DEPARTMENT OF HEALTH

STATE OF HAWAII

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| In the Matter of | ) | Docket No. 19-UST-EA-01 |
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| U.S. NAVY'S APPLICATION FOR A UST PERMIT FOR THE RED HILL BULK STORAGE FACILITY. | ) | VOLUME III |
| | ) | (Pages 454 - 761) |
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The above matter came on for hearing via Zoom Videoconferencing, commencing at 8:00 a.m., on Wednesday, February 3, 2021.

BEFORE:
LOUIS L. C. CHANG, ESQ., Hearing Officer

APPEARANCES:

For the U.S. Navy:
JONATHAN McKAY, ESQ.
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KARRIN MINOTT, ESQ.
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Reported by: Donna N. Baba, CSR #103
Certified Shorthand Reporter

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P R O C E E D I N G S

HEARING OFFICER CHANG: Let's go on the record. Good morning, everyone. May we get the appearances, and please indicate those who are with us at the hearing.

MR. MCKAY: Yes. Good morning, sir. We have for the Navy, myself, Jon McKay and Mr. Mike Law with the Office of General Counsel for the Navy; and we have Ms. Marnie Riddle with us now, and Karrin Minott will be joining us with the Naval Litigation Office.

HEARING OFFICER CHANG: And some of your witnesses are present?

MR. MCKAY: Yes, sir. Dr. Gaur Johnson is here as well, and we -- I'm sorry, we also have Mr. Frank Cioffi and Curt Stanley, who are with our ACOM, our expert consultants.

HEARING OFFICER CHANG: Okay. And then for the Board.

MR. BROWN: The Board you have David Brown, Ella Foley Gannon, Wogai Mohmand from Morgan Lewis & Bockius on behalf of the Board of Water Supply. Also in attendance is Jeff Lau from the City and County of Honolulu, and as witness participants we have client representative Erwin Kawata, and our two expert witnesses, Dr. David Norfleet and Dr. Nicole DeNovio.

HEARING OFFICER CHANG: All right, very good. Thank you. And then for the Sierra Club?

MR. FRANKEL: Good morning. David Frankel for the Sierra Club. Sierra Club members and representatives are all glued to the YouTube Live.

HEARING OFFICER CHANG: Okay. And for the Environmental Health?

MR. PAIGE: Department Attorney General James Paige, client representatives Lene Ichinotsubo, Roxanne Kwan, and Fenix Grange.

HEARING OFFICER CHANG: All right, very good. Good morning, everybody. Hope everybody's well rested for our day.

We are going to start with the next witness, Dr. Gaur Johnson. Dr. Johnson, may I ask you to take your oath at this time. The court reporter will administrator the oath.

Whereupon,

GAUR JOHNSON,

called as a witness on behalf of the United States Navy, being first duly sworn by the court reporter, was examined and testified as follows:

MS. RIDDLE: Thank you. Dr. Johnson is a registered structural engineer employed by the Navy. He has earned three degrees, including a doctorate in civil

engineering from the University of Hawaii at Manoa.

DIRECT EXAMINATION

BY MS. RIDDLE:

Q. Dr. Johnson, could you please briefly summarize the direct testimony that you've given so far in this case.

A. Okay. So the direct testimony includes some of my background. Also addressed some of the construction, the methods of construction of the tanks themselves, and my understanding of that construction. Also addressed some of the issues with regard to seismic and earthquake hazards relative to the tank construction. Also addressed some issues with regard to corrosion related to the lining of the reinforced concrete tanks.

Q. Thank you. I believe there was a printing error in your testimony. If we could bring that up now. I'll bring it up on my screening and we can look at what that is and how it should read. One moment.

So this is -- can everybody see the bottom part of page 25?

HEARING OFFICER CHANG: Yes.

Q. There's a bit of overlap on the last line. The last sentence should read: I have not seen any data indicating that the reinforcement embedded in the concrete has begun to corrode as supported by the

following data reported in the destructive testing report. Then the next line, which is overlapped there, should be a bullet point reading: Chloride levels in the concrete are low.

Does that comport with what you meant to say here?

A. Yes.

MS. RIDDLE: All right, thank you. We'd like to present the witness at this time for cross-examination.

HEARING OFFICER CHANG: All right, thank you. For the Board, who will be handling the examination?

MR. BROWN: I will, Hearings Officer Chang.

HEARING OFFICER CHANG: All right, Mr. Brown.

CROSS-EXAMINATION

BY MR. BROWN:

Q. So good morning, Dr. Johnson, and thank you for taking the time to join us today. Yesterday we heard quit a bit of testimony about the extensive corrosion that is afflicting the steel liner of the Red Hill tanks, and we also heard testimony about two common forms of corrosion protection, coatings and cathodic protection. I'd like to ask you a couple of questions about your opinions on those forms of corrosion protection.

Is it your opinion that as the Red Hill tanks are currently configured and proposed to be operated in the Navy's permit application, that the implementation of cathodic protection at the exterior surface of the Red Hill tanks' steel liners is not possible?

A. Because of the presence of reinforced concrete tank and the method for using a cathodic protection system to provide the protection at the outer surface, the concrete actually will inhibit the flow of ions that will be needed to provide that protection, and so it becomes an onerous task at that surface.

Q. And is one of the reasons that it is -- well, let me take this back. So you're saying it's not possible, or it's not feasible, or it's not practical? What is your opinion on that?

A. So my understanding, and I think there's a NACE, National Association of Corrosion Engineers, and other documentation that in this particular setup it would be difficult to make it effective. Basically the performance would be hard to implement and guarantee.

And cathodic protection, depending on the type of system, could potentially set up other issues, such as stray currents, et cetera, that could potentially exacerbate corrosion in certain areas. And so it would be very difficult, and I think would not be a

recommended path forward to mitigate the corrosion at this site.

Q. Is one of the reasons that you believe it would not be recommendable to employ cathodic protection is because there are gaps between the steel liner and the concrete?

A. It's my understanding that there were some observed steel gaps, and that would be one of the things that you'd need to mitigate. By creating that gap you're not able to complete the circuit, and that's basically what a cathodic protection system is, it creates a circuit. And so if you're not able to complete the circuit you're not able to provide the uniform protection that a cathodic protection system is intended to provide.

Q. Okay, thank you. I'd like to switch topics real quick to some of your testimony regarding seismic issues at Red Hill. Are you aware that the Navy is planning on performing an assessment of the seismic risks to the Red Hill Facility as what was initially presented as Phase 3 of the Quantitative Risk and Vulnerability Assessment?

A. As I recall, yes, the risk assessment seismic portion wasn't the initial -- they didn't do it in the Phase 1. I believe they had developed or are developing a scope of work to improve the seismic evaluation.

Q. Are you involved in that development of the scope of work for the seismic evaluation?
A. Not directly involved, but I did speak to Frank Kern at EXWC about that. I think -- I believe he or others within EXWC are developing the scope of work for that.
Q. And so is it fair to say that the Navy has not quantified the seismic risk, or finished its risk assessment at this time?
A. I think it's fair to say that the seismic portion of that risk study was not conducted because of the understanding that the seismic contribution to risk at this site is relatively low compared to other items that were assessed in the, I think, Phase 1 of the risk assessment.
Q. But Phase 2 or 3 of the risk assessment has not been completed; is that correct?
A. Yeah, I believe recently they've developed a scope of work. I don't know the status on the consultants they're using to do that. I think that's part of the AOC process is to go through the different risks and add that to their overall model, and so, yeah, I believe they're at the beginning stage of doing a detailed assessment for potential items that would be affected by the seismic catheter.

Q. Okay. You stated in your written testimony that the tank structures at Red Hill performed well during an earthquake on June 28, 1948; is that right?
A. Sounds right, yes.
Q. Do you recall what the magnitude of that earthquake was?
A. I believe there's a Cox report that is one of the exhibits that actually shows a table that -- I don't know if we could bring that up.
Q. Cox report?
A. Yeah.
Q. Is that a part of your written testimony?
A. I do refer to it in the written testimony, I believe. I think that's Navy 62, or N-062.
Q. Okay. Let me pull up your written testimony for you. Okay, can you see my screen, Dr. Johnson?
A. Yes.
Q. Is this the reference that you were making to Dr. Cox? I'm sorry, Doak C. Cox, Exhibit N-62.
A. Right. Yeah, it looks like there in the testimony I summarized that, yeah, estimated magnitude of 4.8, yeah.
Q. And so that's not a particularly strong earthquake, is it?
A. Not necessarily, no.

Q. And it's not nearly as strong as the February 1871 earthquake that you referenced with a magnitude estimated to be 7.0; is that right?
A. Well, for the shaking at the -- that was observed at the Red Hill site and is detailed and summarized in a table in the Cox article, at the Red Hill site they were similar in magnitude. But because the 7.0 or Lanai earthquake was at a greater distance, then the level of shaking on Oahu was less.
Q. Okay. So is what you're saying is if the 7.0 was closer to Oahu, it would have resulted in more shaking?
A. Yes.
Q. Do you know how many gallons of fuel were released from the Red Hill Facility as a result of the 1948 earthquake?
A. I don't specifically recall the number.
Q. I'd like to pull up a document for you here. Are you familiar with the Engineering Survey of U.S. Navy Petroleum Facilities at Pearl Harbor prepared for the Navy in 1948 by Bechtel Corporation?
A. Yes. And I reviewed that specifically with regard to Tank 16, so I didn't review the entire report, but was more focused on the post-seismic analysis or investigation.
HEARING OFFICER CHANG: Do we have an exhibit

in reference to that?

MR. BROWN: Yes.

Q. I'm showing you Exhibit B-12. Can you guys see my screen?

A. Yes.

Q. Okay. So does this look like the Bechtel report we were just discussing?

A. It looks like it if I recall. Maybe if you scroll down to the bottom there, have the actual --

Q. I could scroll down. Does that look right?

A. Yes.

Q. And we're here on page 2 of the PDF which the Bates No. BWS003939, and under item No. 2 it states that Bechtel was directed to proceed with the survey at the very same day, June 28, 1948, the earthquake occurred, isn't that right?

A. They did do an investigation after the earthquake. I don't specifically recall when they started the inspection, but it was -- they were inspecting Tank No. 16.

Q. Yeah. The survey started here it says on August 16, but very close in proximity to the actual earthquake, wouldn't you agree?

A. Yes.

Q. Okay. Let's move to page BWS003966, which is

page 29 of the PDF for ease of reference. This report documents a total leakage in the order of 1100 barrels as the result of the 1948 earthquake. Isn't that correct?

A. So they indicate that there was a leakage, and in this Bechtel report they weren't able to necessarily attribute it to structural damage of the tanks themselves. So when I speak of, as a structural engineer, when I speak of a tank's performance as a structure, I'm talking about the reinforced concrete tank, so I did not see anything in the report that spoke of damage to the structure.

There was leakage, as indicated, and I reviewed this document, and then there's also a document which talks about the history of Tank 16 where they do talk about some of the narrative in this Bechtel report, including some additional testing they did after Bechtel was done with their investigation. Bechtel did not come to a firm conclusion, and during testing and the process after Bechtel was done to get this tank back up and running, they continued to have some leaks, and they eventually discovered it actually, I believe, in 1952.

So I could -- I think in Exhibit B-194, I believe it is, is the tank history, and I can sort of walk you through that timeline to show that it's not necessarily

the structure, but my understanding, based on what I've read, is it's more the telltale system, that's no longer used in the tanks, and their connection to the liner may have been a contributing issue of why they would identify leakage within the telltale system.

Q. So if I understand you, Dr. Johnson, what you're telling me is when you testified in your written testimony that the tank structures at Red Hill performed well, you were talking about the concrete and not about the steel or the pipelines or any other places where leaks could occur, you were focused on the concrete?

A. Yeah. So the reinforced concrete tank, I see the lining as a liner which is not a part of the structure, it's not needed for structural integrity per se, but to the extent that the deformations that the tank structure may have gone through, items that are attached to structures, such as the telltale system or other pipes, et cetera, can be vulnerable to damage during an earthquake.

And so that's, I guess, my understanding based on the data that I have now is that that telltale system was susceptible to damage, and a small amount of movement by an earthquake could have exacerbated that system's integrity or ability to prevent leaking into that system.

Q. I appreciate that clarification. So, and just to make sure I have this right, so you're not stating in your testimony that earthquakes can't cause fuel releases, are you?
A. Well, depending on the magnitude of the earthquake, anything is possible. But based on the hazard at this site, and the hazards that we designed to, by modern day and the historical earthquakes that we've had, I think the pending report was accurate to say that there's a relatively low risk for this site to be significantly affected by seismic ground motion.
Q. But the Navy has not finished its risk assessment to make its own conclusions on that, has it?
A. Well, so like with any evaluation in structural engineering, you take a first pass at understanding what the situation is, what are all the contributing factors to a potential problem that there is, and so that first iteration I think rightly reached the conclusion that the seismic hazard was low, and we understand that there is still concern with that, and just as a part of the AOC process seismic was going to be evaluated and why it's in there, the risk analysis and a more detailed study of the behavior and the interaction of the concrete with the surrounding rock during a seismic event is going to be undertaken.

Q. So a leakage in the order of 1100 barrels would correspond to over 40,000 gallons of fuel released into the environment, wouldn't it?
A. I don't recall the specific conversion factor between barrels and gallons.
Q. Do you have any reason to believe that's not accurate?
A. Your conversions can be problematic, but okay, yeah, it sounds -- I know there are more gallons than barrels, so it sounds like it's in the right order of magnitude.
Q. So, and just to make clear, you would not be saying that a fuel release of over 40,000 gallons as a result of an earthquake meant that the tank liner or non-concrete structures would be performing well, would you?
A. Sorry, can you repeat the question?
Q. Sure. You previously testified that your description of the tank structures performing well was limited to the concrete, and so I'm just making sure you're not saying that a release of over 40,000 gallons means that the tank liner and/or, you know, pipeline-related structures surrounding the tank performed well?
A. So I guess based on this earthquake and the

performance during that earth quake, one of the 20 tanks had an issue. My understanding, based on my analysis of the document you have here and the overall history of Tank 16 as described in another document is that the vulnerability that may or may not have resulted from seismic is related to the telltale system, and so if the telltale system was still in use, then that might represent a hazard if an earthquake the size of the one that occurred in 1948 were to occur again.

However, that telltale system is no longer in use and I think that's a good thing, because it's my understanding that the telltale system had problems, irrespective of the seismic threat as well.

Q. Do you know, Dr. Johnson, if the Navy ever found the over 40,000 gallons of fuel that was released into the environment as a result of the 1948 earthquake?

A. I'm unaware of the specifics of that part of the analysis. I was more looking to see what mechanisms based on the structure's performance and the record of release and leakage and inspection after the fact. So I did not follow the documentation to determine where that leak may or may not have gone. Others are better suited to answer that question.

MR. BROWN: Okay. Thank you, Dr. Johnson. I don't have any further questions.

HEARING OFFICER CHANG: All right. For Sierra Club, Mr. Frankel.

MR. FRANKEL: Thank you.

CROSS-EXAMINATION

BY MR. FRANKEL:

Q. Dr. Johnson, I want to ask you questions about P-E-M-Y, PEMY. We talked about that the other day with the court reporter. They produced, I don't know if you'd call it a report, or a study, or a paper, or some notes. Does this -- I've just brought it up on the screen. Is this the PEMY paper that you know about?

A. Yeah, that's the one that I was referring to earlier, and I believe that was prepared for the EPA by one of their consultants. That's my understanding.

Q. What terminology should we use to describe this 8-page document. Is it a report, is it a study, notes? What should I call it?

A. I guess it's a summary of analysis. A summary of a desktop analysis.

Q. Okay. More than back of the envelope. A desktop analysis, I like that. So this is Exhibit N-2, and you thought it was a good report, didn't you?

A. When focused in on the seismic portions of it I thought it was a fair representation of my understanding as well.

Q. And you thought it was accurate, as you testified to Mr. Brown, right?
A. Right.
Q. Okay. And you think the Hearings Officer should rely on it, don't you?
A. I think that it's one piece of information that was developed in 2015 at the time, and so I think it speaks to the seismic portion, sure.
Q. And your understanding of the earthquake hazard is consistent with the PEMY desktop analysis?
A. I believe that's what my testimony indicates, and, yes.
Q. And the PEMY desktop analysis considered the impact from just three earthquakes, right?
A. I'm not aware of the specifics of that because they actually do speak to the overall seismic hazard. I believe if you go down a couple of pages on this document there's a table that compares the seismic hazard here compared to other locations across the U.S.
Q. Okay. We'll get there, but let's talk about specific earthquakes. The PEMY report looked at -- not report, I'm sorry, the PEMY desktop analysis looked at three earthquakes it appears, one in 1969, one in 2006, and one in 2014. Does that sound right?
A. I didn't look to these specific earthquake

events, but I have no reason to dispute that statement that you've highlighted in yellow there.

Q. Okay. And did you see anything in this PEMY desktop analysis that considered stronger earthquakes that hit Oahu other than the dates 1969, 2014 and 2006?

A. Yes. So down at the bottom of the page there's seismic hazard that's speaking to the overall hazard. So USGS is the agency that develops the ground motions that are used in the building code, and so to the extent that you're speaking of the seismic hazard relative to the expected performance based on the type of construction, I think that is where he's considering all potential seismic events and hazards, and that the building code requirements are built on an assumption of how much risk society's willing to take with respect to the seismic hazards.

HEARING OFFICER CHANG: Mr. Frankel, as a favor, can you enlarge the text so that it can be a little more readable?

MR. FRANKEL: I have no idea what you can see versus what I can see, so does that work?

HEARING OFFICER CHANG: It's better. Thank you, yeah. That's good, thank you.

Q. (By Mr. Frankel) Okay. And, you know, you reference, you said he. Do you know who did this

desktop analysis? Is it one person, or is it a group of people, or was that just sort of a casual reference?
A. I think that was casual and, yeah, they. I mean they; their analysis here, yeah, sorry.
Q. Okay, fine. But you did not see in this PEMY desktop analysis any consideration specifically of the June 28, 1948 earthquake, did you?
A. I don't specifically recall.
Q. And was there any specific reference to the 1871 earthquake in this PEMY desktop analysis?
A. Would you allow me to scholarship through the document to double check?
Q. I mean I don't know if you can scroll through a document on my computer, but I can just sort of scroll through for you.
A. Sure.
Q. It's not very long. It's, let see, almost -- I guess you could call it eight pages.
A. Maybe scroll up from there. I don't recall if they specifically addressed those earthquakes, no. Doesn't appear.
Q. All right. And just go back to where we were here. So the 1871 earthquake was the earthquake with the greatest intensity to hit Oahu, correct?
A. That's what the report by Cox indicated.

Q. Okay. And that magnitude is estimated at 7.0, right?
A. That sounds about right, yes.
Q. And the earthquake with the second greatest intensity was in 1948?
A. Correct. Again, based off of the Cox article.
Q. And its magnitude is estimated at 4.8?
A. Yes.
Q. And, you know, I think I'm a little -- I think I may have misheard you when you were answering questions with David Brown. You seem to suggest that the earthquake as it was felt on Oahu was the same level of intensity in 1981 and 1948 because of the location.
A. That's what the table in the Cox report indicates based off of the Modified Mercalli index that they report. So a Modified Mercalli index is basically a level of shaking that's associated with the damage that's observed, or maybe not even damage, sometimes it can just be can you feel it. So USGS today still uses that type of information which they call Felt Reports, so, you know, if you felt it, go ahead on your cell phone and indicate what you felt, what kind of damage you have.

So that's what the Modified Mercalli index is based on, and so there's a range, and so that range, the

Modified Mercalli index is somewhere between 6 and 7, and so those are estimated, they're not necessarily measurements as we would do today, but so they were in the same range.

Q. Okay. I think I might understand. But let's look at this other document. So this is Exhibit S-2, and this is a report also by Doak Cox, who's the same person you were just referring to, correct?

A. Yes.

Q. Have you seen this report, do you know? Have you seen it?

A. No. No, I have not.

Q. Okay. I'm going to go down to little Roman -- little iii, and let me read this to you, the highlighted portion: "The historic quake with the highest Oahu intensity occurred in February 1871. Its epicenter was estimated to have been near the south coast of Lanai, and its Honolulu intensity was estimated to have been on the border of MM steps VI and VII. That with the second highest Honolulu intensity occurred in June 1948. Its epicenter was estimated in the ocean just south of Honolulu, and its Honolulu intensity was estimated in the middle of MM step VI."

A. That's correct.

Q. So that suggests that the 1871 earthquake was

more intense in Honolulu than the 1948 one, correct?
A. Yeah. So I based it off of the Cox article, which I believe is a different exhibit, where that table reflects a range for Oahu that went from -- and I can't specifically recall, but if we could bring that exhibit up -- it reported a range, and so in that range, if I recall correctly, middle VI was sort of in the middle of the range that was reported on Oahu.
Q. For Lanai, even though this report by Doak Cox says between VI and VII?
A. Right.
Q. Okay. Now, the 1848 (sic) earthquake caused significant damage to the Red Hill facility, correct?
A. Again, as a structural engineer I did not see any evidence that there was significant damage to the structure, but it appears that the earthquake may have been contributory in damaging the nonstructural telltale system, which is no longer in use, but I do not -- I did not see any records of any of the other 19 tanks being damaged in a similar way at the same time.

