UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

SPRING BOARD MEETING

Wednesday

April 27, 2011

Marriott Buffalo Niagara
1340 Millersport Highway
Amherst, New York 14221

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Dr. William Howard Arnold
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Dr. David J. Duquette
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PROCEEDINGS

8:30 a.m.

HORNBERGER: Good morning once again.

I want to welcome you to this meeting of the U.S. Nuclear Waste Technical Review Board. I am John Garrick--Oh, no, Carl, you gave me the wrong speech here. Strike that. I’m George Hornberger, a member of the Board, at best, a pale substitute for our Chairman, John Garrick, who unfortunately couldn’t be here. I’m standing in for John. Unexpected circumstances developed this past week, and he couldn’t be here. He really regrets not being able to be here.

It has been a long time since the Board has visited the West Valley Demonstration Project, so I’d like to take a moment to say a bit about what the Board is and why we are here.

The U.S. Nuclear Waste Technical Review Board is an independent federal agency in the Executive Branch. It was created in 1987 as part of the Nuclear Waste Policy Amendments Act. That Act assigns two clear and explicit missions to the Board. The two missions are (1) to evaluate the technical validity of the U.S. Department of Energy’s activities to implement the Nuclear Waste Policy Act of 1982; and (2) to report to Congress and the Secretary of Energy the findings, conclusions, and recommendations stemming from our evaluations. We generally write at least two reports a year.

In addition, we usually write a letter to DOE, Department of Energy, after our public meetings, and we testify before Congress. Our reports, letters, and testimony all are on our website.

There are eleven Board members. Board members are chosen through the following process. At least two candidates are nominated by the National Academy of Sciences for each of the eleven positions, and the President selects Board members from that list of nominees. The President also designates the Chairman. Brief bios of the current Board members are included in the handouts at the back of the room. I’m not going to take the time to introduce each member. Nine of the eleven members are here today. Besides John Garrick, Board members Andy Kadak is unable to be here.

In March 2009, Secretary of Energy Chu announced that the proposed repository site at Yucca Mountain was no longer an option. This meant that DOE-owned spent fuel and high-level waste no longer had a designated location for final disposal. Not long after the Secretary’s announcement, the Board decided that it would visit DOE sites with significant amounts of spent fuel or high-level waste to determine how they were planning to manage those wastes and the technical bases for those plans.

Accordingly, the Board visited the DOE Hanford site near Richland, Washington in July 2009, the Savannah River

Site near Aiken, South Carolina in March 2010, the Idaho National Laboratory site near Idaho Falls in July 2010, and now the West Valley site, which technically is a New York State site, but New York makes the core portion of the site available to DOE to carry out the West Valley Demonstration Project. The findings from these visits will form the basis for a report that we plan to issue later this year.

We also have been working on several other major projects having to do with evaluating the technical validity of DOE activities related to implementing the Nuclear Waste Policy Act. In the Fall of 2009, we issued a survey report on the programs being undertaken in the U.S. and other countries to manage radioactive waste. Since then, we have been working on an extension of that report. The extension will be released next month. Also to be released next month is a report on the technical advances made during work to develop the Yucca Mountain program that we believe will be a useful resource for future developers of repositories for spent fuel or high-level waste in the United States.

In addition, we have been working on a personal-computer based systems analysis tool we call NUWASTE, N-U-W-A-S-T-E, and that stands for Nuclear Waste Assessment System for Technical Evaluation, and this tool can be used for evaluating the effects on nuclear waste management of various nuclear fuel-cycle approaches. A 12-page Topical Report will be issued shortly on NUWASTE. We also developed and issued in December another Topical Report on the technical basis for very long-term dry storage of commercial spent nuclear fuel. That also is on our website along with an extensive literature survey that documents supporting information. Also, we have a fact sheet on deep borehole disposal, and that fact sheet is available at the back of the room. As you can see, over the past year or so, we have undertaken a very substantial workload.

It has been almost seven weeks since the great March 11th Tohoku earthquake off the northeast coast of Japan and the devastating tsunami it produced. On behalf of the Board and the Staff, I want to say that we are very saddened by the loss of life and the suffering of the Japanese people.

The situation at the Fukushima Dai-ichi nuclear complex is still perilous, at least for the workers. It appears that significant radiation doses were limited to plant workers. Clearly, the events at the Fukushima site affect the nuclear power industry world-wide. The director general of the International Atomic Energy Agency, Yukiya Amano, has said that “...the crisis...has enormous implications for nuclear power...”

We don’t know what the implications might be for high-activity radioactive waste management in the United States, although we are already seeing a revival of discussions about the wisdom of having spent nuclear fuel densely loaded in storage pools, the relative safety of wet storage versus dry storage of spent fuel, and the advantages and disadvantages of centralized spent fuel storage versus storage at reactor sites. Because the Board’s role is to evaluate the technical validity of Department of Energy activities, we will review DOE’s work and decisions related to these issues and report our findings and recommendations to Congress and the Secretary of Energy.

Now, let me turn to today’s agenda. The meeting today is entirely focused on the West Valley Demonstration Project, which we will usually refer to simply as “West Valley” throughout the meeting. We will start with representatives of the New York State Energy Research and Development Authority (NYSERDA is a lot easier to say), and that’s how we will refer to that organization the rest of the day, and DOE, Paul Bembia and Bryan Bower, respectively, giving background information on West Valley. Then, Moira Maloney will describe the recent Environmental Impact Statement, the decisions that stemmed from it, and the plans for decommissioning West Valley.

Then, we will have a special panel on a quantitative risk assessment that was performed for the NYSERDA disposal area. John Garrick is particularly proud of this QRA, which was issued in August of 2009. He was the study director. He had his consultant’s hat on for that study, not his NWTRB hat. He is proud of the study for three reasons: first, the results of the study actually played a significant role in NYSERDA’s determination of what to do about the disposal area in the near term; (2) the draft study was done in just four months, providing results that were timely for NYSERDA; and (3) the depth and breadth of the scope fulfilled the goal of a quantitative risk assessment. All but one of the study participants are here today, and they will participate in the panel discussion. I will introduce them later.

This afternoon, we will hear first about reprocessing at West Valley from Jim Clark, who was a key member of the Nuclear Fuel Services management team at the plant and was one of the chemical--that reminds me. I’d ask everyone to switch their cell phones to mute, or turn them off. So, Jim Clark was a key member of the Nuclear Fuel Services management team at the plant, and was one of the chemical engineers providing technical support for plant operations. Then, we’ll hear about vitrification from Dan Meess, who was in charge of technical activities during that period. After the break, we will hear from Zintars Zadins and Laureen Rowell about future storage of vitrified waste and determining the waste classification of the melter. The melter is one of the engineering components of the vitrification plant, and its waste classification is important in determining how it must be disposed.

We will end the day with our traditional public comment period, which we believe is very important. Public comments are always an essential part of our meetings because they help us measure how well we're doing our job. If you would like to make a comment during this final session of the afternoon, please enter your name on the sheet at the back of the room. There are people there who will assist you. We have an attendance sheet there as well that we would like everybody to sign. If you prefer, remarks and other material can be submitted in writing and will be made part of the meeting record. These statements will be posted on our website along with the transcripts and presentations from the meeting.

I might also note that tonight, there is a meeting of the Citizens' Task Force at the Ashford Office, and that meeting starts at 7 o'clock.

Sometimes we are asked whether it is appropriate to pose questions during the course of the presentations, and we have a convention about that. Following each presentation or panel, Board members will have the first opportunity to ask questions. Then, time permitting, Staff members will ask their questions. And, beyond that, members of the public are welcome to ask their questions. And, quite frankly, we do not often get past the Staff and, in fact, we can rarely give Staff an adequate amount of time to ask their questions. There is another mechanism that may allow you to question our speakers. If you write down your question and submit them to a member of the Board Staff, he or she will see to it that the appropriate Board member gets the question for possible inclusion in discussion.

We do have one very important disclaimer. In these meetings, we Board members like to freely exchange our views and express our opinions. We want to continue to operate in that open and free manner, and we ask that you all realize that individual comments made by Board members do not necessarily reflect the considered positions of the Board.

To minimize interruption, again, I ask you to take out your cell phones and turn them off, or mute them. If you are going to speak to us, please use one of the microphones, identify yourself, give your affiliation, and speak clearly into the microphone, because sometimes the pick-ups are not always perfect, and we need your name and affiliation so we have a completeness in our transcript.

Now, next we can start with our speakers, and actually start our show here. The first speakers are Paul and Bryan. And, I want to remind Paul and Bryan, and really all the speakers, to be mindful of the time allotted for presentations. The Board really does need to keep to the question period.

So, Paul and Bryan? By the way, I’m going to do these very short introductions, like Paul and Bryan, and I’ll ask the speakers to say one sentence about themselves.

BEMBIA: I’m Paul Bembia, and I’m the Program Director for NYSERDA at West Valley. I have two presentations, brief presentations, as part of this section. There’s one on the site geology, and I wanted to do that one first. If we can pull that one up first?

Thank you. Okay, so, there are two main components to what under foot at site, and that’s some relatively old bedrock, and then much younger glacial deposits. And, I’m going to briefly describe both of those.

First, the bedrock. This is kind of a reconstruction of what the earth looked like about 400 million years ago. Western New York was the land mass that’s now Western New York was south of the equator, and it was covered by a tropical sea. There’s land off to the east, and sediments are coming into the area where Western New York is into this shallow ocean basin. And, as this environment existed for a few hundred million years, and several kilometers of sediment accumulated during this period. The sediments were eventually deeply buried, highly compacted, and eventually formed sedimentary rock.

About 100 million years later, the continental masses are coming together, and Western New York is kind of uplifted. That area that had been under the sea is uplifted, and it now comes above sea level, and we start eroding material rather than depositing it.

And, about 250 million years ago, this continental collision really comes together. This is the collision that most people know about. It’s the collision between the North American continent and Africa, and we’ve got significant rock deformation and mountain building off to the east. And, the rocks there are significantly folded and faulted.

In Western New York, the bedrock there, we see some rock fracturing, some faulting, and a general dip to the south that was imparted by the continental collision. But, the rocks there are not highly deformed are faulted.

On top of the 350 million year old bedrock, there’s a covering of much younger sediments that were deposited in the area by glaciers during the last ice age. And, because the material is moved, deformed, deposited by ice and it’s reworked by glacial melt water, these glacial sediments, it’s a very complex sequence that can change character quickly in both vertical and lateral directions.

Now, we’ll look specifically and some geologic cross-sections across the center. First, we’ll look at that section line that’s shown there. It’s kind of through the developed area of this site, and this is what we see. The bedrock that I just talked about is not that wedge shape. The bedrock is actually the white page around the bedrock, and that wedge shape is a pre-glacial river valley that's now filled with about 500 feet of these glacially deposited sediments. So, it's sediment that was deposited by glaciers, sediment that was deposited by melt water, and sediment that was just deposited in the area between glacial advances.

For the members who were there yesterday at the site, we talked about this, that this is unconsolidated sediment. It's not rock. It's clay, it's silt, it's gravel, and sand. So, it's easily erodable.

This is the North Plateau area of the site where most of the reprocessing facilities are located. You can see down at the bottom, is the shale bedrock. This is now kind of just one section of that wedge shape that we saw. There's units here that are identified as tills, and those are glacially deposited clays. They're highly compacted. In between that, we've got water deposited sediments that are known as these recessional sequences.

On the north plateau, so we have that thick clay, the lavery till, and on top of that, we've got an alluvial fan that does transmit water pretty well.

On the South Plateau, the main difference between the North and South Plateau is on the South Plateau, that alluvial fan is not present, wasn't deposited, so that upper rind that you see on that figure is not the alluvial fan, it’s actually weathered and fractured till. So, the disposal areas on the South Plateau are constructed right in that clay.

Because the facilities are in or on glacial sediments, erosion is a significant long-term and short-term issue, and I think we’ll be talking more about that as the day goes on here.

Okay, with that just site setting and the site geology, I’m going to move right into my presentation on the history.

Bryan Bower is going to talk about the demonstration project, and Jim Clark is going to cover the details of the reprocessing operation, so I’m going to cover kind of the important events on the periphery of those two things.

The origins of the West Valley facility can be traced back to the federal government’s program to develop a civilian nuclear power industry. And, this effort stems from President Eisenhower’s Atoms for Peace initiative and the Atomic Energy Act of 1954.

In 1957, as part of its effort to provide the infrastructure for a civilian nuclear power industry, the Atomic Energy Commission offered incentives to private industry to develop a non-federal nuclear fuel reprocessing capability, and the AEC announced that it would make technology on reprocessing available to private industry. They would invite proposals by private industry to design, construct, and operate reprocessing plants, and provide a baseload of fuel from AEC production reactors until there were enough commercial power reactors to provide enough fuel to keep the reprocessing operation moving.

New York State saw this as an opportunity to promote industrial growth and to be involved in this exciting new industry, and New York developed an Office of Atomic Development in 1956, and by 1961, it had acquired 3300 acres in the Town of Ashford in Cattaraugus County. The property was taken by eminent domain.

The news that the nuclear reprocessing facility would be located in Western New York was seen as positive in many ways. There would be new jobs, new businesses, and a great potential for economic growth. There was a sense that this could really transform the area.

Not everyone was happy, though. About 50 to 55 properties were taken from local landowners, and some people were forced to give up property that had been in their family for generations.

So, this is the Western New York Nuclear Service Center as it was established in 1961, again, at 3300 acres in the Town of Ashford in Cattaraugus County. The property was state owned, so it was tax exempt, and eventually a PILOT, or payment in lieu of taxes, was established to offset property tax losses.

In 1962, NFS, Nuclear Fuel Services was given an option to develop the plant. Nuclear Fuel Services was a company that was established by Davison Chemical Company and American Machine and Foundry, and I think Davison Chemical was bought out by W.R. Grace and Company pretty early in that process. Ground was broken in 1963 for the construction of the plant.

The plant was licensed by the Atomic Energy Commission under Part 50 regulations. NFS was licensed as the operator, and New York was licensed as the owner. The plant cost $33 million to build. It was completed in 1966, and was granted a provisional operating license that same year. And, as part of the agreement for establishing the facility, the Atomic Energy Commission set the fee that NFS could charge for reprocessing.

This is how the center was laid out in the 1960s. The reprocessing facilities were located in the central portion of the site. NFS also operated two disposal facilities at the Center. The State licensed disposal facility was the commercial disposal facility, and we’ll talk more about that when we discuss the quantitative risk assessment. And, the other disposal facility was the NRC licensed disposal area, and that’s a facility that received waste from the reprocessing plant, wastes that were too hot to go into the SDA.

NFS halted reprocessing in 1972 after six years of operation. It wanted to increase capacity and make some other modifications to reduce worker dose and reduce the level of radioactivity of effluents. NFS expected the modifications would cost about $15 million. At the same time, the AEC was issuing new requirements related to earthquake and tornado protection, and even more significantly, the waste solidification and waste management.

NFS then estimated that these new requirements would cost $600 million, and would probably require an entirely new license process, and said it was withdrawing from the reprocessing business. And, NFS also said they wanted to return the facility to New York. New York said it would not accept the facility and the wastes from NFS, said that the wastes were not in good condition, as was required by the waste storage agreement, and said that perpetual care fund was not adequate to properly maintain the facilities and wastes.

In response to that, Congress held hearings. The GAO was directed to investigate the West Valley situation, and DOE was assigned to study to look at options for the future of the Center. And, this eventually led Congress to pass the West Valley Demonstration Project Act in 1980.

And, I think it’s clear that the reprocessing facility at West Valley failed to live up to its high expectations. And, it appears that a combination of economic factors, technical difficulties, and an evolving regulatory framework led to the failure of the facility.

And, this is the central portion of the Center as it looks today. And, we can refer back to this figure if we need to throughout the day.

So, that’s the end of my presentations.

HORNBERGER: Thank you, Paul. Questions? Ron?

LATANISION: Paul, before you leave the microphone, just one question. The big disparity between the estimate of what it would cost to modify the site, and the $600 million estimate, from 15 to 600, in retrospect, was that $600 million really a correct estimate? Has anyone looked back at that?

BEMBIA: Well, maybe Mr. Clark can give us some more information on that. But, the new requirements were going to require a significant retrofit of existing facilities to meet the seismic requirements, and AEC, this was Appendix F to 10 CFR, Part 50, which required the solidification of high-level waste. So, the process that NFS would plan to store the waste from tank to tank to tank, was no longer acceptable. So, there were very, very significant changes that had to be made to the facility.

CLARK: I agree with all of that. The vitrification, the protection, especially the seismic protection, drove it, whether it’s 600 million, it was clear it was in excess of 300 million.

ARNOLD: Howard Arnold, Board.

Are we going to hear during the course of the day who the customers were and what fuel went through the plant while it was operating?

CLARK: I hadn’t put that specifically in the presentation, but I have a very good memory of which fuels, and not necessarily how much, but I can identify all the participants. And, there is a report that goes into great detail about how much from each of the utilities.

HORNBERGER: Okay. Bryan, do you want to finish? And, then, we’ll have another chance for questions.

BOWER: While they’re bringing up the slide presentation, I’m Bryan Bower, the Department of Energy Director at the West Valley Demonstration Project. Again, we have a number of speakers that will be talking today, including Dan Meess, who is going to go into the details of the vitrification or solidification of liquid high-level waste in the tanks. So, we’ll just briefly discuss those aspects in the 15 minute time frame we have, talk a little bit about what happened when the Department of Energy first came to the site, and what we’ve been focusing on post-vitrification of the liquid high-level waste.

As Paul concluded his discussion, we were at the signing of the West Valley Demonstration Project Act that was signed by President Carter in October of 1980. He was actually in Niagara Falls at the time, also signed the Love Canal Legislation at the same time he signed the West Valley Demonstration Project Act, again, highlighting the fact that it was the West Valley Demonstration Project Act which was to have the Department of Energy come to West Valley and do a demonstration project. And, the primary focus of that demonstration project was to demonstrate the full-scale solidification of liquid high-level waste.

The West Valley Demonstration Project Act did have five requirements for the Secretary of Energy. The first to solidify the high-level waste at the Center. That activity has been complete. There are currently 275 canisters of solidified high-level waste stored in the original reprocessing facility at West Valley.

The Department of Energy was also to develop a container suitable for the permanent disposal of the waste. And, again, that container was a two foot in diameter, ten foot tall, stainless package, very similar to that used at the Savannah River site as well, and also similar, although shorter than the proposed canister for the waste treatment plant at the Hanford facility.

The Secretary of Energy was to transport that solidified high-level waste to a federal repository. Of course, as you know, that federal repository is not available, so we cannot complete that portion of the Act until the repository is available. The Department of Energy is responsible eventually for the transport of that solidified waste to the repository.

We were to dispose of the low-level and transuranic waste generated as part of the project activities, and that is currently ongoing. The members, some of the members, most of the members were at the site yesterday and they did get to see some of the facilities that we are in the process of using for size reduction and segregating of the low-level and transuranic waste.

And, then, to decontaminate and decommission the high-level waste tanks, and the facilities and hardware that we used in the solidification of the high-level waste. And, again, that activity is in progress. Moira Maloney, who will be speaking shortly after I get done, will be talking about our first phase of the decommissioning that we have planned starting later this year.

The Department of Energy essentially took control of around 200 acres of the site in 1982. The original Part 50 license is still in effect at West Valley. However, the technical specifications for that license were placed into abeyance while the Department of Energy was at the site on the 200 acres.

One of the first activities that was done when the Department of Energy came to the site was the removal of spent nuclear fuel at the facility. There were 750 spent nuclear fuel assemblies stored in the fuel receiving and storage facility when the Department of Energy arrived at the site. New York State was successful in having 625 of those fuel assemblies returned to the commercial entities. There were 125 spent nuclear fuel assemblies that were left at the site. Nuclear Fuel Services had taken over ownership of those spent nuclear fuel assemblies. An agreement with the Department of Energy, the Department of Energy took responsibility for those 125 spent nuclear fuel assemblies.

In return, Nuclear Fuel Services developed a dual purpose cask for the transportation and storage of that spent nuclear fuel. The fuel was loaded into those casks in 2001, shipped to Idaho in 2003. And, those fuel assemblies are currently stored in the casks at Idaho National Lab. There is no other spent nuclear fuel at the West Valley Demonstration Project except for some debris left over from the decontamination of several process cells in the original reprocessing facility.

Again Dan Meess is going to talk in detail about our vitrification experience at West Valley. There were around 25 million curies of liquid high-level waste that was vitrified into 275 high-level waste canisters. The dose rate on those canisters varied between 2000 and 7000 R/hour. The average dose rate around 3000 R/hour.

We did do transfer of some cesium loaded zeolite midway through the vitrification campaign from one of the spare high-level waste tanks into Tank 8D-2. That high-level cesium in that zeolite did drive up the canisters to the 7000 R/hour canisters. We do have a few that are that high.

The vitrification operations began in 1996 and ran through 2000. There is some residual liquids in the tanks, both 8D-1 and 8D-2. Around 350,000 curies remain in the tank, primarily cesium in zeolite in Tank 8D-1. There’s also some transuranic waste in a bathtub ring in Tank 8D-2, as well as some residual sludges in the bottom of 8D-2.

After completion of the vitrification activities in 2000, the Department of Energy proceeded with the decontamination of the vitrification facility. West Valley Nuclear Services Company was the prime contractor for that work. They did assemble a team of highly experienced D&D personnel to come in and do that work. We did have very high radiation fields that we were dealing with, so they brought in expertise associated with high radiation D&D, waste management expertise, and also the ability to handle the high activity waste and package that high activity waste.

A comprehensive plan was developed for moving forward with that. And, again, the intent of doing this effort was to gain some insight on how we would do other de-activation efforts within the main plant. We did take large advantage of off-the-shelf technology in doing this work.

We also had to transition our work force from making glass, from glassmakers, to D&D operators and waste managers. So, we did go through that process as well. We did have to go through work force restructuring associated with that, and we did do an operational readiness review to demonstrate our ability to move from the making of glass to the D&Ding of facilities. That experience has come in very handy as we move from the D&D of the vitrification facility into the main plant process building.

Which is a lead into the next slide. As Paul talked about, this was the only commercial spent nuclear fuel facility to ever operate in the United States. While it’s a compact facility, it’s quite a complex facility. It’s a five-story high facility, and many areas of the plant are constructed like Lego blocks with cells stacked in various directions. Because of the compact footprint, five-stories of reinforced concrete, nearly 300,000 square feet, about a tenth of it is stainless steel lined.

There were over 70 contaminated rooms and areas within the site. About 10 percent of the plant has dose rates in excess of 1 R/hour. Two rooms in the main plant, the process mechanical cell and the general purpose cell, had dose rates of over 50 R/hour, so of course requiring remote decontamination efforts. Over 100,000 linear feet of process piping in the plant, and about a third of that transferred reprocessing liquids. So, quite a challenge in the decontamination--deactivation, decontamination of the plant.

This is a schematic of the main plant. It is actually a five story main plant. The lower level of the main plant over in the--let me move out a little bit--right below the chemical process cell, there’s a general purpose cell. It’s actually located 20 feet below ground level. The first floor is essentially located at ground level. There are some areas, for example the extraction cells, that start at the first floor and go the whole way to the fourth floor. Those have long palls (phonetic) columns, 50 foot long palls columns.

Some of the more contaminated areas of the main plant are the chemical process cell, which was gutted for the storage of the high-level waste, the process mechanical cell, which is where the fuel assemblies were chopped, and the general purpose cell, the fuel assemblies fell by gravity from the process mechanical cell into the general purpose cell. They were stored in stainless steel baskets in the general purpose cell, and then eventually dissolved in the process mechanical cell.

You can see from the key that we have that there are a number of areas in the main plant that were deactivated and decontaminated by West Valley Nuclear Services Company. There’s work that’s currently being done by West Valley Environmental Services. And, then, we have some other work that’s beyond the scope of this contract and will be done as part of the final decommissioning of the main plant.

Some of the activities that we have going on right now. The work began in earnest in the mid 2000s. 2003, 2004, we started with the gutting of the process mechanical cell and the general purpose cell. Other activities that we have had ongoing since 2007 include decontamination of the upper warm aisle pump niches, hot acid cell, acid recovery cell, and extraction cell Number 3.

This is a photo of work that was done in the hot acid cell, and unfortunately, I failed to point this out to the members that were touring the site yesterday, this opening was over top of the office building when we went into the front of the main plant, that three-story office building. They’re actually working off of the roof of the three-story office building.

These vessels came out and were wrapped, went into a DOT transport package, and were placed on the truck and went to the Nevada Test Site. Essentially, that activity was completed in one week. To bring them out through the side of the main plant, so we had to open up the side of the main plant, bring them out. There are a number of openings that we have had to put in the main plant to get these large vessels out. There are other large vessels that are in the middle of the plant that actually had the concrete poured after the vessels were in place in the liquid waste cell. So, again, some challenges to get to all the vessels inside the main plant.

Extraction Cell Number 1, this is a first of the extraction cells, so it had a lot of mixed fission products coming into this portion of the cell. With the mixed fission products, we had high gamma fields, so this work had to be done remotely. This work is being done with a single arm, with 6 degrees of freedom that can move up and down on the mass, and then different end effectors that can be placed on the arm.

Some of the other areas in the main plant where we have the stainless steel line cells, again, high activity both in the process mechanical cell and the general purpose cell. Those were the cells where we had the 50 R/hour. We deployed Nitrocision, which is a liquid nitrogen decontamination technology, 50,000 psi of liquid nitrogen at around negative 250 degrees Fahrenheit.

When we completed the gutting of the process mechanical cell and the general purpose cell, a fixative was applied to the cell, and that had a dark blue color to it, actually was very helpful that it had that dark blue color to it, because it allowed us, when we deployed the Nitrocision, to track exactly where we had deployed the liquid nitrogen system.

And, as you can see from the photo, after we deployed the system, you can see the shiny stainless steel when we get done. This was used without a vacuum collection system on the wall. The waste fell to the floor, and then we deployed Nitrocision with a vacuum system on the floor. Remote application, to our knowledge, this is the first and at this point the only remote application of the liquid nitrogen decontamination.

Again, deployed in the process mechanical cell and the general purpose cell. The process mechanical cell has been completed. General purpose cell, the walls have been completed, and next week, we will start with the application of the vacuum system to the floor of the general purpose cell. General purpose cell is still our most contaminated cell in the main plant even though it was completely gutted in the 2004 through 2006 time frame.

Other challenges in the main plant. The facility was built in 1963 through 1966, so there was extensive use of asbestos in the main plant. So, we have a number of asbestos removal activities ongoing throughout the main plant. And, again, this is just one example of our asbestos removal activities under the contract we have with West Valley Environmental Services. Essentially all accessible asbestos is being removed from the main plant, and will be completed by June 30th of this year.

As we're doing all this waste removal efforts from the main plant, we also are generating a considerable amount of waste. We also had a considerable amount of legacy waste that was stored at the main plant. West Valley did not start shipping waste off-site until 1997. We did dispose of some waste when the Department of Energy first came to the site. We did dispose of some waste in the NRC licensed disposal area from 1982 to 1984. But, from essentially 1984 until 1997, all waste that was generated at the site was stored on the site.

Again, some of the facilities that are now available for waste were not available at the time, so the concept was to just get the waste in boxes and store it. And, there was not a lot of effort done in the sorting and size reduction and repackaging of the waste. We did bring online a remote handled waste facility in 2003 for the remote size reduction and repackaging of waste, as well as we have three contact handled waste processing facilities at the site.

Again, the purpose primarily is for size reducing, repackaging and verifying that the waste meets waste acceptance criteria for the disposal facilities. This work is being done in our newest contact handled facility, the container size reduction facility.

As I talked about earlier, there is about 350,000 curies remaining in the residual liquids in the waste tank farm. Using recovery money in December of this year, we completed the installation of a tank and vault drying system. The tank and vault drying system serves three purposes. One, to dry the remaining residual liquids in the tank. Again, I know this might be a naïve way of thinking about things, but if there’s no liquid in the tank, then there’s no liquid to leak from the tanks. The second benefit of the tank and vault drying system is it does reduce relative humidity in the tank farm.

For years, we did have corrosion inhibitors in the liquids in the waste. We also used, for a period of time, nitrogen inerting in the tank farm, as well as dry air inerting in the tank farm to minimize corrosion of the tanks. The two large 750,000 gallon underground tanks are carbon steel tanks, and of course we have a humid environment in Western New York, so we have had to take a number of steps to ensure that we minimize corrosion. The tanks were originally designed with a 50 year design life. We do have coupons in the tanks that we can pull to look at the corrosion of the steel in the tank farm.

The third benefit of the tank and vault drying system is that we keep the groundwater artificially low and if the tanks, if there were to be a leak from the tanks, it would not move into the groundwater. It would actually flow towards the tank farm. That does require the pumping of the water and the processing of the water. This system will also help maintain that sink, lower level of water in the area of the waste tank farm.

