to it and see what is involved.

It also includes a fully developed documentation procedure and analytical process. We make a distinction between procedure; in fact, documentation procedure and process.

When we talk about documentation procedures, no matter how good an analysis is, if the documentation isn't there, fully filled out and fully logged, then you are going to have problems somewhere in the future.

The other problem is there is no matter how good the analysis is, if you don't have a clearly stated process, at least in broad general terms -- and we are not proposing to tell everyone, an analyst who may not be on board yet, exactly what he has got to do and what he has got to use. There are 90 techniques listed in the system safety manual to do that.

We want to make sure that the reader can understand that there is a systematic process there that helps you get a better feeling that you have done a credible job of looking for accidents and hazards, so that you can document them and mitigate them.

Going on to the next viewgraph, I would like to spend a little bit more time on the procedure because the procedure is the document that contains the analytical process. That process is an appendix.

Typically, procedures just have purpose applicability, responsibilities, the documentation procedure. Since they don't have typically procedures in analytical process, we put that in as an appendix.

This is in the review cycle, by the way. We are resolving final comments from all of the participants. The plan that we just talked about has already been reviewed. Comments have been incorporated, and that, in fact, is in its last higher management sign-off cycle.

It may be done now. I have been gone for a week. So I don't know its exact status, but that was there at that point in time.

By the way, we didn't wait for the road map. We know how to go about documenting analyses. So the fact that these haven't completed yet doesn't mean we are not following the same procedure. We are just now documenting it for those who are reviewing to actually see what we have been up to.

On the next viewgraph, we will go through each one of those. The purpose applicability and responsibilities, that was the first viewgraph, and basically, all that is, is to provide methods to identify, analyze, mitigate, and monitor hazards. The applicability is the YMSCO, the Yucca Mountain Project team mates who accomplish a review of the systems safety analyses, and when you see SSA, unavoidably, we have used acronyms, that means a systems safety analysis. That is our code name for the document that contains all the information on a particular design package.

Then going on to responsibilities, everyone is involved, in one way or the other. DOE has responsibilities, and initiating organization has responsibilities. By the way, initiating organization is a name we invented because it is possible with this procedure for anyone to initiate a scenario analysis on any particular one, even if something has been done before or even if the equipment is designed and it is out there. If someone sees a problem, we will illustrate that a little bit later.

There is still a mechanism for any organization to go through what we go through. However, we are the M&O system safety group, and we usually are the ones who do that. We just wanted to let you know that anyone is allowed to do that. It is not a closed society.

The construction management organization and design organizations are also involved and have responsibilities.

Going on from there, the documentation procedure is actually very straightforward. There are only three documentation steps, but what we want to highlight here is the fact that the accident analysis summary sheet -- that is just one sheet for each hazard in each scenario -- that is the key piece of documentation being processed.

What happens oftentimes in some of the safety reports is people lose sight of the forest for the trees, and what we want to do is make sure that everyone understands. Even if a report on a design package had 400 scenarios, each one of those are important, each one are ranked, and each one of those sheets are the important focus, not the up-front, not the boiler plate, not the format.

Nonetheless, let's talk about the documentation steps. There are only three of those, and once we get those out of the way, we can get talking about some meaningful stuff, some actual examples.

Anyway, the documentation steps, of course, are the preparation of a systems safety analysis. You have requirements for standard cover sheet, sign-off sheets, table of contents, and format. That is pretty well standard. Everyone that reviews a technical document all sees the same format, no matter what it is.

What is unique in the preparation of an SSA is that in each step we have a procedure of performing a system safety working group, and that involves all people who have any vested interest in that equipment, and all people are listed on a sheet that is used for them to become active members in a particular design package. That is circulated early.

What is done is we circulate the design packages, the safety analysis, for preliminary review, and all members of that group independently go up and do their own thing. This is one of the things that Dr. Price mentioned about the independence.

For the systems safety working group, we allow them to do more than one independent theme because a maintenance person or a construction person is going to have a different viewpoint maybe than a design person.

They take those scenario sheets, and they go through them and they try to make very possible comment they can from their perspective. Those comments come back to us, and then we resolve them. We incorporate their comments, but if they are conflicting comments between two independent groups or we have trouble resolving their comments, then we have a formal meeting of the system safety working group and we hammer that out.

If at the end of that meeting, the systems safety working group cannot come to agreement on all the sheets -- and we will show you all the contents on a typical sheet -- then it is escalated to higher management. Then there is a responsibility for the acceptable level of risk and what they are going to accept.

I am happy to say, thus far, we have had official systems safety working group meetings. They have been continuous, and we have resolved all of our problems. So far, we haven't had to escalate it to higher management, but that is there. We have that ability.

Going on, the actual performance of a system safety analysis, we follow an overall general process, just so that people can say you have gone about it in an orderly way without telling an analyst every step he has to take on the way.

This, of course, results in competed accident analysis summary sheets. By the way, you may hear us referring to them as scenario worksheets. We have been doing that so often informally. So we use both names, but the official names for these sheets is accident analysis summary sheets, and we will talk about those on the next viewgraph, but before that, the last thing we do is no matter how hard you try to make a systems safety analysis thorough and complete, there are always changes, procedural changes, design changes, a design because something in practice didn't work properly. The TBM had, I think, around 400 pages.

Rather than revising the entire document, we only issue change pages, and we only issue new summary sheets, whether there are new ones added or changes made on the sheets, because it is very important for people to get this information and to be motivated to go through it.

If you receive a revision of a 40-page document and you only change 10 pages.

The equipment location that we are working with is noted there. A scenario is generated which generally describes the overall background and events surrounding the kinds of hazards we are looking at, and that is followed by a system of component failure description. By the way, that includes the human element. The human being is considered a part of a system, and a human failure, a human error is considered just like an equipment error, and the impact on the system is evaluated. Les will talk a little bit more about that.

In addition to that, on the accident analysis summary sheet, we have accident classifications. For those of you who have had some risk background, you will know that frequency times consequence gives you risk, and what we have done is used the 882 approach since we don't always have exact numbers on particular activities. We assign categories.

For instances, on the TBM, there are five frequency categories, four consequence ratings resulting in a risk designation matrix of 20 categories. How they are subdivided, we will show you a little later, in fact, a color-coded matrices to help you with that.

Then, in addition, we give the mitigation and control features. Those mitigation and control features are explicit steps, whether it is hardware design or procedural measures, maintenance and operating manuals, training, addition of guardrails. Whatever it is, those are listed here.

The accident classification ratings here are based on all of the mitigation and control features being in place. Any control or mitigation feature that is modified, altered, or does not get into place and we check -- in fact, on June 3rd -- was it, Les? We had a walkdown, what is called in the System Safety Society Manual as a change analysis. We did a walkdown on the TBM on June 3rd to go through and check all the scenarios we have generated to date to make sure that everything got into place, or if it was into place, then nothing was then subsequently replaced.

Then, of course, last, we have a mitigation documentation which could range from anything. It could be design specifications or drawings. It could be memos from construction citing specific notations where modifications had been included, anything that we can use that is a verifiable way of determining that something is in place.

So that gives you an idea of what we are after. This is the focus of what we are trying to do is complete one of these sheets for every identified scenario and every identified hazard related to that scenario.

Going on to the next one, then, having said that about the scenario sheet, we would like to discuss a little bit about how you go about generating those sheets. This is kind of a broad-brushed approach, and what we are trying to do here is not necessarily use so many safety acronyms, but to try to get a message across to people who may not have a safety background that it is a systematic approach designed to try not to overlook potential hazards.

We have divided it for the purposes of discussion and making it unique to what we are doing. We are going to call the first part safety assessment which includes scenario identification and safety analysis.

Then we have step or activity we are calling mitigation of hazards. That is because even if you have scenario worksheets, you must make a pronounced definitive effort to make sure those get into place. So we call that the mitigation of hazards.

Both of those activities have a strong interface from the systems safety working group. They have to agree with everything that goes in there from all parties. This is a good check to make sure we found everything. When you get through with that, you are in pretty good shape, at least from the standpoint of design. We check out in operations later on.

Going on to the next viewgraph, probably the best way to try to piece all these pieces together is to talk about system safety assessment in our context as broken into two parts. Part 1 is the scenario identification which relates to a specific design package, and the second part is safety analysis which relates to actually doing an analysis on the design package.

The scenario identification, we will talk about in a little detail later, but to make a long story short, scenario identification has two parts. I think Dr. Price alluded to that, too. We are utilizing previously known information about hazards.

Right now we have gotten about seven work packages altogether. There is a lot of equipment that is repetitive that we can utilize previously identified information. We search for that to utilize that right off the bat, but in addition to that, there is a systematic way of looking at design packages to help disclose previously unknown hazards, and we will talk about that on the next viewgraph.

After the viewgraph on scenario identification, we will talk about how we apply techniques and methodology in a very broad-brushed sense. So, hopefully, some of these different techniques you have heard about that Dr. Price has alluded to, that we have alluded to, and that you will see later on, you will see in a little better perspective, in a highly simplified manner, I might add.

Let's go look now at the next viewgraph. This is our attempt to try to make sense of the question of have you found everything that is wrong. The answer is we don't know, but we have a systematic way of looking for problems. You don't know if you have found them all, but you have a systematic way of looking for them. We are looking for hazards, and we have a systematic way if we are trying to disclose that existence.

One way for people who haven't seen this before to help them understand that and particularly from a systems engineering or an engineering standpoint is to review a design package as a system.

We already know down on the bottom there that there are energy and materials that are intentionally introduced in any system. That is part of what a system does. That includes the human being, the human element, both operations and maintenance.

At the same time, we also know that energy and materials are unintentionally introduced in any system, and that could be from natural phenomenon, failures of systems outside of this system, or, again, human error outside of this system.

Those two phenomena impact the system design, and it results in two areas. The first area -- and this is the area we are going to talk about -- is called type 1 or accident scenarios, and those are potential accidents resulting from equipment failure, design layout, or design-caused human error.

Along those lines, there are others responsible for maintenance in operations hazards, which are documented in a similar manner. For the purposes of illustration, so that we don't lose sight of it, at the same time when you are doing this, you can also note that even a system under normal operation has effluents, internal combustion engine. That can do harm.

One of the mitigations is to put a catalytic converter on it, or you could have an HVAC system operating out of tolerance. Maybe it isn't cleaning up the air. That doesn't cause any immediate deaths or any accident, but that does have health implications.

What this means is that this overall approach can also be used by industrial hygiene, people involved in health hazard analysis and that sort of thing, to help develop their scenarios.

Because of the focus of this presentation, we are going to look at accidents and look at the ones we have looked at to date so that you can get a feel for what we have been doing and what the results are of those.

Going on to the next viewgraph, here again for the purposes of illustration, we have divided our discussion into techniques and methodologies, kind of splitting hairs here.

What we are saying is a lot of the techniques you will see in the Systems Safety Society Handbook -- we call it the green book -- you will find scenario analysis, hazard analysis, human factors analysis, failure mode effects and criticality analyses. Those, in fact, are four of the techniques we used on the TBM.

We want people to know that doesn't mean the job is necessarily done because you may have in the course of design competing design alternatives. So we have coined a term "comparative analysis" for that, where you are going to weigh one design alternative against another one.

There are cases, and it is not very often in non-radiological safety, where you will have an absolute analysis where you will have a prescribed safety goal you are trying to see if you can meet. In that case, you have to evaluate your systems to see if in an absolute sense they came up to that prescribed goal.

That generally is very difficult to do. What we mainly do, and what is done is our system safety analyses, is that we use a subjective analysis which is kind of what we refer to in MIL Standard 882 as a mixture of both numerical boundaries rather than specific numbers, so that we set overall categories, and then relatively rank our hazards into scenarios, so that we can better judge what we should do where and how good the mitigation should be.

It goes without saying that in any case when you have a generated scenario, you have got to have at least one mitigation. That goes without saying. In most cases, we have five or six. It is a mixture of design to procedural changes, but we want to just make sure that you know that even though it is called a subjective analysis, the approach is still very thorough, and the categories oftentimes work just as well as straight numbers.

Going on to the next viewgraph, then, that takes care of what we call the systems safety assessment. The second thing we use is what we call systems safety mitigation.

You will remember I talked about the systems safety working group, and they have to review and agree and sign off on all the mitigations, all scenario sheets, every aspect of it.

Once they have done that -- and let's assume we have revised it, we have got all the comments through there, and rarely does a scenario escape without several comments -- and those are implemented into the design, we initiate a mitigation hazard control, mitigation implementation and tracking system, which leads us into the next subject matter, which will be on the hazard tracking and resolution database.

No matter how good you have done the analysis and no matter how many times it has been reviewed, there is always something that happens in reality. Maybe your mitigation didn't work as well as you thought it was going to.

What we have is we are creating -- and we are doing it manually at the moment -- the Ingres database which already existed in our computer system back there. We didn't have to create a new database. We simply enter our scenario worksheet into this D-base-oriented database.

Right now we are using just straight data entries, but in the future, what we will be doing is every time we create a scenario worksheet, that goes directly into the database. So, if we have any revisions or any updates or want to follow up on it in the future, we can call it out, we can sort on design package, on hazard, on scenario, on risk level. Any factor, any attribute in that scenario worksheet, we will be able to pull out the relevant worksheets, and in the future, it will make it easier for our preliminary hazards list because the farther you get and the more documentation you get, the more difficult it is to do by hand.

We would also like to say that we could do some tracking and some predictions based on this, but due to the uniqueness of some of the equipment and the lack of numbers of components, that probably won't be as powerful as we would like it to be. There is some unique components that there aren't very many of, for instance, out there, but that is there. We can use that.

Of course, if we saw some hazards in a repetitive nature grouping up, we certainly would do that. We would certainly be producing that sort of thing.

That is the hazards side of it. The other side of the coin in the next viewgraph is the failure reporting analysis and corrective action database. The reason I put this in here is that is there for other reasons. It is there because it is needed for integrated logistics support. Maintenance has to utilize it, but any time you have a failure, there is a potential for a hazard. What we are trying to do is make sure that any documentation that involves a failure out at the site, we get the report on that, and then we can incorporate it into our information.

We are trying to streamline this. At the moment, the maintenance inter-database they have out there is very large, very comprehensive, and our fear is if you get these databases so large and the data entry is so time consuming, it could well be a week before failure happens and you find out about it. We would like to have a system, even if we have to do a little side step and have a direct hookup, so that we could find out about those ahead of time.

There have been some failures that have affected equipment operation. Thus far, we haven't had any reports on actual equipment failures that have caused the severe accidents. That is basically where we are coming from there.

So, with that in mind, the next part, Les Eisler will be covering, and he will be doing the lion's share of the work because he has got to give the examples, the real meat of the aspect, and he also is going to emphasize the importance of human factors.

The problem is a lot of people divide those two into two separate categories, and we have found -- and correct me if I am wrong on this -- at least 50 percent of the hazards we have been dealing with so far as heavily influenced by the human factor just in the scenarios we have looked at so far.

They are not just looking at the efficiency of operation. They are looking at what the human does, either acts of commission or omission, that can cause those problems, and he will be going into that.

MR. EISLER: Good morning, ladies and gentlemen. My name is Les Eisler, as has been indicated several times before. I work on the Yucca Mountain Project in Las Vegas, and I am a human engineer.

I guess I am presenting the rest of the system safety presentation because I have spent the last two years working in system safety and human engineering. I have become quite intimate with some of the things we have done.

Before I proceed, I would like to reiterate two points that Lewie Booth mentioned earlier. The reason for reiterating them is I think they have defined how we have actually implemented our system safety program and provided a framework for how we are doing systems safety in Las Vegas.

The first is in '93, as Lewie indicated, we decided to transition from the preliminary safety analysis report to a final safety analysis report, non-radiological, by the way, and the second point is we recognized that the delivery of a single safety analysis report would not disseminate that information in a timely manner. So we chose to develop a technique and support our analyses by organizing our activities along system safety analyses, or SSAs as you see in the slides. This allowed us to get that information out in a very timely manner.

What I would like to do next is to use the tunnel boring machine system safety analysis that we performed, and are still performing, by the way, as the example for how we do our SSAs. What I will do is I will describe the types of analyses we have done, and a lot of that will be a reiteration of what Lewie Booth has presented, but it will help tie together and make sense of what we are doing. I will give a description of the risk methodology and, finally, how the system safety working group plays its role in our ongoing activities.

In selecting the types of analyses we did, as has been mentioned several times by Dr. Price and by Lewis Booth, we used the System Safety Society Handbook, which has approximately 90 techniques or methodologies in them, and we combine that documentation with our previous experience and opinions as to what we thought was applicable and achievable within our resource limitations.

Based upon that, we used four types of analyses. I know I have listed five, but I will get to that in a moment.

We did a scenario analysis which Lewie described in great detail in how we fill up the sheets, the information contained in those sheets, and then how we ultimately track them and follow that all the way through to implementation.

We did hazards analysis. We did human factors analysis. We did failure modes effects and criticality analysis. I have listed job safety analysis. We did not do job safety analysis.

In the Yucca Mountain Project, we have two safety organizations. We have system safety, of which Lewie Booth and myself are part of and which Greg Smith has been supporting for the last two years, and we have a health and safety organization.

Our charter was to look and is to look at design-related hazards or potential hazards, and it is the health and safety group to look at and develop JSAs or procedural solutions to problems.

Also, another complicating factor in all of this in the way we are structured is it is the instructor and operator's responsibility to prepare JSAs. We do not prepare JSAs.

Why I listed it is because we have recognized and recommended -- and I will talk about it a little bit later and highlight again -- JSAs are being done by the operator and instructor, and they are being tied to our analyses through an activity that is going on right now, as a matter of fact.

Next slide, please.

The risk methodology that we followed involved 14 steps ranging from hazard identification to hazard tracking, and let me interject at this point. Lewie Booth mentioned the DBMS that we have developed. It is our hope and intention that that DBMS will be available to all Yucca Mountain personnel. Certainly for us, it is a working tool. It will help us do the analysis. It will help us document the analysis, but our hope is that when we get this fully up and operational, anyone in the Yucca Mountain Project will be able to access the information in there on-line. We won't let them change it, but we will let them read it.

We developed a threats checklist. We defined hazard frequency and consequence and ultimately a risk matrix, and in the next few slides, I will discuss that, and you will get a chance to see how we did it and how we applied it to the TBM system safety analysis.

I would just like to spend a few more minutes on the system safety working group. Especially for the TBM, they were really critical to us being able to accomplish the analysis.

TBM was the first full analysis that we did as part of the M&O. It is the largest and perhaps the most complex analysis that we have performed to date, and I must say that without the system safety working group, we probably would not have achieved it, and we would not have been able to implement some of the things that we felt were really critical.

For the system safety analysis for the TBM, we assembled a team of system safety specialists, primarily Lewie Booth and myself, human engineering representation and myself and Mr. Greg Smith, tunneling and mining experts, and TBM operations experts.

Let me interject at this point that for each analysis we have done, whether we have had an official systems safety working group or an unofficial systems safety working group, we have assembled a team that represents the items or components that are being evaluated. In other words, the team is not always the same, except for system safety and human engineering.

The other thing I would also like to say at this point -- and I don't know how many of you have had an opportunity to look at the TBM and other system safety analyses we have performed -- I believe very proudly and I think correctly that you will see more of a human engineering flavor than you do in the traditional system safety analysis.

Lewie has already mentioned that we did consider and we do believe that the human component is an important element of system safety, and we spent a lot of time making sure that human engineering did have inputs and was a major contributor to the analyses we have performed.

The role that the system safety working group played for the TBM analysis was they reviewed our analysis, sometimes quite actively.

During the summer of '93, we probably had three or four two-day and three-day sessions. Sometimes they got quite painful and heated, but the benefit of that was, as Lewis Booth mentioned earlier, there was a good deal of interaction. At the end, what we did is we reached a consensus.

Obviously, we come from a human engineering and system safety and design point of view. The people with operational experience have very valuable inputs into what is done and what is ultimately implemented, and that really was the benefit to having those kinds of people there and actually having a lot of face-to-face and a lot of interaction going on.

Their responsibilities were to review the TBM analysis and ultimately to sign off on it to say they approve and they agreed. That is what we presented to our management.

As mentioned earlier, we used MIL Standard 882 as a starting point for our analysis. By the way, for all of you who are not familiar with MIL Standard 882, it defines the system safety program, and the analyses that are described in there are largely qualitative, and really, that is what we have done. We have done a qualitative analysis rather than a quantitative analysis.

One of the first things we did was to try to use the criteria defined in 882 and apply them to our scenarios, and we found that given those definitions, they really weren't adequate. We developed our own definitions with interaction with the system safety working group, and what we developed was a frequency rating scale consisting of five definitions, frequent being likely to occur, some times in the life of an SSC, and SSC, by the way, stands for system structural component, probable and likely to occur several times in the life of an SSC, occasional and likely to occur sometime in the life of an SSC, remote and unlikely but possible to occur in a life of an SSC, improbable and so unlikely it may be assumed occurrence may not be experienced in the life of an SSC.

We applied those criteria to our analysis, to our draft analysis, and found that even those weren't adequate, but since we were doing a largely qualitative analysis, we couldn't come up with hard numbers, but we did feel that it was really important to try in some manner to quantify those definitions.

On the bottom half of the chart, you will see those definitions. Frequent was defined as greater than 4.5 occurrences or more than one occurrence per year. With the 4.5 occurrences, we determined the life of a TBM and ESF, and we had a great deal of input from DOE, and 4.5 years seemed like a reasonable number, and we have used that number consistently since then. So that is how we came up with 4.5.

Probable, we defined it as greater than 2.25, but not more than 4.5 occurrences, or one or fewer occurrences per year during the TBM lifetime.

We are splitting hairs here. We did have to use some judgment. What we are really trying to imply is greater than two occurrences. Again, there is some judgment left to the analyst developing the analysis and then ultimately to the system safety working group in applying these definitions, but we tried to provide some flexibility for everybody.

Occasional was defined as greater than 1, but not more than 2.25 occurrences. Remote was greater than .25, but not more than one occurrence during the life of the TBM, and ultimately, improbable was zero to .25.

We went through the same kind of process in defining our consequence ratings and definitions. What we ended up with were four consequence rating definitions, one being catastrophic, death, system equipment loss, or severe environmental impact.

Our analysis, to be very honest with you, concentrated and was primarily concerned with personnel safety rather than equipment safety. That does not mean to say that we ignored that, but in looking at the analysis and defining hazards and identifying mitigation features, we were concerned with personnel, primarily.

Number 2 is critical, severe illness or injury, major system equipment, or environmental damage. What we further refined into that definition was that the individual who was injured could not return to the original job. It does not mean they could not return to work, but they could not return to the original job. Obviously, if they needed 10 fingers for their job and they lost five, they could still be gainfully employed, but not doing the tasks that they were doing before.

Marginal was defined as minor injury or illness, minor system equipment damage, minor delay of data collection or loss of data. We further refined that definition to mean that there was a loss of more than one work shift, but the person could return to their work after one or more losses of work shift. It could be a broken bone. It could be a dislocated shoulder. It could be something that required sutures.

Lastly, we defined negligible to be less than minor injury, occupational illness, or system damage. What we meant there was that basically there was no work hours lost, cuts, scrapes, and things like that, a guy goes up and pulls out the first aid kit and goes back to work.

