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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON NUCLEAR WASTE & MATERIALS

October 18, 2007

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE & MATERIALS

(ACNW&M)

183rd MEETING

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THURSDAY,

OCTOBER 18, 2007

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VOLUME III

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The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland at 8:30 a.m., DR. MICHAEL T. RYAN, Chairman, presiding.

MEMBERS PRESENT:

MICHAEL T. RYAN, Chairman

ALLEN G. CROFF, Vice Chairman

JAMES H. CLARKE, Member

WILLIAM J. HINZE, Member

RUTH F. WEINER, Member

NRC STAFF PRESENT:

ANNA BRADFORD

CHRISTOPHER L. BROWN

THERON H. BROWN

LYDIA W. CHANG

NEIL M. COLEMAN

ANTONIO F. DIAS

YOIRA K. DIAZ-SANABRIA

DAVID W. ESH

JOHN H. FLACK

SCOTT C. FLANDERS

FRANK P. GILLESPIE

LATIF S. HAMDAN

AMIR KOUHESTANI

KAREN E. PINKSTON

A. CHRISTIANNE RIDGE

DEREK A. WIDMAYER

ALSO PRESENT:

STEFAN ANTON

KRISTOPHER W. CUMMINGS

KEN ROSENBERGER

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(8:30 a.m.)

17) OPENING REMARKS BY THE ACNW&M CHAIRMAN

CHAIRMAN RYAN: Good morning, everyone. I guess we will get started. This meeting will come to order, please. This is the third day of the 183rd meeting of the Advisory Committee on Nuclear Waste and Materials.

During today's meeting, the Committee will consider the following: the Mallinckrodt site decommissioning plan, the vendor's views on transportation-aging-disposal performance specifications, a revision of NUREG-1854, NRC staff guidance for activities related to the U.S. Department of Energy waste determinations. It is a draft final report for interim use at this time. We will also have a session discussing ACNW&M letter.

Derek Widmayer is the designated federal official for today's session.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. Should anyone wish to address the Committee, please make their wishes known to one of the Committee staff.

It is requested that speakers use one of

the microphones, identify themselves, and speak with sufficient clarity and volume so they can be readily heard. It is also requested that if you have cell phones or pagers, that you kindly turn them off.

Feedback forms are available at the back of the room for anybody who would like to provide us with his or her comments about this meeting. Thank you very much.

Without further ado, I will turn this first session over to our cognizant member, Dr. Clarke. Dr. Clarke?

MEMBER CLARKE: Thank you, Dr. Ryan.

18) MALLINCKRODT SITE DECOMMISSIONING PLAN

MEMBER CLARKE: I present to you this morning Ms. Lydia Chang. Lydia is the Chief of the Special Project Branch in the Decommissioning Directorate, the Office of Federal and State Materials in Environmental Management Programs. She will give us an update on the Mallinckrodt Incorporated downtown St. Louis site decommissioning project.

Lydia, it is a pleasure to have you here. Thank you.

MS. CHANG: Thank you.

Let me just go ahead and start the presentation. Today I am just going to go through

some of basically Mallinckrodt's overall decommissioning program. And the topics that I will be covering will be some site history. I think it is really important to understand the history so that you understand the contamination that the site involved.

I will give you some brief description of the facilities, their decommissioning approach that they have incorporated, and the decommissioning status and schedules, and some of the outstanding issues that we are still working on, and our plans for the path forward. And, lastly, I will save some time for the questions that you might have.

Mallinckrodt plant opened in 1867. In the early stage, they were primarily a chemical plant. They produced a wide range of products, including product oxides, oxide salts, ammonia, organic chemicals, and various uranium products.

Since 1940s to 1960s, they have produced uranium for the Manhattan engineering district for the atomic bomb research projects. During the process, they have extracted uranium from ores. And the contamination, that would involve uranium, thorium, and its daughter products.

In 1956 through 1960, they were also involved in extracting columbium, which is also known

as niobium, in addition to thallium, uranium, thorium, and some rare Earth metals for the Atomic Energy Commission at that time.

Since 1956 through 1977, Mallinckrodt was involved in producing uranium and thorium salts, not only for the AEC, but also they saw some portion of uranium salts for commercial purposes. The maximum quantities that they were allowed to sell per year were 450 pounds of uranium salt and 400 pounds of thorium salts.

In 1961 through 1985, basically they used the same plant that was used for the AEA process to extract columbium back 1956 and 1960s for columbium and tantalum extraction, usually referred to as a C-T plant. Those processes were very, very similar to the one that was used during the AEA days, when they used usenide in their processing, usenide ores in their processing, to extract columbium at that time.

In 1987, they were planning to restart the C-T process. They operated for two months under some kind of pilot trial production run. And as a result of the trial period, they decided to shut down the Mallinckrodt operations permanently. At that time, they also generated some limited quantity of thorium and uranium contamination in the ten subcurie amounts.

So since 1993, Mallinckrodt has not been involved in any radioactive production. They only have a possession-only license for the decontamination and decommissioning operations. Currently they still produce a lot of products for food, cosmetic, pharmaceuticals, and some specialty industrial materials. And these operations do not involve radioactive material.

The facility is pretty small. It only contains about 43 acres. Its facility is on the west bank of the Mississippi. It's found in the northeast region of the City of St. Louis.

The facility is subdivided into ten plants. And later I will show you on the map where are those ten plants. The former C-T process, which is the area that the NRC is most interested in, it's only about 4.2 acres, roughly 10 percent of the total site.

The C-T process area is primarily in plant 5 but also involved plants 1, 3, 6, 7 and 8 as a supporting building, plant 1 being the laboratory. Three is the change room area. Six is the staging area that is used. Seven is the storage and they used for waste stabilization. And plant 8 was the maintenance area.

I just wanted to give you a sense of how compact the area is. In the middle, this is basically the plant. And, as you can see, they have railroad access to the plant. This is a huge railroad spur. They also have some railroad here and there.

In the foreground, it is the plant 6, plant 7. Plant 5 is right here. It is a primary C-T processing area. And plant 1, that's the laboratory, plant 8 the maintenance, plant 3 the change area. And, of course, 6 is the staging area. And also it has some burial pit in there. And 7 was the waste stabilization area and the storage unit.

Here are schematics to show the C-T process area. Again, here is the plant 5 laboratory. There is only one building that was involved, the maintenance area and the change room area, here at the staging area. And this is the burial site that we will be discussing later on as part of license amendment. And here is the waste stabilization unit and, again, the railroads coming in and out of the site, which it is kind of nice and kind of help with the disposal transportation since they have a railroad on the site.

Oh, one more thing. This is the west. Here would be the river for the right of the railroad.

MEMBER HINZE: How close is it to the river?

CHAIRMAN RYAN: It is actually east.

MS. CHANG: I am not so sure. Personally I have never been to this site.

CHAIRMAN RYAN: It is pretty close.

MR. KOUHESTANI: It is one block.

CHAIRMAN RYAN: Yes. It is pretty close.

MR. KOUHESTANI: One large sized block.

MR. WIDMAYER: You need to identify yourself.

MR. KOUHESTANI: Oh, I beg your pardon. For the record, my name is Amir Kouhestani. I am the current project manager for the Mallinckrodt site.

MS. CHANG: Actually, in the audience also are Tom Youngblood and Karen. They are the technical support staff reviewing the license amendments. They both are HPs.

The decommissioning approach for Mallinckrodt is that Mallinckrodt will be deluding the remediate, primarily the C-T processing area under NRC jurisdiction. U.S. Army Corps of Engineers will be remediated in the Manhattan and related area that was used for defense purposes.

And for the C-T process area, their

approach, the Mallinckrodt's approach, is to have two phases. Their phase one primarily is above ground dealing with the buildings and equipment. And phase two would be dealing with subsurface, including the buildings, slabs, and the foundations that paved the surfaces and any subsurface area.

CHAIRMAN RYAN: Excuse me just one second. I am sorry to interrupt. But we need to dial into the bridge line --

MS. CHANG: Oh, sure.

CHAIRMAN RYAN: -- so other folks can participate. So Theron is just going to take a second to do that now.

(Pause.)

CHAIRMAN RYAN: There we go, Theron.

Thank you, Lydia. That just gives all of our remote participants and members of the public the chance to dial in if they want to. Thank you for the interruption.

MS. CHANG: Okay. Yes. Again, the first bullet is basically Mallinckrodt is in charge of cleaning up the non-defense-related contamination. U.S. Army Corps of Engineers is in charge of the defense-related contamination, both radioactive and nonradioactive materials.

And for the Mallinckrodt's decommissioning in phase one, they will be just removing the buildings or decontaminating the building and equipment above ground. And phase two will be anything below grade, including the building slabs and foundations or the paved areas, subsurface areas. All of their decommissioning goes to be able to release for unrestricted use. And hopefully in the future we will be able to terminate the NRC license for the site.

Here is just some schedule to give you a sense of where we are at. For the phase one, the remediation started back in July 2002 and was completed a few years later, in February 2005. Phase two decommissioning plan was submitted back in 2003. We have not approved a decommissioning plan. There were some requests for additional information back and forth. And there are also some issues that need to be resolved that will be touched upon later in my presentation.

Most recently the licensee also submitted a license amendment request in August 2007 to remove the unreacted or in nine trenches in plant 6W.

In order to fully understand the Mallinckrodt decommissioning approach, it is really necessary to at least have some understanding of what

the Army Corps of Engineers and how the Mallinckrodt's cleanup kind of fits in and where they have to have some interactions.

For future remediation, even back in the '50s and '60s, DOE actually has cleaned up a couple of buildings. They actually cleaned plant 1 and plant 2 back in the '50s and '60s. They also cleaned up for the old plants in 6, 7, and 4, but in the new map, it is the plant 10 area. So they also have decontaminated those areas back in the '60s based on the standard at that time.

The FUSRAP program was created by Congress to basically clean up and control this contamination that might be left by the defense operations in the weapons research projects.

In the early stage, DOE was involved in the Mallinckrodt cleanup of the Manhattan engineering district operations. And later on, it was transferred to the U.S. Army Corps of Engineers in '97 in an Energy Water Appropriation Act. So right now Army Corps of Engineers is in charge of the whole remediation program at the Mallinckrodt.

These are the remediation activities ongoing from the U.S. Army Corps of Engineers. Right here it is a schematic diagram of the FUSRAP buildings

that they have cleaned up.

And this one is kind of interesting. It actually shows both the C-T production, which the Mallinckrodt would be cleaning up at the site and also the Army Corps of Engineers portion at the Manhattan engineering district operating area.

From the map, we can see the dark blue area. That is the C-T process area that the NRC will be looking at and Mallinckrodt will be cleaning up. And the blue lined area, here and there, is Army Corps of Engineers. You can see for plant 6 and plant 7, there are some commingled and overlapping issues that need to be resolved. And that is one of the major issues that we need to resolve with the Army Corps of Engineers and the licensee who has that responsibility.

And for the C-T area primarily, this is plant 5, the primary C-T processing area. And, again, this is the laboratory, the maintenance, the change room, staging area, and also the waste stabilization area. This is just a look at the building for the C-T process.

In plant 5, I guess most importantly solvent extraction, the solvent extraction was used in this area and same thing with filtration. So this is

the primary processing area.

The phase one decommissioning activity started back in July 2002 and completed in February of 2005. In phase one, several buildings were demolished. Some buildings also have some surface decontamination and equipment removed. Some buildings also have some local decontamination performed on them. There are certain areas that were also sampled and deconned. Some were surveyed and released. And other areas were just local survey and then released. Oh, here I have a map to show you all of that.

The color codes are such that the red one are the demolished buildings. So within those, the equipment was removed. The buildings were knocked down. And the debris was packaged and shipped off site for disposal.

The pink one has some surface decontamination and the equipment removed right here. And the hash line here has some local decontamination and equipment removal. The green one is kind of hard to see. It's right here. The roof was decontaminated.

And the blue ones, here are the blue ones. Some surveys were performed and then released. And the blue lined area, only local survey was necessary.

And then it was released for industrial use.

During the phase two decommissioning plant, Mallinckrodt will be removing the C-T processing building slabs, any sewage wastewater neutralization basins, soil affected by C-T processing area.

Here it shows all the impacted area in blue. So here will be the processing area, again the staging area, and the waste stabilization area, labs, and also the maintenance area and change room area.

Early August of this year, Mallinckrodt submitted a source removal license amendment application to the NRC. Back in 1972 and '73, Mallinckrodt buried unreacted ore in 10 6W trenches. There were ten burial pits that were used. It was in accordance to the old regulation 10 CFR 20.304 at that time.

Most of the wastes were buried probably at a depth of six foot. Basically they dug up a six-foot trench, put a waste in there for about two feet or so, and then piled and backfilled it with dirt.

VICE CHAIRMAN CROFF: Excuse me. What is unreacted ore?

MS. CHANG: Those are the leftover residues from the C-T processing. So basically you

have the solvent extraction. You have the filters. It's a leftover residue that was not able to be extracted.

VICE CHAIRMAN CROFF: Oh, I see. It's more or less the raffinate or something from a solvent extraction.

MS. CHANG: No. It's more like a solid ore.

VICE CHAIRMAN CROFF: Okay. Well, it's to precipitate a raffinate or --

MS. CHANG: Well, you have the ore.

VICE CHAIRMAN CROFF: Oh, I see.

MS. CHANG: And you try to extract the real metal. It's the leftover. It's almost like a uranium milltailing.

VICE CHAIRMAN CROFF: Okay. It's what didn't dissolve?

MS. CHANG: Right.

VICE CHAIRMAN CROFF: Got it. Okay. Thank you.

MS. CHANG: So the license amendment request to remove this disposed unreacted ore burying in the nine trenches, the tenth trench, unfortunately, is under an existing building. So that still needs to work out in the future.

Once the licensee removed those building materials, then the U.S. Army Corps of Engineers would be able to conduct the FUSRAP clean-up in the plant 6 area.

Here is a schematic diagram of the burial site. It is a little bit hard to see. It is burial 1, 2, 3, 4, 5, 6. And here it will be treated as one huge boundary in the amendment. And then we have pits 7 and 8. This is treated as a one boundary, then pit 9 another boundary. Pit 10 is under an existing building. So right now it is not included in the license amendment application.

I guess let me just touch a little bit on this. Since this area is being remediated by FUSRAP, the goal is to have delineation between Mallinckrodt and the U.S. Army Corps of Engineers so that once the source is removed, then the Army Corps of Engineers can go ahead and do their remediation.

So what Mallinckrodt has been able to achieve is to negotiate with Army Corps of Engineers and reach some kind of consensus on what boundary they basically decided on, some kind of geographical area, instead of concentration but basically the dimension to remove the material. So once the Mallinckrodt removed the dimension, then Army Corps of Engineers

can move in to do what they needed to do.

Even though we have received the license amendment, there are some inconsistent issues between the delineation agreement and the license application. So right now we are working with the licensee to resolve the issue.

And, secondly, the licensee also requests us to withhold the delineation agreement from public disclosure and have submitted affidavits. So currently we are evaluating the basis for such request. So right now the delineation agreement has not been released for the public.

Another issue is approval of phase two, not only the delineations issued for the plant 6 area, but it would also be an issue for the plant 7 area. So that would be another thing that Mallinckrodt would be working with the Corps of Engineers to resolve that.

The path forward, basically, you know, they have to come to some kind of consensus on how they want to divvy up the responsibility for the remaining area for the facility and also to follow up the request for additional information about the review in phase two DP process.

That concludes my presentation.

MEMBER CLARKE: Lydia, thank you. I guess I have a general question. This decommissioning is complicated due to activities that took place during one period of time and activities that took place after that and who is responsible for what and different agencies' involvement.

There are other FUSRAP sites. Do they deal with the same issues? This is not a unique situation or is it?

MS. CHANG: This is actually quite unique because you have commingled issues in there and they --

MEMBER CLARKE: Okay. Because of the overlap.

MS. CHANG: The overlap, yes. Yes, especially in the vertical sense. I mean, if you have overlap, you know, in the horizontal sense, it's a little bit easier to develop, but this is actually in vertical. So it was very difficult for the Mallinckrodt to come to consensus with the U.S. Army Corps of Engineers.

Another thing that is very difficult for FUSRAP activities is that it takes a long time for the Congress to allocate appropriation for the U.S. Army Corps of Engineers to clean up the site. And there

are a lot of competing sites for the fund. So the sched. is always a challenge.

VICE CHAIRMAN CROFF: And that is because the same facilities were used for different purposes at different times?

MS. CHANG: Right. This facility basically --

VICE CHAIRMAN CROFF: And so you will have a general area of contamination. And then there is a need to sort out who did what and when they did it and who is responsible.

MS. CHANG: Right, right. It is actually two issues. One is Mallinckrodt competing with other sites that Army Corps of Engineers has. So once they prioritize, they may or may not be able to put their fundings toward cleaning on Mallinckrodt if there are other higher priority competing sites.

And another issue is within Mallinckrodt itself. Since Mallinckrodt was used for both defense-related activity and non-defense-related activities, we really have two regulatory authorities. One is the Army Corps of Engineers and DOE cleaning up the defense-related material and the NRC trying to clean up the commercial site. So there is a lot of interaction that is needed to see who is doing what.

VICE CHAIRMAN CROFF: Well, one of the things the Committee has engaged in is the, well, tracking, decommissioning for different kinds of facilities. But we're in the process of preparing a white paper, trying to pull together a number of initiatives that the NRC has undertaken.

And lessons learned through decommissioning is a big piece. And so we would be interested to hear from you at some point the lessons that are learned when you have a facility that poses these kinds of challenges.

MS. CHANG: Actually, my branch has been collecting a lot of the lessons learned for the decommissioning activities. And I believe one of the staff has briefed the Board in the past. And definitely as we learn more through the FUSRAP process, we will be contributing to some of the lessons learned.

And I think at this time, I think the biggest lesson learned is to start early negotiation with the Army Corps of Engineers to come up with some kind of consensus early on so that we can start working on the decontamination.

VICE CHAIRMAN CROFF: Thank you.

MS. CHANG: That is very time-consuming.

I mean, the licensee has been working long hours to achieve just for the plant 6W.

VICE CHAIRMAN CROFF: I appreciate this. I have been involved personally in a number of cleanups where ownership changes took place. And not so much rad but the same chemicals were used by different parties for different reasons.

MS. CHANG: Right, right.

VICE CHAIRMAN CROFF: And there comes a time when you have to sort all of that out, who is responsible for what. So I appreciate what you are dealing with.

Let me turn to the Committee for other questions. And I am going to want to start with our Chairman. Mike?

CHAIRMAN RYAN: Thanks. It is an interesting site. It does have a long history.

Tell me about groundwater in this case. I think it's relatively close to the Mississippi River. So groundwater is an issue, I am going to guess, because it is relatively close to the surface. Has that made a complex problem for you or --

MS. CHANG: Well, I don't believe so. For the FUSRAP process, they have installed a number of monitoring wells and also bore hole samples. To the

best of my knowledge, I believe it's only one shallow well that has found contamination.

CHAIRMAN RYAN: That is good. You know, the other thing, in the history of Mallinckrodt, they have done a number of clean-ups or one sort or another through the years, I guess shortly after the Manhattan Project work kind of ramped down and so forth.

I am going to guess -- and I would appreciate any detail you could put to it -- that early clean-up is a good thing --

MS. CHANG: Right.

CHAIRMAN RYAN: -- for any site. Have you seen that kind of effect on this site that it really has caused it to be probably a smaller problem than it could otherwise have been?

MS. CHANG: I think so because for plant 1 and plant 2, it was cleanup back in the '50s and '60s. And, as you know, plant 1, right now it is used for non-radioactive industrial use purposes.

CHAIRMAN RYAN: I think, Jim, that would be an interesting exploration for your white paper is to look at this as a case where early cleanup might have avoided some headaches. Mallinckrodt paid particular attention to that, I think, basically at the end of the war and shortly thereafter. That is

interesting.

There is one other site that is complex in the same general way but not specifically. And that is Cannonsburg. The Cannonsburg site in Pennsylvania was used to provide Madame Curie with radium in the early days and, of course, uranium later on. So it was used for two different purposes, neither of which were really Atomic Energy Act or Nuclear Regulatory Commission-licensed, but that is one where there were two distinct periods in time where the same materials are handled. That is an interesting site.

MEMBER CLARKE: The other site that comes to mind is West Valley. It's different, but it has some of the same challenges.

CHAIRMAN RYAN: Yes, kind of. But I think Cannonsburg would be one that was interesting. And they actually took the uranium-bearing materials and used it for fill all around Strabane and other places around Cannonsburg because at that point in the '30s or the '20s, it didn't have much value.

MS. CHANG: Right. Plus, it's a good, fine material, just like milltailings.

CHAIRMAN RYAN: Sure.

(Laughter.)

MS. CHANG: How little do we know?

CHAIRMAN RYAN: Then when radium came along, uranium came along as a more important material. Of course, everybody has got an interest in the uranium side of it.

That is interesting. Thanks very much. Thank you, Jim.

MEMBER CLARKE: Thanks, Mike.