So the word significant damage, I don't think there's any significant damage in terms of the structural performance, and it appears that the telltale system due to the timing may have, may or may not have been the result of the shaking.

Q. So I understand you use words precisely. I am not, and the citizens of Honolulu are not concerned about whether a structure is damaged or not, they're concerned about the facility because it's the water that's affected. So I want you to take the word structure out of your vocabulary for the next few minutes because we don't care if a structure is stable --

MR. MCKAY: Badgering the witness.

MS. RIDDLE: I'd just like to object to Mr. Frankel's treatment of the witness that the Navy has presented, and I'd like to request that he be asked to tone it down just a bit. Thank you.

A. I can appreciate -- I can appreciate the sentiment and concern and I -- you know, the water is important, and the structure is actually very important because this is a reinforced concrete tank that has a steel liner on it. That steel liner is supported by the structure. So if the structure is damaged, then the liner would be damaged, and so my profession and what I am testifying here with regard to is the structure's performance, which is the area of my expertise.

Q. So you're not able to testify whether the facility itself is safe from the risk posed by earthquakes, you can only testify as to whether the

cement structure is safe?
A. I'm testifying that the structure seems to have performed well. We are going -- the Navy is embarking on a more detailed analysis, and our understanding of the construction of the facility is such that it's in a moderate hazard zoned for seismic. It did experience an earthquake in which it appears that there may have been some nonstructural damage that may or may not have resulted solely from the earthquake, and so to the extent that the structure supports all other parts of the facility and provides protection from a seismic threat, I would say that the facility has a decent level of protection with respect to the seismic hazard as far as the analysis that we've done to date shows, and the Navy is continuing to do a more detailed analysis as we've talked about before.
Q. There's no report that determined that the oil loss was due to the telltale system. There's no Navy report to that effect, is there, that made that determination?
A. Well, the Bechtel report did not come up with a known conclusion, and my analysis of the tank history, and I can -- if you bring up Exhibit B-194, I can walk you through the history as reported in that document to see that they found the leak and was able to get it back

into commission in 1952, and it's my understanding that the weld that they observed to be damaged at that time was a part of the interface of the telltale system with the tank. And so that telltale system's potential vulnerability, because of the construction and the way that it's attached to the liner, and that liner moves along with the structure during the earthquake, I believe that was the vulnerability that may have been a result of seismic damage on the one Tank No. 16.

Q. I understand that's your conclusion today. That's not the question I asked you. The question I asked you is, is there any Navy report that made the determination that it was the telltale system that was the cause of the oil losses at the time of the 1948 earthquake. Is there a --

A. No, there's no report.

Q. -- Navy report? Thank you.

A. No, just that that's my conclusion based on my analysis of the records.

Q. Okay. And so we -- and your analysis that the telltale system was problematic suggests that the brilliant folks, in basically Frank Kern's words, who designed the Red Hill Facility screwed up in their design of the telltale system?

A. The telltale system gave them problems, and it

was a -- that system, I think, was -- my understanding is that was a unique implementation, and so I think that's why they had trouble with the telltale system's performance during the history.

Q. So Frank Kern's testimony was that these folks who designed the facility were just the eminent people in the field, these were brilliant people, these guys knew what they were doing and they screwed up. They included a design element that led to the loss of what you went through with David Brown, over a thousand barrels of oil all of a sudden.

A. Well, so I think the overall construction of the tank was done in a quite innovative way and demonstrated their -- the designer's knowledge of tunneling through rock and creating tanks. I did review the as-built drawings, and some of which included their loading diagrams, and so I think they did a very good job, and my testimony speaks to the construction and how they accounted for things like shrinkage to, in my mind, my interpretation of what I saw, and as is shown in my testimony, is that they took the time and designed these reinforced concrete tanks in such a way to mitigate or minimize any potential leaks, and then they used the steel liner.

And we can go into some detail like, for example,

they used these things called strain gauges which were put through the concrete, attached to the rock behind the concrete, and those strain gauges are not typically used even during construction today. So they wanted to monitor the deformations of that tank during construction at the time, and so they -- I believe they took great care based on the technology they had at the time to understanding what they were building so that it could perform well. So, and I speak to that in my testimony as well.

Q. Sure. So let's bring this screen up. So you talked about this a little bit with David Brown. This is the Bechtel report, and let's see here, this -- I want to go to 17. So this, there's an earthquake disturbance on June 28, 1948, right? And careful hand gauging during the test indicated a loss of 37 -- more than 37 barrels of fuel loss per day, and you're suggesting that this system was really well-designed and built, these guys were innovative and creative and did this incredible job with everything except making sure that our water is protected, right?

A. So I'm not sure if you are speaking about the gauging here, or if you -- what I was speaking to is on the prior page if you scroll up one page. I can show you the figure that's there. So this is the

construction of the over --

Q. Which one? Was this one? Okay.

A. Yeah, so this is a schematic of the tank, and so there's a couple of different things that they did to try to make sure that they wouldn't be losing the fuel that they're storing there. So the first thing, you know, they -- when they did the construction they created the upper dome first, they excavated to the bottom, and then they cast the concrete from the bottom towards the top.

And you can see there is a thick black line that's between figure labeled C there, there's a thick black line that is shown between the gunite rock and the rest of the concrete there. So that was, if you scroll up a little bit so we can see the words on the top of the figure, yeah, so that asphalt coating with red earth slurry, I believe, is basically a debonding agent to allow that concrete to potentially shrink away from the outer edge. They used, in the figure A, you can see there are grout grooves. In figure D they are showing where a, basically a detail that's similar to where these grout grooves are and they would basically be injecting grout to the back side of the concrete.

And if we scroll down to the bottom of this figure, you can see where it points to grout, it goes

around the circumference of the tanks, and they have the -- at four locations they have grout pipes, right, so those are sort of at the 45-degree angles in those figures, and then they also point to strain gauges. And so those grout pipes are where they were injecting grout into behind the concrete, and so you can image that grout as it's pressurized is going to be pushing inward on that tank. And so when you push inward on that tank you're putting the concrete into compression.

So in my testimony you'll see there's a description about when they're adding that grout, they're basically creating a prestressing, and that prestressing is going to close any existing cracks or prevent cracks from forming in the first place, and my testimony talks about that.

And then, so you could just do that and assume that it's working, but the strain gauges, which are detailed in figure E here, you can see there's basically a pipe that passes through the liner. On the inside there's a rod that passes into the narrowest portion there. That passes all the way through and it's embedded into the rock. And so what you can do, there's something that's labeled an, what looks like I.P.S. Cap, and then I.P.S. Pipe and Coupler, and so you can measure the distance between the end of that rod that goes all

the way into the rock, and the cap and the change in distance is going to give you an indication of how much that concrete is changing in dimension.

So in engineering, the change in dimension is directly related to the force that's being applied, and so it appears, based on this figure, that they were using those strain gauges to monitor how effective they were at performing the grouting operation to prestress that concrete, and so in my mind it shows that they were careful and wanted to understand how the tank was performing relative to their designed intent.

And so on the page down below where you're talking about gauging, I just wanted to make sure that we're talking about the same thing. When I speak of these professionals who designed this taking great care, this hand gauging, I believe that that is actually referring to just the measurement of where the fluid was during their observed leaking. So I didn't want to inflate those two.

Q. Okay. And this is indicating a loss of 37 barrels of oil per day, right?

A. That's what the report says there, yes.

Q. Okay. And you recognize, don't you, I know it's a little bit outside your field, but you recognize that the groundwater below the Red Hill tanks has been

contaminated with fuel, don't you?
A. I'm not aware of the specific test results of the groundwater itself.
Q. If you were aware of it, that might affect your conclusion about what a good job these tanks are doing, wouldn't it?
A. No, because I did a structural -- I'm just talking about the structural performance. I looked at the construction to see, you know, what methods of construction they used, was it appropriate for designing a tank. Did they, you know, in terms of the details of the tank, what's the relative risk to seismic performance. And so, you know, a leak that occurs is one thing, but I was simply evaluating the structural performance, and to the extent that the liner is attached to that, the telltale system was attached to it. I can speak to the seismic behavior and how it might affect those types of systems.
Q. Okay. Let's see here. Let me bring up this other document, series of documents. So you may not be aware of this, but there is a technical report that was prepared in 2007, and it says: Three groundwater monitoring wells were installed within the lower access tunnel of the facility and samples from each have consistently detected petroleum dissolved in the

groundwater beneath the site.

Does knowing that fact affect your opinion as to how well this facility is performing in containing fuel? Yes or no?

A. I think tanks are known to have leaked. Again, my analysis was based on the structural performance or potential risk for seismic, and then I spoke to some issues with respect to corrosion, and there were leaks, there are leaks that have been documented, and so --

Q. And to be clear, that structural performance doesn't imply that this structure contains the fuel. What you're talking about in terms of structural performances, making sure the tank liner doesn't collapse, but you are not opining as to the ability of the facility to keep the fuel inside?

A. Yeah, so there are many systems that are, you know, that are geared at understanding and maintaining the integrity of the system to prevent fuel, and so the structure is one system and the support of the steel lining is inherent to that structure, and the corrosion environment at the lining to tank interface, and questions about the reinforcement within the concrete itself, those are the items that I was addressing.

Q. Okay. So I'm not clear what that includes or doesn't include. So again, I want to know -- my

question to you, and if you can't answer it, that's fine, you can say you can't answer it. I'm concerned about the facility as a whole, so my question to you is, has the Navy or you assessed the risk that seismic activity may have on the entire facility and its likelihood of releasing fuel into the environment? Have you done that or not?

A. So the PEMY report --

Q. It's a yes or no. It's a yes or no, have you done that or not?

A. So --

Q. It's a yes or no.

A. It's actually not, because in engineering it's a process. And so the process is you do an initial evaluation, and I think the PEMY report, as well as my analysis, documents that there is a relatively low risk for seismic being a concern for the tanks. And in the AOC risk analysis, the Navy has developed a scope of work to do a more detailed analysis.

And so has an analysis begun? Absolutely. We did our initial analysis, which is what we always start with in engineering, is what is your initial assumptions, what should we go into, what are the highest threats that we should analyze first, and then dive down deeper if we need.

And so in terms of assessing risk with respect to seismic, that initial desktop analysis that are talked for before has been done, and we have developed a scope of work that includes both the tank and pipelines associated with the overall facility, and that is a part of the AOC process that the Navy is working on.

Q. Okay. So this initial assessment was this desktop analysis that we talked to, the test analysis, and this says -- the first sentence on page 5, top of page 5 -- hope you can read it -- says "There are no records of damaging earthquakes occurring close to the site." Is that sentence true? Is that accurate?

A. Well, that sentence by itself is -- I guess depends on the definition of close to the site and what damage is.

Q. Is there any question in your mind that the 1948 earthquake damaged the site?

A. The specific site with respect to Tank 16 is the only one that I am aware of where there was a question, and I think we talked about that with respect to the telltale system. I am unaware of any other specific damage at our site.

Q. Yes or no, did the 1948 earthquake cause damage to the Red Hill Facility?

A. The 1948 earthquake may have contributed to

damage of the telltale system that's no longer in use at the site.

Q. It's a yes or no question.

MS. RIDDLE: Objection. This has been asked and answered already.

HEARING OFFICER CHANG: Sustained.

Q. (By Mr. Frankel) Okay. Could an earthquake at Red Hill, earthquake that affects the Red Hill Facility cause a small chunk of concrete to break off, let's say in the tunnels?

A. Well, depends on the magnitude of the earthquake.

Q. Okay, one, say, the size of the Lanai earthquake of 1871?

A. Well, it depends on the location. The 1971 (sic) earthquake on Lanai as we discussed before had a magnitude that was -- created ground motion in the range of the one in 1948.

Q. A little bit larger though. Cox says it was greater intensity.

A. Sure.

Q. Those were his words.

A. Sure.

Q. So my question again to you is, could that cause a small section of concrete to break off in the tunnels?

A. I don't -- I haven't done a detailed analysis,

but, you know, one of the things that my testimony does speak to is damage, the difference in damage for aboveground structures compared to underground structures, so --

Q. And we'll get there; we'll get there. This is just a question, yes or --

A. Yes, I'm trying to answer your question. So the Felt Reports that Cox indicated, those are based on observable damage at the surface, and so the damage for underground structures behaved a little differently from what is reported to create a Modified Mercalli index.

And so it would be difficult for me to say, you know, the mechanism that you're describing, concrete coming off of the facility, I don't think that there would be the level of damage where you would necessarily get concrete spalling based on the fact that the magnitude of shaking on Oahu for the 1971 (sic), while it may have been greater in Cox's reports, as much at least his range, I don't know that based on the performance that I saw from the 1948 earthquake, I don't think that the level of shaking would be such that you would have that type of damage. And the damage mechanisms you'd have to -- we could spend days talking about different damage in mechanisms, but I know that's not your intent.

Q. So it's unclear to me, is your answer no, or I don't know?
A. Without doing a detailed analysis it is difficult to determine that question, but I think that it is relatively low risk or a low probability that that type of damage would occur if the 1871 earthquake were to reoccur today.
Q. Okay. Now, let's talk about the report on the 1976 Tang-Shan earthquake. That's a report you referred to in your testimony, and that's Exhibit N-61. I'm not going to bring it up if I don't need to. That report noted the appearances of cracks from the earthquake, didn't it, underground?
A. There was some description of some damage in underground facilities.
Q. The concrete floor of the pump station had a 30-meter depth heaved up to 300 millimeters and experienced a crack of 30 meters long, correct?
A. I don't specifically recall, but that could be what the document spoke to.
Q. Okay. Let's bring it up. Are you seeing --
A. I'm seeing the PEMY report.
Q. How about now, are you seeing N-61 yet?
A. Yes.
Q. Okay. Do you see that the report says that,

let's see, the concrete floor of the pump station at 30 meters depth heaved up to 300 millimeters and experienced a crack 30 meters long.

A. So it's -- I see that it says that, however, this --

MS. RIDDLE: Objection, actually. The document speaks for itself and it doesn't say, I believe, what Mr. Frankel said it does.

MR. FRANKEL: Well, I think I said 30 meters and I meant to say 30 feet, which is 10 meters, but yeah.

HEARING OFFICER CHANG: The witness may answer. Go ahead.

A. Yeah. So this article, the main point of this article is not necessarily the minute details, because where the details will not be similar is that there is no discussion about what the geotechnical strata is, basically, you know, what type of soil is it, right? Is it rock, like at our site, or is it clay, or is it something else?

And so the overall narrative of this is, I think, more descriptive. So here it's really the last two sentences of the first paragraph. On the surface, destruction was nearly 90-percent complete, and several hundred thousand lives were lost. So, you know,

magnitude 7.8 earthquake, significant loss of life, significant damage, 90 percent complete on the surface. Damage to underground structures, however, was relatively minor, and all miners, some 1,000 in number, were evacuated safely.

And it talks to some damage here. There is a -- I speak to in my testimony of several different potential mechanisms for underground compared to above ground. So in an aboveground structure you basically have a, let's say, a building, so you can imagine a high-rise building that is attached to the earth. Now, the building wants to stay in the location that it is.

Q. Okay. Mr. Johnson, I want to focus on my question. Your attorney will have an opportunity to redirect you, but I want to keep this focused now so we can wrap up.

This exhibit you chose to reference in your testimony, correct? This is a Navy exhibit.

A. Right.

Q. Yes or no, you referred to this exhibit in your testimony. Yes or no?

A. I referred to it as an example of the behavior difference between aboveground structures and underground structures in general.

Q. Correct. And my question to you is, in this

article or case history that you chose to use in your testimony, it refers to pumps and transformers in the underground were damaged, correct? Does it make that reference, yes or no?

A. It does speak to specific damage that occurred underground.

Q. Thank you. And, in fact, water squirted out of fractures during the earthquake, correct?

A. That, sure. If it says it there, sure. You have it highlighted there, yeah.

Q. Okay. The damage may not have been as extensive above ground, but there was still damage under ground, wasn't there, in this example you chose to use in your testimony? Yes or no?

A. Right. So --

Q. You'll have a chance, your attorney will have a chance to redirect you. It's a simple question, yes or no.

A. I'm sorry, can you repeat the question?

Q. This facility, the underground section was damaged by this earthquake. There may have been more damage --

A. When you say this facility, which facility are you referring to?

Q. The one described in this case history.

A. So the case history does speak to damage of underground structures.

MR. FRANKEL: Thank you. No further questions.

HEARING OFFICER CHANG: Mr. Paige?

MR. PAIGE: No questions.

HEARING OFFICER CHANG: Okay. Redirect from the Navy?

MS. RIDDLE: Sure. Can I just have four, five minutes to get my exhibits lined up?

HEARING OFFICER CHANG: Okay, why don't we take ten. We've been going about an hour, so let's have a general break.

(A recess was taken.)

MS. RIDDLE: Yes, we do have a few question on redirect.

HEARING OFFICER CHANG: Okay.

REDIRECT EXAMINATION

BY MS. RIDDLE:

Q. My first question is, if there were no gaps between the steel and the concrete at the Red Hill tanks anywhere on any tank, would the Navy install cathodic protection?

A. It would still be a difficult proposition and probably not recommended. And in addition to that, the

concrete itself provides cathodic protection to steel. That's why steel and concrete are a good marriage in reinforced concrete structures.

Q. I would like to bring up document B-194, and I'd like to ask you to just walk us through what that document says and what we can learn from that. So can you see the first page of that document on your screen?

A. Okay, yes. So this one, July 21, 1948, so this is basically just a summary, right? So dates and remarks about what occurred, what happened. So first leak developed, a leak at a certain elevation, and I believe this is basically in the time period immediately following the 1948 earthquake. They transferred oil, emptied tank. Cleaned, washed, filled, tested tank with water. Leak found on telltale pipe in tank.

Then Shop 72, sandblasted inside the tank, right? Shop 8 painted inside tank bottom. And I believe by this point Bechtel had already left the facility. So tank back in commission, started filling tank with oil. Stopped at 10 feet. No leaks at this height for three days.

And in July to August 1949, filled oil in tank up to 167 feet. Telltale started leaking again. Lost a couple of inches in 11 days. Lowered oil down to 47 feet and leak stopped. Topped off tank at 242 feet,

lost 3 and five-eighths inches in four days. Tank still leaking.

Checking and testing for leak. Tank leaking. Oil transferred and tank emptied. In 1950 they started cleaning and washing the interior of the tank. 3/50, filling and testing tank with water.

Leak determined to be cracked weld on jumper pipe in dome. Weld would open up after 150 feet, plus a head imposed. Meaning the level of fluid within the tank needed to get up to 150 feet. So this weld that was cracked, the pressure of the fluid once it got to 150 feet caused that crack to open up sufficiently to cause a leak.

So then after that -- and I see that as when they finally determined what the cause of that original leak that they noticed after that 1948 earthquake.

Then in January tank back in commission. Start filling tank with oil. Tank topped off. Okay. No leaks. Then they calibrated gauge and started to use the facility.

So I think, yeah, the Bechtel report talks about different theories that they had, but they never definitively came up with the answer or the cause for the leaks. And even after they were offsite and they attempted to put it back into commission, they noted

leaks in the telltale system, and then not until January of 1951 did they determine what the -- that it was a cracked weld on the jumper pipe, and it's my understanding that that jumper pipe in the dome is a part of that telltale system.

And so after they identified that and fixed it, they put it back into commission, and it was used no leaks from 1951, end of January, so immediately after they've repaired that crack. And then the next thing in this record is 1963 where they were doing other things.

So that's the part about engineering is, you know, the site investigation sometime doesn't always tell you the full story. You might not be able to reach a conclusion just based off of even a rigorous onset analysis. You develop some theories, and then you test those theories. And so in my mind Bechtel did that, they were done with their project, they created a report, and the Navy continued to use the facility, and eventually found the leak that I -- that is consistent with what Bechtel's process of trying to detect the leaks were.

They, too, if you look at a Bechtel report, they have a record of lowering the level of fluid in the tank, raising it up higher, I believe they were using water to try to detect area of leaks, and when they

filled it up higher, then the leak rate would increase, and when they had it lower it wouldn't be as much, and so there was some. They're using their engineering judgment to see what they thought it was, and I think, finally, the leaks did not persist anymore after they fixed that part of the system.

Q. Okay. But you can't tell from either this report or the Bechtel report what the cause of that cracked weld was for sure; is that correct?

A. That's correct. However, the -- so the connection points between, say, something that is rigid, like hard to bend like a pipe, when it connects to another structural component like at this weld, the weld is going to be at a location where an engineer would check to see what the stresses necessarily are, and welds are actually quite complicated.

Turns out even in 1994, there was an earthquake in Northridge, California where only at that time did they discover that welds that are -- larger welds can have some vulnerabilities, and so in today's building code we understand that phenomena, and so when we have connections like this we now know how to properly detail that. And since this was a nonstructural item, you know, telltale system to collect leaks and transport them to another location for collection and being able

to tell if maintenance is needed, and those connections to parts of the structure or liner is where that vulnerability can occur, so much so that in today's code for structural steel buildings or seismic in particular, we ban connections to occur in certain locations where we expect a good seismic performance, and we allow those connections in other areas.

And so it's really the details and the detailing of how we make these connections that are important, and so in modern construction when we need things like pipes to cross from, say, the outside of a building to the inside of the building we design those pipes with enough slack to take up that displacement that would occur during that seismic event. And so it seems that that telltale system did not include that, and at that time they would not have had that understanding for the seismic threat for these nonstructural items.