We are using a slightly different color coding scheme here, but don't let it throw you off.

Having defined frequency levels and consequence levels, we developed a 20 cell matrix and divided them into several consequence levels ranging from high to extremely low.

The ultimate risk was defined as the interaction of the frequency and consequence. Let me note at this time, also, you will see all 20 cells numbered. They are not numbered in sequential order.

What we did was within each category of high, medium, low, and extremely low, we created a subprioritization scheme and prioritized those cells. So, in other words, within the high cells which are the light beige colors, we have 1 through 6, and those are prioritized in some form of order, also. So a priority 1 within high is higher than a priority 5 within the high category.

Next slide, Lewie.

The DOE orders prescribe how we try to mitigate hazards, and we did try to mitigate them in this manner on the TBM.

The first way of mitigating a hazard according to DOE orders is to eliminate them or mitigate them by incorporating features into the original design.

The second method or less preferred method is to add safety features and devices onto an existing design.

The third are control precedence prioritization, and it is to use warning and alerting devices, and ultimately and lastly, to establish procedures and train personnel.

Let me say two things at this point. The first is that, as a human engineer and a system safety person, it is not always possible to use only one of these precedents, and again, if you ever get a chance to look at the analyses that have been done, you will see that we have recommended and are implementing a combination. Even if you incorporate something into the design, in many cases you have to properly train personnel, and you still have to put warning and alerting devices out there.

Also, in the case of the TBM, we became involved after the TBM was originally designed or while it was quite far along in its design.

So, in the case of the TBM, at least the initial delivery of the TBM, we had a lot of recommended mitigation features in the area of additions, the use of warning and alerting devices, and the establishment of procedures and training personnel.

For subsequent deliveries of the TBM and the mapping and appendages like that to the TBM, we have gotten involved earlier and earlier and, thus, have been able to move and make additional recommendations in eliminating hazards by incorporating them into the design.

In a little while, I will be showing you a tape on the TBM system safety analysis, and I think you will see some of those things, and this item will become clearer.

This chart is very similar to the risk matrix I showed you earlier. I have put up two charts here, and there are two different ways of presenting the results of the safety analysis performed on the TBM.

The chart on the right shows the risk matrix with the numerical number scenarios that fall within each category, and the chart on the left showed the percentage breakout.

One of the charters we had in the system safety working group was to have the results obviously as low as possible as far as risk was concerned, but certainly to have no high-risk scenarios when we were done with our analysis and our recommendations.

By the way, and I am not sure that it was made clear earlier, the risk categories and the frequency and consequence categories are after the mitigation features have been implemented.

If we find or if it is not agreed as part of the system safety working group to implement all the recommended mitigation features, we are obligated and we have made it very clear that we will go back and reevaluate the scenario, and if the hazard becomes higher, it will be so reported. That is why it was very important to get consensus from the system safety working group that we could present to management as our recommended methodology for lowering the hazards to as low a category as possible.

As you can see, we ended up with no high-risk scenarios in here, and we only ended up with about 10 or 11 medium-risk scenarios. The remainder of the scenarios fell in the low and extremely low category.

Again, let me make very clear that does not mean that these accidents or hazards are not there and that they can't happen. What we believe is by doing what we have done in an organized cohesive manner, we have lowered the risk of those accidents occurring, and if they occur, the injury to personnel will be lessened because of what we have done.

Again, we can't look into the future, as Dr. Price has said, and we certainly can't cover everything that is out there, especially when we don't know about it.

Basically, I think we were very successful in lowering the scenarios. The TBM probably has about 150 or 160 hazards identified for it, and it is still being developed. It is a living document, and as changes are made, we will go back and update our analysis.

As mentioned earlier, we have performed or are currently performing seven system safety analyses. Most of them have been divided up into what are called design packages, and I will go through those for you rather briefly and at least identify the major components that we have looked at in each.

What a design package is, is the design is based on a segmented schedule, and they are building pieces of the ESF that way, and we are doing our analyses in concurrence or in conjunction with the schedule developed for design, but there are really two analyses that we have done differently, and one is the TBM, and the second is the conveyer.

At the end of this presentation, we have a 10-minute videotape we would like to show you that will highlight some of the work done on the TBM. For those of you who aren't familiar with the TBM, it should give you some interesting footage, especially of the mapping entry, which I am sure for many of you will be of interest.

The second analysis that we did separately was the conveyer. The conveyer really crosses the surface and subsurface boundary, and we wanted to look at it as a system in and of itself. So that is why the conveyer analysis has been done not in a design package orientation.

I am going to quickly go through what, as I said, are the components in some of these analyses that we have done. The first one is design package 1C. By the way, when you look at design packages, when you see the "1," that means surface, and "2" means subsurface or underground. The ABC designation is defined according to the schedule and what they will be doing at that point, but the key one is the numeric value. So, whenever you see 1, we will be talking about surface, and whenever you see 2, we are talking about subsurface.

The design package 1C included surface compressed air systems and equipment and the standby generators.

Design package 1B included the muck storage area, the conveyer access road -- and when we looked at the conveyer access road, we did consider, obviously, the vehicles that were being used on that road, not just the design of the road itself -- the compressed air system, lighting, fencing, and piping on the pad, and then the building pads and foundations.

Design package 2B consisted of subsurface ventilation system and the subsurface trolley, and let me note before moving on, we actually did this as two separate analyses at one time. We did a ventilation system analysis or subsurface ventilation analysis and a subsurface trolley system analysis.

Then when we revisited the package, it made more sense to put it together. So we updated our own analysis, and it became the 2B system safety analysis.

Design package 2C included the north ramp, the support areas in the north ramp, subsurface water, subsurface compressed air, ground support system, subsurface lighting. Again, the ventilation system was part of this because it made sense to put at least a north ramp portion in there. Here is the subsurface rails, not necessarily the trolley, the fire detection and protection systems for the north ramp, and lastly the north ramp walkway.

I have asterisked the north ramp walkway because that was done a little bit differently. It actually was done as a tradeoff study, and a lot of human engineering went into that. There is a lot of work that has been done on whether we need walkways and what the structure of the walkway should be if they are present.

We did a tradeoff analysis. That has been fed into a value engineering study, and for those of you who don't know what value engineering is -- and I am not an expert in it -- value engineering basically looks at all of the design components and pieces, plus cost and schedule impacts. That discipline tries to make a recommendation based upon all those factors.

Where specialty engineering, system safety, and human engineering are coming from are the technical disciplines, and we are proponents of those disciplines. The value engineering discipline actually assembles a team of value engineering experts and consultants and looks at the problem from another multidiscipline point of view.

They have made recommendations to management concerning the walkway alternatives, and management is currently considering that.

What I would like to do now is go through some of the features that have been documented and/or recommended. I have broken them up a little bit differently than the design package since the design packages jump all around the place. I have tried to organize some of the features that we recommended based upon things don't make sense, like walkways, platforms, et cetera, et cetera, independent of where you are finding them in the design schedule.

I would also like to point out that these examples are identified in one place, maybe, but if they are applicable to other areas, such as Lewie indicated earlier, because they will be found in subsequent analyses or other parts of the ESF, they certainly are, have been, and will continue to be implemented there.

Some of the recommended features that we made on the TBM -- and these are fairly specific in this case since a TBM, again, was the largest in the first analysis we did -- we recommended the addition of a second conveyer emergency stop cord.

When the TBM was originally delivered, there was only one conveyer emergency stop cord, and in fact, it was on the opposite side of the walkways. So users had to cross the train travel area to get to it. We recommended adding a second stop cord on the walkway side, and that was done.

The relocation of segment hoist controls, again, some of this stuff you will see in the video. There are several sets of hoist controls that were permanently mounted to the posts along the TBM trailing gear cars, and we recommended that they be relocated, and you will see that they were.

The addition of safety gates at all walkways where there are ladders or openings, the labeling of controls -- and here again is where human engineering came in very heavily -- we wanted to make sure that the labels were permanent, that they clearly identified the functions being performed or controlled, and that the settings of values were displayed to the users so they knew what were value and within range and out of range and out of tolerance conditions.

Finally is the definition of master-slave control relationship. Especially on the mapping gantry, there are two sets of controls in the mapping gantry. There is one on the upper deck, and there is one on the lower deck. The mapping entry operator can control that device from either of those locations.

We wanted to make sure that built into the design and built into the training, there was a master-slave control relationship so that only one set of controls could be active at a time. We don't want people getting hurt because the wrong person is operating the wrong set of controls, unknowingly.

In the area of work platforms, you will see, again, on the TBM the addition and extensive use of guardrails and handrails wherever personnel are walking or climbing, the implementation of toe kicks, adequate lighting for the task being performed, obviously in different places in the ESF. There are different levels and types of illumination needed. We wanted to make sure that they were proper.

On the use of non-skidded work surfaces and walking surfaces, there is a lot of dust and grease and oil down there. People have to wear the right equipment, but we also have to provide an area where they can walk fairly safely, and the access to different portions of the ESF are per OSHA and MSHA requirements.

On the ventilation system, features documented and recommended were performance monitoring systems -- for example, temperature and vibration -- and the inclusion of a mechanism for a maintenance personnel to get in and remove debris from the fan. Obviously, if the fan gets clogged up with debris, we are going to reduce ventilation and ultimately overheat the fan, and we could have personnel injury.

On the trolley or train, personnel and equipment restraints -- in addition, by the way, there is a rule down there, and we recommended it, that personnel are only allowed to ride on authorized man cars, and those man cars are supposed to have benches in them and seat belts. They are not to be riding on equipment cars or hopping on or hopping off. There is the use of dead man controls for the operator and a redundant breaking system.

I am trying to give you some more examples here instead of just talking the words. This is a diagram of the trolley pantograph. By the way, this is based on an electric trolley which is still the current design in the ESF. We made sure that several features were incorporated into that pantograph.

The first is that the design hopefully will prevent the trolley wire from coming off, but if it doesn't, there is a protective cover implemented to prevent the trolley wire from swinging wildly around and potentially injuring personnel.

In the tunnel itself -- and here again, as I mentioned, we did several safety analyses and I am trying to combine them in something that is meaningful for the audience -- there were a number of different mitigation features recommended. One is that utilities be located so that personnel can't walk into them so they don't obstruct the personnel access and egress from the tunnel, and that protective barriers be provided wherever necessary.

Again, adequate illumination will be provided. In this case, by the way, adequate illumination could be tunnel lighting or it could be the requirement for all personnel in the tunnel to wear cap lamps. If all the power goes out, they still have a way to see to get out.

The proper use of warning signs and signals, for example, train traffic lights throughout the tunnel and warning signs about water pressure and things like that are here.

As I indicated earlier, we did make recommendations in a number of different areas, and obviously training and procedures and getting in and out of the tunnel are important, and we did make recommendations concerning the proper training and identification of areas where personnel should be allowed and where they should not be allowed.

Here we are talking about it being identified as the result of our safety analysis. If in our safety analysis one of the mitigation features is the use of personnel protective equipment, then that is something we were concerned about, even though it really could be an overall health and safety issue. We were concerned about it and we documented it, and those are our recommendations.

The proper travel speed of the trains, especially, is important. There is restricted travel. That is standard in the tunnel, and that is something we did use in some cases as a mitigation feature.

In the area of the conveyor -- and by the way, the conveyer analysis has just undergone a review and draft format, and I think it was due to come back to us the day we were traveling out here. So, hopefully, some of our compatriots and our supervisor are updating the analysis so we can do this briefing for you, and we will have an easier time when we get back.

Several of the features implemented on the conveyer are emergency shutdown controls, lockouts and tagouts, and again, let me remind you that because I have identified them here does not mean they are not implemented elsewhere. The use of lockouts and tagouts are extensive on the TBM.

The use of covers and belts and flashing around the conveyer and the use of start-up signals and proper training of the operate is shown here.

Jumping over to the other slide, what you are looking at is a cross-section of the TBM conveyor underground. Some of the safety features there are embedded in the design, and others are added on to the design.

The conveyer is designed to handle 972 tons per hour. It is actually only handling 572 tons per hour. So we have built into the design, basically, almost a safety factor of 2 to 1, a little bit less, but certainly that is helpful and a positive thing for the users.

Also, you will note that the inside of the conveyer is angled to prevent muck from being ejected over the top. There is flashing on the sides and the bottoms to prevent muck from being ejected from the bottom of the TBM.

In addition, procedural features that have been implemented are the underground portion of the subsurface conveyer on the same side of the tunnel as the utilities, and that has been defined as a personnel exclusion zone. Personnel are not authorized to walk there under normal conditions.

What I would like to do now is take a few minutes here and show you the videotape. We have put the videotape together for a number of audiences. We hope you will find it interesting, informative, and it will demonstrate some of the work that we have successfully accomplished. It will take about 10 minutes.

[Videotape presentation.]

MR. EISLER: In concluding the system safety analysis portion of the presentation, I would like to make two points that have been brought up numerous times, but I really do feel they are important.

One is system safety in human engineering and trying to be very proactive on this program. All of the analyses we have done, we consider living analyses. As designs change, we go look at those designs. We go look at those designs. We update the designs, if necessary. We will reconvene the system safety working group, if necessary, and we republish the report or portions of the report.

That is really important in realizing that we don't just publish the report and walk away from it. We want to be involved. We are trying to be involved. We are trying to be actively involved in all phases to make sure that the ESF right now is safe for all the people in there, either workers or visitors. By the way, there are a tremendous number of visitors in the ESF, even as we are being dug there. So we have got to be real sensitive to system safety.

The other point that was brought up by Lewie Booth earlier is -- he is a system safety professional, and I guess until about two years ago, he probably wasn't as sensitive to human engineering and how important the human being is both as a contributor and as a mitigator and how important human engineering is to the overall system safety effort.

I am glad that Lewis recognizes that, and I think a number of other people are starting to recognize that. Because of that, we have formed a very close working relationship, and we can produce a more effective system safety program for this project.

That concludes the system safety portion. Are there any questions of either Lewie Booth or myself before we move on?

MR. PRICE: The next is the human factors portion, right? So I think we will just go on, and then we will do questions all at once.

MR. EISLER: The next two portions will be a lot shorter, obviously. As I said, we have spent the last two years in system safety.

The human factors engineering program in Las Vegas as a separate and identifiable entity, is really in its infancy. We are about where we were two years ago with the systems safety program as an identifiable entity and discipline.

I think the main advantage that people like myself, human engineering people, have out in Yucca Mountain is that we have been doing human engineering. We have been doing it under the auspices of system safety, but we have been making an impact in what are considered traditional human engineering areas.

So I am hoping that with the success that the system safety program has seen up to this date, with us having had an impact through system safety, that our growth and viability will be quicker and easier than is pretty typical in most environments.

Why are we doing human engineering? Obviously to maximize human performance. On this program, probably, though, safety is at least as important as operability. There is a lot of attention being paid to safety.

So, through our proper application of human engineering criteria and design principles, we obviously want to reduce errors and increase user productivity. That could be for a lot of the users to work faster, work smarter, and work with less people, to decrease damage to equipment and facilities within the ESF and ultimately to improve the safe operation and maintenance of the ESF.

Let me point out right now, again, if any of you have the opportunity to read any of the analyses that have been done up to this date, we look in the area of system safety at normal operations. We have excluded maintenance activities and JSAs.

In the area of human engineering, the maintenance is an important link and has an input to design. So our human engineering program intends to cover maintenance and maintainers, also.

Our ability and our capability to implement a human factors program are mandated by DOE Order 6430.1A, general design criteria, and for the repository, it will be mandated by UCRL-AR-108791, human factors engineering. It is used in design modification and the valuation of DOE nuclear facilities.

Let me note that that document has recently undergone a document number change. I think originally it was 10879A. It is currently in draft status. Our latest piece of information is that is being transitioned to a final deliverable document, and our plan is to use that.

How do we accomplish our human engineering program? Where are we getting it all from? Well, there are several sources. Obviously, the Department of Defense has long been a proponent and activist in implementing human engineering programs.

There are, however, other sources that are just a important and may be more important in the future. I don't want to make that judgment, but they include the ANSI human factors standard, 100-1988, which deals with the design of work stations and computers for the user population; the Americans with Disabilities Act guidelines. This will have an impact on the ESF and ultimately the repository.

While not required for subsurface, there is that requirement for the surface facilities, and I believe there is even going to be a visitors center there. So we have to provide access for special user populations, not only ambulatory blind users. That Act defines how we are going to do that.

Last but not least, there is a draft standard under development by DOE, Number 1062-94. We have asked DOE, our counterparts in DOE, to please request that that document continue to be developed and released in its final form.

Right now the MIL Standard 1472 is used as a guideline, but it is only a reference in most of the specs. It would certainly be nice to have a DOE design guideline to fall back on and be able to lay on as a requirement, and Dan Royer and his group have been very cooperative in helping us try to accomplish that.

As I said, the human engineering program as a viable entity is in its infancy right now. A discussion centered earlier about the human engineering program plan, and here is the one slide on it.

It is currently being developed for the YMP project. It is our intent to have a draft completed by the end of July and then distributed for internal review out at Las Vegas.

Dr. Price indicated some concern. We are using Greg Smith's document, obviously, as a guideline. He said that is how it is to be used, and we will implement a program that meets our specific requirements.

I am trying to be as specific in how we implement the human engineering program, including identification of all the program phases and tools and techniques we will be using including task analysis and operational sequence diagrams. Depending upon how this plan works out, maybe we will look at scenario development, assimulations, et cetera, et cetera. I don't know yet. I am still working the document, to be very honest with you.

I will consult with both Lewie Booth on it from the system safety area and Greg Smith quite heavily on this, and we hope to have a plan that is detailed and implementable.

The reason for doing it now is the same as system safety. We have actually been doing the work, but we have a long way to go. We do need a road map. That road map has been partially completed because of work that has been performed, but we still have a long future, we hope, and we would like to have a good human engineering program in place.

Specific activities that we intend to propose and that we do want to execute and that we have executed already, obviously, is to be much more active in the system engineering and up-front design, and that includes defining of requirements from a human engineering point of view, performing special tradeoff studies. We have done a few, and I will mention those later. Being very active in how the design evolves, all the way from conceptual design to final design.

One of the things is our staff has grown. Rather than just act as reviewers, it is to be included up front and throughout the process. We have been pushing our way into those design groups to get that involved, and we have been actively involved with Rick Memory's people on a couple of studies. So we are getting there. It is a long, hard road, but we are trying to make that progress, and we know where we want to end up.

Obviously, it is to continue and evolve our support to Lewis Booth in the system safety area. Believe it or not -- I don't know if most of you are aware of it -- human engineering has a very viable role to play in training development, and that is to define tasks and help through the human engineering tools and techniques to define how you accomplish those tasks.

Continuing on with the tasks and activities that we are performing and want to continue to perform and propose to perform is obviously to review all specifications, drawings, and analyses that come out for human engineering impacts and inputs wherever viable, and I have concluded a configuration control board bullet.

Let me say a little bit more about that. We currently, as a part of specialty engineering, do sit on a configuration control board at the YMP project level. I am an active member. My supervisor is an active member. Lewis Booth is an active member.

We do represent all of the specialty engineering disciplines, not just human engineering, and that includes ILS, integrated logistics support, safeguards and security, systems safety, and human engineering. That is a very viable tool for getting information and having inputs into what the design is.

I know it is the tail wagging the dog, but it certainly makes sure that we at least see it before it goes out and get a chance to review it. So it is important.

As I indicated earlier, we have done several of what I am calling human engineering and system safety special studies, tradeoff studies, other activities that are not part of our regular workload.

Briefly, as Lewis Booth indicated earlier, on June the 3rd, we did a TBM walkdown which is identified in the System Safety Society Manual. A team of 10 people, including representatives from Vienna, basically took eight hours and walked down the TBM from the cut ahead all the way to the end of the trailing gear to verify that what we thought was there was there, to identify any additional hazards, and to see if there was anything else that we needed to or could recommend to improve system safety.

In the area of special studies, there have been a few done. In 1994, there was a human engineering study, a tradeoff study done on the track switches whether they should be manual or automatic. It was released in a draft form and has been used since then.

There has been, as I indicated earlier, walkways and equipment studies done, and that was part of the system safety analysis effort, and it became an input to a subsequent value engineering study.

There has been a TBM mapping entry follow-up done under the auspices of system safety. What happened there is after the TBM was being used, members of the scientific community came to us with a number of concerns concerning safety, the design of the mapping entry, of the types of procedures that are in place. We met extensively with them toward the TBM, took photographs, as a matter of fact, came back and actually did an update to the mapping entry, safety analysis portion of the TBM safety analysis.

As part of the walkdown that we did on June 3rd, we verified that some of the features have been implemented or are in the process of being implemented right now. It also laid some responsibilities on the scientific community for training their scientists, by the way.

Last, we have supported Rick Memory and his crew in the area of the ACD, or advanced conceptual design.

Other activities, just very quickly. System safety has done a poster session at the High-Level Radioactive Waste conference earlier this year in Nevada and has submitted a proposal to the Human Factors and Ergonomics Society for the San Diego meeting in October to do a similar poster session. It won't be identical. It will be more towards human factors. That paper has been approved for presentation.

Future plans. Obviously, we are being proactive. We will continue to develop our system safety and human factors in the work packages as they come along, and Mr. Lewie Booth and I will complete our plans and procedures for delivery as planned.

Staffing. As I said, we are part of the system engineering group. We are specialty engineering. We represent a number of disciplines. We currently have system safety, human engineering, reliability, availability, maintainability, and value engineering. We are still hoping to grow in the area of integrated logistics support in safeguards and security.

That concludes our presentation. Are there any questions?

QUESTIONS/COMMENTS

DR. PRICE: Thank you.

I wonder if you both might go to the mike in case there are questions for either of you.

Questions by the Board or consultants?

I have one question on system safety. With regard to the TBM, you got into the loop a little bit late, and so you had to do design changes after the design. Is that correct?

MR. EISLER: That is true for the initial delivery of the TBM. The initial delivery of the TBM consisted of the TBM cutter head, which is the first 50 feet, and five trailing gear cars.

When I came on this project, the TBM was already well under, I would say, construction at CTS in Seattle, Washington, and at that point, we commenced our safety analysis.

Since then, as I said, there have been other deliveries. Primarily, the mapping entry was the largest delivery. That included the mapping platform, the camera platform, and nine additional cars, and we were able to get into that process earlier and, thus, get, I think, more of an impact in integrating system safety features rather than adding them on.

DR. PRICE: Jim, I guess this is directed toward you. There is nothing in the DOE process that in the future will keep them from getting in, in a timely way.

MR. CARLSON: There is nothing in the process, yes. That is correct.

DR. PRICE: That is a correct statement. Good. Of course, I would really hope you could say that.

Another question on system safety. You have the probability and consequences and so forth, and you did the matrices. Did you develop a hazard action matrix with policies related to the probability of occurrence and consequences and so forth?

MR. BOOTH: What we did after each scenario, take a given scenario, was generated, we then assigned actions for mitigation of each one of those, but we didn't generate a separate list.

We did have in the safety analysis itself, up front, a complete listing in order of importance in terms of risk, the entire list of scenarios to be used as a guide for any additional actions, but we didn't initiate a list, per se, as you are talking about.

DR. PRICE: The curiosity is that if you do the hazard action thing, you have to come up with policies.