Allen?

VICE CHAIRMAN CROFF: A couple of things, I guess. At this site, do they have a pretty good understanding of where the subsurface contamination is, where waste has been buried, and what kind of waste has been buried?

MS. CHANG: For the waste burial, they have pretty good knowledge on where, how deep the dimension. I mean, that is one of the primary reasons that they were able to achieve agreement with the U.S. Army Corps of Engineers.

For contamination, I believe there are bore hole samples. I could ask one of my technical staff, you know. Amir, do you have any exhibits on --

MR. KOUHESTANI: The record is what it is with respect to these ten burials in plant 6. Incidentally, this is Amir Kouhestani again.

As you noticed in the case of

Westinghouse, records are kept somewhat not in the fullest sense. However, surfacial gamma specs or walk-overs is limited in the sense to precisely determine the exact dimensions.

Now, my understanding is with respect to this amendment that Lydia referred to, Mallinckrodt is currently engaged in obtaining some additional bore hole samples. And those results are in the process of being reviewed by Mallinckrodt and eventually provided to us.

But the understanding is that these nine burials in three groupings will be the extent of -- within certain geographical boundaries and at certain depths would be the limit of what Mallinckrodt has proposed to remove and balance of whatever remains would be Army Corps, however Army Corps, as Lydia again indicated, has a different view of responsibilities that it has on their FUSRAP.

VICE CHAIRMAN CROFF: But their understanding is a lot better than, say, the Hematite site, where they are not even sure they know where the burial grounds are, let alone --

MR. KOUHESTANI: Oh, yes, sir. It is --

MS. CHANG: This one they definitely know where they are.

VICE CHAIRMAN CROFF: Okay.

MR. KOUHESTANI: It is fair to say since 1992 to 2003, there have been at least to my count 13 campaigns of characterization, with '94 being the major drive and then follow-up. We reviewed the characterization plan. However, the results of the characterization have remained with the licensee subject to inspection.

VICE CHAIRMAN CROFF: Okay. And there's one bore hole that showed water contamination. What is the contaminant?

MS. CHANG: I don't know.

MR. KOUHESTANI: This is Amir Kouhestani. It is uranium.

VICE CHAIRMAN CROFF: Uranium. Okay. You are not seeing organics at this point?

MR. KOUHESTANI: NRC receives the results, primarily the characterization results, including in the EPR, essentially all radiological results. And I can't speak to the chemicals based on the information that's submitted.

MS. CHANG: U.S. Army Corps of Engineers is in charge of cleaning up the hazards constituents. NRC really does not have the regulatory authority over that.

VICE CHAIRMAN CROFF: That must make an interesting interface if they are both in the same groundwater.

MS. CHANG: Right. That's a huge, biggest challenge.

VICE CHAIRMAN CROFF: I see. Okay.

On to another area. On one slide, you mentioned some slabs. Will some of these slabs be left in place after remediation is complete?

MS. CHANG: No. I believe the slabs all will be removed.

VICE CHAIRMAN CROFF: Slabs will be removed. Okay.

MS. CHANG: For the heavy contaminated building that was demolished, the slab would most likely be removed.

VICE CHAIRMAN CROFF: But you noted there was one burial ground that is underneath an operating building.

MS. CHANG: Right.

VICE CHAIRMAN CROFF: I am assuming that is going to be left there.

MS. CHANG: That one we really don't know what the licensee is going to propose.

VICE CHAIRMAN CROFF: Okay.

MS. CHANG: And there are also diminution issues associated with that. It is a currently operating warehouse. And then the burial ground is below ground.

FUSRAP is responsible for cleaning up the whole area except there are some unreacted or end-up aerial site that Mallinckrodt is responsible for. I guess right now we are waiting for the licensee to come up with a proposal.

VICE CHAIRMAN CROFF: Okay. And you noted the interface a couple of times with the Corps of Engineers. In your discussion, it was more who is going to be responsible for what.

Isn't there going to be sort of a next step in interface and consistency, where if you're both remediating basically in the same area, there has to be some technical consistency and sanity of the approach or in the worst case where it crossed purposes?

MS. CHANG: Right.

VICE CHAIRMAN CROFF: So this is going to be an ongoing kind of a thing --

MS. CHANG: Right. We actually --

VICE CHAIRMAN CROFF: -- to coordinate the technical approach?

MS. CHANG: Right. We actually have constant coordination with the U.S. Army Corps of Engineers headquarters on all the FUSRAP activities. We also have coordinated with the regional district from the U.S. Army Corps of Engineers, who is actually doing the cleanup at the sites.

U.S. Army Corps of Engineers is using the CERCLA process, therefore, or that we have to evaluate relevant requirements. And NRC license determination, it's one that they would have to consider.

MR. KOUHESTANI: This is Amir Kouhestani again.

You have touched on a very fundamental issue. Army Corps essentially followed the 40 CFR 192, the milltailing and, as a result, came up with a series of layered concentration numbers for their cleanup, surfacial, mid-depth, and at depth, with the understanding that to their risk-based assessment, they will achieve the NRC's standard 1402; whereas, we operate obviously under our part 20 and our own dose assessment.

So this nexus of Army Corps providing a 25 millirem all pathways to meet our standard using their own methodologies versus us with our DCGL depth line is an issue certainly which Lydia referred to as

commingled area and who ultimately will be responsible for meeting the standard towards the license determination.

VICE CHAIRMAN CROFF: Okay. Thanks.

MEMBER CLARKE: If I could just jump in, you said the Corps is following the CERCLA process? The site is a Superfund site?

MS. CHANG: It is not a Superfund MPR site, but they do follow the same process as a Superfund. They have done preliminary assessment, site inspections, remediate investigation, and feasibility study.

MEMBER CLARKE: Same process?

MS. CHANG: Exact same process. They are the other lead regulatory agency.

MR. KOUHESTANI: This is Amir Kouhestani again.

Per the authorization, Congress provided an early transition of the program. Corps was required to conduct their remediation consistent with the requirements of CERCLA and NCP.

MEMBER CLARKE: Okay. Thank you.

Mike, did you want to do another one?

CHAIRMAN RYAN: That is fine. I am fine.

MEMBER CLARKE: Ruth, why don't you go

next?

MEMBER WEINER: What are the radionuclides that are the contaminants? And what is the radionuclide inventory of contaminants, if you would?

MS. CHANG: I really don't have that information with me. It's uranium, thorium.

MEMBER WEINER: And you are cleaning up. The standard to which you are cleaning up is the 25 millirem?

MS. CHANG: The 25 millirem per year.

MEMBER WEINER: Is that on site or off site or where?

MS. CHANG: On site.

MEMBER WEINER: On site?

MS. CHANG: That is just in the area.

MEMBER WEINER: And you have all pathways, which I assume would mean air and external --

VICE CHAIRMAN CROFF: Contaminants are --

MEMBER WEINER: You don't have drinking water, do you?

MS. CHANG: No. It is an industrial area.

MEMBER WEINER: Yes. It is an industrial area. So all of your contaminants are either dust in the air or --

MS. CHANG: Inhalation.

MEMBER WEINER: -- inhalation or surface contaminants.

MS. CHANG: Right, exposure.

MEMBER WEINER: Exposure. Well, the buried sites wouldn't give you any exposure, would they, any direct exposure, would they?

MS. CHANG: Probably not.

MEMBER WEINER: I am just a little curious as to -- I mean, this is just an off-the-wall question -- as to why the unreacted ore, which is basically, I guess, uranium --

MS. CHANG: Uranium.

MEMBER WEINER: -- of why this is being dug up and removed.

MS. CHANG: Because if we want to have unrestricted release, in the future people want to intrude into the burial site.

MEMBER WEINER: Okay. So you have an --

MS. CHANG: Industrial use.

MEMBER WEINER: So you have an intruder standard, basically?

MS. CHANG: Right.

MEMBER WEINER: Okay. Where is the material that is removed going?

MS. CHANG: Well, right now licensee is

evaluating several potential disposal locations depending on the concentration.

MEMBER WEINER: What are those? Do you know?

MS. CHANG: I guess it would be EnviraCare, Ecology. What was the other one, Energy Resource?

MR. KOUHESTANI: This is Amir Kouhestani again.

Primarily Energy Solution. And in the past campaigns Mallinckrodt has sent materials below unimportant quantities to both U.S. Ecology Idaho as well as Waste Control Specialists in Texas. Those have been the three primary places.

As to the material and how it's been categorized for the purpose of disposal, Mallinckrodt has in the past essentially for materials that they now in their phase two DP consider of a concentration that is above the DCGL and below .05 percent waste they have requested to have a blanket disposal of that material if encountered to facilities other than Energy Solution; i.e., the Waste Control Specialists and U.S. Ecology, based on pedigree of the past.

MEMBER WEINER: So essentially you're digging up a great deal of dirt, old tailings that

have relatively little contamination and shipping it across the United States to a disposal site? Does that pretty much describe what is going on with the waste?

MR. KOUHESTANI: I wouldn't quite put it that way, particularly with respect to the drum burial, UROs concentrations are way above what in the old days under the STP action plan of 30 fixed programs we dealt with material. Obviously there is our standard 1402 of 25 millirem. But those are essentially the guiding principle in terms of the safe removal of this facility.

MEMBER WEINER: Okay. Thank you. That's all.

MEMBER CLARKE: Just to follow up on that, isn't there a potential -- and this may not be your issue -- isn't there the potential for chemicals in those tailings as well depending on how those extractions were done and what was used? I mean, that's an issue at milltailing sites, where the groundwater contamination is often the chemicals that were used for the extraction, less important than uranium.

MR. KOUHESTANI: Well, as Lydia, again, mentioned, there are the aspects of FUSRAP authority

that deal with a material commingled with so-called FUSRAP material.

MEMBER CLARKE: Right.

MR. KOUHESTANI: That could very well include a certain amount of chemical, and they have dealt with that.

MEMBER CLARKE: For example, milltailings have been moved into new disposal cells for just that reason.

Okay. Bill Hinze?

MEMBER HINZE: Well, to follow up on some of the questions regarding the subsurface contamination, is the contamination that's been detected in a drill hole in the saturated or unsaturated zone? Is it in the groundwater or is it in the contaminated soil around the trenches?

MR. KOUHESTANI: I will be out of my depth, but I will give you the best answer that I have pending further verification with our groundwater people. This one particular well was in plant 5. And plant 5 again, as Lydia indicated, was the primary place where -- and it is in the shallow aquifer. Army Corps and FUSRAP have essentially categorized the site as 2, unit A and B. Again, I would be out of my depth to indulge. We can certainly respond to that, but

this has been in the shallow aquifer at uranium now.

Army Corps in their record of decision established because of the record of decision not only dealt with the soil operable unit, it also addressed the groundwater committed to conduct a groundwater remedial activities assessment short for monitoring subsequent to removal of the sources as, again, indicated earlier on. There is a substantial number to monitor the site.

Corps has gone to one round of five-year review. And, to my knowledge, nothing has been communicated to us with respect to the result of that assessment.

MEMBER HINZE: The monitoring of the groundwater situation, then?

MR. KOUHESTANI: It is the responsibility of the licensee to inform if there is exceedance of part 20, appendix B levels. To my knowledge, we have not received that indication from the licensee with respect to the groundwater and the wells that they have on site. And they collect samples.

MEMBER HINZE: I believe you mentioned that there were bore holes going down. Are these for the purpose of that monitoring or are they for the purpose of determining the kind of movements that were

seen away from the trenches within the soils? I see the term "soils" here, and I don't relate soils to aquifers.

MR. KOUHESTANI: Understood. As best I can answer that question subject to, again, our groundwater individual associated with the project to verify, there has been no, to my knowledge, groundwater modeling of the site per se were these wells to operate as the verification and calibration of the model.

The notion of dropping these wells, as I understand it, was as part of the Mallinckrodt overall characterization of the site campaign.

MEMBER HINZE: Is there any evaluation of how much in excess of the trenches must be dug to remove contaminated material?

MR. KOUHESTANI: I will answer this this way. If I may, in our last site visit back in May, Army Corps pointed out two areas where they had dug down to the depth of 18 to 20 feet.

So, therefore, although the initial record of decision had an indication of perhaps going down as deep as six, seven, or eight, as it is indicated in this amendment to us that the depth that Mallinckrodt will go at the very bottom of their excavation is nine

feet below surface.

But there have been instances. And that's where, again, the issue becomes one of how to sort out when Mallinckrodt is finished with their excavation. And the Army Corps will continue on to clean up what is regarded in Mallinckrodt's view as the Corps' responsibility. And that is an issue to be yet resolved.

MEMBER HINZE: So the bottom line is there really is contaminated soil that exceeds the limits of the trench, of the original trench, and that will be excavated by Mallinckrodt. And the Corps of Engineers will pick up from there.

MS. CHANG: Let me try to clarify a little bit. Actually, Mallinckrodt is a big plant. Let me just go back to the map to kind of give you a sense. I mean, the trench that we are talking about, it is like right around in this area, in the 6 West area. So it is a very small area.

And I believe the bore hole sample was collected throughout the plant as part of the characterization work to see the --

MEMBER HINZE: Bore holes did you say?

CHAIRMAN RYAN: Yes. There's a bunch of them.

MS. CHANG: I believe the bore holes, yes.

-- to see the characterization of the subsurface contamination. So let's not confuse that with the burial ground. The burial --

MEMBER HINZE: I'm not confusing it with the burial ground. I'm asking the question, do you know how much beyond the trenches will need to be removed?

MS. CHANG: I think the licensee knows exactly what a trench is. Right now they are collecting bore hole samples to see the specific concentration so that they can determine whether the waste will meet certain waste acceptance criteria so that they can look forward on which disposal facility to get to dispose of the waste.

CHAIRMAN RYAN: Lydia, maybe I can help out here.

MS. CHANG: Thank you.

CHAIRMAN RYAN: It seems to me that if there's an excavation, whether it's under the NRC license or in the FUSRAP program, Bill, it has got to be a confirmatory survey to show that you're meeting whatever your criteria is at the end of the day.

MS. CHANG: Right.

MEMBER HINZE: But you draw out the plan

beforehand how much you are going to be digging up.

MS. CHANG: Right.

MEMBER HINZE: And that's what --

CHAIRMAN RYAN: Absolutely.

MEMBER HINZE: And I don't get a good sense that we have the information at hand of whether we have to extend beyond the trenches or not.

CHAIRMAN RYAN: Could you put up the photograph of the site, the aerial? I think that might --

MS. CHANG: Aerial of the trench.

MR. WIDMAYER: Photograph.

MS. CHANG: Okay.

CHAIRMAN RYAN: The photograph, yes. Thirty years ago, Bill, I did probably the first FUSRAP survey that was done at Mallinckrodt. I spent two months in the summer one summer there, '77 I think it was. The railroad track that's at the bottom of the picture, directly below that is the Mississippi River. The land slope is sloping up back from the river, pretty much through the plant.

MEMBER HINZE: What is the elevation of the plant site above --

CHAIRMAN RYAN: I'm guessing now. I'm guessing. It's probably, you know, 20 feet off the

river up to 30 or 40 feet up, going back at the plant. So it's relatively close. I'm guessing this unsaturated zone is relatively thin, like 10 feet or 15 feet. And if you get down to the river, it's thinner.

MEMBER HINZE: Sure.

CHAIRMAN RYAN: So it's fairly straightforward. As I recall, everybody was talking about groundwater flows being almost directly to the river. So it's a fairly straightforward thing.

So I think contamination from uphill coming downhill is the only way to look for it. And I don't have any idea what the rates might be. So I don't know if that gives you any insight that helps you a bit, but --

MEMBER HINZE: Well, there are different soils, too, and within the trenches.

CHAIRMAN RYAN: Right.

MEMBER HINZE: And so there are some of these where any contamination may not have moved far enough because of the permeabilities involved and others where --

CHAIRMAN RYAN: Oh, no.

MEMBER HINZE: -- it might be considerable.

CHAIRMAN RYAN: Oh, no.

MEMBER HINZE: So that's what I was trying to get at.

MEMBER CLARKE: I had one question. Mike, did you?

CHAIRMAN RYAN: I have a couple of more.

MEMBER CLARKE: Let me just ask one to Lydia. I understand from reading some of the material on the site that there is at least a discussion around long-time control license, which tells us that there are areas that are not going to be remediated for unrestricted release. Is that correct?

MS. CHANG: Right now the phase two still calls for unrestricted release. It is possible depending on the burial pit number 10 that might have impacted on the future of release.

MEMBER CLARKE: Okay. So it's one particular area, then.

MS. CHANG: With the material, it's going to be left on site. Then it exceeds certain dose limits. Then some kind of institutional control might be needed.

MEMBER CLARKE: Okay.

MS. CHANG: But right now licensee has not come in to propose that yet.

MEMBER CLARKE: Okay.

CHAIRMAN RYAN: You know, we had a discussion yesterday about the rulemaking that's on the way. And it strikes me that 20.304 -- you know, we could ask the question, well, is that a smart thing to do? And that was done. Here we are digging it up some 30 years or 20 years or whatever the right number is later.

And, you know, the whole rulemaking and avoiding legacy sites sort of tells you from this example and maybe others don't do that anymore. Take things out of the ground and get it off the ground as they occur. And the Committee is thinking about those issues relative to this new rulemaking.

Do you have any thoughts on that?

MS. CHANG: I think it is always the best way to try to clean up the spills as soon as possible because the longer you leave in place, the bigger problem you are going to have.

So I guess in this case, it's probably the right thing to try to remove the material from the burial site.

MR. KOUHESTANI: Dr. Ryan, as a footnote, State of Missouri as a matter of commenting -- and they have commented in several instances; the record

is available on the docket -- had informed NRC that in accordance with the state regulation, leaving the stuff at the concentration. There would constitute essentially creation of a disposal facility. In fact, to that extent, they have asked for the most part all the radiological contaminants to be removed from the State of Missouri.

In another similar instance -- and we have four sites in the business of FUSRAP at NRC-licensed facilities. Shallow land disposal area was one that Army Corps of Engineers subsequent to preparation of the remedial investigation and a sense that they were moving forward with unrestricted release at the feasibility study thought that creation of a waste cell, at three areas on that western Pennsylvania site would be a good idea.

Certainly there was a very strong registration of disagreement on the part of the state. And obviously NRC asked the questions in terms of the appropriateness of the application of 1403 as well as the compliance with part 61 because some had shipped and course-corrected and moved to unrestricted release of the site and will remove the material.

CHAIRMAN RYAN: Yes. That is helpful for the Mallinckrodt site specifically, but, really, I'm

asking a broader question.

MR. KOUHESTANI: Yes.

CHAIRMAN RYAN: You know, the current rulemaking, I guess you could take a view that it's not as encouraging in trying to get licensees to clean up small issues before they become legacy issues. It's something to think about.

MR. KOUHESTANI: I listened to the discussion and how you all were grappling with the issue in the space of enforcement.

CHAIRMAN RYAN: Again, this is a history lesson that probably could inform that discussion. Those are the other FUSRAP sites. I think it's also interesting to note that this facility, the Mallinckrodt facility in St. Louis, is the facility where all of the uranium if I recall right was purified for the first chain reaction in Chicago.

MR. KOUHESTANI: That is correct, CP-1.

CHAIRMAN RYAN: Yes, CP-1. So interesting time for that company.

Thanks.

MS. CHANG: Thank you.

CHAIRMAN RYAN: Jim?

MEMBER CLARKE: Okay. John?

MR. FLACK: John Flack, ACNW staff.

Just a question as if the -- and I understand a 25 millirem and need to clean the site up, getting down to that level. What kind of millirems would we be talking about or what would be the dose if the site was not cleaned up, if it was just left the way it was, say, on an intruder scenario? For example, do you calculate? Do you make those calculations how bad it would be in the sense of dose that an intruder might get if they dug it up if it was left in place?

MS. CHANG: I am really not familiar with the scenarios that they used. I don't know if Karen or Tom is familiar with the scenario assuming that no remediation is going to be performed.

DR. PINKSTON: All right. This is Karen Pinkston.

I reviewed the dose assessment. I don't know if they did that calculation or if nothing was removed. If you look at many of the soil samples, most of them were well under -- when they did the calculation of some of the fractions based on the DCGLs, many of them were well under one. But I don't know that they did an actual calculation of what the dose would be standing on the site with no removal.

CHAIRMAN RYAN: But that would indicate

based on the summer fractions being below would be it is complaint.

DR. PINKSTON: Or in many parts of the site, there are probably hot spots that wouldn't be.

CHAIRMAN RYAN: Okay.

MR. FLACK: Okay. Thank you.

MEMBER CLARKE: Okay. We have reached the end of our allotted time. Lydia, thank you very much.

CHAIRMAN RYAN: Thank you, Lydia. Thank you, all.

Our next presentation is vendor's views on the transportation, aging, and disposal performance specifications. And Dr. Weiner is the cognizant member for this presentation.

MEMBER WEINER: Thank you, Mr. Chairman.