Q. I'd like to turn to Navy Exhibit 002, page 6 of that document. I'm looking at Figure 2, which is titled "Red Hill Seismicity Comparison." And can you tell me what this bar graph shows about the relative seismicity hazards at Oahu compared to other places?

A. Okay. So on the vertical axis it's labeled 2,500-year PGA with the units of g. So that's units of gravity, so a value of 1 would represent the

acceleration of gravity that we feel as we stand here, and that's in the direction of the surface of earth. PGA stands for peak ground acceleration, and so that is the parameter that is probably most significant in terms -- seismic design parameter that's most significant for an underground structures. That's the ground accelerations themselves.

On the horizonal axis we have different locations across the U.S., and so if we go all the way to the right-hand side of the figure, San Francisco, California, I think everybody understands that California has a high seismic threat, and in particular, San Francisco area is among some of the highest. And then Denver, Colorado, which is not particularly known as a high seismic threat, but still does have some seismic threat, is at that lower end. And then between there are New York City, Knoxville, Tennessee, and then Red Hill, Oahu.

So Red Hill, Oahu here looks like the peak ground acceleration is around the .270, say, on that graph. So I think this figure fairly represents what the range of seismic hazard that exists in the U.S., and not based on my understanding, but based off of what the USGS, who is responsible for determining the seismic hazard, the range of hazard across the U.S. So Denver would be on

the lower scale, San Francisco would be on the higher scale, and Oahu is more in the moderate seismic hazard area.

Q. Does this show that the seismic hazard at Red Hill's pretty comparable to the seismic hazard at Knoxville, Tennessee?

A. So, yes, this particular graph is indicating that.

Q. Thank you. I'd like to switch over to Exhibit N-62, and I am looking at the seventh page of the PDF. Let me get the Bates number for what. That's Bates No. NAVY0010846. And in your testimony earlier you referred to a table in the Cox report. Is that the table you're referring to?

A. Yes, it is.

Q. Can you tell me what this table indicates?

A. Okay. So this is, I believe the title of this report basically spoke to the seismic hazard in Honolulu, and so this is the historical events within Honolulu, intensities of V or greater. So that's the Modified Mercalli index or scale. And so that's based on what people observe at the surface and the damage.

And so an index of I would be maybe not even felt, and then what's reported here above V are considered to be potentially damaging earthquakes and

why I believe Cox included these in his analyses. So it shows from 1861 through the date of publication of this report, you know, anywhere from mid-level V up to the greatest, which was brought up the 1871 earthquake, south coast of Lanai 7.0 magnitude, had a Modified Mercalli index in the lower VII range, so the V-I-I there.

So the magnitude is the strength of the earthquake at the location where the earthquake occurred, and the intensity is what was the resulting level of shaking at -- in the Honolulu vicinity. So that was identified as the largest intensity for Honolulu in the historical record. And then if we go down to 1948, June 28th, south coast of Oahu 4.8 magnitude, so that's at the site south of the Oahu, and that is indicating a mid VI of a range. So lower VII, middle VI, but you can also see that the in the south coast of Lanai it went from, I guess, upper VI to lower VII. And so I guess in this reread it's in a similar range. The south coast of Lanai was at a slightly greater magnitude, at least as documented here.

Q. Generally speaking, is it your understanding that earthquake risks, seismic hazard on the Island of Oahu is increasing or decreasing over time?

A. So I've recently attended -- USGS is going

through the process of reevaluating the seismic hazard for the state of Hawaii using current technology and historical records through this past year, and part of that analysis they did have a discussion with the Hawaii State Earthquake Advisory Committee, I know they renamed that, but through our discussions through my current job, it's our understanding that the way that they're modeling the hazard is actually that they split up this time period, which is roughly shown here into three different segments, and the seismicity or earthquake hazard has been actually decreasing, and so their model reflects that, yeah.

Q. Do you know why that is?

A. I'm not a seismologist. I just take what the USGS tells us. But it's my understanding just based on the discussions -- and again, seismologists would be better at this -- you know, the seismicity or the earthquake hazard here in Hawaii is associated with the Island of Hawaii and the volcanic activity there, and so as that activity changes, then the seismic hazard also changes. That's my understanding at least in the short-term historical record.

Q. Thank you. I'd like to pull up Navy Exhibit 61, which we started talking about before. Would you like to explain the overall point that is made by this box

example that you referred to in your testimony?

A. Sure, yeah. So this comes out of design guides for underground structures at the -- that is a military design guide document, and this is -- you know, in that document they basically describe the mechanisms that you need to consider when you're designing for earthquakes for underground structures. In there they give some information to help engineers understand the behavior and performance of structures so that we can appropriately implement our designs.

And so this earthquake magnitude 7.8, so a significant earthquake occurred in an industrial area with coal mines. Surface faulting extended for more than 10 kilometers. The fault traces with displacements up to 1.5 meters transversed underground mine facilities. On the surface, destruction was nearly 90 percent complete. Damage to underground was relatively minor.

There are some differences with our site, right. So the purpose of me using this is just to say you could have 90 percent complete destruction on the surface because the behavior of structures on the surface is different from behavior for underground structures, and underground structures tend to behave better. But there are some differences in which you need to consider.

So, for example, that second sense, surface vaulting extended for more than 10 kilometers and fault traces with displacements of 1.5 meters transversed underground mine facilities, so based on what the USGS information is, there are no known faults anywhere on the Island of Oahu that they are using for considering earthquake design. It's my understanding that all the faults that are in their current models are on the Big Island.

And so faulting, as I'm sure you've seen on television where the roadway used to be straight and you can see basically a crack that extends through the roadway and you have a digs continuity. So that continuity could be a threat to an underground structure, and for very long structures, like long tunnels, there is a greater likelihood that those might cross a fault or cross a zone where you have more displacements, and that structure could be vulnerable.

So with respect to the tanks themselves, the tanks are -- individually are not going to be prone to crossing faults because there's no documented vaults that USGS has reported on Oahu. And based on my understanding of the geotechnical strata or the rock that surrounds this facility, it's all basically very similar through the height of that structure. So I

don't anticipate that there would be -- that we would need to consider a potential damage mechanism where you might tear through that structure. It doesn't appear that that exists.

So when we start so get into the details about these other paragraphs, that's the -- talks about things like the unreinforced concrete floor of the tunnel, and you know, other events that happened and damage that occurred, but I -- in no place in this discussion does it talk about -- oh, actually it does. In the second -- sorry, in the third paragraph, the first 15 meters of tunnel through the clay experienced circumferential cracks 1 to 3 meters apart. So that's clay. That is a different soil condition than what we have at our facility, so the behavior specific to that particular tunnel is going to be different from the behavior of our facility. Our facility is embedded in rock. Rock is not going to deform as much as clay would, and so that's where there are differences.

And the main point, I guess, to your question is, you know, the performance of aboveground structures is different from underground structures, and that's what I considered in my analysis, and based on the recommendations in this overall document, that's what I formed my conclusions or my current understandings from.

Q. I'm just going to highlight a few words at the top here. Can you just read what it says about the earthquake in 1976?

A. Right. So this earthquake, again, surface Mercalli indices of X to XI. So that X to XI, that's going to be compared to a Modified Mercalli index of VI or VII, so that's three orders of magnitude larger earthquake. So this is a completely different event from the events that we would expect to have in Hawaii or that we have seen in recent history.

MS. RIDDLE: Thank you. We don't have any more questions at there time.

HEARING OFFICER CHANG: Thank you. Mr. Brown?

MR. BROWN: Just a few questions, Hearings Officer Chang.

RECROSS-EXAMINATION

BY MR. BROWN:

Q. Dr. Johnson, your attorney, Ms. Riddle, asked you about some of the risks that earthquakes pose in the Red Hill vicinity, I just want to clarify your statements about the potential increase or decrease or tending of those earthquakes with time. Your opinion, as you stated, is not based on any peer review, scientific published studied, is it?

A. So that is a work in progress that the USGS is

going through. So, yeah, what I spoke to there was more based off of discussions when they're going through the process of reevaluating what the seismic hazard is.

Q. So just so that I'm clear, that's a no?

A. That's correct.

Q. And it's not based on any published document of which you're aware; is that correct?

A. I am not aware. That was based on meetings that were had with the Hawaii State Earthquake Advisory Committee and the work of the USGS, which is ongoing. So that's correct.

Q. So it's what you think USGS might do in the future potentially if they do it, right?

A. Sure.

Q. Okay. And then one other follow-up question with respect to this risk that we just talked about. You mentioned earlier you were aware of the quantitative risk and vulnerability assessment that was performed as part of the AOC process, the Phase 1 risk assessment; is that right?

A. I'm familiar in general terms. You know, just I'm familiar with the overall AOC and understand that one of the portions is the risk and vulnerability assessment.

Q. And we went over how you're aware that the

seismic assessment as part of that process has not been complete, correct?

A. So my understanding of the risk and vulnerability assessment is that they took a step-by-step approach to identify what they thought in our initial analysis as what were the higher risk items, and that was included in the Phase 1 part of that overall risk study, and that the seismic hazard was identified to be a lower risk similar to what PEMY had indicated, and so that's why they selected to choose that for part of future phases after Phase 1. And the seismic, more detailed seismic assessment that would go into the risk part is -- that scope of work has recently been developed.

Q. So just so that the record's clear, and I just want to make sure everyone understands, seismic was not included in the phase 1?

A. It was considered, but a -- it was determined that a detailed analysis would be implemented at later phases because of the understanding at that time that there were other items that would contribute more to risk than seismic.

Q. And again, just because I'm not quite sure I got your answer there, the numbers that were included in the Phase 1 risk assessment did not include seismic hazards, those were pushed off to Phase 3, which now I understand

is going to be combined into a Phase 2 with some other components; is that correct?

A. Right. So the Phase 1 report did not consider seismic.

Q. Thank you. And so you do acknowledge there is at least, and I'll use your words, a moderate seismic hazard at Red Hill, correct?

A. That's what USGS determines. Oahu is in the vicinity of a moderate or medium risk.

Q. And so any risk that was quantitated or part of the Phase 1 would actually only be able to increase one seismic risk or action considered; is that correct? It's not going to be zero is what I'm saying.

A. The way that that -- the seismic hazard and the calculation of risk gets incorporated to an overall risk assessment, I'll leave those details to people preparing that risk assessment. But, yeah, considering all sources of risk, the consideration of the identifiable sources of risk is part of the AOC process is my understanding.

Q. And you believe that the seismic risk should be considered, don't you?

A. Well, we are considering it because it's a question that people have and it's identified as part of the AOC, so it is going to be considered.

Q. And that risk is moderate at least, correct?
A. Well, so let's be careful on risk versus hazard, right?
Q. Okay.
A. So hazard is what is the earth doing, right? It's the ground motion. But risk, you know, is going to be affected by the details of the design of the facility. So we could very well find that based on the hazard that's present, the facility is not going to have any damage based on the level of risk that USGS determines, and if that's the case, then the risk would be very low even if the hazard is a moderate hazard. And so let's be careful not to conflate risk with hazard.
Q. But you are saying that the hazard and the risk has not been incorporated into the numbers in the Phase 1 risk assessment?
A. From a quantitative point of view, that is not a part of Phase 1. From a qualitative point of view we've considered risk for this facility based on the moderate hazard, the details of the construction as we understand them, and that desktop analysis that we spoke to before, and we consider the risk to be low, and is why it was not included in the Phase 1 risk and vulnerability assessment. That's my understanding.

MR. BROWN: Thank you, Dr. Johnson. I don't have any further questions.

HEARING OFFICER CHANG: Thank you. Mr. Frankel?

MR. FRANKEL: I don't have any more questions.

HEARING OFFICER CHANG: Mr. Paige?

MR. PAIGE: No questions.

HEARING OFFICER CHANG: Okay, thank you.

EXAMINATION

BY HEARING OFFICER CHANG:

Q. Dr. Johnson, I'm looking forward to hearing from you on the construction, since that is part of your scope of retention to this problem. I'm going to put up a picture of the tank construction and ask you a series of questions. Let me know when you can see it.

A. Yes, I can see a tank, a Red Hill tank exhibit.

Q. Your description in your testimony was quite helpful, and I wanted to clarify some things.

A. Okay.

Q. I am understanding that the construction then --

HEARING OFFICER CHANG: Hold on, let's go off the record a moment.

(Off-the-record session.)

Q. Okay. Dr. Johnson, back on the record, please. I'm understanding the construction was they were mining

or excavating out what I'm going to call caverns, into which they would construct these fuel tanks. So far is that correct?

A. Yes.

Q. And do we have then 20 separate caverns in which 20 separate tanks are constructed?

A. Yes. So they basically excavated vertical hole starting at the center of the tank at the surface above the tank location and, yeah, 20 separate tanks.

Q. Okay. So the picture that I'm showing on the screen is a depiction of one tank surrounded by concrete, and so the other tanks are going to be similar, but they'll be separate -- they're in separate caverns, if you will, surrounded by basalt rock.

A. Yes.

Q. Okay. Now, one of your statements is that the lining with the steel plates welded to a structural steel framing that remains embedded within the concrete tank, and the phasing of "within the concrete tank" is a little bit unclear to me as to what you were referring to.

A. Okay. So I see this as a reinforced concrete tank. So you have the upper dome, which is shown at the top, you have the lower dome at the bottom, and then the concrete, which I think here is labeled as barrel

reinforced concrete, basically the gray areas on the side, all that is reinforced concrete, meaning there's rebar or steel reinforcement embedded within that concrete. And then they used angle irons, which are basically L-shaped pieces of steel and other structural steel members as a framework to hold the quarter-inch thick steel lining in place. They created that steel framework prior to placing the concrete, and so that the steel lining basically acted as the formwork to form the surface of the concrete barrel.

And so they didn't -- you know, in construction if you go to a building site today there'll be formwork, they'll cast the concrete. Once the concrete has set up and achieved the strength that they need, then they'll remove the formwork. And so that formwork will consist of, might be plywood or steel framing members. And so in this case that formwork is not removed and the structural steel that the plates are welded to remain in place and are embedded in the concrete.

Q. Isn't the concrete also part of the formwork, if you will, because the steel is being applied against the concrete shell?

A. Right. So in my evaluation as a structural engineer, I think the concrete structure would be able to stand on its own. I don't believe that they

utilized, or are utilizing any of the steel liner as a structural support providing any strength for the stability of the concrete structure.

So, you know, in a different system, right, you might have a reinforced concrete tank. So let's say like at a wastewater treatment plant we might have a tank where we're processing materials and we would build it out of reinforced concrete, and on the inner surface where the fluid is in contact with the tank, we would do like an epoxy coating on the inside of that tank to prevent leakage, to retain that fluid.

So I see the steel lining performing a similar function preventing the fluid that's retained in this tank. So it's basically a barrier, but it's not necessarily a structural component.

Q. You were explaining that the installation of the grout was to also create tension on the side of the barrel in the concrete pressing up against the steel. Do I have -- am I understanding it correctly?

A. Not quite. So concrete is really good in compression, right, so we can push on that concrete and it's going to have a lot of strength. But if we take that same concrete and we pull on it in tension, its strength is about one tenth of its strength in compression, and so that's why we use reinforcing steel,

because steel is very good in tension, and so they work together when we have reinforced concrete structures.

In some structures, like the rail that we're building, what we do is something called prestressing the concrete. So we take the steel that's in, you know, in those bridges and we stretch it out, you know, we use force to make that steel longer, and then we attach that stretched out piece of steel to the concrete, and when we let go of that, that tension force that's in that steel gets transferred into the concrete and puts the concrete into compression all the time, so that you -- it is very unlikely that you will develop a tension in the concrete, because if you develop tension in the concrete it could lead to cracking.

So that prestressing that we do to build the rail and other bridges in modern construction, it appears that they were doing something similar, but using a slightly different approach, which is using pressurized grout. So the grout here on this figure is shown to be behind the concrete barrel, and they had some grouting pipes that went through the thickness of the concrete barrel, and by filling that space with grout under pressure you are basically pushing that concrete cylinder, trying to make that cylinder smaller in diameter. And so in order to do that, you are going to

push the concrete into compression all along the circumference of that circle, and by providing that compression, in order for a tension-based crack to form, we would first need to release that compression load, and then apply some additional force or displacement to overcome the tensile strength of the concrete. So in order to form a crack, you have the tensile strength of the concrete, but if you precompressed it, then you also need to overcome that.

So it appears that their method of construction was intentional to precompress what I'd call the, I think I may have called it the hoop stress, being the stress around the circumference of that barrel, precompress that.

Q. So I have a lay understanding that that is going to be pushing in against the steel liner.

A. So it will be pushing directly on the concrete on the outside, and the concrete barrel will get smaller in diameter, and the steel liner will go along for the ride, yes.

Q. Okay. Is there any movement with the addition and removal of fuel within the tank?

A. There likely will be any time you impart a load. All matter will change in shape, yeah.

Q. One of the things I'm puzzling about is the

problem of identifying what happened to fuel. There is a 2014 event where it's reported that 27,000 gallons of fuel was released from Tank 5, and given this type of construction, there's no space, or very little space for fuel that might somehow get past the steel liner to go. And so one, just a practical question was if there was leakage, where did the fuel go. And in this type of construction, the steel liner is an initial barrier, isn't the concrete shell a secondary barrier?

A. So one of the things that we teach young engineers is that concrete cracks. And so we understand that, and so that's why I believe that that grouting process that the original designers intended, you know, they were attempting to provide some precompression to prevent cracks from forming. Also, the method of construction that they used where they first cast the upper dome, they excavated down to the bottom, and then they started pouring the concrete from the bottom up towards the top, and right at the location where you see where it says expansion joint, they ended up filling that space at the end. That's the very last space that they filled with concrete. And so all of the stresses that would be associated with movement of that concrete during construction would have been taken up and would minimize any additional movement. But, so I think they

did a -- they considered in the design of that reinforced concrete tank that they would try to minimize cracking of that tank, and I think the design document shows, or at least to me indicates that there was some deliberate consideration of that.

And I don't have any documents to say that's absolutely what they were thinking, that's my interpretation of the intent of this design. And so it is possible and it probably has happened that once the steel liner is breached, that there may be pathways for that to follow a crack to the outside of the tank.

Q. This drawing does not show that the shotcrete that was placed against the face of the basalt -- and my understanding is that the shotcrete surrounds the tank and continues under the tank and the like, so that -- and I'm thinking of shotcrete like a swimming pool construction product. So wouldn't the shotcrete layer also constrain flow of any released fuel?

A. Right. So there is, you know, concrete and shotcrete. Shotcrete is basically a different application of concrete, and so you're right, they excavated the tunnel and they used shotcrete to fill spaces within the rock as they discovered them, or softer areas they had a specification on how to apply shotcrete to basically create a surface on which the

concrete tank itself would be cast against, so the outer formwork, if you will. And so the minimum thickness of that shotcrete, even at locations where you had good sound rock was 6 inches, and then in other areas where there might have been more porosity in that rock strata, then they had thicknesses, you know, up to the order of like 18 inches and more, depending on the specific conditions at a particular location.

So you're right that the shotcrete itself is going to provide a barrier for most locations, and then the concrete itself will provide a barrier for most locations, and then the steel liner will provide a barrier for most locations. But -- yeah.

Q. Okay. You talked about the telltale system being problematic. Why was the telltale system potentially more vulnerable to seismic damage, if that was the cause, than the tank?

A. Yeah, so the telltale system, I think there's a figure of it in the -- within the Bechtel report or others, but I'll just describe this telltale system. So there's basically a pipe, and it's a steel pipe. I want to say it's somewhere in the order of three-quarter of an inch internal diameter, and it's -- and I could be wrong about that. It's an inch or two, something on that order, and it extends about 150 feet. So basically

the vertical dimension that you see on this figure here, there's one continuous pipe from top to bottom. I believe every 5 to 10 feet there was a very short stub out from that pipe that went horizontally, and I believe I was about 3 inches in dimension. So from that long one-inch diameter pipe, a short 3-inch distance from that pipe to the lining where that short stub was attached.

And so one of the things that, you know, we consider as structural engineers is something called the coefficient of thermal expansion, and what that means is when things get hotter they get longer, they change in length. When they get colder, they shrink, right? And so if you have something that's 150 feet long and you change its temperature by a couple of degrees it will get longer in proportion to that change. So if you have something that's 1 inch long, it will change a certain distance, and if it's 150 inches long its change in length will be 150 times greater than that 1-inch length.

So here we have 150 feet of pipe, and you have stub outs every 5 or 10 feet going to that liner, and so the stub out at the very top and the stub out at the very bottom, maybe 140 feet apart, that pipe as it changes temperature is going to start to push those two

pipes in opposite directions from each other, and that change in length will happen. And so you are forcing a displacement of this very short pipe, and so that's basically going to be like, you know, you're prying on a nail with a hammer and it's going to induce stresses in the weld around that short stub. And so that is something if the temperature of the concrete liner is different than the temperature of the fluid or the air, and that telltale system heats up to a slightly different temperature, which is plausible in this case, then you could be inducing stresses in those welds, and any other additional movement that might occur, even if it's relatively small magnitude, could exacerbate that state of stress.