In addition to the installation of the tank and vault drying system, we did do a number of activities to minimize the in-flow of groundwater and surface water into the tank farm. Again, one of the things that was done when the facilities were built back in the 1960s, is they laid the piping that goes into the tank farm in either gravel or sand. And, they put it on a downward slope such that it would--I mean, waste would flow into the tank farm. So, we created these opportunities to have the underground rivers, as water moves through the--the groundwater moves through the tank farm, it gets to these areas where you have the piping runs, and it would naturally flow towards the tank farms.

We’ve done a number of other activities, including grout injection to minimize--grout injection around the edges of the tank farm off the tanks to minimize the in-flow of groundwater into the tank farm as well.

Last big item that we completed using Recovery Act money was the installation of a permeable treatment wall. This permeable treatment wall has been in the works for about two years planning, and in about one month of installation. It was installed using a once through trenching system that was designed to cut a trench that was between 19 and 30 foot deep, three feet wide, and we put over 2000 tons of zeolite into the ground, 850 feet long, again, it varies in depth from 19 feet to 30 feet, tied into the clay that Paul was talking about below that sand and gravel unit on the site.

And, that’s, in a nutshell, West Valley for the last 20 years.

HORNBERGER: Thank you, Bryan. David?

DUQUETTE: Duquette, Board.

I’m not sure, Bryan, if you or Paul want to answer this. But, there seemed to be a gap between what was happening at the site between 1976 and 2000--I’m sorry--in 1980. What went on at this site during that four years, from the time that the commercial operation pulled out and the State basically stepped in?

BEMBIA: NFS was doing--they were doing some preparation work after the plant shut down. In 1972, they were flushing systems and that kind of thing. When NFS announced that it was going to withdraw from reprocessing, I think that was in 1976, and from ’76 through ’80, Nuclear Fuel Services remained on the site, and they maintained the facilities. So, things were just shut down, and that was the time when Congress was investigating, they were holding hearings. The Department of Energy did its study on options for West Valley. So, all of that was going on during that time period to, you know, try to come to agreement on what would be done with the facility.

DUQUETTE: So, it was basically mothballed during that four year period?

BEMBIA: Yes. Maybe again, if Jim Clark could add anything to that?

CLARK: That was a period of dispute. And, NFS was the licensee, maintained the facility. There still was spent fuel on the site that was being returned to some of the utilities, like San Onofre and things like that. So, there was a period of moving out all the fuel that didn’t below to NFS, preparing diagrams and inventories for the eventual take-over by NYSERDA.

DUQUETTE: Was there any feeling as to what would happen if DOE didn’t step in?

BEMBIA: You know, from New York’s perspective, there was a very significant federal component to the responsibility. So, you know, New York state was certainly the licensee. We were there, but, you know, the Demonstration Project Act was passed, and we moved forward.

HORNBERGER: Okay, Mark and then Ron and Thure.

ABKOWITZ: Abkowitz, Board.

This question may be for one of two, or both of you, I’m not really sure. So, take turns if you will.

One of the things the Board has become more interested in looking forward at different alternative fuel cycle strategies is the cost associated with various options. So, this is obviously a case study in that respect, to some degree, so I guess my first question is how much plutonium was actually recovered during the time that the facility was in operation? That’s Part One.

BEMBIA: I can’t speak to that. And, again, Mr. Clark is going to cover the details of the reprocessing operation.

ABKOWITZ: Okay. Could we ask Mr. Clark to just answer that question?

BEMBIA: Yes, certainly. Maybe Mr. Clark can come up here.

ABKOWITZ: I just need a number.

CLARK: I believe it was 1946 kilograms.

ABKOWITZ: Okay.

CLARK: At least that was what was recovered and returned to the government or the owners.

ABKOWITZ: Okay. So, we’ll call that 2000 kilograms for now. Between the construction, operation and maintenance, and what you believe at this point in time will be the final disposition cost, how much will have been spent to recover that 2000 kilograms?

BOWER: I’ll talk to the Demonstration Project. To date, over $2 billion has been spent in the West Valley Demonstration Project Act. Over the next decade, we will spend close to another $750 million, maybe close to a billion, depending on the amount of contamination that we discover in the soil as we do the first phase of the decommissioning of the West Valley Demonstration Project. And, Moira will be talking about our phased decommissioning decision, but there are also three primary facilities remaining after Phase 1 decommissioning, the state licensed disposal area, the NRC licensed disposal area, and the waste tank farm, to fully remove all those facilities to an unrestricted release is in the order of $4 to $6 billion. The emplaced closure of those facilities would be in the order of a billion dollars.

ABKOWITZ: I want to make sure I get this straight. So, roughly an $8 billion overall cost; is that a fair guess for 2000 kilograms of plutonium?

BOWER: Yes. About $8 to $10 billion would probably be the--you know, if we’re just talking billions, probably somewhere in the $8 to $10 billion range.

ABKOWITZ: Okay, thank you.

HORNBERGER: Ron?

LATANISION: Latanision, Board.

The other dimension to what Mark Abkowitz just asked is that with a designation as a demonstration site, I take it that the implication is that during the 30 years from 1980 to 2011, and then for the next decade, a total of 40 years, we're going to be learning something about how to decommission a site such as this, presumably with the intention that other sites in the future will have benefit from the experience and the lessons learned.

What is the methodology which has been set up to preserve the institutional memory of what you're doing now, and what you've done for the last 30 years, so that other people will benefit in the future from all of this?

BOWER: Actually, that's a very good question. When the West Valley Demonstration Project Act was passed, it was primarily a demonstration of solidification of liquid high-level waste. The work that had been done at the time was vitrification at a benchscale level, not at a full process level like was done at West Valley. The work that we were doing at West Valley was shared very closely with the Savannah River site, and there was a lot of back and forth sharing of information when the defense waste processing facility was being constructed at Savannah River. In fact, we had a number of working groups that were involved with both facilities.

And, many of you may remember back in that mid 1990s time frame, there was a real question as to which facility was going to pour the first high-level waste canister. We did have some issues with our naulder (phonetic) during cold start-ups, so Savannah River got a little bit of a neck out or nose out in front of West Valley and actually poured the first canister before West Valley did. But, there was quite a bit of sharing with that. That information has also been shared with the waste treatment facility out at Hanford. In fact, a number of former West Valley employees have been or continue to work at the waste treatment plant out at the Hanford facility.

As we move into the decommissioning work, actually we’ve been able to benefit from the decommissioning work that has been done at other sites, Rocky Flats, Fernald, Miamisburg, Asterbuhl. We’ve been able to learn some of the lessons from those facilities.

As we move into our higher activity D&D, we do have some lessons learned that we will be sharing through the Department of Energy complex through our lessons learned program as we move into this work. Again, a lot of the things we’re doing at West Valley, we’re trying to take advantage of off-the-shelf technology and not invent new things. For example, Nitrocision is used in commercial applications. It’s used in contact handled applications. We’re taking that off-the-shelf technology and applying it in remote applications and sharing that information with the rest of the complex.

I don’t know if I--

LATANISION: Well, just to follow-up. One follow-up question. Is there a prescribed protocol for preserving information? I mean, look, you’re going to go through a whole generation of workforce over four years plus. Some of those people will be retired. What is the mechanism for maintaining the institutional memory from back in 1960 when it was built?

BOWER: We currently don’t have a process in place for that.

LATANISION: That sounds like a pretty big issue to me.

BOWER: A formal process for that.

LATANISION: Yeah. It just seems like a pretty big issue to me, because having gone through the exercise of time and effort, not withstanding the cost, without having some mechanism in place for ensuring that we’re going to preserve the lessons learned and make sure it’s passed on to the next generation who will find it of value, we lose.

BOWER: Excellent point. We’ll have to certainly look into that.

HORNBERGER: Thure?

CERLING: Cerling, Board.

I was just wondering if when the facility was being constructed, if there was any thought or concern in the design with respect to eventually having to clean up the site? And, irregardless of whether there was or not, would it really have made any difference since we had many new laws and other things in place 20 years later when the actual clean-up is going on?

BEMBIA: I think the Demonstration Project folks are finding that the plant really wasn’t constructed in order to make it easy to take it apart, decontaminate it, and decommission it, and I think a lot of effort went into the design of the vitrification facility, the high-level waste solidification facility to, you know, kind of learn from some of those lessons, and to make that facility easier to dismantle.

BOWER: I would agree with Paul. I don’t know if when the plant was constructed, they had given a lot of thought to the eventual decontamination, deactivation of the facility. If they did, we certainly haven’t seen much of the benefits associated with the efforts that were put into that. We did, in the construction of the vitrification facility and the remote handled waste facility, begin with the end in mind, with the expectation that these facilities would eventually be decontaminated and decommissioned. So, you would find stainless steel lined, completely lined cells for both the vit facility and remote handled waste facility, again, designed to have the equipment removed remotely when it was done, did design it for water decon, or at the time, we were looking at remote handled waste facility, we’re envisioning CO2 decon of the cell if we needed to do that as well.

HORNBERGER: From the Staff? Dan?

METLAY: Dan Metlay, Board Staff.

I’m not too sure whether you folks have this information. Perhaps Jim Clark might. We know that under Part 50, there are financial requirements that licensees have to satisfy to receive an NRC license. What, if anything, was done with respect to the NFS facility when it was licensed?

BEMBIA: There was a perpetual care fund that was established, and the idea behind that perpetual care fund was to allow the construction of additional tanks, because, again, at the time, the approach to managing high-level liquid waste was to keep it stored in tanks, and eventually, it would have to be moved to another tank. So, the perpetual care fund was set up to do that.

At the time that NFS transferred the facility over to the Department of Energy, wanted to transfer it back to New York State, I think that perpetual care fund was only something on the order of $2 million, I think I’m recalling.

So, it certainly wasn’t adequate for clean up, or even for maintaining the facility.

METLAY: Can you say something more about how the perpetual fund was funded?

BEMBIA: It was--well, again, Jim can help with that. But, I believe it came out of the reprocessing fees.

CLARK: I think it was either seven or eight molar was the chemical composition, and for every gallon of that molary that went into the tank, each month, NFS made a payment to either ASDA or NYSERDA, based upon the transfers into the tank.

HORNBERGER: Okay, great. Thank you very much, Paul and Bryan. Next, we’re going to hear from Moira about the Environmental Impact Statement.

MALONEY: Good morning. I’m Moira Maloney with the Department of Energy. I’m responsible for regulatory strategy and environmental compliance.

I’m going to speak to you this morning with regard to Phase 1 decommissioning at the West Valley Demonstration Project. In particular, I’m going to be covering the Environmental Impact Statement, the Decommissioning Plan, and the Phase 1 studies process.

In January of 2010, the Final Environmental Impact Statement for decommissioning and/or long-term stewardship of the West Valley Demonstration Project and the Western New

York Nuclear Service Center was issued. Four closure alternatives were evaluated: total removal, close in place, phased decision-making, and the no-action alternative.

In April of 2010, the Department of Energy issued its Record of Decision and phased decision-making was the selected alternative. So, decommissioning at West Valley will occur in two phases.

Under Phase 1, we will be removing the main plant process building, the above and below grade structures of that facility. We will be removing the underlying soils to get at the source term of the Strontium 90 groundwater plume. We will be removing soils up to maximum depth of 50 feet. We will be removing the Vitrification Facility as well. We'll also remove Lagoons 1 through 5, and the wastewater treatment facility associated with that. We'll continue to manage the NDA and the waste tank farm. We'll continue to operate the tank and vault drying system, and we'll be conducting Phase 1 studies during Phase 1. All this work is expected to begin in July of this year.

We will complete the decommissioning and/or long-term management decision-making in Phase 2, and we will be addressing the NDA, the waste tank farm, the construction, demolition and debris landfill, and the non-source area of the Strontium 90 plume.

So, again, we have our phased decision-making

Record of Decision. We also have the Phase 1 Decommissioning Plan in order to implement that work. And, in Phase 1, we’ll be performing Phase 1 studies. Now, Phase 1 decommissioning will actually occur in two stages. Stage 1 is the Phase 1 facility disposition, and in this stage, we’ll be relocating the 275 high-level waste canisters to new dry cask storage facility down at the South Plateau. We’ll be demolishing the Vitrification Facility and the main plant process building. We’ll be removing ancillary facilities and shipping legacy low-level waste.

Stage 2 of Phase 1 is the soil remediation stage. We will be removing the below grade portion of the main plant process building and the Vitrification Facility to get at the source area of the plume. We’ll be removing Lagoons 1 through 5, the liquid waste treatment facility. We’ll be shipping legacy transuranic waste, and we’ll also remove the remote handled waste facility and all the remaining ancillary facilities. So, in total, we’ll be remediating waste management area Number 1 and Number 2.

And, as I mentioned, the facility that will be addressed in the Phase 2 decision will be the waste tank farm and the NRC-licensed disposal facility, the State-licensed disposal area, the construction, demolition and debris landfill, and the non-source area of the groundwater plume.

We expect to be issuing a Final Decommissioning

Record of Decision to complete decommissioning of the West Valley Demonstration Project. We will also be issuing a Phase 2 Decommissioning Plan.

We have a very unique regulatory framework at West Valley. Decommissioning is actually going to be done under the West Valley Demonstration Project Act in accordance with a Memorandum of Understanding that the Department of Energy signed with the Nuclear Regulatory Commission. The Memorandum of Understanding procedural-wise is arrangements for review and consultation by the Nuclear Regulatory Commission. So, essentially, the Decommissioning Plan is a document by which NRC can make a determination as to whether our selected alternative will meet the decommissioning criteria in the license termination role.

So, the Department of Energy has submitted a Phase 1 Decommissioning Plan to the Nuclear Regulatory Commission. It identifies the Phase 1 decommissioning actions that will take place within the project premises. It’s consistent with the EIS Phased Decision-Making Alternative.

In Phase 1 of decommissioning, we will be removing the main plant process building, the Vitrification Facility, and the underlying source area of the groundwater plume. We will also be removing Lagoons 1 through 5, the wastewater treatment facilities, and the underlying soils.

It’s our objective to meet the unrestricted release criteria for Phase 1 to ensure that all decommissioning options will be available for Phase 2. The Decommissioning Plan also developed the Derived Concentration Guideline Levels for surface soil, subsurface soil, and streambed sediment that meets the unrestricted release criteria of less than 25 millirem per year.

There are two supporting documents to the Decommissioning Plan, the Characterization Sampling and Analysis Plan, and the Final Status Survey Plan.

So, the Characterization Sampling and Analysis Plan identifies the characterization activities that will support the Phase 1 decommissioning activities. And, the Final Status Survey Plan identifies the radiological surveys and soil sampling requirements to support Phase 1 Final Status Surveys.

We've made several revisions to these documents. We initially submitted our Characterization Sampling Analysis Plan to the Nuclear Regulatory Commission in February of 2010. We also then sent--we received comments and we modified the document and submitted it in November of 2010, and we are currently working on another revision to the document to address comments received, and we will be submitting it to the Nuclear Regulatory Commission this spring. The Final Status Survey Plan has been initially submitted to the Nuclear Regulatory Commission in December of

’09, and we most recently submitted a revision in November of 2010.

Okay, so, now as I mentioned, during Phase 1, we’ll be doing Phase 1 studies. And, the Department of Energy and NYSERDA have agreed to perform scientific studies during Phase 1 in order to facilitate interagency consensus to complete decommissioning of the remaining facilities at the West Valley Demonstration project.

The Department of Energy and NYSERDA have spent a great deal of time and effort to develop a process by which the Phase 1 studies will be conducted jointly with each agency having an equal voice. There will be open and transparent dialogue with all the stakeholders and an opportunity for meaningful input into the process. There also will be independent scientific input into the process.

The Department of Energy and NYSERDA are jointly funding the Phase 1 studies through an independent agency-neutral 8(a) contractor.

Phase 1 studies will examine a number of potential areas of study. And, you can read through the list. These are potential areas of study that have been identified based on comments received and discussions had with NYSERDA and other stakeholders.

So, this is what the site looks like today before we actually commence Phase 1 activities. And, the next slide is what the site is expected to look like at the close of Phase 1.

Are there any questions?

HORNBERGER: Questions? David?

DUQUETTE: Duquette, Board.

What I think we heard yesterday in some of the presentations, was that the complete decommissioning should be done in about a ten year period. Maybe I was wrong on that. But, seven to ten years was the number that stuck with me yesterday. Is that a correct number, or a planning number?

MALONEY: We expect that the first stage of Phase 1 will be completed within seven years, and the Department of Energy committed to making a Phase 2 decision within ten years of issuance of the Record of Decision.

DUQUETTE: Okay. The reason I’m asking the question, and for some clarification, was that even if Yucca Mountain were to be reopened, and it’s not likely under the current administration, we’ve been told as a Board that it would probably take ten years before work could even begin again at Yucca Mountain. And, so, you’re going to have a situation of 275 containers of high-level waste that are still going to be at the West Valley site at the end of a seven to ten year period when you’re supposed to be complete. What are you going to do with it?

MALONEY: Well, we don’t expect to complete the decommissioning of the West Valley Demonstration Project within ten years. We expect that we’ll complete the Phase 1 within seven to ten years, depending upon funding. And, then, we will make a Phase 2 decision within ten years of April 2010. And, the canisters will be addressed in Phase 2.

DUQUETTE: Will there be the capability to store those containers for another 30 years at West Valley?

ZADINS: The high-level waste canister relocation project, I’ll be discussing that a little bit later in the day, but the plans for the canisters are we need to definitely remove them from the process building in order to go ahead and complete its removal. And, at this stage of the game, the thought is to go ahead and store them in an ISFSI type pad, independent spent fuel storage installation type in a dry cask storage scenario. And, at least the thought is that we would be storing them on a concrete pad down here in the South Plateau, removing them from the main plant and then relocating them.

DUQUETTE: And, that means the facility will be manned for as long as those canisters are in place?

MALONEY: That’s correct.

HORNBERGER: Ali?

MOSLEH: It’s a follow-up on the first question. Are there any Phase 1 activities with the stations that are dependent on what kind of assumptions you're making about the Phase 2 decisions?

MALONEY: No.

MOSLEH: Totally different?

MALONEY: Totally. Are there any Phase--

MOSLEH: Yeah, Phase 1, Phase 2.

MALONEY: No. What's interesting about this is in Phase 1, we will be cleaning up to unrestricted release criteria such that it won't prejudice any of the options that are available in Phase 2.

HORNBERGER: Henry?

PETROSKI: This is Petroski, Board.

In your Slide 11, you describe a study process. And, it talks about, under the second bullet, that studies may be conducted jointly, each agency having an equal voice, open and transparent dialogue, independent scientific input, et cetera. What will happen if there's disagreement between the two parties in this case?

MALONEY: Well, the agencies will have to work it out, and there are opportunities for each agency to proceed as they deem appropriate.

PETROSKI: But, if you're laying out a process, it seems to me you should anticipate that there could be a deadlock.

ZADINS: The Phase 1 studies process has provision for what's called an independent scientific panel. Currently, it’s thought to be a three member panel, individuals who are considered to have a great deal of experience, both within the ethical aspects of science and also science in general. And, the thought is is that this independent scientific panel would be able to go ahead and adjudicate any kind of disagreement that exists between NYSERDA or the DOE.

Now, if there still is some disagreement, more is said that there would still be the potential to go ahead and have each agency go its own way on the study.

MALONEY: Yeah, and I guess let me clarify. The independent scientific panel that Zintars was referring to wouldn’t necessarily adjudicate, they would provide guidance to the Department of Energy and NYSERDA with respect to a particular issue.

PETROSKI: Who would appoint that independent panel?

MALONEY: The Department of Energy and NYSERDA.

PETROSKI: Thank you.

HORNBERGER: Thure and then Ron.

CERLING: Cerling, Board.

And, so, your Phase 1 project involves shipping low-level waste, and so on, and where is the final site that all that’s going to be shipping to?

MALONEY: Bryan, do you want to speak to that?

CERLING: Pardon?

MALONEY: Bryan Bower?

BOWER: That will certainly depend on the low-level waste. We have a number of disposal facilities available, including NNSS, formerly Nevada Test Site, or NTS, Energy Solutions facilities. We’re also looking at Andrews, Texas for potential future disposal of waste as well.

HORNBERGER: I have a follow-on question to that. In some of our briefing material, I noticed that it stated that you didn’t have a disposal path for TRU waste. But, I notice in Phase 1, you say you’re going to ship legacy TRU waste. So, you’ve resolved that problem? Tell me how?

BOWER: That’s why we’re showing legacy TRU waste as being part of the Stage B activities. As Moira stated, Phase 1 facility disposition, which we’re going to be awarding the contract this summer, will address the next seven years worth of work. The transuranic waste at West Valley is being addressed in the greater than Class C EIS, which just went out for public comment about two months ago. We are looking at having a pathway for the greater than Class C waste in around the 2019 time frame. If we can move forward with the greater than Class C EIS, make a decision on where the greater than Class C waste is going to be disposed, and then set up the transportation route, set up the facility, the 2019 time frame is about the earliest we would be looking for the disposal of transuranic or greater than Class C like waste.

That’s why we’re showing the remote handled waste facility being removed as part of the second stage of Phase 1 as opposed to the first stage, because it is our newest facility, it was designed for remote processing. Until we have the waste being accepted by the disposal facility, there is always a chance that we may have to do something different with it. So, we will be keeping the remote handled waste facility at the site until the transuranic waste is disposed.

HORNBERGER: Ron?

LATANISION: Yeah, if we could turn to Slide 9, please? When I was discussing with Bryan and Paul the question of whether there were protocols set up associated with decommissioning, this is just what I was looking for. And, I want to say I think this is important, to identify protocols, the technical basis for those protocols. And, then, on your Slide 12, to have identified topical areas of study. And, this is obviously a list that may change dramatically over the years. But, there will be presumably a permanent record associated with what you find in terms of soil erosion; right?

MALONEY: Oh, absolutely.

LATANISION: And, just so that we’re clear on the situation in terms of decommissioning. For example, is Nitrocision, is that technology that is accepted as being the technology to use in decommissioning, or is it kind of an experimental evaluation like decision, that’s part of your process?

BOWER: The Nitrocision technology is just one of a number of different technologies. At each site, as you look at the condition for each site, each site will be making a judgment based on the best technology. Again, as we talked about yesterday, we originally looked at using the CO2 decon systems in the main plant. We did do some testing with Nitrocision as well as CO2 decon and high-pressure water, concluded that we thought for the application that we needed at West Valley, Nitrocision would be the best application.

Again, each site, each situation being different, Nitrocision works well on stainless steel. Obviously, if you’re looking at concrete, then you may be looking at scabbling. Nitrocision is a technology that can be used for scabbling, but you can also use mechanical scabbling as well. So, again, I would imagine that each site would look at it on a site by site, application by application basis.

We’re using Nitrocision in two cells. We used scabbling in other cells where we don’t have the stainless steel liner. So, we vary our approach within the main plant, depending on the conditions that we encounter.

LATANISION: So, is there coordination among the sites so that, for example, at Idaho, they’re using different technologies, and Savannah River using others?

BOWER: Yes. I’m sorry, I didn’t understand your question. Obviously, the Office of Environmental Management has a technology panel, and so all these technologies that we’re looking at are evaluated by the panel at Headquarters. They have done some direct funding of technologies to see if there was application. In the case of West Valley, we have decided to move forward with Nitrocision based on our own internal studies on the quality of the decontamination that we could get using the system.

LATANISION: Thank you.

HORNBERGER: David?

DUQUETTE: Duquette, Board.

Referring to this particular slide, it’s a very aggressive science study. Do you--it probably is going to require some different kinds of people on the site than you have at the present time, number one. Number two, it probably is going to require a significant amount of funds to do it. Do you think you can do this within your current budgets?

BOWER: As Moira mentioned on her earlier slide, the Phase 1 study activities will be done in a joint fifty-fifty effort with the State of New York. So, we will be 50 percent Federal funding, 50 percent State funding. Based on our projected profiles for budget, we are looking at $60 million a year Federal funding. Any of the money that goes towards the West Valley the West Valley Demonstration Project Act activities is done 90/10. So, if we assume that everything was 90/10, which is the lowest level of NYSERDA contribution, $60 million of Federal funding equates to $66 million of total funding for the project.

For the work that we have planned for the Phase 1 facility disposition work, not the Phase 1 studies, but the actual on-the-ground work, we’re looking to set aside $60 million a year. So, that does leave $6 million to do other things. Not all of it, of course, would be spent on Phase 1 studies. We have other things that we have to spend money on, including some of the characterization work that’s not under the facility disposition contract. But, we are looking, and Paul, if you want to step in, we are looking at possibly up to a million dollars a year for the phased studies from the Federal government, and a matching contribution from the State, so in the order of $2 million per year.

Federal government, again, if we are at the $60 million Federal funding level, we could put more towards it, but again, we have to work with New York State because we are going to be joint funding the studies at a fifty-fifty allocation.

DUQUETTE: The reason for bringing it up is this Board has seen in its recent history an attempt by the Department of Energy, connected to the Yucca Mountain project again, to do a certain amount of science studies. When the budgets became tight, those were the first to disappear.

HORNBERGER: Questions from the Staff? Carl?

DI BELLA: Thank you, Moira. I have a question about your Phase 2 options. I take it that those options will include the same options that were addressed in the EIS, as well as any additional options that you can come up with over the next seven to ten years. And, in particularly, in the EIS, you looked at closing in place versus total exhumation, and that gives a very different pattern of costs. Closing--total exhumation has very high up-front capital costs, but zero operating costs after that, whereas the capital costs for closing in place are a lot lower, but then you have continuing operating costs that go on virtually forever, which you can treat by discounting. But, you always get into arguments about what’s the proper discount factor to use. How do you handle that kind of decision making?

BOWER: Very judiciously. Again, they are tough decisions. If they were easy decisions, we probably would have made them already. Again, as you asked, what options are we looking at? Obviously, we are looking at the alternatives that we evaluated in the decommissioning EIS, the full removal back to unrestricted release, also looking at close in place. But, I think with the studies, it gives us an opportunity to look at some other actions that we didn’t necessarily consider at this point in time for the disposal areas, the tank farm, including what are the benefits of partial exhumation.

We do know that there are some high-activity waste streams in the NRC license disposal area. We do know that there are some high-activities in the State license disposal area. We didn’t look at the concept of relocating disposed waste on site. So, I think that for the disposal areas, for the tank farm, there might be some other alternatives that merit consideration, and it will be interesting when we get into that Phase 1 study process, what other ideas come up from New York State, Department of Energy, stakeholders looking at what other options we might want to consider for the Phase 2 decision.

HORNBERGER: Howard?

ARNOLD: Arnold, Board.

Do I understand that the eventual situation is a walk-away, or do you have some permanent sacrifice zone?

BOWER: I can only speak for the facilities that the Department of Energy is responsible for, and I’ll let Paul Bembia speak to the State licensed disposal area.

Under the West Valley Demonstration Project Act, NRC was to establish the decommissioning criteria for West Valley, and they used the license termination rule, and applied it to West Valley. What NRC is looking for, and again, we have Mark Roberts in the audience, so if I misspeak, I’m sure Mark will correct me. The intent from NRC’s perspective is to attempt to get to unrestricted release. If you can’t get to unrestricted release, then move towards restricted release. And, if you can’t get to restricted release, then go to perpetual care license. But, again, their methodology is push first for unrestricted release, then restricted release, then perpetual care license.

NRC Policy Statement also made it clear that you may have different end states for different facilities on the site. There may be portions of the site that we can get to unrestricted release. There may be portions of the site that can achieve restricted release. There may be portions of the site that need to remain under license. But, again, their approach is push for unrestricted release, then restricted release, then perpetual care.

BEMBIA: And, from NYSERDA’s perspective, in regard to the Phase 2 decisions and what ultimately happens to the remaining facilities, we believe that we have quite a bit of work--more work to do, collectively DOE and NYSERDA, to look at the issues that were on the slide on the Phase 1 studies. You know, we identified some concerns that we had in regard to the long-term performance assessment, the erosion modeling, the assumptions for engineered barriers, and some of the assumptions for exhumation. So, you know, part of the reason that we went with this phased decommissioning approach is the first phase allows us to move forward with the clean-up, while it gives us time to do the additional Phase 1 studies to try to resolve some of these technical issues before we make the Phase 2 decisions.

So, you know, we've not identified one option or the other in regard to what the future looks like for the site. We believe the first thing we need to do is get those long-term analyses done in a way that we can all be confident in.

HORNBERGER: Questions from the Staff? Doug?

RIGBY: Doug Rigby, Board Staff.

With respect to the soil remediation, as you recover these different soils, then the ones that maybe contain a lot of the source term, you know, yesterday we had some discussion maybe under the plan, there's some cesium, strontium sources and things, what's the plan, what are you going to do with that soil? Will it be processed or what kind of plans do you suspect you'll do?

MALONEY: The soil is intended to be shipped off-site, and the excavation area will be backfilled with clean native soil.