19) VENDOR'S VIEWS ON THE TRANSPORTATION-AGING-DISPOSAL (TAD) PERFORMANCE SPECIFICATIONS

MEMBER WEINER: Our speaker this morning is Kristopher Cummings, who is the manager of DOE projects at Holtec. And he is going to address the Committee on Holtec's perspective on the transportation, aging, and disposal canister.

So, with that, Mr. Cummings, go ahead.

MR. CUMMINGS: Great. Thank you very

much. I want to thank you for the opportunity to be able to present Holtec's views on the TAD concept, the specification as it is, and the various issues that we're going to have to deal with and are dealing with currently in implementing TADs and licensing these.

I just wanted to note that also with me today in the back is Stefan Anton, Dr. Anton, who is our licensing manager; and Dr. Bill Woodward, who is Vice President of International Development.

Brief agenda. I won't go through all of these. I have a very chronological -- you know, I want to give you an idea of what we have done so far, including the history, give you a little bit of the idea of the concept that we came up for for the aging cask, the transportation cask, and the TAD canister itself.

Specifically I want to illustrate to you some of the benefits that we think Holtec brings to this project for DOE. And then I want to look forward a little bit and look to see what we are going to be doing in the future and also what potential obstacles we may have.

Brief history. Back in November of 2006, so about a year ago, DOE issued a preliminary TAD specification. And then with all of the vendors, they

issued a design concept contract, which we completed in February and presented to them in March of this year.

Since then they revised the TAD specification, issued it as a final based on some of the comments we provided and obviously some of the comments that other vendors provided. And then in August of this year, we submitted a TAD proposal to DOE according to a solicitation that they issued. And we are currently awaiting feedback on that TAD proposal.

So from March of this year until now, we have essentially not done much work. It has been mostly involved with putting our proposal together for DOE.

We developed a TAD canister design; in fact, two of them. One was 21 PWR assemblies. Another one was 44 BWR assemblies; an aging, overpacked design. This was specifically for Yucca Mountain. It would not be used at the utility sites. It's too heavy. It's too big. And it doesn't have various features that would be needed at the storage site. You would use existing storage casks for the utility sites.

And then a transportation overpack design

we also developed. And we did various scoping analyses in the different disciplines to give some level of confidence to DOE that the design that we had come up with would meet their specification and also the part 71 and 72 requirements or 71 for transportation. We're not dealing with 72 here, specifically with DOE. We will have to deal with that and license it, but DOE is not providing any jurisdiction I want to say over the storage operations.

So these are basically what we came up with. We have a storage overpack with the TAD canister. You can see a lifting device on the top of the TAD canister. And then with the transportation overpack, that's very similar to the transportation overpacks that we have now.

With our conceptual design, the canister itself consisted of a honeycombed fuel basket, which provides an uninterrupted heat transfer from the center of the canister to the exterior shell of the canister. That is based on our existing MPC technologies. And we made use of that in our design.

The aging overpack is a METCON constructural. It is a metal weldment that is fabricated in the shop, shipped to the site empty, and

then filled with concrete at the site. There is no rebar within the central concrete area, which could be a potential cause for crack propagation.

The transport overpack was a layered gamma and neutron shielding, specifically steel for gamma shielding and Holtite, which is a Holtec-developed -- it's like a concrete. It's got some boron in it to provide additional neutron absorption capabilities. And then the construction of it was such that we have top and bottom flanges that connect to a containment boundary with steel shells wrapped around that.

In the process of revising the specification from the preliminary, which we did our design concept on, to the final specification, DOE made some changes to the specification which were based on those design concepts.

Of course, the biggest one was they had now allowed a variable length TAD. Before they had specified a length of 212 inches, no more or no less outside of tolerances. But that created some real complications in being able to fit that into a nuclear plant and get the canister and the transfer cask out of the cask.

So that was in response to our comments that they now allow a variable length TAD and have

left it up to use to basically use our knowledge to come up with the appropriate length and then design the various overpacks to integrate that.

The integral lifting device, which I pointed out before, that had to be welded to the top of the canister. That now is removable. It needs to be attached before you transport it. But that small, six-inch, integral lifting device would have created some interface issues at certain plants, most specifically BWR plants in, again, getting it out the door.

The trunnions on the transport cask have been simplified. Before they were specified something like 30 to 40 inches from the end of the cask, which meant that you had to put the trunnion on the cask body itself, not the upper/lower flange. They have now simplified that and allowed the trunnions to be placed on the flanges, which makes our impact limiter design much more simple and our analysis to show that we meet various transportation accident requirements much easier.

Previously they had specified specifically vacuum-drying. And they now have allowed a larger range of drying options, specifically forced helium dehydration. That is currently what we use and what

is required for high-burnup fuels. So that was a needed change.

I believe a one-foot TAD canister drop was in the preliminary spec, but they specified that amount. And so the steel surface is specified.

The transportation cask now has upper fixed trunnions similar to what you saw on the top here, right here, although we can move them up now. The bottom is now pocket trunnions, which allows for rotation.

And then they added five inches to the maximum diameter of the aging cask, which is presumably to counter a 3g earthquake, which I will mention now.

They added a railcar skid design. So we're going to have to do some work to address the railcar skid. They have added a TWPS, which is a waste package spacer. Because the TADs are not 212 inches and the waste packages are designed for 212 inches, they need a spacer in there so that the canister does not move around axially within the waste package.

One of the I want to say surprises that we were not aware of that was added to the final specification was the aging cask now has to withstand

a 3g earthquake and remain upright. And it can't be tied together, and it can't be anchored.

And so we see some challenges there. We are definitely going to have to sharpen our pencil to come up with an aging cask that can withstand this 3g earthquake and not tip over. And then they added a more severe fire scenario than what was previously in the specification, but, again, we don't see that as a major challenge.

Holtec's perspectives on the TAD concept itself. Obviously the advantage of the TAD is that it provides a level of standardization to aging transportation and disposal but also storage.

One of the things that I want to point out here, there has been some discussion in the public that there may be the potential at some point for DOE to show up with a TAD and a transportation overpack and basically say, "Here you go, utilities. You load it. And we will ship it off site."

We don't think that that will be a realistic option for the majority of utility sites. And the reason why is the thermal loadings, a lot of storage casks are being loaded at higher and higher heat loads. Nobody I believe, to my knowledge, has loaded at 38 kilowatts, but we have gotten over 30

kilowatts.

Now, I use an example here that if you were to load a storage cask at 38 kilowatts, the transport cask you're looking at theoretically, the highest that you can go is 22 kilowatts on the transportation cask. That is the allowable heat load that you can put in there for the canister. It would take 20 years to cool from 38 kilowatts down to 22 kilowatts.

And that is not only I put this in terms of heat load, but it is also a dose requirement. There is part 71 dose requirements for the exterior of the cask. And once you get to a high enough heat load, that corresponds to higher burnup, lower cooling times. And it will be very difficult to meet those dose rate requirements on the outside of the transportation cask when you go to higher and higher heat loads.

An aging cask, of course, will only be loaded with transportable TADs. If you can't get it to Yucca Mountain, you can't put it in an aging overpack.

And, finally, the waste package itself has a thermal limit of 11.8 kilowatts. And you will require an additional 30 years of cooling to go from

22 kilowatts to approximately 12 kilowatts.

So TADs provide a level of standardization, but they are not a magic bullet to eliminate storage at utility sites. We are still going to have dry storage. And all of these utilities will have their existing MPCs and various other canisters out there along with TADs.

The vertical operations for the aging cask and the transfer cask at the Yucca Mountain site, which is the GROA, geological repository operations area, we believe is the simplest operational sequence available out there. That is the way that we have been doing our casks. And we were certainly pleased to see that that is the way that they are going to do it out at Yucca Mountain, is vertically.

To be able to transport these higher heat load TADs in a reasonable time frame, the canisters absolutely must be loaded with regionalized loading. Let me show you where you put hot fuel in the center and cold fuel on the exterior.

Here is an example of our MPC-68, where we have an inner region where you can put very high-burnup fuel with low cooling times, 5 years, and then on the outside, you put either low burnup or longer cooling time fuel. And that helps to reduce

your dost rates because those fuel assemblies on the outside shield the assemblies, the high radium dose fuel assemblies, on the inside.

One of the things that we would like to see, obviously, is bringing the cask, is for DOE to bring the cask designers into the product development process to help improve the cask design and the loading process.

Right now the process is that DOE issues a specification. The cask vendors respond to that specification. And we have had a lot of industry interaction, which has been absolutely essential with this process, but at some point we need to be brought into the fold of DOE so that we can provide our input and our expertise on cask design in a way that doesn't continually cycle us.

The aging cask has -- and they aren't shown real well. On the bottom of the aging overpack, which has the TAD canister, there are two inverted sea channels, which are about 12 by 12 or 14 by 14, which is essentially they are in there so that the aging overpack could be picked up by a forklift essentially, a 200 or 250-ton forklift. And as part of the specification, we are required to show that the TAD canister would not reach under a three-foot tip-over

and drop off that transport in that forklift.

We don't feel that this is the most economical design. It puts some severe structural design limitations on our design with the aging overpack; whereas, all storage overpacks right now are picked up from the top, either the top lid or the base of the body itself, in a vertical orientation. And they have a very simple process for doing that.

The heat load capacity -- and specifically I am talking about transportation here -- is specifically set by the basket material. The basket material has been specified as borated stainless steel. You can put aluminum in it. That's allowed. But certainly there are materials out there, such as Metamic, which is a metal matrix composite of aluminum and B4C, that we feel can hold up very well in the repository environment. We have done testing, corrosion testing, on this material, likely not to the extent that DOE has done on borated stainless steel in previous neutron absorbers that they envisioned. But we would certainly welcome the fact that Metamic were added to be able to make our baskets out of that.

Holtec specifically has some innovations in technology that will benefit DOE in this whole TAD process. We developed the forced gas dehydrator or

forced helium dehydrator to dry the fuel. And that was specifically for storage of high-burnup fuel, above 45,000. And that is patented.

We also have patented a gamma shield cross plates for the vent. It is essentially like a wine crate structure made out of steel, which reduces your dose rates at your vents by about an order factor of two.

Regionalized loading. Again, I discussed that with the hydro furl in the center. That will lower your dose rates. Holtec was the first cask vendor to successfully license that with the NRC.

Credit for thermosiphon effect, the convective heat transfer within the basket. Holtec has approved and is the only cask vendor approved with a burnup credit methodology, which we used for our MPC-32 to be able to transport fuel in that where you have to assume that fresh, unborated water gets flooded into the canister. And that would certainly help us in the TAD process if burnup credit was required.

We are currently with a cask in front of the NRC right now. It's docketed with them. We're addressing the use of moderator exclusion and the transport of high burnup fuel.

We have a cask that's called our HI-STAR 180. We are specifically looking for burnups as high as 60,000. And we are using a combination of moderator exclusion and burnup credit to allow these higher burnup assemblies to be transported.

And then we also in front of the NRC have a docket related to our underground storage, which has a patent pending. And I want to discuss that a little bit more and specifically the applicability of the underground storage facility or storage modules to the aging facility at Yucca Mountain.

There is this concept we have had for, oh, probably two years in front of the NRC, a bit longer within our company. We think it logically makes sense to put the canisters in what I call a subsurface facility. It is not underground in the sense that Yucca Mountain is underground, but it puts the fuel in a protected area below the subsurface of where your aging or ISFSI pad is. It produces a non-existent site boundary dose because you have now got all this dirt around it.

There is virtually zero risk of release of radioactivity in terms of environmental impacts, aircraft impacts, various missile impacts, which we are now seeing the effects of in the dry storage

industry, having to address these things, environmental phenomena, earthquakes, tornadoes, fires, floods, all those sorts of things would have little to no effect on the fuel in the canisters or the canisters themselves and then certainly for the Yucca Mountain site, no risk of groundwater intrusion. This is designed with a thick steel container with no penetrations. And certainly the Yucca Mountain site is a very dry site.

So here is a 100U module. There is a lower base plate at the bottom or a subsurface pad. Let me put it that way. And then there is a cylindrical steel shell that the canister goes into. And then there is a top lid, which the lid that you see there in its current envisionment is for part 72, but you could certainly modify the lid to make it heavier, beefier to meet whatever dose rates that you feel are necessary.

Specifically in regard to the specification, the 100U provides some real benefits. The first, of course, is you want to have a tip-over possible in a 3g earthquake because of the overpacks underground.

We could certainly design the underground module to withstand a 3g earthquake and show that the

amount of over-utilization that you would get in the canister in the cavity that holds the TAD canister would not prevent you from getting that canister back out of the ground.

You are not going to have a three-foot drop from a cask transporter because your cask transporter will be transferring a transfer cask. And I have some movies of the operations that you would see there.

Of course, the 40 millirem per hour dose rate would be very easily met. One of the other advantages is you have a smaller land area footprint, about 60 percent of the above-ground systems. And that is because the above-ground systems get placed on a 15-foot pitch and the below-ground system can be placed on a 12-foot pitch. So you get a significant land usage area that is smaller, which translates to cost.

There is no handling of a loaded aging overpack, which is 250 tons. All vertical lifts and transfers, which is how everything would be done vertically, would preclude any damage to the exterior of the TAD canister during the transfer. And then, of course, an aircraft impact would only damage the lid itself and not damage the canister interior.

Again, what I showed you on the 100U, you could make it deeper. You know, there are various variables that we can improve specifically for Yucca Mountain. And, of course, it makes the loading operations at the repository simpler.

So you see here you would bring your transfer cask. Now, what we have got here is a HI-TRAC 125D, a 125-ton HI-TRAC that we use at the utility sites. It would bring in on a cask transporter either something envisioned like this or something unique for Yucca Mountain.

It would bring it in. You would align it over the top of the underground storage cavity. And then you would do your TAD transfer with the cask transporter itself. And then I have simplified the operations here for time convenience.

You would then take your transfer cask off the device that you have here, pull it away, and then you would eventually put your lid on, which you could put the lid on, actually, with the transporter itself. So we feel like this is a very simple and straightforward operation and such that you are not moving 250-ton casks around at the aging facility.

I also wanted to be able to provide to you some perspectives of our Holtec users groups. These

are our clients who currently use our dry storage at their utility sites because we have our perspectives as a vendor, but the utilities certainly have a slightly different perspective.

Hands down, our utility clients welcome as a concept the TAD canister and the fact that they would have something sitting out on their storage pad that would essentially have an imaginary sticker on it saying, "Yucca Mountain-approved." This is ready to not necessarily go into the mountain but be sent out to Yucca Mountain. That provides them a level of assurance that they are not going to have stuff sitting out on their ISFSI pad for eternity.

The lower capacity is by far the most significant issue for the utilities. A larger ISFSI would be required because of the lower capacity. Instead of 32 assemblies, you now load 21. Instead of 68, you now load 44. So you need more storage pads or you need more underground storage locations.

More casks would be needed to load in each campaign. The utilities have to load a certain number of assemblies, not a certain number of casks but a certain number of assemblies, each time that they do a loading so that they can maintain their full reserve in their pools. So before, where they had to do six

casks, they now need to do nine casks. And that translates into needing more time to load those casks.

Most of our clients or a lot of our clients load one cask in about three weeks on one eight-hour shift. So, instead of now taking 18 weeks, they now need 27 weeks. That's half a year that you're loading. I mean, every year half a year you're loading casks. So that is a significant issue for them. And, of course, more casks mean more cost in terms of operationally and having to actually buy the hardware.

TADs themselves would have to be treated as a new cask type. In terms of revising their procedures, doing training, and doing various engineering evaluations, they will have to revise their 72-212 to show that they meet site boundary doses and so on.

Utilities have a fairly healthy level of skepticism that TADs will be realized. You know, despite my first bullet that they welcome this, they want to see some real progress being made.

I think DOE is getting there. You know, they are going to do some demonstrations with the cask vendors to build and load some of these, but there is still some skepticism out there amongst the utilities.

And, of course, the incentives from DOE will dictate whether the TADs are implemented by the utilities. The TADs will cost more on a per-canister basis. Because you need most of them, it will cost more.

So the utility looking at it says, "I have an MPC, which costs me X. I have a TAD, which costs me X plus 1" or "X plus 2." So obviously DOE will have to incentivize. And what those incentives are will dictate whether TADs are implemented at the sties.

Our path forward. Our ultimate goal at Holtec is to submit to NRC a SAR for a transport cask and a storage cask separately in December of 2008.

Based on the changes that DOE has made to the specification and the length of the TAD canister itself, we believe that we can license the TAD canister and do our existing part 72 docket. It will be the same exterior dimensions as our MPCs. The transport cask would have to be a new docket.

Additionally, we will have to provide a SAR-type document for the aging over-package we imagine DOE will use in their part 63 license application.

There is a large amount of work that needs

to be done over a very short period of time. We're in October. The current deadline in the solicitation was December of 2008 to have a docketed storage and transportation canister. That is about a year to design three overpacks and two canisters and any various ancillaries that might need to be different.

Licensing time frame. That's from the time that the NRC gets the docket to the time that we would need to have a CFC in hand is about two years each for license submittal, storage and transportation each.

Potential obstacles to this process. First, of course, is the NRC workload in SF/ST for commercial spent nuclear fuel. They currently have ten storage applications and five transport applications being reviewed. And, of course, all the cask vendors are expecting to submit more license amendments on their existing technology, MPCs, and so on.

TADs could involve up to eight additional complex applications. The complex in there is specific.

DOE review time. As I mentioned previously, we submitted our design concept to DOE in March. It is now November. And outside of writing a

proposal, we have not been modifying our design.

There is a continued start/stop process related to that DOE review time. The licensing review is two years. That will limit the number of contentious issues that we will be able to put into either the storage or the transportation application. There are already contentious issues that need to be included, borated stainless steel specifically being one of them.

The question will then be under transportation, are we going to want to try to bite off transporting high-burnup fuel, above 45,000, if we don't have a high level of confidence that we can get that licensed in two years?

The change process. As we fabricate, we will have small changes that we may need to make to the casks. If we have to go back to DOE for approval of every little change, that may make things difficult.

Of course, material availability of the borated stainless steel and the cost of the borated stainless steel is a significant issue.

And then, of course, the political environment is an issue. Harry Reid is Senate Majority Leader. And he has made it very clear that

he doesn't want Yucca Mountain to occur.

CHAIRMAN RYAN: Kris, I want to remind you this is a technical committee.

MR. CUMMINGS: Okay. Okay.

CHAIRMAN RYAN: Move along.

MR. CUMMINGS: Okay. No problem.

Final conclusions. We feel like DOE needs to provide some addition confidence to the TAD concept. I think I have made that clear. Changes in the final specification will require redesign of the transport and aging overpacks, but we have known that.

Submittal of the transport and storage licenses to the NRC by December 2008 is achievable. We think that is achievable. It is very aggressive with a speedy review process and a very smooth project to implementation.

We would certainly like to see future modifications of the specification to include underground aging system and higher capacity systems.

And, finally, we would like to see DOE get the cask designers more involved in the operational sequence at Yucca Mountain because we feel like we can provide some benefit to them based on our years of experience.

That is my presentation. Thank you for

your time. Do you have any questions?

MEMBER WEINER: Before I entertain questions from the Committee, I would just like to remind you as a point of information this Committee does not advise DOE.

MR. CUMMINGS: We understand that.

MEMBER WEINER: We advise only the Commission. And so that was just a final comment.

Mike, do you want to start off, Chair, with questions?

CHAIRMAN RYAN: Thank you, Ruth.

I second Ruth's comment. This looks like a presentation you should make to DOE, not us. That's all.

MEMBER WEINER: Allen?

VICE CHAIRMAN CROFF: A couple of questions. First, these aging overpacks you mentioned, the 250-ton things, what happens when you are through with them? In other words, the TAD is taken out. It goes into the mountain in theory. And you've got these leftover aging overpacks. What do you do with them?

MR. CUMMINGS: You dispose of them. I imagine they would not be radioactive or they would be very, very lowly radioactive. At some point, they

would need to be gotten rid of.

VICE CHAIRMAN CROFF: Presumably on site since they can't be moved off?

MR. CUMMINGS: Possibly, yes. Yes. I mean, you're not going to transport them anywhere without cutting them off.

VICE CHAIRMAN CROFF: Okay. Is there any indication that is being thought about, sort of the end game?

MR. CUMMINGS: I would have to defer to DOE to answer that question.

VICE CHAIRMAN CROFF: Okay. Second, in one of your early slides, you noted on improvements to the final spec a one-foot TAD canister drop. I am scratching my head a bit on that because it seems to me in any case you are going to have to lift a TAD up a distance much greater than one foot to either get it into an aging overpack or into an underground thing, whatever. Basically you have got to lift it at least the length of the TAD.

MR. CUMMINGS: Right.

VICE CHAIRMAN CROFF: Are there other testing requirements concerning heights and drops?

MR. CUMMINGS: Well, again, some of that may be related to whether they have single

failure-proof cranes at the receipt and handling facilities. And if that is the case and they have a single failure-proof crane at the receipt facility, then you wouldn't need to address the fact that the TAD could drop while you're transferring it from a transfer overpack into a storage overpack.