MR. BOOTH: I was going to say the mitigation documentation are mostly in terms of documentation to make sure that the hazards are taken care of.

Some are done by policy. Some are done by procedures. Most of the ones that we have been involved in are procedures.

Les, do you know of any policy change?

MR. EISLER: No, I don't know of any policy change, but let me also add in addition to what Lewie has said that in our program, the construction management office is responsible for implementing those procedures, and they have been procedures. So the responsibility shifts from us doing the analysis, identifying the hazard, to at least for the ESF construction, and we will talk about the TBM or the north ramp extension or whatever it is.

The responsibility shifts from us performing the analysis to the construction management office verifying the analysis and verifying that the implementation features are there.

Let me add this. One of the last slides, we talked about the TBM walkdown. That was a cooperative effort, and it was done specifically to look at design features if they were implemented.

There is a subsequent task which our supervisor is currently participating to look at the JSAs in training. So, while the responsibilities shift from one functional organization to another, there is some cooperation between the groups in making sure that we cover all the bases.

DR. PRICE: Really, the thrust of the reason for asking had to do with whether or not you could service or emerge specific policies given risk, and it sounds to me like that at this point there is not specific, clearly identified policies given risk.

MR. BOOTH: Yes. As I say, the actions connected to risks are usually handled by way of procedures, and that is our most direct way.

I would presume that if there were a number of repetitive things that would warrant a policy, that could easily be done, but what we have done to make sure we get our risk handled in a very expedient manner, we immediately attack the problem from the procedures standpoint by making sure we have documentation that immediately goes into effect, but I think it would be a good idea, certainly, if you had the ability to generate a generic problem that could be handled by policies. I don't see why that couldn't be done.

DR. PRICE: The next quick question is that we have seen this morning, Mr. Carlson, some system safety applied to the Yucca Mountain subsystem, and we mentioned several subsystems including storage and transportation and so forth. How is this kind of an approach going to be implemented in the other subsystems or has been implemented in the other subsystems?

MR. CARLSON: As Dr. Smith indicated, in the development of the systems engineering management plan, there is a system safety plan at the program level which lays out the policies on what the projects need to address, the guidelines.

This is a specific example of how the Yucca Mountain project has implemented that policies down. Within the old waste project where they have definitive subsystems to address, they should be developing flowdown paths on how they will address these requirements. I don't believe it is as mature in those areas as it has evolved at Yucca Mountain at this time.

DR. PRICE: For example, if I wanted a preliminary hazard list of the transportation system, could I get it?

MR. CARLSON: Let me switch to Mr. Tiera on that.

MR. TIERA: No.

DR. PRICE: The answer is no.

MR. CARLSON: The answer is no, not at this time.

DR. PRICE: Bill Tiera says no.

Don't you think by now we should be able to?

MR. CARLSON: I will defer on that one.

DR. PRICE: Dr. Cantlon?

DR. CANTLON: Could you walk us through, say, for instance, on the TBM and the surveying area, scientific surveying area, the process you go through to look at the tradeoff in terms of safety, cost effectiveness, and project schedule? Give us kind of a feeling for what that process is like.

MR. BOOTH: I will say something about the safety first, since he has had some exposure to the tradeoff scenarios.

What we do in safety is there are certain levels that you don't go below that aren't subject to tradeoff. Now, obviously, we are not endowed with infinite resources. So there are some situations where you have to decide where to best spend your resources. Those were the difficult problems that come into play.

I wasn't involved in the value engineering study which involved that kind of tradeoff, and maybe Les can elaborate on that, but we have a certain bottom line, so to speak, from a safety standpoint that we can't go below, and maybe Les may have some information on the value-engineering aspect.

DR. CANTLON: I was thinking of the scientist, in particular, who clearly would like to get on with their work.

MR. EISLER: First of all, just to answer the second part of your statement, they are not prevented from getting on with their work. They have continued to work under what they felt were not the optimal conditions.

We did come up with quick-fix solutions. We came up with some longer-term solutions. We came up with training solutions.

The answer to your question, I am not sure. I think the charter of our group is to look at system safety and human factors. That is our prime concern. The decision of whether to do something or not to do something based upon cost and schedule is a management decision, and we have made it very clear in doing our system safety analyses that we are concerned about personnel safety. We will pass that information and our findings on to management. It is their decision whether to implement or change or partially implement something based upon a cost and schedule concern.

In some cases, that is handled directly by management. In other special cases, it has been handled as a value-engineering study. There have been none, I don't believe, from a TBM, but, for example, the walkways was a value-engineering study, and there have been others. They do take some time to do. They take two to three weeks to perform an individual value-engineering study.

I guess my answer to you, very honestly, is -- and maybe this is a selfish issue and maybe I shouldn't say it, but I am going to. I am a human engineer in system safety, and I'm going to do my job technically. I will pass that information on because I am not chartered to look at cost and schedule.

I know what my costs and schedules are, and I obviously can't recommend something that is going to take 20 years to produce, for example, but I really do want to do the best job I can, technically, and I think that Mr. Booth and I know Greg Smith have felt very strongly about doing the best technical job we can.

By the way, from a safety program point of view -- and, Dan, you better correct me if I am wrong on this -- when DOE or our management has to make a decision, there is a lot more that goes into that than the system safety report. There are health and safety issues. There are training issues. There are schedule issues. There are all those others issues. We are only one piece of the pie that provides a total picture to everybody.

MR. BOOTH: They need the scientists, too, by the way. I have been quite pleased. They have been pretty conscientious about their working environment, and as Les mentioned, one of the activities on the mapping gantry was initiated by them. As we mentioned, other people can initiate these efforts, and in fact, they did do that and followed through. They didn't let it lay around.

DR. PRICE: Let me thank the speakers this morning, and I am going to suggest we break now with a plan to come back at 1:00 so we still get our hour and 10 minutes in for lunch.

I understand there is a buffet in the restaurant here in the hotel.

[Whereupon, at 11:40 a.m., the meeting was recessed for lunch, to reconvene at 1:00 p.m., this same day.]

AFTERNOON SESSION

[1:00 p.m.]

TRANSPORTATION - ENGINEERING PROJECTS

DONALD NOLAN, JAI - M&O

T.C. SMITH, JAI - M&O

ALAN SALTON, TRW - M&O

MR. NOLAN: I am an employee of E.R. Johnson Associates. My topic is going to be a brief review and status of the GA-4 legal weight truck cask systems.

I have five topics. The first is a background, and I just wanted to do that before getting into the GA-4/9 to bring you up to date on where the cask systems development program is. Then I will get into the significant milestones on the GA-4/9 program, some future events and milestones, and then the focus of my presentation will be on the half-scale model fabrication.

There has been quite a lot of progress made over the past year, and I have some photos I am going to show you. The model will be used to do the regulatory drop test in accordance with the Code of Federal Regulations, Part 71, and these tests are very important because the results will help facilitate the licensing of the cask and, of course, demonstrate the adequacy of the cask.

Then my last topic will be the preparations that have been going on and completed on preparing for the testing of that model.

On the background of the cask system development program, as you are probably aware, there were five contracts awarded in 1988 by DOE. Two were legal weight truck cask systems, one, of course, which was the GA-4/9, and there were three rail barge cask contracts awarded. However, over the years, as a result of program redirection and, of course, most recently because of the MPC system development, the cask system development program now really has boiled down to the GA-4/9 cask system, and that is proceeding to certification, and we need the legal weight truck cask for the truck reactor sites. Based on latest information, that could be a minimum of four or a maximum of 19. In fact, it will probably wind up somewhere in between.

The legal weight durability testing has been completed. It was completed in February. A test report will be coming out shortly. DOE has accepted the trailer. They accepted the trailer in April of '95, and we have received the first round of questions from NRC on the safety analysis reports, just approximately two weeks ago, and we are starting to look at those.

Some of the major events on this system will be the legal weight truck trailer for performance and operation, and Mr. Smith will give you a briefing on that following mine.

We expect the fabrication of the half-scale model to be completed in August of '95, and the regulatory drop test to be performed in September of '95. The test report and results will then be submitted to the NRC in November, and we are anticipating receiving the certificates of compliance towards the end of fiscal '96. As of now, the program plan calls for a delivery of legal weight prototype cask in September of '97.

Before I get into the fabrication of the model, I just wanted to refresh your memory in terms of the design of the GA-4/9. The model is a half scale of the GA-4 legal weight truck cask.

Here is a multi-layered design. As you can see, it is a 4PWR assemblies. There is a stainless steel interliner followed by a depleted uranium gamma shield. Then there is an outer stainless steel body which is actually the containment boundary. That is followed by a polypropylene neutron shield, and then there is a stainless steel enclosure around that. It has a welded-on bottom forging, and there is a closure lid that gets bolted to the top of the cask with 12 closure bolts.

There are two removable impact emitters. They are interchangeable and identical on each end. They are aluminum, honeycomb-filled impact limiters, and then there are six trunions for lifting and tiedown during handling and transportation.

Just to remind you, again, here you can clearly see the layer design of the casks. The GA-4 is on the left. The GA-9 is on the right with a different fuel support structure for the nine assemblies. The thicknesses are a little bit different, and the GA-9 is about 10 inches longer.

I might mention that in terms of legal weight truck casks, the existing one can only carry one PWR and two BWRs. So this is quite a large increase in capacity.

You can skip the next two. The next two slides, just for your information, they show the key design features that I talked about.

This is a schematic sketch of the half-scale model, and it points out the different features that we just looked at on the cask. The neutron shield and the enclosure for the neutron shield is not modeled on the cask. The weight is simulated by these steel blocks which there are four per side, four sides, and they are welded onto the outer body to simulate the weight of the neutron shield.

This shows a schematic of the impact limiter, just an exploded view starting from the bottom. We have the inner housing, and then the next section shows the segments or wedges of the aluminum honeycomb that are adhesive-bonded together.

Now I would like to get into the fabrication, and I'll start with the outer shell.

Initially, it was attempted to cold-form the outer shell. The outer shell is made starting with a flat plate. Two 90-degree bends are put into the plate to form a U-section, and then the two U-sections are put together and welded along the longitudinal seam.

The first cold-forming attempt didn't work. The plate broke. It was just too sharp or severe an operation to do cold. So a hot-forming procedure was developed.

As I mentioned, what is shown on the right, you can see the one bend, and following that, a second bend is put into the plate. Then you wind up with a U-section that you see here. Then you make another one and you weld those together along the longitudinal seam, and that forms the outer shell.

The next thing I wanted to talk about was the fuel support structure. It is a cruciform, and there are four wings, as they're called, and they are welded to a centerpiece. You can see the dimensions there. There are a number of holes, approximately 300 holes per wing, and the drilled holes would be filled with the B_4C pellets in the actual unit. For the scale model, the holes are there, but the pellets will not be in there. If you look hard enough, you can see the holes along the edge and the centerpiece, which the four wings are welded to.

The next couple of photos will show the insertion of the fuel support structure into the inner liner. Right here, it is about halfway in. On the side, there are some lateral guides to keep it straight as it is inserted. It is inserted into keyways. You can just almost see them.

There is also some vertical support, so that as it slides in, there is less weight on the keys to reduce the friction and help it go in easily, and actually it did go in pretty easily. A fixture was set up around the liner to keep it straight during this process.

This shows the fuel support structure completely inserted into the inner liner.

The next operation I want to get into is the assembly of the depleted uranium rings. I have a number of other photographs that I'm not going to show, but they are available. I have some here if people are interested in looking at them later.

This shows a depleted uranium ring. I think that is the last one that will be assembled onto the top, over the inner liner. You can see the U-blocks have already been assembled. The DU ring is held by an inflatable bladder. You just fill it with pressure, and it puts some pressure on the ring to hold it.

The next operation was to put the outer shell over the assembly of the depleted uranium rings, and hopefully that is the next picture.

Well, that slide is missing, but at any rate, once all the U-rings are put onto the inner liner, then the outer shell is placed over that.

Now, after that assembly is complete, then their impact limit and support structure ribs are welded onto each end of the outer body, and that should be that picture.

There are 36 ribs, or gussets, that are welded onto each end of the body. These are of different lengths and at different angles, because you have to transition from the square configuration of the outer shell to a round configuration because the impact limiter that fits over this, after the outer shell is put on, is round.

Then, over the impact limiter support structure ribs goes an outer shell. As you can see, the outer shell has slots machined into it, and they will line up with the ribs, or the gussets, that you saw in the previous picture, and then these are plug-welded to those gussets to form the enclosure. The shell is tapered at the top to conform to the configuration of the impact limiter.

This is the impact limiter housing. It is the one section that I showed on that exploded view of the impact limiter. The aluminum honeycomb sections will be bonded to this shell. The tubes are for the impact limiter attachment bolts, and they will pass through these and then will be threaded into lugs which are welded onto the outer shell. The picture that seems to be missing would have shown those.

The final one, as I mentioned, the neutron shield was not part of the model, but in order to demonstrate the fabricability of the neutron shield shell and the neutron shield, a full-scale mock-up -- this is about 2-1/2-feet long -- was built. General Atomics had it built.

You can see this is the outer enclosure for the neutron shield. You can see the neutron shield blocks. This simulated the outer body or the containment boundary of the cask. You can't see the aluminum tubes that transfer the heat through the neutron shield, but they are there.

I just wanted to mention where we stand with getting prepared for the drop tests. The contract was awarded to Maxwell Laboratories in March of '95. A drop pad is being constructed. It is almost finished. It should be finished this week.

GA is preparing the test procedures. They are in the final review process. We expect to have them completed by July of '95. They will perform some benchmark tests with what they call a dummy cask, but it is really just a dummy weight, and this will be used to test the release mechanism for dropping the actual model and also to test out the instrumentation system. That is expected to occur in August of this year.

Then the drop test would be performed in September. We would complete the test report of the results from the drop test in October and then submit the test report to NRC, hopefully, in November of this year.

There will be three 30-foot drop tests, a side horizontal test, a slap-down at a shallow angle, probably around 5 degrees. There will be a CG, a corner over CG test. The angle will be about at 80 degrees. There will also be three puncture tests, and each puncture test will follow the drop test.

In other words, after the side horizontal test, there will be a puncture test dropping it onto the puncture bar, into the damaged part of the impact limiter; in this particular one, the damaged part, directed at the lid and lid seals.

That concludes my presentation.

DR. PRICE: Are there questions from the Board or consultants?

[No response.]

DR. PRICE: What have you done in terms of validating that your scale model is a valid representation of the full scale? You have, in some cases, simulated weight placement and so forth.

MR. NOLAN: Other than the neutron shield, there are some differences, but obviously during fabrication, there will be a dimension inspectional report to assure that the dimensions meet the half-scale drawings. There are a set of fabrication drawings that they have to build it to.

If there are any deviations from those, those are recorded and evaluated to assure that they will not affect the results.

DR. PRICE: Carl?

DR. Di BELLA: I have got two questions for you. What are the parameters for the fuel, the maximum parameters for the fuel, say, the TWR fuel, that you will be able to accommodate in this cask as far as minimum age, maximum burn-up, maximum initial enrichment, and so forth? Do you recall those? Are you going to be able to accommodate the fuels of the future that have higher enrichment and/or higher burn-up?

MR. NOLAN: Yes, but it will require that there will be some burn-up credit. The cask was designed for burn-up credit, but it can carry a significant amount of fuel without that. The original intention was to use burn-up credit.

DR. Di BELLA: Do you need burn-up credit for the one that you showed us with, say, the normal enrichment fuel?

MR. NOLAN: No. This would be for high enrichment and high burn-up levels.

I don't remember the exact number of what can be carried with or without burn-up credit, but a substantial amount of fuel can be carried without burn-up credit.

DR. Di BELLA: I have a second question. On the drop test, will you have some sort of simulated fuel assemblies inside the cask, and will you be looking at how the drop might affect the fuel?

I know that is not part of the regulatory requirement, but will that be done?

MR. NOLAN: The assemblies will be simulated by dummy weights to simulate the weight and the effect on the fuel support structure and the liner, but there will be no similarity to a fuel assembly.

DR. PRICE: All right. Ellis?

DR. VERINK: Noting the configuration of this part and the manner in which it was assembled, how closely does this represent the intended manufacturing procedure when you get to a full-scale unit? Are you actually going to put it together in little pieces like that?

MR. NOLAN: I am not sure I understand you completely, but there will be some differences.

As I mentioned, the original process performing the outer shell with the cold form, and then it didn't work.

So it was hot-formed. The method that they used there would probably not be the method that you would use for the full-scale.

DR. VERINK: I would think not, too.

MR. NOLAN: But there will be a lessons-learned document that will be put together by the fabricator and General Atomics to document the experience and what the resolution of the problems were that they ran into, so that when you do get to building a full-size unit, you will have the benefit of what the experience was of building the model.

DR. VERINK: Do you have any idea how many would be manufactured at the first procurement?

MR. NOLAN: Not really.

If you had the minimum number of sites, I think it is, like, about six or seven casks. If you go to the maximum number of truck sites, you are probably talking twice that, maybe 14 or 15.

DR. VERINK: So it perhaps wouldn't justify greater and bigger equipment, then, to do this work on?

MR. NOLAN: Bigger equipment? I am not sure I understand.

DR. VERINK: Manufacturing equipment. It looks like you were limited as to the length and all kinds of things.

MR. NOLAN: Well, it is only half-scale, obviously.

DR. VERINK: I understand this is that way.

MR. NOLAN: The manufacturing equipment is less. Doing that operation of the forging will take quite a bit more, a bigger piece of equipment to do it, yes.

DR. VERINK: And that is anticipated to be procured for full-scale production; is that right?

MR. NOLAN: Yes.

DR. VERINK: So there will be changes to the design?

MR. NOLAN: Well, what would happen is that we would have to put together a procurement specification, send out a request for proposal and have companies bid on it, and then evaluate the proposal based on our experience gained with the half-scale model.

DR. VERINK: Thank you.

DR. PRICE: Are the purposes of the drop test actually being performed to satisfy requirements? And that goes back to the question Dr. Verink is bringing up and the first one I had as to the validity of the scale drop tests, given that there are some differences.

MR. NOLAN: As I said, we will take dimensions of the models so that we know what differences there might be between a true half-scale and the unit that was built, but I think the key is really the performance of the impact limiters. If the impact limiters give you the performance that you expect and you get the G levels that you expect, I think that probably overwhelms any slight differences you might have between an exact half-scale and the actual.

DR. PRICE: John Arendt?

MR. ARENDT: Are you in a position to prove that the half-scale model fulfills a full-scale model test? In other words, does a half-scale model represent a full-scale model test?

I realize you are going to do all of the measuring and what have you, but has there been any proof, or are you required to provide proof to the NRC that the half-scale model does fully represent a full-scale model test?

MR. NOLAN: These tests have been presented to NRC, and they do accept the fact that scaling laws in effect are correct. You can take half-scale model results and scale it up to full scale. Now, other people would prefer to see a full-scale test.

DR. PRICE: If there are no other questions, then we will go onto the next speaker.

MR. SMITH: Good afternoon. I am T.C. Smith. I am here today to talk to you about the legal weight truck testing. I appreciate genuinely the opportunity to do so.

Don and I had a little contest going to see who could generate the most multimedia presentation. Don had two charts and a stand-up chart. Well, I'm going to try the degree of difficulty of 9.5. I've got two viewgraphs, a video, and a chart. So please bear with me.

The purpose of the presentation is to update you on where we are with respect to the tractor testing. In that regard, I am going to briefly cover these subjects and review for you basically, why we need this system, a little bit about where we have been, what we have learned, and where we are going.

With respect to transporting spent nuclear fuel, rail transport is the preferred mode. We are going to maximize rail everywhere we can, but as Mr. Nolan mentioned earlier, there are a number of utilities that we know of now, reactor sites, that cannot now nor are they expected to accommodate rail transportation in the future. So we know we have some limited transportation, highway transportation, movement requirements.

Department of Energy asked us to design a system that is legal weight. Legal weight means it must comply with the gross weight and axle weight limitations outlined in the 1982 Surface Transportation Act. In plain English, that means basically we are talking 80,000 pounds and below to be legal weight on the interstate highways today.

This system is being developed right now and tested right now, so that it is available to provide legal weight transportation through the GA-4 or the GA-9 cask as early as 1998, should we have to do that.

This is what it looks like. This is an actual picture of what we call the LWT, legal weight transportation system. This was taken out at the test track. This is a freight liner, cab-over-engine-configured tractor. This is a General Atomics GA-9 trailer, and this is a simulated 55,000-pound load designed to represent the gross weight and center of gravity limitations of characteristics of the GA-9 cask.

This was built especially for the cask. This is a conventional tractor that you can buy in downtown Arlington today. We just went through, and where we could, we tried to save weight. Remember, 80,000 pounds is our target. We know that our load weighs 55,000 pounds. Using a little advanced math, then, we know that our tractor and trailer combined cannot weigh more than 25,000 pounds.

The target weight for our tractor is 16,000 pounds. We have met that. Our target weight for our trailer is 9,000 pounds. We are beneath that. Right now we are 1,400 pounds overweight, and the way we accomplished that was going through and when we outlined the specifications for the tractor where we could save the weight, we did.

We have one 100-gallon fuel tank, 720 pounds, with a range of 300 miles. That is with a 25 percent fuel reserve. We saved 400 pounds by using aluminum wheels. We saved 850 pounds by using a 350-horsepower engine.

So, having said all of that, the reason we need to test this system is to make sure that a system designed in this matter is durable and it operates in the manner that we think is consistent with a safe vehicle operation.

In way of review, I think I discussed most of this with some of you last year in July, out in Denver. The test is broken down into two basic components, and that is the durability of the trailer -- and that's the part of the test that Don Nolan mentioned we just finished -- and the operational performance of the tractor and the trailer with the 55,000-pound load on it.

The durability test, that is 240,000 equivalent miles on a test track. 7,500 actual miles was completed back in February. Let me show you a picture of what the test track looks like.

This is Allied Signal Automotive Proving Ground in New Carlisle, Indiana. It is about 20 miles from South Bend. This is the durability part of the track, which I will show you a film clip of here, and this is the oval track where you accumulate mileage. Here is a skid pad where we do our braking tests that are currently underway right now.

This test track was originally purchased by Studebaker in 1926. If you fly over the test track right now, you can still see Studebaker written out in the trees. It was bought by Bendix, and then Allied Signal in 1966, and they have been operating it ever since then.

Let me show you a film clip, if I could, first, to show you some of the testing events that transpired as part of the durability test.

This is a homemade take, taken out of the back of a pickup truck, but I think it shows pretty clear some of the test events.

This is the inverted chatterbox, 1-inch deep, 24-inches wide, and is separated 5 to 9 feet. These are the cobblestones. They are 5-inches wide. You can imagine 7,500 miles of this type of driving would be very fatiguing to any transportation system.

These are impact bumps, 1-1/2 high, 18-inches wide. You can see the stress that is being transmitted to the tractor and the trailer.

I rode in the back of the trailer around the test track, and I needed almost $200 worth of dental work when I finished.

This is the undulating bumps here, that you can see the torsion and the torque that it places on the trailer. Again, this thing goes around and around the test track at various speeds to induce the type of stress and strain we are looking for. These are lane change maneuvers. You can see the stress and strain that this maneuver puts on the trailer.

Every mile we drove on the test track was worth 32 miles on the highway. The trailer was instrumented to capture this type of data.