RIGBY: So contaminated soil will be shipped off-site?

Is it expected that the--will highly contaminated soil receive some sort of special treatment, or is it expected it’s going to be a problem to dispose of it if it holds a certain amount of cesium, where it will be old enough, there won’t be much of a source term left?

BOWER: Again, as Moira said, all the soils, contaminated soil will be shipped off-site for disposal. We’ll have to treat the soil to the extent necessary to meet the disposal facilities’ waste acceptance criteria. So, once we get there and see what we have, then we’ll have to make the necessary treatments in order to meet the waste acceptance criteria at the disposal facilities.

HORNBERGER: Do we have any questions from the audience?

(No response.)

HORNBERGER: Okay, thank you very much, everyone. That was very informative. A good way to start us off.

We are now scheduled to take a break. We will take a break and we will reconvene very promptly at 10:25.

(Whereupon, a brief recess was taken.)

HORNBERGER: Next, there’s a distinguished group of panel discussion next, and we have just a little over an hour, and then we’ll have time for questions and answers. The panelists are Paul Bembia, who we met earlier, John Stetkar. On your agenda, John Stetkar is listed twice because he’s going to do double duty for the panel here, because John Garrick is absent. Stephen Wampler and Thomas Potter. And again, as Paul did earlier, I will not read bio information. I'll just ask everybody to give a very brief self-introduction.

So, take it away.

BEMBIA: Okay, thank you.

John Garrick asked me to just give a few minute introduction to the Quantitative Risk Assessment, and why New York State, NYSERDA commissioned that study. But, I'll start off first with just a little bit of some additional information on the State licensed disposal area.

The State licensed disposal area is located on the part of the site that we call the South Plateau. It's in the southern area of the developed part of the site. It's adjacent to, but it is not part of the West Valley Demonstration Project. So, NYSERDA manages this facility, not the Department of Energy. The SDA, and that's the term I'm going to use for it, SDA, State licensed disposal area, is one of the six commercial radioactive waste disposal facilities that began operation in the 1960s and 1970s. The others are there. It's one of two radioactive disposal areas at the Center. I mentioned the other one in my previous talk, and that's the NRC licensed disposal area.

The SDA was the first operational facility at the Center. It was operated by NFS. It began operation in 1963 under an exemption to the New York State Sanitary Code, which my understanding is the Sanitary Code prohibited the disposal of radioactive waste, and this was allowed under this exemption. So, it’s not regulated by the Atomic Energy Commission under the Part 50 license for the reprocessing facility. The NRC licensed disposal area is under that blanket of the Part 50 license. NYSERDA took over management of the State disposal area in 1983 when NFS left the site.

The wastes in the SDA came from a variety of sources. You know, the common generators in the 1960s and 1970s, I’m not going to read this list. About a little over 10 percent of the waste did come from the West Valley Reprocessing Plant. There was a limit on the dose rates of waste that could go into the SDA. Any waste that exceeded that limit was placed in the NRC licensed disposal area.

For the NRC licensed disposal area, it only accepted waste from the process plant. The State licensed disposal area, on the other hand, accepted wastes from off-site generators as well.

There were about 2 ½ million cubic feet of wastes that went into the trenches. It’s a shallow land disposal. There were 12 of these shallow land disposal trenches. They’re about 20 feet deep, about 30 feet wide, and the length varied from about 400 feet to about 650 feet. There were two other kind of special trenches, and these are the key radionuclides in the curies as decayed to the year 2000.

There were some performance issues for the SDA over the years, and these performance issues became important in constructing the QRA. And, one of the most widely known performance issues for the SDA is water infiltration and bathtubing. This occurred because, as I showed earlier, the trenches are constructed in that very tight silty clay, and any water that got through the trench caps or might have come through some sand lenses, tended to accumulate in the trenches.

Water infiltration was a problem from even the early days, and I think you can kind of see right in this disposal picture here, there’s a reflection, so there’s water in the bottom of that trench even during disposal.

This issue led to the shut-down of the disposal area in 1975 when water actually filled up to the closed trenches, and it seeped through the trench caps, and was released into a creek adjacent to the disposal area. Eventually, NFS did pump down the trenches, and they treated the water and discharged it to the creeks.

NYSERDA took over day to day management in 1983, and we also took steps to control water infiltration that were not all that effective. We rolled the caps. We took a sand lens out, but water was still accumulating. And, in the 1990s, we took a different approach and put in a slurry wall, and membrane covered that. You saw at the site yesterday. And, that effectively stopped the water infiltration.

Another management or performance issue is erosion, and we talked about it a little bit yesterday. The facilities at West Valley are located in these glacial tills. They are easily erodable, and NYSERDA is working right now, and we're working with the Department of Energy, and we're installing erosion controls in the creeks adjacent to the disposal areas. We have one set of controls that was installed in 2009, and that's that reconfigured channel here, and we're working on more of those this coming year.

So, why did we want to do the QRA? DOE and NYSERDA were working on that Environmental Impact Statement that Moira talked about. We were considering managing the SDA in place for an additional period of time of a few decades. We had identified some technical issues with the EIS, and that is what we talked about earlier today, with the Phase 1 studies. Also, the EIS was a long-term, presented a long-term analysis and it wasn't really structured to present details about performance over a decade period, and, so, NYSERDA decided to commission its own what I was calling at the time a "short-term performance assessment" to evaluate 30 years of additional management for the SDA.

And, it was strongly recommended that I talk to Dr. Garrick. Several people had told me that he would be the right person to talk to about this analysis. And, after meeting with Dr. Garrick and speaking to him, there were some things that we needed as a part of this analysis that really he felt weren’t normally part of the PA process. And that was, first of all, we had a pretty short period of time that we were looking at, and we needed to consider the details of our ongoing monitoring and maintenance programs.

We also wanted to look at probabilities as well as consequences, and there were a number of different triggering events and release scenarios. So, Dr. Garrick recommended that we commission a Quantitative Risk Assessment rather than this thing that I was calling a “short-term performance assessment.”

The results, in terms of what NYSERDA got out of the study, the QRA provided us with information on impacts and probabilities for managing the SDA in place for 30 more years. We got information on a full range of release events, including low probability events.

And, I guess the next one is related to that is that the analysis considered release mechanisms that hadn’t been previously studied. For example, it looked at several different scenarios for failure of the SDA slide slopes, and down into the creeks. It improved our monitoring or our ability to detect a release in a timely manner by recommending that we add some surface water monitoring in the creeks around the SDA. And, it also provided information that we’re using to evaluate and improve our emergency response planning. So, the SDAA was a critical input for our 2010 decision to manage the SDA in place for ten more years.

So, that’s kind of the background for why we wanted to do it, and I’ll turn it over to John Stetkar.

STETKAR: Thanks a lot, Paul.

I’m Dr. B. John Garrick giving a brief overview of sort of the methodology. John, again, you’re all well aware he feels terrible about this, one of the meetings that he certainly was very much looking forward to attending and participating in actively, and circumstances don’t let him do that. So, he’s sitting in California right now sort of tearing what little hair he has left out, hoping that we do well.

I’m going to go through quickly--I need to warn you that the amount of material that we have to present is daunting in the hour that’s been allocated to us. So, I’m going to skim through things pretty quickly. I hope that as you go through the slides, if you have questions, you know, we can certainly come back in the question and answer period, but I’m warning you, we’re all going to skip over slides because time management has become a real issue.

The purpose of this slide is not to give you a detailed laundry list, it’s simply to note to the Board that

Quantitative Risk Assessment is certainly not a new technology, nor is it limited to the applications which receive probably most visibility, and those are nuclear power plants. It’s been applied to a wide variety of engineered systems, and also natural systems, evaluation of risks from, for example, earthquakes, hurricanes, climate change, and so forth. So, it’s not a new technology. It’s something that’s been around for decades actually.

Why do a QRA as opposed to another type of assessment? We think that the benefits of Quantitative Risk Assessment are, number one, it’s a very systematic and thorough process to evaluate threats, vulnerabilities, of engineered and natural systems to those threats, and the consequences from the possible damage to those facilities. It’s quantitative. The numbers help. The numbers help because the quantification provides your ability to consistently develop structured lists of contributors to risk. And, that structured list is invaluable to making reasoned decisions to manage the risk.

We talk about the fundamentals of Quantitative Risk Assessment, and we’ll see this more in practice in our presentations, we ought to think of risk assessment as being defined as the triplet definition of risk, which is a very simple, but very elegant definition. And, that’s basically answering the questions of what can happen, how likely is it, and what are the consequences. It’s very simple. It’s very elegant, but it’s held us in good stead for any risk assessment application in any types of facilities or industries where we’ve applied this.

One thing that I did want to mention is the last bullet on this slide. Inherent in our definition of Quantitative Risk Assessment is explicit identification and quantification of uncertainties. In our presentation of the actual study, you will see that reinforced repeatedly. Uncertainty assessment is an integral feature of our risk assessment process. It’s not something that’s added as an after thought. It’s not something that’s done subjectively by ad hoc assessments. It is an integral part of our framework, and I think you will see evidence of that when we present the study itself.

The form of the results, you will see more clearly when indeed we summarize the results. The form is typically in the form of risk curves, which are probability of frequency format with explicit treatment of uncertainties. And, as I said, when we present the results from the study, you’ll see that.

One thing I think is very important to mention is that a Quantitative Risk Assessment doesn’t predict the future. It doesn’t tell you when an undesired event is going to occur. It provides you information about the likely frequency of that event with associated uncertainties. And, that information is useful for making decision about how to manage that risk.

So, for example, the age old one in a million years prediction, 10 to the minus 6, that doesn’t mean it won’t happen tomorrow. It could happen tomorrow. But, the information that the risk from a certain type of scenario could occur once in a million years compared to a different type of scenario that might happen once in a thousand years is very, very useful information for making reasoned decisions about managing that risk. By the way, once in a thousand year event could happen tomorrow also.

Let’s skip this slide. You’ll see the process of doing a risk assessment as we march through the various steps in what we did for the SDA/QRA. And, there are a couple of graphics here that show that process pictorially. The important takeaways from these graphics are that three large elements, what we call in this format a threat assessment, which in other formalisms, you might see an initiating event analysis where you coalesce a large number of potential what can happens into a set of challenges to your engineered or natural system, you perform a, in this sense, a vulnerability assessment or analysis of those systems to determine their ability to deal with those threats.

The output of that are a number of scenarios. This is the scenario based assessment, each scenario being characterized by all of the information that's developed from the initiating event, through the facility response, to a characterization of what the damage is from that. And, you will see examples of how we treated that in the SDA/QRA.

And, in the interest of time, I will, and I'm sure John is turning over in his grave now because he really likes this stuff, if you could bring up my presentation, I would appreciate that.

By way of introduction, I am now John Stetkar. I'm the Independent Consultant for the purposes of this presentation. And, to keep the intro short, I will leave it there.

What we're going to try to do here is give you, in one hour time period, an overview of a Quantitative Risk Assessment that is very very complex and very detailed. The slides that you have in your handouts are highlights of what we think are important elements of that risk assessment. What you'll hear orally are highlights of those highlights. I hope as you go through the slides, if you have questions on details, come back and ask us about it. We just don't have time to talk about every single element of every single slide.

I do want to mention--this is an important topic--the scope of the study. An important issue is, you've heard in the preceding presentations the scope--the time period for our study is 30 years. An important assumption is that NYSERDA will maintain the current physical administrative controls over the site for that 30 year period. This is not a 100 year study, it’s not a 1000 year study, it’s not a 10,000 year study. It is a 30 year study. We’re looking at the risks for the facility over that 30 year period. That’s an important simplifying condition for some of the analyses that we did.

The undesired consequence is radiation dose to a member of the public. Tom Potter will tell you much more about that aspect of the study. The hazards are pretty evidence, from what you know, they’re the solid wastes that are buried in the trenches, and the contaminated trench liquids.

In terms of evaluating the threats to the facility, we have two general classes of threats, and this is a little bit different from those types of threats that you’re more familiar with, for example, nuclear power plant risk assessment. We consider what we call disruptive events, or episodic events that cause an immediate change to the state of the site. For example, a severe storm, an earthquake, something like that. We also in the QRA consider a class of threats that we call nominal threats and processes, which are ongoing natural phenomena that have been there since the site was built, continue to this day, and will continue in the future. And, those are examples of things like groundwater flow, aging of engineered and natural barriers, for example.

It’s important to note, and I don’t want to dwell on it at this point too much, that the study does not explicitly, it does not quantify the risk from intentional acts of sabotage, terrorism, things like that. I mention it here because during some of the public reviews, questions came up about that topic. We do have, in one of the appendices, a simplified sensitivity analysis to give us some confidence about what that level of risk is. But, we will not claim that we’ve quantified the actual risk from those events.

Transport pathways, Steve Wampler will discuss more about that. We’re concerned about releases of liquids, solids, and gaseous materials to the environment in their transport to our receptors.

This graphic mimics some of the material in John Garrick’s preliminary presentation, which is why I skim through it a bit. It shows you the basic logic structure of the risk assessment, starting at a threat analysis where we look at these disruptive events and natural processes, run it through our what we call a release mechanism model. And, I’ll explain that in a little bit more detail to give you a feel for what that is. This is basically an evaluation of the vulnerability of the facility to those threats, and the development of our release scenarios.

Characterizations of the releases from each scenario, models for dispersion, transport, and dilution of the releases as they progress through the natural environment, and finally, models for exposure to our receptors and quantification of their doses.

I have to admit, having been through this study, and my colleagues will certainly back me up on this, that this is a nice linear flow picture. It gives you the impression that this is a very straightforward process. It’s not. There’s a lot of iteration that goes on here in practice. And, that iteration is important because there are a lot of cross-cutting issues that you need to treat very very carefully. But, it’s a good graphic to give you an idea of the general flow, the general topics, and the type of analysis that we do.

As I mentioned, we developed this construct, logical construct of release mechanisms to help us focus that mapping from initiating threats through release categories. I’ll talk much more about that in a couple of minutes. So, wait a few minutes and you’ll hear more details about what these are.

The next two slides, I will not spend any time on. They’re meant to show you the level of detail and the breadth of potential threats that we evaluated. This slide is a list of threats that we evaluated primarily qualitatively and screened out as relatively insignificant. The next slide is a list of threats that are indeed actually quantified in the study. If you read that list, you can get a feel for, as I said, the breadth and depth of detail.

The next few slides, I wanted to give you a couple examples to show you how we treated information from external sources to help us characterize the frequency of the various threats that we evaluated in the study. Meteorological data you’ll hear in a few minutes, precipitation in particular, is a very very important parameter affecting the site.

To give you an idea of the level of detail and the scope of the data that we collected, we used three National Weather Service stations at Buffalo, Dunkirk, and Jamestown, plus data from the site. Data from the site was only available from ’91 through 2007. You will notice that we didn’t restrict our data to ten years. We didn’t restrict our data to one site. We want to capture the variability and the uncertainty in those weather patterns, and you can’t do that by just looking at five years worth of data from one meteorological tower.

So, for example, from Buffalo, we actually processed 30,000 plus daily weather records to gather the information that we used. To give you an idea--I’m not going to tell you how we did that. If you're interested, ask us. We'll bore you to death.

How do we characterize the threats? And, this is kind of a uniform theme for all of our threat analyses. In the particular example of precipitation, if I am concerned about what is the exceedance frequency for cumulative precipitation in a one day period, which is this piece of information, why am I interested in that? I'm interested in cumulative precipitation. I'm also interested in precipitation intensity. So, I'm interested in both parameters. This happens to be our one day measurement of intensity, if you will.

How do I read this? For those of you who aren't familiar with this format, suppose I'm interested in what is the exceedance frequency for having ten inches or more precipitation in a one day period, based on all of the information that we have from those years of experience from those four meteorological sites. It's rather uncertain. This is a logrhythmic distribution. It says that we're 90 percent confident that it will happen once in more than 10,000 years, and our 95th percent is about once in, oh, it looks about 150 years, or something like that. The mean value is once in about 600 years. That's a coalescing of probabilistically weighted data from those years of daily weather records to come into this type of representation.

We did this same type of analysis for various durations to give us information about both cumulative precipitation and intensity. This is a set of 14-day curves, and so forth.

Another example of how we used various sources of information was our seismic hazard analysis. It’s based on two sources of information. One is a 2004 study done by URS Corporation. One is a 2008 U.S. Geological Survey characterization of seismic hazards in the Central and Eastern United States. It’s important to consider both of those pieces of information from this slide because you see the USGS estimates for the frequency of higher acceleration earthquakes are somewhat more pessimistic than URS estimates.

So, similarly to the precipitation part of the study, we developed standard seismic hazard curves in the sense in this representation, the frequency of exceeding a certain peak ground acceleration. And, again, that’s a combination of both of those sources.

Another issue that you will hear quite a bit about, and I won’t spend much time on this slide, are trench liquid levels. I only want to mention the fact that they’re very important for several elements of our study. For example, they determine the volume, the actual volume of liquid radioactive contaminants that are released in a particular scenario. They determine the hydraulic head for groundwater releases. You will hear a little bit about how we did groundwater analysis. The level of water in the trench preceding a particular event determines the net free volume available to fill up the trench for trench overtopping scenarios. And the amount of water in the trenches determines surrounding soil saturation conditions, which have an effect on our analyses of seismically induced slope failures and non-seismic slope failures and landslides.

I promised to get to these release mechanisms because they are a key element of the way that we structured the model, and they are a key element in understanding how the analysis was performed and how the results are characterized.

As I said, they’re a fundamental construct of the model and they serve that function of developing the linkage from initiating threats through undesired releases. And, we define five release mechanisms, the first of which is lateral and vertical groundwater flows through the Unweathered Lavery Till and Kent Recessional Sequence Layers. If you remember Paul’s very first introductory slide, you will remember what those are. Steve will remind you what they are. These groundwater flows are natural processes in our construct from either episodic events versus natural processes. They obviously result in liquid releases to the surrounding streams.

We have developed four scenarios. Those four scenarios are characterized by different levels in the trenches because of their effects on the hydraulic head. And, the fourth one that we internally characterize as the down and out scenario is a vertical release through the bottom of the trenches through the Unweathered Lavery Till intersecting the Kent Recessional Sequence Layer with a horizontal release out into Buttermilk Creek. And, again, Steve will tell you much more about those geometries.

The second release mechanism is also a groundwater release mechanism, but this is strictly a shallow groundwater release mechanism through the Weathered Lavery Till Layer, right at the surface of the site. Similarly to the other groundwater releases, it’s a natural process. It’s a liquid release. There’s only one scenario that was developed for this particular release mechanism. It can only occur if the levels in the trenches are high. If the levels in the trenches are below that interface between the Weathered and Unweathered Lavery Till, there’s no water to go out through the Weathered Lavery Till.

The third release mechanism are overflows of the trenches, conceptually quite similar. You fill a trench up, water flows out of the surface, it flows down into the creeks. That’s a pretty simple minded scenario. The evaluation of these is not so easy. They’re driven by severe storms and precipitation, as you might imagine. They result in liquid releases, as is fairly evident.

We have nine scenarios that contribute to this release mechanism, based on initial level of water in the trenches, how much free volume is left to fill the trench, the status of the geomembranes, which we have not spoken about before, but it’s very important to understand are the geomembranes intact. If they are not intact, what’s the likelihood that they are damaged. It’s important to understand that the likelihood that they might be damaged could be directly correlated to the initiating threat that may be filling the trenches.

For example, a tornado accompanied by very very severe thunderstorms with continuing rainfall over a protracted period of days. Talk to the people in the Southeast U.S. this week.

What are the status of the trench clay caps? Underneath the geomembranes, the trenches have highly densified compacted clay caps, which indeed were the original barriers against water intrusion. They’re still there. So, even if the geomembrane is failed, those clay caps provide some measure of protection against water intrusion. They’re pretty good for relatively modest rainfall rates. However, you need to consider the fact that very very severe rainfalls can cause erosion of those caps, exposing the weathered surface to infiltration.

So, we look at the status of the clay caps. We look at the status of the geomembranes. We look at the status of the water levels. And, of course, as I mentioned a few times, the severity and types of storms that might be hitting the site.

Release mechanism four is also a complex release mechanism. That’s breaches of the trench walls, physical breaches of the trench walls initiated by erosion and gullying of the slopes adjacent to the site, seismic events, and non-seismic landslides. Release mechanism four produces liquid releases when the liquid in the defaulted trenches is mobilized, and it releases solids into the environment. This is the only solid release mechanism that we have.

Twenty scenarios. Important parameters are, again, water level in the trenches, status of the geomembranes as it affects gully erosion. We have two different levels of seismic damage based on the degree of damage within the site footprint, and we also have two different degrees of damage from non-seismic slope failures and landslides. It’s a rather complex analysis.

And, finally, the fifth release mechanism is an airborne release mechanism. This is the only release mechanism to quantify airborne releases. This occurs from physical disruption to the site surface. It’s easier to just think of a large aircraft crashes, a military aircraft crashes, a commercial aircraft crashes, and surprisingly enough meteorite impacts. If you look at the frequency of meteorite impacts in a comprehensive risk assessment, meteorites with diameters between about .1 meters and a meter have enough energy to cause substantial damage to the site if it was to impact it, and, with frequencies that you just cannot just dismiss out of hand. So, indeed, with have meteorite impact analysis as part of this release mechanism.

And, with that very very rushed overview, I’m going to turn it over to Steve Wampler, who will tell you more about the transport analyses, and some of the soil evaluations.

WAMPLER: My name is Steve Wampler. I’m Chief Engineer with AquAeTer, an environmental and engineering consulting firm.

I’m going to talk a little more about the release category analyses, and the transport analyses. I’ll start with a little more, not a whole lot more detail, but a little more specific discussion of the groundwater system that was considered for the SDA.

The subsurface materials, as were described earlier, are glacial materials. And, the materials that are of most interest to us are this veneer, in QRA that is, veneer of Weathered Lavery Till that occurs at the surfaces in the neighborhood of ten feet thick in the area of the State disposal area. That's underlain by the Unweathered Lavery Till, which is a unit that is in the neighborhood of 70 to 90 feet thick in the area of the State disposal area. And, those are underlain in turn by the Kent Recessional Sequence, which is a coarser grained material, an outwash or a type glacial deposit, well, a little bit higher permeability than the tills that overlie it. They are underlain by the Kent Till and the bedrock shale, both of which are certainly of hydrologic interest, but not of concern for the Quantitative Risk Assessment.

A little more information here on the tills. I'm not going to spend any time on these, other than to just mention, as has been mentioned previously, that the Weathered Lavery Till is characterized by being quite fractured and relatively moderately porous throughout as a result of its textural content, and also that fracture. The Unweathered Lavery Till beneath it is fractured in the uppermost part, but becomes less fractured, unfractured, more dense, less likely to transmit groundwater rapidly at that depth.

I'll talk just very briefly about the significance of trench contents to the estimations that we made for the QRA. As has been mentioned previously, twelve of the trenches are ones that we are concerned with in the QRA, or primarily concerned with. Those trench contents are assumed to be 75 percent solids, of which two-thirds is disposed waste, and about one-third is soil. The remaining 25 percent is a combination of liquid and air or gas, with the distinction between what part of that volume is occupied by liquid or gas, depending on the fluid level under this--we’re considering in the scenario that we’re looking at.

Those trench contents, under the release mechanisms that we’ve looked at for the QRA, will either be partly or fully exposed, or partly or fully released. I’ll talk a little more about that in a few moments.

The mechanisms for release that we considered were overflow, basically a liquid only release, groundwater movement. Again, a liquid only release out of the trenches. And, various categories of catastrophic failure. And, I’ll talk about slope stability in particular here in a moment.

For trench overflow, we considered again the liquid only release that would result from a breach of the capping material, that being the geomembrane and the soil cap over the--beneath the membrane but over the waste. For trench overflow consideration, we did look at four trench fluid levels, ranging from basically a dry trench, fluid levels at the base of the trench, to a full trench, fluid levels in the trench at the surface of the trench. And, obviously, with the fluid level at the top of the trench, if the capping material was removed, the next drop of rainfall would produce theoretically an overflow and a release. With fluid levels at the base of the trench, it would take a substantial quantity of rainfall to fill the trench before overflow would occur.

We looked at release by groundwater movement, as has been mentioned previously. The methodology and analytical methods that were used are similar to a method that was suggested to the QRA team by Dr. Shlomo Neuman as part of the expert elicitation process that was integral to the early portion of the Quantitative Risk Assessment.

The model that was utilized is we would describe as highly simplified, but it’s intended to provide a reasonable estimate of conditions of flow and contaminant transport in a relatively complex and heterogeneous geologic environment. The slide also identifies how some of the properties, material properties and aquifer properties that were considered for the QRA, how those were handled. And, we may come back to that later if there’s some questions.

A discrete table showing what we looked at as far as pathways in groundwater. It’s actually a little more helpful to look in cross-section. There. We looked at two horizontal pathways. John described them as shallow flow pathways. They are horizontal flow pathways in the Weathered Lavery Till. That’s the shallower one. And, the Unweathered Lavery Till beneath that, both of those discharge to the surrounding creeks. And, those are Frank’s Creek and Erdman Brook. The pathway link that was looked at in groundwater modeling was 165 feet.

We also looked at what John described as the down and out pathway. We have vertical flow out the bottom to the trenches, through the Unweathered Lavery Till, down to the Kent Recessional Sequence, a vertical flow path of about 70 feet, and then a horizontal flow path in the Kent Recessional Sequence to a point of discharge along the banks of Buttermilk Creek at an area that is approximately 3000 feet from the SDA.

We also looked at releases, John mentioned, by seismic induced slope failure. We considered the actual topographic slopes on the north side of the SDA location, and on into east facing slopes on the east side of the SDA. The east facing slopes daylight--or, the failures with daylight come to the surface. Within Frank’s Creek, a north facing slope with daylight, Erdman Brook. All of those slopes are relatively steep slopes at present, and we did do the evaluation of slope stability through using a program, a computer program developed by Purdue University, the WinSTABL, or actually a STABL model with a--the WinSTABL is a variation on the Purdue model.

What we were able to look at and consider in those evaluations are failure surfaces ranging from shallow, very shallow surfaces, they didn’t pact or effect basically the till--only the till, and deep seated surfaces that run deeply into the till and actually intercept the trenches and the disposed waste.

A little more on the slope stability modeling. The slope properties for these models, the slope properties, the groundwater levels and seismic loading or seismic accelerations were varied in each model that we considered. We did consider, as this slide indicates, three different ranges of soil properties. Those properties being cohesion and density and angle of internal friction or FEE angle.

We considered three water levels within the trenches. Basically, a high, medium and low level. We considered five levels of maximum horizontal acceleration attributable to a seismic event. By those three water levels, three soil property determinations, five seismic events, three slopes, we looked at 135 different configurations of the slopes in determining their stability. The model itself for each run considers 200 conceivable failure surfaces. So, the total number of surfaces that were considered through this slope stability modeling effort was 27,000 surfaces.

Once we’ve gotten to this point, we have looked at overflow, we’ve looked at groundwater flow, we’ve looked at the slope stability, those are the mechanisms that would release liquids and solids into the surrounding environment, that environment being the basins or the stream channels of Erdman Brook and Frank’s Creek, and also the stream channel of Buttermilk Creek further downstream.

What we consider now is the transport or movement of those released fluids and solid into the environment, down to the points in those creeks, creek basins that we’re considering the potential for human exposures.

This map shows the locations of what we’re concerned with. And, we’ll come back to that, if you like, a little later on. But, I’ll move ahead, if I can.

For the solid and fluid transport in surface water, we considered estimating the flows and the amount, the movement of those solids using some models by the U.S. Army Corps of Engineers. Those two models are the HEC HMS model, hydrologic modeling system model. That model was used to determine stream hydrographs or flow over time in response to a range of precipitation events. We also used the HEC-RAS model, the river analysis system model to estimate--to model and estimate solids mobilization, solids transport, and solids redeposition within the channels of the streams that we’re concerned with for the Quantitative Risk Assessment.

This slide gives a little more information on what we looked at as far as initiating advance for flow. We looked at flows, normal flow, basically the flow that would--

no additional rainfall needed. And, we looked at this range of rainfalls all the way up to approximately 25 inches in a 24 hour period, and developed the hydrographs for each of those precipitation events.

Fluid transport in surface water, we considered the slow continuous discharge of groundwater or the slow discharge of liquids by overflow from the trenches. Those are a continuous release type events. We also looked at the rapid event scenarios. That would be the release of the entire contents, the entire fluid contents of one or more trenches in response to one of the disruptive, the catastrophic disruptive events that we talked about.

The release volume and the timing were considered together with stream flow to estimate the dilution of trench fluids at potential points of exposure.

Further, we looked at solid transport. The results of the solids transport modeling are summarized here on these slides. First, solids originating at the SDA, at the State disposal area, are mobilized, transported, and deposited under all of the stream flow conditions that we considered, from normal flow all the way up to the 25 inch rainfall.