That is typically how it is dealt with in the utility environment, that, for instance, our current system, the transfer overpack is put on top of the storage overpack. And then you transfer the MPC from the transfer overpack into the storage overpack.

And we are not required specifically to do analysis of dropping that MPC the full 18 feet into the storage overpack because most, if not all, of the utility sites have single failure-proof cranes.

VICE CHAIRMAN CROFF: Okay. Thanks.

MEMBER WEINER: Dr. Hinze?

MEMBER HINZE: A few questions, Mr. Cummings. First of all, one of my concerns is the corrosion of the TAD. And one of the weak points in many people's view is the welds associated with the lids.

How does your company envision that the welds will be performed at the nuclear power plants? How will this be effected?

MR. CUMMINGS: We would envision that the welds, specifically the lid-to-shell weld, which is the final closure weld, --

MEMBER HINZE: Right.

MR. CUMMINGS: -- would be done very similar, if not identical, to the way that that MPCs are welded currently. I can't speak to the corrosion issues in the repository environment.

MEMBER HINZE: Right.

MR. CUMMINGS: But we have had tremendous success with welding MPCs. And we don't see that the welding process would be different.

MEMBER HINZE: Thank you.

A second question. If the HI-STORM 100 system is not accepted by DOE and we have a simple aging pad that we set the overpacks on -- and you can only increase the maximum diameter by five inches, as I recall, something like that -- to achieve this 3g threshold, it seems to me you have to lower the center of gravity or that is one of the ways that you can do that? And I wouldn't think that you would want to do that. You wouldn't want to make the TAD with the center of gravity that is highly asymmetrical.

MR. CUMMINGS: I don't disagree with you. Certainly if we could change the distribution of the

weight within the aging overpack itself and limit it to that versus having to make changes to the TAD canister, that would certainly provide additional benefits to loading those TAD canisters, then, in a storage environment at the nuclear power plant.

MEMBER HINZE: Are you and the other vendors looking at how to do that?

MR. CUMMINGS: We are looking at how we can do that. I can't discuss, unfortunately, the details.

MEMBER HINZE: I understand. A final question. We are hearing more about the possibility of puncture of the waste package by the internals after corrosion, some general corrosion, has taken place. I found this to be a very interesting new concern.

Can you give us a little more information on your borated stainless steel and your other approaches that you had mentioned for the internals and what your view of their long-term strength characteristics would be and their decay, their destruction, within the canister itself?

MR. CUMMINGS: Again, unfortunately, that is not a question that I can answer. And the reason why is because the cask vendors are being asked to

design a TAD canister, the aging overpack, and the transport overpack.

MEMBER HINZE: But not the internals?

MR. CUMMINGS: Right. And the internals. I agree. The thing is is that DOE is asking us to be responsible to do the analysis to show that aging at the Yucca Mountain repository on the aging overpack and the transportation can be done safely. What they're not asking us to do and what DOE is taking responsibility for themselves is the actual repository environment.

So I would imagine at some point they would take our design and they would have to either do some sort of analysis within the repository environment or they may have already done that analysis and they can show that that is applicable to the canister design that we come up with.

MEMBER HINZE: Well, what predicated my question was you talked about aluminum as an alternative to the borated stainless steel. And my intuitive feel is that the puncture capabilities of aluminum would be far less than with borated stainless steel.

So it seems to me that as we look at some of the drift degradation problems within the

repository, that the strength characteristics in a long-term aspect of the internals becomes an important piece.

MEMBER WEINER: Jim?

MEMBER CLARKE: Could you pull up slide 13, please? You know, this concept of subsurface or mostly subsurface spent fuels, is this purely conceptual at this stage and focused totally on Yucca Mountain? I guess my question is, how would the cost of doing this at another location compare with the typical ways of dry cask storage now?

MR. CUMMINGS: Let me address the first question. No, it's not a conceptual design. This is docketed in front of the NRC. We have gone already through about two years worth of review with the NRC.

There were some issues with the seismic analysis that we did that didn't satisfy the SF/ST to the level that gave them confidence. So we went back, did additional seismic analysis. And it's now in front of the SF/ST again as a docket, as an amendment to our existing HI-STORM 100 docket.

MEMBER CLARKE: Okay. Well, I guess a better way that I could have asked my question is, is this approach in service anywhere?

MR. CUMMINGS: No, it is not.

MEMBER CLARKE: And I guess would it be cost-prohibitive for spent fuel storage at places other than Yucca Mountain, I mean?

MR. CUMMINGS: It's based on the specific site. Depending on what a site has to do to build their ISFSI pack could or does affect the cost of either above-ground or below-ground.

MEMBER CLARKE: Sure.

MR. CUMMINGS: And so that is done on a site-by-site-specific basis. And that is a decision that gets made by the utility to implement it at a utility site.

I mean, what we are licensing now is to use underground storage at the nuclear power plants. And we have brought this to DOE and said we think that this would be very good for the aging facility on a technical basis.

MEMBER CLARKE: Okay. Thank you.

MEMBER WEINER: What are you going to do about heat dissipation with that underground storage?

MR. CUMMINGS: The underground module is constructed in such a way that if you -- let me go to the next slide -- see here, there is a downcomer region this is showing up, right?

MEMBER WEINER: Okay.

MR. CUMMINGS: There is a downcomer region where the air gets sucked in, comes down to the bottom of the storage module, and then comes up again using thermosiphon effect or convective heat transfer to then cool the outside of the canister, very similar to, you know, our current HI-STORM overpack technology, only there's vents in the bottom and vents in the top. Here you only have vents in the top, but you have inlet vents and you have outlet vents.

So we have done thermal characterization and thermal analyses to optimize the size of these downcomer events and the upcomer events to show that we can maintain the 400 degrees C cladding limits that are required for part 72. And that would certainly be the same for the Yucca Mountain aging facility.

MEMBER WEINER: My other concern has to do with the transportation. If you are doing a transport, everything vertically, it is a much less stable configuration than -- I mean, these are big casks. You are transporting something that is five meters vertical. And it seems to me that you are losing a lot of stability with that. It gets back to Dr. Hinze's question about the center of gravity.

MR. CUMMINGS: Right. And in terms of normal operations, you know, moving these things

around, setting them on the pads, even the earthquakes of 2,000-year return earthquake and 10,000-year return earthquake, we have been able to show with our design concept that the cask will not tip over under those 2,000 and 10,000-year earthquakes.

But the 3g earthquake is a drastically more severe earthquake than the previous ones, the 2,000 and 10,000-year returns. So we realize that there will be some issues in coming up with a design that will meet that requirement.

We have been talking about how to address that, but that is something that we would do in our next phase of work with DOE.

MEMBER WEINER: My final question is, why are you using steel as your gamma shield? Most transportation casks use BU or lead. And you will need more steel.

My guess is it's a weight difference, but is there that much difference when you think about it?

MR. CUMMINGS: I agree. And those are options that we have explored to use different shielding materials for gamma shielding other than steel.

As of this time, there are no approved transportation casks for commercial spent nuclear fuel

with a uranium shield, certainly not within the major vendors who deal with this. I can't speak to lead. I don't believe there's anybody licensed with lead in their transport cask.

Now, we have licensed our transfer cask used at the utility sites with lead in it because of the gamma shielding issue. And that may be an option that we explore at some point, but, again, that gets back to the schedule issue that we have got two years to license this with the NRC. If we add lead or we add depleted uranium and it's not something SF/ST has seen before, that increases the review cycle for our cask application process.

MEMBER WEINER: I don't license casks, but we do have staff --

CHAIRMAN RYAN: Nor does this Committee.

MEMBER WEINER: Nor does this Committee, by the way.

CHAIRMAN RYAN: Or its staff.

MEMBER WEINER: But I am a little surprised to hear you say there are no licensed transportation casks that use either lead or DU. There is something.

MR. CUMMINGS: I can't speak for DOE and what they have done in the transportation casks that

they have, but I can say with pretty much absolute certainty that there is not a transportation overpack out there amongst the major vendors for commercial spent nuclear fuel that uses DU.

MEMBER WEINER: Thank you.

John?

MR. FLACK: Yes. John Flack, ACNW staff.

I would just like to follow up on a question that Allen Croff raised about the crane and the failure in a single proof failure crane. We studied those types of situations in events that have occurred in the past for nuclear power plants. The question, of course, is transporting casks across these plants during operation.

We found that most of the failures, the events that occurred occurred because of human error and not because it was a single failure-proof crane or not.

So eliminating these drops because they are single proof failure cranes would not be appropriate in these situations, I would think. But how would you deal with the human error part of this equation?

MR. CUMMINGS: That's a good question. I mean, essentially the licensing that we do and the

analysis that we do is partly predicated on what the NRC asks us to do.

And at this point they haven't asked us if there is a single failure-proof crane to do, say, for instance, a drop of a canister of 20 or 25 feet.

MR. FLACK: Okay. So you are not eliminating these events because of single failure-proof cranes? It's just that you haven't been asked to do that analysis at this point?

MR. CUMMINGS: That's correct.

MR. FLACK: Okay.

MR. CUMMINGS: We're not saying that drop can't occur. And the drop within the Yucca Mountain repository would be most likely DOE's domain, but that's not something that's part of this specification that DOE has created to say that "You need to make sure that you analyze this for a 25-foot drop." They said, "You need to make sure that this will be able to satisfy a one-foot drop onto a steel slab."

MR. FLACK: Okay. If I could have one more question?

MEMBER WEINER: Sure.

MR. FLACK: Getting back to the 3g earthquake, I understand the concept of trying to keep it upright or not tip over. Now, I can't imagine or

maybe I can imagine having a cask like this on a shake table that goes up to 3g. Now, I would kind of think that this thing would shake apart, break apart, at that level.

MR. CUMMINGS: The overpack itself?

MR. FLACK: Yes, everything. It would just shake apart. Wouldn't that be the case? I mean, is the point of it not falling over? I can't see the relevance of that to the whole thing falling apart, I mean.

MR. CUMMINGS: That's a good question. I don't have a good understanding why the 3g earthquake is in there. I can imagine operationally it would be very difficult to pick up, say, 1,000 aging overpacks that have all tipped over in a speedy time frame. That may be the only insight that I can give into it, but that is specifically something that DOE has not wanted to relax that the aging overpack cannot tip over under that 3g.

MR. FLACK: But the tipping over is a criteria that's being used with success for a 3g earthquake.

MR. CUMMINGS: There's more than just the tipping over. There's also that the canister can't breach and you have to maintain cladding temperatures.

But what I was trying to address here was specifically that the 3g earthquake and not tipping over is a major design challenge.

MR. FLACK: Okay. So are the others, I would imagine.

MR. CUMMINGS: Some of the others are, too, but that is the big one.

MR. FLACK: All right. Thank you.

MEMBER WEINER: Chris, go ahead.

MR. C. BROWN: Chris Brown, ACNW staff.

You mentioned in one of your slides that you have an application in for moderated exclusion/burnup credit. Is the moderated exclusion portion solely based on ISG-19 or maybe an exception, just out of curiosity?

MR. CUMMINGS: That is a good question. I will probably defer that one to Dr. Anton on the HI-STAR 180 and moderator exclusion.

DR. ANTON: It is partly based on -- sorry.

MEMBER WEINER: Would you identify yourself, please?

DR. ANTON: This is Stefan Anton, Holtec International licensing manager.

This is partly based on an exemption from

ISG-18. So we already had numerous discussions with the NRC on that issue.

MEMBER WEINER: Further questions?

(No response.)

MEMBER WEINER: Thanks for the presentation.

MR. CUMMINGS: Thank you very much for your time.

CHAIRMAN RYAN: Thank you. We will take a 15-minute break and reconvene at 10:40. The Committee will take up its discussion of letter writing and follow-up after.

(Whereupon, a luncheon recess was taken at 10:24 a.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:01 p.m.)

CHAIRMAN RYAN: With that, we will open our afternoon session. Our cognizant member for this -- order, please -- is Allen Croff. Allen, take it away.

VICE CHAIRMAN CROFF: Thank you.

21) REVISION OF NUREG-1854, NRC STAFF GUIDANCE FOR ACTIVITIES RELATED TO U.S. DEPARTMENT OF ENERGY WASTE DETERMINATIONS - DRAFT FINAL REPORT FOR INTERIM USE

VICE CHAIRMAN CROFF: By way of background for the Committee, if you will remember, we have this waste incidental to reprocessing business, where DOE submits a draft waste determination and for at least two of the sites, there is a congressional act that calls for them to review it and prepare a report that goes back to the Department of Energy with their views on the draft waste determination.

Last year they created a report formerly known as a standard review plan, now known as staff guidance, that indicates how they are going to conduct this review.

It was put out for comment. They got a number of comments. And they have documented the

comments and the comment resolutions in a document that's on our meeting CD and I assume in ADAMS someplace. And what they are going to do here today is to summarize those comments as sort of a close-out of this part of the episode.

Anna, take it away.

MS. BRADFORD: My name is Anna Bradford. I'm the Chief of the Low-Level Waste Branch in the Division of Waste Management and Environmental Protection.

Here next to me is Dr. Karen Pinkston and Dr. Christianne Ridge, both of whom are systems performance analysts in our Performance Assessment Branch.

CHAIRMAN RYAN: Let me on the record say congratulations for being named branch chief.

MS. BRADFORD: Oh, thank you.

CHAIRMAN RYAN: It is well-deserved --

MS. BRADFORD: Thank you.

CHAIRMAN RYAN: -- and a good recognition for your ability. Thank you.

MS. BRADFORD: Happy to be back involved with incidental waste and low-level waste.

CHAIRMAN RYAN: Congratulations.

MS. BRADFORD: It is very interesting.

So we are here today to give you an update on the revision to NUREG-1854, NRC staff guidance for activities related to U.S. Department of Energy waste determinations, which was published in August.

I also wanted to point out that it was actually Mike Fuller of my staff who was the project manager for this revision of the NUREG. He is out of the office this week. So I am standing in for him, but he is the one who actually put all of the work into this document, along with all of the technical contributors.

As this document has evolved, we have briefed the Committee several times on the staff's approach and the progress, with the most recent briefing being this past July.

And, just to clear up any confusion, like Dr. Croff said, this document was previously called a "standard review plan" for NRC activities related to waste determinations. We decided to change that title just because the information in this document didn't really fit into the typical mold of NRC's standard review plan.

The main focus of today's briefing is on the most significant changes from the last version of the guidance and this most recent version. I am going

to spend a minute or two giving a background, some background information on the NUREG, and then an overview of the comments that we received during the public comment period.

I am also going to describe the most recent staff activities with respect to waste determinations because those activities did help inform our revisions to the guidance.

I am not going to describe the National Defense Authorization Act of Fiscal Year '05 or the NRC's responsibilities because I know the Committee is very familiar with those topics.

Then Christianne is going to talk about some of the more important information in the guidance: performance assessment, the removal of radionuclides from the waste, as well as our monitoring activities with respect to DOE's disposal actions. And then Karen is going to talk about the concentration averaging guidance, which, as you know, can be a very complicated issue with respect to waste determinations.

So, as you heard us say before, the objective of NUREG-1854 is to ensure consistency of NRC staff reviews, of waste determinations submitted to us by DOE. It is also to help ensure consistency

of our monitoring activities of DOE's disposal actions. It also is an important tool for us to facilitate knowledge transfer among the staff as the number of staff working on these problems has increased over the last year or two.

So the NUREG was published as a draft standard review plan. And that was put out for public comment in May 2006. The public comment period lasted until July 31st, 2006.

During that comment period, we received 12 comment letters. We also took part in interactions with key stakeholders, both during and after the public comment period. And I will talk more about those in a moment. And, as you know, the ACNW provided us some feedback and recommendations in a letter in December 2006.

So we took all the comments that we received, regrouped them by subject. We developed responses to those comments as well as revised the guidance as appropriate according to the comments that we received. Those comments and responses are now in appendix C to the NUREG.

We published the NUREG this past August. We titled it "Draft Final for Interim Use." And the reason we used the draft final designation was because

we do plan to revise it again once we have completed the work on some generic technical issues that we think will help inform us for revisions in the future of this document.

As I said, we received 12 comment letters during the public comment period. Four of those were from states: Idaho, New York, Washington, Oregon. In general, the states all supported the contents of the SRP, the technical contents. Oregon did raise some concerns about the application of the SRP to Hanford because, as you know, the NDAA does not apply to Hanford. And they were concerned that we were equating Hanford with the Savannah River site and with Idaho.

We received one letter from DOE, which raised concerns about how we were implementing the NDAA in general. And also they were concerned that the SRP implied that we were regulating DOE when, in fact, we are not regulating DOE with respect to waste determinations.

We received one letter from the West Valley Citizen Task Force, which is a group that is very involved in the cleanup of the West Valley site up in New York. They also liked the technical contents of the SRP, but they in general to not

support the overall idea of WIR and being able to classify this waste as incidental in dispose of it on site.

We received one letter from the Natural Resources Defense Council. They have been an important stakeholder in waste determinations. They are especially interested in our role in reviewing waste determinations. But, again, they do not support just the overall concept of incidental waste.

And then we received five letters from private citizens. And the comments in there ranged from waste volume left in tanks to groundwater transferred at Hanford to our monitoring activities.

As I mentioned, we took part and completed some very important activities between the last version of the guidance and this most recent version. For example, we issued the technical evaluation report for waste determination for tank closure at Idaho. And this was the first review we completed for tank closure under the NDAA.

We also issued and implemented monitoring plans for salt stimulase at the Savannah River site and for the Idaho tanks. We have gone out to Idaho twice to audit their activities. And we have issued two observation reports that discuss our findings.

And, actually, implementing our monitoring role helped us sharpen the related discussion in the NUREG.

We also issued in the Spring of 2006 a request for additional information for tanks 18 and 19 at Savannah River. And subsequently DOE decided not to go forward with that waste determination as submitted. So that review has not continued, but we did gain some value experience just from completing the first part of that review.

We have also held discussions with DOE regarding technical issues, which may affect waste determinations that DOE submits to us in the future.

For example, we have discussed concentration averaging with them. And those discussions have been valuable in helping us clarify our positions to DOE and letting us better understand how they were reading and interpreting the guidance.

We have also held two public meetings with DOE to discuss the consultation process in general. The most recent one of those was in July. And during that meeting, we allotted time for public comments. And we did receive some comments on the NUREG during that meeting.

I am now going to turn this to Christianne to talk about the details of performance assessment.

DR. RIDGE: Good afternoon. I am going to speak about some of the changes we have made in three areas, in the performance assessment area, in the area of radionuclide removal, and in monitoring. Dr Esh, of course, was the author and chief reviser of most of the performance assessment guidance that I am going to talk about today.

One of the main changes we made in the performance assessment area -- actually, there were very few changes in the philosophy of the performance assessment area or in the technical guidance. Most of the changes in this area were an expansion of clarification or the previous guidance. An example of that is that we expanded the guidance regarding the advantages of probabilistic analyses and the disadvantages or challenges associated with deterministic analyses.

For example, we expanded the guidance regarding the need to assemble appropriate combinations of parameters to examine and if you are looking at a deterministic approach.

We also expanded the guidance about how to look at these deterministic analyses. And we emphasize the evaluation of whether assumptions that are said to be conservative are conservative,

especially looking to whether or not they are conservative only locally or globally because, of course, this can be a difficult thing to look at in a deterministic analysis.

For example, if you assume a waste form is completely saturated, that can appear to be a conservative assumption. And it is with respect to the relative porosity of the waste, but if you assume it's saturated, you have also eliminated gas-based transport in the waste form. And that can be a difficulty because you might limit the amount of oxidation or carbonation that occurs to the waste form. So we have added more detail and emphasized the need to look at whether these assumptions are actually conservative globally.

We have also emphasized the recommendation that reviewers use independent, probabilistic analyses to identify risk-significant assumptions when DOE does submit a deterministic analysis, many of these changes -- and the added emphasis was in response to ACNW comments.

We have also made some clarifications in the area of dose calculation. The Committee had expressed a concern that there was a disconnect between the regulation and part 61, which has limits

that were based on ICRP 2. And 61.43, of course, worker dose, is expressed as TEDE, total effective dose equivalent, because it's performed under DOE's regulation, 10 CFR part 35. The Committee expressed concern about that disconnect.

We have in the guidance previously -- and we have clarified this and emphasized this a bit -- expressed the view that the NRC believes that it is appropriate to use the 25 millirem TEDE limit as essentially not equivalent but as an alternative to using the 25 millirem whole body and the 75 millirem thyroid and the 25 millirem organ doses. That precedent actually comes from the proposed rule for part 63.

We have emphasize in the revision that the dose calculations may be based on the dosimetry consistent with ICRP 26 and 30 or the more current dosimetry consistent with ICRP 72. And, actually, in that emphasis, we are following direct Commission direction. The Commission had previously directed us to make sure we maintained the flexibility for DOE to use the dosimetry consistent with ICRP 72.

I would just like to point out that the two waste determinations that we have reviewed so far pursuant to the NDAA, in those two determinations, DOE

has used dose methodology consistent with ICRP 26 and 30. And so there doesn't actually seem to be much of a concern that they would want to use the older ICRP 2 methodology that is what the part 61 limits were based on.