Having said that, I would like to preface this durability testing with just kind of a preamble. That is, this trailer, the GA-9, General Atomics 9 trailer, was already designed, fabricated, and tested to the ANSI N14.30 standards, and that ANSI N14.30 is the standard that talks to the design and fabrication and testing of a trailer configured to carry concentrated loads of radioactive waste.

So it had to pass a dynamic road test as well as a static load test. It had already done that. Having said that, we still went through a very comprehensive, very stressful durability test, 240,000 miles, and here is what we found.

We did find some cracks, which I will show you a picture of one of them here. These cracks all occurred at connections typically between cross-members and the eye beam.

I would like to draw your attention here. This is the diagram of the trailer. This is the front, this is the rear, top view, and this is the view from the left side. These numbers here are not cracks. They are simply locations on the trailer. What I would like to point out here, though, is the crack I am going to show you on the photograph is located right here, but again, they happen typically at these connections.

We found that the stiffeners and gussets where they were welded, we needed to modify the way they were welded, and that is to say we had to back off the welds 1/4 of an inch from the end, and we found where we did that we didn't incur any additional cracking.

We did find that some of these connections required modification. What we did there, or what General Atomics design engineers recommended is that when this goes into production, the thickness of the stiffeners and the eye beam be increased from 3/16ths of an inch to 1/4 of an inch.

We also added stiffeners to the side here, and I will show you a picture of that right now. This is a picture, and the reason it is colored orange like this is because everywhere on the trailer where we had welds, we blasted off the paint so that we could monitor the trailer for any cracks that might develop.

This is an inside shot, taken right here, and this is an outside view, right here. This crack did go through.

This is one of the gussets I mentioned, and this is what I was referring to where we back off the weld 1/4 of an inch. Where we did that was where the crack was already welded to that extent, and we grounded it off. We found that we didn't have any additional cracks.

So this is a problem. It was a small crack. We found it at a 30,000-mile equivalent mile marker, and here is how we fixed it.

This is a picture of the outside; again, same location. By adding the stiffener, we found that we did not incur any additional cracks. What we did with this durability test, the bottom line to it, was we did incur some small cracks. We did validate the structural integrity of the trailer, but I think, equally important, we now know some areas that we need to pay particular attention to as we develop an inspection program for this trailer during its operational life.

The durability part of the test was completed in February. The trailer was then refurbished. It was painted, it was inspected, it passed a commercial vehicle safety lines inspection, and it was accepted by a representative of the Department of Energy in April of this year.

Here is where we currently are. We have now transitioned from the durability of the trailer to the operational performance of the tractor and the trailer with the load on it.

We are currently, as we speak, out at South Bend testing the braking performance of the vehicle with the load on it and the trailer on it, hooked up to the trailer, against the standards that are outlined in the Federal Motor Vehicle Safety Standard 121, 49 CFR 571.

They outline the standards for brake performance. We are measuring this system against that. We will then measure the ability of this system to accelerate -- we just talked about braking -- and to accelerate and change lanes.

You will remember I mentioned earlier that we were a little bit concerned about a 350-horsepower engine. We saved 850 pounds with that. Now we want to be sure that we don't put ourselves in a predicament that -- I don't know if you have ever been in, but I have, where you get into a small, typically Japanese car that doesn't go very fast, small engine, good fuel economy, but you try to merge in traffic and it becomes a problem. We want to be sure that we don't have that kind of a problem in the system, and we are going to validate that as part of this test.

The second bullet there is your human factors considerations.

I need to mention, also, to you, I am sure many of you will notice here that the schedule has slipped a little bit since last year. Despite our best efforts, we did incur some problems when we found that first crack in redesigning, coming up with engineering repairs to that, and to finding qualified welders. We had qualified Level II welders ready to go, but they were certified in vertical welds. What we needed to do was a horizontal weld, and they are not the same.

So you either have to get the guy qualified in horizontal weld, which is incredibly more difficult than we expected, or do what we did and ship the trailer back to the factory and have them put it on a rig and move it around so that the welder is always welding in a vertical position.

All I can tell you is we are doing the best we can to manage this program to make sure it stays on schedule. We have learned from our past mistakes. We are doing our best to anticipate future problems so that we don't incur any future delays, so we can report back to you next year that we are complete with the test.

In terms of human factors considerations, we have modified the way we are going to do that. We had talked last year about comparing a cab-over-engine configuration, that we have here, to a conventional engine-out-in-front tractor. We found by doing further analysis that there is actually a standard, ISO standard 1236-1, that relates to whole body vibration.

So we are going to take our cab. We are going to capture whole body vibration from the driver's perspective, and we are going to measure that against a standard to ensure that we don't induce any accelerated fatigue in the operation with this particular environment in cab-over-engine.

The last part of our test is, we have now left the test track and we are going to go on a 17,200-mile trip, visiting 16 sites in 13 States, traversing 25 different States, and we are going to visit utilities and put this thing in an operational environment in which we are actually going to use it and make sure we validate the kind of information that we found on the test track.

We are going to use a test truck driver as a primary driver, and as his co-driver -- and I made the mistake of calling this guy an assistant driver one time, and you do not do that with truck drivers. This is a co-driver. He has nuclear transportation experience. We are putting him under contract right now, and his job, in addition to being a co-driver, is he is our institutional insurance policy. He is going to be there when this LWT system pulls into a truck stop to get refueled.

When I gave this briefing to Dr. Chu, he mentioned that I shouldn't use the word "radiate confidence," but maybe I should use the word "exude confidence." He is going to exude confidence to the American public that we have the very finest drivers that we can get our hands on. He is going to represent the kind of drivers we are going to have in this program. He is going to be a minimum of 25 years old. He is going to have a minimum of 100,000 miles of semitrailer truck driving experience. Two of those years must be continuous and must be within the last five years. He is going to be as qualified to inspect that vehicle as the inspectors will be in the truck stops.

He is going to be Commercial Vehicle Safety Alliance Inspector-qualified. We are going to send him to the Dale Carnegie course. We are going to send him to courses with additional supplementary training in braking performance, rollover prevention, and speed management. He is going to receive dosimeter training, how to take those kind of readings.

The picture I am trying to paint, and we want this gentleman to paint -- and he can be a lady, too, as well. We do have test track lady drivers at Allied Signal. -- is that we understand that the weak leak in any transportation system is the vehicle operator, whether you're talking trains, pilots, or truck drivers, and our objective is to go out and recruit, train, and then retain the finest vehicle drivers in this country. That is going to be increasingly more difficult because we are experiencing throughout this country a tremendous shortfall in qualified experienced truck drivers.

So the bottom line is we finished with the durability test. We are in the operational performance part of the test right now. Right now, as we speak, they are doing brake testing out at Allied Signal, and we anticipate being finished with the test by this time next year. I hope to be able to report out to you next year that we are complete and we have a great system.

Sir?

DR. PRICE: All right. From the Board or our consultants, are you needing to exude any questions?

[No response.]

DR. PRICE: Thank you very much.

MR. SMITH: Thank you.

DR. PRICE: We will go onto the next speaker.

MR. CARLSON: Dennis, if I could add something?

DR. PRICE: Yes, please.

MR. CARLSON: T.C. incorrectly said we came in at 1,400 pounds overweight. He actually meant 1,400 pounds underweight.

DR. PRICE: Yes. I kind of drew that inference. Yes.

MR. SALTON: Good afternoon. My name if Alan Salton. I am here to brief you on our progress in adopting a risk management approach towards transportation.

I would like to thank T.C. Smith for that nice warm-up he just gave me. He is always difficult to follow.

I know at TCG, I told the same story. So I'm going to risk offending those who were there and tell it again. When I was asked to present risk management, I was very honored. I went home and told my wife I have to go out and I have to tell these people why we need to do risk management and what it really means, because it's sort of a fuzzy thing that is hard to get your hands on.

My first idea -- this is why you should never go with your first idea -- my first idea was to show a clip from Jurassic Park, the dinosaurs, and say this is why you need to do risk management because if you're not really careful in any technological enterprise, it is going to go haywire.

I said to my wife what I'd like to do is show the clip where the dinosaur eats the lawyer. My wife said if you tell people that risk management will prevent lawyers from being eaten, nobody will support you at all, and so went Jurassic Park.

There are two parts of risk management. One is a process and a program, and what you hope to do is you hope to be able to identify, analyze, and address risks associated with transportation operational activities. I think you've heard briefly that we actually do that and do a pretty good job.

The other part of it is it is more than that. It is an attitudinal orientation that you take in the work that you do. It's a pervasive attitude that shows that we're concerned about adopting a conceptual framework for dealing with risk in all transportation activities in a systematic fashion.

With that, the way we talk about it in transportation operations, it is generally defined as the relationship of the probability of a hazard occurring times the consequence of that hazard occurring, and what we hope to do in the design and development stage of the transportation system is anticipate where the risks are in a systematic managed fashion, assess the significance of the risk, and then address them, mitigate or reduce them, as the case may be.

The risk management approach that we are hoping to adopt is proactive, for those of you who like that word. It plans, assesses, and improves the risk management of process. We are always interested in doing something better. This is not a stagnant kind of approach. It is dynamic.

As we move from planning to operations, we are going to find new risks that are going to be presented, and we constantly need to be able to respond to the changing environment.

We also hope to integrate the past, the current, and the future activities that relate to risk management in an integrative fashion.

This is the purpose of the risk management approach. It is to enhance public safety by reducing or mitigating risks to health and the environment associated with transportation-related activities.

This is the process that we are promulgating. It is similar to something the National Academy of Sciences put forth a couple of years ago. What you see here is, first, risk communication and stakeholder interface. The entire risk management process is predicated on this. Everything that we do has to be done in an environment of open dialogue.

All of the subsequent steps -- the risk identification, risk assessment, risk reduction, and risk monitoring -- are predicated on the public and the stakeholders, the technical and scientific community being aware of what we're doing, why we're doing it, what the assumptions are that form the basis of our work, and understanding the data and the uncertainties that are in our analysis.

First, we're going to talk about the risk communication and the stakeholder interface. This is a critical part here. Of course, this is the part we're attempting to deal with right now.

This is really the most difficult part. How do you communicate technical risk, technical information, to a public that is often not familiar with the concepts. Probabilistic assessments often are counter-intuitive to the way people reason. When you tell somebody that the risk assumption is 10 to the minus 8, well, they don't really understand what that means.

What we're attempting to do is use the National Academy of Sciences' risk communication model that was introduced in 1989 in improving the risk communication study that they did.

It says, pretty much, you need to have an open forum for identifying risks, real or perceived -- including stakeholders, the science and technical community -- engineering standards, economic, political, legal, regulatory risk.

The information that we're going to get from the risk identification of the assessments goes to the decision-maker who makes some determination about how to reduce and mitigate those risks, and then that information is passed back out so that the community and the external community has an attempt to comment on it.

Now we're going to talk about how we identify risk.

I'm going to try to speed this up a little bit.

Risk identification comes from a number of different sources.

It comes from the ones we just said. We have statutory and regulatory foundation for the risks that have to be assessed, and we've heard a number of the CFR regulations that form the basis for a lot of our work.

We have engineering, modeling, and simulations in codes like RADTRAN that tells things that need to be addressed. We have experiential data, the literature, qualitative experts, and again, we have the stakeholders who form a great deal of the basis for our risk work, whether that be the public or the professional societies.

Those risk, then, go through an assessment stage, and the assessment stage is the heart of the analytical process where we make some determination of the significance of the risks.

Generally, risk assessment is made up of this little process, which is data acquisition going out and finding the information that's available, both internally and externally to the program.

Obviously, there's been a lot of hazardous materials in transportation that's gone on for years, and it's been done very well. We're very fortunate to have the cooperation of the Chemical Manufacturers Association in doing this risk assessment work, looking outside for data.

Then there's a number of risk analysis methodologies that we apply to come up with some assessment, which is some determination about the significance of the risk.

Risk assessment activities that have been ongoing are things like environmental reports, EAs, EISs, technical activities, the kind of things that T.C. just spoke about and we'll get back to in a second, computer modeling data acquisition. We can use things like Highway and Interline for data acquisition and codes like RADTRAN to give us some assessments.

Then we have system benchmarking, where we can look at what's going on in the external environment and benchmark those kinds of transportation activities against what we are planning.

Then we've got the risk reduction. This is actually where you implement some specific measures to reduce or mitigate risk.

Risk reduction usually takes the form of recommendations about design, as we saw in T.C.'s presentation, operational policies and procedures, training inspections, certification of drivers and performance,

performance standards -- again, engineering standards -- and maintenance protocols to make sure the equipment lives up to its performance standards.

There has been some talk about human factors here, and we want to talk just a little bit about the transportation operational activities and human factors.

The first that we've done is we have some ongoing research going on in the statement of work that has been put out to the University of Maryland, Department of Transportation, the Business Management School, to actually do a search for us, a database search and literature review of both operational and technological innovations in human factors in transportation.

We have the statement of work out, and we're waiting to get some results back. What we hope to get is some preliminary reports about which studies are applicable to us, what recommendations we can use, and use that in design and development of the transportation subsystem.

Again, we have things like human factors, engineering design requirements in the MPC statement of work, which we'll hopefully hear a little bit about later in the GA-4/9 cask design, and in the driver performance evaluation of the light-weight cab that we just heard about.

Then there is monitoring. What you need to do is make sure that the risk reduction activities are actually effective, and we do that through risk monitoring activity.

We are going to set up a transportation risk management database. What this will include is follow-up reviews on changes and modifications based on risk assessment activities. For instance, when we make a structural change to a tractor trailer, we're going to have follow-up reviews to make sure that those modifications are effective. We are going to have routine inspections of the equipment as part of the standard protocols and performance assessments of both the equipment and the personnel.

To make this a little less academic, hopefully, I am going to tell you what a fine job T.C. Smith has done, as if you didn't know, in applying risk management to the GA-4 tractor trailer.

The first thing is that we have forums like this in the transportation coordination group where we can communicate the activities that we perform and conduct for risk management in an open forum. The access to data assumptions, everything in this program is open. None of it is classified. So all of that is available. Our assessment methodologies, as you have just heard, have been explained to you. They're available too. We hope to show the credibility and the competence that we see in the system.

We have seen some risks or identified GA-4/9 in terms of design durability, operational performance, the effects on the drivers, and the maintenance, and those are identified through historical precedent, through engineering standards, the ANSI 14.30's.

On stakeholder concerns, we have worked with CVSA in addressing some of these issues, and professional society interactions.

Then we do some assessments, but again, you have just heard about all of these activities.

First off, we use computer design modeling for the stress and strain. We have durability testing for the trailer, the performance testing in terms of braking and acceleration, the track assessment which is a more subjective evaluation of the drivers and the performance of the configuration, the tractor-trailer configuration, the human performance evaluation where we're going to look at things that T.C. talked about in terms of how the light-weight cab is going to affect driver performance, and over--the-road testing.

What we hope to get out of this, depending on what we find in these assessments, is, first, we will use design standards to make sure that we are up to industry specs. We will have design recommendations. You saw some of the modifications to the trailer. That is actually the result of a risk management activity. We will probably be developing policies and procedures for the operation and driving of the vehicles.

As T.C. explained, again, on the driver training certification qualification, we expect to have the very best drivers, with very good experience, and perfect records, and finally, there are inspection standards of the equipment.

That is all I have for you today. Do you have any questions?

MR. PRICE: Are there questions from the Board, staff, or consultants?

[No response.]

MR. PRICE: Thank you very much.

MR. SALTON: Thank you.

MR. PRICE: That brings us, then, to where we can go back in our schedule, now that Mr. Williams is here, and we will go into the multi-purpose canister design effort.

MULTIPURPOSE CANISTER (MPC) DESIGN EFFORT

JEFFREY WILLIAMS, DOE, AND

JAMES R. CLARK, E.R. JOHNSON ASSOCIATES - M&O

MR. WILLIAMS: Thank you. Sorry for being late. I haven't been to this building before. I had been to your other one.

I am the engineering division director in the Office of the Waste Acceptance, Storage and Transportation. Basically, I am just going to give you a little bit of the background status. We are going to break this into two pieces, and Jim Clark is going to follow me up to tell you about the subcontract that the M&O has let to Westinghouse on the MPC.

I am just going to go through some background, let you know how the MPC fits into the program approach, mention the procurement and certification schedule and some interactions that we have been having recently with the NRC that you might find interesting, and then Jim will talk about the Westinghouse proposed design.

For those of you who are new -- I know most of you have seen this picture several times. I thought I'd quickly just remind you, and for the new people, what the multi-purpose canister system is about.

It's a sealed canister up here that is loaded in the reactor, containing multiple assemblies. It's a rather thin-walled canister, less than an inch thick. It will have shield plugs on the top. It is welded closed, and it will work in concert with what we have termed overpacks. This is a storage cask here. It's envisioned to be concrete; it could be metal. This is the transportation cask here that the canister would work with. Then at the repository, it would work with a waste package.

Basically, it functions differently whether it's in storage transportation or disposal. In storage, for example, the canister provides the containment, however, the majority of the shielding is provided from the storage overpack. It has to be able to facilitate heat removal, and the canister does that in conjunction with the overpack.

In the transportation area, the approach that we have taken is the containment is provided by the transportation cask, not the canister. The shielding is provided by the transportation cask.

Then in the repository, right now, we have not taken any credit for the canister for long-term containment. It would be from the waste package, which is a multilayered package consisting of a corrosion allowance and a corrosion resistance material.

We believe that the MPC is a key aspect of the Waste Acceptance, Storage and Transportation project. This comes out of our program plan that was published last December that one of our goals is to ensure that the multi-purpose canisters are available in the 1998 time frame for reactor storage, and in that regard, we awarded the contract to Westinghouse on April 21st. It was announced on April 21st. I believe the signing was actually April 20th.

The procurement is laid out in three phases. The contract that we have awarded right now is for the design phase, with the preparation of a safety analysis report; that if we chose to go to the next phase, we would ask Westinghouse to submit to NRC on our behalf.

Really, what the contract consists of -- and I think Jim is going to go into more detail -- is primarily the transportation and storage aspects of the canister. Each one of these phases, Phase 2 and Phase 3 is an option that we would have to approve before we went to the next phase.

With respect to certification, I think you know we're trying to certify this to meet the transportation requirements and the storage requirements, and the method in which we've chosen to do this is we've gone out to hire vendors who are experienced in Part 71 and Part 72.

With respect to the Part 60 approach, basically what we have done is we have placed requirements into the specification that are above and beyond the Part 71 and 72 requirements, the transportation of storage. I'll briefly mention some of those in a minute. The goal is to make this canister compatible with the requirements of Part 60, the repository, to the extent we can at this point in time.

We have been dealing with NRC rather closely over the last year on a certification schedule. Our program plan, which came out last December, had a January 1998 deployment, with a submittal of a safety analysis report next April, which is consistent with the contract that we just awarded.

As NRC went through the review, basically, this is the schedule that they have laid out, which has MPC deployment later in 1998 than what we had anticipated. This is primarily a result of what they wanted to do. They would normally hold a rulemaking, which they hold for a storage certificate. They have never done that before for transportation. Our plans hadn't included a rulemaking for transportation. What they have told us is that they won't issue either the transportation certificate or the storage certificate until after the rulemaking. This, in effect, stretched out the NRC review a little longer than we had anticipated.

Some other things that have happened recently over the last few months related to NRC is that they have established a Spent Fuel Program office, which we believe will be a real benefit to the NRC and to us with respect to the review.

They will have all of the 71, the transportation people, and the 72, the storage people, reporting to the same director there, who is Bill Travers, assisted by Charlie Haughney. We believe that this will help to get an integrated review of this package.

Another thing that they have done recently is established a burn-up credit task force who will be able to review our burn-up credit report that we recently submitted, and it contains people from all three of the different parts of the NRC program.

In addition, one of the other things we have been dealing with NRC over the last year is how will they review the Part 60 aspects. We know they have got an established procedure or process for doing transportation and storage. The Part 60 was the one that was a little bit of concern because we did want NRC to tell us something with respect to Part 60, and we asked them whether they would review the concept early on to determine whether they had any objections based on current knowledge.

We got some letters back from them which said they would review it. As a matter of fact, they provided us some guidance on the scope and content for preparing a technical report, which we will do over the next year in the same time frame as the transportation and storage safety analysis reports, and that report will address how the MPC interacts with the waste package, interacts with the engineered systems, the natural systems, and repository operations. We will submit that to them and ask them to review it to determine whether they have any objections based on current knowledge.

Some of the MPC specifications that come from the repository that are in the spec I just wanted to quickly relate to you are the material requirements. These are requirements that wouldn't have necessarily been in the package had it only been a storage and transportation package.

First of all, we have the low carbon stainless steel requirement for the shell enclosure lids. We have precluded lead from the package which, if you look at some of the existing storage technologies today, they have lead in them.

The basket is low carbon stainless steel or high nickel alloy. Many of the basket materials of storage concepts are made out of carbon steel.

We have a thermal requirement to maintain cladding temperature below 350 degrees, with a total heat load of 14.2 kilowatts, and a surface temperature of MPC of 225 degrees. These are things that came from the repository, again.

On long-term criticality controls, we have a requirement that we must maintain subcriticality with collapsed flux traps, and we could only take credit for 80 percent of the as-manufactured ^{10}B, Boron 10, the neutron-absorbing material.

Lastly -- and this is the last slide before I turn it over to Jim -- is that we have a requirement in there where the vendor is going to have to show the ability to remove and potentially fill the container if we had to. These are requirements that aren't on a 71/72 package.

I think maybe we ought to go straight to Jim before we take questions.

MR. CLARK: Carlson always kids me when I get behind a podium, but this one is low.

What I'd like to talk about is the Westinghouse proposed design, with the emphasis on the proposed. Westinghouse, as part of their proposal, gave us an extensive amount of design information that led us to select them. It was proprietary information. At our request, they released a whole lot of information so that we could make presentations.

The contract was signed on the 20th of April. It was announced on the 21st and kicked off on the 25th. Soon thereafter, we received three protests, and because of those protests, some of the information that might otherwise be available is being withheld to protect Westinghouse's position until we resolve the protest, but this information that I am going to give you has all been released by Westinghouse for presentation.

As kind of a reminder about the work scope, it includes both large and small, the 125-ton and the 75-ton where the weight is the weight of a loaded MPC in a transportation cask, on the hook, in a reactor storage pool.

It includes also the equipment to seal-weld the MPCs. It includes the storage modules. It includes the transfer system to take the MPCs from the storage pool to the storage modules, or from the storage modules to the transportation cask.

In addition to that design, the scope of work at this phase, and it is the Phase 1 was what was contracted for, requires the preparation of preliminary design reports and the conducting of safety analysis in an NRC format preparation of a report. Subsequent to a review, Westinghouse might be empowered to submit those to the NRC.

The safety analysis will be both under Part 71 for the transportation cask and Part 72 for the storage cask. It will be both pressurized water reactor and boiling water reactor. My guess is there will be four safety analyses, but it's possible there will be eight, and Westinghouse and the NRC are engaged in that conversation.

The work scope also includes alternate design studies. The design procurement specifications that resulted in the contract award were focused on optimizing for what we believe is about 80 percent of the fuel in the first 10 years of OCRWM's operation. That leaves out some significant amounts of fuel that the Department has an obligation to accept.