Second major observation is that the flow volume does influence where that SDA originated sediment is deposited, but materials originating in the SDA released by these failure mechanisms that we’ve looked at are deposited along these streams, in some segments of these streams under each of the flows considered.

And, one more slide, one more comment on the solids, the results of the solid modeling, and solids transport modeling, and how we use those results. Considering the model stream deposition estimates in Frank’s and Buttermilk Creek segments that we’ve looked at, the conservative assumptions, we made conservative assumptions relative to the deposition of diluted sediment originating from the SDA source. Those are--that’s human receptors in Frank’s Creek segments would be assumed to encounter sediment consisting of 50 percent material released from the trench, the various solids release modes at the trenches. Human receptors in Buttermilk Creek would encounter sediments consisting of 10 percent of materials originating from the trench solids releases.

And, Tom will carry on a little further about what we then did with those results.

POTTER: My name is Tom Potter, and I’m going to talk about the release categorization and the dose assessment.

Here’s where the release category analysis falls within the study framework. But, you can see we kind of jumped ahead a little bit and are coming back. That’s kind of the way it went in the study. The purpose of release categorization is to develop more complete descriptions of the scenarios that John talked about, the event scenarios, to include information necessary to evaluate the consequence, in this case, to calculate the doses.

The quantities of interest for us are for three types of releases, generally, radioactive material release quantity for the first and third release types, and in the middle, radioactive concentration in solids and the total solids release quantity, because in that case, the source is solids. I include some information about dilution here because the dilution was, to some extent, dependent upon the event scenarios for some of these events. So, we had to kind of handle them hand in hand.

I’m just going to show you the trench layout quickly here. Trenches 1 and 2 up in here are kind of like one trench together. There are two small trenches, 6 and 7. Here’s 1 through 5, and here’s 8 through 14. And, Frank’s Creek is up in here, Buttermilk Creek is up in here somewhere. That kind of gives you the layout.

These are physical characteristics for a typical trench, taking 1 and 2 as a combined trench, and leaving 6 and 7 out. You can see that the trenches are pretty similar from a physical standpoint.

From the standpoint of trench radionuclide content, burial records were used to characterize that content, and as Paul has mentioned earlier, high variability in waste material form and content. The highest radioactive material inventories, relatively speaking, were in 4, 5, 8 and 11. We excluded from analysis Trenches 6 and 7. Either 7 had a small inventory and 8’s inventory was entirely activation products in large stable metal forms.

The outcome of that analysis, this is a short summary, gives you an idea. There are substantive quantities of radioactivity for a number of radionuclides. These are only the major ones. We leave out the daughters, and stuff, that appear in the tables, short lived daughters. Total, excluding Tritium, 53,000 curies, and a substantial amount of Tritium.

We calculate a concentration in trench solids based on dividing the inventory activity by the total mass of waste and soil fill in the trenches. It’s an uncertain estimate, and to apply an expression of uncertainty, we use a multiplier, M1, which is a probability distribution with a median of 1 and error factor of 3.2, which is a way of saying we have an idea about the trench inventory within an order of magnitude. That multiplier is then applied to the entire nuclide spectrum together. So, we move them all up and down, all nuclides up and down at the same time.

Trench liquid nuclide concentrations, we calculate trench system average basis. And, I should point out in both the solids and the liquid releases, all or many of the trenches are involved in contributing to those releases. The point estimate liquid concentration is calculated by--or calculated solids concentration, divided by a distribution coefficient Kd, simply a largely empirical ratio between concentration in solids and concentration in liquids, and a mix.

The ranges in calculating concentrations in water, trench water are given here, and you can see, other than Tritium, we’re typically in the 1 microcurie per liter range.

The uncertainty for trench--expression for trench liquid is more complicated, because we have to include the uncertainty in trench solids, and also the uncertainty in Kd. And, the outcome of that is a product of two multipliers, and their distributions, a median of 1, an error factor of 20.4 which says we have some confidence in our estimates of trench liquid concentrations, within a range of about three orders of magnitude.

I’m going to move now to the dose analysis--oh, I should back up here a little bit. There are a number of nuclides for which we have measurements in the trenches, and are calculated, some of those nuclides we actually derived Kd based on measured nuclide concentrations in the water, and our derived concentration in solids, and calculated the Kd for those. And, overall, I would say that our spectrum of concentrations agrees pretty well in the measurement experience.

I’m going to move to the dose assessment now. And, the objective is to develop probability distributions of the consequence end point, conditional on the radioactive material release category, or release type. The end point was chosen for the study, is the maximum annual radiation dose to a person, TEDE, conventional radiation protection jargon, as comparable to the 10 CFR 20 limits for exposures to members of the public.

This is a very compact list of pathways that we evaluated for actually three different receptors. I’m not going to get into the bottom of that. That’s the one for the airborne releases, which do not contribute to risk, so we didn’t really focus on it for purposes of the presentation. We included it in the analysis, though.

With respect to the water releases to streams, the receptor of interest is a resident farmer on Buttermilk Creek near the confluence with Cattaraugus Creek. And, there is in fact a resident farmer there. This implies that he’s very independent with respect to producing his own food, and a variety of things like that. And, we met this resident farmer, and I can attest that he is very independent that way.

We found, though, that with the solids releases, he was not the critical receptor from the standpoint of dose. A casual hiker along Buttermilk Creek and Frank’s Creek where he might encounter some of these diluted solids, could get higher doses from direct exposure to the radioactive material in the solids. So, we included that receptor as well.

Our dose computation, we used GENII, V2, PNL Code, conventionally used for these kinds of things. We did not include season effects. We included--and, that means he’s irrigating, you know, around the clock all the year, around the year. We used ICRP 30 dose factors, compatible with 10 CFR 20.

And, now, getting into the various release types, and the release of trench water to surface water. In that case, the dose is proportional to the time-integrated nuclide concentration in Buttermilk Creek down at the resident farmer’s receptors. We calculated a normalized receptor dose for a one day receptor withdrawal of water with nuclide concentrations equal to concentrations in trench water. That’s our normalized dose.

We calculated the normalized doses for two nuclide spectra. One is a poorly retarded spectrum, the other an all nuclide spectrum. The poorly retarded nuclide spectrum, we applied to groundwater releases in the down and out scenario, or through the Unweathered Lavery Till, lateral releases through the Unweathered Lavery Till. We found in our sensitivity studies with the groundwater models that very little retardation, or very low Kd’s, gave you basically no dose from nuclides other than these four. So, we simply, rather than try to calculate a dose for all those nuclides, calculated a dose for these four. For all other release pathways, water to water, we used the entire nuclide spectrum, so no retardation or any of that.

You can see the point estimates, 240 millirem in a year for the poorly retarded, about 20 times higher for the all nuclide. And, then, to calculate dose, it would simply be a matter of multiplying that point estimate times the dilution factor, or less than 1, it might be an inverse dilution factor is the way some use it. And, the release duration in days. I’m not going to go into the uncertainty there, because I’m short of time here.

But, here is the similar process for trench solids to streams. In this case, the dose is proportional to the nuclide concentration in trench solids. And, again, we calculated a normalized dose, normalized dilution factor of 1. 25,000 millirem in a year. So, that’s for 100 hours worth of exposure. And, the dose is simply that factor times a dilution factor, which is the exposure time weighted soil dilution factor along his hiking path up and down Buttermilk Creek and Frank’s Creek.

This is the release of trench solids to air. We had a conservative estimate of the mass of release, 500 Kg’s of trench solids. We didn’t do probability distribution on that. It’s conservative because there’s a low risk item. We calculate 12.2 millirem in a year, some uncertainty on the doses.

In Section 12 of the report--Section 9 of the report, all of the release category information is brought together. In Section 12, it’s combined with the event frequency information to provide basically a recipe for the integration part of the risk assessment.

And, I’m going to turn it over to John for the rest of that.

STETKAR: Okay, short time depends on who the audience is, relative levels of interest. I’m not going to dwell too much on numerical results. If there’s interest, again, we can discuss it in the question period.

A couple of highlights related to the results that I did want to mention are that in the introduction, we mentioned this probability of frequency format for expressing the results of the Quantitative Risk Assessment. People ask me what are the results of your risk assessment? These are the results of the risk assessment. These are the risk curves. If you’re not familiar with risk curves, the way to interpret this is similar to the exceedance curves that I showed you evaluating the threats. This is a plot of the frequency of events, if you want to consider them as events, as a function of the accumulated dose for our receptors.

So, for example, the way to understand this is that--let me give you first, because of the bumps and the wiggles, until we get to the understanding--these are, for those of you who have ever seen risk curves, these are a bit strangely shaped. The general shape is typical. You expect a lower frequency of higher consequence events, a higher frequency of lower consequence events. And, they satisfy that general shape.

The particular shape is determined entirely by the assembly of all of the scenarios that contribute to those various release mechanisms. In a general sense, I can tell you that this part of the curve is determined primarily by groundwater releases that occur at a relatively high frequency, but with relatively low dose consequences. This part of the curve is generally driven by those large trench breach scenarios that generally have rather low frequency, but quite high releases and high dose consequences. In between, there’s kind of a transition. There’s a map into some of the trench overtopping and gullying types of scenarios. So, that’s a qualitative picture for why bumps and wiggles are in these curves.

How to read these curves, if we take, for example, the 100 millirem in one year dose limit that Tom mentioned, and we take a vertical slice through these curves, that will give us the uncertainty in the frequency of exceeding that dose limit. And, in numbers, what is that? In numbers, that tells us that to--there are two significant figures, or more reasonably, something around a few thousand years. The mean expected frequency of a release that would result in a dose of 100 millirem or more from the site is roughly 1 in 2000 years.

Our 90 percent confidence in it, if you think of the range of those curves, varies between about one event in 1600 years, and one event in 2600 years. This graphic actually is much much more informative about the risk, because this graphic is literally sliced through the entire family of those risk curves. And, in the former graph, it only showed you the four parameters of the fifth percentile confidence, the median, the mean, and the 95th percentile.

Why is this important to understand risk? It's important because if I just take a single number, that mean value, roughly once in 2000 years, I get something about here in this probability density distribution. That's informative. It gives me some information about the level of risk. If I take the 90 percent confidence interval, which ranges roughly here to here, that gives me some measure of my uncertainty in the risk. However, you will notice that this is certainly not a normal probability distribution in a mathematical sense. It's a very skewed probability distribution.

So, for example, the entire information about the risk tells us indeed that there is a small, but measurable, probability that the frequency of releases could be not very high, but quite a bit higher than that 90 percent confidence interval.

Why is that important to understand? It’s important to understand what an impractical sense is. Back in 2006, would you have managed your investment portfolio different if the banks had told you that there was a very small probability that you would lose all of your money? It’s important to understand these tales. And, it’s important to characterize the risk as the full spectrum of our uncertainty for that particular reason. It’s called risk management.

The next slides I’m going to skim over a little bit. This is at a high level from risk release mechanisms. You see a little less than half of the risk comes from that release mechanism 1, which are groundwater releases. About 40 percent of the risk comes from those trench breaches, and the rest are rather small contributors.

I have two sets of slides that show the distribution of risk from individual scenarios. I’m not going to dwell on those. However, there’s a message here that again in the sense of risk management, the decomposition of the contributors to risk, to this level of detail, allows now NYSERDA, for example, if there were an outlier, to very quickly identify what that outlier is, what the contributors are, and how best to mitigate or manage the risk from those outliers. That’s sort of the power of this scenario based assembly and decomposition process.

And, something that Paul likes to see me say at the end of these studies, the overall conclusions from the study are that the QRA results confirm that the public health risk from operating the SDA for the next 30 years is well below, while the widely applied acceptance standards, it’s that 100 millirem per year limit. Not only is that true in a mean sense, it is also true if you look at the details of our uncertainty analysis, because even at the upper bound tail of that distribution, the frequency is much much smaller than once in 30 years.

And, of course, I always have to qualify that by the low level of risk will be maintained only if NYSERDA keeps in place their continuing physical and administrative controls.

And, with that, and only about five minutes over, is the end of our summary. Thanks.

HORNBERGER: Very good. I congratulate the panel on your time management. That was an awful lot to pack into, and I only have you four minutes over. So, you did even better than you thought, John. Questions from the Board? Mark?

ABKOWITZ: Abkowitz, Board.

First of all, I commend the team for a very comprehensive piece of work. As someone who is involved in risk assessment, I can appreciate the effort that's required to collect data that you can work with and cobble together models that talk to one another, and all of those kinds of things.

I have kind of two lines of questioning. I'll try to be brief, although my colleagues will remind me that I never am. The first one has to do with the big picture. My understanding is this entire effort is focused on only a portion of the wastes that are being stored at the site. And, so, when you start talking about risks to hikers and farmers, and so forth, I want to just make clear in my own mind, that those risks that you're talking about are only from the portion of the site that the State owns. Is that correct?

STETKAR: That's absolutely correct. It is only the State licensed, the SDA.

ABKOWITZ: Has that been made clear in your communications to the public?

STETKAR: I hope so.

BEMBIA: I believe so, yeah.

ABKOWITZ: So, they’re aware that this is not the total risk portfolio for everything that’s on the site?

BEMBIA: That’s correct. There was--this work was included in an appendix--an abbreviated version of this was included in an appendix in the Environmental Impact Statement, and I think we made it very clear that it was only for the State licensed disposal area.

ABKOWITZ: Okay, thank you. The other line of questioning I have has to do with the fact that it appears that you relied exclusively on historical weather data. And, as you are aware, we are experiencing different weather patterns today, and the climate scientists are telling us that we can expect higher mean temperatures, greater maximum temperatures, more frequent heavy storm events, and changes perhaps in vegetation and other things. So, I’m curious the extent to which that factored into any aspect of your analysis.

STETKAR: That’s an excellent question. And, in fact, it’s an issue that came up, I think as Paul mentioned, we did the study in two parts. We did a Phase 1 part in 2008, and then sent the report out for review by DOE, NYSERDA, public comments. Some of the public comments that we received asked the same question. How did we account for the effects of potential climate change? The simple answer is that the analyses do not explicitly try to project the effects of climate change.

We did, however, and I have a backup slide if you’re at all interested in it, we did go back through those historical weather records, and note that over the 80 plus year period that we had weather data from Buffalo in particular, that was the longest stretch, and Dunkirk was not far behind, there are certainly very very large, not only annual variations, but almost variations within three or four year periods in terms of severity of storms. We looked at specifically severity of rainfall totals, and also, to the extent possible, thunderstorms, and things like that. And, you do see very large variations historically over time.

We looked at that information for trends over the last two to three decades, could not discern any identifiable trends. That doesn’t mean that they are not there, quite honestly. They may be, but they may be very very subtle, because it is difficult, looking at the annual variability and trying to discern a net trend over, for example, a period of 20 years, isn’t necessarily very easy to do.

That isn’t very comforting, except for the fact that an important qualification of this study is it only applies over the next 30 years. So, we’re not looking at climate changes projected out over the next century to two centuries, where more explicit treatment of those projections could have a larger influence.

So, in some sense, we’re protected a bit by the very well-defined scope of our study in terms of looking at only the next 30 years. And, the fact that we couldn’t, at least in patterns around this region, couldn’t identify any distinct trends.

ABKOWITZ: Okay, thank you. I appreciate that.

I guess the only comment I would offer is that, and I don’t know the extent to which this study did this, you could always run sensitivity analyses off of your distributions, or do one-offs, or anything of that nature, just to see if that would have an impact on the rigor of your results. Thank you.

HORNBERGER: Bill?

MURPHY: This is Bill Murphy of the Board.

I thought this was quite interesting and I think we heard earlier this morning, that in fact there was at least one occasion in which there was water overflowing the trenches. Were there radionuclide releases associated with that, and were they characterized? And, could those data be used as a test of your model?

BEMBIA: There were radionuclides released. There was data collected I believe in the surface water streams, and I don’t believe we used that information in this. But, I think that’s a great thought.

POTTER: We didn’t use it in the quantitative analysis.

We did look at it. I don’t recall, there was a problem with the usability of the data in terms of concentration and total release and data, as I recall. This was a couple of years ago now, so I’m a little fuzzy on it. But, I remember being introduced to some data about that. And, actually, I remember the events happening at the time. But, it was very limited information and not very usable to us.

HORNBERGER: Ali?

MOSLEH: Mosleh, Board.

John, you integrated the analysis of different pieces; right? To some high-level model of event trees.

STETKAR: Is that a question?

MOSLEH: Well, yeah. Well, I’d like to get a confirmation of that.

STETKAR: Okay. Not to the formalism of event trees, Ali, because the formalism was literally the scenarios. We did use, in some cases, limited decision trees, and in the backup, I have some examples where I could show you that, but it was more to structure partitioning of different mechanisms. So, for example, if you had a windstorm that is severe enough to damage the geomembrane covers with a precipitation intensity that is severe enough to erode the trenches clay caps, and a cumulative precipitation to cause the trenches to overfill, that was a direct contributor to release category 3, for example.

If those conditions warrant that, you could still leave the site with destroyed geomembranes, which take time to replace, and disrupted trench clay caps, which leave you then more vulnerable to later perhaps less severe precipitation events. So, there was some decision logic in that way to sort of structure the scenarios. But, the actual quantification was done essentially straightline scenarios.

MOSLEH: So, I’m thinking where you had phases or blocks of the analysis, you had some pinch points, I think, different levels, one levels of the trench. Are those the pinch points?

STETKAR: Not in the sense that you’re thinking of. They weren’t pinch points. They were actually parameters that had--there was a probability distribution for levels of water in the trenches. We discretized that probability distribution into four distinct water levels. Those water levels, with their associated probability, were then used to characterize input criteria for the individual scenarios. So, it’s not so much as a pinch point, it’s information that’s carried through on the scenario.

MOSLEH: But, the rest of the analysis depends on those four levels?

STETKAR: That’s right.

MOSLEH: Or classes.

STETKAR: That’s right.

MOSLEH: Okay. So, then, carrying it forward, you also had--the states which you calculated the dose to individuals; right?

STETKAR: Right.

MOSLEH: So, is there a difference between the continuous exposure, such as a farmer, and an episodic event such as a hiker, because one is a continuous scenario, a farmer's exposure, the other one is more like somebody is hiking?

POTTER: You mean the farmer being a hiker?

MOSLEH: No, the farmer having more continuous exposure, as opposed to someone who just--

POTTER: Oh. Practically speaking, the farmer's exposure occurs when that slug of water goes by.

MOSLEH: So, it's also a one time.

POTTER: So, the dose is really--his does is proportional to the, if you imagine the concentration in water, Buttermilk Creek being constant, that concentration times the time it takes for that slug to pass. It's the time integrated concentration that determines the dose to the farmer.

In the case of the hiker, you've got this solid that's moved downstream, and it resides there and it's got radioactive material in it, and this guy is hiking up and down over the course of the year, we assumed 100 hours a year, plus or minus. So, he gets a little bit on every hike, and he gets a little bit less per hour on that Buttermilk Creek breaches, than he does on the Frank’s Creek breaches, where the concentrations are higher. And, we sum that all up over 100 years of exposure.

MOSLEH: Aggregate it.

POTTER: 100 hours of exposure.

STETKAR: Let me just add one thing, and it’s implicit in what Tom said, is that none of these releases are continuous releases that continue ad infinitum. They are all--each release scenario is characterized by release duration. So, for example, some of the groundwater releases can continue at the upper ends of the uncertainty distributions for I think a year, or close to a year, or something like that, I can’t remember what they were, but they can be rather protracted.

Some of the more episodic events, for example a tornado accompanied with, you know, like a thunderstorm, the release will probably occur only over a couple of days. So, each scenario is characterized by a release duration also, which factors into the dose calculation. But, none of them are releases that--even the groundwater releases, once they’re detected, we have mitigation models in there for NYSERDA to intercede, identify the location of the seep, and take either remedial action to stop the release, or in the sense of the receptors, you know, protect the receptor.

MOSLEH: That’s already factored in.

STETKAR: Yes.

MOSLEH: So, on the uncertainties, what are the biggest contributors to the uncertainty? Because you correctly highlighted the fact that the tail of those distributions are important, so they’re sensitive to what?

POTTER: The overall uncertainty in the analysis?

MOSLEH: Right.

POTTER: I don’t know that we have it resolved, but my gut feeling is it’s uncertainty--it probably depends on different parts of the curve. But, a substantial part of the overall uncertainty has to be uncertainty in the concentration of nuclides in the water in the trenches. That’s one of the things we have the broadest uncertainty ranges associated with.

MOSLEH: What about assumptions such as those that I think you mentioned of the, what was it, groundwater--the highly simplified by Dr. Neuman’s model? He used a highly simplified model, and characterized by reasonable characterization of the complex process. So, there, you have one expert providing input on something that you agree that’s not very--

WAMPLER: Well, the properties that are most critical to the outcome of the flow model and the transport model are hydraulic conductivity and effective porosity, really, and those properties--I kind of skipped by that--but, those properties were varied probabilistically within ranges that are either based on what has been measured and observed at the site for these particular strata, or strata like these in other previous testing, and just a certain amount of professional judgment as well to consider whether those ranges should be broader or narrower.

One porosity range was particularly broad because we considered in this simplified model, considered the effect of fracturing as a very small effective porosity number, which in effect increased the rate at which groundwater would move, not as much groundwater would move, but the rate would be very high. So, those factors that highly influenced the results of the modeling, hydraulic conductivity, horizontal and vertical, and effective porosity were varied probabilistically and actually, what am I looking for, the statistical method that was used--Monte Carlo. We had distributions for those parameters, and we stuck them in the sample, and we got uncertainty distributions.

MOSLEH: Okay. So, there’s a little bit of model uncertainty in this?

WAMPLER: There could be in that sense. We did not look at other possible groundwater release modeling constructs in that sense, if that’s what you’re going for, that’s true.

STETKAR: Within this model, we tried to treat all of the key parameters with uncertainty distributions.

HORNBERGER: Okay. David?

DUQUETTE: Duquette, Board.

I’m not going to pass myself off as any kind of an expert on risk analysis, but I want to address that last bullet on that slide. What that looks to me like is an atta boy, you’re doing everything right and you don’t have to do anything any different, and you’ll be okay.

Does your analysis help the project to better define how they do their job, that is, could you based just on the analysis, could you say you don’t have to do this, or if you did that, it would be better, or you might save money, or do something else. Does the analysis allow you to do that, or does it just say you’re okay?

STETKAR: Absolutely. You’re a wonderful straightman, you must have looked ahead in the slides, one that I didn’t get a chance to--indeed, in the first part, we didn’t identify anything that they’re doing now that they need to stop doing. We did identify, certainly coming out of the Phase 1 study, and even some remaining recommendations out of the Phase 2 study, things that we felt would be improvements.

One thing that Paul did mention was as a result of the Phase 1 study, they’ve installed another monitoring point in Buttermilk Creek. And, indeed, not only another monitoring point, but we used the results of the study to determine where the most effective location of that monitoring point would be to maximize, in particular, detection of these so-called down and out releases, which only come into Buttermilk Creek. Put it too far downstream, you get mixed things coming in from the other part of the facility that we don’t talk about. Put it too far upstream, you’re not going to capture the most likely release point. So, there’s an example of something that was done actually during parts of the study in response to our recommendations and findings.

We made some other recommendations that I think NYSERDA is considering. I don’t want to speak for NYSERDA.

BEMBIA: There’s actually another one that really came to play. One of the recommendations was to minimize the amount of time that the trench caps, the clay caps are not covered by the membrane cover. And, just last year, we installed a replacement cover over about two and a half of the trenches, and the recommendation from the QRA went into our decision to actually leave the old cover on, and just place the new cover over the top of it.

STETKAR: That’s a good point because, for example, in our study at the time we did it, we talked to NYSERDA about physically how are you going to do that. In the study there is--it accounts for this planned replacement of the covers, that one section, which is the older section, plus the newer section, will need to be replaced at some time in the next 30 years. NYSERDA at that time wasn't sure whether they were going to leave the old cover in place and just recover it, or whether they were going to remove the cover and, hence, leave the surface exposed for some period of time.

The study assumes the more conservative, that they will remove the cover and leave the surface exposed. If we were to go back and redo that part of the analysis with this information, we'd see a little bit better effect from that planned type event.

DUQUETTE: All right. One other very last quick question, John, it's for you since you represent John Garrick. Okay? Something that has bothered the Board for a very long time, and you can solve the mystery, is what does the "B" stand for?

STETKAR: I've known John Garrick for 31 years now. I know Liz Ward for 31 years. Ask Liz. Liz knows. I don't.

HORNBERGER: Okay, I have Howard and then Nigel and Bill.

ARNOLD: First, a comment. This is Arnold, Board.

First a comment. I think if you had a major disruptive event, you would probably fence the place off and not let that hiker walk by. So, you probably could eliminate that from the analysis.

STETKAR: We’ve accounted for that, but indeed it will take some time to do that. You know, we’ve tried to account for that. We have mitigation distribution.

ARNOLD: If an airplane hits, you’ll fence off the site.

Question, though, I maybe missed the release mechanism of what goes on that puts the radionuclides in the water. You put a drum in there and it’s got various things in it and it’s got a shallow zone, and how do you calculate the probability of the material getting out of the form it’s in, the various form, a capsule or whatever. How do you calculate that, that chain of events that leads to it being mobilized in the water, or do you?

POTTER: You didn’t miss anything. As I mentioned, I won’t put the slide up again, but it’s Slide--in my package, it’s Slide Number 9. We had a variety of information to work with. We had a very large and detailed database on what was put into the trenches in terms of form and nuclide quantity, highly varied. We also had some measurements of concentrations of nuclides, some nuclides in trench water from various trenches over a period of--there’s a table in the report in Section 9--at least 10, maybe 20 years, not all the trenches, but a number of them.

So, we had something to go on. One of the things that it showed was that the concentrations measured in trench water at any given time varied greatly from place to place in one trench, or from trench to trench, typically over a couple orders of magnitude. But, we do have this problem of, you know, in looking forward, about the possibility of exposing new source with time, so to speak, as containers deteriorate. And, our feeling on that was that this has been going on now for close to 50 years, and a lot of that has gone on.

We’re not so much interested in the concentration of a nuclide in a little particular part of a trench. We’re really interested in the average concentration over the trench system, because, you know, in the down and out, water is going through the bottom of all the trenches. In the big releases where you lop off the ends of the trenches, they all drain, and then even in the groundwater, there’s enough water movement that you move from trench to trench. So, there’s some homogenization going on in there, we can assume.

And, then, we thought that the next thing we ought to really factor in somehow is that somehow the inventory in the trench ought to have some bearing on the concentration of water that we assume for the analysis. And, that’s kind of how we came down to our Kd, or partition coefficient approach to it. We thought about the idea of trying to go through some geochemistry stuff and kinetic stuff, and things like that, and concluded that we probably wouldn’t wind up in any better position than we are right now.

ARNOLD: You’re in no way trying to look at a rusty drum and calculate its disappearing and release--

POTTER: No.

ARNOLD: Okay. So, the 30 year is your savior there.

POTTER: Well, it helps. It helps.

HORNBERGER: Ali, did you have a follow-up or are you just in line again?

MOSLEH: No.

HORNBERGER: Okay. Then, we have Nigel and then Ron.

MOTE: Nigel Mote, Executive Director, Staff.

Could you bring up Steve Wampler’s presentation, please, Slide 3? This follows on somewhat from Mark Abkowitz’s first question. The assessment was of the SDA site. Adjacent to it is the NRC site. And, on that plan there, in the NRC site, there is an area that is called leached holes. Now, I don’t know whether the engineering of the disposal trenches in the SDA site is the same as the NRC site. But, if they’re the same vintage, they may well be.

Can you comment on whether your analysis has been applied or would be successfully applied to the leached holes part of that facility? Because leached holes in other countries, I’m not sure about the experience of NFS, and Jim Clark may be able to comment on it, but typically the holes retain something like a half of 1 percent of the spent fuel that isn’t successfully dissolved, in which case, it has been percolating there with residual dissolver--for 30 years.

That might be a soluble source of activity that may be much more of a potential release threat than the State controlled area site.

STETKAR: I’m not quite sure if I understood the question. Let me see if I--if the question is did we consider that as a possible source in our study, the answer to that is no.

MOTE: I understand that. What I meant was--

STETKAR: Could this methodology account for that? The answer to that is I believe yes. Characterizing the source might take a little bit of effort.

MOTE: I understand. What I’m concerned with is we may be looking at an example which is not the most prone to the highest release. If engineering technology at the time was the same, there may be a larger potential source there than in the trenches that you--

STETKAR: From the overall site? From the entire West Valley site?

MOTE: No--well, initially I’m looking at the NRC licensed site. It’s adjacent to it. It seems to be similar. We saw it yesterday. I would guess that the overcap is similar. If it was built in the Sixties and Seventies, I would guess the engineering of the trench is similar. But, that may be the much larger potential source of releases. And, it may be that the State would want to look at, and do they want to do the same thing on that part of the site?