So I think that that thermal expansion issue, as well as you tend to develop stresses even during the welding process itself, so you clamp one end, and if you ever put on lug nuts on your car tire, right, to put your wheel back on, you're supposed to tighten it in a star pattern, and that's so that you get even stresses. If you put your first bolt on and you just went around the circumference, you might not be able to get that last one in, or you are might break the first one.

And so the telltale system, because of that long length and the short stubs, which are very stiff, you

can induce a fair amount of force into the -- or stress into those welds that would be susceptible to additional movement from seismic activity, or even thermal changes. And so that's why I think they had trouble with the telltale system. While the intent was good, I think just the details of that didn't work out.

And so, you know, an alternative system might be something similar where you would have a more flexible connection to the exterior, or at least shorter segments of that vertical connected by flexible connections. And that's what we do for seismic connections for pipes and sewer and everything else when we're talking about buildings and designing for seismic deformations that might occur.

Q. Thank you, that's helpful. If there was a problem with the telltale system leading to release of fuel, where would the fuel be released? Would it be at multiple points, or would it be at top or bottom?

A. So I'm not sure where that is, but it's my understanding that a lot of times the welds, or the telltale system when it breaks it actually -- the fluid would then leak into the telltale itself, and then drawn to the bottom, and I think that's -- based on my understanding of the history, and I didn't go through every single tank and its history with respect to this

leaking, but I think that's where often they would discover leaks within the telltale, but when they monitored the overall -- yeah, so I think, you know, a lot of times that leaking then, it just leaks back into the telltale system but, you know, presumably in my mind that's like the path of least resistance, right? So if you put some fluid into that short stub it can choose to go through concrete in a crack, or it can just go down a pipe that's designed to receive fluid.

But I don't -- the right answer is I don't know whether in every instance that went out through the concrete or if it went into the telltale system, but it seems like the more probable is that it would leak back into the telltale system and be collected at the bottom of the tank.

Q. Okay. Another general question. A lot of the testimony has been focused on the tank and the integrity of the tank and its ability to withstand seismic pressure and whatnot. I had seen something in another document that had tried to ascribe the relative risk for release events and the risks attributed to leaks from the tank were in rough order magnitude one-third of all the risks identified, and roughly 50, 60 percent of the risk was not associated with the tank, but was associated with nozzles and piping, what I'll describe

generally as parts of the distribution system.

Do you have an opinion, or is it outside your scope of attention that the risk, or the hazards and risk of loss of fuel associated with the distribution system, not the tank, is not great, that it has performed well, doesn't seem to be vulnerable to seismic movement and the like. I am not sure if I'm making my question clear enough for you, but --

A. Sure, yes. So that, yeah, so I believe I recall seeing a statement in that general regard, so the tank nozzles were identified as an area of risk, and that's a little bit outside my area, but it's my understanding that work has been done on the nozzles. A part of the seismic contribution with respect to the rest of the distribution system is the non-tank part of the facility, right, so the tunnels, and the connection of the pipes to the tunnels, et cetera. And so that -- it's my understanding that that is one of the components that is going to be studied, and again, I'm isolating the seismic concern relative to the pipeline that goes from the tanks down to the distribution point, and so that's where, again, behavior of underground structures, right, the tanks are basically co-located in one area in basalt rock, and the pipelines are several miles long down to where it's distributed, so there's different

behavioral considerations.

Again, in your mind if you think about roadways where you've seen damage, or even pipelines sometimes you've seen as well, aboveground pipelines where they intentionally design the pipeline to take whatever relative displacements you'll get from one end of the pipeline to the other, and the connections need to be designed in such a way to accommodate that potential movement during a seismic event.

And so to the extent -- so basically for the seismic assessment, again, I think is related to that document that the initial pass or initial understanding is that it's relatively low risk given the moderate seismic hazard, but the analysis that is a part of the scope of work to consider the pipelines within the tunnels towards the distribution as a part of the AOC risk and vulnerability assessment and whether it was Phase 2 or Phase 3, it's going to happen at the same time that the more detailed tank evaluation would happen. So it's definitely related, but I think there are also some other risks associated with that, you know, 60 percent risk for nozzles. I'm not familiar with the exact details of the nozzle-identified risk.

I hope that answered your question.

Q. Well, it does, and I'm going to try to summarize

this, see if I'm understanding it. Is it your sense that the seismic risk with regard to the pipeline and the distribution system, parts of the facility other than the tank is less of a concern than the tanks? Or is it that you don't know yet?

A. Yeah, it's harder to determine. It's a little bit more complex. There is, you know, because the tanks are longer, some variability in the strata under which it's buried. But the analysis is going to be performed as a part of the AOC process, and in very general terms, there's risk there that needs to be identified, and I think my testimony speaks of four mechanisms that need to be evaluated for underground structures, and they talk about axial deformation, right, as the tunnel get longer or shorter, bending of this long tunnel so you can think of it like the bending of a beam, or shearing of that beam, and then changes in the material in which it's buried can potentially cause risk.

And so I don't have enough information at this time to identify all of those potential mechanisms for the tunnel structure itself, and then on top of that, it's not necessarily about the tunnel itself, it's about the pipelines that are supported off of the tunnel structure which makes it just a little bit more complicated because then it becomes a, what is the

tolerance of movement for the pipes and the connections between the pipe segments, all of that needs to be considered. So it's not strictly a structural question.

Q. Okay, thank you. And just a clarification of terms, in terms of the magnitude of earthquakes, there's also been mention of the Modified Mercalli and the like, and you showed -- we've looked at the chart that shows an order of -- the earthquake order of magnitude that we commonly hear, but then there's another system that relates to Roman numerals, you know, VI to X. Is the modified Mercalli something different than the earthquake magnitude that we commonly hear?

A. Right. So there's several different terms. So I think Richter scale, right, is something that as I was growing up that was talked about, and that's similar to the magnitudes, you know, 7.0, 7.8 earthquake magnitude. In today's science they don't use Richter scale, it's actually a measurement of the amount of energy that's released during an earthquake. So that earthquake is -- some locations like in California where you might have two tectonic plates that are sliding past each other, how long was that deformation, how far did the earth slip, all of that can be used to quantify the amount of energy that's put into the earth because of that deformation or that action. So that's what the

magnitude is.

The Mercalli index is more of what is the effect at a particular site, and so it will change. So the Mercalli index on Kauai will probably be a very low number, I or II, whereas at the site of the earthquake you might -- you would have something larger. And so that's a distribution in space. And so we don't really use Mercalli index anymore, except the USGS does have like something called Felt Reports, so they use that as a way to just get more information.

But nowadays they use seismic instrumentation to observe the either ground movements, or ground velocity, or ground acceleration at sites. And so we talked about the spectral acceleration and the peak ground acceleration is basically the maximum acceleration during the event of the earthquake, and that is the design parameter that we use for evaluating an existing structure or designing a new structure.

And that peak ground acceleration also changes in space. And so, for example, on the Big Island you can have peak ground accelerations that are greater than the acceleration of gravity acting downwards, right, but now it's acting in a horizonal direction. On Oahu it's something less. I'm sorry, I can go on and on, but I hope that answered your question.

HEARING OFFICER CHANG: Okay. My brain is getting full. Thank you very much.

THE WITNESS: Apologize for that.

HEARING OFFICER CHANG: No, no, no. No problem. Appreciate the explanation and help. Thank you. Counsels, any follow on questions?

MR. BROWN: I have no further questions, Hearings Officer Chang.

HEARING OFFICER CHANG: Mr. Frankel.

MR. FRANKEL: I do.

HEARING OFFICER CHANG: Go ahead.

FURTHER EXAMINATION

BY MR. FRANKEL:

Q. Dr. Johnson, do you recognize that despite all the, what you described as containment mechanisms around the tank, that fuel has gotten to the groundwater?

A. It's my understanding that vapors from fuel were detected. So I don't know whether that's in the groundwater or not, but I believe outside the tank, that's my understanding.

Q. Okay. Let's look at this. So I guess you've never seen this document, which says: Three groundwater monitoring wells were installed within the lower access tunnel of the facility and samples from each have consistently detected petroleum dissolved in the

groundwater beneath the site.

Is that a fact that you are not aware of?

A. I'm aware that they installed, I think, three --

Q. It's a yes or no question.

A. I'm sorry, could you --

Q. Are you aware of that? Are you aware of this study, this report from the Navy that three groundwater monitoring wells were installed within the lower access tunnel of the facility and samples from each have consistently detected petroleum dissolved in the groundwater beneath the site? Yes or no.

A. It appears that's what this report says, and I'm aware that there have been leaks.

Q. Okay. I'm not just talking about leaks, I'm talking about it being in the groundwater itself, that it's not confined to any of the many, what you call barriers around the tank.

How about the, are you aware of the 2010 audit that says fuel releases which have -- sorry, let me back up a little bit. Site investigations have shown evidence of fuel releases which have resulted in contamination of rock bed, soil, and groundwater surrounding the Red Hill tanks. Is that something you're aware of or not?

A. So I didn't study or review or look at anything

pertaining to groundwater. My expertise has to do with the structure, and I've acknowledged even today that concrete cracks. And so to the extent that there is a steel liner, if the steel liner is breached, there is concrete, and that depending on where the steel liner is breached, that the concrete may or may not provide a level of protection, and it's plausible that fuel could go through the cracks in the concrete and shotcrete, et cetera.

Q. And shotcrete can crack too, correct?

A. It is a form of concrete, so absolutely.

Q. Yeah. And, in fact, people with swimming pools have to replace their shotcrete periodically, don't they?

A. I'm not aware. I don't have a swimming pool, but I imagine that would be true, yes.

Q. Okay, good, good. Now, rigid connections can be vulnerable to earthquake motion, correct?

A. Yes.

Q. Piping systems are an example of a rigid connection?

A. Piping systems do have rigid connections, sure.

Q. And the risk to the piping system at Red Hill has not been systematically analyzed based on the type of earthquake that struck in 1948, correct?

A. I believe that work is part of the scope of the phases of the risk and vulnerability assessment. I'm not aware of others, yeah.

Q. Okay. But this proceeding is not about the AOC, it's about the permit application, and so the Navy has not completed information for this permit application that quantifies the risk posed to the piping system by an earthquake of the magnitude that struck Oahu in 1948, correct?

A. So I think --

Q. Yes or no?

A. So they did evaluate the PEMY report in fact. Evaluated the --

Q. A quantitative -- my question was a quantitative assessment, that hasn't happened, correct?

A. Not a detailed one.

MR. FRANKEL: Thank you. No further questions.

HEARING OFFICER CHANG: Any other questions from counsels?

MS. RIDDLE: Yes, I have one for Dr. Johnson.

FURTHER EXAMINATION

BY MS. RIDDLE:

Q. Are you aware of a regulatory requirement that a seismic hazard analysis be conducted before a permit to

operate an underground storage tank system can be issued in Hawaii?

A. I'm not aware of that requirement.

MS. RIDDLE: Thank you. No further questions.

MR. FRANKEL: I have one.

HEARING OFFICER CHANG: All right. Go ahead, Mr. Frankel.

FURTHER EXAMINATION

BY MR. FRANKEL:

Q. Is a tank system, and I'm including the piping, not just the structure of the tank, that is vulnerable to earthquake damage protective of the environment if that system contains thousands, tens of thousands, hundreds of thousands of gallons of fuel?

A. So -- sorry, could you repeat the question?

MR. FRANKEL: You know what, I'll withdraw the question. I'll leave it at that. Thank you. That's fine.

HEARING OFFICER CHANG: Thank you, Dr. Johnson. I believe we are concluded with your testimony. Thank you very much.

THE WITNESS: Okay. Thank you.

(Witness excused.)

HEARING OFFICER CHANG: Let's go off the record for a moment and see where we are.

(A recess was taken.)

HEARING OFFICER CHANG: Back on the record. Commander Frame, may I ask you to take your oath at this time.

Whereupon,

DARREL FRAME,

called as a witness on behalf of the United States Navy, being first duly sworn by the court reporter, was examined and testified as follows:

DIRECT EXAMINATION

BY MS. MINOTT:

Q. Good morning, Commander Frame, how are you?

A. Doing well, thank you. How about yourself?

Q. Great. What is your position?

A. I'm the Red Hill Program Management Office Director for NAVFAC Hawaii, and I'm the Deputy Director for the Environmental Department at Navy Region Hawaii and NAVFAC Hawaii.

Q. And what is your involvement at Red Hill?

A. Well, I started in Red Hill in June of 2018, and at that point it was pretty -- initially just to oversee the construction process on the tanks, the CIR process. Shortly thereafter I became involved in providing technical oversight on behalf NAVFAC Hawaii for the Administrative Order on Consent, and since then I've

been -- I've also periodically acted as the Region Program Director for Red Hill, and the deputy for that position as well.

Q. And is there any correction that you need to make to your testimony?

A. No, ma'am.

Q. Your written testimony?

A. No, ma'am.

MS. MINOTT: We'd like to offer Commander Frame for cross-examination.

HEARING OFFICER CHANG: Thank you. For the Board of Water Supply who will be conducting the examination?

MR. BROWN: I will, Hearing Officer Chang.

HEARING OFFICER CHANG: Okay, go ahead.

THE WITNESS: Sir, if you don't mind, what's the best way to address you gentlemen?

MR. BROWN: You are welcome to address me as Mr. Brown, you can call me David, whatever works best for you.

THE WITNESS: Okay, thank you.

And yourself, Mr. Chang?

HEARING OFFICER CHANG: Mr. Chang is fine, or Hearing Officer Chang is fine.

THE WITNESS: Thank you, sirs.

HEARING OFFICER CHANG: Thank you.

CROSS-EXAMINATION

BY MR. BROWN:

Q. Thank you for joining us, Commander Frame. My name is David Brown, I represent the Honolulu Board of Water Supply, and I have a few questions for you today concerning the written testimony that you submitted in connection with this proceeding.

The first thing I'd like to ask you is what is your understanding of the mechanism by which fuel was released during the Tank 5 fuel release incident that was reported in 2014?

A. That's a good question. So my understanding, and this is probably the best documented release record we have out of all the releases is this 2014 release, so it's pretty in-depth research in that. So my understanding was, after reviewing that, was that those defects in the tank were caused as a result of construction, drilling holes into the tank to look for gases that could be explosive on the back side of it prior to conducting welding inside the tank. Once those holes were drilled, they did not find gases, they proceeded to renovate the tank, and as a result of not sealing those holes properly, that's what caused the release in 2014.

That release was further exasperated (sic), I believe is the word I'm looking for, as a result of the operator's failure to acknowledge those alarms and conduct an immediate investigation, and we've since remedied all of those issues.

Q. So, and I want to make sure I understand this correctly, is it your testimony that there was a pathway from the back side of the steel liner through the tank, and that was what caused the fuel to be able to be released?

A. I don't have any evidence of the fuel being released beyond the steel liner. I can say it went beyond the steel liner because we drilled holes in there and we didn't properly repair those holes, but as far as releasing into the environment, I don't have any evidence of that, no.

Q. And the Navy actually conducts repairs to patch the areas of the steel liner that may be compromised; is that correct?

A. That's correct, sir, yes.

Q. And how did the fuel get past the patch plate?

A. So there's a couple different things. Industry does a similar test, right, they drill a hole in the wall, right, to make sure that there's no explosive vapors behind before they do the -- before they conduct

the welding repairs, put the patch plates in so to speak. So, but what industry doesn't do is patch that hole that's drilled in there. So what our specifications require is that we grind a slot where that hole is, fill that slot in with weld material, and then put a patch plate over the top of that and conduct a thorough weld all the way around that patch plate. And then once that's done, we conduct what's called a vacuum test to make sure that there's no air coming through those welds on the back side of the tank so that you can certify that with a vacuum test. It's basically you fill a clear box full of dish soap type material and you look for bubbles as you draw a vacuum on there.

So those types of things are done constantly, and we've got QA oversight and all that sort of stuff now, but that was not done properly in the 2014 repair and resulting release.

Q. So was there a vacuum test performed on the welds at the time prior to the Tank 5 release?

A. I don't believe that's the case.

Q. And so is it accurate to say the fuel got through those bad welds?

A. I would say that's probably the most likely thing. I think that's true.

Q. You mentioned in your testimony that there were

certain unscheduled fuel movements since the facility began operation in 1942. What do you mean when you say unscheduled fuel movements?

A. An unscheduled fuel movement is generally when there's fuel moving into or out of the tank that we're not expecting or we're not controlling.

Q. And can an unscheduled fuel movement be a release?

A. Certainly, yes.

Q. You provided a table in your written testimony in which you describe certain releases that were indicated in the expert report of Dr. David Norfleet and you provided some information from the reference documents. You recall that in your written testimony?

A. Yes, I do, sir.

Q. I'd like to walk you through a few of those documents, if you don't mind.

A. Okay.

Q. Bear with me as I work the technology here.

A. No, that's fair. I can appreciate that.

Q. Okay. I'm going to share my screen here, Commander Frame, one second. All right, are you able to see my screen, Commander Frame?

A. Yes.

Q. Okay. So this is a document that has been

introduced in this proceeding as Exhibit B-195, and you reference it in this table on information for reference documents related to release No. 23. If we take a look at -- well, maybe before we start that, are you familiar with what this document is?

A. Yes, sir.

Q. Is it the tank history for Tank 1 that was produced by the Navy in connection with this proceeding?

A. I would believe so.

Q. Let's go to page 16 of this document. In your written testimony you state that the telltales drain to a common collection point which discharges into a slop tank; is that correct?

A. Yeah.

Q. Here we have a reference in -- dated September 21st, 1999 that states, at 0700 with level at 22.396, a stub of a telltale pipe, No. 11, second from the top, is found to be leaking a steady stream into the lower access tunnel.

Do you see any reference to a slop tank here?

A. No, that's -- there's not a reference to that. But looking at other similar telltale discharge points on other tanks, that would be where that would go.

Q. Are you familiar with the intended purpose of the telltale leak detection system?

A. Yes, sir.
Q. What was the telltale leak detection system intended to do?
A. Well, it was intended to -- if there were leaks beyond the steel liner, it was intended to collect those leaks, distribute that through a piping system and discharge into the lower access tunnel, again, over the slop tank drain, similar to our sample lines, and that would be indicative of a potential release beyond the steel liner. And there's similar systems they use on ships for seawater heat exchangers and things of that sort as well.
Q. And so the intent of the telltale system was detect leaks, the leaks that got past the steel liner?
A. That was based on the design of the telltale system, yes, that's correct.
Q. So if we have a telltale system that's collecting a leak from the tank, isn't it reasonable and conservative to assume that this was a breach of the steel liner?
A. I would say the intent of the design of the telltale system was for that. I think there were some -- and don't get me wrong, I think that the concept of a telltale system is a really good idea, it's brilliant. The problem with our telltale system in

particular is that the materials and the pipe diameters that they used for that at the time were not conducive towards the system that was constructed in the Red Hill tanks.

Q. So if you were taking a conservative approach in trying to identify all potential releases from the Red Hill Facility, wouldn't you consider the releases that a release detect system actually identified?

A. I guess not knowing what I know about -- if I didn't know what I knew about the telltale system, I could see how someone could come to that conclusion. But again, the materials that the telltale system were constructed of, and really it goes down to in the lower dome of the tank, right, when they built that lower dome and they put those telltales in, the way fuel used to be delivered to Red Hill is through -- they would barge, you know, with open-top containers across the Pacific Ocean, right, so as the Pacific Ocean, you know, is not -- it can be a little bit rough sometimes, so you will get seawater entering into those tanks as it transited across the Pacific Ocean to Hawaii. Okay, so when that seawater gets introduced into the Red Hill tank, if you recall, oil is lighter than water, so the seawater goes to the bottom, and so that is a potential corrosion spot on the inside of the tank for the

telltale systems, and I believe that was the biggest flaw of that whole system was the telltales at the bottom of the Red Hill tanks were exposed to saltwater, marine water and that sort of thing, and that's what caused them to leak. But I don't believe those were releases from outside the tank going into the telltales, I believe it was inside the tank into the telltale and drained to the slop tank drains, if you will. Does that make sense?

Q. It does. I think I understand what you're saying. I have a couple of questions to follow up on that. I think the first is, had the Navy performed any detailed analysis or provided any documentation to demonstrate that any of the releases, the specific releases that are included in your table were not actual releases and were instead a failure of the telltale system?

A. Well, I would say that's really hard to do now because the telltale system has no longer been in use. It's been out of use for since, I want to say like 1983. I think the P0060 project took those out of commission, so they're not in use, and I don't know how we go back to do that now.

Q. So just so that the record is clear, the answer to that question was no?

A. Yeah, that's -- but I would add that when we had the initial meetings for the QRVA, and the Board of Water Supply sat in on these meetings, that all those people agreed that the telltale drains releases were to be discounted. So I think everybody has come to that conclusion.

Q. I can state for the record that is not the position of the Board of Water Supply, nor am I aware of any document that documents that that would be the Board of Water Supply's position. But I appreciate your opinion on that matter.

So, and then again, just so that we're clear, there has been no systematic documentation of past releases to determine whether they were actual releases or failures of the telltale system, particularly with respect to any of the releases on the table that was provided in connection with your written testimony?

A. No, not to -- that an engineering analysis has not been done, other than the fact that we believe that that's -- the causes of those telltale failures were noted, and that's why the system was taken out of commission.