They are the fuels with enhanced fuel characteristics. Those characteristics are burn-ups above 40,000-megawatt days, initial enrichments above 3.75 percent uranium 235.

It also would require an extension for stainless steel-clad fuel. There are about 2,100 fuel assemblies out there, from Yankee Row and reactors like that, that would not necessarily be under this optimized design, and part of the design studies is to develop a recommendation on the cladding temperature allowable in that kind of transport.

On long fuel, the optimized design of 180-inch maximum cavity would leave, notably, South Texas and some of the CE fuel. The system 80 that has the non-fuel bearing hardware in it would not fit in that cavity. So part of the alternate design studies is to assess how the optimized design would have to be modified to take care of long fuel.

In addition, the Phase 1 includes the preparation for the regulatory testing in Phase 2. Because of the schedule, we allowed the Phase 1 vendor to not only design the regulatory model, but also to purchase any long lead materials, so that upon award of Phase 2, we could initiate regulatory model testing.

The proposal evaluation is detailed in the request for proposal, and with the caveat, which is not necessarily exactly what I'm going to tell you here, the qualification criteria went to the experience, design, and fabrication of NRC-certified systems. We received five qualified offerors.

The evaluation factors were separated into business and management, technical and price, with business and management being more important than technical. Within business and management, it went to the success of the offerors with regard to large complicated projects and NRC certification.

It included the experience of key personnel, which were the program manager, the chief design engineer, the quality assurance manager, and five other important personnel that were, for example, the criticality analysis.

The management plans went to the ability of the offeror to demonstrate that he could pull off this complicated task within the schedules, which were one year for the Phase 1, 18 months for Phase 2, and fabrication of MPCs by early 1998.

On the technical side, the subfactors were design, the capacity, for example, and the compliance with specifications. The certifiability went to the ability to get the certifications from the NRC in a timely manner. Generally, it went to the use of techniques and materials that the NRC had seen before.

System operability went to maintainability, safety, and radiation safety as well.

Fabricability, we were interested, since this is a potential three-phased system, that you could manufacture these MPCs with standard processes and equipment.

I missed facilities, but one that was under the business and management factor was the ability of the offeror to have facilities that could manufacture MPCs, the transportation, and the storage cask.

I should say on the manufacturing, we do manufacture prototypes for the storage cask, and we do manufacture prototypes for the transportation cask under a Phase 2 of this contract, but only under Phase 3 is it that we only manufacture the canisters themselves.

On the evaluation process, there are restrictions on what I can say until the GAO makes their recommendations on the protest, but in general, we had oral discussions with each of the offerors. We had extensive best and final offers from each of the five. We went through a best value evaluation that looked at technical, business, and management end price. We made a recommendation -- the Source Evaluation Board made a recommendation -- and there was a review and determination by a source selection authority, and Westinghouse was awarded the contract.

On the subcontractor, the Westinghouse team, Westinghouse is the prime and Westinghouse has the subcontract. It's the Government and Environmental Services Company of Westinghouse, the same Westinghouse company that has M&O experience at WIPP, Savannah River, Hanford, Idaho, Fernault. It includes a Scientific Ecology Group out of

Carlsbad, New Mexico, and Oak Ridge, Tennessee.

There are two principal subcontractors, who are Packaging Technology out of Tacoma, Washington, and Chem-Nuclear Systems out of Columbia, South Carolina.

The contract is fixed-price, awarded for just over $14 million. It has a one-year duration from April 25th. It includes nine months to do the preliminary design and to provide the preliminary design reports.

We would then engage in an extensive evaluation of those reports against our design procurement specifications. Meanwhile, the Westinghouse team would be completing the safety analysis reports, with three months to do that.

The actual personnel that are in this may or may not be names you know. Pat Hopper, the Westinghouse, is out of the Scientific Ecology Group. He is located now in Sunnyvale, California, at the Westinghouse Marine Division. The Marine Division is the lead on the fabrication for Westinghouse, and even though we have no fabrication during this phase, Westinghouse is doing concurrent engineering so that the fabrication aspects are folded into the design as the design proceeds.

Dick Haelsig is the chief design engineer. Many of you may know him from the TMI-2 activities, father of the 125-B. That team probably has about 30 Type B packages certified under Part 71. They have about 10 packages certified under Part 72.

Quinn and Lehnert come out of Storage, Part 72, out of the NUHOMS-type equipment experience. They have the certification and design leads, respectively.

Ed Bentz, whom you may know, is a subcontractor to PacTec. He is well versed in liaison and requirements at reactor sites.

Carl Ross, the Westinghouse quality assurance manager, comes out of the Scientific Ecology Group, located in Sunnyvale now, and this work will be under the umbrella of the SEG QA program, which has been approved by the NRC.

The MPC assembly which is shown in the schematic is, as Jeff pointed out, rather thin-walled. They are stainless steel 316. They match ODs that come out of our design specifications.

The lengths, in addition to having large and small, we have long and short, the 192 and the 180 inches, and they're the overall lengths, not the cavity lengths.

There are six cavity lengths, and the number is driven by the fact that there are shield plugs, both top and bottom, and those shield plugs can be either depleted uranium or carbon steel, depending upon the type of fuel to be put into the canister, and they are fully interchangeable within any one size. All of the large MPC shield plugs are interchangeable, and all the small ones are interchangeable.

The capacity, as you remember, in the conceptual design report, we had a capacity of 21, 40 and 12, 24, which became the minimum specifications. The Westinghouse design is a 21, 44/12, 44.

The basket configuration is a support plate, typically around 8 or 10 of them, not unlike perhaps a Vectra NUHOMS design with guide tubes.

On the ability on enrichments, they are flux trap designs. They have ability on initial enrichments that exceed the 3.75 minimum in our specs. They have burn-up capability that exceeds our minimum of 40,000-megawatt days.

Typically, subject to detailed confirmation, Westinghouse projects that that set of specifications of characteristics could handle 90 percent of the fuel that would be available until the year 2015 and physically, by dimensions, could handle 95 percent of the fuel that's available in the pools in 1998.

They have chosen, mainly I believe for cost, to change the neutron-absorber material between the pressurized water and the boiling water reactor. We allowed them Boral, borated stainless and borated aluminum. They chose those two.

I should mention the borated stainless has no structural strength. That's kind of a no-no with the NRC. They are in the basket for neutron absorber. There is no borated stainless that has structural requirements.

The MPC storage mode is a vertical precast concrete-type device. Details are kind of being withheld. The transfer is horizontal with optional vertical. We do have some details.

The transfer device, as you remember, is to get out to the storage module. There are two of them. One is a 100 tons to service. Everything that has over 100-ton crane capacity and, therefore, take care of a lot of reactor sites. There is a 75-ton transfer cask in order to handle about 19 or 17 sites that are under 100 tons.

It has the capability in this transfer cask, as you can see those lids and bottoms, to go both horizontal, which is the direction people got, with optional vertical. It could, if the reactor building was big enough, take care of vertical.

It then results in kind of a novel device, an up-ender down-ender tilt fixture, which rotates the storage module from its normal vertical position to a horizontal in order to mesh up with the transfer cask. After that matchup, the canister is pulled by that hydraulic ram into the storage.

After being buttoned up, the storage module is rotated back for its storage orientation of vertical. When you choose to remove the MPC from the storage module, it can either go back to the transfer cask or directly to the transport cask by the same device matching up and using the hydraulic ram to push it into the transfer or transport cask.

The transportation cask, I characterize it as pretty plain vanilla, something the NRC has had. It is pretty consistent. It has demonstrated its stainless steel containment. They utilized depleted uranium gamma shielding, just for shielding not for structure, because of the weight constraints. They used cement-like material, the NS-3. For neutron shielding, it has pretty standard polyurethane foam impact limiters.

The rail car the Westinghouse bid is common for both the large and the small. It will be 6-axle. It will be AAR-approved, and it will be essentially designed from scratch. Therefore, it will be subject to having a test demonstration.

I was asked to address the analysis versus test requirements that will happen. Because the designs are rather straightforward compared to NRC requirements, there will be quite a bit of reliance on previously accepted features, and analysis will be used for events, such as fire and emersion and for the storage event.

However, there are characteristics that the NRC will probably view as not completely reviewed previously, and they will be impact limiter attachments, which always get attention, and the seal material performance. So Westinghouse is projecting doing engineering, bench scale type-tests during Phase 1 for those kind of characteristics.

There will be quarter-scale certification tests in Phase 2 for structural response, the 30-foot drop in the puncture test. It might be that you didn't have to do that because of the simplicity of this design, but with the schedule it appeared prudent to at least plan on doing these, and they are embedded into the schedule and the plan.

They are done in Phase 2. There will also be confirmation tests, we believe, in Phase 2 for the thermal tests, the storage.

I used to call this "package challenges." Someone pointed out it really is the drivers for the design. The heat loads, to be able to store 4-year-old cooled fuel, requires the enhanceability to remove the heat. Westinghouse has proposed aluminum heat removal panels within the support plates, meshing into the guide tubes to wick the heat out and make contact with the MPC shell and dissipate the heat. That's only for the large PWRs and is driven by the 5-year-old cooled fuel specification.

On the weight constraints, depleted uranium was used in a small transportation cask, as we expected the 75-ton weight limit was a challenge.

Also, the large transfer cask that I had up there, I forgot to point out a characteristic. It uses a liquid neutron shield which will be drained before the transfer cask goes into the pool and will be refilled when it is off the crane hook. It doesn't detract from the shielding because, at that time, the transfer cask is full of shield water.

On the Westinghouse criticality approach, they used flux trap designs in order to get that high initial enrichment capability, but they still must meet our specification with regard to collapsed flux traps, and they still have to do the calculations on fuel capability based upon our burn-up credit.

As Jeff mentioned, we submitted on May 31st the topical report for burn-up credit. It focused on actinides only. That means there was no fission product credit being sought by that. We will evaluate the Westinghouse design for its fuel capability using the "how to" book that comes out of this topical.

Let me quickly point out some of the schedule for Phase 1. What I have done is take a few hundred items. Actually, it is worse than that. I have taken a few hundred items and truncated it down to one page in order to give you some feel of what has happened.

It started on the 25th of April. We will run into

August on refining the design concept. We have already started developing the system safety plan with a submission due on the 24th or 25th of April.

We have started to engage the NRC. There are a series of meetings, at least four, that will be held with the NRC. The first one has already occurred. The preliminary design will come to us nine months out for an extensive review against our design requirements documents.

The other thing I would point out is that we will get the system safety report, and we will receive the human factors report at the same time.

I think Greg reported to you at one of the previous meetings that a requirement in the statement of work was that the vendor have a human factors specialist. Westinghouse has two of them on board. One is Dr. Roth, whom I know, and one is Dr. Mumaw, whom I don't know. Dr. Roth -- she is from the University of Illinois, I believe, and other gentleman is from the University of Pittsburgh. They are already involved in the design. We have a quarterly management meeting the 11th off July, and we will focus in on where they stand at that time.

I think that's about it. I've probably run over my time. Thanks.

QUESTIONS/COMMENTS

DR. PRICE: Gary Brewer?

DR. BREWER: On the challenges that have been tabled, was there any prospect that that will slip the schedule?

MR. CLARK: The protest?

DR. BREWER: That's right.

MR. CLARK: We have a determination that we need not stop work. Westinghouse is moving ahead on the proposed schedule. So we have signed a contract, and we are holding that to them.

There is an extensive amount of work that goes on, on a protest, that could well go, say, 90 working days after. So there is a lot of time. Anything could happen between that, and we obviously feel confident. The short answer is yes, something could happen and could interrupt, but we are proceeding as if the protest will not be upheld.

DR. BREWER: The second question, in rough numbers, how many of the MPCs are you planning to construct and at what price?

MR. CLARK: The first part is easy. For budgetary purposes, we budgeted for about 150. We have options in the contract that we could get any number of big, small, short, long that fits within whatever we want, and the maximum under the contract is above the 150.

The price is a closely held number. The conceptual design numbers are available, and we could provide those to you if you haven't seen those.

One aspect of this is when Westinghouse gives us the preliminary design in nine months, they will give a firm fixed price for Phase 2 and a revised estimate for Phase 3, and Phase 3 includes the price of those canisters. So, depending on what could happen in this procurement, probably the most sensitive is that number.

DR. BREWER: Thank you very much.

MR. WILLIAMS: Could I just add, the numbers out of the conceptual design range from 280,000 to 426,000, depending which little or big PWBWR.

DR. PRICE: Any other questions?

Carlos DiBella.

DR. Di BELLA: I have to admit, when the press release came out announcing the award, I didn't honestly know who PacTec was. Is this a new company or an old company with a new name?

MR. CLARK: I'm getting too old. I use these acronyms. Packaging Technology was a spinoff of New Tech/New Pac some time ago, has been around at least, maybe, a dozen years or so from the TMI days, with a size of around 20 people.

DR. PRICE: Any other questions?

Woody?

DR. CHU: Dr. Brewer asked the first half of my question, and that's about the number of packages that are to be procured.

Now, if the need arises and the MPC is a runaway hit, so that everybody wants one, the additional MPCs that need to be fabricated after that, could anyone be eligible to make that or only the offeror of this procurement can make that?

MR. CLARK: The DOE will own the design, and it plans to make it available to whoever would want to fabricate.

DR. CHU: Okay. So after the Phase 3 part of this procurement, then it becomes open; is that correct?

MR. CLARK: At least then, yes.

DR. CHU: At least?

MR. CLARK: I am begging the part whether utilities might elect to go off on their own with this design and have them built.

DR. CHU: And take Phase 3 away from you? Is that what you mean?

MR. CLARK: No, no. A parallel effort.

DR. CHU: Parallel. I see.

Thanks.

DR. PRICE: Carl Di Bella.

DR. Di BELLA: Both Jeff Williams and yourself have used thus term "collapsed flux trap," that I frankly don't remember seeing in exactly those words in the RFP. Was it there or was it phrased a different way?

MR. CLARK: Carl, I'd have to look. It may be jargon, but obviously it's getting rid of that spacing that you depend upon for neutron moderation. It might be better defined than that, but it is clearly defined in the specifications.

DR. Di BELLA: I have one last question. Jeff, you showed a schedule for NRC review, and I think that actually that schedule originated with NRC, but as I recall, it is predicated on them accepting an application from you in the first place. Do you feel you understand well enough what their requirements are to accept an application?

MR. WILLIAMS: Yes, we do understand that fairly well, and you are right that it is based on their accepting the application. I don't know what more to add to that.

It is based on a quality application, too, and they told us several times. It is based on two rounds of questions, rather than three or four, which may result from an incomplete application. So it has to be done right, and good, to meet this schedule.

DR. PRICE: Any other questions?

[No response.]

DR. PRICE: I would like to thank you very much for the presentation.

I would like to be sure to mention to the audience that there is an opportunity coming up for public comment, and if you have not signed up on the register and would like to make public comment later in the day, please be sure and do so.

We are running just slightly ahead of schedule, and we will take a 15-minute break and see you in 5 minutes until.

[Recess.]

DR. PRICE: We are going to begin, and J.C. de la Garsa of DOE Nevada is going to give us an introduction.

TRANSPORTATION - NEVADA STUDIES

J.C. DE LA GARSA, DOE

RICHARD MEMORY, TWR - M&O

MR. DE LA GARSA: Good afternoon. For those of you who haven't met me yet, I am J.C. de la Garsa,and I am the special studies manager under Dennis Royer in the Office of the Assistant Manager for Suitability and Licensing at the project office.

Studies related to issues that cut across project elements are called system studies, or special studies. Within the M&O, the special studies group, a part of the Systems Analysis and Modeling Department, reports directly to the M&O systems engineering manager, Mr. Rick Memory.

Today, Rick will present the results of Part 1 of the Nevada Potential Repository Preliminary Transportation Strategy Study. This study, which was submitted to the DOE in February of this year, was conducted in order to gather existing transportation data and to identify the reasonable alternatives for waste transport to a potential repository at Yucca Mountain.

Rick holds a master's of science degree in mathematics. He has over 20 years of experience in systems analysis activities. Rick spent 18 years with TRW's Ballistic Missile Division developing system and cost-effective models for evaluation of alternative basing modes for the Nation's intercontinental ballistic missile force. For the past three years, Rick has been manager of the Systems Analysis and Modeling Department with the M&O in Las Vegas.

Rick?

MR. MEMORY: Good afternoon.

The purpose of this study was to support the NEPA information needs relative to transportation mode evaluation and corridor selection. To do that, our goal was to determine and document the process, timelines, and costs associated with acquisition of a transportation capability of spent fuel to the repository site at Yucca Mountain -- potential repository site.

Our scope of the study was to look at the fuel that is leaving the waste producer sites via rail transport; that is, what we did was focus on the rail transport of the fuel within Nevada.

Our objectives, then, were to identify reasonable alternatives for transportation. So, to clarify what I just said was, the rail delivery of the fuel to Nevada, once it gets to Nevada, we looked at alternative modes for transporting it from the rail head in Nevada to the potential repository site.

For the rail transportation options, we categorized those into three categories of rail corridors that we recommend for further detailed evaluation, but we needed to monitor them for changes and then other options that we think can be eliminated from further study.

We also developed and/or updated cost, as was applicable, for existing corridors. We updated the cost, and there were some corridors that we created that were new. So we developed new costs on those.

Finally, we documented some potential EIS options and showed their linkage to design and construction activities.

Just a little background. In 1990, the Preliminary Rail Access Study was published. That study basically brought together all the transportation activity that had been conducted prior to that date. That study proceeded in evaluating 10 of the rail routes that had been identified, 10 of the 13 routes that had been identified in the past. That study did some very rough cost estimating to allow comparison of the rail corridors, and they came up with a recommendation for further evaluation of three of the routes, Carlin, Caliente, and Jean routes.

That further evaluation was then continued in 1992 when the Caliente Route Conceptual Design Report was published, and that provided a very detailed analysis of the potential Caliente route, including land use, environmental and institutional aspects, and provided some refined costs in comparison to the Preliminary Rail Access Study activities.

Since then, also, there have been other studies conducted by Eureka County, Lander County, and the University of Nevada-Reno, and these studies pertain primarily to the Carlin route that is coming out of the northern part of Nevada.

At this point, I just want to remind the audience that the criteria that will be used for the transportation mode selection and the actual route selection can't be finalized until we go through the EIS scoping. Once that EIS process is completed, the output from that process will then provide input to the final mode and route selection.

So the modes that we did consider in this study were rail, heavy haul truck which is the truck shipments in which the gross vehicle weight is in excess of 129,000 pounds, and we looked at legal weight truck from the point of view of handling the waste that comes into Nevada via legal weight trucks that doesn't come in by rail. We looked at that just peripherally.

Next is a map of Nevada, obviously. What I want to do here is I am going to be showing a number of maps like this. So I will point out some of the features that this map shows.

First of all, it is showing roads. Down here, we have Las Vegas. This is Highway 95, up to the Yucca Mountain site right there. This is 93, going north. What I wanted to show is also the existing railroads that are currently in Nevada.

We have the Union Pacific and Southern Pacific running east-west in the northern part of the State. At this point Union Pacific has a line that comes down here. Union and Southern Pacific share this route here.

There is a Nevada Northern branch line here. Union Pacific enters Nevada at this location, comes down through Caliente and right through Las Vegas, on into California.

That is the existing rail network as it currently exists in Nevada. So you will notice, obviously, there is no rail line to the test site. There was back around the turn of the century a Las Vegas-Tonopah or Las Vegas-Gold Field rail line that ran this way, but it has long since been abandoned and there is no right-of-way associated with that route any more.

I have other features and, because these are going to be on the following charts, just let me point them out real quickly.

This is the Desert Natural Wildlife Refuge. This is the Nellis Air Force Range, and this is the Nevada test site. We have the Walker River Paiute Indian reservation there.

These are the routes that were at least in existence at the time of the Preliminary Rail Access Study. There were, in essence, three routes coming out of the north. There was the Cherry Creek route that connected to the Nevada Northern route here that came south, the Carlin route, and there was the Mina route that hooked up to this rail line here that comes off of the Southern Pacific line. This is the Southern Pacific line here.

There are a number of options coming out of the Caliente area. There were three. There is the Lincoln County A, B, and C option that came out of here, and then there are a number coming out of the south, the Dike siding, Valley siding, Jean, Arden, Ludlow, and Crucero. So, basically, the State was covered, in a sense, with options to look at.

This chart gives a summary of the findings of our current study. What we have is basically four routes now that we have identified that we think do warrant further detailed evaluation. We have three routes that we have put into the monitor category for changes in their status, and then we have these six routes that at this time, I think, can be eliminated from further study.

In this box, this column here, we have basically a short description of the reasons they were put in each of these categories.

What I want to do now is, I have basically a map for each one of these and we will just go quickly through these. I will spend more time on the routes that we propose for further evaluation.

This is a map that identifies the Carlin route. We have originating in Carlin, off of either the Union Pacific or Southern Pacific line, that goes south. We branch off and can go either through the Monitor Valley or Smokey Valley, and on down south to west of Nellis Air Force Range and to the Yucca Mountain site.

One thing to notice here is that we have shown basically a range or a certain width here that says that we think within this width there is a good potential to be able to find some place to lay down a track and get the right-of-way for doing that, or at least it warrants further examination.

This is the Caliente Route that originates in the vicinity of Caliente. This particular schematic shows it coming off of Panaca. There is a Caliente option A and B. This goes through a fairly severe topography. This one bypasses it a little bit and then goes around the Nellis Air Force Range and on down to Yucca Mountain.

This is the Jean Route. Jean is 25 miles or so southwest of Las Vegas. You can pick a starting point somewhere around Jean, all the way, perhaps, to the California State border, and then go up to the Yucca Mountain. In this pathway, it goes up around Pahrumb and behind Spring Mountain.

There are basically three options that we have identified there, the Table Mountain, State Line option, and he Jean Route Wilson Pass option.

This is the valley route that originates just north of Las Vegas. Its potential is to stay north, just south of the wildlife refuge. There is a Paiute Indian Reservation here that would go north up between that and this Wildlife Refuge and then move on out to Yucca Mountain from there.

I will try to go through these fairly fast. This is the Cherry Creek route that we had an origination point about here, but there is uncertainty about the quality of this line. It is currently being upgraded, but it may not be upgraded to the quality of rails that we will need, and it doesn't offer much advantage over Carlin. So we have recommended not to consider that any further unless the quality of line changes.

I will show you some information about the Mina route. This is the Walker River Paiute Indian Reservation. The rail runs right through that reservation, and actually, the Army owns this rail. It is operated by, I believe, Southern Pacific, and the actual land in here is owned by the Indians. It is leased to the Army. The Walker River Paiutes have told us that they would prefer not to have a route there. If we were to go around it, we would start infringing on the Fallon Air Station operations. So, for that reason, it has been put on hold for the time being.

This map shows the growth in the Redrock Canyon area and why some of the routes out of the Las Vegas area have been rejected for the time being. The area outlined in black there is what the Redrock area looked like at the time of the 1990 Preliminary Rail Access Study. It has since grown to include this entire area here.

You can see that the Arden route originated here and runs right up through the Redrock Canyon National

Conservation area. So that doesn't look like that holds that much potential.

DR. PRICE: Excuse me. We have asked you to speak right into the microphone for the Court Reporter.

MR. MEMORY: Okay. I'm sorry. I have a hard time seeing this.