POTTER: Could I qualify on one thing? When John says the methodology could be applied, I agree with that. Our results are conditional risk distribution, or conditional dose distributions, and so on, could not be applied because we have--our approach has made use of some results that, for example, I mentioned the down and out scenario. We have assumed by sensitivity--based on sensitivity analysis that radionuclides that have some retardation are going to be contained within the SDA trenches. I would not, given if this figure is anywhere near representative to scale, I would not leap to that conclusion for the NDA site, because there's a much smaller distance, vertical distance to the recessional sequence.

MOTE: So, it could even be a higher--which is less prone to holding up the release.

POTTER: Possibly.

HORNBERGER: Paul, do you have a comment on that?

BEMBIA: Yes. Just that it is a good comment. You know, NYSERDA's focus at the time was on the SDA because, you know, we had complete management responsibility for it, and for that decision, for the Phase 1 decision. The Department of Energy and NYSERDA will be evaluating issues like this, and we've got to make decisions for Phase 2 on what's going to happen with the NDA and the SDA, and I think that's a comment that we’ll take into account. We’ll look at that.

HORNBERGER: Ron?

LATANISION: Latanision, Board.

If we could have Paul’s Slide Number 8? It will come up. I’ll just read the statement that is of interest to me. It says, “NYSERDA was considering managing the SDA in place for an additional period of 10 to 30 years.”

What were the options? I mean, were you considering that, well, maybe you wouldn’t manage it? Were you going to pull it all up and move it somewhere?

PEMBIA: That is an option. But, the Environmental Impact Statement looked at complete exhumation, so that is on the table for the SDA and the NDA and the tanks. The other option is in-place closure, where you would do something, you’d put more permanent caps on, so you wouldn’t have geomembranes. You’d do more for the erosion issue. Remove leachate and perhaps even grout trenches. So, that would be a more permanent or a longer term in-place closure approach. And, on the other end of that spectrum is complete exhumation.

LATANISION: I see. So, with the analysis that these gentlemen are talking about, do you feel comfortable that you have 10 years or 30 years, or what is your timeline here?

PEMBIA: Well, I feel comfortable that--you know, I feel comfortable with 30 years. The decision, we’ve actually made a decision to make the Phase 2 decision within 10 years. So, the fact that this analysis went out for 30 years, and we’re going to be re-evaluating these longer term issues that I mentioned about erosion and some groundwater issues, exhumation, you know, so our next decision point is in 10 years. So, we feel very comfortable with the 10, and certainly this study showing us that the impacts are minor over 30 made us feel pretty good about that decision.

LATANISION: Good. Thank you.

HORNBERGER: I have a question that sort of follows on what Ali started, but let me just put it in terms of the erosion and sediment transport and deposition.

Sediment transport and deposition is extraordinarily poorly constrained, and, yes, you use the nice model done by the Army Corps of Engineers, but if you didn’t have local data to even consider whether you’re in the ballpark, you could be really out of the ballpark. And, I’m just curious how this--and, I understand you can use broad ranges in the Monte Carlo sampling, but even there, you can, it seems to me that you can have a kind of strange picture on the shape of the uncertainty, if nothing else.

POTTER: We talked about this a lot. But, in the outcome, I think if you look at the way things settled out, so to speak, we calculated that the sediment deposition along Frank’s Creek would be about 50 percent of the concentration in the turn stylus. It can’t be much higher than that.

We also calculated 10 percent in the Buttermilk Creek breach that I had, and it could be somewhat higher than that, but not enough to greatly change our results upward. Could change them downward substantially because, you know, unless it got scoured out and wound up way farther downstream, it wouldn’t be available to the hiker. But I think we’re limited in terms of damage to the assessment on the upside by the way the answers came out.

HORNBERGER: So, you just said that at least intuitively, the sensitivity to erosion is taken care of because you have, in effect, what you’re saying is you think that you have about a worse case scenario, it can’t get any worse.

WAMPLER: I certainly agree with Tom. But, the numbers that we didn’t bring out in the conversations, just the basins that we’re talking about, the Buttermilk Creek basin is over 30 square miles, and the SDA is in the neighborhood of 15 acres. As far as the proportion of--we believe that we’re conservative in the assumptions that we’ve made as far as what sediment impacts, or the amount or proportion of the sediment that would be encountered by a receptor at these different breaches, we believe that is quite conservative.

And, the models that were run, many many assumptions there, and very--the models really are written for other purposes. We're trying to make the best use we can of a model that does look at mobilization, transport and deposition, but it's a very complex situation. And, thus, the conservative final assumptions based on those model results.

HORNBERGER: So, would it be feasible, and maybe the answer is that in this case, it's not interesting enough, but again I think Ali asked if you--if somebody asked you what are the five top contributors to uncertainty, and you said well, you didn't really look at that; right? Is that just not of interest, or is it not of interest because you bounded the problem?

STETKAR: The simple answer is if you had asked that question about a year and a half ago, I could probably have rattled off the five top contributors. It's something I have not looked at. We have all of the uncertainty distributions for everything, and I'm sure that, you know, given an hour or so, I could go back and answer that. And, I think Tom mentioned something that's important. Where you go through the spectrum of that risk curve, are different contributors to the uncertainty. For example, at the very high end, I can tell you the uncertainty in the seismic hazard for very large deep ground accelerations is an important contributor. But, that's only one part of it, because part of the mobilization of all of the solids that we're releasing is another part of it. As opposed to, for example, on the low end, although there is uncertainty in precipitation data, meteorologically, the uncertainty in that data, on a relevant basis, is not nearly as large as some of the other uncertainties that we have. For example, on the radionuclide concentrations in the liquids that would be released by those things.

So, when you ask what are the top five contributors to uncertainty in the overall risk, I think you need to slice, you know, where across the risk spectrum are you answering that question. And, I think the answer might vary a bit.

HORNBERGER: Okay. Ali?

MOSLEH: This is probably for John Garrick. What was the level of effort that went into this study?

STETKAR: That is an excellent question, Ali. You're looking at what I would call the core team of the study, the three of us did the lion's share of the work. We didn't do all of the work. We were helped by a number of people. Let me see if I can find my notes here. Dr. Andy Dikes (phonetic) was a member of our team. He did all of the final scenario assembly and quantification process. We used crystal ball, and Andy can run the crystal ball inside and out, and he was invaluable because even from the back end of the process, he identified some things that we had to go correct.

Steve mentioned Schlomo Neuman from the University of Arizona, was invaluable for giving us guidance on the groundwater model. Sean Bennett from the University of New York at Buffalo did develop models and did the trench cap erosion calculations, and gully erosion in the nearby slopes. He actually did those analyses for us. And, we worked together to do the uncertainty analysis in those.

Dr. Robert Thakendiny (phonetic), who is the former Chief of the New York State Geological Survey, and Dr. Michael Wilson from the State University of New York, Fredonia, did the baseline analyses for the non-seismic slope failures and landslides. We also worked with them to evaluate the uncertainties in those analyses.

And, finally, we had an awful lot of help from NYSERDA. They had people who provided data for us. They--I mentioned we had mitigation models in there. So mitigation strategies, estimates of times, normal maintenance practices, and so forth, all that type of information. So, although we’re the key members, we did have some other bodies that helped us out.

In terms of calendar time, I mentioned the Phase 1 study was done in 2008, over about a four and a half month period, we started in about mid May of 2008 at a relatively low level, trying to get our understanding of the problem, and really geared up sometime in about late June, and we went to press with the report in late September, so it was four to four and a half months calendar time. We sent the report out.

NYSERDA gave a presentation to the Citizens Task Force. We received review comments from NYSERDA, from DOE, from the public, some very very good comments from the public, and did an update to the study that began in mid April of 2009, and effectively finished in mid June. There was a little bit of tail-on work for editing the report, and things like that. The report was published in August. So, all told, in calendar time, it was about a six to six and a half month calendar time period, with a block in between where people were doing report reviews.

I don’t have an actual estimate of person hours. I mean, you know, we spent--none of us worked full-time on the project in the sense of human beings. You’re familiar with the TV program, “We’re professionals. You shouldn’t try to do this at home. It will drive you crazy.” We put in a lot of hours in that four and a half month period. But, none of us were working on it full-time. We all had other responsibilities. So, that will give you a sense of the level of effort. It’s certainly not a ten year, five person study.

MOSLEH: Okay, thank you.

HORNBERGER: Questions from the Staff? Doug?

RIGBY: Doug Rigby, Staff.

One scenario that I don’t see, maybe it’s not appropriate here, but it’s fairly comment, a lot of the DOE, local waste sites where you have trenches with a lot of heterogeneous waste, even non-DOE sites, is you have differential settling within the trenches, so you get cracks developing on the sides, even across some of the trench sometimes, that over time, under your clay, and so suddenly, these cracks can open up, and then, you know, if you have heavy rain, a lot of infiltration, it can change a lot of that. Was that a scenario that you considered, or you assumed maintenance might fix that problem?

STETKAR: The simple answer is we did not consider it explicitly. We did discuss it quite a bit. In fact one of the gentlemen I mentioned, Robert Thakendiny, mentioned that as a concern.

And, we had--Paul probably wants to speak to this a bit. One part of this whole process that we didn’t emphasize, because of the time, in our presentation, is we did convene a group of experts and run several of these issues past them, and all I can say at this point is not enough concern was raised about that particular type of failure mechanism for us to carry it forward.

PEMBIA: Plus, with the membrane covers over the trenches, the issue of the differential settling of the caps and cracking of the caps is taken care of. There was quite a bit of that in the time prior to the membrane covers going on, but now with those covers in place, those kinds of, you know, cracks forming, it's really not an issue anymore.

RIGBY: Unless a tornado removed your membrane.

PEMBIA: That's right. That's right.

RIGBY: One other comment.

STETKAR: Let me tell you.

RIGBY: Sure.

STETKAR: I think the differential settling between relative trenches would probably be a minor perturbation in terms of the way--we correlated that damage with a high likelihood of sufficient rainfall to erode those caps. So, you know, you don't get much benefit from the caps, and in terms of mobilization of the trench inventories under those tornadic induced high storms, I wouldn't be concerned about it in that particular kind of threat at all.

RIGBY: Do I have time for one general question regarding uncertainty?

HORNBERGER: I'll come back to you.

RIGBY: Okay.

HORNBERGER: Carl first.

DI BELLA: Carl DiBella, Staff.

I have a question for Paul, and it's about the scope of this study. I understand that the SDA is a radioactive waste disposal location. But, the fact of the matter is what was disposed of there was not radionuclides that's probably one or two-tenths of 1 percent of the mass that went into the disposal area. Many of the materials went in, and I have no familiarity with the regulations for the State of New York, but I'm wondering whether there are any other risks than radiation doses to the public that might come from leakage or discharges or failure of the SDA? I'm thinking, for example, of soluble heavy metals, or organic materials that might be harmful.

Did you look at those before you set the scope and ruled them out or studied them in some other way?

PEMBIA: We did study them another way. And, I neglected to mention before. You know, I mentioned the SDA was first constructed under that exemption to the New York State Sanitary Code. It's now regulated very closely by the New York State Department of Environmental Conservation. And, the RCRA regulations for hazardous wastes do apply to the State licensed disposal area. So, under a process that's called a Corrective Measure Study, and that's something that's under the blanket of the RCRA regulations, we were required to look at the possible hazards from release of hazardous constituents from the disposal trenches.

We did a limited scope Corrective Measure Study, also a short period of time, for 30 years because it's consistent with our overall decision-making process, and we found that for that 30 year period, there were not significant health risks from the hazardous substances in the SDA. But, that also has to be revisited as part of our Phase 2 decision.

DI BELLA: I assume that would be a deterministic rather than a probabilistic study?

PEMBIA: That was a deterministic evaluation.

DI BELLA: Thank you.

HORNBERGER: Doug?

RIGBY: Doug Rigby, Board Staff again.

I like the QRA approach. I've actually encouraged its use with low-level waste sites. Of course, there's a lot of resistance to that. I'm sure you guys are familiar with some of that. One issue of practicality, though, in doing this is there's a lot of professional judgment that is involved with a lot of this. I've been through your big report.

You know, even though there's ranges and probabilistic distributions, I looked through your report and I have a list of maybe, you know, ten items where I might do something a little bit differently. And, so, undoubtedly if you have a different group of experts that would go through and do this, to some degree, they would have a different result. And, I know, Shlomo Neuman, he's proposed for, you know, an approach to deal with that, where you can even somehow incorporate some of those different expert judgment uncertainties. But, that's sort of a difficult problem, and there's subjectivity involved.

As we go forward and see best how to do this, is there a way you think that this can be dealt with a little more--this is always going to be a problem I think we're going to have to live with, and how much confidence do we have in experts, I guess is the question?

STETKAR: That's a good question, everybody asks. It is a concern. I agree with you that these studies and the amount of information, and in many cases, the lack of qualified data, my nature requires some element of expert input, and I tend to believe that if you try to automate these things, you're probably losing some of the value of them. In other words, there's I believe value gained from having knowledgeable, experienced experts look at a problem and express their opinion, or their expert judgment about it.

Now, that being said, there's a danger to it, as you well know, because if you take one expert, me, nobody died and left me in charge, so my opinions are strictly my opinions. We tried, on this particular study, as I said, we did have expert panel sessions. They were conducted not completely according to formal methodologies. There are formal methodologies documented about expert elicitation, about qualifying the panel members, about formulating the questions, about mediating the responses, and formally quantifying the uncertainties from expert to expert variability. It’s important that you have a panel of qualified experts, first of all, and that you capture their variability and their uncertainty. There are methods to do that.

We didn’t go so far in this particular study to do that. It’s quite a time consuming process. But, we did not also sit down and just ask Joe for his opinion about something. We did indeed try to capture differences of opinion.

The way we resolved that without doing a formal expert to expert variability, accounting for their uncertainty, was to try to build consensus among the experts. So, in a sense, what you see in many cases, in this particular study, is expert opinion, is the consensus of the group that we used. And, we feel that because of their experience and their familiarity of the site, they were probably the most qualified experts that we could convene for this particular problem. That’s a partial answer, I realize, to your question.

But, going forward in a more complex study, there are indeed formalisms to try to capture some of your concerns about variability in experts, both in their qualifications and given equal qualifications in their different opinions about a particular topic.

HORNBERGER: Okay. Well, I want to thank the panel. It was a very interesting session. And, we are now going to break for lunch, and reconvene at 1:45.

(Whereupon, the lunch recess was taken.)

AFTERNOON SESSION

HORNBERGER: Okay, we are ready to start.

We are down to eight Board members. Thure Cerling had to leave. We are going to continue, as I mentioned this morning, on our discussion of the West Valley Demonstration Project. And, to start off this afternoon, we have Jim Clark, and he will do his own one sentence bio introduction.

CLARK: Good afternoon.

I'm Jim Clark. I joined NFS the day it went into operation on April 19, 1966. I became Technical Service Manager. I led the effort to license an expanded and modified reprocessing plant. And, then from '76 through '82, I was in charge of the technical details for the turnover of the facility.

What I'm going to do is move smartly through things that you heard this morning rather than be redundant. And, I've made some notes which I think answer the questions that came up, and I'll try to factor those into the presentation as we go.

You heard about the origin of the NFS reprocessing plant. What I would add is that the AEC, when they gave their 1957 announcement, that announcement was couched in the terms, "unless the commercial plant was competitive, the AEC would build their own."

The eventual participants was New York State, ASDA, the Atomic Space Development Authority, the predecessor to NYSERDA. W.R. Grace had a division, Davison Chemical, and NFS was part of Davison Chemical, and then eventually a separate division of W.R. Grace. American Machine and Foundry was a participant on the mechanical side, and Bechtel out of their San Francisco office was the architect/engineer.

The base-load contract was what started the whole venture, and it guaranteed a certain amount of fuel to NFS, essentially 125 tons per year for five years. And, I ought to caution that like all things in a contract, tons doesn’t mean exactly what you think it means. Tons varied with the initial enrichment of the fuel.

The contract with AEC also required licensing by the NRC predecessor, the Division of Material Licensing of the AEC. Significantly, it limited the pricing to about $23,000 per tonne. The AEC had S.M. Stoller do a study in 1959, I believe, that came up with a number of what it would cost AEC. AEC was willing to support a commercial venture if it met that price by not more than 15 percent above it.

It required AEC access to almost all the information, and a resident AEC representative who could follow the process. So, there was an institutional means for the Department of Energy, the AEC then to capture all the information. I don’t really remember how many documents went to AEC. Savannah River was the contract representative.

But, the other day, I was looking down at the NRC Public Document room, and I noted there was 1575 documents in the NFS docket about West Valley from the period 1966 to 1976. So, there's a tremendous amount of information.

The contract also included monetary penalties. One was that you had to meet product recoveries, and the product recoveries were based on dollar value of the product. And, it was interesting, first of all, a campaign means fuels that's similar that was processed together. It ran under a specific letter of authorization for the fuel, and it specified in a run plan specific settings for the instruments and the chemicals. And, it required a clean-out at the end of that campaign.

With that said, the first campaign, NPR, new production reactor AEC fuel, the settlement for that campaign didn't meet any of the 11 examples in the contract. So, the recovery guarantee was pretty complicated. It also required specifications be met, AEC product on the uranium and plutonium, by delivered batch.

And, one of the things I guess I ought to mention is one of the great things about the West Valley Plant was it had a lot of flexibility. Unlike perhaps the Morris, Illinois plant, it was able to recover from off-spec material by blending, because it had a lot of rework capability.

You visited the site. You saw where it was. It's a rather big site. The plant is kind of in the middle of it. When I say the plant, the reprocessing plant, the waste tank farm, the lagoons, the licensed burial areas, including the commercial burial area that NFS operated for the State of New York under a State license.

Here, I’d like to point out some of the issues. I was asked to point out things that went well at West Valley and things that didn’t go well, and might bode investigations for future plants.

With regard to siting, I don’t know if you noticed, but the 200 foot stack is almost below the crest of the hill to the south. That didn’t influence the plant at the time, but it could have influenced the expanded plant because the difficulty predicting dispersion patterns from the krypton 85 releases. That later factored into some of the cost that we’ll talk about, the $600 million.

Now, the second was the liquid discharge that was designed and occurred--was to small on-site streams, Frank’s Creek, Erdman Brook, Buttermilk Creek. Over time, that became a challenge on many fronts, and NFS built a low-level liquid treatment plant on the site that began operation in 1970. It looked like a commercial water treatment plant, except it had some Zeolite in there. And, the focus people talk about, recovering Cesium, but the focus really was to recover the Strontium and perhaps the Ruthenium which were under Title 10, Part 20, were the significant contributors to the discharge to Cattaraugus Creek. And, at the time, I don’t think any time the discharge ever went over 20 percent of 10 CFR, Part 2. But, despite that, the pressure, the plant built the low-level liquid treatment plant.

The next issue was a very in depth, to bedrock. You saw in Paul’s presentation this morning, how the slope of the soil compared to bedrock. Well, unfortunately, the site was put right over where there was a steep slope. It wasn’t near bedrock, and it didn’t have--in some places, it was near bedrock, and at one end, it was not really deep. And, this intermediate soil level became probably the reason that NFS abandoned reprocessing.

The plant was under discussion about seismic. NFS convened experts, six noted experts in seismology, geology from around the country, MIT, Cornell, Bruce Bolt from University of California. Their conclusion led us to believe that the g-value wasn’t as much of a problem to us as the response spectrum would be with the different soil levels to bedrock, and the fact that the plant had used pilings under its initial construction.

The reason it became really important was our competitors wouldn’t have had that problem. A lot of the other costs escalating, all the plants would have had to follow that. The plant at Morris, the plant at Barnwell. If our friends at Atlantic Richfield had gone forward at Oak Ridge, they would have had it. But, this one was unique to us.

The construction moved along pretty well. The AEC issued a construction permit in May of ’63. The fuel receiving and storage pool was built and started receiving fuel. The waste tank farm went into operations, the ones you saw. 8D-1 and 8D-2 were the tanks where they neutralize waste. 8D-3, 8D-4 were the stainless steel tanks to take care of the Conad Coray (phonetic), which was a Thorium based, high enriched fuel.

The reprocessing plant began operation on April 19, 1966. Total cost was about $33 million. NFS’s budget was $31.8 million. The significant part of that was during construction, the costs started to escalate towards 40 million, and there were decisions made to bring that cost back under control. And, some of those decisions became problematic, one of which was the lack of--cut back on stainless steel, the use of coatings instead of. I think the discussion today talked about half the plant was stainless steel lined. The original plant would have had almost all lined, and that cost savings of stainless steel came back to bite the plant, especially in areas like the fuel receiving and storage, the acid recovery cell, the interceptor on the low-level liquid waste treatment.

The second part of the cost was that some of the tools, the master-slave manipulators, the ones that went in were more laboratory grade than industrial grade, and that became difficult. Tools that were supposed to help became more of a maintenance problem than a help.

The actual operations were what’s commonly called a chop leach, used in mechanical as well as chemical. On the mechanical side, an abrasive saw removed the non-fueled hardware, and a hydraulic shear cut the fuel rods into half inch pieces, and that’s nominal, depending on the fuel, you could cut them up as big as maybe an inch, an inch and a half in length. The shear had been developed by Oak Ridge National Laboratory, an American Shear, unlike the French and the British. It turned out to be really well designed. The shear blade took a lot of work, experiments. Luckily for NFS at the time, Silver Creek and Buffalo was supporting the NASA space effort. There were tons of small shops that had skill in handling all kinds of metals. Things could be done overnight.

The leach part was dissolution in nitric acid in baskets. The dissolvers were built as annular over a concrete annulus in order to be able to handle fully enriched fuel, and they did. The difficulty between these was that the shear could not make really good cuts at the last chop. Right near the end pieces, it would crimp them slightly, and a lot of the material losses came about on what we call "end pieces." The shear did well on normal pieces. Other shears, other countries had a crimping problem throughout. This shear, the crimping problem was only down towards the last inch, inch and a half towards the non-fueled part of it.

The plant used for chemical separation, a PUREX separation like that used at the Idaho Chem Plant, Hanford and the pilot plant at Oak Ridge. The first plant manager was Wes Lewis, who had run the pilot plant at Oak Ridge, and we had lots of knowledge about how to run a PUREX, and it performed superbly.

It was two cycles of uranium separation after the initial separation from the fission products, and then followed by silica gel clean-up. We had one plutonium cycle after separation, and then ion exchange. The ion exchange limited the plant to about 5 kilos a day, and would have been replaced in the modified plant by another solvent extraction cycle. The products were concentrated by evaporation, and shipped as uranyl nitrates.

It was licensed by NRC, its predecessor, the AEC, Division of Material Licensing. It received a provisional operating license, CSF-1 under Docket 50-201, and it was under Part 50, as a production and utilization facility. So, the licensing action looked just like you would see for a reactor, compared to a fuel cycle facility.

The provisional meant they didn’t issue a 20 year or 40 year term. It was issued for 18 months, renewable every 18 months. So, there was continuous licensing action going on.

The technical specification, there were about 75 pages of them. They focused on effluents, shut down if you exceeded the effluent limits. Criticality safety, and especially avoiding accidents like red oil explosion and fires that had occurred in the AEC facilities.

The inspections, we did not have a resident inspector. The inspections were out at the Philadelphia NRC Region I, and their headquarters in Washington.

Operational successes. PUREX process performed superbly. Every batch made product specification. As I said, we had a lot of flexibility, were able to do that. The only difficulty we ever got into is there was a 10 part per billion equivalent boron content where the impurities, the minor impurities, depending upon their neutron cross-section effect, would have to be considered. We had an analytical lab that had both an emission spec and a mass spec, so we ran these calculations and, of course, we had the NRC inspector, resident AEC inspector watching.

The shear performed very well for a first-of-a-kind production device. We had to modify the shear blade several times, but as I said, there was a lot of capability both in-house and locally at the machine shops.

The personnel staffing I wanted to mention really was a highlight. They were lean in numbers in order to support the pricing limit. It was limited to 131 people. Once in a while, it was more than that, but they were working on sundry other things and not reprocessing. So, it was pretty lean on a facility doing that work. The managers, scientists came from the DOE facilities, especially Hanford, Oak Ridge, and Idaho. I don’t believe we had anybody from Savannah River.

But, one of the surprises when I arrived was the talented local hires. We had a whole panoply in ages, but most of these young operators had great agility, acuity to see through windows, had to remove things, replace remotely big devices within a fraction of an inch, and they just added a lot. The problem we had with the master-slave manipulators were modified by NFS mechanics, and became far better than the ones we ever purchased.

The operational issues, of course you can expect there were many. Some of the big ones were the fines from the abrasive saw. When the fuel assemblies came into the process mechanical cell, they went into a horizontal position, and the non-fuel hardware was cut off as close as you could get to the fuel without going into the fuel. The big end pieces were removed, for example. The first saw was much too complicated, and it was replaced by a much portable saw, neither of which had really adequate ventilation for dust control. And, that became a problem with ventilation.

As we talked about, the end piece cuts by the shear were difficult and got a lot of attention because they affected the product recovery and the guarantees in the contract. We never really solved that problem. We worked on that problem a lot, but we were never able to avoid the crimping at the end of the final end pieces.

So, the holes that went to burial after being leached, these end pieces contributed significantly to the amount of material that’s in the burial ground, NRC licensed burial ground.

The contract maintenance of manipulators and cranes became a problem not only because of them being under-sized, but also because of the ventilation system that allowed the dust to get into crane areas or onto the manipulators. We started in 1967 a major modification to add a head-in ventilation system to solve this, and also an MSM, master-slave manipulator repair shop to be able to take the cranes--I’m sorry, the manipulators directly to the shop and work on them remotely.

One of the things that escaped the early design and became problematic for us was the use of greasy lubricants to pick up this dust. The large shield doors on jack screws, the lubricants would pick up fine particles and become very radioactive and have to be decontaminated often.

One of the famous problems was degraded fuel element cladding. The new production reactor fuel was zirconium clad slugs that came out of the Hanford facility. It caused what I talk about as exothermic reactions. That’s kind. It lifted the shield plugs off the dissolvers. It glowed cherry red. It put a hole in three-eighth inch stainless steel. It was a difficult time with that fuel, and it didn’t happen with all the fuels, all the NPR fuels. So, it was never really discerned by us. There was a lot of interest to the AEC what was causing it. And, it was also the cause of the fuel that eventually went down to the burial. It arrived at NFS in a pretty sorry condition, and after consulting with the AEC, it was buried in the cask it arrived in.

The problem for the plant, though, from this was it caused a lot of radioactivity to enter the dissolver off-gas system, DOG, and eventually transported over to the HEPA filters. The HEPA filters just weren’t designed for remote removal. The first ones were strange. They were round rather than square. They were lowered into a concrete niche where water could accumulate. So, all those modifications were underway or had been made when we started getting this fuel from NPR fuel. And, that because a cause labyrinth.

In the modified plant, the dissolver off-gas system filters were being designed and would have been relocated and designed for remote removal. We didn’t believe we would be able to achieve the high efficiency requirements of the license by remote replacement, but they were going to be removed remotely.

Another operational issue was the Rad Waste Evaporator performance. I use the term “burps.” They would, I guess burp is a good term. The material would exceed the free board and get into the separators, and eventually over into the vessel off-gas filters. So, the moisture carry-over loaded down those vessel off-gas HEPA filters, and, therefore, increased the radioactive load.

Part of the problem really has been solved by modern technology. This plant operated with I guess at the time state of the art pneumatic devices on control. And, of course, time delays made it pretty tricky how to operate those. Now, with electronics--this was before even PLCs existed, but now with electronics, I doubt we’d have that kind of trouble. And, with design of adequate free board, that problem probably just went away.

I think I missed somewhere in my--I’m going the wrong way. Sorry. The plant processed about 625 tonnes during 26 campaigns. And, some of the reactors that we processed was Commonwealth Edison, Dresden 1, Conad Coray out of Indian Point 1, Yankee Atomic Row Massachusetts. I don’t know if Dr. Kadak was there then.

ARNOLD: He wasn’t, but I was.

CLARK: The Carolina Virginia 2 Reactor, the Southwest Fast Oxide Reactor, NFS Erwin had made that fuel and it was brought to West Valley to process it. So, we were even our own customer for one of the fuels. Oyster Creek in New Jersey, Northern States Pathfinder, the Bonus Super-heater Fuel out of Puerto Rico was supplied by the AEC under their baseload, and the Big Lot Point reactor in Michigan. And, I think that’s all. I’m stretching my brain. I think that’s all that we had.

We recovered 99 percent of the uranium and 97.4 percent of the plutonium. And, probably could have and would have recovered more of the plutonium in the modified plant. The contracts were on uranium value recoveries, and not to downgrade to uranium and to get as much as you can. So, it got a lot more attention than the plutonium. But, the technology is sufficient in PUREX that that 97.4, with another cycle, could have been increased significantly. They would bump up eventually at how much you could get out of the end pieces from the shearing.