Q. Okay. Let's switch to another document. And again, apologize as I pull this up, it will take a little bit of time.

So Commander Frame, we were just talking a little bit about the Phase 1 of the quantitative risk and vulnerability assessment that was performed under the AOC. I know your testimony discusses that in some detail, and I think we'll get to that a little bit later. Are you familiar with this document that I have just put up on the screen which is Exhibit B-216?

A. I believe this looks similar to the one that ABSG used when they created the QRVA, if I'm not correct.

Q. Correct. So would you have any reason to believe this is not the Excel spreadsheet produced by the Navy in connection with this proceeding that was the Excel spreadsheet that ABS used to calculate different releases from the Red Hill Facility?

A. You know, without going line by line I can't say that for sure, but it looks similar to that, yeah. I would say generally speaking, I would --

Q. So on lines 27 and 28, you indicate in your written testimony that they appear to be referencing the same event and should not be counted twice.

Do you see two entries here on row 63 and 64 on this ABS spreadsheet?

A. I do, actually, yeah. But it looks to me like that's the same release.

Q. And did the Navy -- let's back this up a little

bit. Who is ABS Consulting?
A. They're the subconsultant to a couple other consulting firms that performed the QRVA Phase 1 assessment.
Q. And who did they perform that assessment on behalf of?
A. I think it's HDR Engineers was the second, and then they performed it for, I believe it was Element Environmental.
Q. And who was it submitted on behalf of?
A. Are you -- I guess I'm not understanding your question.
Q. That's okay. Is it a Navy contract? Was it a Navy --
A. Yeah, yeah, it was a Navy contract, yes.
Q. Okay. So the Navy ultimately reviewed ABS's report before it was submitted to the regulators; is that correct?
A. We did the best we could. That report was about 2200 pages, as I recall, so we didn't review everything, but we did the best we could. There were two of us looking at that thing.
Q. So the Navy didn't review the ABS report before it submitted it to the regulars, not thoroughly?
A. Again, 2200 pages, and we did not look at every

single line typed on that thing, so ...
Q. Does the Navy typically submit inaccurate information to regulatory agencies when required to submit information as part of the Administrative Order on Consent?
A. No.
Q. And I would assume, and then correct me if I'm wrong, is it true to say that the Navy had the opportunity to provide feedback to ABS consulting in connection with the preparation of that report?
A. We did have the opportunity to present some feedback, however, ABS, it was their intention to make sure that this was a document that would -- that was not -- it was going to be impartial. So the Navy did not have influence on the preparation of it, but we provided some feedback, and we provided the information, yes.
Q. And when you say provided information, how many documents did the Navy provide to ABS Consulting, historical records or otherwise, for them to be able to review and put together the Quantitative Risk and Vulnerability Assessment, including quantification of releases from the facility?
A. You know, I'm sure those documents are all listed in the appendices or included as references. I don't

happen to know the number, but I know it's a pretty substantial amount.

Q. Would you think it was more than a hundred?

A. It could have been. I don't remember the number off the top of my head.

Q. More than 500?

A. Again, I mean we could speculate numbers all day long, but I mean I don't remember the number off the top of my head.

Q. But to your knowledge the Navy never indicated to ABS consulting that these numbers in their report that was produced and prepared on behalf of the Navy and submitted to the regulatory agencies contained any inaccuracy or double counting?

A. I would say we did not make a comment related to double counting.

Q. Okay.

A. Yeah.

MR. FRANKEL: Just for the record, you were talking about Exhibit B-216, and Mr. Brown, I think there's a lot of, I don't know what you call them, but tabs that are internal to that, and so do you want to make a specific reference as to what tab you were looking at in case someone wants to look at the record later on?

MR. BROWN: Yeah, that's fine. Let me pull it back up. All right, we have it again for everyone?

HEARING OFFICER CHANG: It's up.

MR. BROWN: Okay. So we are on Exhibit B-216. This is the native file version that was produced by the Navy in correction with this proceeding. You're correct, or Mr. Frankel's correct, there are many tabs. The tab you were looking at at the bottom is the tab called "Red Hill Release Incidents," and what the specific items that we were discussing, or entries for releases, were rows 63 and 64 of the Excel itself that relate to October 2018 release incidents from Tank 2.

Q. I'm going to pull up my next exhibit. Okay, can you see my screen Commander Frame?

A. Yes.

Q. So what I have pulled up here is Exhibit B-242, and are you familiar with this document, Commander Frame?

A. I have seen similar documents. I can't say for sure whether I've looked at this one or not. I probably have to some extent because it's Tank 5.

Q. Sure. This is the Clean, Inspect, and Repair project for Tanks 5 and 17, dated November 18, 2010?

A. Okay.

Q. And this is, I guess, BWS Exhibit 242. If I can

refer everyone to page BWS 029889. And apologies, this is a long document, but it's on page 481 of the PDF.

Here if you look, we have on the upper, I guess the right side of the screen, an indication of a weld repair leak. Is it your understanding, Commander Frame, that this would indicate a leak in the weld?

A. Actually you bring up a great point because I have struggled with this question a lot, because I don't really understand how a weld leaks, okay. So I can understand how a structure would leak or something like that, so I did give this quite a bit of thought. And as I said, when we conduct these types of tests, you know, when we test welds now we look at them with a vacuum box type test. And again, a vacuum box will show the passage of air through a weld or a plate, or something of that type, right? So that in my interpretation now, I would say that's probably what happened there, is it failed a vacuum box test.

Now, what that doesn't say is that -- that says they won't hold air. What it doesn't say is it won't hold fluid. So I don't see how you can infer that a weld leak won't hold fluid when it may have certainly not passed a vacuum box test, but it could still hold fluid.

Q. Do you have any information, or have you provided

any in your testimony that demonstrates that it doesn't hold -- or that it can hold fuel?

A. I don't know one way or the earth other. I'm just saying that's a strong possibility based on what I know. And now that -- I considered this for some earlier tanks, but if this is the 2000 -- or if this is the Tank 5, I'm sure we were using vacuum box technology back then. So, yeah, that's probably what that is. I don't know for sure, but that's probably what that is.

Q. So similar to what we talked about previously, if we're being conservative and we're estimating the number of potential fuel releases, wouldn't it be reasonable to consider a leak in a weld as a leak of fuel to the environment?

A. I don't think so, and this is why, because even if you've got this steel structure, right, you've got this steel lining, you've still got two-and-a-half to four feet of concrete behind that, right, so that necessarily -- that would, I believe, would resist some of that fluid from leaking out of that system.

Additionally to this is this tank passed a tank tightness test prior to undergoing this inspection, and so based on that, I don't believe that this is -- you can say that this is a leak because it's passed a tank tightness test.

Q. I'm glad you bring those two things up, Commander Frame. We had much testimony about that earlier this week.
A. Okay.
Q. And isn't it true that the tank tightness test only detects leaks above a certain threshold?
A. That is correct.
Q. So the tank could be leaking at a rate below, let's say, .5 gallons per hour?
A. I would say that's true, but that also meets the requirements of the Hawaii Administrative Code.
Q. Does it meet the requirement of State law to prevent releases for the operational life of the tanks if you're having release from these tanks?
A. I think that's a different question, and I don't believe that these tanks are leaking.
Q. We have a leak in a weld here, so we just ruled out the tank tightness test as being definitive evidence of not being a leak. I think the other thing that you mentioned, and correct me if I'm wrong, was the concrete behind the tank; is that correct?
A. Mm-hmm.
Q. And we just had testimony from Dr. Johnson stating unequivocally that concrete cracks, and there are pathways for the fuel where they can travel through

that concrete and get into the subsurface. Do you have any reason to disagree with that?

A. Well, I would say that that is true if you're looking at just concrete itself. But I think with that system, those layers of protection or those layers that were involved in the construction of the tanks, I think that release -- and if you go back to the QRVA, for instance, right, so -- and I'm sure you'll get to this at some point -- but those releases are only penetrations through the steel liner. Like the QRVA only estimates releases outside the steel liner, it does not address concrete, it does not address grout, it does not address gunite, and it does not address basalt.

Q. Commander Frame, are you aware of impacts to the subsurface, including the soil, the soil vapor, and the groundwater beneath the tanks from historic fuel releases from the Red Hill Facility?

A. I would say soil vapor monitoring as a result, or following the 2005 release, did spike in Monitoring Well 2.

Q. If the Monitoring Well 2 -- or sorry, the fuel was held up completely inside the tank, would you see it in the groundwater?

A. I would say as a result of the 27,000 gallons that released in 2014, I do not have that evidence. I

don't know where that fuel --
Q. You don't have evidence?
A. I don't have any reason to suspect that reached the groundwater.
Q. So I guess that's not what I asked. I asked if you have evidence of fuel in the subsurface, it is not within the tank structure, is it?
A. Could you rephrase that? I guess I'm not understanding the question.
Q. Sure. We talked about soil vapor monitoring. If you've having soil vapor monitoring detection, petroleum, in the subsurface below the tanks, can they still be within the tank structure?
A. Well, soil vapor monitoring doesn't necessary look for petroleum, it looks for byproducts of petroleum releases.
Q. Okay. So can you have that petroleum still in the concrete if you're getting its byproducts in the subsurface?
A. I would suppose probably -- well, I mean some of -- there is evidence of historic releases at Red Hill. I think we all agree to that. Now --
Q. And evidence of those in the subsurface, including the groundwater, correct?
A. Honestly, that's more of an environmental

question. I'm not really qualified to answer that.
Q. Are you aware that the Navy's expert, Mr. Curtis Stanley, has said that the Navy has never pretended that there weren't impacts to the groundwater in the vicinity of the tanks?
A. I guess I'm not sure that he said that or not.
Q. Okay.
A. But I know Curt Stanley.
Q. Let's move on to the next exhibit. So that was number 33. Number 34 in your -- or for row 34 in the table in your testimony you've just indicated recorded 27,000-gallon release from Tank 5 in 2014. You're not denying that was the release from the facility, are you?
A. No, no.
Q. Okay. The next exhibit is, I'm going to pull up -- or sorry, the next one is for row 36, and we will be looking at Exhibit B-207. Okay, so this is Exhibit B-207. Commander Frame, are you familiar with this document?
A. I believe so. Hold on a sec there's something --
Q. I can scroll down.
A. No, there's something just popped up on my screen, I can't see, that's all.
Q. No worries, take your time.
MR. MCKAY: We have tech support on the way.

THE WITNESS: Okay, I think we're back up and running again. Thanks for the patience.

MR. BROWN: Sure, no problem.

Q. So are you familiar with this document?

A. Let's see, could you scroll a little bit to the right? I can't quite see the date.

Q. Oh, do you have people popping up on the right of the screen?

A. Yeah. Let me see how I do that.

Q. No, no, no, I can move this. Hold on.

A. Bear with me. You're not the only one technically challenged.

Q. No, that's okay. Is that better?

A. Yeah, that helps. Thank you.

Q. Okay. Are you familiar with this document, Commander Frame?

A. I believe so, yeah.

Q. What is this document?

A. That's a Confirmed Release Notification, or CRN I think they refer to them as.

Q. Does this say suspected release notification?

A. It does not. I mean I don't remember it saying that, but.

Q. And when we scroll down to this page, and I apologize if the readability is difficult, this states

that there is a confirmed release from Tank 6 right here. Do you see that?
A. Mm-hmm, yes.
Q. And that the method of observation was an inventory check. Do you see that?
A. Yeah.
Q. And that the type of substance was JP-5 fuel?
A. Mm-hmm.
Q. And that the tank has been drained and taken out of service. Do you see that?
A. Yeah.
Q. And it's signed by a Mr. John Santo Salvo, I think that's -- is that Lieutenant Commander?
A. That's correct.
Q. On April 16, 2002?
A. Mm-hmm.
Q. Do you see this section right here? I'm sure it's hard to read, but the section I'm circling with my cursor. Do you see my cursor actually?
A. Yeah, I can see your cursor, but yeah, that is very hard to read.
Q. Yeah. If I represent to you that this says, I certify under penalty of law that I've examined and am familiar with the information submitted in this notice, that based upon my inquiry of those individuals

immediately responsible for obtaining the information, I believe that the submitted information is true and accurate, would you have any reason to disagree with me?
A. I'm sorry, could you say that again? I mean I understood the -- what was the question? I understood the --
Q. The question is, yeah, do you have any reason to disagree that this document was signed under the penalty of perjury?
A. Oh, no, I don't believe that, yeah. I don't -- I wouldn't disagree with that.
Q. So it's a proper fuel release, wouldn't you say?
A. I would say that in having reviewed these, and I reviewed a number of them, I think that the Navy was overly conservative in what they call a release on several of these. Not to say that a release didn't occur, I'm not questioning that. I'm questioning when it occurred, when the release occurred.
Q. Okay. So you're not questioning that a release occurred?
A. No, no, no.
Q. Okay, thank you. We'll go to the next document. Again, I apologize for the time it takes to pull these up and get them on screen. Okay. Hopefully you can see this, or it will pop up soon, Commander Frame. What

we're looking at here is Exhibit B-187, which refers to line No. 40 in your testimony.

A. Mm-hmm.

Q. And your statement is that this provides instructions to a contractor for repairing a weld; is that correct? So I'm looking at page BWS0255779, which is page 5 of the PDF.

A. Mm-hmm.

Q. We have here indication of a leak in a weld seam. Do you see that?

A. Yes.

Q. Do you have any reason to believe there wasn't a leak in a weld seam?

A. I would assume not. I would assume there is a leak in the weld seam. What I can't -- what I don't think you can assume is that a leak in a weld seam results in a release to the environment. It doesn't indicate that, it just -- it indicates a repair that needs to be made.

Q. And does the Navy repair items typically that shouldn't be fixed?

A. I would say normally, under normal conditions sometime we would not. In the case of Red Hill, I think we go above and beyond that.

Q. Above and beyond?

A. Mm-hmm.
Q. In 1998 it's your testimony that the Navy went above and beyond what needed to be done with respect to inspecting, repairing, and maintaining these tanks?
A. I would say, well, maybe not '98, but certainly now we do.
Q. Right. But this is a document dated 1998, correct?
A. Mm-hmm, yeah. Appears to be.
Q. So we know that a leak in a weld seam can result in a release in the environment. That's what happened in the Tank 5 incident. This is dated 1998. Do you have any evidence to indicate that this leak in a weld seam did not result in a release to the environment?
A. I don't any evidence to indicate that it did.
Q. But you don't have any that it didn't, correct?
A. One way or the other, I don't think you can make a -- you can't infer a leak to the environment because of a leak in a weld seam. I don't believe that's the case.
Q. Was there a leak in a weld seam at Tank 5?
A. Well, like I said before, when we looked at Tank 5, that was the most exhaustive investigation ever done on a tank, so we have a lot of evidence that has been reviewed and looked at to determine the cause of that

release. We can't say that about any other release. Tank 5 is kind of its own animal.

Q. Is it the Navy's position that because they didn't look into what may or may not have happened with all of these leaks in the tanks, that you cannot infer that there was a release?

A. I think what we've done is we've looked at each one of these things and made a judgment call, right? Some of them -- I mean you can ask ten different engineers about this, you'll probably get ten different answers.

Q. So if you were going to ask a conservative engineer, what would the conservative engineer who's -- and when I say conservative, I mean most protective of human health and the environment, what would you say?

A. Oh, I would say you're looking at one right now.

Q. Okay. So as a conservative engineer, you have a leak in a weld seam, you know a leak in a weld seam can result in a release to the environment, do you have any reason to discount the fact that this could be, not saying it is, could be a release to the environment?

A. Could be, but it could also not be.

Q. Thank you. All right, let's go to the next exhibit, and this will be Exhibit B-233. Again, bear with me, I apologize. All right, so B-233 corresponds

to row 49 of your testimony, and I want to direct the parties and Commander Frame to BWS028518, which is page 28 of the PDF.

So real quick, and I don't want to belabor this too much, but same question, this is a repair and instruction to a contractor, that's dated November 24th, 1995, and can you see here that on No. 6 and No. 7 it says repair leak and repaired leaks?

A. Yeah, okay.

Q. Same question, do you have any evidence to suggest that these are not actually leaks to the environment?

A. So this is part of contract documents, so this does not necessarily indicate that there are leaks, this says if you have to do this, if you run into this type of deficiency, for instance, deficiency F or deficiency G, this is the process you would use to repair those deficiencies. That doesn't indicate there's any of those deficiencies, they're just saying how to repair them if you do run into them. You run into this an awful lot in construction documents.

Q. Just to be clear, this doesn't say if you run into the leak, repair it. It says repair the leak.

A. Again, it's a construction document. It provides the contractor direct instructions on how to repair

something if they come across it. It's very common in construction.

Q. Understood. All right, I'd like to walk through one more document. Okay, can you see my screen, Commander Frame?

A. Yeah.

Q. Are you familiar with this document?

A. I think so.

Q. This is Exhibit B-204, which corresponds, I believe, to line 70 of your testimony?

A. Mm-hmm.

Q. Do you know what this document is?

A. Looks like an interview form for a confirmed or suspected release.

Q. And it says here, as I scroll down, that the date the release was discovered was November 22nd, 2000; is that correct?

A. Looks that way, yeah.

Q. And it was reported apparently in December 1st of 2000?

A. Does look that way, yeah.

Q. And the means of detection was PID readings, which my understanding would be soil, vapor, photoionization detections, right? That's what that says right here?

A. I would say it could be that. That sounds right, but I don't know for sure.
Q. And the extent of the contamination was to soil; is that right?
A. That's what that form indicates, yeah.
Q. Correct. So do you have any reason to believe that there wasn't an impact or contamination of the soil that was detected in late 2000 and was reported in this notification?
A. Do I have a reason to believe that soil was not contaminated?
Q. Correct.
A. Is that what you're asking?
Q. Yes.
A. I don't know one way or the other.
Q. But what does this document say?
A. The document says that the apparent extent of contamination was limited to soil.
Q. And do you have any reason to believe that this document is incorrect?
A. Well, the only -- I mean, again, this goes back to a release reporting, right?
Q. Correct.
A. But at the time that this document was submitted there was no fuel in Tank 19.

Q. Correct.
A. So, yeah, as far as the contamination, I can't comment on that one way or the other. I didn't fill out the form. But there was no fuel in Tank 19 at the time that this thing was submitted, so --
Q. But just because a tank doesn't have fuel in it doesn't mean that it didn't leak before then, does it?
A. Oh, no, I mean that's certainly possible.
Q. So do you, again, have any reason to disbelieve that someone at the Navy didn't find contaminated soil in November 2000?
A. No, I don't have any reason to not believe that.
Q. And if that soil was contaminated in the vicinity of this tank, it would have escaped the steel lining, correct?
A. At some point probably. I mean if it's -- assuming the contamination came from this tank, I would say yeah, that's --
Q. And the grout, correct?
A. Possibly.
Q. Traveled through the concrete. It's in the soil, it traveled through the concrete, right?
A. Could have, yeah.
Q. And past the gunite, correct?
A. Sure, yeah.

Q. And it's in the environment.
A. I would say yeah, that's possible.
Q. Okay, thank you. Let's go ahead and switch gears here a little bit, Commander Frame. You testified about the Navy's Phase 1 quantitive risk and vulnerability assessment report prepared by ABS Consulting and the Navy's future risk work, isn't that right?
A. That's correct.
Q. At the outset I have a few questions concerning your familiarity and qualifications in the risk arena. Do you have any formal education in performing or evaluating risk and vulnerability assessments?
A. No.
Q. Do you have any formal training in performing or evaluating risk and vulnerability assessments?
A. No.
Q. Do you have any certifications related to risk and vulnerability assessments?
A. No. That's why we hired a consultant.
Q. Right. Why is the Navy required to perform a risk assessment for the Red Hill Facility?
A. That's required by the Administrative Order on Consent, Section 8.
Q. And the purpose of the risk assessment is to assess the level of risk Red Hill poses to the

groundwater and the drinking water aquifers and to inform the development of tank upgrades required under the AOC; is that correct?

A. Sounds close. I think it's more about protection of human health.

Q. And the environment?

A. Certainly, but the emphasis is on human health.

Q. So is it the Navy's position that it can continue to contaminate the environment as long as human health is not at risk?

A. I would say that's not the Navy's position, because in the last, what, 5 years we spent a quarter of a billion dollars, or close to that, on this facility. If that were the case, then we would not have spent that money.

Q. And isn't it also fair to say the Navy spent that money because there's been episodic and consistent fuel releases throughout the history of the operation of Red Hill?

A. There have been historical releases. I don't think consistent is an accurate term to describe that.

Q. Have there been multiple fuel releases?

A. Mm-hmm.

Q. Have there been fuel releases as early as the inception of the facility, the 1940s?

A. Maybe late 1940s, I think. I don't recall anything early 1940s, but --

MR. FRANKEL: I'm sorry --

Q. Have there been releases as recently as 2014?

HEARING OFFICER CHANG: Mr. Frankel?

MR. FRANKEL: The purposes of the transcript, two question ago Mr. Frame answered "mm-hmm," and can we get a yes, you know, articulate that in words yes. Just for the court reporter's sake I want to make sure the transcript is clear.

THE WITNESS: I'm sorry, what was that question again? Can you read that back to me then?

MR. FRANKEL: I think he asked if there were multiple releases or leaks.

MR. BROWN: Could we have the court reporter read it back?

(The record was read by the court reporter.)

THE WITNESS: I believe what I said was, and correct me if I'm wrong on this, but there have been historical releases in the facility, but to say there's -- I believe that to say it's a consistent record of releases in the facility is inaccurate. That's what I would like to have in the record. There have been historical releases. To say that there are consistent historical releases I believe is inaccurate.