The Original Valley route is shown here. That runs through some land that is currently owned by BLM, but The North Las Vegas is eyeing that land for potential expansion.

It also went across 95 and went in the Redrock area, and for that reason, that route has been modified to what we now call the Valley Modified route.

The Ludlow-Crucero routes originated in California in what is now a California desert conservation area, and for that reason, we have removed those for further consideration.

These are the Lincoln County options that came down and went through a portion of the Nellis Air Force Range, Lincoln County Options A and B, and for that reason, the mission conflict with the Air Force, we decided not to look at that any further for the time being.

Option C was incomplete. It would either have required intermodal transfer at this location or a continuation of the rail that goes through some fairly heavy topography in this location. So we have decided not to consider that further as well.

That is the summary of routes. So you can turn off that other screen over there.

What we did, then, was did a cost for these routes that we are saying should be considered, potentially considered, further. The assumptions that went into this was that we used our unit costs for the Caliente Conceptual Design as a basis for the cost on the other routes.

We looked at features, such as grades, grade separations, tunnels, and drain structures and used those to cost the various routes, and we added contingencies for construction costs and a 24 percent assumption on the cost of planning, engineering, and construction management.

Finally, we assumed for our operations costs that this was DOE-owned and -operated equipment and that we were using it for a single mission, to transport fuel to the repository.

So these are basically the results. The Caliente Option B, which was the cheapest of the two options, is 355-miles long and a cost of about a billion dollars with roughly a $6 million annual cost.

The best-looking route in terms of cost and mileage is the Modified Valley route. It has the best topography. It is the shortest distance of 103 miles, and it has a number of the other considerations that I already addressed, but it is $355 million, at about $3.6 million annual cost.

The Carlin routes are in the $1- to $2-billion range, and the Jean routes are actually a little bit less than $500 million.

That is a summary of what we did on the rail. Then we looked at heavy haul, what we might be able to do to ship the fuel via heavy haul.

The reason we have to look at heavy haul is because we are carrying such a heavy load, a 125-ton-maximum loaded cask weight for the large MPC, and even the defense high-level waste cask is 115 tons, approximately.

So that drives us to consider heavy haul for road transport. What we did in this particular study was looked at developing an intermodal transfer station and how we might transport it, what the transporter might look like. What we did was identify three routes, and I will show those to you in a second, the Caliente, Arden, and Valley. The thing to note here is that we did not assume we were building new roads to do this heavy haul. We assumed we were using existing highways.

The intermodal transfer station has to basically provide a crane to be able to pick up the 125-ton payload and transfer it to a truck.

This is basically a notional picture of an intermodal transfer facility. You have the mainline. We built siding, or a spur, off the mainline, and constructed a high-bay building with a bridge crane that would pick the waste up off the rail car and put it on the transporter, which you can see on the top here.

This is a very notional picture of what a heavy haul transporter might look like. This particular transporter is about 150-feet long, 148 feet in this picture. It has a maximum tandem axle loading of 58,400 pounds. It obviously has 13 axles. Its weight is about 120,000 pounds. So, when you put the payload of roughly 250,000 pounds on it, it comes up to looking much like the weight of one of the rail cars. This trailer back here would, in fact, be steerable to allow you to negotiate turns.

As I said, we identified three routes. One route originating out of Caliente would go down Highway 93 to State Route 375, and up across Highway 6 and down 95 to Yucca Mountain.

There are a number of options for the starting locations over here. We could start back up in Cress line, which is off the map over here, or we would start down in Elgin. At one point, Elgin was a location that Caliente was proposing as an interim storage location. So we were just looking at how you might get out of there.

Then we could do the Valley route, which basically comes down 15 and goes back up 95. There is also an option of coming out of Arden that would go up Highway 160, and then this goes past Pahrump as well and on up to Yucca Mountain.

There is an option here, potentially. This goes right in. If all we were to do is stay on 15 and 95, we would go right to Las Vegas, or there are cross streets across here, but we could potentially look at building additional roads here, closer up here toward the mountains. We didn't do that for this study.

We did a real quick cost estimate. Our first indications from the State of Nevada would be that we would have an annual permit costs of approximately $30,000 a year.

If we were to lease the trucks, it would cost between 10- and $15,000 per shipment. Our estimate at the time we did the study was about $2.6 million for that intermodal transfer facility. So, based on 11,230 shipments which is one particular fuel scenario and over a 24-year period, the cost comes out to about $170 million, life cycle cost to do heavy haul, and this compares very well to rail cost that I quoted earlier.

I think that we have looked at this a little bit since then, and this is pretty much a bottom number. I am sure it would be more than this, but it is probably not terribly significant anymore.

There are some downsides to this, or at least some issues that need to be worked. The first is that there are frost restrictions on portions of these roads. This is toward the Caliente route, where you would either have to reroute three months of the year or do something to get permission to go on these frost-restricted roads. The frost-restricted locations out of the Caliente route would be here on 375, and then over here on Highway 6, there would be frost restrictions there three months out of the year.

The Arden route is here. There is some narrow road in this region that would need to be upgraded. If it is not upgraded by the time we need to ship this waste, which in our assumptions here was 2010, we would have to widen that road.

The Valley/Dike siding origination point has the downside of coming through the Las Vegas area, and all three options do have time-of-day and day-of-week restrictions that limit when you can actually do the shipments.

Just for completeness, the legal weight trucks are limited to gross vehicle weight of not greater than 80,000 pounds. As has been mentioned earlier, there is a potential for having 4 to 11 percent of the spent fuel arrive into Nevada, if that's where its final destination is, via legal weight truck. That is based on somewhere between 4 and 19 reactors, and it won't be able to accommodate rail transport.

The legal weight truck routes in Nevada are determined using the United States Department of Transportation regulations which allow for State designation of preferred alternatives, utilizing 49CFR 397.101 and 103. Now, of course, these preferred routes have to match up with the routes of the neighboring States, and I believe Markus Popa will talk further on how this road routing takes place.

This is a schedule chart that shows how the EIS activities will potentially link up with construction activities. The EIS starts here in the middle of 95. Right about now, they're in the process of putting out a notice of intent, and that will go on through the year 2000.

The design activity for rail and heavy haul needs to feed into that NEPA activity by the end of 1996. In this case, we are doing a single EIS that includes the transportation option that will be done in the year 2000. Based on that finding, we can begin doing some land access activities, determining what land needs to be accessed and how we would do that, but at the end of the EIS point, we could then make a decision between heavy haul or rail. So what we would do here is either the rail system or the heavy haul. Our assumption was not that we would do both. It would be that we would do one or the other.

In this case, then, we would hold off any further design activities until about the year 2005, and then it's a 5-year activity to develop rail line, basically independent of which one we choose, but it's a 5-year activity which is 3 years of contractor acquisition and design and 2 years of construction. For heavy haul, it's about a year-and-a half activity of getting yourself on-line.

In the handouts, you have a bar down here. It doesn't belong here, which says repository construction is taking place. That's not correct. Obviously, it doesn't take place until after 2004.

What's different on this chart, intentionally, is that we have an update of the EIS that occurs in the year 2002 through about 2005. In supporting that, we would then provide updated design information for rail and updated design information for heavy haul, so that there is not a gap between the EIS activity and the actual implementation of detail design. That pushes the land access activities out to the right as well, but still, given that you do this, you can still meet your 2010 timeline.

So, in conclusion, what we have done toward this transportation strategy in Nevada is that we have gone through this identification phase of identifying four rail corridors; at this point, three heavy haul truck routes. We are looking at the legal weight truck option for fuel that can't be accommodated by rail.

We then will move into the evaluation phase, which is the NEPA EIS, which comes out of NEPA EIS activity, and conceptual design feeds into that, ultimately leading to a decision on what the mode ought to be, what route we should use, who will use this rail, and when do we want to bring it on-line.

That concludes the presentation.

QUESTIONS/COMMENTS

DR. PRICE: All right. Are there any questions?

[No response.]

DR. PRICE: Are you all alive down there?

[Laughter.]

DR. PRICE: Dr. Chu.

DR. CHU: Are you using the $30,000-a-year annual permit fee to the State as a surrogate for road maintenance? I didn't see any road maintenance.

MR. MEMORY: No, that does not include road maintenance. That is just a permit fee.

DR. CHU: So, in other words, when you say life cycle cost for heavy haul is $170 million for 11,000 shipments, there is no road maintenance in there?

MR. MEMORY: That is right. That is why the cost will probably go up from what we estimated.

DR. CHU: Okay. Thank you.

DR. PRICE: If there are no other questions, then we will proceed on to the next speaker. It's on Transportation, Operations Considerations, with Linda Desell and Markus Popa.

I understand, Linda, that you have no butterflies, even though they are clipped to your coat.

MS. DESELL: Right here.

DR. PRICE: Yes.

[Laughter.]

TRANSPORTATION - OPERATIONS CONSIDERATIONS

LINDA DESELL AND MARKUS POPA, DOE

ROBERT ROONEY, ROY F. WESTON, INC.

MS. DESELL: My name is Linda Desell. For those of you who don't know me, I'm the division director for environmental and operational activities in the Office of Waste Acceptance, Storage and Transportation.

In your handouts, we brought one handout that I'm not going to go over, and the reason is Woody Chu had asked me to come here and to give you all, in part, a recap of what we did at the Transportation Coordination Group last week. I did give this update presentation there. It is there in the handouts for your information. If you have any questions, I'll be happy to answer them about that, but the details of what I went over in the update are actually contained in the other materials that I, Markus, and Bob are going to go over for you. So I would like to go straight to the transportation report, if you don't mind.

Quickly, here, what I would like to do is go over a little bit of background, talk about the report itself, and then get into the details of what we have in the various chapters. Copies of this report were released for the first time at the TCG meeting, a week ago.

In 1986, OCRWM published two documents describing plans for a Transportation System. These were the Business Plan and the Transportation Institutional Plan. We had intended to combine these into an overall OCRWM Transportation Plan.

Since 1986, as you all have watched us grow and change, there have been some very major shifts in this program. The Nuclear Waste Policy Act was amended, of course, in 1987. We have legal weight truck casks that are now in design, which were not at that time, and the multi-purpose canister design contract was let just a short few months ago. We have also had increased institutional activities. Our level there has increased since that time.

Our plans now for transportation system are reflected in several major documents, some of which you have seen and have reported to you by Jeff Williams in the past, and others. There is the Civilian Radioactive Waste Management Program Plan, which came out this past winter. There is the System Requirements Document, the overall for the waste management system, and the Transportation System Requirements Document. All of these were completed a few years ago. Most recently, Jeff Williams produced and put out the Transportation Subsystems Operations Plan.

As the current and future documents cover our technical information, the Transportation Business Plan and the Transportation Institutional Plan, we don't believe will any longer be necessary because they will be incorporated into these other documents.

Most of the documents that I have just listed for you on the last slide already cover many of the issues that were intended to be in these two plans.

In addition, the OCRWM Transportation Report, which we released last week, will be a document that we plan to update annually to improve and to provide information to all of the oversight groups and to our stakeholders on an annual basis.

The report gives the status of our overall transportation system, with special emphasis on our institutional issues. It consists of the three chapters, an introduction, description of the system, and a description of the institutional issues and what we are doing with those issues.

The introduction describes the waste management system, our spent fuel storage locations -- not ours, but where they are now -- repository siting activities, and waste acceptance.

In describing the actual system itself, we talk in the document about the development principles for the system, how that fits with the overall program approach, the transportation segments or pieces that we feel we have to put together, cask development, of course, the multi-purpose canisters, our major milestones that we need to meet in the program plan, and the bare-bones outline of our campaign planning approach.

Next is transportation institutional issues, and what I have listed is just a sampling of the things that we address in the document, such things as routing which Markus Popa will talk about in a few minutes, emergency response which involves our questions from stakeholders and others about what we are doing on 180-C, physical protection that has to do with the NRC regulations, also inspection enforcement which is NRC and State and local regulations and things like that, cask testing and design, and of course, liability coverage under the Price-Anderson Act.

The report is available. For anyone who doesn't have it, if you see me after the meeting, I will be happy to make certain that you get copies of it. I have made copies available to the Board, and if you all need more, just give us a call and we will be happy to get them to you.

Would you care for me to go through all three presentations and then take questions?

DR. PRICE: Yes.

MS. DESELL: Then let's wing right on into the old contingency plan, keeping with our butterfly mode here.

I want to go over the purpose of the plan, our early shipment scenario, and the elements we believe are necessary to support our early shipments.

Before I get into the purpose of the contingency plan, I want to make one short explanation. We have out at the moment two versions of the contingency plan, a Revision Zero and a Revision One. Revision Zero was done at the request of many stakeholders and our management to show what would we have to do if we had to reach 1998 from last April. We did that. That was Revision Zero. The only problem is that within 30 days or so, we are going to have to go back and do a Rev One where we can show people how much time it takes to do each of these elements, so they and we can sit down, and we can look at how this plan could be expanded or contracted to meet different dates.

I have not sat down or had my contractor sit down and play with those dates to do that work, but we have in the contingency plan, Rev Zero, the basis for ourselves to be able to do that, and also the basis for anyone else in oversight or otherwise who wishes to try and do that to figure out what we would have to do to meet a particular date.

We wanted to discuss the activities that we have to accomplish to make sure we could get to transport prior to 2010. We had to hurry up and do it faster.

We made certain assumptions in doing this. We assumed that Congress mandated the establishment of an interim storage site, and that that storage site would not be operational before 1998. The reason for that assumption is that we already had one Rev Zero that talked about 1998.

Another assumption is that the storage site would be Government-owned or leased, capable of handling bare spent fuel and all the different transportation casks, our own that we might design, but also those that industry might design and capable also of handling the MPCs.

In addition, we felt the acceptance capacities might not satisfy the levels set forth in our existing Annual Capacity Report if we are trying to move faster than 2010. We might not be able to meet those levels.

Development also that the OCRWM transportation subsystem will continue towards being a goal of fully operational in 2010, this would assume some preliminary operations.

Of the elements we believe are necessary to support early shipment are the cask availability. What we needed available are internal planning, traffic management, field operations, service and maintenance planning, and the institutional considerations that we have to deal with appropriately so that transportation is acceptable to the public and our oversight.

Cask availability. We have existing legal weight truck casks. Five legal weight truck casks are available at present for usage. There is the GA-4/9's which were explained to you that could be made available for usage starting about 1998. On the MPC transport cases, present schedules have the canisters and storage ready in 1998. The transportation overpacks are a little bit later than that. They are in calendar year 1999, somewhere in the beginning of it. So they wouldn't be available right in 1998.

Nuclear Assurance Corporation has developed a cask for storing and transport, as you know. NRC has certified that for transportation. So we know at least we could use that cask for transportation.

There are some other casks. They are out there. I believe there are five of them, but we cannot replicate those casks. So we did not use them, basically, in our planning because we cannot go. They have been grandfathered, they can be used, according to the NRC presently, but we can't build new ones just like them without going through certification again.

In our planning, we need to develop our draft campaign plans, beginning no later than 12 months before the shipments; earlier, if we can do it. For example, long-range plans for a second and third campaign would have to be started at the same time you start the first campaign.

For operational testing for transportation, it needs to begin nine months prior to the shipments.

Our traffic management would have to provide operational management through a Transportation Operations Control Center. This would be similar to the one that DOE already runs and should be operational at least six months prior to shipment.

On vehicle tracking system requirements, we believe that the Transportation Tracking and Communication System that is presently being used by DOE would be sufficient. However, it has been questioned. So we are continuing to look at that and respond to our stakeholders' questions about it.

In transit, physical NRC safeguards and security planning would begin about 18 months before operations and, of course, would have to be fully in place at the time that we began to transport.

The Control Center would have to establish the highway, rail, and service contracts, and you see here the time periods, 6 months for highway prior to operations, 9 to 12 months for rail. We would have to have those contracts in hand and ready to go, so that we would be able to do the finalization of our campaign planning.

With respect to field operations, this would be a matter of being ready to go out and have site-specific servicing plans for each of the institutions or facilities where we have to pick up spent nuclear fuel. Those have to be ready at least 12 months ahead of time, so contracts and everything else can mesh together.

We would have to have pre-operational testing on our casks 12 months prior to shipment.

We might have to contract training services, et cetera. So we're trying to keep that in mind.

We also need to identify any specific purchaser, purchaser being the reactors or DOE facilities to be serviced, who might need some kind of special equipment we might need to provide in order to pick up their waste.

There would need to also be supporting plans to the Federal Radiological Emergency Response Plan, and I hope I can explain this better than I did the first time at TCG. This is something that each shipper has to do. This overall plan is already in place, but OCRWM itself is not yet a part of it. We haven't filed our appropriate plan with the Defense Programs people at DOE yet because we have yet to develop it.

When we do, we will file with them, we will enter the system, and we will do that so that we are ready to go. Initial planning for that would have to be about 24 months out. The system exists, but we are not yet a part of it because we are not yet shipping.

Service and maintenance. We have responsibilities to maintain the casks and provide inventory management of all the pieces of equipment we will own. If we don't have our own cask maintenance facility, of course, we will have to hire someone to do it for us. We will need to begin to acquire all of the necessary automated equipment, et cetera, to be able to keep the inventory, do the campaign planning, et cetera, about two years prior to operations.

Again, these are the institutional considerations. This is a sampling of them. You can see the same sort of things crop up over and over again in transportation. It's the same thing. Sometimes it's stated just a little bit differently. For example, emergency preparedness was listed in the previous document, but it is covering the same things here with Section 180(c).

We plan to continue a good institutional program to keep people informed so that transportation will be acceptable as we begin to move forward.

The last presentation before you all can ask any questions is on Section 180(c) of the Nuclear Waste Policy Act. I want to give you a quick background and talk a little bit about the Notice of Inquiry we put out this past January, the comments that we received, and we have another Notice of Inquiry going out this month. In fact, it started through concurrence yesterday. I concurred on it myself yesterday. It is sitting in Sam Russo's box right now on what future actions we plan on this will.

For anyone who might not have had the chance, this is the actual section. It's a matter of providing technical assistance and funding to the States so that they may provide funding to the local governments and providing funding to Indian tribes. If we're going through their jurisdictions, the idea is that we need to provide them with a way to get ready to be able to handle emergency preparedness in their jurisdictions and any impacts that might happen from our work.

The document that we did, the strategy that we would like to approach or that we did in 1992 was put out, and it tried to show how we wanted to approach the idea of providing the assistance. It outlined a process to meet the requirements of Section 180(c).

At the same time, we put out preliminary draft options for providing the technical assistance and tried to identify the different kinds of options that were available to the Department to implement the funding and technical requirements in the Act.

As roles changed a little bit, we felt that it might be, instead of just working with the Transportation External Coordinating Group and the Transportation Coordinating Groups, that we might want to broaden this a little bit more to pick up a little more of the public flavor and the concerns about Section 180(c). So we started to do an administrative procedure-type process that would allow us to use the Federal Register to try to reach more people.

In January of 1995, we put out a Federal Register notice about our need to develop the policy and solicited comments from the public on all aspects of 180(c), and due to comments from three of the four -- well, we had cooperative agreement groups with various groups of states, such as the Midwestern Governor's Conference, et cetera. Three of those groups wrote in and asked for an extension, and we granted that extension so that they could provide us with fuller comments, and they did so by the extended date on May 18th.

That Federal Register notice we put out in January committed the Department to investigating the funding and technical assistance that were contained in the original 1992 Draft Options Paper. Some of the options that we had there were using established Federal agency programs that are already out there. DOE has some, and other agencies have some.

They were things such as establishing direct agreements with state, tribal, and other organizations; establishing a Department-wide grant program in conjunction with the Office of Environmental Management or just having a OCRWM grant program or using some kind of composite approach.

We received 36 comments, and I wanted to note one thing. On your handouts, I don't know how it happened, but in using the computers and shuffling things around, your slide in there, I believe, says that we received 16 comments, and it's really 36.

We at one time used this same slide because, as we began to categorize the comments when they came in, the categories of folks who were sending the things in didn't really change, but the number of people who sent things in did. So this slide here is the correct one. I will give you a moment to make any notations you want to do.

As you can see, we got a wide range of people responding back to us. Some of these folks responding were the folks who attend our tech and our TCG meetings and some were not. So we did achieve our purpose in trying to reach a slightly wider audience.

The Federal Register notice in June will present additional information on the funding and technical options. We tried to expand on these options as a result of the comments we received. We received a lot of good suggestions from people, and so we tried to rewrite our options to provide people another opportunity to take a look at what the different options looked like as their input was put in. We are still very open on the policy in that we're trying to formulate, and so we are looking again for comments from people on these more detailed options.

Once that comment period is over, we'll be looking at another Federal Register notice in which we will actually propose what we are going to do on Section 180(c) in March of 1996, and then put out the final policy in June of 1997.

To be fair about reporting to you on what happened at TCG, several stakeholders got up and made a very strong pitch that if Congress were asking us to move faster, then our schedule here is going to have to be modified, and that is quite correct. If Congress does indicate that we have to move faster, these dates will tighten up and move a little bit faster for all of us.

That is all I have to report on that. Do you have questions?

DR. PRICE: Questions from the Board or staff?

[No response.]

MS. DESELL: Silence is golden.

DR. PRICE: When you indicated initiation of transportation before 2010 and you gave that particular talk --

MS. DESELL: The contingency plan, yes.

DR. PRICE: Yes. -- is there a contingency on when that begins and how does training fit into that? Do you have to get the training done before the contingency shipping would start?

MS. DESELL: We are not going to ship without having trained personnel and drivers. I will lay down in front of the trucks at that point.

DR. PRICE: But the 180(c) is what I'm talking about, the training.

MS. DESELL: All right. The 180(c).

DR. PRICE: Yes.

MS. DESELL: The Department presently is committed to provide that money three to five years in advance of the first shipment. If for some reason, the time period shortens up considerably more than that, then we will have to work with our stakeholders to find an acceptable solution.

At this point, I don't want to start guessing on exactly what that solution would be because I want to work with the stakeholders on it, but if we had to do it sooner, then we will have to work with them to find a way to do it sooner.

DR. PRICE: Could you briefly describe the transportation, tracking, and communication system now existing that you referred to earlier?

MS. DESELL: Could I defer to Markus Popa on that, please.

DR. PRICE: Sure.

MR. POPA: Presently, they use Transcom, which is located in Oak Ridge, I believe. It is satisfactory.

I believe the complaint was on the last foreign fuel shipment, when everyone in the world logs onto it, it can get a bit overloaded. There are also existing defense systems that have the capabilities, and we are looking at that.

DR. PRICE: With respect to transportation, tracking and communications upgrade from the existing system, what plans are there for upgrading traffic? Obviously, capacity is one, but how about programs for alerting where the spent fuel truck is and shouldn't be or dwelling too long or things like that?

MR. POPA: They exist right now. I actually watched a demo in Sandia of the defense use. It is classified, but it's called Star Base, and it already does that, but actually, it is based on a mainframe. It is kind of hard-wired. It might be pricey and it might be slow, and it was built 15 years ago. We've come so far with PC-based technology that we're looking at upgrading.

DR. PRICE: In the upgrade, if the existing is classified by DOD, I take it, does that mean that for this Board to understand and get access to it, we have to get a DOD clearance?