In addition to these comments that we received from the Committee, we also made changes based on our previous experience. Two topics that we have had a lot of technical interaction with DOE about in previous reviews have been grout degradation and the point of compliance. These certainly aren't the only two, but these are two main areas where we have had a lot of interaction with them. And we, therefore, wanted to clarify our guidance.

With respect to grout degradation, we have added more specific guidance related to specific degradation mechanisms, such as wet/dry cycling or carbonation. We have added a little bit more specific guidance there. And we have also emphasized a bit more the guidance related to the mean to modeling the uncertainty in degradation effects.

And some of those sources of uncertainty; for instance, uncertainty, in the environment with respect to subsurface carbon dioxide concentrations, for instance, or the moisture environment at the site.

And so we have emphasized the need to understand those sources of uncertainty and to carry those through into the performance assessment modeling.

With respect to the point of compliance, we have emphasized that the size of a buffer zone around the waste needs to be consistent with its purpose, which is given in part 61. The purpose of a buffer zone, as given in part 61, is to provide an area for monitoring and for any necessary mitigation that needs to take place.

And so there is no strict limit on what we require for a buffer zone. We continue to expect it to be approximately 100 meters, which is what was used in the part 61 EIS, but we certainly would be amenable to evaluating other buffer zone sizes. We are guided by the purpose of the buffer zone, which is given in part 61.

And, of course, as you know, the size of the point of compliance is related to institutional controls because where a member of the public can be is limited by DOE's institutional control of the site.

We have not made any changes in the guidance regarding our assumption of institutional controls, again, in that we are guided by part 61, which indicates that institutional controls should not

be assumed to be maintained more than 100 years after site closure and in that we're guided largely by the discussion in the environmental impact statement for part 61, which indicates, in part, that the question of institutional controls is not really meant to be an estimate of how long the government will survive.

And, of course, in part 61, it was assumed that the government would take ownership of these commercial low-level waste sites. And so the question is not really one of how long the government will stand but of how long it should be responsible for maintaining the site, how long it should be responsible for the waste. And so we haven't changed any of our guidance on that topic.

We also received public comments related to performance assessment. There were public comments on both procedural and technical topics. We did receive a number of comments about the public availability of documents. And we have emphasized in our guidance that our technical evaluation reports, documents we get from DOE during the waste determination review, are made public.

We also received some comments about the funding for DOE to pursue waste cleanup and for NRC to review it. And those were largely outside the scope,

but we did receive public interest on a number of procedural topics, those being two examples.

We also received public comments on specific technical topics. And in many of those cases, we thought there were some good points made. And we incorporated more specific guidance into the guidance documents. For instance, we added some specific reference to looking for manmade preferential flow pathways, such as well casings or certainly at the DOE sites, there is a great deal of underground piping, the effects of co-containments on radionuclide transport, for instance, if there are any effects of organic solvents that have been spilled on the site.

We received comments about evapotranspirative barriers and a suggestion that we include the effects of anthropogenic climate change in our review.

On that last topic, anthropogenic climate change, we are following the lead so far of the high-level waste program in that our understanding is that we expect that the effects of anthropogenic climate change will be to change the timing of any large changes in the climate that happen naturally.

And so we would expect that DOE would look for any sensitivity to the timing of changes in the

climate that are expected but that other than that, we expect that there is so much uncertainty in the prediction of the climate change, that looking at the effects of anthropogenic climate change is essentially taken care of by looking at the uncertainty in what future climate states may be.

There were also a few changes to the radionuclide removal section. As you will recall, radionuclide removal is required. Radionuclide removal to the maximum extent practicable and, more specifically, highly radioactive radionuclide removal, to the maximum extent practicable is required by criterion 2 of the NDAA.

And there were a few changes here, one in the area of technology selection and removal efficiencies. We incorporated the ACNW's recommendations about technology selection, one of those recommendations being that DOE should evaluate a suite of technologies and not pick one single technology that they think will --

CHAIRMAN RYAN: I need to interrupt you. I'm sorry. We need to turn on the line so folks so can dial into to the presentation.

DR. RIDGE: Oh, of course.

CHAIRMAN RYAN: So if you don't mind,

Theron is going to come in and just dial it up. So I apologize.

DR. RIDGE: No problem.

CHAIRMAN RYAN: We didn't have anybody scheduled, but they have called in to the office. And we need to hook them up.

(Pause.)

CHAIRMAN RYAN: Good afternoon.

MR. ROSENBERGER: Hey, how are you doing?

CHAIRMAN RYAN: This is Mike Ryan. We are already underway just for a few minutes. Could you tell us who you are and who you are with?

MR. ROSENBERGER: Yes. This is Ken Rosenberger, Savannah River site.

CHAIRMAN RYAN: Welcome, Ken. We will pick up right from here. Thanks for joining us.

MR. ROSENBERGER: Thanks, Mike.

CHAIRMAN RYAN: Christianne, thank you for your patience.

DR. RIDGE: No trouble. I think I was saying that we have incorporated the ACNW recommendations about technology selection, specifically that in our review we should look to and in our analysis DOE should look to international sources, industrial sources for ideas of what

technologies could be used, and also that they should consider a suite of technologies and not one single technology. Those are all good suggestions, and we incorporated them directly.

We also clarified the guidance about removal efficiencies. The ACNW has expressed some concern, I believe, that we are overemphasizing removal efficiencies and that removal efficiencies are not a direct measure of risk, with which we agree. And it was, in fact, never our intention that we would say, for instance, DOE has removed 99 percent of the activity and that is our measure and, therefore, they are done and they have removed radionuclides to the maximum extent practicable.

So we clarified in our guidance some appropriate uses and appropriate uses of removal efficiencies. We have indicated that it would be appropriate to compare removal efficiencies in comparing alternate technologies.

So, for instance, if you are removing radionuclides chemically from a waste stream and you have one that could remove, for instance, 80 percent of the cesium and another technology that could remove 95 percent of the cesium, we would expect that to be taken into account in the selection of radionuclide

removal technologies.

We also indicated that would be appropriate to look at removal efficiencies when looking at the impracticality or practicality of additional removal by a selected method.

For instance, if you have a tank-cleaning method that removes a certain amount of radionuclides per gallon of waste and, for instance, if you started by removing 1,000 curies per 1,000 gallons of waste, if that removal efficiency drops off to a point where you're now removing 100 curies per 1,000 gallons of waste, that might be an indication that this technology either needs to be optimized or replaced.

Again, we wouldn't assume that once that particular technology was no longer effective, that that means you are necessarily done, but it is certainly an indication that you should be looking to either reconfigure that technology. Perhaps there are parameters that can be changed to improve the removal efficiency or perhaps it should be replaced.

We have also explicitly indicated that it is not appropriate to use the removal efficiency as the sole evidence that you have removed radionuclides to the maximum extent practicable. Certainly it would be one factor, but essentially it is really the

cost-benefit analysis I think that provides a lot of the support for the conclusion as to whether it is practical to keep removing radionuclides.

We have also added some clarification in that section. We have expanded the discussion of the disadvantages of attempting to quantify benefits in terms of averting collective dose.

We do believe there are a lot of difficulties that would be presented, not the least of which is attempting to predict what the population around a site might be for the next 10,000 years. Certainly that would present a difficulty.

We believe there are a lot of disadvantages there. We also believe that we need to be ready to review what DOE gives to us. And so we have looked at that in expressing the disadvantages and what a reviewer would need to be careful of and not say explicitly that we would not need to review a waste determination that used that type of modification of the benefits.

That said, DOE has not yet given to us or indicated in any other way that they would expect to give to us a cost-benefit analysis in which they did quantify benefits as aversion of collective dose. So we don't necessarily expect this to be an area of any

disagreement.

We have added guidance about the appropriate scope of cost-benefit analyses. And this change, largely, was in response to public comments. We had said previously that we believe that the direction that DOE should remove highly radioactive radionuclides to the maximum extent practicable was a fairly broad direction and that the issues that could be considered under the scope of practicality included potential mission impacts on DOE, potential impacts on other parts of their site.

And we have expanded the scope somewhat to more explicitly include non-radiological worker hazards, environmental benefits that might be accrued by pursuing more waste removal. Those are the two main areas. We have expanded that guidance slightly. And that, in essence, is in line with what we do for ALARA analyses for decommissioning.

So essentially the same types of issues that we would consider in a decommissioning analysis of whether dose is maintained as low as is reasonably achievable, those are the same types of things we would include. However, we still expect that the main benefit is going to be averting public dose and that the main costs are going to be financial costs and the

dose to workers who are involved in the process.

So those are the things that we had focused on earlier. We have expanded the scope somewhat, but we still expect to maintain the focus on the averting public dose and the cost being financial and worker dose, just as we had earlier.

We have also added some examples of selecting which radionuclides are highly radioactive radionuclides, mostly to emphasize that it's not just radionuclides that affect public dose that are important but also those that affect an intruder dose or a worker dose. And this isn't really a change from the previous guidance. It's more of a clarification. And, similarly, we have added some examples to clarify how you would incorporate uncertainties into cost-benefit analyses.

Now, the last area of change is monitoring. And this actually was an area in which the guidance changed a fair amount, but I am not going to speak about it at great length because we have recently briefed the Committee, just in July, on our monitoring plans and recently received a letter from the Committee about the briefing and about our monitoring plans.

So I am just going to mention here briefly

that our essential philosophy that monitoring provides a way to manage uncertainties that are inherent in any long-term dose prediction, that has not changed and that monitoring is not a substitute for robust demonstration of compliance. And that philosophy has not changed.

The essential change in that section of the guidance is that we have added additional detail. And the main areas that we have added detail in are we have given examples of types of monitoring activities that are related to each performance objective, we have explained more about what we expect from our interactions with DOE and the affected states, and we have talked more about how we are going to document our monitoring results; for example, with reports for each on-site visit, and annual reports.

And, again, our monitoring remains risk-informed and performance-based in that we focus on the most risk-significant aspects that we have identified in the technical evaluation report and that they are performance-based in the sense that the plans describe what information we would need, but they are not prescriptive in exactly how DOE would have to get that information.

With that, I am going to turn it over to

Karen. Karen is going to talk about risk classification.

DR. PINKSTON: My name is Karen Pinkston. I am going to be talking about waste classification and new concentration averaging guidance. Dr. Esh was the primary author for the new concentration averaging guidance.

The reason that waste classification is important for incidental waste is that the NDAA requires additional concentration if the waste does not meet the part 61 class C concentration limits.

It is not completely straightforward to determine the class of incidental waste because the part 61 concentration limits were derived based on many assumptions that may not apply to incidental waste. For example, the part 61 analysis was based on an intruder construction scenario in which the foundation for a house was assumed to be excavated into the waste. This scenario assumed a particular geometry and a particular dilution of the waste with clean soil that was also exhumed when the waste was exhumed and spread around.

There is also some credit taken for the dilution of the waste that is at class C concentration limits with waste that is at lower concentration

limits. So the whole waste stream into the low-level waste landfill was not assumed to be all at class C limits.

Finally, there was an assumption about the presence of an intruder barrier cover in the part 61 analysis. In order for the intruder dose for an intruder that intrudes into a low-level waste facility to be less than 500 millirem, all of those assumptions have to be true.

Part 61 also allows for the use of concentration averaging in waste classification. The goal in generating concentration average guidance for WIR is to be consistent with the principles and the branch technical position will also allow inflexibility to account for differences between incidental waste and low-level waste disposal.

In the NUREG, we have three different methods for doing concentration averaging. The first two methods are in the original guidance. And the third method is new.

The first category is physical homogeneity. In this category, waste is mixed with stabilizing materials and results in a product that is homogeneous. An example of something that would fall in this category is saltstone. And in this approach,

the concentration is averaged over the total amount of waste and the total amount of stabilizing materials.

The second approach is stabilization to satisfy 61.56. And in this case, the waste is stabilized in place. And the concentration is averaged over the amount of material needed to stabilize the waste. In this approach, the concentration of the stabilized waste must approach uniformity in the context of the intruder scenario.

And, finally, our new concentration averaging approach is a site-specific averaging approach. And this type of approach was recommended to us in the ACNW comment letter. This approach is a more risk-informed approach that allows you to take into account the specific characteristics of the waste disposal site and the methods of disposal and allows you to take into account differences between the scenarios used for a low-level waste landfill and incidental waste.

Now, this picture depicts the part 61 intruder construction scenario that was used to develop the concentration limits as well as a scenario that would be appropriate to incidental waste.

And, as I mentioned earlier, the part 61 analysis considered multiple scenarios in the

analysis, but the limiting one that was ultimately used to develop the concentration limits was a intruder construction scenario. In this scenario, clean soil as well as waste was exhumed when building the foundation for a house.

Some major differences exist between that scenario and scenarios that are appropriate for incidental waste. One main difference is the physical configuration of the waste and the accessibility.

A variety of different configurations exist for incidental waste. For example, you might have a tank with a very thin layer of waste at a deep depth. There also might be some ancillary equipment and piping that has waste at a level much closer to the surface. And there are also things like saltstone, where there is a large volume of a lower-concentration waste.

And a different amount of dilution is expected for each of these scenarios when exhuming the waste. And this level of dilution would likely be different than the amount that was exhumed in the part 61 analysis.

A new site-specific averaging approach also can take into account site-specific parameters, where the part 61 analysis used generic parameters.

The original analysis for part 61 was also based on deterministic analysis, where a new analysis could be done, either deterministically or stochastically.

And, finally, the dosimetry used in the part 61 analysis was the ICRP 2 dosimetry. And it is expected that site-specific analysis would use newer dosimetry.

The category 3 approach represents a conversion from the snow depicted on the left side of the picture for the part 61 analysis to the one on the right side and uses a risk-informed approach to take into account the depth of the waste, the presence or absence of intruder barriers, current dosimetry, and the propagation of uncertainty into concentration events.

Waste classification system is designed to establish a protected upper limit to the concentration of material that may just be suitable for a near-surface disposal. And the use of reasonable conservative scenarios for waste classification ensures that the waste is described in a proper risk context and that classification calculations are reviewed within an appropriate level of effort.

This table on this slide shows the scenarios that should be used for the category 3

site-specific averaging. The type of scenario that should be used depends on the depth of the waste, whether or not it's shallow or deeper than five meters, and the presence or absence of a robust intruder barrier.

A robust intruder barrier is assumed to delay intrusion of the waste by 500 years. And the management of intruder risk by a complex intruder barrier that would prevent access to the waste by more than 500 years is not likely to be practical.

The residential construction scenario is appropriate for shallow waste. And this scenario would be a scenario similar to the one used in part 61 in which the foundation for the house is excavated, waste and clean soil above it is exhumed.

For waste that is deeper than five meters, the appropriate scenario would be a well-drilling scenario in which waste is exhumed when a well is drilled to reach water or some other thing below the site.

The dose should be calculated for both the acute -- such as acute scenarios, such as a worker who is doing the exhuming of the waste, as well as a chronic scenario, such as a resident that then lives on the land after the waste is exhumed and spread

around. And whichever scenario is limiting should be used. If the scenario other than you solicit is likely to exist and is more limiting, that scenario should be used for the waste classification.

In the guidance, example averaging expressions were developed for each of the scenarios presented on the previous slide. These averaging expressions allow NRC staff to quickly evaluate the concentration averaging approach used by DOE to determine when site-specific averaging calculations would require additional review effort.

The resulting site-specific averaging expressions for incidental waste should be carefully reviewed, even if it is found that it's consistent with these averaging expressions.

The averaging expressions were developed assuming generic site and receptor characteristics and were developed using moderately conservative assumptions. For example, one assumption used was that delimiting short-lived and long-lived radionuclides were used in the averaging expressions. And these averaging expressions were then applied to all radionuclides of that type.

The averaging expressions in the guidance are not to be used as a basis for site-specific

averaging by DOE for waste classification. It is expected that they will develop their own calculations for concentration averaging.

One reason for this is that site-specific variability can result in an order of magnitude or more in the range in these example averaging expressions. So site-specific analysis should be done.

The goal in developing these averaging expressions was to compare an analysis that's appropriate for incidental waste to the analysis used to develop the part 61 concentration limits. Adapting the waste classification approach from the one use in part 61 to incidental waste is not just as simple as applying a new dilution factor because there are other differences between the two analyses, such as differences in their dosimetry and differences in the treatment of uncertainty.

Conceptually the intruder dose is a function of the concentration in the waste, the volume of waste that is exhumed, and a factor that converts the amount of activity to a dose. This conversion factor is a function of the dosimetry used, parameter value selected, uncertainty, and assumptions used in the model, such as the amount of dilution assumed.

By making a ratio of the top equation for the new analysis to the top equation for a part 61 analysis and rearranging, you can generate the equation shown at the bottom of the screen. In this equation, the x divided by v times x for part 61 is equal to an unknown constant.

So to solve for this unknown constant, a probabilistic Goldsim model was developed and was used to calculate the intruder dose for each scenario for unit concentrations of radionuclides, of all the radionuclides present in tables 1 and 2 in part 61.

It was assumed that the class C concentration limits in part 61 correspond to a 500-millirem dose for this use to develop these concentration limits; in other words, for the low-level waste facility in which the waste is exhumed during a construction scenario.

The equation shown at the bottom of this slide is the same as the equation shown at the bottom of the previous slide but has been rearranged algebraically in order to solve for the unknown constant for each radionuclide.

The values of the concentration for the part 61 analysis are equal to the values in the tables in part 61. And the dose from the part 61 analysis

was assumed to be 500 millirem.

The value for the dose from the Goldsim analysis was just the output from the Goldsim analysis. And the values for the concentration using Goldsim and volume using Goldsim were to adjust the input values using the Goldsim model.

Once the value of this constant for each scenario was calculated for each radionuclide, the constant was plugged into the equation to develop the averaging expressions. And, as I said earlier, the limiting constant was used for each scenario for each type of radionuclide.

In other words, all the long-lived radionuclides used the same constant. All of the short-lived radionuclides used the same constant.

It would be possible to make a vector of constants for each radionuclide, but for the sake of simplicity in suing these averaging expressions, the conservative assumption was made that the constant from the limiting radionuclide was going to be used and applied to all radionuclides.

So conceptually the volume of waste exhumed times this constant can be thought of as a factor that converts the scenario used for the part 61 analysis that is appropriate for WIR.

So then the radio of this concentration times the concentration in the waste and incidental waste times this factor can be divided by the concentration in part 61 in order to calculate a radionuclide classification factor.

And the value of this classification factor needs to be less than one in order for the waste to not be greater than class C. And the fractions approach is used to account for the presence of multiple radionuclides. And some of the radionuclide classification factors for all radionuclides present needs to be less than one.

Now I will turn it back over to Anna.

MS. BRADFORD: So, in conclusion, the guidance has been revised, taking into account the public comments we received as well as increased staff experience gained from related activities.

However, the guidance remains flexible, is still applicable to many different types of reviews while still providing a consistent basis for those reviews and also for different reviewers. And we look forward to continuing to interact with the Committee with respect to waste determination.

CHAIRMAN RYAN: Great. Thank you.

VICE CHAIRMAN CROFF: Mike, go ahead.

CHAIRMAN RYAN: This method that you have just presented is pretty neat. That is some good work. There is a lot of action, isn't there, in that factor X for the specific sites? There is a lot of meat behind that one factor that is larger than to go through that one process and evaluate. That is a real interesting method. Good work.

I don't have any other questions. I just think it's real interesting, great follow-up, and thanks for the feedback.

VICE CHAIRMAN CROFF: Ruth?

MEMBER WEINER: I am very interested in the fact that you have developed a method that has more general application than just WIR. And I just wondered if you tried applying it to anything else greater than class C waste, any other kind of site.

MS. BRADFORD: Not as far as we know, no.

MEMBER WEINER: No?

MS. BRADFORD: It was just put out in this WIR guidance specifically for WIR. And I think we even said in there that this was developed specifically for these types of situations.

MEMBER WEINER: Well, it's just interesting because it encompasses a number of general concepts that I think are more widely applicable to

that.

MS. BRADFORD: Right.

MEMBER WEINER: What has been the reaction of your various stakeholders to this method, to your averaging method?

MS. BRADFORD: I'll let Karen and Christianne talk about that, but I know that DOE responded pretty positively to it. They understood it a little bit better and understood how to apply it a little bit better, it sounded like. Do you want to add anything to that?

DR. RIDGE: All we would want to add is that we did meet -- as Anna mentioned at the beginning of the discussion, we did recently meet with DOE to discuss the guidance. I wasn't actually at that meeting. I heard about it.

MS. BRADFORD: It did just come out at the end of August, though. And I'm not sure all of our stakeholders have had a time to digest it. But we haven't yet herd from others about this particular part of the guidance.

CHAIRMAN RYAN: Just a quick follow-up. You know, I am sitting here thinking more about your calculational method. You have actually devised a way to take a classification system based on concentration

and convert it to a classification system based on a risk assessment.