Somebody asked what we would recommend. Well, a lot of the changes and the challenges of West Valley had been overcome by technology or regulation. There wasn’t, in West

Valley, a requirement at the time to plan for decommissioning. There is now. You can’t license a facility without a detailed submission of your decommissioning plan. You have quality assurance. If we had had some better quality assurance during construction, we might have been able to make a better case on seismology. But, we were lacking some of the construction data that we would have needed to convince the NRC.

The remaining issues that I thought about were obviously the ventilation system, as you heard us talk about as Lego type of cells sitting on cells. Ventilation was very complex. In a lot of ways it worked well. The stack had a--you could shut down the plant for ventilation for 24 hours, and the stack would maintain a chimney effect and keep the right differential pressure for you. But, moving big crane doors, opening lids into the fuel receiving and storage or into the scrap removal, all these perturbed the ventilation. So, if there’s another plant, you have to provide very detailed attention to the ventilation system, especially for abnormal occurrences.

The ventilation system probably would have worked very well even with the odd dissolver off-gas filters if we hadn’t had things like the NPR fuel episodes, and things like that. But, it was the abnormal events and getting moisture onto those filters and high radioactive loading that became a problem.

The second would be to include robust design bases for mechanical equipment used for remote maintenance. It was obvious the manipulators should have been stronger, better thought out on what their uses were. And, over time, we modified and improved them, both the power manipulator, the cranes were a problem, but shortening the electrical leads, using remote electronics to move cranes, doing the mechanical stuff on the master slave manipulators, all that was a great improvement. But, it would have been a lot better to have it designed into the facility.

Someone asked about the--can I go back to 12? No, somewhere I lost--someone asked about a couple questions about information. It was a 1981 Oak Ridge report written by E.R. Johnson, Ed was one of the founders of NFS, but also represented a lot of utilities during the processing phase. And, in 1981, he took thousands of documents and consolidated them down to a 100-page synopsis of NFS's years operation. And, it's about 100 pages, and I think it's official use only now, but it sounds like you guys could be okay with official use.

With that, I'll entertain questions.

HORNBERGER: Thank you, Jim. Questions from the Board?

Howard?

ARNOLD: You promised to talk about how the price of the upgrade escalated so much.

CLARK: Oh, right. I wasn’t really there to see why it escalated. I only saw the effect of not letting it achieve the $40 million. I saw what they cut out. So, it was obvious the stainless steel sheathing was a major component.

ARNOLD: No, I’m talking about after the plant was shut down at it was going to be upgraded.

CLARK: Oh, yes, I did, and I have that. The $15 million going to $600 million.

ARNOLD: Right.

CLARK: Okay, there were several things going on at the time. The $15 million did not include what was already underway at the time, like the head-in ventilation, some engineering studies, you know, a few million dollars of those kind of things. It also didn’t include the vitrification facility. The regulation came out after NFS had initiated this idea of expanding the facility. And, so, the vitrification was a brand new facility going in there. I don’t remember, but I suspect it’s like the cost of whatever this was here.

The seismic protection factor was a major contributor. As I said, the problem was it wasn’t something that competition had to do. So, it was unique to NFS. It easily would have been $100 million.

I gave a talk to the American Nuclear Society in

Toronto, I don’t remember what year, but ’74, ’75, where we laid out an action that looked like a containment, I think we called it confinement, that was targeted to convincing, even if we had a seismic event and had done all the studies, if we had it, it wouldn’t exceed the Part 100 limit. So, it was that in there.

The tornado was a minor, but, you know, we had to protect against the telephone pall and the Volkswagen, because the cells went from three foot to five feet, mostly reinforced concrete. That wasn’t going to be a problem, but it was something new beyond when we started the modification.

Safeguards and security came about. 10 CFR, Part 73 showed up. The first adventure was to modify the fuel receiving and storage area, protect that. And, that, my memory was, you know, $5, $6 million and didn’t include any work that we were going to have to do to protect the plant site itself.

GESMO was going on, the Generic Environmental Statement on Mixed Oxide. We had a premonition before that that plutonium nitrate, which was our main product, was going to be banned. So, instead of shipping plutonium nitrate, we were going to have to ship a solid plutonium. So, there was a design effort that had assembled a team and started licensing a MOX plant and a plutonium oxide conversion plant down near between the reprocessing plant and the burial grounds, there would have been two facilities there. And, they came about by regulation, namely this GESMO action.

As we got into it, the customers didn't want uranyl nitrate. They wanted UF-6. And, so, the plant had to also add a conversion facility to take care of that, and Catalytic Construction Engineering in Philadelphia had already designed for us a UF-6 plant as a contingency. But, that one hadn't been factored into the initial.

Whether it was $600 million, as you can imagine, we ran a discussion and our case went by how big that number was. But, on the other hand, there was no doubt it was very big, and 300 to 400 million was easily justifiable, and then there was kind of add-ons, maybes.

HORNBERGER: Questions? Ali?

MOSLEH: Mosleh, Board.

You mentioned mechanical problems, the system issues. Are there any human error issues?

CLARK: On the mechanical side?

MOSLEH: System side, mechanical.

CLARK: I'm sorry?

MOSLEH: On the mechanical side.

CLARK: I guess if there were, they were kind of overwhelmed by, you know, we had a guard shoot a gun in an area, that kind of stuff, but it didn't hurt anybody, didn't affect the plant, got a lot of attention. Dropping canisters once in a while, but they didn’t really damage the fuel, they were inside a cell. The cell was built for that. It would cause a requirement to do an investigation and a, you know, “get well” plan, or something like that. But, I can’t remember any. Most of the operators early were contributing a whole lot, so the focus wasn’t on any operator errors. They just didn’t stand out.

HORNBERGER: Carl?

DI BELLA: Carl DiBella, Staff. Thank you, Jim.

I have three quick questions. The amount of plutonium that you recovered relative to the amount of fuel that you processed implies that you were running fuel that, on average, had low initial enrichment and low burn-up.

CLARK: Yes. I don’t have that data in front of me. I’m sorry. But, there is, when we put the environmental report and the safety analysis report together at the end of ’72 and submitted it, so the NRC has a big thick report that summarizes the fuel operations during these 26 campaigns. Most of the fuel was new production reactor fuel, some of which had only a few hundred days of exposure on it. The highest fuel that we processed was I believe Yankee Row under the commercial contract, and it had about an average of 24,000 megawatt days per ton. So, it challenged the PU ion exchangers.

But, on the other hand, a ton under the contract was about 750 kilos of that fuel. So, you know, the production input went down, so we weren’t looking at 10 kilos a ton, a day.

DI BELLA: Did you track person/rem per year, and roughly what kind of number was it?

CLARK: Hold your hat. Two years, it was about 2000 person rem.

DI BELLA: For 131 people?

CLARK: No. Temporary employees were changing filters.

DI BELLA: Okay.

CLARK: It was under the 1.25 rem per quarter, 5N minus 18 period of time. It was before Appendix I. It was before as low as reasonably achievable. And, why I know that number is that what I did in the expanded plant was to take the Appendix I, thousand dollars a person rem, and to see what various modifications would be made. And, they generally ran around $8 to $10,000 a person rem, is what we were--based upon what we were planning to do compared to what we were going to achieve. But, the big achievements were those filters, dissolver off-gas vessel off-gas. They were the main contributors, the personnel exposure.

DI BELLA: Last question. I take it the plutonium all went to AEC. Where did the uranium go that you recovered?

CLARK: It depended on the client. The uranium went to Fernald, their feed material plant at Fernald, if it was AEC material, or if the commercial client could cut a deal to sell it to the AEC. Some of it went to a facility at NFS Irwin to make other fuels for the client. Yankee Atomic and Commonwealth Edison and perhaps one other sold them overseas. So, plutonium went over to Italy and France and England.

DI BELLA: Thank you.

HORNBERGER: Howard?

ARNOLD: You mentioned Indian Point First Core. If I recall right, that had thorium.

CLARK: Yes.

ARNOLD: Thorium 233.

CLARK: Yes, it had 235 on a seed, but it had thorium, so it generated a lot of uranium 233. As part of the contract, NFS recovered it and shipped it to Oak Ridge National Laboratory.

ARNOLD: You didn’t have any problem with the thorium?

CLARK: We recovered it. We shipped quickly after recovery. So, the in-growth wasn’t our problem.

HORNBERGER: Last question?

ROWE: Gene Rowe, Staff.

Just quickly, could you give us your opinion of what you think the future of reprocessing is in the United States. That was not a joke.

CLARK: Yeah, as an observer. I can’t see any--I think it’s obvious there’s no monetary advantage to reprocessing.

As you can imagine, there’s going to be effluence, no matter what. Tritium and krypton are probably difficult to recover in any kind of fashion. There may be circumstances where, for other reasons, to get rid of damaged fuel or something like that, maybe there’s a niche for it. But, it’s not obvious why we would do that in the U.S.

ROWE: Thank you, Jim.

HORNBERGER: Thank you, Jim.

Our next presentation is on vitrification, and Dan Meess is going to do that.

MEESS: Good afternoon. I’m Dan Meess. I’m the Chief Engineer at West Valley Environmental Services. I’ve been there since 1989, through the vitrification campaign and our waste retrieval campaign that essentially fed the melter.

You’ve been to the site yesterday, so I won’t go into detail here. But, this is pretty much what it looked like in 2002 at the end of vitrification, a little busier with regard to facilities, especially waste storage because at that point in time, we were storing all the waste. We were not shipping at that point in time.

Just as a refresher, when the West Valley Demonstration Project Act was promulgated, essentially there were two tanks that held high-level waste, the 8D-2 tank, carbon steel underground tank, three-quarters of a million gallon tank, had 660,000 gallons of PUREX neutralized waste in it, essentially 24 million total curies. That includes the daughters of cesium and strontium in that 24 million. And, then, there was a smaller tank, 8D-4, which held the acidic thorex waste from the one campaign from Indian Point 1 with the thorium uranium fuel. So, there were two tanks held the waste.

In the 8D-2 tank, in the PUREX tank, there was a liquid zone and a sludge zone. Early on, the project sampled and characterized the liquid and the sludges in that tank, as well as the liquid in the acidic tank to determine the chemical concentration composition and the radioisotopic composition. And, the net result was the liquid was decontaminated, processed into a low-level waste form, essentially reviewed by the NRC for their stability criteria, and passed RCRA stability requirements because it was a mixed waste liquid, producing roughly 20,000 cement drums. And, then, we made the 275 glass canisters.

The reason for making the low-level waste is that there was enough salts in the liquid and the sludge, based on the glass recipe, that if we didn’t get a lot of those salts out of the sludge and the liquid, we would have had to make eight times as many canisters. So, the reason the project went to essentially processing the liquid, decontaminating it, and solidifying it into low-level waste drums is that got rid of the salt, so the salt didn’t have to go to the glass.

Otherwise, we would have, instead of 275 canisters, we would have made eight or ten times that many.

So, the low-level waste process here involved first stripped the cesium out of the liquid, which was our decontamination phase, a concentration phase where that liquid was concentrated, a solidification phase where it was mixed with Portland Cement and other additives to get the right mix and properties, and then all those 20,000 drums were stored in our drum cell really until after vitrification was done. So, they were stored there for quite some time.

On the high-level waste end here, we had what we called sludge and zeolite mobilization. There were remote pumps put into agitate the sludge with the liquid to get a homogeneous high-level waste composition. And, then, that mixture, along with the zeolite, which I’ll cover in a minute, was pumped over to the vitrification facility where it was batched into the melter in batches, and each batch was carefully sampled and adjusted to be within recipe bounds. And, then, the glass canisters were placed into racks into the old chemical processing cell of the old main plant.

One of the things DOE was very adamant about early in the project was don’t build anymore new facilities than you have to. Try to use as much as you can of the old plant.

So, early in the project, all the chemical reprocessing equipment was removed from the chemical processing cell, all remotely because it was too radioactive to enter, and then the racks were remotely installed there later, and then the canisters moved in.

Quickly I'll run through the low-level waste processing here. Essentially, it was a zeolite process where we stripped the cesium out of the liquid using the zeolite. The zeolite was used once and then discharged into the spare tank. It's not easy to see here, but this entire zeolite removal system here was actually installed in the spare high-level waste tank. So, when you see high-level waste tank 8D-1, that was the spare mirror image tank for 8D-2 tank that held the high-level waste, the PUREX waste.

So, that entire system was built in the spare tank, and when a zeolite column couldn't hold anymore cesium, it was discharged into the bottom of the 8D-1 tank under liquid, and that's where it essentially sat until it was time to retrieve the zeolite, mix it with the PUREX waste to send over to vitrification.

Liquid waste treatment system, very quickly, just a very fancy evaporator, steam fired evaporator, titanium tubes, stainless steel shell. We concentrated the waste to roughly a 40 weight percent total dissolved solid concentration before we mixed it with our cement. The cement slide, we used 71 gallon square drums. This is an SI Unit slide, 270 liter square drums, two high shear mixers. We actually put two mixer loads into a 71 gallon drum. The drums ended up being about 1000 pounds a piece.

Drums were remotely transported to our drum cell storage facility where they were remotely placed into an array on edge, as you can see here, and that’s where they were left until about 2005, when we shipped them off, if I recall. That’s a picture of the array, eleven layers high.

Summary of the pretreatment. We used two types of zeolite, the I-96, which essentially adsorbed the cesium 137, a little bit of strontium. It worked great. We got over a 99.99 percent removal efficiency, stripping out the cesium 137 onto the zeolite, and we solidified that into drums, meeting 10 CFR 61 requirements. And, we actually developed three different Portland cement recipes, because there was the original supernatant recipe, and then we did sludge washing with the mobilization pumps to try to dissolve salts out of the sludge into the supernatant, which created two different recipes. So, we essentially went through a bunch of different campaigns to process all the drums.

With regard to zeolite transfers, as I mentioned, we stored the zeolite in the spare tank under water, and when it came time to start vitrification, we had to retrieve that zeolite. We had to size reduce it, blend it with the PUREX waste, which was in the 8D-2 tank. The challenge there was retrieving the zeolite. It had a much larger particle size than the sludge.

We had done some model tests, one-sixth scale tests to indicate that we could retrieve over 95 percent of that zeolite in like ten different transfers from this tank into the other tank. And, just to help you understand just a little bit better, the red is the cumulative removal of cesium in millions of curies, so at the end, we retrieved a little over 6 million curies of cesium from the tank. The blue here is how many curies we actually transferred per transfer.

So, you can see in the first transfer, we retrieved 1.5 million curies of cesium in the one transfer over to the 8D-2 tank, and we thought okay, this is going to be easy. And, that was the last transfer that was easy. The zeolite just proved hard to retrieve with five mobilization pumps starting off, due to the fast settling rate in the tank. And, we played with the parameters a bunch, and you can see how it flattens off up here, and we kind of reached diminishing returns on retrieval of the zeolite, which is the primary vehicle for the cesium.

Once we size reduced the zeolite and got it into the 8D-2 tank, it was blended with the high-level waste and then we transferred the high-level waste and zeolite into the vitrification facility, again, on a batch basis. And, you can see in the first two years of waste retrieval, which is the area I was working in here, we essentially retrieved about 80 percent of the high-level waste from the tank. And, again, the red goes this way, this is the cumulative amount of cesium and strontium removed, and this is the cumulative transfers here.

One of our problems was our mobilization pumps that agitated the zeolite and the sludge and the supernatant, leaked clean water into the tank, so in some cases, we transferred 5000 gallons of high-level waste into the vitrification plant, and our seals leaked 5000 or 6000 gallons of clean liquid into the tank. So, it was kind of working like a dilution model. Once we got that in hand, you still needed about a foot of liquid in the bottom of the tank to run the mixing pumps. So, again, that provided some limitations for waste retrieval. But, you can see after the first two years, our waste retrieval activities kind of leveled off there, and we weren’t able to essentially retrieve a lot more liquid.

It’s even more noticeable, this is the Alpha transuranic content. We started with about 100,000 of the long lived Alpha transuranic nuclides in the high-level waste. And, again, this slide here shows in the first two years, how much of the Alpha activity we removed from the tank. And, then, over here, we were just struggling to figure out when the stopping point is. I mean, it would have been nice to identify the stopping point up front. As we got closer to the end of the design life of the melter, it became more of a topic with regard to when do we turn the melter off, because we're not really getting a lot more along the Delta activity out of the tank.

So, I'll spend a little bit of time now on the high-level waste processing cycle. 8D-4 tank is what held the acidic thorax waste. 8D-2 held the PUREX waste with the sludge and supernatant layers. And, here's the spare tank with the zeolite columns and the pretreatment system in it. Essentially, we blended the waste in 8D-2, sent it over, batch transfers typically 3000 to 5000 gallons per transfer, over to the concentrator feed make-up tank.

When we started high-level waste transfers in 1996, it was one transfer of high-level waste per one batch of glass. About the end of I think a year and a half or two years, the other slide will tell us, is the waste was getting so dilute in the 8D-2 tank that we'd have to make multiple transfers of high-level waste into the concentrator feed make-up tank, our CFMUT, to be able to make up a batch of glass, and in some cases, there were over 30 batches of high-level waste sent from the 8D-2 tank to make up just one batch of glass. One batch of glass typically was about six canisters of glass.

Once the feed was in here, it was sampled, glass formers were added from the cold chemical facility. Once it met all specifications, it was transferred to what we call the melter feed hold tank, the MFHT, and that’s the tank that continuously fed the melter. And, then, the melter obviously supplied the molten glass into the canisters, and then once the canisters were filled and gone through some processing I’ll talk about here in a minute, those were placed back into the old chemical processing cell in what was renamed high-level waste interim storage facility.

We had an SBS, or submerged bed scrubber to try to scrub essentially the vapors and the nuclides out of the off-gas system before it went to another building with the off-gas system to reduce the nitrates emissions from the plant, the NOX emissions.

A quick timetable. ’83, the glass was selected as the waste form. We did what we call FAX testing between ’85 and ’89. That was non-radioactive testing which was essentially key to the success of our radioactive processing. During that period of time, essentially enough glass was made to fill 100 canisters. So, each canister is roughly two tons of glass, a tremendous amount of glass was made to be able to test the recipe, test the process, test the procedures, and help train the people.

At that point in time, vitrification, the construction finished up, commissioning and start-up, campaign 1, which pretty much was the first two years, started in ’96, finished in ’98. And, then, from ’98 to 2002, the waste became more and more dilute as we retrieved it from the 8D-2 PUREX tank.

This is a cut-away. If you were there at the site yesterday, this is the chemical process cell, with the racks in there with the canisters stored two high. This is the EDR here, and there’s a transfer tunnel that was built to connect the vitrification facility to the EDR to the CPC. So, after the canisters were filled, they were put on a remotely operated cart and driven remotely into the CPC where they were remotely grappled with a crane in there and placed into the racks.

This is a pretty picture showing the facility before it went hot. If you looked through the window on your tour yesterday, it looks a lot different. But, the melter is back here. The turntable that held the four canisters is underneath the melter. This is the entire off-gas system over here. The concentrator feed make-up tank and the melter feed hold tank are down in the pit next to the melter here. Weld station is over here and the canister decon station is over there.

The picture of the melter here, roughly ten by ten by ten feet, water cooled jacket, operated about 1150 degrees C. Had three electrodes, single phase, weighed about 60 tons, had a capacity of 5000 pounds of glass a day, so it took roughly two days to make one canister if everything was working good.

And, during the first two years of operation, the facility had I believe it was--it was over a 70 percent availability, which was pretty remarkable at that time. I think it was between 70 and 75 percent availability for the first two years.

Cross-sectional view showing the melter here, the pour spout, the glass went up to the pour spout, and then filled the canisters in the turntable underneath, one at a time. And, again, the turntable held four canisters, an empty one, one being filled, one being cooled, and one ready to come out, or one that is taken out already. So, there was an entrance port, an exit port, fill port, and one for it to cool.

The way the melter, the glass came out of the melter was what we called an airlift. Air was injected down in the pour spout right here, which lifted the flask level above the pour spout, and then it dribbled out the pour spout down into the canister into what we call an airlift. Each of the canisters were typically somewhere between 9 and probably 15 airlifts. So, although feeding the melter was continuous, or near continuous, filling the canister was intermittent. There were, again, between probably 9 and 15 intermittent fills or airlifts into each canister.

One of the important things to us is to try to figure out the level in the canister. It’s pretty embarrassing to overfill a high-level waste canister in the turntable, plus all the mess it would make. So, there were a number of ways that were used to track the amount of glass in the canister. The most successful one was the infrared level detection system. There’s a ledge ridge in here, so that it was opaque and we could actually see with this level detection system, based on the thermal imaging, the level of the glass in the canister. There were also load cells under the canister in the turntable. We could also do a mass balance on the feed supplied to the melter. But, the most reliable one, second most reliable is this. The most reliable one was measuring the glass level with a ruler after it came out.

Once it came out, we don’t have a slide for it, but after the canister came out of the turntable, it came out remotely with a grapple. It was put in a decon bath with nitric acid and ceric nitrate and we actually did a chemical milling of the oxide layer from the outside of the canister to decon the outside of the canister.

I got ahead of myself. First of all, we weld on the lid. But, before we weld on the lid--I mentioned before we use the roller, we got shards out of the top of certain canisters for characterization, and those were analyzed after the fact. So, we did shard sampling through the top of the canister before it was sealed. We measured the level, there was a visual inspection done, and then the closure was welded on remotely with a pulse welder.

We actually monitored eight different welding parameters, recorded them on strip chart recorders and magnetic media. And, then, after the lid was welded on and inspected, the canister was decontaminated, taken out of the bath, moved to a storage container or the transfer cart, and then moved over to the chemical processing cell.

This is our remotely operated cart. There’s a rack on it that actually holds four canisters. So, this is how we moved the empties into the cell from the EDR, and this is how we moved the full high-level waste canisters out of the vit cell through the EDR, and you will see--well, this door takes you into the EDR through the tunnel. But, once you get in there, that will take you into the CPC where the high-level waste canisters are stored right now. A picture as they’re being stacked into the CPC, stacked two high.

The summary of vitrification, processed about 600 tons of glass, 24 million curies including the daughters, the yttrium and the barium, 275 canisters. Dose rate, you’ll see different numbers on that based on what time the dose rate is tagged to. 2600 r per hour, I believe it’s tagged to year

2002 when vit finished, maximum canister dose 7500 r per hour, and essentially 80 months of safe, successful operations.

At the end of vitrification, we did what we called flushing, clean glass formers and essentially flush liquids were added to the concentrator feed make-up tank to be able to reduce essentially the concentration of the heel left in those tanks, because they couldn’t ever be completely emptied, because it was essentially jetted out with the jet in the bottom of the tank. There was no bottom discharged, so there were two campaigns at the end that essentially flushed the vitrification vessels with cleaner and cleaner glass, until we got to the end, and then there was this amount of glass left in the melter that could not be gotten out because it was below the pour spout.

So, some innovative person came up with the idea of an evacuated canister. And, what that is it’s a normal canister with a special spout on the top of it here, a snout that could be inserted down to the melter through a port in the top of the melter. And, then, there was an aluminum plug in the bottom of the spout. So, the trick was to get that down into the molten glass before the aluminum melted, so that the vacuum in the canister could suck the glass up into the canister.

And, that was a little delicate, the first one, the operator wasn’t sure, he was being a little cautious and I’m not sure how close we were, but he got it in before the aluminum melted, and we retrieved as much glass as we could into two of these evacuated canisters. 88 percent of the material in the melter was retrieved in this fashion.

After that point in time, vitrification dismantlement started. Did you get a chance to see the cell yesterday or not, through the window? You did. Okay. So, the cell was kind of all cleaned out. Equipment now, the equipment is back in doing size reduction. But, this is during the era when we had remote equipment, and they’re essentially cutting the equipment out of there and getting all the process equipment out.

Again, the dismantlement began in October of 2003. A lot of the material was packaged for storage, and a lot of that material that was packaged for storage is back through there again for processing and final packaging for disposal off-site. This is how the cell looked pretty much after everything was gutted out of it. What you’re looking at here is you’re looking from the north middle operating aisle. This is the transfer track here back into the tunnel and the EDR. This is the pit in the foreground.

And, after that was done, we finally got approval and funding to be able to ship the 20,000 drums of the low-level waste cemented product out to the Nevada Test Site.

Any questions that I can try to answer?

HORNBERGER: Questions from the Board? Anyone? Carl?

DI BELLA: Did you ever have to rework any of your lid welds, and if so, how did you do that?

MEESS: The question is did we ever have to rework any of the lid welds? We did not. Based on the FAX testing at five years of operation, there was obviously a lot of corrosion in the lid and the inserts that was discovered, and as a result of running for five years, there were some material changes made for the final melter to try to reduce corrosion up in the lid. So, we never had a problem with the lid. We replaced a discharge heater that failed at one point in time.

And, it’s a good thing we had two pour spouts, because in the last year of operation, we actually plugged one pour spout. So, for redundancy, there was a main pour spout, and then there was a back-up, because if for some reason the pour spout and the discharge plugged up, you’re dead. There’s just no good way of going in and cleaning that out. And, that happened to us in early 2002, I believe, and we actually finished up the campaign on the second pour spout, the melter has.

HORNBERGER: Gene?

ROWE: Gene Rowe, Staff.

Do you know what the surface contamination levels are on the outside of the HLW cans now?

MEESS: I can’t answer the question now. All I can answer is they were cleaner when they came out of the decon tank than they are now because they had, once they came out of the decon tank, they had to go through the cell, and then they were placed in racks in the chemical process cell, which is not clean. We have production records for each canister.

ROWE: I’m worried about when they get shipped off-site to a repository, they’re probably going to have to be handled at the repository, wherever that may be, and the contamination levels will complicate that process.

MEESS: Yeah. Well, we have a record of what they were after they came out of the decon bath, and the plan for shipping them would be to either decon them again before they’re loaded into the cask, or actually overpacking them into a clean container, which is clean on the outside. So, there’s two different thought processes there, and that actually might be talked about in I think a later presentation this afternoon.

HORNBERGER: Bruce?

KIRSTEIN: Kirstein, Staff.

Can you give us an idea of what the glass recipe was, and what the fission product loading was in the glass?

MEESS: Fission product loading, cesium was our predominant nuclide. We had roughly 6500 curies of cesium in the glass, and we had I'll say about 5200 curies of strontium, and then the 100,000 curies of the Alpha transuranic. Those were the main nuclides in the glass.

With regard to the recipe, it was mostly silicon dioxide, typical borosilicate glass. So, it almost, although it's black, it almost has the same recipe that you would expect for laboratory equipment, Pyrex with obviously the radioactive materials and hazardous constituents included.

HORNBERGER: Carl?

DI BELLA: Carl DiBella again.

You kept your cement drums in a special shielded location, and yet your shipping campaign, it looks like you're using organic gondoll cars.

MEESS: That's correct.

DI BELLA: In other words, it's unshielded. So, it turned out not to have as much surface dose as you originally thought?

MEESS: That's correct. When I talked about the supernatant treatment system, the zeolite, to strip out the cesium, the design for that was 99.9 percent efficient. We actually got one order of magnitude better removal of that, which actually meant when you're making the drums, the drum facility was designed to be a remote facility to handle up to 1 r per hour drums contact, and we were able, because the zeolite worked so good, we were actually able to limit our drum dose to about 100 mr per hour instead of the 1 r per hour. So, the drum cell was already built and shielded for the 1 r per hour, and we ended up putting, well, the hottest drum down there was about 100 mr per hour. Some were as low as a couple few mr per hour. So, because the drums were lower dose than what everything was designed for, we were able to ship those in gondolls

HORNBERGER: Howard?

ARNOLD: Arnold, Board.

How much heat are those glass cans generating now?

MEESS: When they were made, it was about 325 watts per canister. I believe in 2015, it decays down to about 200 watts per canister. Not a lot of heat generation.

ARNOLD: As we said earlier, this was pretty low burn-up fuel.

HORNBERGER: Other questions? Questions from the audience?

VAUGHAN: Thank you, Dan. Ray Vaughan, West Valley Citizens Task Force. Could you say something about what I thought maybe Bryan would mention this morning, but it hasn’t been mentioned yet. And, that is the last cartridge of zeolite that’s in 8D-1 that is sitting there, is relatively well packaged high-level waste, or at least cesium loaded zeolite that is still there. It seems to me that’s a relatively unnecessary part of the tank source term, but it’s part of what’s left in the two or four big high-level waste tanks.

MEESS: Well, I can say that of the activity left in the tank farm, most of it is due to the cesium and it’s daughter barium. We have some cesium on the floor of the 8D-1 tank and we actually have cesium loaded columns, there’s still zeolite in the ion exchange columns within the 8D-1 tank that were not discharged yet. A decision was made instead of discharging them into a carbon steel tank, keep them in the stainless steel tank until a decision is made on what to do with the zeolite. So, yeah, there’s a large amount of cesium there in the 8D-1 tank, both on the bottom of the tank and in the columns, and a decision for that is obviously going to be a Phase 1 EIS decision. I’m not sure that answers your question, Ray.