MR. BROWN: Okay, we've got that. I'm happy to continue.

THE WITNESS: Okay.

Q. (By Mr. Brown) And were there releases -- actually, let me back up. So were there multiple historic fuel releases starting as early as the 1940s and as recent as at least 2014?

A. Yeah, but not continuous. There were hits and misses during those periods.

Q. That's a yes?

A. Not consistent, but there were episodes of releases during that period.

Q. Multiple releases?

A. Yes.

Q. So Commander Frame, you testified in your written testimony that the QRVA Phase 1 report identifies the most significant internal event risks at Red Hill and quantifies their relative contributions to overall risks. Is that an accurate characterization?

A. I believe that was the intent, yeah. That was the intent of the QRVA, yeah.

Q. But isn't it true that the Phase 1 QRVA does more than that? It quantifies the risk of both sudden acute releases and chronic undetected releases?

A. You know, I would say those are -- when you talk

about quantifying, first of all, the QRVA is a model, right? It's just a model. And I don't have a lot of experience in risk and vulnerability assessments, what I do have a lot of experience in is computer modeling, mostly for wastewater --

Q. Is modeling useful? I'm sorry.

A. Well, it depends, right? It depends on -- what you input into the model will depend on what you get out, right? So I can make models say whatever I want, but it depends on the input going into that model and those assumptions.

Q. So you had indicated earlier that ABS, in preparing this model, you wanted them to prepare an accurate model so the Navy did not thoroughly review every aspect of the ABS Phase 1 risk report; is that accurate?

A. That was ABS's position.

Q. What's the Navy's position?

A. I would have liked to have reviewed that more thoroughly, and I think you understand that, right? I would have liked to have gone through that thing line by line, but 2200 pages, and the software that they used for modeling those risk and vulnerability assessment was tremendously complex, and I don't have the experience and the knowledge to be able to evaluate that as

thoroughly as I would have liked.
Q. Are you familiar with the results of the Phase 1 QRVA?
A. Yes.
Q. The phase 1 QRVA states that there is a greater than 27 percent probability of an acute sudden release of between 1,000 and 30,000 gallons of fuel from Red Hill each year, isn't that accurate?
A. That's what that report says, I believe that's correct.
Q. Does the Navy consider the 20 percent probability of an acute sudden release of between 1,000 and 30,000 gallons of fuel from Red Hill each year an acceptable level of risk to pose to the groundwater and drinking water aquifer?
A. The Navy would say that we don't want anything to be deposited into the groundwater, that's our goal. We don't want anything to be deposited in the groundwater.
Q. And just so that the record again is clear, that's a no?
A. Yeah, I believe that's -- yeah, I would say we, the Navy, does not want anything deposited into the groundwater. So what the risk assessment says and what are goals are are not necessarily the same.
Q. And the ABS Phase 1 QRVA also says there's a

greater than 34 percent chance of a sudden release of more than 120,000 gallons of fuel from Red Hill within the next 100 years. Does that sound accurate to you?
A. It does not sound accurate.
Q. Not an accurate depiction of what the report says?
A. I would say it is what the report says, but I don't agree with that conclusion.
Q. Does the Navy consider that, the sudden release of more than 120,000 gallons of fuel from Red Hill in the next 100 years an acceptable level of risk to post to the groundwater and drinking water aquifer?
A. Certainly not.
Q. The ABS report states that there's a greater than 5 percent chance of a sudden release of more than one million gallons of fuel from Red Hill in the next 100 years. Isn't that what the report says?
A. I'm not familiar with that part, but it sounds like it's something that could be in the report, so -- but I don't know --
Q. Does the Navy consider that -- oh, sorry, I didn't mean to talk over you.
A. No, I think I see where you're getting. No, the Navy would not deem that has an acceptable level of risk, a million gallons, certainly not.

Q. And the Phase 1 QRVA states that the expected volume of chronic, undetected fuel releases from Red Hill is 5,803 gallons per year, isn't that right?
A. I believe that's what the report states, yeah.
Q. And does the Navy consider that an acceptable level of risk to pose to the groundwater and drinking water aquifer?
A. Not only does the Navy not consider -- not only does the Navy consider that an unacceptable level of risk, we don't have any evidence to suggest that that's occurring. If it was, we would take action.
Q. So you're saying the fact that ABS came to the conclusion that the expected chronic undetected fuel releases for Red Hill is 5,803 gallons per year was not based on evidence provided to it by the Navy?
A. Again, that's a model. That's a simulation of what could happen, not what is happening.
Q. We had testimony earlier this week from Commander Whittle and others that testified that a tank tightness test that's capable of detecting a .5 gallon per hour leak rate could be leaking at a rate below that which would far exceed the 5,803 gallons per year that ABS calculates as the expected amount of fuel released by the facility each year. So it is possible that the Navy is releasing 5,803 gallons of fuel per year and doesn't

even know about it, isn't that true?
A. Boy, I just have a hard time believing that.
Q. But it's possible?
A. Well, okay, so if you look at the tank tightness testing, it will tell you, okay, we can't detect below a certain threshold, right? And that number is something, based on, you know, if get .49 times number of hours in a year, and that will give you how many gallons could be released, right? Something along those lines, worse case, right?
Q. Right.
A. But if you look at those other systems involved in monitoring, automatic tank gauging, manual gauging, all those other things, we're not losing -- I don't believe we're losing that level of fuel. I just have a hard time believing that.
Q. No, and I understand that you have a hard time believing that, Commander Frame, but my question is about is it possible, not is that what you believe.
A. Mathematically I suppose it is possible.
Q. Okay. Commander Frame, your testimony includes a table identifying the primary categories of initiating events that could contribute to a fuel release at Red Hill. Could you please identify for the Department of Health the initiating event category in your testimony

that is responsible for the greatest percentage of leak initiating event?

A. Would you mind pulling that testimony up so I could look at that.

Q. I certainly could. Can you see my screen, Commander Frame?

A. Yes.

Q. So you have a table here, this is from page 5 of your testimony, there are two columns and several rows. The first column is, Initiating Event Category, and the second column is number of initiating events.

Can you tell me what the first line and the greatest number of initiating events corresponds to?

A. Small release from steel liner.

Q. Thank you.

A. And this is from the QRVA Phase 1 report.

Q. Correct. Well, this actually -- that was from your testimony, but I'm assuming --

A. But if you look at the line above that, it says it's from the Executive Summary in the -- yeah.

Q. Okay. The QRVA was broken down initially into four phases, isn't that correct?

A. I believe, yes.

Q. Phase 1 addresses the risks posed by internal events not including fire or flooding, such as equipment

failure or human error; is that right?
A. Sounds accurate, yes.
Q. And those were the only risks that were assessed in the Phase 1 QRVA, correct?
A. That's my understanding.
Q. So any other risks not addressed by a Phase 1 would be additive, and by that I mean they would only increase the total risk that would be quantified.
A. Boy, I'm not quite sure about that. I guess I'd have to think a little bit more about that.
Q. So are you suggesting that there could be negative risk with respect to Phase 2, 3 --
A. No, not negative, but I'm saying if you expand that, does that make the risk, the overall risk drop? I suppose it could, right? If you're looking at -- I think if you're looking at like, okay, I'm only compartmentalizing this -- and again, those percentages will probably drop as opposed to -- because if you add all those percentages up, right, it's going to equal a hundred, or should.
Q. Correct. But these are not -- so I'm not asking about the distribution of risks among the whole, I'm asking about the risks that are considered and the amount of fuel that would be quantified as potentially being released as a result of the risks that are

considered. So we already talked about the greater than 27 percent chance of a release of 1,000 to 30,000 gallons.

A. Mm-hmm.

Q. If we include, for example, the seismic issues that Dr. Johnson was including, that number of greater than 27 percent chance is not going to go down, is it?

A. Honestly it, I think -- I mean if you look at those number of initiating events, then I think it could go down, right? Because you run the scenario more times, right? So when we look at those, those are initiating events, right, so the more scenarios you run, those risks will change, right, it will drop. Like if I run --

Q. No, no, no. I --

A. If I'm running 4 million simulations, and their numbers are probably comparable to that, that's one thing. If I run 6 million, now those things could drop, right? If I'm considering different things, I think it's possible it could drop. And again, I'm not a risk expert in this area, I'm just kind of thinking this out through my head, so bear with me.

Q. Yeah, no, I appreciate that, Commander Frame, but I think there's a misunderstanding, or maybe I asked an unclear question. I wasn't asking about the

distribution of initiating events that was in the table we had just discussed. I'm now asking a different question. I'm saying the Phase 1 QRVA estimates these different initiating event categories, but it also provides a level of risk or an expected amount of fuel to be released from the facility based on those initiating events, so they're two different things. And so the probability of a release of certain sizes, if you add more potential risks, can only increase as you go forward through the QRVA process. You can't have less of a percentage of release, isn't that right?

A. You know, honestly, I don't feel like I'm qualified to answer that.

Q. Okay. So you don't feel like you're qualified to answer the questions about the QRVA, but you did submit testimony about the meaning and the importance of the QRVA in this proceeding?

A. I mean that's -- you know, I mean, honestly I just don't know the answer to that.

Q. Okay.

A. I just don't have an answer for that. I mean I'd have to talk to some other folks about that.

MR. BROWN: I have no further questions.

THE WITNESS: Fair enough.

MR. FRANKEL: I'm not sure you heard, he said

he had no further questions.

HEARING OFFICER CHANG: Oh, I'm sorry, I did not hear that. Let's go off the record a moment, do a process check.

(Whereupon, at 12:03 p.m. a luncheon recess was taken.)

AFTERNOON SESSION

(February 3, 2021, 12:45 p.m., the hearing was resumed.)

HEARING OFFICER CHANG: Let's go back on the record. Mr. Frankel, questions for Commander Frame.

MR. FRANKEL: Thank you.

CROSS-EXAMINATION

BY MR. FRANKEL:

Q. Commander Frame, you testified when you were questioned by Mr. Brown there that the risks identified in the ABS report are of leaks that just get outside the steel, but they're still confined by the concrete, gunite, et cetera. Do you remember testifying to that?

A. Yeah, that was the basis of the ABS report.

Q. Okay. Let's look at the ABS report and see what it actually -- what the risk is that it actually looked at. This is what we're talking about, right, the ABS report which is Exhibit N-31, correct?

A. That looks like it, yes, sir.

Q. Okay. I'm going to go down to page ES-4, and do I need to expand this a bit for people?

HEARING OFFICER CHANG: That would be helpful.

THE WITNESS: Yeah, I can't read that.

Q. (By Mr. Frankel) So again, as I said, this is ES page 4, Exhibit N-31, and do you see this reference here

where it talks about the current risk thresholds of concern for the safety of the water table potentially affected by the RHBFSF fuel release to the environment, and then it provides the two scenarios, acute and chronic. Do you see that? It says to the environment.

So when it says to the environment, that's not confined within the concrete, or confined within the gunite, that's to the environment. That's the risk that the ABS study was looking at, isn't that right?

Or we can look further down to that parenthetical, outside the control and physical boundaries of the RHBFSF. And for the record, can you tell us what RHBFSF stands for?

A. Red Hill Bulk Fuel Storage Facility.

Q. So the risk that's being assessed here is the risk that the fuel leaves the facility. Not just enters the lower tunnel, not just enters into the concrete, but leaves the facility. Do you see that?

A. I would say that what this -- when this study was produced it ignored the effects of concrete to provide resistance to release fuel to the environment.

Q. Okay, so that's a criticism you have of the study.

A. Mm-hmm. Oh, no, it's not a criticism, it's just an assumption they made.

Q. Okay. Well, we'll talk about some of those assumptions shortly. Now, the Navy promised in doing its assessment, and in agreement with the Department of Health and the Environmental Protection Agency that this assessment would provide a, quote, in-depth, rigorous, and repeatable approach to assessing risks, right?
A. Well, but we're not completely done with this study yet. We've only completed Phase 1.
Q. I understand. But that was the -- that was what the Navy was -- that is what this risk assessment is supposed to do, it's providing in-depth, rigorous, and repeatable approach. You have other phases to look at, but for this phase that's what you were attempting to do, correct?
A. I guess I'd have to go back and see what the statement of work said, but --
Q. Oh, okay. Well, why don't we do that.
A. Okay.
Q. So this is Exhibit S-17, as I attempt to share the screen again. Let's go down here, and I suppose it needs to be expanded. And do you see this is a letter dated April 13, 2017? Can you see that? Is that visible on your screen?
A. Yes, sir.
Q. And if we go down here, it's signed by Captain

Hayes. I have no idea of the military hierarchy. I don't know, is a captain above a commander or below a Commander?

A. He was my commanding officer when I first got here.

Q. Okay. So he said, this is his letter, and he's calling it an in-depth, rigorous, and repeatable approach, correct?

A. Yeah, looks like that's what it says, yeah.

Q. Okay. And the ABS report is long.

A. Yeah, no disputing that.

Q. You testified earlier that it was more than 2,000 pages?

A. Sounds about right. It depends on which version you're looking at. There is a redacted version and nonredacted version, I believe.

Q. Okay. And which version does the Hearings Officer have?

A. Honestly, I don't know. I couldn't tell you.

Q. Okay. So let's -- why don't we take a look. It's Exhibit N-31. So this is what we're talking about, and our -- on the very top, I think you're probably familiar with PDF documents, you can see at the very top which page of the PDF you are, and this says 1 of 1,666.

A. Okay.

Q. Does that tell you whether it's redacted or not, or would we have to look at individual pages to figure out whether it's redacted or not?
A. You know, as -- and I can't remember for certain, but I believe the stuff that was redacted out of here was proprietary information by the contractor. I think that was -- there are only two reasons to redact information, one is if it's critical infrastructure, and the other one is if it's proprietary information. So that would -- okay, so there you go. So that's the redacted version, yeah.
Q. Except, you know, it's redacted, but the page is still there. So there's propriety information, proprietary information, all these pages, I don't think it's --
A. Yeah, yeah, yeah, that's fair.
Q. So I guess my question to you is, when you said it was 2,000 pages, were you being casual, informal in exaggerating, or is there another document that's more than 2,000 pages?
A. No, I think I was -- I mean if this is it, yeah, I would not expect another version.
Q. Okay, okay.
A. So casual, I think, yeah. That was a rough estimate on my part.

Q. Okay. And what was the time gap between when this report was completed and the time it was provided to the Department of Health?
A. Let me think about that. I believe, you know, if you were to look on the EPA's website, I believe that might have that. But I believe it was completed in November of 2018, and I think we submitted it in May of 2019, if I recall correctly. It's somewhere around there. It's about six months or somewhere around there.
Q. Okay. And in that timeframe you may not have had time to read all 1,666 pages, but in that timeframe did you have time to read the executive summary before it was submitted to the Department of Health?
A. Yes, sir.
Q. Okay. And that executive summary quantifies these risks, right?
A. Based on the mathematical model, yeah.
Q. And again, you're not an expert at risk assessing, but the folks that were hired are experts?
A. Yeah, their expertise is generally in the area of nuclear risk and vulnerability assessments.
Q. But did you feel any constraint about hiring them?
A. I was not involved in the decision to hire them. That happened before I got here, yeah.

Q. Well, the Navy certainly felt comfortable enough to award them a big contract to do this work, correct?
A. Apparently, yeah. I mean, again, I was not involved in that decision.
Q. Okay. And the risk assessment concluded that the risk of a leak -- actually, why don't we just sort of bring this up here. And let's see here, one of the risks it talks about that you went through with David Brown is the chronic release. It's expected -- expected is the word that's used -- fuel release of 5,803 gallons per year for the entire facility. That's what those folks, those experts estimated, right?
A. That's what the model spit out, I would believe. That's what the model produced based on the assumptions given.
Q. Okay. And the risk of a spill between 1,000 and 30,000 gallons in a single year is about 27.6 percent, correct?
A. You know, we looked into that, and most of that 27.6 percent is between, I believe it was 1,000 and 5,000 gallons, so it kind of depends on how you bend those things, I guess. You know, like we could say -- if you were to say 1,000 to 5,000, most of the risk according to the model would be in that range. So I think that is a bit misleading to see it like that

though.
Q. I see. But this is how the report itself -- the experts in risk assessment did characterize it as a 27.6 chance in any single year of a leak of up to 30,000 gallons, correct? That's how the report characterized it.
A. That's what the report says, that's correct.
Q. Okay. And you'd have to do some complicated math to figure out what the risk is in ten years, but do you have any reason to dispute our expert's opinion that using this modeling, that the risk is 96 percent over the next ten years, or can you not do that because you're not an expert in risk assessment?
A. So when you say 96 percent, I guess of what? What is that risk of?
Q. Of a spill of up to 30,000 gallons in the next ten years.
A. I would say I believe that is overestimated significantly.
Q. And again, you're not an expert at risk assessment. Are you an expert at mathematical statistics?
A. Well, so generally speaking if you look -- and I believe somebody put together a bar graph or something, typed thing of looking at when releases have occurred

throughout the history of the facility. I believe you guys have that information, right? I mean I feel like that's been done by somebody over there.

And you'll notice that there are spikes of when those releases occurred and when they didn't occur. So, you know, you can look at -- if you look at the last, say, you know, 40 years, I guess, from 1988 to 2018 -- is that 40? 40, I guess that is; 30, or something like that -- you'll see that we did not have releases during that time period at the rate that we had previously, right? We haven't had that.

So I think it kind of depends on how you look at the history of the facility, and I think when ABSG did this, they assumed, you know, if we had a release every -- if we just, for argument's sake, if we had a release 30 times -- if we had 30 releases in a hundred years, they would say there's a 30 percent chance of release per year. But that assumes that there are no improvements made to the facility, right? So we've made improvements to the facility, and I think that goes -- I mean infrastructure is like that, right? I may not be an expert on risk assessment, but I can tell you a little bit about infrastructure. If you don't -- go ahead.

Q. Well, okay, in terms of the, you talked about a

gap in when there weren't releases. What were the years? What were the years you're talking about there?
A. Generally, I mean motion of those releases occurred before the EPA regulations were enacted.
Q. No, but I asked you when you feel there were no releases detected. What years are you talking about?
A. I would say generally after 1988 the period of releases dropped significantly when the EPA started monitoring those.
Q. You went through with David Brown, him showing you where your report suggested there were leaks, but you disagreed that there were leaks, and so there's sort of a disagreement there.
A. Sure, yeah.
Q. But you acknowledge that the technology to detect releases or leaks is more sophisticated today than it was ten years ago, 20 years ago, 30 years ago, 40 years ago, correct?
A. Oh, yes, certainly, yeah.
Q. So the fact that we don't have information about some leaks may be because the Navy was not able or interested in finding out.
A. I'm not -- I would not -- so the thing about fuel, right, is that we don't want to pay for that and watch that fuel disappear, right? So there's an added

incentive to protect the environment, protect the drinking water, protect the public, and protect the taxpayer dollars, right, because we're all paying for that fuel. So there's the -- I mean I think it's not accurate to say that the Navy is not interested in ensuring that, even throughout history of the facility -- now, are the records as good a long time ago? Certainly not. But I think it's inaccurate to say that the Navy is not interested in maintaining the inventory of that fuel.

Q. Okay. Hey, I don't know if you can answer this question, what poses a greater threat, the small nozzles or the large nozzles?

A. I would say according to the QRVA it would be the small nozzles.

Q. Okay. And they pose a potentially significant risk, the small nozzles do, right?

A. It's a greater risk. I don't think it's potentially significant, but I think it is true to say it's a greater risk, yeah.

Q. And that small nozzle remains in place in Tank 2, correct?

A. Yeah, I believe that's the case, yeah.

Q. And the small nozzle remains in place in Tank 3, correct?

A. Yes. Right now, yeah.
Q. And the small nozzle remains in place in Tank 4, correct?
A. That's correct.
Q. And the small nozzle remains in place in Tank 6?
A. That's correct.
Q. And the small nozzle remains in place in Tank 7?
A. Yes.
Q. And the small nozzle remains in place in Tank 8?
A. That's correct.
Q. And the small nozzle remains in place in Tank 9?
A. Yes, sir.
Q. And the small nozzle remains in place in Tank 10?
A. That's correct.
Q. And the small nozzle remains in place in Tank 11?
A. Yes.
Q. And the small nozzle remains in place in Tank 12?
A. That's correct.
Q. The small nozzle remains in place in Tank 15?
A. That's correct.
Q. Small nozzle remains in place in Tank 16?
A. Yes.
Q. Small nozzle remains in place in Tank 20?
A. Yes. Those nozzles will be decommissioned during the CIR process as those nozzles -- or as those tanks go

through the CIR process.
Q. Okay. So I understand you folks in the military like to use acronyms, but I would like to use dates. So let's say five years, five years from now, 2021, will Tank 2 have a new nozzle? Sorry, will the small nozzle be removed from Tank 2 by 2021?
A. You know, I'm not familiar with those schedules, but I would assume Tank 2 would not. But all the tanks that are currently involved in the CIR process are having -- there's four of them out of service right now, and all four of those are having those small nozzles decommissioned.
Q. Right. I didn't identify any of those that are in the CIR process right now. I identified 13 tanks, and they are currently in use now, correct, those 13 tanks I rattled off?
A. Sounds accurate, yes.
Q. And those risky small nozzles remain in place on those 13 tanks?
A. Again, it's relative risk, right? It's not -- to say risky, I mean we've never had a nozzle fail in any of our tanks. We've never had that happen. So to say that it's risky I think is a bit misleading, but the relative risk compared to a large nozzle is higher, yes.
Q. And, you know, are you familiar with the

expression old generals are always fighting the last war?
A. You know, sorry, I'm not familiar with that expression, no.
Q. All right, well, we'll move on from that. Just because you haven't dealt with a small nozzle catastrophe yet doesn't mean it couldn't happen in the future, correct?
A. I would say it doesn't mean that it could happen in the future either, so you could argue both sides of that equation.
Q. And, in fact, your experts identified it as one of the more significant risks facing the tanks.
A. They said -- I have to look at that, but there's about 10, I want to say 10 or 15 items they said are important to risk, is how they phrase that. Important to risk.
Q. So, and are the small nozzles going to remain in place on all these 13 tanks identified all of this year?
A. Yes, yeah. Again, we'll take those -- we'll decommission those nozzles and reconfigure the piping as the tanks are taken out of service for the CIR process.
Q. And for these 13 tanks I identified, will the small nozzles remain in place all of next year as well?
A. I would say generally speaking, probably, yeah.