MR. POPA: They showed me, and I don't have my DOD clearance anymore. They showed me on a walkthrough at Sandia, but they just couldn't explain certain things. It was sort of funny. They could show the touch screen. It's very impressive, a touch screen panel of where the truck is, and it tells the operator go call the fire department, here is his phone number and all that, but when asked where is the control center, they can't tell you that. They had a representation of how much gear would go on the truck. I asked how much would that weigh, and they said I can't tell you that either, but you can infer from looking at it.

DR. PRICE: With respect to what goes on the truck and also in terms to expect the technology changes with regard to the truck and the cab, how are these going to be integrated into the cabs so that we don't have a plethora of controls and displays and radios and things that are kind of just stuck around?

MR. POPA: They pretty much do it now. Trucking companies have their own systems. I am not that familiar with it, but I know they have their own systems right now to track trucks, and the NRC requirements for communications, I believe it's two different levels. One might be allowed to be a cellular telephone.

DR. PRICE: Yes. I understand they do it right now, but if the end result of the truck cab is a number of displays and it could be a variety of things including brake conditions and so forth that are not presently commonly found in trucks, but you add a number of displays including, say, emergency kinds of things that might be added to these cabs for the transportation of spent nuclear fuels, you are getting into an area in which you've got to do some human factors engineering of a cab design, and that is specifically what I'm trying to get to.

MR. POPA: Yes. I got that, finally.

I am not sure how many displays are actually in the trucks. There are communications. I thought most of them were verbal. I have to infer that. I'm not exactly sure.

MS. DESELL: Certainly, Dr. Price, as we go along designing the system, if we find something that is going to be confusing to our drivers, we would have to address that issue and do something with it to make certain that we don't have the driver distracted from doing his or her job.

As was explained a little earlier, we want to build the best possible system we can. If we point to transportation coming along early, I would certainly expect that activity in the area that you're interested in would pick up considerably.

I realize we haven't done very much to your satisfaction at this point, but it does need to pick up considerably, and I don't think you would find anyone at DOE arguing with you about that.

DR. PRICE: Yes. I'm just hoping you will be very sensitive to the need for an integrated cab design, especially with the number of different things that I have heard as possible things that could be stuck on a truck carrying these things, for example.

MS. DESELL: Certainly, the need to keep the weight down would also argue for a very integrated design inside the cab in terms of what kind of equipment we would use for communications, et cetera. If you have too many whistles and bells, you get too much weight. So that weight is going to drive us towards what you're looking for, I believe.

DR. PRICE: Okay. Are there other questions?

Carl Di Bella?

DR. Di BELLA: I read in this handout that you didn't refer to that you are reconsidering the notion of a full-scale versus subscale testing --

MS. DESELL: Yes.

DR. Di BELLA: -- with the idea of making a policy decision on this by the end of the year.

MS. DESELL: Would you like me to expand on that a little?

DR. Di BELLA: Yes, I would. Where is the pressure coming from and why, and does this mean specifically you've changed the testing requirements for the GD-4/9 casks or any transportation?

MS. DESELL: Let me tell you what our approach is at the moment. When we were doing the program plan, we talked to Dr. Dreyfus and said we have an awful lot of stakeholders out there who have been asking us going on then 11 years about full-scale cask testing, and we need to make a decision about this. He said, "Fine. Next November, you put everything together, and I'm going to make a decision for you on whether we're going to do it or not."

Now, we have a lot of stakeholder input from the last 10 or 11 years, and we're going to use that. We have also been taking additional inputs as the program plan went out. People have been talking to us in meetings and giving us feedback.

We will present a suite of options to Dr. Dreyfus of things that he could do or ideas that have been suggested by stakeholders, and then he will decide whether we will do full-scale cask testing or not do full-scale cask testing.

That does not mean at that point in time he will decide which cask will be tested. He will decide whether or not we are going to do it. Then we will work with oversight groups, stakeholders, et cetera, to decide which cask we test.

The first hurdle when we talked to Dr. Dreyfus about it that has been so hard for the program to get over in the last 10 years is are we going to do it or aren't we going to do it, and we've waffled for 10 years.

Dr. Dreyfus said the first decision is are we going to or not going to. So that's what's going to be done in November, will we or won't we, and then if we are, we will work with everyone to come down and decide what we are going to do and how we are going to do it.

The only decision in November is do we do it or don't we do it, and then to move from there and work with oversight groups, like TRB, with interested stakeholders, other oversight groups, affected parties like the State of Nevada, the local governments out in Nevada, the groups in the different governors' associations, et cetera, that we have cooperative agreement groups with and try to come to some reasoned decision on an appropriate way for the Department to actually do full-scale cask testing, if Dr. Dreyfus decides we're going to do it.

What do we test, when is the best time to test it, and how do we test it, those are things that come after that November decision, but that's basically the approach we're on right now is to get over that first hurdle, that question that we have never been able to answer for the last 10 years.

Anything else?

DR. PRICE: All right. We'll go onto the next speaker.

MS. DESELL: All right. Markus Popa will be covering Routing.

MR. POPA: Good afternoon. My name if Markus Popa, and I work for Linda Desell at the Environmental Operations Branch. I may not be wearing butterflies, but I have them. I just internalize mine.

I will give you an overview of what I will be speaking about on how we presently ship via highway and rail, how OCRWM deals with the stakeholders, the EM and OCRWM partnership in this event, some of the terminology the routing people bounce around, where and what we're doing and how far we've gotten on a Draft Routing Guidance document, and the milestones.

Presently, in highway, there are regulations that actually control what is called Highway Route Control Quantities. There's a technical definition for that, but it has to do with activity levels and amounts, but for us, it's virtually everything.

What the regulations state is that we ship on a preferred route to reduce time in transit, that regulation being, as Rick pointed out, 49 CFR 397. It's also called HM 164 due to the docket number. You'll hear that sometimes.

What these routes state is that we ship on preferred routes. Those preferred routes are interstates and bypasses around cities.

Additionally, we have to take the shortest route to get to that preferred route from the destination and the shortest route to get to that off the interstate to the point of destination, with a slight exception, There is what I call the 25-5 rule that allows us on that shortest route to get to the interstate.

If it looks like it's questionable, we're allowed to go no greater than 25 miles longer than that shortest route or 5 times the length of the shortest route. So, if your shortest route was one mile and you had another 1 that was 6 miles, that would be acceptable for us to select that as another route to get to the interstate.

Additionally, each State and tribe can select an alternate route with some guidelines published by DOT, and that alternate route would become then the preferred route rather than the interstate.

Why do we need this guidance? For short shipments, it is not really a problem. There are only so many options to get on a short one, but on a long, say, coast-to-coast shipment, you can generate that fall within the law multiple routes. The methodology and the logic between choosing between those routes is why we are developing the guidance.

I stated before that 90 percent of the OCRWM shipments will be by rail. Rail is fundamentally different than the interstates, principally because land is privately owned. There are no existing regulations for rail routing at present. What we do have is the 1988 Environmental Management and the branch underneath them, the Transportation Management Division. Each was issued some guidance, that guidance being to minimize time, distance, interchanges, and the number of carriers, use the best track, and it specifically called out the use of interline, a code maintained by Oak Ridge, to use it.

Lastly, we are still studying and looking at the use of either special or dedicated trains, rather than general commerce.

Some of the established OCRWM stakeholders have expressed an intense interest in our development of routing guidance and assistance. These that I'm talking about are 10 cooperative agreements that we keep, and they include all the councils, State governments, and energy boards, the Indians, CBSA, and emergency responders.

Additionally, we receive a lot of this guidance with TEC, the Transportation Emergency Coordination Working Group, the one we're going to hold in July in Kansas City pretty soon, and TCG, two weeks ago. Additionally, in our draft mission plan amendment, we stated that we would develop rail routing criteria if the Department of Transportation did not.

I will talk about our partnership and why it exists with environmental management. About two years ago, EM heard that we were developing routing guidance at one of the TEC meetings, and they let us know that they'd like to be a player. Some of the advantages of this is it would provide a consistency between EM, OCRWM, and actually DOE on how we shift.

When I say "cost sharing", I'm really talking about no duplication of effort between different offices on doing the same thing.

EM is in the lead currently because of shipping. So it made sense. OCRWM is going to stay involved because anything developed by EM independently would probably set a precedent for us. They feel the same way about us.

I will speak about some of the terminology we bounce around on the route selection world. When I say "route selection," I'm talking about the act of choosing between acceptable routes when multiple routes from a particular shipment can exist.

Some of this, also, is also driven by mode. What I mean is if we are shipping a lot, we are going by rail, end of discussion.

Also, as I discussed before, is what the facilities themselves can handle, both the receiving and the destination size of the crane, and whether to use barge, such as that. That will determine the size and the package and determines whether we can go by rail or highway.

When we say route selection criteria, those are the standards we use to determine what leaves of the selectional routes. Examples of these criteria include maximum use of interstates, reducing time in transit, minimizing population along the routes, avoiding high population density areas, et cetera.

Methodology, however, is how you exercise that criteria and apply it to select the shipping route. That led us to develop some discussion papers that we handed out at Tech in January in Charlotte, which talked about our stakeholder input and our base methodology at the time, and right now I'll lead into the draft guidance document and how far we've come with it.

Right now the guidance document addresses highway and rail. It is principally written for the traffic managers to help them choose between multiple routes.

The guidance will include the criteria, which right now our criteria are the DOE guidelines and regulations, which really say reduce time in transit. Additionally, we put in to avoid population exposure.

The methodology we used is first to generate alternate routes, especially on long-distance routes. The way we do that is we alternate the variance in the routing codes, which vary slightly. We generally default to 10 percent, but that is still in the draft and is up for options.

By changing the variance and the variables, which include impedance factors, we can get slight differences, in effect, within the error rate of the code. Over long distances, we may get four or five routes that vary by a matter of hours. That's within the error rate of the code, and all would be permissible by DOT.

We will generate some alternate routes, maybe three to five, and from that, we'll select a primary, what we think is best, basically using avoidance population exposure and common sense.

Then we intend to go to State, tribe, and local companies, and the rails, rail companies in particular because they're the ones that truly know the level of integrity and the infrastructure of their bridges, whether or not they want to go through a different route, et cetera.

Our major milestones -- and I'm trying to work with EM, and they are in the lead -- is to put out a Federal Register notice of availability of the document in June. I'll be handing out the draft in Kansas City in July.

You can see there the Transportation Internal Coordinating Working Group -- the TIC, sorry -- in the summer of '95 we had them review it. That's internal to DOE only, to get a DOE order launched, how much problem it would be between other offices, and we have a document completion in our program plan for mid-1996.

That is all I have. I will entertain questions.

[No response.]

DR. PRICE: If there are no questions, then we will go onto the next. Thank you.

MR. POPA: Mr. Bob Rooney from Roy F. Weston.

MR. ROONEY: I feel like the caboose on this railroad.

[Laughter]

MR. ROONEY: For the first time, there was a Rail

Issues Panel within the Transportation Coordination Group meeting. It appears to have been a welcome addition to the TCG meeting agendas.

There were representatives from the Association of American Railroads, Federal Railroad Administration, American Association of State Highway and Transportation Officials' Standing Committee on Rail Transportation, M&O, and Mineral County, Nevada.

I made some introductory comments, and I focussed on the fact that since the economic deregulation of the railroad industry in 1980, there has been considerable improvement in the infrastructure since the railroad companies now have a great deal more incentive to reinvest in the physical plant and equipment.

Another factor that should be kept in mind is that the Nation's railroad network is going to be continually changing and evolving system, and we can expect more abandonments in the future, the downgrading of some lines and even the upgrading of others, and they will consequently be in effect on the intermodal mix of spent nuclear fuel moving by rail.

The next individual from the M&O summarized a report on the transportability of the large MPC. This report was based on discussions with the Clearance Bureau at each railroad in which those sites that could utilize the

125-ton, or the larger MPC, were examined in terms of access in and out of those sites based on the use of a 6-axle rail car, which has a gross-weight-on-rail capacity of 394,500 pounds.

Generally, the result is that, with only a few instances, there are no restrictions of any concern to DOE, and in those few instances where there was a concern on account of the infrastructure into the site, there were ways to work around those restrictions, such as the use of the spacer cars, reduced speed, or where actually necessary the use of a small MPC.

The gentleman from Mineral County, Nevada, on the panel expressed concern about the rail infrastructure and the large MPC. This is, of course, a subject that has to be continually monitored. As I say, the network evolves over time. He also expressed concern about the train dynamics of the large MPC and preferred the 75-ton MPC as the standard single-design operating unit. He also recommended an examination very thoroughly of the dedicated train option.

The gentleman representing the Association of American Railroads urged that a risk management plan be put together prior to the design of the transportation system. In this sense, the transportation system design is if, for example, there were a dedicated train employed, that all of the components of that train, not only the spent fuel cask car, but also any bumper cars and other equipment on the train be planned carefully to utilize the best available technology to give the best train dynamics available.

Other objectives of the Association of American Railroads are to be able to operate said trains at the timetable-authorized speed without requiring any passing restrictions for those trains. The AAR also recommends the use of dedicated trains. In connection with the risk management plan, the AAR is currently reexamining the NRC's modal study and has retained a consultant to assist in that study.

The Federal Railroad Administration also participated in the panel, and one gentleman from FRA described in general terms the enforcement and investigation functions and how the FRA is organized and operates its inspection plan, and he described the various inspection disciplines, which are tracks, signal and train control, operating practices, mode of power and equipment, and hazardous materials. He also mentioned that the report, which is due from the Department of Transportation on dedicated trains, is expected to be released within 30 days, and it is already quite overdue at this point.

Also, the other gentleman from the FRA reviewed the enhanced inspection procedures employed by FRA in the past on spent fuel shipments and indicated that once the

OCRWM system got up to full rail shipping capabilities that it would necessarily strain the current FRA inspection resources, and that was a cautionary note to us.

The last individual who participated on the panel was from the Standing Committee on Railways of AASHTO, and he urged attendees at the TCG to realize that the State DOT rail planning function can be a source of valuable insight to State individuals. He focussed on the continued growth of short line and regional railroads as the larger railroads, too, sell properties that they no longer wish to operate within the larger Class 1 network. He dwelled on the critical feature of interchanges between railroad companies, which sometimes are the areas where the efficiency of rail transportation suffers because of the exchange of cars and the delays that entail between the railroad companies, particularly now as the railroad companies have increasing traffic and the capacity constraints are becoming more critical.

We had some comments among the panelists, and the gentlemen from the Association of American Railroads was interested that DOT keep very current on the evolving nature of the railroad network; in particular, the situation on abandonments. The AAR was also concerned with recovery time in the derailment of an MPC.

The Department of Energy has spoken to specialists who recover railroad equipment in derailments, and while they cannot conceive of a circumstance where they couldn't recover a large MPC, it is always the question of how long it will take. The railroad, of course, being in the business of flowing commodities over lines is concerned about how long railroad line would be closed, since it's a matter of great economic concern.

The AAR also mentioned they didn't think the 75-ton MPC as the sole cask would be necessary because of the railroad's capability to, of course, handle much heavier loads. As part of the assessment of the NRC modal study, they would be examining the relationship between train speed and the risk issue.

The gentleman from AASHTO emphasized that when a State is notified of a rail shipment that naturally the governor of that State will turn to his State Secretary of Transportation for a review of the features of the particular route in question, and thus, the importance of coordinating ahead of time with the resources and the State DOT.

There were a number of questions and comments from the audience to the panel. One gentleman from the State of Nevada commented that little discussion of routing had gone on within the panel, which is true, and the question was to what extent should routing seek to avoid major metropolitan areas.

Another question of interest was on the FRA's enhanced inspection program for spent fuel which, in effect, is 100 percent inspection of each spent fuel shipment.

There were other questions about, for example, should the rural areas be discriminated in some fashion on the routing issue.

Another question is the extent to which a rail line such as a DOE-owned rail line in the State of Nevada would subject to the same safety regulation as railroad main lines are, and the gentleman from FRA addressed this issue insofar as it was Government railroad line and not part of the commercial railroad network in the country. FRA does not have a clear and firm jurisdiction, but it does conduct courtesy inspections of railroads owned by the U.S. Government elsewhere in the country and has been very satisfied with the conditions they have found on those rail lines.

Another question was on why is there seemingly a considerable difference in routing between railway and highway on hazardous material, and as Markus mentioned earlier, you get to the issue of the railroad companies being private property. It has generally been felt that the railroad company management's knowledge of their own physical facility is the best judge on which route they would use for safety and efficiency, particularly since the motivation to keep the line operating safety is so great. There has never been the same approach towards routing regulation for railroads as for highway.

Finally, there was another comment by a gentleman from the State of Nevada who thought that the 75-ton MPC was preferable to the 125-ton, especially if there were to not be a rail-served storage site in the State of Nevada.

Another comment by that gentleman was a concern that perhaps the study reported earlier on the panel on the transportability of the large MPC might have had an overly optimistic outlook in the way it was conducted.

That is all there is to say on the report at this time. Are there are any questions?

DR. PRICE: All right. Are there questions?

I might comment that the concern about train dynamics and handling and so forth, this has been a concern of the TRB, especially with respect to heavy loads on the rail. We have asked DOT to respond to our concern, particularly with respect to the initiation of residences and things like that, the positioning of a heavy car with lighter loads in between that. We have not really had a satisfactory response from the Department of Transportation on this particular issue, but just for the record, it has been an ongoing concern of ours with respect to very heavy loads.

At this point, I concur with their stated concern about train handling and train dynamics with respect to carrying these kinds of loads.

The adequacy of the present system with respect to train speeds and not reduced speeds, I think, is also a concern that we have.

That is a comment. If you want to respond, please do.

MR. ROONEY: With regard to train dynamics, I would state that everything I have heard thus far, particularly here today, in regard to the design of the 6-axle rail car by Westinghouse is that it will undergo a thorough testing which would include the Association of American Railroads' Transportation Technology Test Center at Pueblo, Colorado. So I suspect the dynamics of that car and/or dedicated train would be very carefully examined.

I think there is a lot of awareness of the issue that you raised.

DR. PRICE: You are assuming a dedicated train in your response.

MR. ROONEY: Well, I would say possibly, if it is in that kind of a configuration, but the dynamics of the car in and of itself can be tested, too.

DR. PRICE: Because the car isn't by itself.

MR. ROONEY: No. And if it were operated in a general commerce freight train, the AAR Test Center has the wherewithal to simulate that very effectively, I believe.

DR. PRICE: If there are no other comments or questions -- yes, Linda.

MS. DESELL: Dr. Price, you asked a question before about equipment in a cab, and T.C. Smith sent me a note and said that he could give you a bit fuller explanation if you like of what he is planning on doing in the test vehicle.

DR. PRICE: Yes, I would.

MR. SMITH: Mr. Price, this is T.C. Smith.

We are going to install and evaluate the Transcom system in the cab as part of our over-the-road operational assessment. The configuration is really not much bigger than a notebook computer, and we are very sensitive to the fact that the vehicle operator in that truck needs to be focusing his or her attention on operating the vehicle.

We will be tracking the progress of the over-the-road test from our offices in Vienna. So we are very sensitive to the configuration in the cab and the need of the truck driver to focus his or her attention on operating that vehicle and not being distracted by other things going on around them.

DR. PRICE: We will be interested in seeing how all of that comes out.

If there are no other questions or comments, we will take a break for 10 minutes. Then, when we reassemble, we will go through questions and comments. So we will reassemble at 4:30.

[Recess.]

QUESTIONS/COMMENTS

DR. PRICE: We are privileged this afternoon to have three persons who have signed up for the public comment session.

The first is Bob Halstead. He was referred to by the last speaker a couple of times as the gentleman from Nevada.

Would the gentleman from Nevada please take the mike.

MR. HALSTEAD: Thank you, Dr. Price. I'm Bob Halstead. I'm with the Nuclear Waste Project Office with the State of Nevada.

If Bob Rooney was the caboose on the train, I suppose, as usual, my role is to be the prickly pear in the punch bowl today, but it may surprise you that I have some criticisms of some parties other than DOE. I would like to run over five topics this afternoon: the GA-4/9 cask system, the MPC system, the DOE Nevada Transportation studies, the other aspects of the DOE Transportation Program activities, and I've saved some special western diamondback venom for some pending and proposed congressional proposals.

Topic Number 1 is the GA-4/9 truck system concerns. I think we need to think about it as a truck system because of the peculiar weight limitations that the cask imposes on the design of the trailer and selection of tractors.

To be brief, point number 1, we believe a full-scale testing is needed because of the innovative design features, fabrication techniques, and materials used in this cask. One of the particular accident scenarios we are concerned about would involve a sideways midpoint impact which bypasses the impact limiters. For example, if a truck jackknifes into an overpass abutment or a bridge abutment at high speed, we are particularly concerned here about loss of shielding whether or not there is a loss of containment.

Point 2, we are concerned about the performance of the GS-4/9 in accidents exceeding the hypothetical conditions assumed in the NRC performance standards, for example, accidents involving longer duration or hotter fires, and in particular, we are waiting to see some modeling results on the performance of that cask in a 475-degree fire that might last from 4 to 8 hours. As you know, the regulatory standard is 30 minutes. In the past, we have identified concerns about fires in the 2,200-degree

Fahrenheit range that might last for 2 hours or more

Point 3, gee, nobody appreciates the human factors work that T.C. Smith is doing more than we do. We called attention to these human factors and safety issues resulting from the weight limitations when the GA-4/9 preliminary design was first unveiled. Because of the lateness of the hour, I am going to gloss over some fine points here.

Some examples about the peculiar concerns about this cask design and the kind of transportation system configuration that would be associated with a repository or a storage facility at the Nevada test site or Yucca Mountain would include the following.

First of all, the trucks are going to be making very long hauls. Our past experience is mostly in medium to short hauls. There have been a few cross-country hauls, but the average distance for truck hauls has been in the 4- to 600 range.

Now, the typical kind of haul we would be focussing on with this cask would be shipments out of a reactor like Ginna or Indian Point, where we are talking about shipments of 2,000 to 3,000 miles in length. With the concerns about induced noise and vibration in the cab-over-engine tractor, we think when you are looking at these long hauls where you are talking about 50-plus hours under the best conditions and possibly 70 hours that we have got real concerns about driver fatigue here. Indeed, it may be necessary to come up with solutions that involve things like changing drivers at predetermined destinations along those routes.

Another aspect of this would be the more frequent refueling stops that would be necessary because of the limited fuel capacity which, again, results from the weight limitations.

For example, on a haul from Indian Point to the Nevada Test Site, you are talking about something like 8 to 10 refueling stops. You couple that with the stops which we expect would be required every 100 miles or so for walk-around safety inspections, assuming that the same protocols have been developed for the shipments of cesium capsules and those that are planned for the shipments that the WIPP would be followed. Again, you are talking not only about long hauls that would test the equipment and human performance, but you are also talking about numerous incidents of leaving the interstate system, reentering the interstate system, and in our opinion, increased opportunities for accidents, human error, and certainly, we would be concerned about increased opportunities for sabotage or terrorism.

Finally, you couple all of this with the western routes. Remember, in the past, we have talked about some of the alternative route designations that may be necessary in Nevada that would have these shipments ending up after long hauls on two-lane roads with steep grades, sharp curves, narrow or nonexistent shoulders, and throw in the more severe winter conditions in the west, and we think there are a whole bunch of particular safety issues that are going to need to be looked at very closely as the plans for the use of GA-4/9 system evolves.