VAUGHAN: The question is really what part of the process led that to being left rather than brought into the vit mix?

MEESS: Well, I can answer the question a little bit, if I could quickly go back to that one slide that shows diminishing returns on zeolite retrieval. Let me try that real quick. We were reaching diminishing returns on zeolite retrieval, and as I mentioned, we were adding more liquid to the tank, running the mixing pumps with the failed seals than we were getting out. And, in addition to that, it was costing I think it was estimated about $50 million a year to operate the vitrification plant, along with all the support activities, and there was a study done indicating when we reached a technically economical and practicality stopping point, and the study came back saying you should have stopped probably a year or two before you stopped with waste retrieval from the tank.

I’m sure everybody could take that study and have their own opinion, but that was the study DOE had commissioned their own review panel, and both West Valley Nuclear Services Company and DOE arrived at the same conclusion, that we had reached that stopping point, and it wasn’t going to be cost effective to continue beyond that point in time, or risk productive.

You’ve got to realize that the melter was designed for five years of life. We were already on our second pour spout. If that second pour spout went the way of the first pour spout, we were sitting there with a melter full of extremely high activity, high-level waste with no home. And, to be able to disposition that would be quite a chore. So, for a number of reasons, the technical and economical practicality study, the cost of running the vit facility, the fact that the melter was designed for five years, and it was in its fifth year, and we only had one pour spout left, and diminishing returns, that kind of all added up into if we didn’t stop yet, we ought to stop now.

HORNBERGER: Okay, thank you.

We are now scheduled for a break and we will do so. We will reconvene at 3:25.

(Whereupon, a brief recess was taken.)

HORNBERGER: In case you didn’t hear, I know some of you didn’t hear the bugles, but we are started.

Okay, continuing with our topics on West Valley, we have a presentation by Zintar Z. Zadins, who will give presentation. How did you get all three Zs as initials?

ZADINS: Well, you’ll have to go ahead and ask my mother about that. She was a lifetime Republican, but she always used to bring up Hubert Horatio Humphrey when I asked her that.

Hi. My name is Zintar Zadins. I’m a contractor for the U.S. Department of Energy at West Valley. And, today, I’d like to go ahead and provide you an overview for the high-level waste canister relocation project, that’s part of Phase 1 decommissioning, talk something about the challenges associated with this project, and also describe a conceptual approach to how this may be done.

I’m not going to spend a lot of time on the EIS or ROD. Moira talked about this at length. But, once again, just to remind you that there is the phased decision making alternative that the DOE selected as the decommissioning alternative for West Valley. It consists of two phases. Phase 1 which is going to--expected to begin in July 2011, involves several main efforts, one of which is to relocate the high-level waste canisters to a new on-site storage pad. And, then, there is the removal of major facilities, such as the main plant process building, vitrification facility, and also the removal of the North Plateau Groundwater Plume source area.

Phase 1, as was presented to you earlier, is expected to take around ten years, and then a Phase 1 decision will be made for the remaining facilities.

The high-level waste canister relocation project is going to involve the removal of 275 canisters of vitrified high-level waste, two evacuated canisters, and two drums of spent nuclear fuel debris that are currently stored in the Chemical Process Cell of the main plant.

Now, why is this relocation project important? Well, we need to go ahead and remove these canisters in order to go ahead and remove the main plant, and then also to excavate the source area of the North Plateau Plume.

Once these canisters are removed, they’re going to be stored on-site at a temporary facility until a Federal repository becomes available.

Now, Dan Meess had showed you a number of slides in his presentation showing the high-level waste canisters, and

I think all of you saw the Chemical Process Cell on your tour yesterday, but I provided a slide that goes ahead and shows--again, the canisters themselves are stored within storage racks within that Chemical Process Cell, or as is referred to now as the high-level waste Interim Storage Facility.

And, associated with this figure, I have put a plan view of the main plant and the CPC or high-level waste Interim Storage Facility is located in this cell. Basically, when you went ahead and took your tour, you went through the main plant office building here, went upstairs to the second floor, and went and looked into, I would imagine, the north window of the CPC and got a view of these canisters yesterday.

To give you some sense of scale, CPC is on the order of 22 feet in width here, and about 100 feet in length, and each of these canisters are on the order of two feet in diameter.

This slide basically goes ahead and gives you some information of the high-level waste canisters. Stainless steel construction, approximately 10 feet tall, 2 feet in diameter. They do have a welded lid with a grappling attachment on there to allow them to be moved around the CPC using a grapple device that’s suspended from the CPC crane.

Dan went ahead and mentioned maximum contact dose rates associated with the cylinder is on the order of 7500 R per hour, average 2600. As part of the next contract period, we will be revising the canister inventories, and these dose rates may change some. That’s just something to keep in mind. We also need to go ahead and get information on these canisters when we go ahead and do our designs for our storage casks, which I’ll talk to you about in a minute.

What’s the conceptual approach to the high-level waste canister relocation? Well, to go ahead and sum it up, we want to go ahead and use a modified independent spent fuel storage installation, dry cask storage system that’s currently in use at commercial nuclear facilities in the United States.

As part of this dry cask storage system design, we would like to go ahead and use a modified spent nuclear fuel multiple purpose canister design that has a current NRC 10 CFR Part 71 certificate of compliance with it to store multiple high-level waste canisters, and what’s most important, to allow future transport without high-level waste canister repackaging. So, once we go ahead and get these into our MPC, we want those to be welded shut and have it in the configuration that they don’t need to be opened up any longer in order to be disposed of in a Federal repository.

And, once again, at the bottom, we are planning to revise this high-level waste canister inventory to facilitate storage cask designs and also the NRC multi-purpose canister certificate of compliance reviews.

All right, the high-level waste canister relocation project is going to require a variety of different tasks associated with it. Certainly preparation of engineering designs, regulatory submittals, DOE operational reviews, potential modifications to existing facilities, construction of new facilities, and then finally, there is going to be the actual high-level waste canister relocation operations.

And, what I'd like to do is in the next slides, talk about each of these bullets briefly. I mean, I know the slides will seem contradictory, but I'll try to go ahead and get through them as quickly as possible.

For the engineering design preparation and approvals, the DOE and the future site operations contractor is going to have to come up with designs for potential modifications to existing facilities, such as the Chemical Process Cell, Equipment Decontamination Room, Load Out Facility, and perhaps site roadways.

There may also be a need for new construction designs for new facilities, certainly for the high-level waste canister Interim Storage Facility, where the casks that contain the multi-purpose canisters that contain the high-level waste canisters will be stored. And, if required, there may be a need for a multiple purpose canister storage facility, basically a Butler type building that will go ahead and store these canisters before they’re utilized in receiving the high-level waste canisters from the CPC.

Concerning regulatory submittals, reviews, and approvals, there’s going to be a great deal of work associated with this. In particular, there’s going to be interactions with the NRC preparing authorization basis reviews for changes to the existing facilities if we need to do that, authorization basis reviews for the high-level waste canister Interim Storage Facility. Future contractor is going to have to file for the NRC 10 CFR Part 71 COC for the multiple purpose canister storage and transport cask.

And, then, there’s going to be need to prepare NRC documented safety analyses, both preliminary and final, and also perform those reviews. Finally, there’s going to be other Federal and State permit applications and modifications that are going to be necessary to go ahead and complete this task.

From the DOE operational review perspective, again, quite an involved list here. We’re going to have to prepare NEPA review for the high-level waste canister Interim Storage Facility, and we believe we do have coverage for this in our EIS that was submitted in early 2010. There’s also going to be a need to prepare a DOE authorization basis review for both the changes to existing facilities and also for the high-level waste canister Interim Storage Facility.

Once again, DOE documented safety analyses with their associated review, both preliminary and the final documented safety analysis. And, then, finally when we go operational, there’s going to be need for a DOE Readiness Assessment Review.

I’d like to go ahead and talk about some potential modifications to existing facilities, and these are going to include, at a minimum you would think, the Chemical Process Cell where the canisters are currently being stored, perhaps the Equipment Decontamination Room, Load Out Facility, and site roadways. And some of the modifications that may be necessary there are to go ahead and refurbish or replace some of the shield doors, cranes, windows in the main plant, some of which are on the order of 50, 60 years old.

And, one of the main things that we may need to do, and is expected, is that we’re going to go ahead and install canister decontamination stations that may include an initial canister decontamination station within the CPC, and perhaps maybe even a primary decontamination station in the EDR. And, this is all conceptual. None of this has been finalized yet. This is going to be the responsibility of the next site contractor to come up with plans to go ahead and do this work.

In addition to the canister decontamination station, because what we expect is that CPC is not a clean cell. There’s potential for airborne contamination, and also for contamination to settle on these canisters. It’s a good idea to go ahead and provide for decontamination capability in order to clean these canisters before they go into these MPCs, and before they get shipped out for storage in the container Interim Storage Facility.

Also, thoughts for inspection stations for weighing canisters, for measuring them, to go ahead and get dose rates off of them. So, there’s a variety of potential modifications that may exist for existing facilities within the main plant, and also within site roadways. The weights that we may be carrying may require regrading of the roadways, resurfacing them, installing culverts, things of that nature.

Going on to the construction of new facilities, the principal facility is going to be this high-level waste canister Interim Storage Facility. The proposed location is on the South Plateau of the WVDP. The initial thoughts are that’s going to be a reinforced concrete slab on grade, and this is going to be designed to have a long-term use associated with it. It’s currently unknown when a Federal repository is going to be available to accept these canisters, so we need to have something that’s going to be able to go ahead and store these for a significant period of time. And, this facility itself may include security fencing, lighting, and if required, stormwater runoff controls.

Finally, there may be a need for this multi-purpose canister storage facility, and if it is required, a temporary on-site facility will be built to store and prepare these MPCs prior to them being loaded with high-level waste canisters. And, again, we feel this is going to be a steel sided building on a concrete slab on grade. So, this is a small Butler type building that would probably need to be constructed.

Now, I’d like to go ahead and at least talk a little bit about conceptual or potential relocation operations for these high-level waste canisters. Once again, this is just a repeat of the slide that I showed you earlier showing the CPC and the planned view of the main plant. But, what I’ve done here is highlight in purple a potential path that we can go ahead and remove these canisters. The canisters themselves are located within the south end of the Chemical Process Cell, and a pathway could be into the EDR located here, and then out the EDR into load in, load out, and then eventually, once they’re packaged, use the site roadways to go ahead and bring these canisters in their casks down to the South Plateau where the storage facility is located.

I’ll try to go through these next slides a little quickly here. Once again, this is just the proposed conceptual approach. Nothing has been finalized yet. But, concerning the Chemical Process Cell, the high-level waste canisters would be removed from their storage racks using the existing crane or a refurbished or a new crane within the CPC, depending on what’s required.

There may be a decontamination station in that CPC to do an initial gross decontamination of the high-level waste canisters. And, once that’s completed, the decontaminated canisters would be transferred over to the Chemical Process Cell transfer cart similar to what Dan Meess showed you in his presentation. And, those would be transferred into the Equipment Decontamination Room with that cart through the shield doors that separate the CPC from the EDR.

Once you got into the EDR, once again, all operations would be done remotely because of the dose rates associated with the canisters. A canister could be transferred from the transfer cart into the EDR decontamination station, where you would have a more complete decontamination associated with these canisters. Once that’s done, you could potentially bring it over to a canister check station, where the size, weight, and dose rate would be evaluated.

And, then, once those measurements were taken, and you would obviously need these for eventual--for a waste acceptance criteria for whatever repository these canisters would go to, you would go ahead and perhaps transfer the high-level waste canisters using another transfer cart to the load out facility.

The load out facility, one of the ideas that you could have as far as managing these canisters is to go ahead and bring a transport trailer in, which contains a shielded concrete storage cask with an MPC in it already. And, with that, you could have a loading station that's specifically built within the load out facility in order to manage the transfer of high-level waste canisters into the MPC.

Load out facility crane would be used to go ahead and place those high-level waste canisters into the MPC, and when the MPC is filled--and there's still no idea as far as how many canisters would be in an MPC, obviously the more that we can get into an MPC, the better, it will be cheaper to the Federal government with respect to purchasing casks--a lid would be placed on the MPC and that lid would be remotely welded to the multi-purpose canister. And, eventually, the multi-purpose canister will be helium tested to assess weld integrity.

And, then, a lid on that shielded concrete storage cask would be placed on that cask, bolted, cask surveyed, and eventually transferred over to the high-level waste canister

Interim Storage Area on the South Plateau.

This is just a figure, a photo showing loading of high-level waste canisters into an MPC. And, this MPC basically, for those who are unfamiliar with it, it’s a thin walled stainless steel cylinder. By thin walled, I mean on the order of like a half inch, I think probably it would be somewhat similar to some of those coffee urns that you would see back there that have partitions in there available for placement of individual high-level waste canisters.

Once these MPCs are filled, again, that lid would be placed on top of the MPC, remotely welded, and then the MPC would be helium tested to go ahead and evaluate the welds on this MPC. The MPC would be placed within a shielded transport cask, and transferred to either a vertical or a horizontal storage system on the high-level waste canister Interim Storage Facility.

We have a proposed location for the high-level waste Canister Storage Facility on the South Plateau of the WVDP. This pad, identified as Area Number 3, and that’s located in close proximity to the MDA and to the SDA. We don’t expect that there’s going to be significant soil contamination in that area. We are going to be doing characterization of that area in the near future to assess that.

As I said earlier, this is going to be a storage pad similar to ISFSI pads that are at commercial nuclear facilities, and a good approximation of the size of the pad is on the order of 100 feet by 300 feet and 3 feet thick. And, it’s not decided yet as far as what type of canister storage is going to be located there. It could either be a vertical or a horizontal system. And, I will describe those shortly.

This is typical vertical high-level waste canister storage facility, and what we see here on the concrete pad is a series of concrete and steel storage casks. And, this is a picture taken from the Connecticut Yankee Nuclear Facility. And, what it’s used to house are spent fuel assemblies. So, an MPC is loaded into this vertical cask for storage, until at some point in time, it’s going to be shipped off-site for storage at a yet to be named repository.

Again, in this particular case, this system here is able to, and I guess maybe this needed to have a little clarification in there. It should be up to 7 canister MPCs. So, basically what we’re talking about is these vertical storage casks can house an MPC that may contain up to 7 high-level waste canisters that we have currently stored within the CPC.

These casks themselves, they are fabricated on-site by the vendor, and currently right now, Holtec International and NAC, Incorporated are the current vendors for these type of vertical storage modules.

This is an example of a horizontal high-level waste storage module. The MPCs themselves are put into these in a horizontal configuration in each of these storage modules. Unlike the vertical ones, the concrete module is fabricated off-site and shipped to the facility. And, currently, TransNuclear is the sole vendor for these horizontal storage modules. And, again, no decision has been made yet as far as what type of module would be used at West Valley.

The last few slides are just to go ahead and give you some perspective as far as how these canisters are transferred. This, once again, is from a nuclear facility. We have a cask that’s already been filled with spent fuel that’s being pulled out of the facility. It gets put onto a transporter and slowly wheeled over to the ISFSI pad, and loaded into the vertical concrete storage cask.

An example of a horizontal canister transfer, spent fuel assemblies are loaded into this transport cask. It’s tipped over in a horizontal position onto a transporter, and the transporter itself drives over to the site, ISFSI, and then there is provision for, on this transporter, to go ahead and, I don’t know if extrude is the proper word, but to basically extrude the MPC into the horizontal storage module. And, that’s like two types of scenarios that may be used over at West Valley as part of the high-level waste canister relocation project.

Any questions?

HORNBERGER: I have one to start. What are the trade-offs, the pros and cons of going through everything that you have just laid out for us versus packaging these things appropriately and shipping them to Savannah River to let them store it?

ZADINS: I think I'm going to have to let Bryan take that one.

BOWER: Actually, this was a question that was asked about a decade ago. Of course, there are the issues associated with getting the waste through those states between West Valley and Savannah River, so that's a consideration. The storage capacity at Savannah River would also have to be built to accommodate the West Valley canisters. There are still some issues regarding the payment into the Nuclear Waste Fund. That issue is yet to be resolved between the State of New York and the Federal Government, and still part of an ongoing litigation between the Federal Government and the State of New York.

I imagine the attorneys of New York will love for these canisters to be at Savannah River, and the Department of Energy to say they're not going to go to a Federal repository until you pay the bill. New York might like that, but I'm not sure that the State of South Carolina would like that. So, those are some of the non-technical aspects of it.

Of course, the technical aspects of it are you have to do a transfer of 275 canisters to Savannah River. So, that would be, if you can get 5 canisters into a cask, we're looking at 55 shipments from West Valley to Savannah River, and then at some point in time in the future, a transfer of those same canisters to the Federal repository. So, there is some inherent risk in the movement, multiple movement of the canisters that needs to be taken into account as well.

It's not a no-cost option. The load out facility would have to be constructed if we were to do it, and the multi-canister configuration still requires the purchase of the MPCs, still requires the leasing of a shipping cask, still requires the construction of a load out facility, requires the construction of a load in facility at Savannah River. So, there are considerations of cost, as well.

But, probably the biggest thing was that the Department of Energy did look at this about a decade ago on the programmatic Waste Management EIS for high-level waste, and the decision was made at that time that the high-level waste was going to stay at the point of generation until the Federal repository was available.

HORNBERGER: David?

DUQUETTE: Duquette, Board.

I've got a couple of what I think will be short questions, and I hope short answers. One of those is on the dry cask facility itself. You mentioned that you’ve going to use designs that are similar to those that are currently used at nuclear power stations. And, there’s been talk, at least, of storage for more than just a 50 year period, and your design, at least that you’ve mentioned, has a 50 year design lifetime. Are you going to take into account the fact that you may have to keep it for a lot more than 50 years?

ZADINS: I guess at this stage of the game, the thought is is that we’re going to design to 50 years. If there’s going to be a repository available, that’s going to meet our design requirements, and if it’s not, I think then we go ahead and sometime in the future we go ahead and make provisions for a new design. I don’t think that it’s reasonable to expect or be able to design a facility to exist for more than 50 years. So, I think that if there isn’t a facility that is available in 50 years, you just go ahead and redesign another one. I think you take a look at West Valley, the plant itself is 50 years in age, and it’s reached its useful, or it’s gone past its useful lifespan.

DUQUETTE: The second question has to do with the--

BOWER: Can I add to that?

DUQUETTE: Sure. Absolutely.

BOWER: I’d like to clarify that it may be possible to design facilities beyond 50 years. But, there’s a cost associated with doing that. So, again, there are other facilities that are being looked at to store high-level waste, spent nuclear fuel beyond a 50 year design life, but there is cost associated with any type of facility. If you want to design for 100 years, then you have to take that into account in your design. If you're going to design for hundreds of years, then again, you have to take that into account in your design.

So, if we want to talk very complicated designs, titanium type of, you know, expensive exotic materials, I'm sure that it could be done. There's a cost effectiveness in doing that as opposed to replacing a concrete facility every 50 years, might be more appropriate. But, hopefully, we wouldn't have to replace it beyond the 50 years.

DUQUETTE: Okay. The second question has to do with your casks, the MPCs that you're talking about. As you probably are aware, I'm sure you are, in the latter days of the Yucca Mountain project, there was a move away from MPCs towards TADs. Are you taking that into consideration at all at this point? Have you ordered MPCs?

ZADINS: There hasn't been any ordering yet. I mean, again, this is going to be a design that's going to be finalized with the next site operations contractor. These were just a conceptual approach that may be utilized here. So, there hasn't been any kind of design that's finalized yet.

DUQUETTE: But, your timing is within about seven to ten years; right? I mean, at that point, your planning on the building not being there, and those canisters going someplace?

ZADINS: The canisters have to be out probably within the next five years, in order to enable the process building to be taken down.

DUQUETTE: Which means that if you’re going to use MPCs in concrete dry storage, they have to be pretty much under contract almost immediately.

HORNBERGER: Howard?

ARNOLD: Yeah, mine is a related question. Who do you expect will tell you whether you’re using the five or the seven or what the specific design of the outer wrap canister is? That’s question one. And, two, will you take upon yourself the decision whether it’s vertical or horizontal?

BOWER: Again, after we select this upcoming contract, we will get a proposal from the offers on the approach to take. Ultimately, it will be DOE’s decision on whether or not we move forward with the five or the seven, based on the recommendations from the contractor we selected.

Again, the same with the vertical or the horizontal placement. There are pros and cons of each of those. We’ll listen to the recommendations of the contract that we select, and then we’ll move forward with a decision.

ARNOLD: But, the contractor you select can’t make that decision. That’s part of the overall system design of the entire repository, storage, et cetera, and that’s really what I was probing. Somewhere in DOE, I’m wondering if anybody is working on this integration issue, because it’s not just your decision here, it affects all the sites.

BOWER: Again, from a systems perspective, we would like to think that that decision would be made before we do the work. Again, we can’t wait on every decision to be made before we move forward, or we wouldn’t have put the high-level waste into the 275 canisters. That’s what we expect the repository to accept, but there is no repository that exists today that’s accepting canisters like West Valley is making, or Savannah River. Of course, we do have processes in place to make sure that the facilities that are constructed in the future will hold something like that.

We are planning at this point in time and decontaminating the canisters as they come out of the main plant. If in the future we would have to open up that multi-purpose canister and take them out and put them into some different configuration for shipment or disposal, then that’s a decision that we would have to make. Hopefully, we are working now with the right people to avoid having to change that in the future.

The point was brought up about the TADs. You know, when I started in the Department of Energy in 1990, we were back at MPCs. I believe Westinghouse was under contract to design an MPC, and we kind of went full circle over 20 years, away from MPC and then back to what we're calling the TAD, which was basically back to an MPC. And, that was when we had an organization that was focused on making sure that everybody was doing the same thing.

HORNBERGER: Mark?

ABKOWITZ: Abkowitz, Board.

I think we're on a theme here, I'm going to follow it. Again, getting at this issue of the uncertainty over the length of time the high-level waste may stay at West Valley, and the cost that's involved just to transfer the circumstances as they are now to a dry storage facility, I guess from a practical standpoint, I'd like to start my question by asking is there any concern that the structure in which the canisters are currently being housed is unable to perform safely for the foreseeable future, if it weren't for the fact that you have this sort of broader objective of trying to demolish the building?

BOWER: Actually, I was involved in the safety analysis back in the 1990's when we were looking at that. I just came in on the tail end of that. And, again, we were involved with NRC in looking at that. At that period of time when we were moving the high-level waste canisters into what was formerly the Chemical Process Cell, now the high-level waste Interim Storage Facility, we were thinking that it was going to be there on the order of one or two decades, not multiple decades. There was really not a lot of investigation into the long-term aging effects in that facility.

When we started this process, when we were gutting the cells, which we started back in the mid 1980’s, the main plant at that point in time was on the order of two, two and a half decades old. Now that we have the canisters in there, they’ve been in there since starting in 1996, 15 years has gone by since we first put the canisters in there. So, now the building is approaching 50 years. Could it stay there longer? Probably could. We would have to look at the aging effects. The ventilation system is a 50 year old ventilation system. Again, it can be maintained. We spend an awful lot of money maintaining that facility. There are 12 systems that are required to be in operation just to maintain the high-level waste canisters in that building.

The O&M costs of maintaining the building right now are over $10 million a year. Could we modify it to make it more efficient? Yes, I’m sure we could modify it to make it more efficient. Could we do some aging studies and analyze how long we could stay in that facility? Sure, we could do that. Do we know the roof leaks? Yes, we know the roof leaks. Could we fix the roof leaks? Sure, we could fix the roof leak. But, again, it’s trying to maintain that 50 year old facility that was really reaching the end of its design life.

ABKOWITZ: I appreciate all that. But, it’s a cost comparison and a risk comparison, and it strikes me from the several slides that we were just presented that have costs and risks associated with them, it would just seem to me, and I don’t want to call it the “do nothing” alternative, because clearly, you have to do some things, but I just, I wonder especially in the uncertainty that we’re facing--it would be quite different if there was a repository that was scheduled to open at a certain time or there was some assurance that there was a central interim storage facility.

But, given that we don’t know what the final disposition is going to be, and the possibility that if you went through all this trouble and costs, you may actually have to then repackage, and God knows what you’d have to build in order to be able to do that at the facility, I just wonder whether, and I don’t want to use the word “limp,” but I just wonder if we can’t consider what you’ve got right now as a dry storage facility, that, you know, you tear the rest of the building down, and do what you need to do to kind of keep it where it is, but as long as there’s no indication that you’re bumping up against some margin of safety, I just, I would encourage that that be at least an option that’s on the table.

BOWER: Yes. Actually, there have been--I’m aware of three studies that have looked at this, including a study that looked at the possible transfer of the high-level waste canisters to Savannah River, I believe the first study was done in 1998. I think there was another one done in the 2000, 2001 time frame. I believe at that point in time, it looked like if we were storing the canisters for more than a decade, the business case was to remove them from the main plant, and put them someplace else, looking at the cost for maintaining the main plant at that point in time.

Now, those studies, if I recall correctly, were primarily based on maintaining the main plant in the configuration it was in at that point in time, not doing a number of modifications to the main plant to specifically design it for high-level waste storage.

Another concept that was evaluated was to relocate the high-level waste canisters into the vitrification facility. One of the concepts that we had very early on when we were designing the remote handled waste facility was to make the remote handled waste facility, when it got to the completion of the need for the remote handled waste facility, was to modify the remote handled waste facility for the storage of the high-level waste canisters as well. So, there have been a number of studies that looked into that.

Over and over, the conclusion we come back to is it’s better to put it into a system that’s designed for that long-term storage than to retrofit or modify or try and use existing facilities for long periods of time.

HORNBERGER: Great. Thank you very much.

We’re going to move on, and this is our last oral presentation of the day, and Laurene Rowell will discuss the waste classification for the melter.

ROWELL: Okay, my name is Laurene Rowell. I work for West Valley Environmental Services. I am the Project Integration Strategic Planning and Communications Manager at the site currently. Prior to this, though, I was heavily involved in waste management and environmental restoration kinds of activities. For the past ten years, though, I have also overseen the implementation of the Waste Incidental to Reprocessing process at West Valley.

And, I’m actually very excited to be up here to say that we have published our first Waste Incidental to Reprocessing evaluation for the project, and that evaluation was for the vitrification melter that you’ve heard a little bit about with Dan Meess’s presentation earlier.

Essentially, the Waste Incidental to Reprocessing process that we follow at West Valley is outlined in DOE Manual 435.1-1, which is the Radioactive Waste Management.

The Waste Incidental to Reprocessing requirements have three criteria essentially. One is that we demonstrate that we removed key radionuclides to the maximum extent that’s technically and economically practical. We manage the material to meet the safety requirements comparable to the objectives of 10 CFR Part 61, which is the Land Disposal Requirements. And, then, finally, that it meets the Class C concentration limits and will be managed as low-level waste.

On March 14th, the Federal Register notice went out on the vitrification melter, indicating that the evaluation was available. So, we really are at that point in the process. The technical evaluation has been conducted. NRC has been enlisted to consult and review that evaluation and provide feedback to the Department of Energy, as well as we’re going through a State and public comment process, which is a 45 day comment period.

April 28th is actually the close of that comment period, and then at that point, DOE will continue--will consider all of the information that they have received, any comments they’ve received, as well as consultation information from the NRC, and then at that point, will make a determination of whether or not the vitrification melter can be managed as low-level waste or not.

This is just a close-up picture of the vitrification melter. The picture on the left is in process while it was in use. It was used to solidify 600,000 gallons of liquid radioactive waste glass between 1996 and 2002 per the Act. The picture on the right is when we were removing the melter during the dismantlement activities in 2004. Electrodes were removed, the melter is removed from the vit cell, packaged and placed on a hardstand ready for shipment.

The unpackaged melter is basically a ten foot square box. It’s an inconel shell filled with refractory brick and the outside of that is in a stainless steel cooling jacket, so it’s a very large, heavy container. And, in fact, when Dan talked, he talked about the very deliberate evaluation that was done to determine when was the appropriate time to shut down the vitrification. When had we achieved the point of really no additional added benefits to continue the operation.

Well, as part of that, we also looked at flushing the system and making sure that we had a very controlled shut down on that system. As part of that process, we flush with increasingly dilute waste through the vitrification system, then use some dilute nitric acid to flush some piping and the two previous vessels to the melter, and use glass formers to continually remove as much of the radioactivity from the melter as possible.

We also used the two evacuated canisters that Dan had talked about to remove as much of the glass that remained in the vessel before it was finally shut down.

This is a picture of the packaged melter, and those of you who have been out there, that is now in blue instead of white. It’s basically packaged in an IP-2 container, six inch steel box essentially, very robust. When it was packaged, it was 160 tons. We are looking at grouting that for purposes of shipment and disposal once a determination has been made. It contains about 4600 curies of radioactivity, 4300 of them are estimated for cesium 137, another 200 or so are strontium 90, and the remaining are the other radionuclides associated with the material that was processed through the melter.