I mean it kind of depends on where they fall in the CIR process. There's a whole schedule that we've got laid down, and we're prohibited from taking all the tanks out of service at one time due to strategic necessity.

Q. Unless you're so ordered by the Department of Health. Well, we'll get to that.

A. Sure.

Q. You testified on page 6 that it's not likely a 6-inch hole would develop in the large nozzle unless there's a catastrophic event, such as impact from a piece of construction equipment. Does that sound familiar, your testimony?

A. Yeah. I think it's -- after having gone down there and looked at that, I think that -- the probability of getting a 6-inch hole in the nozzle is very remote.

Q. So one catastrophic event that you mention is a piece of construction equipment?

A. Mm-hmm.

Q. Another type of catastrophic event is an earthquake, isn't it?

A. Yeah, that would -- I guess it could be, yeah. Depends on the magnitude, severity, all that sort of thing, yeah.

Q. And you folks have not completed a rigorous study

that quantifies the risk that earthquake could pose on the large nozzles, for example?

A. Well, I would say that that work was -- and I think that work was delayed to the future phase because we did not feel -- and the group as a whole, and I think Board of Water Supply was included in that group, that did not feel that that needed to be addressed up front. That was kind of a smaller concern than some of the other concerns, like the internal risks.

Q. Just to be clear, this is a proceeding that the Navy has applied for a permit in order to legally operate, and in the context of this application you folks have not, and are not planning on submitting information that quantifies the earthquake risk to the facility or to parts of the facility, are you?

A. Our understanding is that's not required, so no, we are not planning to do that.

Q. I see. And so you don't think earthquake risks are related to the issue of whether the tanks are operated in a manner that are protective of the environment?

A. Again, it's not what I think, it's what the regulations require.

Q. All right. Well, the lawyers will argue about what the regulations require. You oversaw preparation

of the Tank Upgrade Alternatives and Release Detection Decision document, right?

A. That's correct.

Q. The Department of Health and the Environmental Agency rejected that document, right?

A. I don't agree with that statement, no. They've asked for additional information. If you read that letter we got, I believe it's the end of October, October 26 or something like that, they've asked for additional information, but they've not rejected the document yet. It's just asking for -- and Mr. Linder said that during the Fuel Tank Advisory Committee, that question was asked, and that's how he responded. So that's not my words, that's the words from the EPA.

Q. So let me rephrase the question then. Did they disapprove of your document?

A. They've asked for additional information, and we're working on that right now.

Q. That's not my question.

A. That's my answer.

Q. Okay. Let's look at the document. It's Exhibit B-28. Are you able to see this document?

A. You're going to have to zoom in bigger than that.

Q. Okay, with pleasure. Do you see on the first page of this document, maybe I should go to the top,

it's on letterhead, has both EPA and Department of Health letterhead there. It says, "the Regulatory Agencies disapprove this submittal and are providing this Notice of Deficiency on the Decision Document."

Do you agree now that they disapproved of the document you submitted?

A. The following sentence says, "We are granting the Navy and DLA an opportunity to cure the deficiencies and resubmit the decision document." So we're working on that now.

Q. But initially they have disapproved your submittal, correct?

A. Again, they've asked for additional information.

Q. And the document that you oversaw the preparation for lacked detail, correct?

A. That's what this letter says.

Q. It lacked clarity, correct?

A. That's what the letter says here, yes, sir.

Q. And the Department of Health and the Environmental Protection Agency concluded that the document that you oversaw the preparation for lacked rationale and justification that the actions were the best available practicable technology, correct?

A. Again, that's what the letter says.

Q. All right. Now, you oversee the Red Hill Bulk

Fuel Storage Tank Facility Tank Clean Inspect and Repair Program, correct?

A. That's correct, sir.

Q. So on Thursday the Hearings Officer and the attorneys got a chance to look inside Tank 13, and Tank 13 is currently undergoing repair, right?

A. That's correct, yes, sir.

Q. And it was inspected last year; is that right?

A. I believe so. That sounds about right. I mean it was inspected previously, I don't know if it was last year. I can't remember what year that was, but yeah, it's been inspected and they're conducting the repairs right now.

Q. And prior to this most recent inspection it had been 25 years before the previous inspection, correct?

A. I guess I'd have to look back at records to confirm that, I don't know offhand. It's certainly possible, but I don't know for sure.

Q. Yeah, I understand. Let's see if this -- are you familiar with the document that's called TIRM?

A. Yeah. That would be under Section 2 of the Administrative Order on Consent.

Q. If you say so. I just want to know if you know about that document.

A. Mm-hmm. Yeah, it's part of the AOC.

Q. Okay. So that's exhibit, what did I say, B-6, and there's this kind of helpful table there that I'll bring up here. Have you ever seen this table before?
A. You know, I'm not sure that I have.
Q. So you're not that familiar with the TIRM document?
A. I'm familiar with it, but this schedule has been revised since we submitted the TIRM document. And by we, I mean the Navy. I did not have -- I was not involved in the preparation of the TIRM document.
Q. Okay. But to be clear, you oversee the Red Hill Bulk Fuel Storage Facility Tank Clean and Inspection Repair Program, right?
A. That's correct, yeah.
Q. And I've forgotten, what does TIRM stand for?
A. Tank inspection, Repair, and Maintenance.
Q. Okay. So this falls within your bailiwick, as they say?
A. Yeah, that's -- yeah.
Q. Okay. So this table says Tank 13 -- do I need to expand this? Is this not clear?
A. It would be helpful if you expand it.
Q. Tank 13 last inspected in 1995. Do you see that?
A. Yep.
Q. Okay. So you have no reason to disagree with

that information do you?
A. No, that's certainly possible. I mean, again, I didn't prepare the table, but I'm assuming that's correct.
Q. Okay. And so this tank had been inspected about 25 years before the most recent inspection?
A. Sounds about right, yeah. I mean, I guess the other thing is that the tank was emptied, so it's not, you know, it's not containing fuel right now, so you can't say it's been 25 -- it's had fuel in there that whole time. But you can say it's -- you know, that inspection deficiency is noted, that minus 2. But it was emptied, and I don't remember what year it was emptied either, so I can't help you there.
Q. All I'm interested in now is the interval between inspections, and the interval between inspections is about 25 years, right?
A. It does appear that, yeah.
Q. Now, the most recent inspection revealed that mandatory repairs were required. That sound familiar?
A. Oh, in Tank 13?
Q. Correct.
A. Oh, yeah, so -- yeah, that's correct.
Q. Those repairs were necessary to preserve or restore the structural and hydraulic integrity of the

tank, correct?
A. So what happens when we go -- we do this -- these tanks are normally inspected every 20 years, or depending on who certifies them, right, how long that certification is good for. And so what happens is the contractor will go in and he will inspect this entire tank, and then he will produce a series of recommended repairs and proposed repairs, I guess you could say, and so he says -- so he would provide this list and he'll say like in order to certify this tank for the next 20 years we need to complete these repairs, right.
Q. So he or she makes this recommendation, but some of these recommendations are mandatory, correct?
A. Mandatory as necessary. Like they won't certify the tank for another 20 years until those repairs have been completed.
Q. And actually, they're actually necessary to preserve or restore the structural and hydraulic integrity of the tank?
A. I think, so structural, it's more about I would say preserve the hydraulic integrity for the next 20 years. Now, structural doesn't necessarily mean the concrete surrounding the tank, it could also make -- there's components inside the tank, like there might be a bracket or something like that that needs to be, you

know, inspected and repaired to keep that in service. So, yeah, that's -- you know, I just want you to understand that.

Q. Sure. But, so these repairs are mandatory for the integrity of the tank, that's what the inspection revealed.

A. Mandatory to certify the tank for another 20 years.

Q. Well, hmm. Let's look at a different document and see what it says. So I am going to be bringing up, if I can figure out how to do this, Exhibit N-81, and we're going to go to -- and this is for Tank 13. Do you see that on your screen?

A. Yes.

Q. And this is something, you're familiar with this kind of document or this specific document?

A. Not that specific document, but that type of document, yeah.

Q. You are in charge of the Tank Clean, Inspection and Repair Program, right?

A. Mm-hmm.

Q. Okay. Let's go down here. So this is page 3 of Exhibit N-81, and I have to make it bigger for you, or for everybody.

A. Thank you.

Q. So let me -- it says here in the second paragraph "The tank inspection revealed that mandatory repairs are required to return the tank to service." That doesn't say anything about certification, does it, or how long it's good for. It says to return to service.
A. So what they're saying there is that we're not going to certify this tank until these repairs are completed. That's what they're saying.
Q. Well, maybe that's your interpretation of what they're saying, but the words in English are "that mandatory repairs are required to return the tank to service." It's not a piece of paper, it's saying there's no way these tanks should have fuel in them until these mandatory repairs are made.

There's nothing in this paragraph, is there, about any certification. It says -- the second sentence says "Mandatory repairs are considered actions necessary to preserve or restore the structural and hydraulic integrity of the tank." Do you see that?
A. Well, but the following sentence says "This includes any condition which has or may breach the hydraulic or structural integrity of the tank prior to the next integrity inspection." So I think it's important to include that last sentence in there.
Q. Okay. And that's because there could be a break

before the next inspection, right? There could be a catastrophic release. That's why these repairs are so critical, right?

A. Are you making a statement or asking me a question? I'm not sure.

Q. I asked you a question. This is not a paper pushing exercise, is it? This is about the integrity of the tanks, and this talks about mandatory repairs.

A. Again, mandatory to certify the tanks prior to the next integrity inspection by the bottom -- the last sentence in that paragraph.

Q. That last sentence makes no reference to certification. Those are your words. That's not the words in this report. This report that you've never read before, you just said you're not familiar with this report, and now you're going to insert words in it?

A. I'm not inserting words, I'm just saying that that last sentence is important to put this whole thing in context.

Q. Okay. Let's read that last sentence again. "This includes any condition which has or may breach the hydraulic or structural integrity of the tank prior to the next integrity inspection." That's so that there's no collapse or calamity in the tank before it can be inspected again, right?

A. That's the contractor certifying that the tank is suitable for service for 20 years, or I think it's a nominal periodicity after that. That's the whole point of this inspection. It's not a corrective maintenance action, it's a preventative maintenance action. Just similar to changing the oil in your car and all that sort of thing.

Q. Fascinating interpretation; fascinating. Okay.

So let's talk about the schedule for inspection, repair, and maintenance. The Navy applies the principles found in API Standard 653, right?

A. Mm-hmm. That's correct, modified 653.

Q. And that provides, that standard provides for the frequency of inspection of the tanks, right?

A. I believe that's correct.

Q. And do you recall, or maybe I don't know if you're too new to this, that in 2007 the Navy established inspection objectives of inspecting each tank every ten years. Do you know that?

A. I'm not familiar with that.

Q. Okay. So let's again look at B-6, and let's see, again, this is the TIRM report. You're familiar with that, right?

A. A little bit, yeah. I didn't prepare it. You can see the list of people that prepared it there. I

think you've already talked to some of those folks.
Q. Yes, sure. And again, you are the one who oversees the facility's Tank Clean, Inspection and Repair Program.
A. Mm-hmm.
Q. Okay. So let me expand this. So do you see that, that in 2007 the Navy/DLA initiated the CIR tank program with the objective of inspecting every tank every ten years?
A. Yeah, but the next sentence tends to make more sense. In 2016, the Navy/DLA realized there are too many constraints that prevent the schedule for the overall program to be realized. So that's why we've had to modify that schedule.
Q. Sure. So it wasn't because the tanks were all in pristine condition, there was no corrosion and everything was looking good, but there were other constraints that affected -- that precluded the Navy from meeting it's objective, right?
A. Yeah, I would say that after the 2014 release we looked really hard at things that had to have been done that needed to be done, and so we repeated that whole process for Tank 5 before we put that back on schedule.
But I think like right now we're scheduled to put -- I mean we're kind of -- we're not there yet, but

we're moving towards getting that schedule back to every 20 years.

Q. Okay. So Tank 3 was last inspected in 1983, right?

A. Boy, you know, I'd have to look at that table, but I'm assuming that's where you got that information, and I'm assuming the table's correct. That's probably what it says.

Q. Let's go down one more page. Can you see that, is it big enough? Should I make it bigger?

A. No, no, that's fine, I think.

Q. There's this curious language in a number of the items that say inspected previous to 1994. Apparently 1994 is some sort of cutoff, but that doesn't mean they were inspected in 1994. The date that the prior inspection was is in parentheses. So Tank 3 was last inspected in 1983, right?

A. Looks that way.

Q. Okay. And that's nearly four decades ago.

A. Thirty-seven years, or something like that I would say.

Q. Okay. Tank 3 is overdue for an inspection?

A. According to this, yeah.

Q. Tank 4 was last inspected in 1983, correct?

A. I think so, yeah.

Q. And that's, again, nearly four decades ago?
A. I think one key component you're missing in all this is that all these tanks have undergone tank tightness testing repeatedly while they're in service, and they've all continued to pass. So I would say that if something indicated one of these tanks was not performing in an environmentally friendly manner, that we would take that tank out of service.
Q. Understood. But you don't know how vulnerable the insides of the tank are to a catastrophic release because you have not inspected the inside of it in nearly four decades, correct?
A. Yeah, that's subjective. I suppose vulnerability to a catastrophic release is a pretty subjective statement.
Q. Tank 4 is overdue for an inspection, right?
A. According to table.
Q. And this table is produced by the NAVY in the TIRM report, correct?
A. That's correct.
Q. And Tank 7 was last inspected in 1998, right?
A. Let's see, where is that at on here? Yeah, looks like it.
Q. More than 22 years ago?
A. Mm-hmm.

Q. Tank 7 is overdue for an inspection?
A. Again, we don't have any reason to believe that this tank is leaking, or releasing to the environment, otherwise we would take it out of service.
Q. Okay. And I think Mr. Brown sort of asked you about chronic releases, whether you're detecting them all or not, and I assume you have a lack of concern about that. But I have a different concern, and that is the integrity of the tank, and we just looked at an inspection report for Tank 13 that talked about the mandatory inspections that needed to be made. But my question to you --

MR. MCKAY: Mr. Chang, I'm sorry, we're having a technical problem. Ms. Minott's mute button can't come off, I apologize.

But we have an objection to Mr. Frankel's over-characterization and commenting, and offering testimony that's not in the record. We'd ask that he just ask questions and allow the witness to answer.

And we're going to work on restoring her mute button.

HEARING OFFICER CHANG: All right. She can go out and come back in and see if that fixes it. And Mr. Frankel can continue with his examination.

MR. FRANKEL: Oh, I'll wait for her to get

back on.

HEARING OFFICER CHANG: Oh, I'm sorry, yeah. That's fine. We'll go off record for a moment until we fix this.

(Off-the-record session.)

MS. MINOTT: I'm back in now. I can unmute mute. Thanks.

HEARING OFFICER CHANG: All right. Back on the record. Mr. Frankel.

MR. FRANKEL: Okay. So I will attempt to recreate where we were, but I'll rephrase the question.

Q. (By Mr. Frankel) Pursuant API 653, Tank 7 is overdue for an inspection, correct?

A. According to this table.

Q. And Tank 8 was last inspected in 1998, correct?

A. According to this table.

Q. Again, which was prepared by the Navy, right?

A. Mm-hmm.

Q. And that was more than 22 years ago, correct?

A. If my math serves me correctly.

Q. And Tank 8 is overdue for an inspection pursuant to API 653, correct?

A. I guess according to the table, yeah.

Q. Tank 9 was last inspected in 1995, correct?

A. According to the table, yes.

Q. And you have no reason to dispute the accuracy of the information provided by the Navy in the TIRM document, do you?
A. No. I didn't prepare that document. That document was prepared before I was assigned here, so no.
Q. So Tank 9 was last inspected in 1995, and that's more than 25 years ago, right?
A. Yeah, it appears that way.
Q. Tank 9 is overdue for an inspection, isn't it?
A. According to the table, yes.
Q. Tank 10 was last inspected in 1998, correct?
A. According to the table, yes.
Q. More than 22 years ago?
A. According to the table, yeah.
Q. Tank 10 is overdue for an inspection pursuant API 653?
A. Yes, generally towards -- for our TIRM planned inspection periodicity, yeah, it's overdue.
Q. Tank 11 was last inspected in 1981, right?
A. According to the table, yes.
Q. Nearly four decades ago, correct?
A. That's correct.
Q. Tank 11 is overdue for an inspection, right?
A. According to the table, yeah.
Q. Tank 12 was last inspected in 1995.

A. Yep, according to the table.
Q. And that's more than 25 years ago, right?
A. Yes.
Q. Tank 12 is overdue for an inspection?
A. According to the table.
Q. You know, when we began the cross-examination we talked about the ABS report and you were not entirely happy with the assumptions made in that report, and you know, I kind of agree with you. Let's look at Exhibit N-31.
A. Just to clarify something, it's not my happiness, it's whether I agree or disagree with the assumptions, that's really what it comes down to. It's not a happiness thing.
Q. Okay. So I'm trying to find page 4-1, which I should have bookmarked. So this is page 4-1 of the ABS report, and as you know, when you do modeling you make some assumptions, right?
A. That's correct, yeah.
Q. So let's look at the following key bases and assumptions for the facility baseline QRVA. You know, we use these acronyms a lot and people are comfortable with them, but just to remind people, what does QRVA stand for?
A. Quantitative Risk and Vulnerability Assessment.

Q. Okay. And one of the bullets here, again, this is on page 4-1 of Exhibit N-31, it says "Each main storage tank undergoes a major API 653 inspection once every 20 years." Did I read that correctly?

A. Yeah, you did read that correctly.

Q. And it's pretty clear that the vast majority of the tanks at Red Hill have not undergone a major API 653 inspection once every 20 years, isn't it?

A. I think that, you know, that was the Navy's intent, but I think that the -- out of an abundance of caution after the Tank 5 release, we tried to do things a little bit more thoroughly and slow the process down a little bit, and I think now we're actually getting back to where we can -- that last sentence with the one tank inspection being performed each year on average, I think we're getting closer to getting back to that.

But I would say that, you know, the deficiencies we uncovered when we had the Tank 5 release in 2014 significantly slowed down this process. And I would also say that the process has also been slowed down because of the level of technology that we invoke now to do these inspections is much more complex than what it used to be. So the inspections take a little bit longer, the repairs take a little bit longer, and but I feel like the end result will be a better quality tank

than what we had previously. And as those processes get refined, you know, it takes us awhile to get up to speed and to meet our schedules, but we're actually doing much better at that now.

Q. Okay. But my question, and I want to focus your attention on the risk assessment report that was done, the QVRA --

A. The QRVA, is that --

Q. Yeah, maybe I did that -- my dyslexia pops in, QRVA. So the QRVA calculations are based on an assumption that each tank undergoes an API 653 inspection once every 20 years, and the fact is for at least eight tanks that is not true.

A. I would say there are tanks that have not -- we have not met or timeline on some of our tanks. I don't know the exact number.

Q. Well, we just went through it with you. Tanks 3, 4, 7, 8, 9, 10, 11, 12. My math says eight. Maybe there's higher math that comes up with a different number, but for those eight tanks, they have not had a major API 653 inspection once every 20 years, have they?

A. No, they have not.

Q. And so the risk would be higher than this report calculates given that assumption, correct?

A. I suppose one might infer that. I don't know how

that changes. The risk, you know, like when they talk about volumes being released and quantities being released, that is based on historical items, right? So I'm not sure how much this plays into it. I'm sure it plays a part in it, but I'm not sure how much.

Q. Well, if we look at the top of this page here, I don't know if you can see the top, it says, the following key bases and assumptions for the baseline QRVA, include this once every 20 years. That appears to be a key assumption, a key basis, doesn't it?

A. It's listed under there, yeah. Again, I don't know how much it plays into it.

MR. FRANKEL: Okay. No further questions.

HEARING OFFICER CHANG: Thank you. Mr. Paige, any examination?

MR. PAIGE: No.

HEARING OFFICER CHANG: Okay. Any redirect?

MS. MINOTT: Yes. We would just ask for a quick, five-minute break.

HEARING OFFICER CHANG: Certainly. We'll recess for five minutes.

MS. MINOTT: Thanks.