Again, I want to end this, while I have been critical, on a positive note, and I think the kind of work that T.C. Smith has been doing is exactly the kind of work that we feel is necessary. Our argument would be it needs to go further and it needs to address a number of issues that we feel have been glossed over so far.

Topic Number 2 is State of Nevada concerns about the MPC system. Again, I will try to be brief in these, and if you have questions, I would be happy to elaborate.

Point number 1, we were very surprised by the way the award decision was made, specifically making an award to only one submitter. We had expected multiple awards, and we had hoped there would be a competitive process moving towards the final selection of a preliminary design.

Point number 2, we are very concerned about the anticipated delay and release of detailed information on the Westinghouse design package. We certainly understand the complications that the protest to the award, and the possible litigation that might follow raise, regarding proprietary and confidential information, but DOE has got to find a way to balance protecting Westinghouse's interest and providing those of us who are stakeholders with the information we need to do a meaningful assessment of these designs.

Point number 3, there is no plan for stakeholder involvement in the MPC system in the schedule that Jeff Williams and Jim Clark talked about today. We raised this point at the TCG meeting last week.

Except for the promise that's been made to continue taking input from the railroads, I have heard nothing from DOE about stakeholder involvement. Remember, this was one of the strong points on the front end of the MPC design process with both the MPC workshops that were held and the earlier commitment to an MPC EIS.

Now, it's possible that the MPC EIS is going to provide good opportunities for stakeholder input, but I certainly think DOE should have something worked formally into that schedule.

Point number 4, the schedule appears to us to be a fast-track schedule. It's too inflexible to allow full-scale testing of MPCs, if that decision is made in November. This is particularly a concern with drop testing the 125-ton MPC. There's going to be a much longer lead time there to prepare the lift and target requirements at whatever testing facility is used.

Point number 5, let me summarize the reasons why we think that the focus on the 125-ton MPC is a mistake as opposed to focussing on the 75-ton.

Admittedly, this focus came about out of a safety concern initially and a desire on DOE's part to reduce the number of shipments in the system, and certainly, most people who are involved with transportation safety would agree that, all other things being equal, reducing the number of shipments, enhances safety, but as is usually the case, all other things are not equal. We would argue that there are advantages in using the 75-ton version of the MPC in the following areas: full-scale testing, MPC handling at reactors, intermodal transport of MPCs from non-rail-capable reactor sites to the nearest rail head, transportation of MPCs on branch lines and main lines, handling of MPCs at the repository surface facilities, and placement of the MPCs in the repository drifts, retrieval if necessary from the repository drifts. There are a whole range of issues associated with thermal loading of the repository and the near field thermal loading implications of using the 125-tonner.

Beyond that, we would argue that in accident situations, there are also a number of advantages that we believe can be argued for use of the smaller MPC, whether or not those accidents involve a loss of shielding or a loss of containment.

If I can conclude on a constructive note here, recommendations to DOE would be: (1) rethink your stakeholder strategy for the MPC; (2) focus on the storage and transportation aspects of the MPC and go further in acknowledging the uncertainties about the disposal aspects of the MPC; and (3) refocus your effort on the 75-ton version.

Topic Number 3 is State of Nevada comments on DOE's Nevada transportation studies. The new TRW Transportation Strategy Plan is a very interesting document. Of the preliminary plans that I have seen over the past decade and a half working in this area that I would classify as a NEPA implementation plan, I think it is a very good document.

We have only had it for a few weeks, and we have just begun our review of it. I think the best way that I can give you a sense of our preliminary sense of that is to go over the four rail routes, the heavy haul and legal weight truck issues, and give you kind of our first-line assessment.

Regarding the four rail routes, first, the Caliente route option, we believe that one is probably feasible, but it will be very difficult, and it will be very expensive to build.

The Carlin route, there are two options. We believe that both are probably feasible. We believe that both will be very difficult and very expensive to build.

The modified Valley route, feasibility of this route is unproven. We believe it will be extremely difficult, if not impossible, to develop this route, and if it is possible to develop it, we are certain it is going to be much more expensive than the current DOE estimate. The key issue here is that that route would bring the entire stream of rail shipments of high-level waste and spent fuel to the repository or the storage site within 9 to 15 miles of the strip in downtown Las Vegas. From the standpoint of all the perceived risk studies that we have done, this is perhaps the worst-case rail access option. It is, of course, ironically the one that people in Congress have seized upon because, looking at the preliminary numbers, it looks like it would be the easiest route because it is short and appears to be less expensive, but I will say a few comments about that in my concluding remarks on congressional approaches.

Finally, the Jean rail option, which actually involved three options, appears to us to have unproven feasibility. We believe it would be extremely difficult because of a number of conflicts with endangered and threatened species, designated critical habitat within the corridors, as well as proximity to other environmentally sensitive areas. We also believe it would be more expensive than the current DOE estimates.

Turning to heavy haul truck, to be blunt about it, we believe the 125-ton MPC presents an overwhelming problem for heavy haul truck transport in Nevada, and we believe that option is probably not feasible. We hope DOE won't spend too much of their limited budget studying it.

If you turn to the 75-ton MPC, I believe that will be difficult both for technical and institutional reasons, but it is probably feasible. I certainly would add that we don't believe it is desirable.

Turning to legal weight truck shipments, various routes are available either to Yucca Mountain or to Area 25 of the Nevada Test Site, which was mentioned is a storage facility location. Our assessment is that legal weight truck transportation to those areas is probably feasible by a variety of routes, but it will certainly be controversial regardless of which route is used. As I said earlier, our recommendations will be forthcoming based on our review of this report.

Topic Number 4, State of Nevada comments on the aspects of the DOE Transportation Program, I will go through these very briefly.

Point number 1, the OCWRM Transportation Report, we believe the DOE is moving in the right direction here, although there were a number of issues yet to be resolved, including the way that that document will be presented to the public in review and comment.

Point number 2, the DOE Transportation Contingency Plan is, in our opinion, extremely overly optimistic on the amount of spent fuel that could be moved in 1998. It states that about 800 MTUs could be moved. In our opinion, the maximum amount that could be moved would be about 200 MTU. we believe it is particularly a bad time for DOE to put out an overly optimistic approach which is inaccurate and will be misinterpreted over on the Hill as suggesting that some of the more overly optimistic proposals in Congress might actually be feasible.

Additionally, I would state that that report could give heavier emphasis to the inadequate time for safety planning, and frankly, I think it needs to bluntly acknowledge the likelihood of massive public opposition in corridor states if shipments were to occur under those conditions.

Point number 3, Section 180(c) implementation, again, I am happy to say that is one area where, while there are a number of issues to be resolved, DOE seems to be moving in the right direction.

Point number 4, regarding the routing guidance document, the highway portion of this effort seems to us moving in the right direction, but honestly, we believe the rail portion needs to acknowledge what we have found out the hard way, looking at rail routing options for the last four years. That is, there are simply very few options to carry your interchanges in the downtown yards in Cleveland, Chicago, Atlanta, St. Louis, both Kansas Cities, and frankly, we think that the rail safety planning has to focus on issues other than routing, particularly on the use of dedicated trains, the use of administrative controls like time-of-day restrictions, seasonal concerns, bad weather protocols, and the AAR's proposal to reexamine the modal study and possibly even to pursue that in terms of specifying the way that full-scale cask testing should be done.

Point number 5 are rail issues. Boy, that is one issue where there has been some real progress. For years, it seems like folks at DOE were intent on planning a system that was more and more dependent on rail, and all their planning work was focussed on highway. I certainly applaud Bob Rooney and whoever else it is who has been able to turn DOE around on this. Now the test is going to be see if this continues and particularly whether design input from the railroads is reflected in the way that the MPC program proceeds.

Let me conclude with Topic Number 5, the State of Nevada's concerns about pending and proposed legislation in Congress. Gee, if you are as concerned as we are about the Transportation Program that DOE is evolving, I must say that there is one thing that makes the DOE proposals look less bad, and that is to look at some of the common features of transportation planning in the bills that have been introduced by Senator Johnston, which is S 167, Representative Upton, which is HR 1020, the Congressional Budget Resolution, and the most recent draft that we have seen of the bill that we are told Senator Domenici plans to introduce at any time.

There are six areas here, and I am going to just waltz over them very quickly. Mostly what I want to do is call these issues to the attention of the Board. It may be that Congress in its wisdom will ask you in the conduct of the hearings on these proposals to comment on these bills, and certainly, given the respect that the Board has built based on its past analyses, we would hope that the Congress would ask for the Board's opinions on these issues.

The issues that concern us most are, one, the recommendation that a full implementation of DOE spend fuel acceptance begin in 1988. We are, secondly, concerned about the proposals for interim storage at the Nevada Test Site, at or near Yucca Mountain, coupled with uncertainty about the future commitment to geological disposal generally and repository investigations at Yucca Mountain, in particular. Three, we are particularly concerned about the micro-management efforts that occur regarding the specification of storage and transportation hardware that the Federal waste management system would use.

As many of you know, the Johnston and Upton bills attempt to speed up the MPC program. Whereas, the Upton bill and the Domenici draft are either silent on the MPC or actually specify that other types of equipment would be used.

I think, perhaps, the wrong-headed approach that I have seen in, maybe, the last 17 years of work on this area is the way that the Domenici bill would bifurcate the responsibility for planning storage and transportation. On the one hand, it directs the utilities to go out and specify and procure the storage and transportation equipment that would be used, and it mandates that the utilities make contracts with the carriers who would transport spent fuel from their facilities to a central storage facility, but then it says that the moment that the spent fuel is delivered for off-site transportation, it becomes DOE's responsibility and DOE's liability. It certainly seems to me that it violates all the principles of system safety planning which Dr. Price so eloquently talked about in his introduction this morning.

I have a fourth point here regarding the emergency management, financial and technical assistance to States and tribes. The bills are either silent, which in our opinion means no provision, or as in the case of the Upton and Johnston bills, they would severely limit this funding.

A fifth point is the designation of rail corridors to Yucca Mountain. I always think it is a bad idea for statute language to memorialize choices that have not been well investigated, and these bills would designated that rail corridor that we have been referring to as the modified Valley route, which we believe is the worst-case route from the standpoint of socioeconomic impacts on the State of Nevada, and that appears to be the route that all of these bills would agree upon establishing.

Some of the bills that have language that simply authorizes the Secretary to pursue that route. In the case of the Domenici bill, the most recent language actually directs the Secretary to follow that route only and to begin attempting to acquire right-of-ways.

Finally, the sixth point, is a combination of many of these aspects: the combination of the 1998 fuel acceptance date and the assumption that the priority acceptance rankings that are based on the DOE utility contracts should be used for cuing of shipments to the repository or the storage facility, the location of the storage facility at NTS or Yucca Mountain.

The limitations on emergency response assistance to corridor States. In our opinion, this results in the worst of all possible worlds, earlier spent fuel shipments, more spent fuel shipments, and most specifically, most of the early shipments would be long-distance truck hauls from the older eastern and midwestern reactor sites where the distances are over 2,000 miles, where there would be little or no money and little time, certainly, for emergency response or general safety planning, given the fact that rail would certainly be available no earlier than the 2003-2005 time frame, maybe later and maybe not at all.

I am sorry for the length of time it took for this, but it has been some time since we tried to do an overview of the State of Nevada's concerns on these transportation issues.

I am very appreciate of the opportunity to be here today, and while my comments, perhaps, that perhaps my friends at DOE have been overly critical, I do want to acknowledge the many areas in which there is very fine work going on over there. Nonetheless, there are still many, many things that need to be resolved before we can have confidence in the development of a transportation safety system that would make these shipments safe and routine.

Thank you.

DR. PRICE: Thank you, Bob.

I know it was quite an effort to get all of that compressed. That was a condensed version, too. So thank you very much.

Mary Olson?

MS. OLSON: I am Mary Olson of the Nuclear Information and Resource Service. I am on the Radioactive Waste Project.

I have a series of what I hope will be very short, straightforward questions. Is that okay to have more than one? Then I will have a brief comment.

I would like to start by appreciating what you have just heard because what Mr. Halstead just enunciated, I have heard in any number of meetings of concerned people who track radioactive waste issues from the citizen's perspective. He has eloquently put it altogether in one very forceful comment, but the threads of what he was talking about are concerns that are not only held in Nevada, but by people all over the country, and people are paying attention to this program.

I should just mention that is my job. I work with communities nationwide who are affected by either reactors or by the radioactive waste. There are many communities who are just contacting my organization because they don't think of themselves as having been affected by this material before because they are not reactor communities, they are not targeted for a dump, but now we have a phenomenon called not the back yard, but the front yard, and that is the rail route and the highway. So, anyway, that is what I do.

Here are my MPC questions. I hadn't realized before that there is going to be officially Boron in an MPC. When I was at the stakeholder meeting about a year or year and a half ago, the statement was that there would be Boron there, but it wouldn't get any credit.

So my question is, at that time, there was talk of burn-up credit. Was there a tradeoff made with NRC? What's going on?

DR. PRICE: Does anyone want to field that?

Be sure to give you name when you speak in the mike.

MR. TEER: Bill Teer with the M&O.

A burn-up credit topical report has been submitted to the NRC on May 31st of this year, taking partial burn-up credit, not accounting for the fission products, just the depletion of the uranium.

The long-term thrust is to continue the burn-up credit work, to go for full burn-up credit, after some experimental work is done over the next few years, and to ultimately use that in the MPCs, particularly for the disposal options.

As mentioned earlier this morning, to get full utilization of the GA-4, we would use burn-up credit in the final work with that cask. The Boron in the MPCs is, in my experience, a routine type of poison that is used in a lot of transportation casks to provide a criticality control.

MS. OLSON: Does anybody remember that stakeholder meeting? Am I remembering incorrectly that at that point, Boron was not assumed?

I just want to make the comment that people are real concerned about the size of the package, and the assumption made that fewer shipments is necessarily better, I think that especially local emergency responders are very concerned that this is a larger package than anything that is currently being shipped or has been shipped.

I am very happy to hear that Mr. Dreyfus is entertaining the idea of full-scale testing. This is one of the things I hear most frequently is that not only is computer testing not credible to the public, but neither is a quarter-sized MPC transferrable or an assumption made that the same things would happen under those conditions.

I just sit here and think, well, I don't make MPCs, but I used to make doll clothes, and fabric sure does behave differently for a Barbie doll than it does for me in terms of the stress and strain and all it can take.

I think that there is a very, very strong consciousness out there that, if you are putting containers on the road that have never gone through even the test they say they are supposed to stand up to, that those tests are meaningless.

Today, I have heard reference to the drop test and the puncture test. I have heard no reference to the fire test or the immersion test. Will there be mock-up or possibly full-scale, if that was decided upon, for those two tests? What is the deal on that?

MS. DESELL: I don't know what is going on with that particular area since I am not specific to it. We can try to get back to you with an answer.

MS. OLSON: The MPC people all left today?

MS. DESELL: I think they did.

Oh, one of them is here. Don Nolan is here. Okay.

MR. NOLAN: I am not an MPC person, per se, but I am Don Nolan. I am with the M&O.

What was explained was that the immersion and the fire test would be analyzed. There would not be tests for that. The tests would be for the drop and the puncture.

MS. OLSON: So no physical testing?

MR. NOLAN: No physical testing is planned at this time for the immersion and the fire.

MS. OLSON: All right. This is another question I just want to get into the record because I don't think anyone here is going to be able to answer it, but I would like you guys to hear it.

When we are dealing with an MPC, the concept of something that is welded shut with the assumption that it will not be reopened, do we also rely upon the concept of having a fuel rod and a fuel rod still in an assembly over time?

I am not a fuel physicist. So I don't know whether a pile of pellets in the bottom of an MPC is the same deal as having the material that you loaded in, but it seems to me that over time, depending on the conditions that the thing is subjected to, that is a possibility.

So who would I call?

MR. KUBO: I am Mark Kubo, M&O.

The MPC is currently licensed with 71 and 72, and that's transportation storage. It will be licensed in the future as part of the repository in which we will consider the long-term impacts of disposal. Under that scenario, your issue will be discussed, and I believe they are currently studying it and the people in Las Vegas are working on that issue.

MS. OLSON: Thank you.

Back to a more transportation-related question on recoverability. I have heard people out in the transportation corridors already beginning to ask how they would get a crane that would lift something that was 125 tons. There are assumptions about how long it would sit in water if it fell in a river and how fast you could get that heavy equipment there. I think that really has to be assessed. So that comes to the question of assessment.

Another question I get from people all the time is what's coming off the surface of an MPC. So I have to find someone else or maybe the SAR will tell us when that comes out, but the surface dose of an MPC is a question I get a lot. Does anybody here know that yet?

MR. TEER: Bill Teer, again.

The MPC will be designed just like any other transportation package to meet the regulatory requirements, which is millirem per hour at 2 meters from the surface of the package and the surface of the vehicle that it's on, if it has a personnel barrier on it. Just because it's a larger package doesn't mean that the dose is any greater.

MS. OLSON: I want to quote you guys right. So I'm glad to have a chance to ask these questions.

When I said something needs to be assessed, this is another concern that people have. It's very interesting to me. It's intellectually challenging to me as a citizen that your professions are all working together and have come up with the fact that you have to have a systems architecture and that that's what you're dealing with.

However, your assessments are still two-dimensional. We have an EIS for an MPC, not for the MPC in its system, which would have been a programmatic environmental impact statement, by my rough understanding. Again, I am not a lawyer or a NEPA specialist, but I heard reference to an EIS transport, but it's not happening right now. When does that start? Is there going to be one?

MS. DESELL: The transportation of the MPCs will be addressed generically in the MPC EIS. However, the MPCs, in and of themselves, do not actually trigger transportation. The opening of either a storage facility or a repository would trigger the actual transportation.

One of those two documents, whichever one comes first, would have your more detailed analysis of transportation, as was promised and committed to by DOE when we did the environmental assessments when we were looking at the first repository sites.

The EIS for the repository is expected to have their notice out sometime a little later this summer or early this fall, and they would include the more detailed analysis of transportation.

MS. OLSON: So you're planning that --

DR. PRICE: Excuse me for just a second. For the record. Linda Desell.

MS. DESELL: I'm sorry. I'm Linda Desell, for the record. I'm sorry.

MS. OLSON: So the presentations of the work that is ongoing right now is not informed by something like an environmental impact statement process. There hasn't been one, right, on the concept of transportation?

MS. DESELL: We have looked at environmental impacts with respect to transportation as we've gone along. When I started with our program 10 or 11 years ago, we were looking at those.

For example, we began to look at possible transportation impacts with respect to the operation of an MRS back in the mid-1980's when we did the EA on that, the statutory EA. So transportation impacts are looked at along the way. The kind of detailed transportation analysis I think you're looking for would be in the final EIS for either a repository or some kind of interim storage facility, whether it's called an MRS or called something else by Congress.

MS. OLSON: But you are saying if there is an interim facility, that that would trigger it. In the meantime, of course, Congress is considering waiving such a facility from many of these requirements. So we'll leave that.

I'm going to go even muddier for a moment, though.

DR. PRICE: Can you try to reach a closure here, also?

MS. OLSON: Yes, okay. Two more questions.

As I said muddier, but I heard a week ago that Northern States Power is planning on trying to certify an MPC concurrent with the DOE's efforts in order to start shipment to a proposed facility at Mescalero.

Whenever I heard about transportation, it is all in regards to transport by DOE to a DOE facility, which is naturally your jobs and what you are doing. I understand that, but if there is an independent facility, DOE will be responsible at least for the shipping away from that facility according to NRC. They won't license an independent facility unless it could be shown that the fuel would be transferred directly to DOE from that facility.

So is there any attention being paid by the Board, by the working group, by any of these programs to what is going on with what we call the "outlaw," any communication at all between you guys and the NSP initiative?

DR. PRICE: With respect to the Board, we are aware of the Mescaleros and what they are doing, but as to this specific initiative, I don't know of any contact that we have had.

MS. OLSON: I heard reference today to handling bare fuel. The GA-4 and 9 casks are not MPCs. You unload them when they get to their destination. I guess I'm just wondering how does the transportation component interface with the plans for such a facility where that handling occurs. I guess that's part of the facility licensing? How does that work?

MR. CARLSON: This is Carlson, DOE.

Within the design of the facility and the licensing, the operations that would be contemplated if it is bare fuel handling would be addressed within the license, within the design. You take into consideration exactly what you are going to be handling. It will affect your heating and ventilating systems, your air-cleaning, your actual confinement and containment for handling the material, but it would be specifically addressed so that you did design the facility to handle bare fuel. NRC would review that design to see that you were adequately addressing their regulations.

MS. OLSON: So the use of that truck cask assumes that whatever facility the destination is has that capability; is that correct?

MR. CARLSON: Correct. You have to have a facility at the receiving end to handle however you are going to package and ship the fuel.

MS. OLSON: Thank you.

DR. PRICE: Thank you very much.

The last person for public comment is Michael Grynberg.

MR. GRYNBERG: My name is Michael Grynberg, and I am with Public Citizen. I have a brief comment and a question.

I have just a comment on the full-scale cask testing. There was discussion earlier on how numerous stakeholders have called for this over the years, and of course, once we go to transportation, it will be hard to find people who aren't stakeholders. As Bob Halstead commented earlier, there is good reason to doubt the very adequacy of these standards.

Given that level of doubt, it is especially important that the public can be positively assured that the casks at the very least meet the standards that are on the books.

Just further along the issue of general public confidence and the whole High-Level Waste Management Program, there is considerable doubt to be had about whether the risks entailed by transportation, whatever you may believe they are, are justified by what is hoped to be gained. This is especially the case if an interim storage site is opened by 1998.

Given this doubt, it is very important that DOE go as far as possible to assure the public of the relative safety of transportation plans.

My question concerns the implementation of Section 180(c) of the NWPA. I was wondering of OCWRM has any plans on how much they intend to request for implementation of 180(c) and how this issue would impact the financing of the Nuclear Waste Fund and its adequacy to cover the price of the High-Level Waste Program.

Thank you.

MS. DESELL: In our total system life cycle cost, there is a number which the level of that number escapes me at that moment, but it is planned in there for 180(c). I can't remember the exact number at the moment.

The Congress, of course, is looking at that also, but there is a number that DOE had put out to Congress in our total system life cycle cost as a suggested number. I just don't recall the actual number at the moment.

If you want to give me a call in my office, I will try and find that number for you with the gentleman who takes care of the TSLCC.

MR. GRYNBERG: All right.

MS. DESELL: And you'd like it, too, right?

DR. PRICE: All right. Thank you very much. We do appreciate your willingness to field some of these questions brought up by the public.

Also, I want to express my appreciation for the presentations on this date. There were some new things and some things that were pleasing to see and some things I hope we see more of that we saw, some things earlier this morning which I didn't expect to see completely as they were, and I was pleased to see some of those things. I think I should be more specific and say it was some of the system safety human factor stuff, and we hope that we see more of that in some of the other subsystems, which have yet to show.

If there are no other comments from anyone else -- I can see I can't turn it over to Dr. Cantlon. I can't turn it over to Dr. McKetta. So I will turn it over to Gary Brewer, who is -- no, I'll just call it quits here and say goodbye to you.

Thank you.

[Whereupon, at 5:30 p.m., the meeting was concluded.]