Contact dose as it sits out there is less than 10 mR on the outside of the box. And, that again is before it’s even been grouted. So, there will be additional shielding on that. You can see next to it are the other two vessels that were used as part of the vitrification system, the SIFMONT (phonetic), which is a concentrator feed make-up tank, and then the MOFET (phonetic), which is the melter feed hold tank. So, glass formers in the waste were mixed in the concentrator feed hold take, and it was transferred to the melter feed hold tank, prior to going to the melter.

This just shows you the melter as it was coming out, and the handling activities associated with getting it out of the facility. Again, it was pulled out in 2004 as part of our dismantlement of the vitrification facility. It was then transported on a 12-axle trailer to the South Plateau, where I showed you a previous picture, while it was awaiting shipment. Once those vessels actually are shipping off-site, they’re going to go by rail, with some special considerations.

Now, if I go back to the criteria that I had talked to, Criterion 1 was removing key radionuclides to the maximum extent technically and economically practical. Essentially, we’re looking at the radionuclides associated with 10 CFR 61.55, Tables 1 and 2. But, we also considered the radionuclides that are important to the disposal facilities that this unit may go for disposal.

We looked at additional flushing, evacuated canister system and dismantlement as the technically practical options. It was determined as part of this evaluation that the flushing and the evacuated canister system was the most technically practical option.

We also looked at the economic considerations associated with it, and any additional flushing above and beyond what we had already laid out, and as you say, the graph showing what was coming out of the tanks, the continued operation, the concern with the lifespan of the vitrification and not wanting it to shut down in a situation filled with material. Additional flushing wasn’t considered practical, and dismantlement was also not considered practical because we were just generating more concentrated waste forms with no place for disposal, as well as creating additional dose for workers.

The second criteria was meeting the safety requirements comparable to 10 CFR 61, Subpart C. We considered two facilities as part of this technical evaluation for disposal. One was NNSS, which is previously known as the Nevada Test Site. The second option was a commercial option, which was the Waste Control Specialists that we considered for low-level waste disposal in Texas. Even though that facility isn’t open, there is waste acceptance criteria that we were able to evaluate against. And, so, again, we considered both of those.

In both cases, as part of this technical evaluation, we were able to demonstrate that in fact, we met those criteria, and it could be safely disposed of at either location.

The third criterion is whether it meets the low-level waste concentration limits and whether it can be managed in accordance with DOE requirements. Our evaluation determined that the radioactivity in the melter waste package will not exceed the Class C concentration, so it can be managed as low-level waste. As part of packaging for purposes of transportation and disposal, the melter will be grouted in place, so it will be in a solid physical form, acceptable for disposal again, and it will be managed and disposed of as off-site low-level radioactive waste in accordance with the requirements of those receiving facilities.

So, we were able to demonstrate that all three criteria have and could be met, depending on where it goes for disposal.

Just running through the timeline again, Federal Register notice went out on March 14th. We do have the document available online. I do have one copy here if anybody is interested in it. The 45 day review period began. That 45 day review period ends on April 28th. We're anticipating resolving comments and incorporating them and taking those into consideration, and then completing that process by July 30th, then giving another 30 days for DOE to make their final decision and determination.

Comments can be submitted either by e-mail at melter@wv.doe.gov, or they can be mailed, and again, if anybody needs that information, it is in the presentation materials, or I can get you copies e-mailed to you if you need a copy of it.

That's it. Does anybody have any questions?

HORNBERGER: Questions from the Board?

ARNOLD: Just curious, the deadline is tomorrow. Did you get a lot of comments?

ROWELL: We’ve gotten some preliminary questions and comments from NRC, and we have one set of comments from the Coalition on West Valley.

HORNBERGER: Carl?

DI BELLA: Carl DiBella, Staff.

The flushing that you’re talking about is flushing with molten glass; right? Or is it flushing with water?

ROWELL: No, it was flushing with a molten glass. So, the melter was never turned off. It was just a continually fed melter. So, you know, it stayed on, it was hot, so the glass with a decreasing or more dilute materials were coming into the system, flushing--mixing with what was already in the melter, and then being removed.

DI BELLA: So, at the very end, you were feeding to it just pure glass with no radionuclides?

ROWELL: There would have been maybe very minor radionuclides just from the flushing of some of the piping coming through the system, very minor.

DI BELLA: Okay.

ROWELL: It wasn’t 100 percent clean glass.

DI BELLA: When you--what I’m getting at is when you then measured what was discharged from the melter, you have radionuclides in that, and that level was continuing to decrease; right?

ROWELL: Right. In fact, what we used for characterization of the melter was data associated with the evacuated canisters. So, those last canisters that were pulling the remnants out of the melter, that radionuclide distribution was, in fact, used for characterization of the melter. But, there was still radioactivity in the melter; right.

DI BELLA: How many curies did you get out with the evacuated canisters?

ROWELL: I can’t tell you exactly what was in the--we took out 88 percent of the remaining material with the evacuated canisters, and there was about 4500 or 4600 curies that we estimate remain in the melter after shutdown.

DI BELLA: I understand. My question was how much came out into the evacuated canisters?

ROWELL: I probably have that data with me. I just don’t know it offhand.

DI BELLA: Let me ask this. Why did you decide not to do a third evacuated canister? It’s pretty useful.

ROWELL: Because I think that the first evacuated canister was about 80 percent full. The second evacuated canister was about 50 percent full. And, the evacuated canisters were used after the melter was unplugged, and so the concern was that it was continuing to cool down and that you wouldn’t be able to draw anymore glass out of there.

DI BELLA: Okay. Let’s try a different way.

ROWELL: Okay.

DI BELLA: How did you decide what is not economically practicable? Where is the dividing line?

ROWELL: And, again, that’s what I was going back to. The whole evaluation for the system, including the tanks, the vitrification system, was really a universal how do we decide, when do we shut the system down, and the only other thing that we could have done with the melter, at the concern or the expense of, you know, having it fail full of material, was to continue to flush it. And, then, when we decided that we didn’t want--well, we couldn’t either continue to do it because it was very expensive, every canister cost so much money to generate, and the concern that the melter was going to continue to operate and fail in operation, we had to make a decision about when we were going to continue to make transfers to the system, and when we felt like we had done everything that we could do.

And, so, there was an economic analysis that was done, and that is part of the whole melter evaluation that looked at the system, and then it looked at the flushing and the benefits of continued flushing.

DI BELLA: Thank you.

HORNBERGER: Other questions?

(No response.)

HORNBERGER: Okay, thank you.

We’re a little ahead of schedule. Linda has not indicated or given me any sign-up sheet. This is the point to just go ahead and start our public comment period. If you do wish to make a comment, again, please go to the microphone, speak into the microphone, and give your name and affiliation.

D’ARRIGO: Hi. I’m Diane D’Arrigo. I’m with Nuclear Information and Resource Service.

I had a few questions throughout the day when there wasn’t a public--time for public to ask questions.

The more recent one is what doses are calculated--this is regarding the high-level waste, the canisters being moved to a new location on the South Plateau. I wanted to know what the doses would be because they would no longer have the building to shield them.

BOWER: The canisters would be stored in compliance with 40 CFR 191, Subpart A for the storage of high-level waste, spent nuclear fuel. Diane, I would have to go back and look, but I believe the 100 millirem dose standard applies. Please let me check on that, and I will get back to you.

D’ARRIGO: Well, 40 CFR 190 is 25.

BOWER: 25? Then it would 191, Subpart A requirements.

DI’ARRIGO: But, just in--I mean, I’m imagining that maybe you’ve done some calculations, because if you’re talking about canisters that have surface doses of over 7000, I didn’t write it down, rems per hour--

BOWER: 7500 r per hour.

D’ARRIGO: Yeah.

BOWER: That’s on the same order as spent nuclear fuel.

D’ARRIGO: Right. So, now, it’s in that building, and I imagine the building has a lot more shielding than the three inch steel building that we’re going to talk--and, I wasn’t even clear. Is there going to be a steel building around these canisters? The picture showed the bowling pin kind of style.

BOWER: The Butler building that was talking about was to store the canisters, the empty canisters before they were loaded with the high-level waste canisters. So, there’s going to be an inner stainless steel liner, and so they would need to be stored outside of the weather. The actual storage module, both the vertical and the horizontal modules, are concrete modules. And, so, you take the high-level waste canisters, put them inside of the stainless steel inner package, and that’s welded, and then that’s moved to a storage pad where that stainless steel package is put inside a concrete storage module, which provides the shielding.

D’ARRIGO: So, if you look at the map of where it’s going to be, you’ve got the SDA, the NDA, and then the--

BOWER: Storage pad.

D’ARRIGO: The storage pad.

BOWER: That’s correct.

D’ARRIGO: With, now, you may recalculate the dose and it may be less, but some canisters that would be giving off 7000 rems per hour, and then a concrete building, and then it’s not that far from--

BOWER: No, a concrete cask, a concrete storage cask.

D’ARRIGO: Oh, okay. So, we’re going to have the casks then, the concrete casks, if that’s what’s chosen.

BOWER: Right. Yes.

D’ARRIGO: And, it’s not that far from the road. I would imagine that there’s going to be some noticeable dose there. Whereas, now, when you drive by, you don’t get--you can’t detect much of anything.

BOWER: No, the casks, the storage systems will be designed to provide the shielding to ensure that the dose to the members of the public are within regulatory guidelines.

D’ARRIGO: Well, regulatory guidelines and what it actually gives off are often--there’s usually a range. So, we would possibly have more potential dose to passers-by at this point. I’m just saying that what we’re looking at reactors around the country is a major push by organizations across the country, some governmental entities, for hardened on-site storage, for better secure storage for high-level waste for regulated fuel because the prospect of a repository, even the NRC says we don’t even have to have one until 60 years after the final reactor closes. So, the prospect of a repository is not all that optimistic. So, the concern being we should plan better for West Valley. I think this is going to be an issue.

BOWER: Thanks, Diane.

D’ARRIGO: And, I had another question on the QRA. How much, if at all, were the various scenarios for leakage from the SDA considered to happen simultaneously?

STETKAR: That’s actually a really good question. I’m glad you asked it.

I had some back-up slides that kind of addressed that, but in the interest of time, let me just try to address it orally.

We thought about that a lot. And, we not only thought about simultaneous, but we also thought about successive effects. A good example of a simultaneous effect that I did mention in my presentation is something like a tornado that would damage the geomembrane covers accompanied with a severe rainstorm. Now, those are things that you would expect to be somewhat simultaneous. The rainstorm being severe enough to erode the compacted clay caps and provide enough cumulative rainfall over a 14 day period. The cumulative rainfall requirements depend on the level of water in the trenches. So, if the trenches were actually full, you wouldn’t need much cumulative precipitation. So, a short duration, very severe rainstorm accompanied with a tornado, for example, would cause overflow under that situation.

If the levels were further down, you would need not only a severe precipitation in terms of intensity over a short period of time, about a two day period, to erode the clay caps, you would then need additional cumulative precipitation over--we took a two week period--to fill the trenches to cause overflow. So, that’s a long answer to your question of an example of simultaneity.

In terms of successive effects--

D’ARRIGO: So, what was the answer then? That sometimes you thought about it?

STETKAR: No, we always thought about it. We always thought about simultaneity.

D’ARRIGO: But, it’s not in the calculations.

STETKAR: Pardon?

D’ARRIGO: But, it isn’t in the calculations then?

STETKAR: Yes, absolutely. Absolutely.

D’ARRIGO: Oh, okay.

STETKAR: That is a contributor to an overtopping scenario.

D’ARRIGO: Okay.

STETKAR: Another contributor to an overtopping scenario in the sense of sequential effects would be--I’ll give you a good example. We considered the effects of forest fires. Forest fires don’t directly mobilize any of the waste material. However, a forest fire could ignite the geomembrane covers, affecting their availability for a reasonable amount of time. Actually, it takes quite a bit of time to get one of these covers engineered and installed in place. That’s a contributor to leaving the site in a vulnerable condition for which then successive storms could come in and give you additional rainfall, erode the trench caps, and either cause gully erosion, which is a contributor if the geomembranes are not intact, or refill and flood over.

And, those types of sequential type of conditions over the period of, in this case, a year or more are indeed considered in the--not considered, but actually quantified in the study. We spent an awful lot of time trying to think about those types of simultaneity, primarily in terms of issues that would affect the mitigation barriers that are in place, either simultaneously, or as I said, sequentially, accompanied with storms or whatever other threats you might have.

D’ARRIGO: I only had one more for you. The Kd values, were those a combination of calculated and measured and standard used?

STETKAR: You’re asking the wrong person. I have to admit that’s not my particular area of expertise. And, unfortunately, Tom Potter, who was involved in those analyses, had to leave early. So, I can’t actually answer that.

D’ARRIGO: I can call him. Thank you.

STETKAR: Thanks.

HORNBERGER: Okay, we did have one person sign in. Richard Parizek, who signs in as a citizen, but in reality, we know he’s a former professor from Penn State University and a former member of this Board.

PARIZEK: I still am a professor. I’ll be back here tomorrow with a class. I’m not as smart as my students.

It’s my understanding that this may be the last meeting, formal meeting for Board members who will recycle as of today. So, for one, I would like to congratulate and thank this distinguished Board for their years of service. They have served beyond normal time ranges, but they have done a lot of very careful work, and so I wish to make the personal statement. And, if you hug each other in the future when you run into each other somewhere, we’ll understand because when you debate serious issues for long period of time in a congenial manner and come to resolution, there’s something very special about that, which is missing in Congress and in the Senate right now, from a national point of view.

Now, this is dealing with the risk assessment.

Obviously, this is done in the context of the state of knowledge at the time, and the people who did the work, their understanding of the problem. And, say, you pick 30 years and it’s a question about why 30 years. There was some discussion about that, but maybe we could hear a little bit more about it, because let’s reflect what was learned or observed in 30 years before that.

First of all, bathtubing was discovered at the sites. Bathtubing is not a surprise, because you have high permeability fill material in trenches, with a groundwater mound trying to form and a cap which is elevated to change the boundary conditions. So, you’ve got a groundwater circulation system which totally changes the distance of travel from what was originally assumed.

Solvents arrive in November 1983, 20 meters that moved in 12 years, if the containers, steel containers with gedders (phonetic) leaked from the day you put them in. If it leaked sometime later, then the travel time was much shorter. So, this is very different than the 160 year forecast that Dan and others talked about in terms of migration perhaps down to the lake deposits and silt deposits underneath the engineered barrier, below the geological barrier, in this case, the Lavery Till.

Joints in the Lavery Till were discovered. At the time I was at the site back in the Sixties, the engineer at the site said that’s the result of desiccation of the clay till. You dig a trench, you’re drying it out, it cracks, and oxidizes. But, if you take that clay till and bring it to your house and leave it there for 50 years, it won’t oxidize in that time period. It’s a petogenic process. It’s forming along the fractures which have been there for quite a long time. It takes a lot of time to get that alteration to occur there. That makes a big difference in the permeability of the till.

And, then, the question is what’s the flow system? There was debate about whether the flow was horizontal, or the flow was vertical. The head data says it’s vertical, it’s downward. But, the solvents helped sideways. So, there’s clearly a lateral flow story and a vertical flow story, and there’s got to be a lot of work done to analyze that, to understand the problem.

So, one of the questions that will come up is what do we know about the vertical flow? How far down do the fractures really go? And, 15 meters was sort of a cut-off as to perhaps how deep they go. But, on the bluffs of Lake Erie, they go 60 feet or more through till, right to the bed of the till. Well, that may be on the shores of Lake Erie, it’s a little bit different perhaps. We want to know whether you’ve got any new information on real fractures extending to the base of the Lavery Till.

The Lavery Till also is not uniformly thick because of the way in which it formed. It’s ice advancing up a slope, retreating down a slope, affects the whole depositional process. And, there was a question about not wanting to drill into the footprint of your State storage area. But geophysics will be done to see if you can pin down the top of the sand and gravel materials that are underneath the till. I’m not sure that was ever done. I heard about that.

And, then, the trenches are really surprisingly close to Erdman Brook and to Frank’s Creek. I mean, if you’re talking about seismic situations, and it was really a seismically active area years ago, you wouldn’t have probably brought the facility here in the first place. But, how close is too close? A lot of effort was put into the landslide mechanisms that could occur; right? And, then, it brings up the question about the cap, the geofabrics covers a big acreage. I didn’t calculate what that is, but there’s a lot of runoff coming off of that so-called pavement; right? And, that water is going either into Erdman Brook or into Frank’s Creek. And, that’s accelerating erosion.

And, then, we saw some examples of some engineering work to slow down the erosion, but I’m not sure that’s being done in the channel bottoms where deep incisions are occurring at a very rapid rate. The Board saw milky waters going down through the creek when you were there, minutes of really erosive part of the landscape. So, it’s another observation.

And, then, we also in this time period, 30 years, understood that the solvents changed the permeability characteristics of clays. Well, that was known long before that, but nevertheless, it appears in the literature. You get fracture flow, you put solvents in there, and perhaps then the solvents eat their way through the barrier, the changing permeability. So, what’s new about that, because a lot of solvent was apparently present, the site still left in place.

And, then, some of the Lavery Till is not saturated based on the water contents from core samples that were taken. There’s some numbers like 15 to 25 percent moisture content, versus saturated till more like 30 and 35 percent. This adds to the complexity of modeling, as Schlomo Neuman apparently dealt with this presumably, but vertical flow downward sometimes fractured, maybe not fractured, some cases variable thickness, not necessarily as thick as you thought it was based on the way in which the tops of the gravels come in, and then this question about saturated and non-saturated states that might occur in the till that’s real, and this is kind of an important problem. It’s exactly what the vertical travel times could be for just water, let alone radionuclides.

And, then, there was going to be a discussion of dealing with Carbon 14 dating, Carbon 13 dating, tritium dating, the deuterium isotopes to see if you could use those as a measure of how old is the water that’s moving down through the tills. And, I’m not sure what was done with that, because nothing was mentioned at this time. But, it would give you some further information on the fracture permeability and the travel times that might actually be really occurring there.

Then, there were side cracks. Doug Rigby brought up this question about cracks. I stuck my foot in the side cracks on the side of trenches when the trenches would be opened up, it would be sort of a stress release as you take mass away, the walls would open up along the cracks that already existed in the soil, but in the late summer when things dry out in the Buffalo area, you could stick your foot in there. And, those cracks are open with debris that can get in, leafy materials, twigs, whatever gets in there. And, then, when you backfill the trench, you don’t really necessarily reseal that open space to its original condition. Right? It was a fracture perhaps to start with, but it’s not as tight as it may have been.

So, your point is well taken about these pathways that you create by the very act of opening the trenches that may raise some question. So, this is just like in 30 years, these observations I'm familiar with. So, then, in the next 30 years, that's a pretty short time in terms of this whole risk assessment projection that was made.

Perhaps the Marcellas Shale, now we have shale gas beside the Marcellas up here. You know, that's like a meteorite in fact, but you're probably not going to allow drilling from Marcellas Shale on this reserve, I don't think. I mean, you can control that. So, I'm just thinking what new things are you going to move that you have to think about for risk assessment in the future.

Then, as far as the compacted clay cap, that's a magic term, but it had holes in it. Part of the reason that the bathtubing occurred is it cratered, we call them sink holes, they were sink holes, there's no carbonated rock, but the compacted clay cover essentially stokes down into the barrels, the space between barrels. You saw the photographs. There's a porosity to a trench full of barrels. There's a porosity to a trench also containing boxes, because Penn State, when we came here, we sort of came to see where it went. And, not only that, but the canisters--well, the barrels perhaps are collapsing, and the boxes really must by now been collapsed.

And, so, if you shrink the waste pile inside the cells, then the cap, I don't care how compacted it is, it's going to want to collapse or break up. So, it’s going to keep your fabric on top of that, otherwise, that thing might have holes in it that you don’t even know about. I’m not sure what sort of draping strength you’d have or how big the crater would have to be to know that it’s occurring. But, be prepared for the cratering. You can’t assume that the clay cap is going to be robust if you don’t have plastic material over the top.

And, then, there was no mention about eating salmon. I mean, there were doses, but I didn’t hear anybody eating any fish. And, Cattaraugus Creek is a beautiful salmon stream, and for that matter, nothing was mentioned about Lake Erie, although you’re bringing up the point of worrying about Lake Erie. I think it would be worthwhile telling the citizens don’t worry about Lake Erie because we don’t have much of a problem near the site in Lake Erie. Right? But, that statement wasn’t completed, I don’t think. But, what about fish? There’s fish in the dose calculation or not?

Then, I don’t know whether or not the precipitation analysis was done with de-watering of the trenches to kind of control the pool levels. If you de-water them in order to keep the bathtubing from overflowing and spilling out, how long does it take for the water level to rise? If it doesn’t rise at all, that would suggest that the cap is pretty damned impermeable, at least the geofabric is doing its job. Right? But, if it rises slowly, then water is coming in somehow sideways between the caps or from uphill, uphill to the west, because you have the shale hill, so you could actually have water traveling through that shallow fractured rock system, shallow till system heading down underneath the cap. So, it’s quite important to know whether you’ve got lateral movement coming from outside of the disposal site versus leaking through the cap itself. And, that’s partly, depending on whether you had to pump the levels down from time to time. I know you did that before the cap was put on the top.

I think there’s more about model uncertainties, but these I think enough occupying your time. But, there’s a series of question that were of a technical nature. They’ve been out there for a long time. The question is were they factored in, because work has already been done to address these points or not. And, I don’t have information on that.

Again, thank the Board for incredible effort, and though we don’t have Yucca Mountain, you did a lot of work since that decision was made to put that on hold.

Thank you.

HORNBERGER: Thanks, Dick. John, do you want to say any words about complexity of modeling or--

STETKAR: Paul, do you want to--

PEMBIA: I can talk about a few of those points. I probably only got about a quarter of them down here. So, first in terms of--

PARIZEK: I’d be happy to either write them out as a note and give them to the Board if that’s helpful, because I was just sort of going through a litany, and I didn’t mean to be--I could stop and ask questions.

PEMBIA: I was writing--yeah, I missed some because I wasn’t writing the first one. But, why 30 years? 30 years was kind of a decision that was made as DOE and NYSERDA and the regulatory agencies looked at the time period between the Phase 1 decision and the Phase 2 decision. We first kind of landed on 30 years, and it was for a few reasons that RCRA closures, for instance, have a life of about 30 years. The temporary caps, the membrane covers, we looked at probably had about a 30 year life. So, there are a few other reasons, too, I think, but 30 years was not a magical number. It was a number that we felt gave us a reasonable amount of time to say that we felt comfortable that we could do the calculations and feel comfortable managing the SDA for that period of time.

We had also managed it for 30 years, NYSERDA had, so that’s why the 30. But, then, again once the decision--we made a decision only to manage for ten years in place before we would make that Phase 2 decision. So, that’s that.

The runoff from the membrane covers, we installed retention basins as part of those runoff systems, as part of those cap systems where the water goes in, and it accumulates in the retention basins, and then it’s mirrored out slowly. So, they were designed with it in mind, not to increase peak flow in the stream system.

Vertical versus horizontal, you mentioned the solvent that ended up, I think that was the solvent at the NDA rather than the SDA. But, you are right that there is a horizontal flow component, and that was considered in the QRA and as well as the EIS, that there is a horizontal flow component in the Weathered Till, and as you said, it’s primarily a fracture driven flow. And, then, the horizontal flow is primarily down through that Unweathered Till. So, they’re both in there, both flow components are considered.

I thought your comment about the use of the isotopes to date the groundwater, the water in those deeper deposits, is a really good comment. And, as far as I know, it hasn’t been done.

And, yeah, the sink holes, the cracks, and things like that, we saw those. I’ve been at the site now for 20 years, and even though we use a proof roller, I think it was, I don’t know, it was a large roller every year, we would still get cracks and things in those trench caps, and that’s why we went with the membrane covers over the tops.

And, we are not getting any increases in the leachate levels and the trenches are actually very slowly decreasing. So, we do feel that those membrane covers are effective.

STETKAR: And, I wasn’t writing things down, so I’m going to have to rely on my memory, which is rather poor. A couple of comments.

I did mention that we did perform a surface erosion analysis for the trench clay caps. As a practical matter, the risk assessment doesn’t gain much credit from that. The reason for that being that the only place where we actually did the analysis was for the condition, if the trenches were full, such that in a principle, a fraction of an inch more precipitation in the trench would cause an overflow. Any of the other conditions where the trench levels were below full, an intermediate level, or at the low level, we took no credit for the clay caps. The reason for that being if you look at the precipitation histories, the amount of water, cumulative amount of water required to fill the trenches to overflowing from those intermediate or low levels is quite a bit of water. Steve had the actual number of, you know, feet on his slide.

If you look at the weather patterns, it’s very very likely over a period of several weeks, if you’re going to have that total amount of cumulate precipitation, that will be accompanied by at least a one to two day severe storm period, they're actually correlated. The severity of the storms over that period of time to give you the required cumulative precipitation would be such that it was quite likely you would get erosion of those clay caps if they were uncovered. So, any of the intermediate to low starting level conditions, we essentially took no credit for the clay caps, if the geomembranes were not there.

The message being that in practice, we get a lot of credit for the geomembranes, we actually don't get much credit for the clay caps. We do--it's a measurable credit, you know, in a probabilistic sense, for the one condition when the trenches are initially almost full, and the geomembranes are then destroyed. But, that's the only scenario contribution.

So, in terms of concerns about the status of the clay caps, they really don't, as a practical matter, affect the risk results by themselves.

As far as runoff and gully erosion, we did consider runoff from the surface of the geomembranes. As part of the gully erosion from adjacent slopes, you know, not the cap erosion, but the slope erosion back into cutting into the trenches, and that was explicitly considered. Because it obviously is a function of precipitation intensity.

And, I don't know if there were other ones. As I said, I wasn’t writing--

PARIZEK: The fish?

STETKAR: No, because we stopped at that resident farmer at the confluence of Buttermilk Creek and Cattaraugus Creek and to our knowledge, there’s no fishing in Buttermilk Creek.

PEMBIA: Let me just say something. The Demonstration Project monitors fish in the creek, and that information is collected and it’s published as part of the annual site environmental report, and that’s a DOE document. And, then, the fish, the contribution from fish dose was considered in the Environmental Impact Statement.

HORNBERGER: Thanks. I think it’s indicative, the Earth Science people tend to think about the geological structure, they’re being very complex and the possibility of lateral subsurface flow, not just surface flow, and different thicknesses of the till, and cracks forming, and we often scratch our heads about QRA that do one dimensional models with Kd’s and I think that there still is an effective interchange of information.

Are there any other--does anyone else want to--

VAUGHAN: Ray Vaughan, West Valley Citizen Task Force.

I want to thank the Board and all the presenters today for some very informative hours that I spent today. I thought a couple of the presentations were a bit what I might call white washed, a lot of useful information, a bit of a slant that would be different from my understanding of the site, since I had been intimately involved with it since 1978. But, those are minor, I think compared to what the purpose is today.

I myself have not gotten into a lot of technical detail today, and I don’t think this is a real good time and place for it. Anybody who has looked at the draft EIS, the final EIS, may have seen my many pages of comments, where I go into a lot of technical detail. I think that I or DOE or NYSERDA could make those available if the Board is really interested.

And, I also look forward to being somewhat involved with the Phase 1 studies that will help inform the larger Phase 2 decision that’s coming in about nine years. So, a lot of technical work to be done on that, but I hope you’ll remain interested.

But, with that as a preamble and thanks, I do have one specific question. Jim Clark is here today and I’m not sure we’ll have this opportunity again. Let me ask Jim kind of a very tangential question. Maybe he knows something about this, maybe not. The question is whether anybody knows the specific site boundaries to which the NRC site licensed CSF-1 applies. The license does not recite the boundaries. There have been times when the boundaries have been handled rather casually, like when the drum cell was being built, they needed to move the boundary slightly. At times, they are being handled very ceremoniously.

So, my question to Jim is do you know if we have somehow missed a place where the boundaries of the NRC site license are spelled out, or is that boundary simply absent from the record?

CLARK: You're testing a 50 year old memory. But, off the top of my head, I don't remember any detailed site map that got down to really great detail. That may or may not be true. But, the maps I was using--no, I don't think so. I don't think the license got into that kind of detail.

VAUGHAN: Thank you.

HORNBERGER: All right. Well, I want to thank all the speakers, and everybody who contributed comments as well. It was a very informative day, and also a great deal of thanks for arranging the tour for us yesterday.

So, with that, we will close the meeting.

(Whereupon, at 4:53 p.m., the meeting was adjourned.)

CERTIFICATE

I certify that the foregoing is a correct transcript of the Nuclear Waste Technical Review Board's Spring Board Meeting held on April 27, 2011 in Amherst, New York, taken from the electronic recording of proceedings in the above-entitled matter.

May 6, 2011

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