I want to ask you a question that's outside of this box a little bit, but why couldn't you evaluate waste that was even greater than class C because it would be based on a quantity and a quantity at risk, rather than the concentration in the waste itself?

You don't have to answer it not, but just think about that. I mean, you really translated from concentration to risk. That's a big deal. What do you think? Dr. Esh, any thoughts?

DR. ESH: Yes. This is Dave Esh.

I would hope so. I mean, that was the goal.

CHAIRMAN RYAN: It is really neat.

DR. ESH: We thought about your input, but obviously we thought about this issue, even before we got your input, --

CHAIRMAN RYAN: That's true.

DR. ESH: -- because we realized we needed some more flexibility. And so we did the groundwork for that, even before the last draft of the document was out.

CHAIRMAN RYAN: Is there any chance you

are going to pursue this as a separate activity and just maybe push this method out a little bit more and see what you can do with it?

DR. ESH: I don't know. I think it's a good idea to see how it works for some other problems at least. You know, people have really strong views about waste classification and concentrations, et cetera. And we got comments on both ends of the spectrum. In all fairness to them, a lot of the commenters that had opinions, they were all right to some degree.

CHAIRMAN RYAN: I hear you, yes.

DR. ESH: I think by trying to turn this into more of a risk-informed approach or risk-informed calculation, it allows you to incorporate all of those views.

Then you can't get into the -- it's harder to get into the philosophical arguments that you need to. And it's more in a quantitative space, which is where I think it should be.

CHAIRMAN RYAN: Yahoo.

VICE CHAIRMAN CROFF: Ruth, are you done?

MEMBER WEINER: I'm done.

CHAIRMAN RYAN: Sorry.

VICE CHAIRMAN CROFF: Jim?

MEMBER WEINER: No. That's fine.

MEMBER CLARKE: Thank you.

Could you put up slide 9, please? I just had a couple of questions about one of the topics. I can't recall. Evapotranspiration barriers, were they in your original guidance or does --

DR. RIDGE: I don't think we spoke to them explicitly.

MEMBER CLARKE: So when it says, "additional review procedures," you have added that topic?

DR. RIDGE: Yes, right. There were several specific topics that we added review procedures to address. One of them was evapotranspirative barriers. Specifically what we indicated was that if DOE does propose an evapotranspirative barrier, it is important for us to look at when the precipitation is expected to occur and whether that coincides or not with the season when the plants would be growing.

Some of these are relatively short-term concerns. We wouldn't expect an evapotranspirative barrier. We wouldn't give it credit for functioning for 10,000 years. But in the shorter term, some of the -- we didn't have specific guidance about

evapotranspirative barriers, but some of the specific guidance we added is that it is important when you look at these to look at when the precipitation is occurring, when the plants are growing because that has a lot to do with how effective the barriers can be.

MEMBER CLARKE: Right. The barrier has a component that is intended to store water during the --

DR. RIDGE: Exactly, exactly.

MEMBER CLARKE: One of the things we have learned with those barriers is don't work with annual averages. You know, you need to work with episodic events. There have been failures because the design didn't do that.

Did that come from public comments or was that --

DR. RIDGE: It did. That was an issue that was pointed out in public comments. And, actually, the staff had meanwhile done additional research in that area. And so that coincided, the staff learning more about that area, with the public comment we received.

MEMBER CLARKE: So if you were looking at a proposal for that barrier, as opposed to another

barrier, again, your intent would be to do a performance-based evaluation of that particular engineered cover, would it not be?

DR. RIDGE: Yes, although I'm not sure we would be reviewing the selection. Essentially the guidance is geared towards if DOE proposes to use an evapotranspirative barrier and --

MEMBER CLARKE: Right, right. These are the things that are important to performance.

DR. RIDGE: Right, exactly.

MEMBER CLARKE: Okay. Has anyone proposed yet? I was thinking of Idaho.

DR. RIDGE: No.

MEMBER CLARKE: No? Okay. Slide 15. This is kind of a silly question. I'm going to ask it anyway. When I first looking at your drawing on the right, it looked like the well was going through the tank. That is not the case.

DR. PINKSTON: Yes. The well is going through the tank and --

MEMBER CLARKE: It is going through the tank?

DR. PINKSTON: Right. And so when you exhumed the material, went into the well, you exhumed waste as well as probably grout up in the tank above

it and clean soil above and below the tank.

MEMBER CLARKE: Say that again. That's not a monitoring well?

DR. PINKSTON: No. It's you have a house and you want to get drinking water and you accidentally happen to hit the tank.

MEMBER CLARKE: Okay. It's an intruder scenario. Yes. Okay. I am with you. Thank you.

VICE CHAIRMAN CROFF: You are monitoring really close to the well.

(Laughter.)

VICE CHAIRMAN CROFF: Are you done, Jim?

MEMBER CLARKE: Yes. Thanks.

VICE CHAIRMAN CROFF: Okay.

MEMBER HINZE: Following up on Dr. Weiner's comment about the possible generic use of this, the Committee has entertained some thoughts about the use of buffer zones and *in situ* leach mining facilities. And I am wondering if you could expand a bit about your guidance in terms of what the guidance is regarding the use of the buffer and further studies upon a possible violation of the limits at the point of compliance.

What do your regulations suggest regarding, what does your guidance suggest regarding,

the use of the buffer in the point of compliance?

DR. RIDGE: Well, essentially, if I understand your question correctly, once you cross over the buffer zone into the waste site, you are regarded as an inadvertent intruder.

And so with respect to the point of compliance, we would expect the member of the public protected by 61.41 to be outside of that buffer zone. And then once you are inside of that buffer zone, the dose limit that applies for compliance is the dose limit for the inadvertent intruder.

But I am not sure I understood your question clearly.

MEMBER HINZE: So this is strictly for the inadvertent intruder. Is that --

DR. RIDGE: Well, it influences the point of compliance for the member of the public who is not intruding because that dose limit applies only outside of the buffer zone. So that person is not on the waste site, and they are outside of the buffer zone.

MEMBER HINZE: And the buffer zone is determined by the local groundwater conditions and the geohydrologic conditions?

DR. RIDGE: Those certainly are factors. Essentially there is flexibility. Buffer zones should

be site-specific in how much space you would need to do to effectively perform monitoring and how much space you would think you would need if you did need to take mitigative measures, what buffer zone you would need for that.

In the environmental impact statement for part 61, it actually was envisioned that the buffer zone would be site-specific in that it could even be larger on one side of a site than on another depending on the direction of groundwater flow. And that was actually in the original intent.

Now, typically we've often simplified that and said 100 meters around a site, but certainly those factors, the local geology, the local hydrology, we would consider as sensible technical things to consider if they were submitted to us.

MEMBER HINZE: And that would also pertain to the monitoring sites as well, I assume? All of those conditions would be entered into, what would be acceptable monitoring?

DR. RIDGE: Yes, and the two are related.

MEMBER HINZE: Sure.

DR. RIDGE: The amount of buffer space you would need is based, in part, on how much space you think you need to implement a monitoring program.

MEMBER HINZE: Are there any monitoring wells or any suggestions regarding monitoring outside of the buffer zone?

DR. RIDGE: Well, I can speak to Savannah River and less to the other sites. I mean, they do have a site-wide environmental monitoring program. And certainly there are wells that are part of that program that are outside of the specific buffer zones for the incidental waste, the waste determinations that we have looked at.

The monitoring wells that we have looked at for saltstone so far, which is the only place we are doing monitoring at Savannah River, are inside or at the boundary of the buffer zone.

But the sites do have, I believe all of the sites do have, environmental monitoring programs that include wells that are placed in various places on the site.

MEMBER HINZE: Thank you.

VICE CHAIRMAN CROFF: Okay. I would like to come back to these averaging equations, which I, too, find very intriguing. Have you exercised these at all to take a typical saltstone vault or hypothetical tank, I mean, representative tank, I guess, and tried to work out what some of these ratios

would be?

DR. PINKSTON: I've not. Dave, have you?

DR. ESH: This is Dave Esh.

I looked at some of the sites and information when we were developing it, but the approach was certainly not designed -- it was designed for the specific problems but not the specific result of those problems. So it wasn't made with consideration of where those sites would come out if you apply this approach to them, but it was made considering their geometries, the distributions of waste, and the depth to waste, and when it may be exhumed or exposed.

So it's a subtle difference that I am trying to convey to you, but it wasn't engineered to give all DOE sites will be less than class C. It was done to do the correct approach from a conceptual standpoint and a risk standpoint. However the results come out, so be it.

VICE CHAIRMAN CROFF: I understand that, but I was wondering if it had been exercised and the kind of result you get. I mean, what would be the difference between -- I don't want to call it an allowable concentration under 61 and this -- what would this new method tell you?

DR. ESH: In general it gives you some benefit. If you looked at it from a pure dilution standpoint, you would think the benefit would be huge, especially for most of the incidental waste sources that are buried deeply.

If you have a drilling dilution factor compared to an excavation dilution factor, they're a lot different. But the reality is it's not nearly that different because the analysis for part 61, as Karen so greatly stated, had assumptions built into it like not all the waste that goes into a commercial low-level waste facility is going to be at the class C level. It is layered or it is very deeply the selection of the various parameters that went in to the analysis.

There are a whole bunch of assumptions specific for a commercial facility that went into that calculation. Some of those cancel out this dilution effect that you might have for this scenario.

And that's why I said the stakeholders had a lot of opinions and comments. I think DOE would probably say, "Hey, it's not fair from a scenario perspective for us to effectively be using this scenario that won't apply to us because of where our waste is and how it's distributed."

And some of our other stakeholders said, "Hey, the analysis to support part 61 had assumptions built in it that aren't appropriate for these WIR sites."

They were both right. So I think it is a benefit that can result in if you have thin layers of concentrated material, which is generally what a lot of these sites have that can result in those being classified as less than class C from a risk perspective, as it should be. But it's not going to allow you if you have a large quantity of waste buried near the surface that is less than three meters from the surface to be classifying that as less than class C when if you used the part 61 approach, it would be greater than class C. That is not going to happen.

VICE CHAIRMAN CROFF: Okay. Thanks. Well, I guess it gets the risk-informed award for the day for sure.

I would like to generalize that, generalize off of this, and go back to something that you mentioned at the outset, Anna, on the generic issues. They have been mentioned before in previous WIR briefings. In some place, there is a list of them. And I don't recall them all, but concentration averaging I think may be one. And there were a number

of others.

Many of those are of interest to us. And, in particular, those that have more general implications, as Mike was alluding to, this concentration averaging thing is interesting in its own right in WIR, but we are thinking an awful lot about broader waste classification issues. You know, part 61, low-level waste disposal industry is starting to think about it an awful lot now.

And, as your generic issues and work on them goes forward, we would be interested in hearing more about them; in particular, those that may have more general applications and think about that maybe in terms of 61.58, the alternative classification systems, which we have had discussions in other contexts about. And some of these generic issues may well help inform what an alternative classification might look like.

So at some point in the future, we would be interested in, I would say, maybe some kind of a general briefing on the generic issues and sort of where they stand and a little bit of thinking about how they might help us in a broader context.

MS. BRADFORD: I agree with you that there might be some overlap there with the sort of larger

low-level waste issues. And, luckily, the way our branches are set up, the low-level waste, our low-level waste program, is in the same branch as the WIR program. And so there is some synergy there.

We realize that those things might be connected, and we are paying attention to that. And if you want a briefing in the future --

CHAIRMAN RYAN: One of the things we heard at our briefing from NEI last month was that they're thinking about as one of their many strategic planning questions if they would consider a 61.58 petition for alternate classification.

MS. BRADFORD: Right.

CHAIRMAN RYAN: So I second everything Allen said and said this is a real interesting and to my view a very insightful way to begin to think about that in a formal and technically sound fashion.

So would it be okay if we wrote a letter saying that? I don't know how it would work, but I think it is a very positive step. And it actually is a way to think about a lot of things we have been writing letters to the Commission about. So, you know, I think we want to certainly recognize it as something that needs some further exploration and good work to add to the good work you have already done.

MS. BRADFORD: Scott wanted to add something.

MR. FLANDERS: Hi. This is Scott Flanders.

CHAIRMAN RYAN: For the record, would you tell everybody who you are with, although we all know?

MR. FLANDERS: I'm sorry. Scott Flanders, Deputy Director, Division of Waste Management, Environmental Protection.

I agree with the comments, Dr. Ryan, you made earlier now in terms of the potential generic applicability of Dr. Esh's work. We have been thinking about that, particularly if you look at the issues that we are dealing with and the low-level waste strategic assessment that we issued.

And if you look at the topics that we have there, in looking at those topics and as we move forward, we see some opportunities to explore how we can leverage some of the work that has already been done. So we fully intend to do that. And we will look for opportunities as we work forward on low-level waste strategic assessment, implementation of the various activities that we are going to do in our low-level waste strategic assessment that come and talk about it in a more generic sense as well as we

wrap up some of the generic technical issues that come back and fill you in.

But we see many opportunities where a lot of this work, as Anna mentioned the fact that the groups -- it's the same groups working on the issues and the opportunity for the integration.

But no, we did not miss the importance of being and the potential to be able to apply this into some of the low-level waste issues we see as we move forward.

CHAIRMAN RYAN: Great. Thanks.

MR. FLANDERS: Thank you.

VICE CHAIRMAN CROFF: Staff? Anybody else?

(No response.)

VICE CHAIRMAN CROFF: With that, thank you very much for a great presentation. It was very interesting.

CHAIRMAN RYAN: Yes. It was great.

MS. BRADFORD: Thank you.

VICE CHAIRMAN CROFF: I look for something a little bit drier in comment resolution, but this had a couple of pearls in here.

CHAIRMAN RYAN: I said it before, but I will say it again. This is one of the most talented

performance assessment teams I have ever seen put in one place. So congratulations again.

VICE CHAIRMAN CROFF: Now they are going to want a salary increase.

(Laughter.)

VICE CHAIRMAN CROFF: Okay. With that, I guess 15 minutes, Mike?

CHAIRMAN RYAN: Yes. We will take a 15-minute break. We will resume at 2:20.

(Whereupon, the foregoing matter went off the record at 2:07 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Nuclear Waste & Materials 183rd Meeting

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Charles Morrison
Official Reporter
Neal R. Gross & Co., Inc.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Mallinckrodt, Inc., Downtown St. Louis Site Decommissioning Project

Lydia Chang, Chief, SPB/DWMEP

October 18, 2007

TOPICS

- Mallinckrodt Site History
- Facility Description
- Decommissioning Approach
- Decommissioning Status & Schedule
- Outstanding Issues
- Path Forward
- Questions

Mallinckrodt Site History

- Plant opened in 1867, produced uranium compounds for MED-AEC (1940s-1960s)
- 1942-1958 - extracted U from ore, produced purified U for defense purposes
- 1956-1960 - extracted Cb (also known as Nb), Ta, U, Th, and rare earths for AEC

Mallinckrodt Site History (continued)

- 1956-1977 - produced U & Th salts for AEC
- 1961-1985 - extracted Columbium and Tantalum (C-T) for commercial purpose
- 1987 - shut C-T extraction down
- 1993 - possession-only license for Decontamination & decommissioning
- Currently – produces products for food, cosmetics, and pharmaceuticals

Facility Description

- Facility comprises 43 acres on west bank of Mississippi River
- Facility subdivided into 10 "Plants"
- Former C-T process area – 4.2 acres
- C-T process area – mainly Plant 5, but also parts of Plants 1, 3, 6, 7, 8

Mallinckrodt Downtown St. Louis Site Aerial

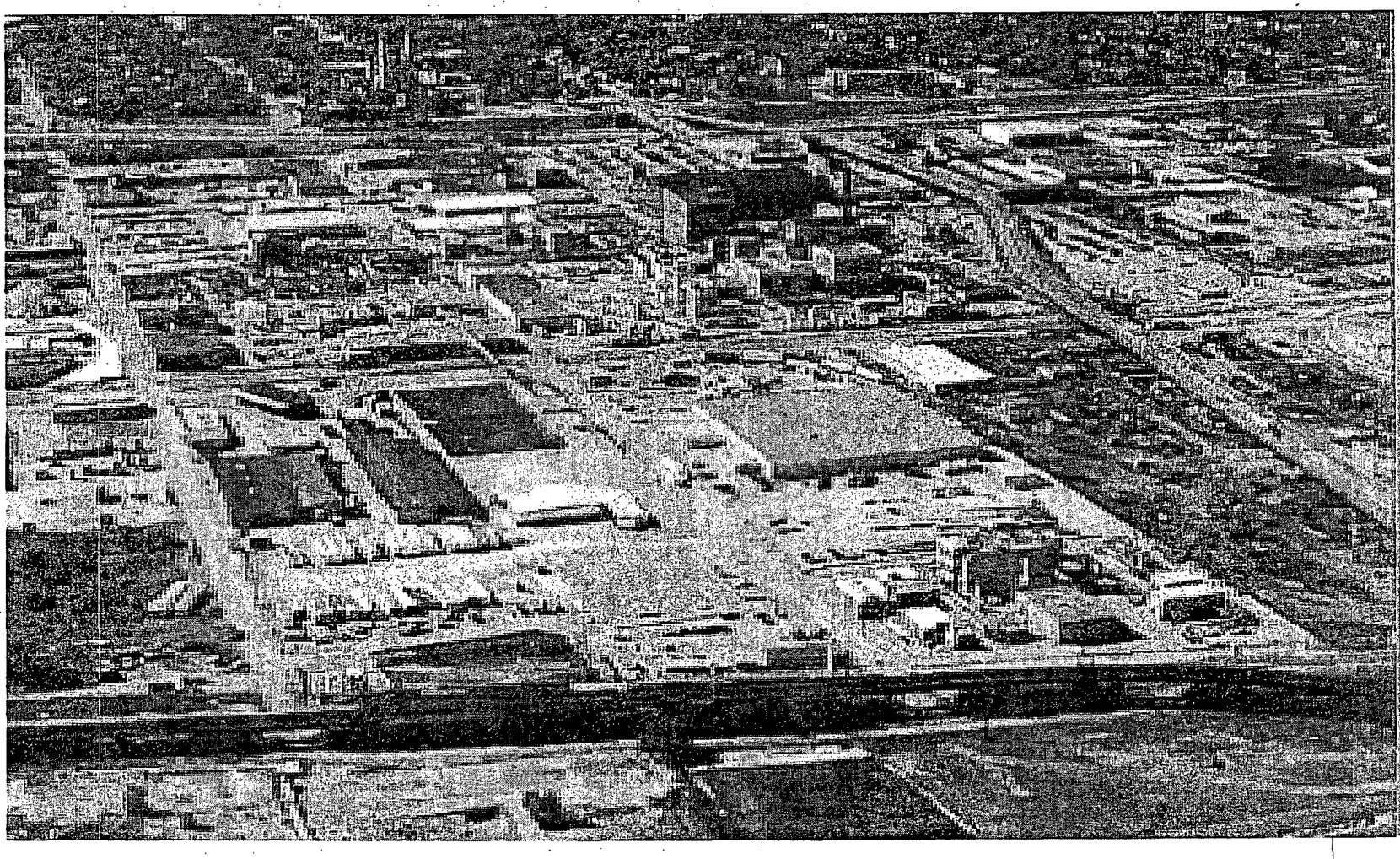
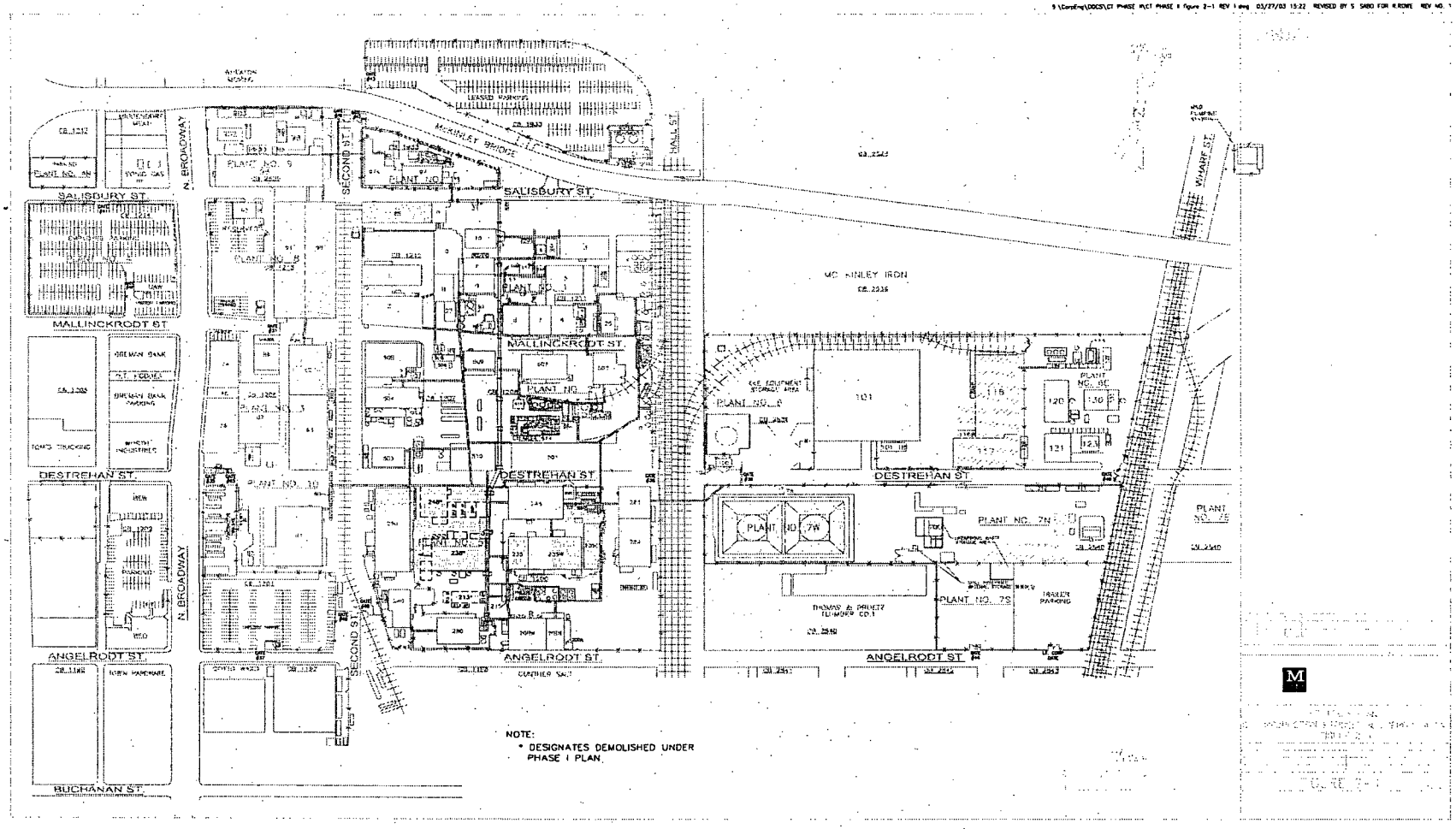


Figure 2-1; C-T Process Area



Decommissioning Approach

- Mallinckrodt to remediate AEC/NRC material
- USACE to remediate MED-AEC material under FUSRAP
- Phased decommissioning project
  - Phase 1 - buildings and equipment
  - Phase 2 - building slabs and foundations, paved surfaces, and all subsurface materials
- Remediate for unrestricted release
- Terminate NRC license

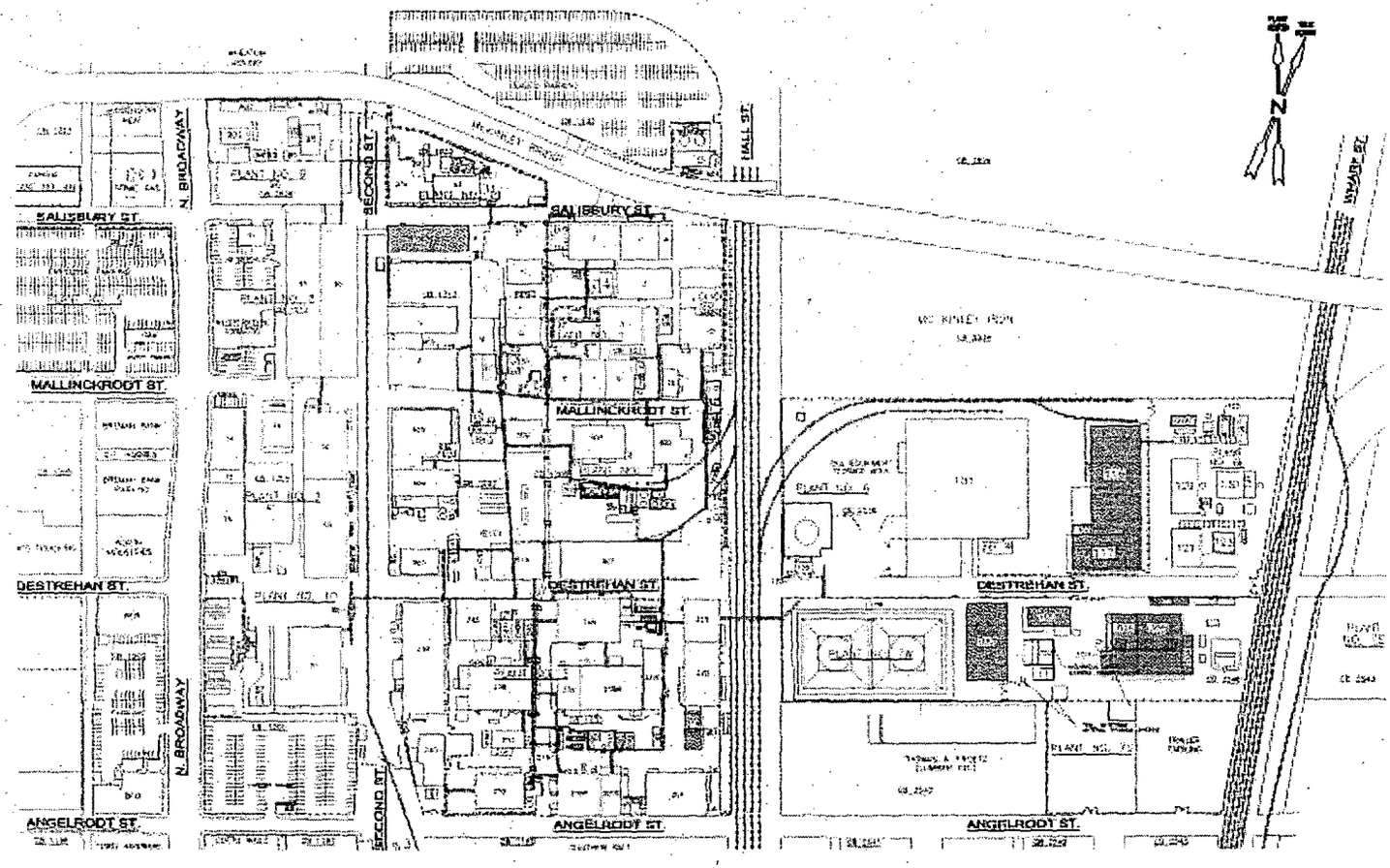
Decommissioning Status & Schedule

- **FUSRAP remediation activities**
- **Phase I**
  - **remediation began - July 2002**
  - **completed - February 2005**
- **Phase II**
  - **DP submitted – May 2003**
  - **License amendment request to remove URO in nine trenches in Plant 6W submitted August 2007**

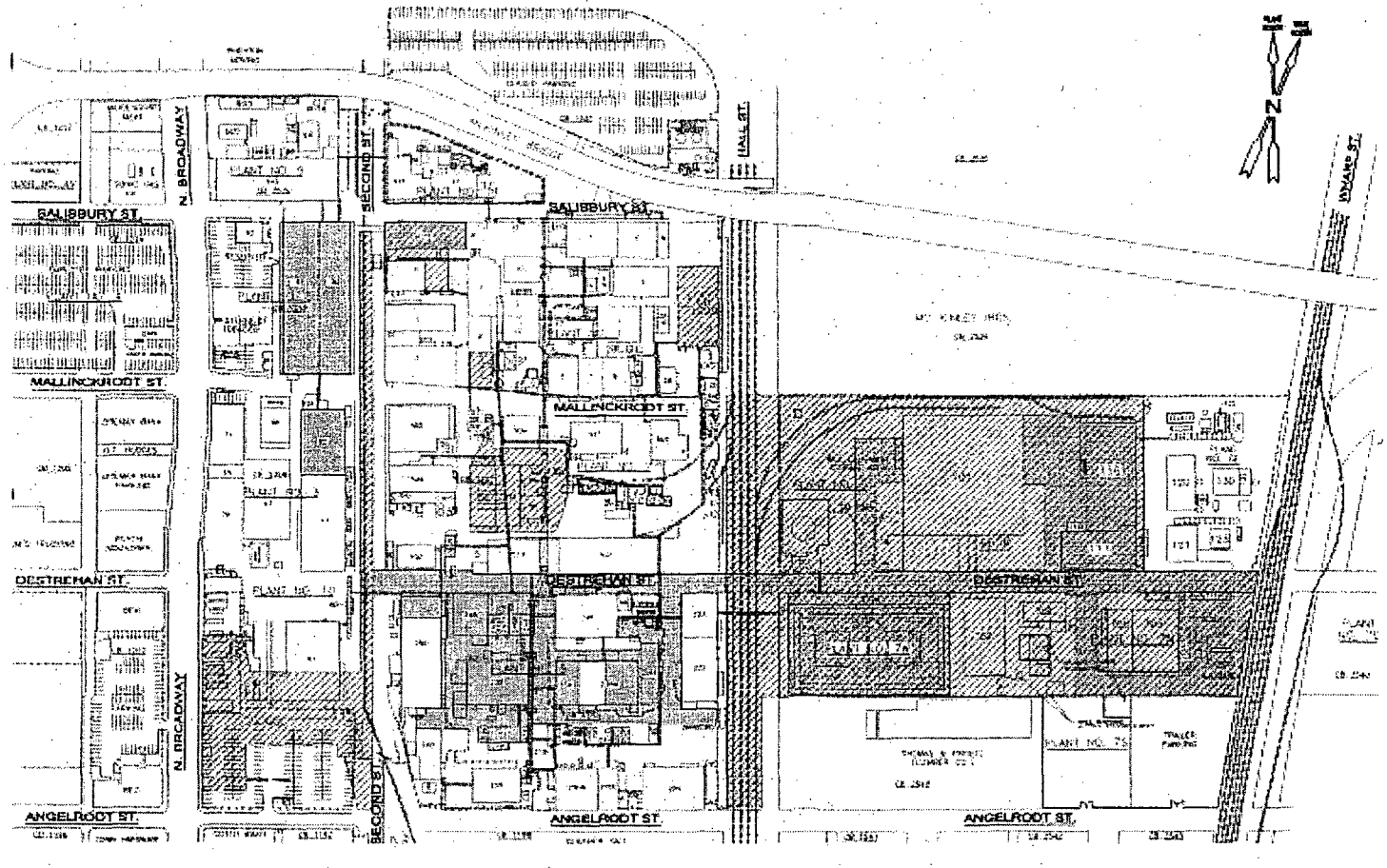
FUSRAP Remediation Activities

- All Plant 6 & 7 buildings used to process uranium demolished by DOE
- Remediation of MED-AEC operation areas under FUSRAP transferred from DOE to USACE in 1997
- USACE soil remediation activities ongoing

FUSRAP Buildings



C-T Production and MED-AEC Operation Areas



C-T Process and Support Buildings

TABLE 2-1
C-T PROCESS AND SUPPORT BUILDINGS

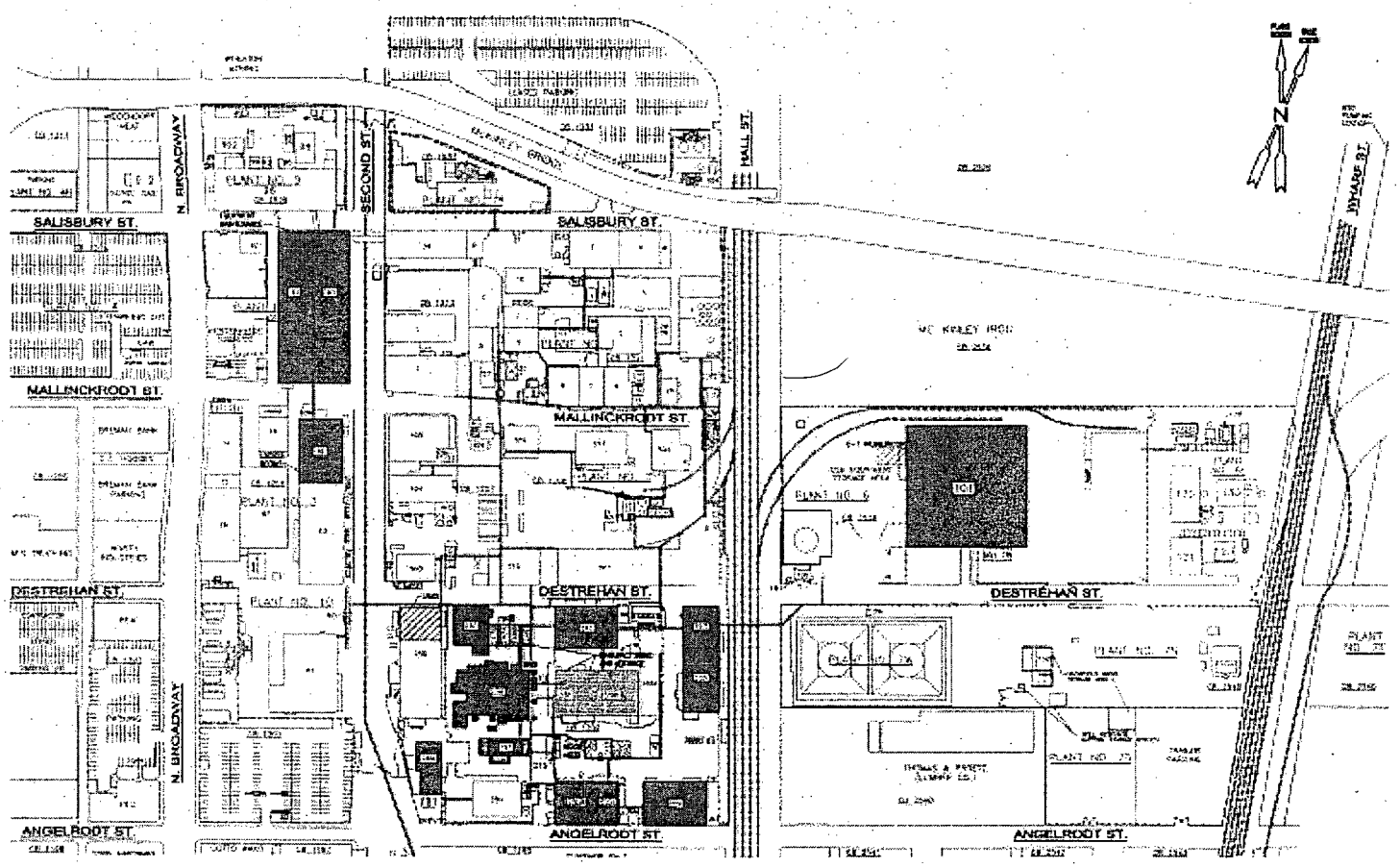
Building No. and Location	C-T Process and Support Areas
Plant 1 Area	
Building 25 (FUSRAP)*	Laboratory
Plant 3 Area	
Building 62	Change Rooms (Lockers)
Plant 5 Area	
Building 213	Change and Break Rooms
Building 214	Transformer/Switchgear Room
Building 235	Feed Material/Storage (East Half)
Building 236	Feed Material Storage
Building 238	C-T Ore Grinding/Dissolving/T Processing
Building 246A	Offices
Building 246B	Solvent Extraction Process
Building 247A	C-T Solvent Extraction/Product Storage
Building 247B	Columbium Filtration and Drying
Building 248	Columbium Filtration/Drying/Calcining
Building 250	Offices and Quality Control Labs
Plant 6 Area	
C-T Incinerator	C-T Incinerator
Building 116 (FUSRAP)	Receipt/Unloading of C-T Ore
Building 117 (FUSRAP)	URO Drum Preparation and Staging
Plant 7 Area	
Building 700 (FUSRAP)	Storage of Tin Slag Feed Material
Building 704 (FUSRAP)	URO Drum Storage
Building 705 (FUSRAP)	C-T Ore Storage
Building 706 (FUSRAP)	C-T Ore Storage
Building 708 (FUSRAP)	Storage of Tin Slag Feed Material
Plant 8 Area	
Building 90/91	Maintenance Areas

* (FUSRAP) These buildings are being addressed under FUSRAP.

Phase 1 Decommissioning

- Phase 1 decommissioning activities included removal of equipment, clean and release of C-T operations buildings, and building demolition

Phase I Demolition



Phase 2 Decommissioning

- During Phase 2 Mallinckrodt will remediate C-T processing building slabs, sewerage, wastewater neutralization basins, and soil affected by C-T processing

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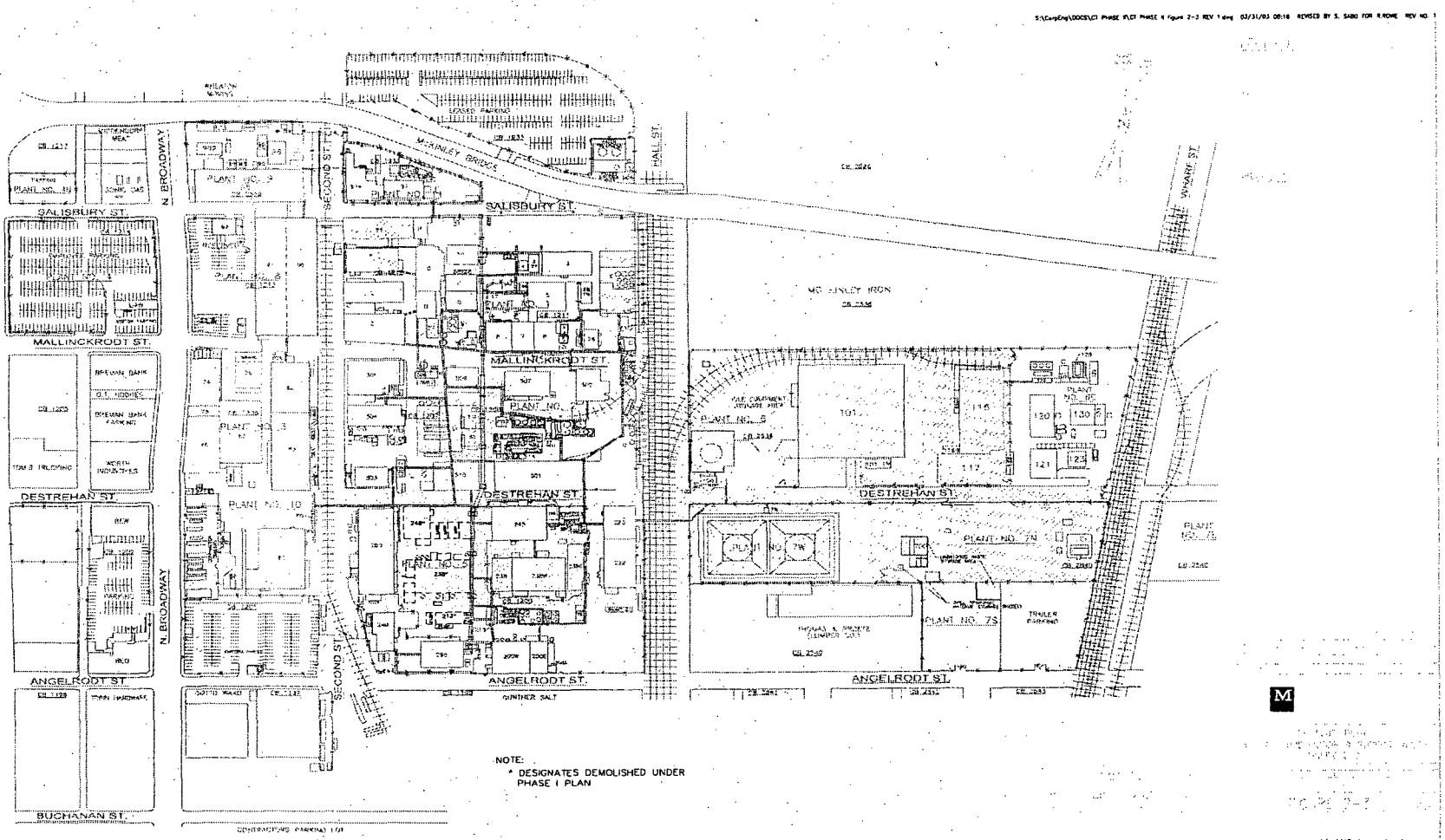
Phase II D&D Impacted Areas



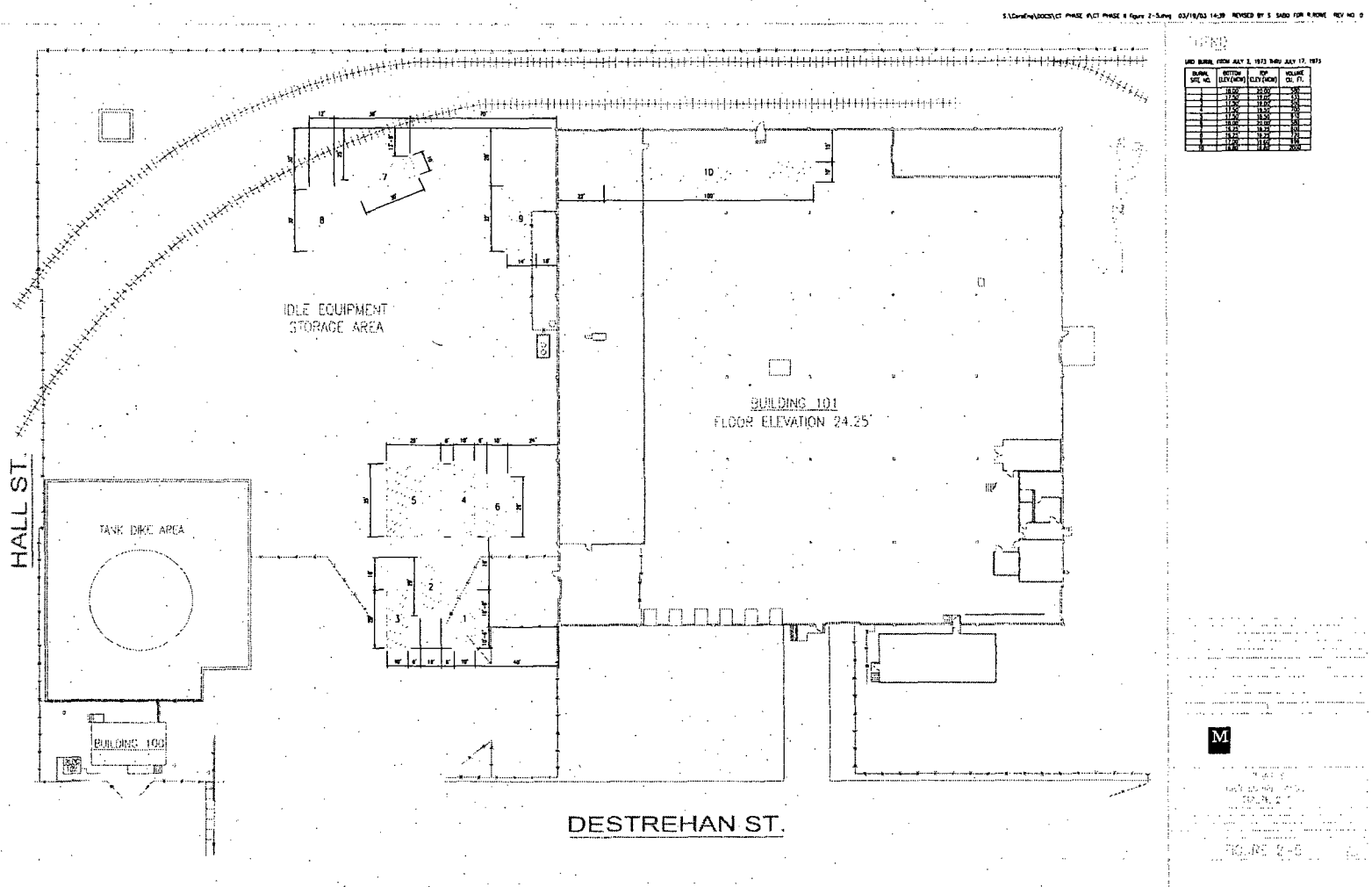
Plant 6W URO Source Removal

- In 1972-73 Mallinckrodt buried URO in Plant 6W trenches in accordance with 10 CFR20.304

- License amendment request to remove & dispose of URO burials in nine trenches

- USACE removes FUSRAP wastes once licensee completes URO removal

Plant 6W Burials



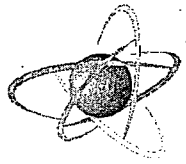
Outstanding Issues

- Delineation issues for Plant 6W soil around trenches
  - Apparent inconsistencies between Agreement and license amendment request
  - Request to withhold Agreement from public disclosure
- Approval of Phase 2 DP
  - Delineation of responsibility for contaminated soil within the facility

Path Forward

- Mallinckrodt and USACE must reach agreement on delineation of responsibility for remaining areas of the facility

- NRC and Mallinckrodt must agree on resolution of outstanding issues to approve Phase 2 DP



U.S.NRC

- **QUESTIONS**

Holtec Perspective on TADs

Mr. Kristopher Cummings
Manager of DOE Projects
October 18, 2007

HOLTEC

Agenda

- History
- Work performed
- Final TAD Specification
- Holtec Perspectives on TAD Concept
- Holtec Technology to Benefit DOE
- Holtec Users Group (HUG) Perspectives
- Path Forward
- Potential Obstacles
- Conclusions

HOLTEC

History

- November 2006 – DOE Issues TAD Specification.
- December 2006 – Awarded contract with DOE for Design Concept.
- February 2007 – Design Concept Report submitted to DOE.
- March 2007 – Presented Design Concept to DOE
- June 2007 – Final TAD Specification Issued.
- August 24, 2007 – Submitted TAD Proposal.
- Currently awaiting DOE feedback on TAD Proposal.

HOLTEC

Work Performed for Design Concept

- TAD Canister Design (TAD-21 and TAD-44)
- Aging Overpack Design (similar to storage overpacks)
- Transport Overpack Design
- Scoping thermal, criticality, shielding and containment analyses performed to verify design
- Scoping structural analysis including basket stresses, side/end drop analysis and seismic analysis

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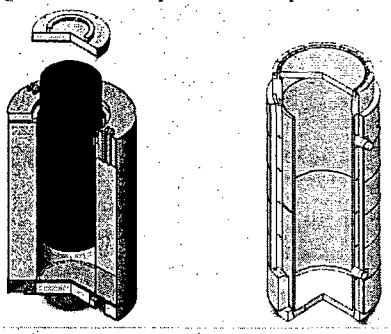
Aging and Transport Overpacks



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Holtec TAD Conceptual Design

- TAD Canister
  - Honeycombed fuel basket providing uninterrupted heat path to canister exterior.
- Aging Overpack
  - METCON™ (metal and concrete) aging overpack
    - Steel weldment with homogeneous concrete
    - No rebar or other sources of crack propagation
- Transport Overpack
  - Layered gamma (steel) and neutron shielding (Holtite™)
  - Top and bottom flanges that connect to the containment boundary.

HOLTEC

Improvements Made to Final Specification

- Variable length of TAD canister allows use of existing HI-STORM cask for storage with no design changes.
- Integral lifting device removable.
- Trunnions on transport cask simplified, in-line with existing transport casks.
- Forced helium dehydration allowed (not just vacuum drying).
- 1ft TAD Canister drop on steel surface.
- Transportation cask has upper fixed trunnions and lower pocket trunnions.
- Added 5" to max diameter of aging cask (presumably to counter the 3g earthquake).

HOLTEC

Additions Made to Final Specification

- Railcar skid design added.
- TAD Waste Package Spacer (TWPS) added.
- Aging cask to withstand 3g earthquake and remain upright.
- More severe fire scenario (1720° F, 30 minutes).

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Holtec Perspectives on TAD Concept

- TAD advantage is standardization of storage/aging/transportation/disposal system.
- TADs do not eliminate the need for dry storage at the nuclear plant sites due to thermal loadings/dose
  - Storage cask loaded at 38 kWatts
  - Transport cask licensed at 22 kWatts (20 years cooling)
  - Aging cask will only be loaded with transportable TADs
  - Waste package requires 11.8 kWatts (30 years cooling)
- Vertical operations for Aging Cask, transfer cask at GROA is simplest operational sequence available.

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Holtec Perspectives on TAD Concept

- To be able to transport higher heatload TADs in a reasonable time frame, canisters **must** be loaded with regionalized loading (hot fuel center, cold fuel exterior).
- Bringing cask designers into product development process will improve cask design and loading process.
- Front loader cask transporter (forklift) not the most economical design.
- Heat load capacity set by basket material – Metamic (metal matrix composite) can hold up well in the repository environment.

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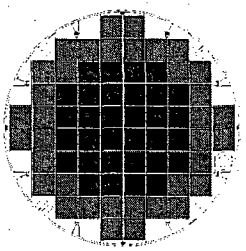
Holtec Perspectives on TAD Concept



Example: MPC-68

- Represents Region 1 (Hot Younger Fuel)
- Represents Region 2 (Cold Older Fuel)

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Holtec Technology to Benefit DOE

- Forced Gas Dehydrator (patented)
- Gamma-Shield Cross Plates for vents (patented)
- Regionalized Loading (Lower dose rates)
- Credit for Thermosiphon effect
- Burnup Credit Methodology Approved (proprietary)
- Currently addressing moderator exclusion and transport of high burnup fuel
- HI-STORM 100U (Underground, patent pending)

HOLTEC

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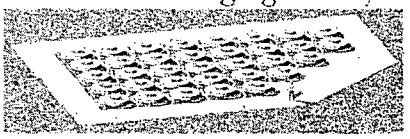
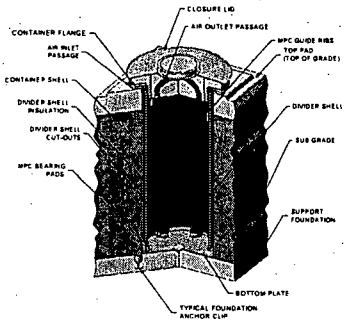
HI-STORM 100U Aging Facility



- Non-existent site boundary dose.
- Virtually zero risk of release of radioactivity from mechanical means (aircraft, missile, etc).
- No damage from environmental phenomena (earthquake, tornado, fire, flood).
- No risk of groundwater intrusion (thick steel container with no penetrations).

HOLTEC

HI-STORM 100U Module



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Benefits of HI-STORM 100U

- No tip-over possible under 3g earthquake since "overpack" is underground.
- No 3" drop from cask transporter.
- 40 mrem/hr dose rate easily met.
- Smaller land area footprint (60% of aboveground systems).
- No handling of a loaded aging overpack (~250 tons).
- All vertical lifts/transfers precludes damage to exterior surface of the TAD Canister during transfer.
- Aircraft impact can only damage 100U lid, no potential to damage TAD canister.
- Simplicity in loading operations at GROA.

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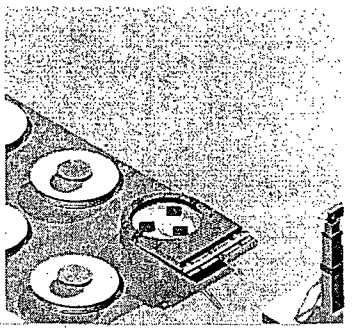
HI-STORM 100U Loading at Aging Facility



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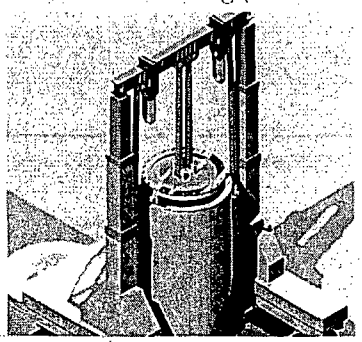
HI-STORM 100U Loading (TAD Transfer)



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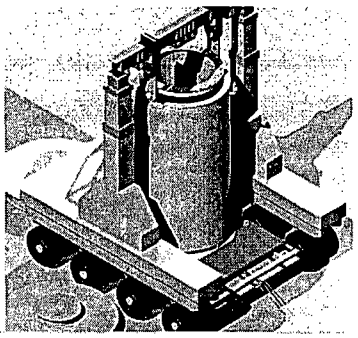
HI-STORM 100U Loading (Remove Transfer Cask)



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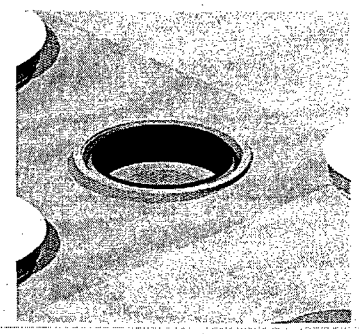
HI-STORM 100U Loading (Lid Installation)



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Holtec Users Group (HUG) Perspectives

- Concept of a "Yucca Mtn Approved" canister is welcomed.
- Lower Capacity is the most significant issue.
  - A larger ISFSI is required (if the land is available)
  - More casks need to be loaded in each campaign (9 versus 6)
  - More time needed to load more casks
  - More casks means more cost.
- TADs will have to be treated as a new cask type (revised procedures, training, engineering evaluations, etc.)
- Utilities have a healthy level of skepticism that TADs will be realized.
- Incentives from DOE will dictate whether TADs are implemented.

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Path Forward

- Ultimate goal is to submit to NRC a SAR for transport cask and storage cask separately in December 2008.
- Provide a SAR type document for the Aging Overpack.
- Large amount of work to be done in a short time frame (3 overpacks, 2 canisters) on a very aggressive schedule.
- Licensing timeframe allowed is 2 years for each license submittal (storage and transport).

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Potential Obstacles

- NRC workload for CSNF:
  - Currently 10 storage and 5 transport applications being reviewed. (and many more expected)
  - TADs would involve up to 8 additional complex applications.
- DOE Review time
- Continued start/stop process
- Licensing review of 2 years – if no contentious issues
- Change process
- Material availability (borated stainless steel) and cost
- Political environment

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Conclusions

- DOE needs to provide additional confidence to the TAD concept implementation.
- Changes in the Final Specification will require redesign of the transport and aging overpack.
- Submittal of transport and storage licenses to the NRC by December 2008 is achievable with a speedy review process and smooth project implementation.
- Future modification to the Specification to include underground aging system and higher capacity systems.
- DOE to get cask designers more involved in GROA operations to simplify design and operation of casks.

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Revision of NUREG–1854
NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations

Anna Bradford
Christianne Ridge
Karen Pinkston

October 18, 2007

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Overview

- Background
- Summary of comments
- Performance assessment
- Radionuclide removal
- Monitoring
- Concentration averaging

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Background

- The objective of NUREG-1854 is to ensure consistency of waste determination analyses and monitoring activities, and to facilitate knowledge transfer among NRC staff
- The NUREG was published as a Draft Standard Review Plan for public comment in May 2006
- NRC received 12 comment letters during the comment period and took part in various interactions with key stakeholders during and after the public comment period
- A letter from ACNW regarding the guidance was issued in December 2006
- NUREG-1854 was revised and published in August 2007 as "Draft Final for Interim Use"

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Letters Received

- Four from States (Idaho, New York, Washington, Oregon)
- One from DOE
- One from the West Valley Citizen Task Force
- One from the Natural Resources Defense Council
- Five from private citizens

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Staff Activities

- Between issuance of the May 2006 and the August 2007 version of the guidance, the staff has:
  - Issued the Technical Evaluation Report for Idaho National Laboratory (INL) tank farm (Sept. 2006)
  - Issued and implemented monitoring plans for Saltstone waste at Savannah River Site (SRS) and tanks at INL (since April 2007)
  - Discussed Request for Additional Information for SRS Tanks 18 and 19 with DOE (Spring 2006)
  - Held discussions with DOE regarding technical issues (beginning in Spring 2006)
  - Held two public meetings with DOE (Nov. 2006, Jul. 2007)

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Performance Assessment
Analysis Approach

- Expanded guidance regarding advantages of probabilistic analyses
- Expanded guidance about sensitivity analysis methods for deterministic analyses
  - Emphasized evaluation of conservatism of assumptions (local or global conservatism)
  - Recommended reviewers use independent probabilistic performance assessment to identify risk-significant assumptions

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Performance Assessment
Dose Calculation

- Revision emphasizes that doses should be reported as TEDE to maintain consistency between §61.41, §61.42, and §61.43
- Use of 25 mrem/yr TEDE limit instead of limits based on ICRP 2 is established in the proposed rule for 10 CFR 63
- Revision emphasizes that dose calculations may be based on dosimetry consistent with 10 CFR Part 20 (i.e., ICRP 26/30) or current ICRP dosimetry (e.g., ICRP 72)
- In the two waste determinations reviewed by NRC pursuant to the NDAA, DOE used dose conversion factors consistent with ICRP 26/30 and quantified dose as TEDE

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Performance Assessment
Topics Identified in Previous Reviews

- Grout degradation
  - Expanded guidance related to specific degradation mechanisms
  - Expanded guidance related to modeling uncertainty in degradation effects
- Point of compliance
  - No change in guidance regarding assumptions about institutional controls
  - Size of buffer zone should be consistent with its purpose given in 10 CFR 61.7(a)(2)

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Performance Assessment
Public Comments

- Public comments addressed both procedural and technical topics
- Additional review procedures address
  - Man-made preferential flow pathways
  - Effects of co-contaminants on radionuclide transport
  - Evapotranspirative barriers
  - Anthropogenic climate change
  - Other technical topics

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Radionuclide Removal

Technology Selection and Removal Efficiencies

- Incorporated ACNW&M recommendations about technology selection, including selection of a suite of technologies
- Clarified guidance about use of removal efficiencies
  - Appropriate in comparison of alternate technologies
  - Appropriate in demonstration of impracticality of additional removal by a selected method
  - Not appropriate as sole evidence of removal to the maximum extent practical

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Radionuclide Removal

Cost-Benefit Analyses

- Expanded discussion of disadvantages of quantifying benefits in terms of collective dose averted
- Added guidance about the appropriate scope of cost-benefit analyses, including environmental benefits and non-radiological risks
- Added examples of highly radioactive radionuclide selection and consideration of uncertainty in cost-benefit analyses

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Monitoring

- Monitoring provides a way to manage uncertainties inherent in any long-term dose prediction but is not a substitute for a robust demonstration of compliance
- Revision provides additional detail about
  - Types of monitoring activities related to each performance objective
  - Interactions with DOE and the affected States
  - Documentation of monitoring results
- Specific monitoring plans focus on the most risk-significant aspects of a disposal facility, as identified in the staff's technical evaluation reports. The plans describe information needs but are not prescriptive

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Waste Classification

- The NDAA requires additional consultation if the waste does not meet the Part 61 Class C concentration limits
- The Part 61 concentration limits were derived based on assumptions that may not apply to incidental waste
- 10 CFR 61.55(a)(8) provides for the use of concentration averaging in waste classification

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Concentration Averaging

- Category 1 – Physical Homogeneity
- Category 2 – Stabilization to Satisfy §61.56
- Category 3 – Site Specific Averaging (new)

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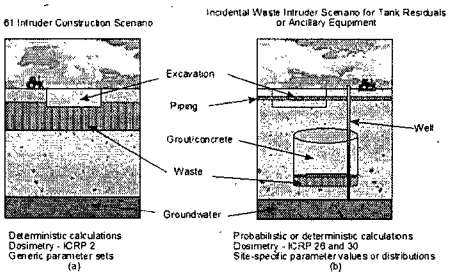
Category 3 – Site Specific Averaging



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Averaging Expression Scenarios

Scenario	Typical Waste Access Time (yr)	Waste Disruption Process	Receptor Type
Shallow waste, no intruder barrier	100	Residential Construction	Construction worker–acute or Resident–chronic
Shallow waste, intruder barrier	500	Residential Construction	Construction worker–acute or Resident–chronic
Deep waste, no intruder barrier	100	Well Drilling	Well driller–acute or Resident–chronic
Deep waste, intruder barrier	500	Well Drilling	Well driller–acute or Resident–chronic

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Example Averaging Equations

- Example averaging expressions were developed for use by NRC staff to determine when site specific calculations may require additional staff review effort
- Conservative assumptions were used in the development of these expressions
- The equations are not to be used as the basis for waste classification

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Example Averaging Equations
Conceptual Approach

- Goal is to develop equations that compare a new analysis for incidental waste to the Part 61 analysis

$$C_{i,j} * V_i * X_{i,j} = D_{i,j}$$

Combining the equations for the Part 61 and new analyses and rearranging gives:

$$\frac{C_{N,j}}{C_{61,j}} * V_N * \frac{X_{N,j}}{V_{61} * X_{61,j}} = \frac{D_{N,j}}{D_{61,j}}$$

where:
- i = the analysis index (either 61 or N)
- j = radionuclide index
- D_{ij} = intruder dose from radionuclide j
- C_{ij} = concentration of radionuclide j
- V_i = volume of waste exhumed
- X_{ij} = conversion factor to convert a source to an intruder dose (function of dosimetry, parameters, uncertainty, assumptions)

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Development of Averaging Equations

- A probabilistic GoldSim model was used to calculate the intruder dose for each scenario for unit concentrations of radionuclides
- The mean dose calculated by GoldSim was used in determining the value of the constant for each radionuclide
- Class C concentration limits in Part 61 were assumed to correspond to a 500 mrem dose for the LLW facility considered in the Part 61 analysis (i.e., $D_{61,j}$=500 mrem)

$$\frac{X_{N,j}}{V_{61} * X_{61,j}} = Constant = \frac{C_{61,j}}{D_{61,j}} * \frac{D_{GoldSim,j}}{C_{GoldSim,j}} * \frac{1}{V_{GoldSim}}$$

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Development of Averaging Equations (cont.)

- The averaging equations were created for each scenario using the constant from the limiting radionuclide

$$\frac{C_{waste,j} * V_{Waste\_exhumed} * Constant}{C_{Part\_61\_tables,j}} = RC_j$$

- The sum of fractions approach is used for multiple radionuclides

$$\sum RC_j \leq 1$$

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Conclusions

- The guidance has been revised, taking into account public comments and increased staff experience
- The guidance is flexible and applicable to many different types of reviews, while providing a consistent review basis
- The staff looks forward to continuing to interact with the ACNW

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