(A recess was taken.)

HEARING OFFICER CHANG: Okay. Back on the record. Ms. Minott?

MS. MINOTT: Thank you.

REDIRECT EXAMINATION

BY MS. MINOTT:

Q. Commander Frank, you stated that you oversee the TIRM program, correct?

A. That's correct, ma'am.

Q. And who oversees the API inspection?

A. That's part of the TIRM program as part of the CIR process.

Q. And who oversees that?

A. That would be under my responsibility as well.

Q. What is the role of EXWC?

A. So the EXWC, they provided the technical expertise to oversee these things, so they're down into -- they develop the specifications, they will do follow-up inspections, and then that sort of thing.

So my responsibility as far as carrying out day-to-day operations is just to keep things progressing in a satisfactory manner, monitoring budgets and that sort of thing. But the day-to-day quality assurance and things like that is actually more -- that's more of an EXWC responsibility.

Q. And can you explain why a leak from the telltale may have included water or fuel from inside the tank?

A. Yeah. So the telltale drains, and I think I've

stated this earlier, it's actually a really interesting idea, the problem was is they didn't use the proper materials. And so one of the things, and we talked about this earlier about, you know, when they used to ship fuel over from the continental United States over to Hawaii, those tankers were open at the top, and sometimes you'd get seawater splashing into there, right? So when that seawater and fuel mixture was put into the tank, the seawater sinks to the bottom because it's heavier than fuel, and it can cause corrosion problems in the lower dome of the tank. And we've actually -- we actually -- all the lower domes now during the CIR process are coated with this special material, and it's been done for, I don't know, 40 years or something like that, I don't remember exactly when they started it, it's called a Novolac epoxy, and so that is what prevents that interior corrosion happening inside the tank.

So the problem with that was the telltales when they were installed, you might get corrosion on the lower telltale drains and that would cause a hole on the interior pipe inside the tank, would cause fuel to go directly on the telltale drain. So wouldn't be capturing fuel from behind the tank, it would be capturing fuel from inside the tank and draining out.

Does that make sense?

Q. Thank you, yes. You mentioned in your cross with Mr. Brown that there were systems in place to detect releases that were below like a certain threshold. What systems are currently in place to detect those small chronic releases?

A. So again, this is -- you know, if you were to look at one system by itself, yeah, it would leave you with the impression that, hey, we can't detect these things, but I mean I think like our Automatic Tank Gauging System can detect down to -- a change in 1/16th of an inch, that's the thickness of a nickel.

I'll give you an example, it's like when having done like numerous Red Hill tours, right, so I go up in Tank 19, which is our typical tank that we go into, I'll go look at Tank 20 and I'll show people the interface and the measurement like that. So that tank was stuck on 204 feet and 1/16th inch out for, I don't remember the exact number, but it was like that for years. Like that tank did not budge for, you know, like two years that I've been here that I'm aware of until we moved fuel around, right, until we had to finally start moving fuel around. But, you know, that's just another way that Automatic Tank Gauging System, the manual gauging system, all of these things work together to help us

detect releases. And we're trying to do some other things as well that will even improve that process.

Q. And when we -- how are chronic releases identified when there are like scheduled fuel movements? You kind of talked about that you had the different inventory, the fuel inventory. How, if there is scheduled movements, how do you then address the small chronic releases if there's numerous scheduled fuel movements?

A. So we will do inventory control, right, there's an operator that sits there and watches the control panel, they call him the control room operator, call sign PAPA, and he will look at this -- you know, these fuel levels in these tanks are continuously monitored 24 hours a day, seven days a week, 365 days a year. So that's one of those extra additional steps we take to make sure that we're not releasing or causing an unscheduled fuel movement. Does that answer your question? I'm not sure.

Q. Yes. And do you do any type of trending analysis or anything regarding the different using the ATG System and inventory?

A. Yeah. So one of the things that came out after the 2014 release was we'll do a trend -- a weekly trend analysis, and they'll look at these tanks to make sure,

kind of like what I was just talking about for Tank 20, right, is this fuel moving at all. Like at 16th of an inch is a pretty small number, right? So on top of -- you know, you've got that, you've got trend analysis, you've got your Automatic Tank Gauging System, you've got your semiannual tank tightness testing, which is actually far -- it's actually twice as often as what we're required to do by law, the semiannual tank tightness testing.

So I think by looking at all of these things at one time, and then we've got a bunch of other things, you know, we monitor below the -- for the monitoring wells in the lower access tunnel we check those every month to make sure there's not fuel sitting on the surface, right, because the fuel would rise to the top, so we check those every month, we do drinking water analyses, we do groundwater analyses, we do soil vapor monitoring analyses, and all of these things work together to help us detect if there were an unscheduled fuel movement that was being released to the environment.

Q. And you mentioned the tank tightness testing. When was that first pilot test for tank tightness testing?

A. That was in late 2008, I believe, is when that

was first done.
Q. And when did the Navy then implement the tank tightness testing?
A. Started doing every other year tank tightness testing in 2009. We twitched to annual tank tightness testing in 2014, and in 2019 we started doing semiannual tank tightness testing. And that's to stay ahead of the regulatory requirements, actually.
Q. And what is planned in the future to detect these slow chronic releases?
A. So we're in the middle of working on -- and we just got funding approval for that sort of thing to get the same -- right now when we do semiannual tank tightness testing we have a contractor come out every six months and he'll do -- he'll conduct a tank tightness testing in the tank, and that's typically done, they'll do five -- they insert this mass -- precision mass detection instrument in the bottom of the tank and they watch it for 24 hours, and then they repeat that same test five times, and that goes off to an independent third-party testing lab, or a certification lab on the Mainland, and we'll look at that and confirm that the tank is not releasing any more than that .5 gallons per hour. Okay, so what we're trying to do now is have that equipment available on

site and installed all the time so that we can conduct that type of testing more frequently.

Q. Great. And we had talked a little previously about the ATG and the AFHE Systems. If one of those systems, if an alarm is triggered, is there a process or anything to shut off or isolate a tank or a pipeline from the system?

A. Yeah. So a couple things about that. Like now, to avoid what happened in 2014, we, the operators, the control room operator is required to contact the fuel director or the deputy fuel director immediately to let them know that an alarm is occurring.

If we need to isolate the tank, we've got two, at least two, in some cases three valves that can be remotely operated to shut the tank down, to isolate the tank.

Q. And moving on on a little bit different topic, what are we doing to respond to the risk identified in the QRVA to help the Navy make operations at Red Hill more environmentally protective?

A. So one of the things we talked about are the importance of the small -- the nozzle configuration is important to risk, so one of the things that was identified in that risk assessment is we can't -- a human being cannot fit inside a small nozzle, and when I

talk about small nozzle, that's the portion of the pipe that's between the bottom of the tank and the first isolation valve. So kind of imagine an elbow-type thing, right? So in order to eliminate that small nozzle, we have to drain the tank to do that, so that's why it's done during the CIR process, and then we've reconfigured the piping with those valves in there so that we only need the one larger nozzle.

Now, the reason that is is the smaller nozzles are generally 16 to 18 inches in diameter, so you can't fit a person inside there to inspect or repair that. But with the larger nozzle is a 32-inch diameter which you can fit a person inside there to do that. So it's a better way to, you know, just prevent the possibility -- reduce the risk of something happened to our smaller nozzles that we're not able to catch, or inspect, or repair.

MS. MINOTT: Next thing I'll pull up -- Razan, I'd like to pull up N-031 to PDF page 49, and let's scroll down to the bottom. So if we can go ahead and zoom out just a little bit, just so we can capture some of the other bullets up there.

Q. (By Ms. Minott) During your cross-examination with Mr. Frankel he had mentioned that some of the key assumptions that were made in the QRVA. Can you read

that last bullet on the screen there?
A. Yeah. It says: The QRVA Model assumes that going forward, 18 RHBFSTs -- which is Red Hill Bulk Fuel Storage Tanks -- will be in service throughout much of each calendar year. This is conservative compared to a realistic account assuming that each RHBFST must be inspected once every 20 years.
Q. And how many tanks of the Red Hill Bulk Fuel Storage Tanks are in service at this time?
A. Fourteen.
Q. Now I'd like to pull up B-216, and I'd like to go to the Red Hill Incidents tab of B-216. I'm also kind of be referring to in your testimony, too.
In your testimony, one of the releases was release No. 40, which was a release in 1998 from Tank 7. If we can scroll through there to around 1998 timeframe in there. Commander Frame, do you see a release that is identified in this table for Tank 7 around 1998?
A. You know what, I don't. I can't see the whole table, but yeah, I don't see that.
Q. Okay. And that's right, so this table, just so everyone's clear, it is sorted by date. At this time it's sorted by date of the Red Hill Release Incidents tab, and we are in the range of from 19 -- on the screen now 1983 through 2008, all the releases that had

occurred during that timeframe.

So next I would like to go on this same table to that 2008, those two which are on line 63 and 64, and those two were also kind of brought up and discussed. Did you base your conclusion that these were -- this is a double counting of a release based on that these two rows contain the exact same notes across the entire section?

I'll go ahead and have -- Razan, if you can go ahead and scroll over and so we can look at all the different columns. Again, we're on 63 and 64.

And so the question is, Commander Frame, did you base your conclusion on that these are the same based on these note sections, that being exactly the same?

A. That's what it appeared to me.

Q. Great. Now we'll go back, scroll to the other side again, back to the beginning, I want to go to -- we're going to be discussing the release 49 from the table, which is a release reported from Tank 10 at 1996. So if we could make sure that we have the 1996. Again, we're on the Red Hill Release Incidents tab. And we are now showing the dates of all reported releases between 1983 and 2000.

Commander Frame, do you see a release reported here from Tank 10 in 1996 on this table?

A. No, I don't.
Q. I would also like to now pull up B-233, and I'm going to be going into the page what's marked as BWS028529. Let's actually scroll up one more page to the previous page.
Commander Frame, do you agree that this is a Pre-Final Inspection Report for Tank 10 in 1996? Is that correct?
A. It appears that way. It's kind of hard for me to read, but I think generally -- oh, there we go. Yeah, it appears that's the case.
Q. Okay. So let's go ahead and go to that next page, BWS028529, and if we notice on the comments section, you go below the comments section, so again, this is for Tank 10, so the comments there says: 060 - Porosity in weld appears to be leaking.
And so Commander Frame, what I'm going to ask you here, where is that comment located on the tank. So where is that, where it needs to be repaired because there's porosity in the weld and appears to be leaking, where is that repair located?
A. 0922.
Q. So 060, so you can go ahead and go to the -- scroll up a little bit to the, so you could see the -- do you see where 060 is located?

A. Oh, that's in the upper dome, yeah.
Q. And is there any fuel in the upper dome?
A. Not typically, no.
Q. Okay. I'd like to now pull up N-107. And so this is in relation to the release No. 70 in regards to Tank 19. The question here is when was the fuel last in Tank 19?
A. Well, according to this document, the tank was last used in December of 1986.
Q. Great, thanks. Just going to go back to B-216, and again, we're on the Red Hill Release Incidents.

So Razan, what I would like you to do, if possible, I'd like to have you give Commander Frame the ability to scroll through, and then Commander Frame, can you take a look on this table and identify all the releases that are reported for Tank 3?
A. I'm trying to --
Q. Yeah, I don't think you're able to. You'll have to just scroll through, take a look. So this is, again, the table of all the reported releases. Can you look on the table and tell me how many releases have been from Tank 3?
A. Okay. It looks like there's one in --
Q. What year was that?
A. '49 it looks like, 1949.

Q. And do you see any other from Tank 3 if you scroll down?
A. Yeah, I don't see -- I think just that one is all I saw.
Q. That's all I was able to locate also.
How about for, Mr. Frankel also stated that -- discussed Tank 11 was overdue for inspection. How many releases are recorded in this table for Tank 11?
A. Looks like one, 1980. I think just that one in 1980.
Q. That's all I noticed, too. Last question here, too. Can you go through this table one more time and let me know how many reported releases on this table are from Tank 4 or Tank 8.
A. I don't see any for either one of those.
MS. MINOTT: No further questions. Thanks.
HEARING OFFICER CHANG: Any questions from the Board?
MR. BROWN: I have a few questions, Hearings Officer Chang.
HEARING OFFICER CHANG: Okay.

RECROSS-EXAMINATION

BY MR. BROWN:
Q. Just to clear up the record, Commander Frame, are you aware that the Navy produced documents in connection

with this proceeding?
A. Yeah. Yes.
Q. And was that just a small number of documents, or was it a considerable number of documents?
A. I would say considerable is an understatement.
Q. Okay. And in connection with preparing the Quantitative Risk and Vulnerability Assessment that Ms. Minott showed you Exhibit B-216 for, when was that prepared?
A. Uh, boy. Well, the report was completed in November of 2019, so sometime before then. I don't have an exact date, but --
Q. Okay. And we're currently in 2021, correct?
A. Yes, you're correct.
Q. So it's not inconceivable or unreasonable to expect that the Navy provided additional documents in connection with this proceeding that were not available for ABS to consider when they put together their risk calculations. Does that sound accurate?
A. That's certainly a possibility.
Q. And in all likelihood, it's not inconceivable that in connection with preparing for this proceeding additional releases were identified that ABS simply didn't have the access for, correct?
A. You know, I guess I don't necessarily agree with

that. I think we gave them as much as we could find. We did not, I would say we probably didn't give them the weld defects because we didn't view those as potential releases, and I still don't. And so, yeah, I think that's a bit of an overstatement I guess.

Q. But it is true that we would have access to documents in this proceeding given just the date and time and the inspections that have happened between 2018, 2017 when the ABS risk report was performing its calculations until now, that ABS did not have when they prepared that table?

A. Yeah, there's probably more information. I'm not sure. We could have -- always we could have certainly provided more information. I'm not sure how much value that additional information would have added to them -- would have added, I think that's fair.

Q. And then I'm going to bring up real quick, just again to clarify the record, this is the Exhibit 233, B-233 that we had spoken about previously, and this is the page that I showed you, which is a different page than Ms. Minott; and then this is Exhibit 204, and this is the confirmed suspected release documentation that we went over, and we discussed how this confirmed or suspected release could have been found after a leak, isn't that correct?

A. That's possible, yeah.
Q. And we also talked about how this release was found in the soil; is that correct?
A. That's what this form indicates, that's correct.
Q. And then for that to have happened it would have had to gone through the steel liner; is that correct?
A. Assuming it was from the tanks, yes, I think that's a fair statement.
Q. And through the grout?
A. Possible, yes.
Q. In through the cracks in the concrete, correct?
A. Yes, I believe you're -- I mean I see your point.
Q. Bypassing the gunite?
A. Or penetrating the gunite, yes.
Q. Correct. And making it into the soil?
A. Into the basalt rock I think is probably a better --
Q. Okay. But the subsurface environment outside of the tank structure?
A. Yes.
MR. BROWN: Okay. I have no further questions.
HEARING OFFICER CHANG: Okay. Mr. Frankel, any further questions?
MR. FRANKEL: Sure. Thanks.

RECROSS-EXAMINATION

BY MR. FRANKEL:

Q. You know, you were just asked about Tank 11, there being just one release in 1980 based on the spreadsheet. Do you recall that, you looked at that?

A. Yeah, I believe that's -- I mean, yeah.

Q. And that release was 25,628 gallons; is that right?

A. I honestly can't remember the number, but you could be right. I didn't make a note of that at the time.

Q. Okay, let's take a note of it, let's look at that. I don't know how anybody reads this screen. Can you see that line 45, the released 25,628 gallons, or is it too small?

A. You know, yeah, it's too small. I'm sorry, I can't read that. I don't have my reading glasses with me, so --

Q. Let's see if I can keep going bigger. Can you see it now? Still too small?

A. Is that 45F, is that what that is? Cell 45F?

Q. Cell 45F, yeah, release -- there, 25,600, can you see that now?

A. Mm-hmm, yeah.

Q. Okay. All right, and you don't know, by the way,

where those 25,628 gallons went, do you?
A. You know, without having to look at the records, I'm assuming that's an unscheduled fuel movement. Where it went, how it got out of the system I really can't comment on that because our records are so sketchy back then. You know, those tank history forms that you referred to earlier, they don't have the level of detail that we had when they had the incident in 2014.
Q. Okay. Now, when you do inspections, one purpose of an inspection is to find out if there's any corrective action that you need to take because, for example, there's a through hole that needs to be fixed. That's one of the purposes, right?
A. Mm-hmm.
Q. And another purpose is to take protective measures because the metal may have been weakened through corrosion and you need to take measures because of that corrosion or what have you that's weakening the metal, correct?
A. I don't know if I'd use the term weakening. I would use the term thinning. We look at that pretty closely.
Q. Okay. The fact that you may not have any recorded release in, for example, Tank 11 since it released 25,628 gallons, that doesn't mean that there

aren't preventative measures that need to be taken because of metal thinning, for example, correct?

A. Yeah, that's the whole point of our preventative maintenance program, yeah.

Q. And that's why the current schedule calls for it to happen at least once every 20 years?

A. Yeah, depends on -- the tank inspector that certifies that is usually a professional engineer, and he will certify a tank for an additional amount of time, and typically it's 20 years, that's correct.

Q. And there's been no certification for Tanks 3, 4, 7, 8, 9, 10, 11 or 12 allowing for them to avoid inspection for more than 20 years, correct?

A. To my knowledge, no, that has not occurred.

MR. FRANKEL: No further questions.

HEARING OFFICER CHANG: Okay. Mr. Paige, any questions?

MR. PAIGE: No questions.

EXAMINATION

BY HEARING OFFICER CHANG:

Q. Commander Frame, thank you for hanging in there. It's probably getting close to the last series of questions.

I wanted to understand generally the opinion that you are offering in your testimony when you showed the

chart of the release incidents that are from 1988. So I'm looking at that list and the chart of those incidents. Generally, and before getting into the questions let me try to be very clear and ask that we keep in mind the distinction between a release of fuel, or unscheduled fuel movement, and a release that results in fuel getting into the environment, okay?

So coming back to your chart, you picked 1988 till the present for what reason? Why do we start from 1988?

A. There were sections of the Clean Water Act that began in 1988 that -- and this is my understanding, I'm not a regulatory expert -- but my understanding is that in 1988 is when the Clean Water Act had certain provisions added to it that regulated underground storage tanks, and prior to that they were not regulated, sir.

Q. All right, thank you. So you're addressing every reported leak or documented leakage from 1988? Was that your intention with these 15 recorded events?

A. That's correct, sir. It's just, like I mean it would take -- you know, there's certainly a lot of work that's gone into looking into all of these reported releases or, you know, records that indicate potential releases, but I focused on those ones that had occurred

since 1988.

Q. Okay. So generally, except for the 2014 event, are you proposing to state that there have been no releases of fuel that have gotten into the environment, again, other than perhaps the 2014 Tank 5 event?

A. You know, sir, after looking at this pretty carefully, I'm reasonably confident saying that. Not to say there couldn't be some different interpretations, but those are my interpretations, yes, sir.

Now, I understand that there were documents identifying releases, but I'm saying that those releases, although they were identified after 1988, the releases themselves did not occur since prior to 1988. There is one on there that's still a little bit fuzzy, but it all comes back to me -- to me it all comes back to the fact that if you've had a release and then a tank passes it's tank tightness test, I don't understand how that can happen, unless it's an extremely small volume, because tanks won't fix themselves. We have to go inside there and fix them.

And so that's kind of what really solidifies it in my mind is that, you know, without -- if you've got a reported release of whatever volume and you go there, you inspect the tank and you can't find anything, then that release either occurred in the past since before

the tank was repaired, or there was some other abnormality there. That's kind of how I interpret that.

Q. Okay. And a lot of the individual items in the chart have date references and they're separated by quite a number of years, and I'm just puzzled by that. And we may not need to spend the time to go into each individual one with the understanding that you are saying from your review of the documentation you don't consider that those events identified so-called releases are events that resulted in fuel getting into the environment.

A. No, sir.

Q. Okay. Again, generally I understand it's not -- it has not been identified as to where the 27,000 gallons from Tank 5 ended up.

A. Yes, sir.

Q. But that, let me describe it as a significant asserted event of release, and from your recent answers, apparently the release incident in 1980 regarding Tank 11 involved a quantity of release similar, 25,000 gallons?

A. Yes, sir.

Q. Would it be fair to say that from what we know, the two most significant events of possible release are those two, the 1980 release and the 2014 release?

A. That's certainly one of them that's up there. I don't know -- I mean I can't comment on volume so much, but I think that's a fair assessment, or at least they're similar in magnitude. Very close to the same magnitude.
Q. And for the 1980 release there wasn't, I presume, the degree of investigation as to what happened?
A. No, sir.
Q. And/or documentation. So we don't know much about what happened with that release.
A. No, sir, not at all. Not anything close to like -- 2014 we've got all kinds of records for that release, and what that looked like, and how those estimates came about, you know. But the 1981, again, that was before the EPA Clean Water Act regulations related to underground storage tanks were enacted, and my understanding is we just didn't pay attention to that type of stuff to the level of detail that we do now, unfortunately.
Q. Okay. Do we know how long evidence of petroleum product that gets into the environment, into the soil, into the water, how long they will exist?
A. Sir, that's a great question, and I think our environmental experts would be much more suited to answer that. But they've done a lot of research in that

area, so I would defer that. I don't really feel qualified to answer that, sir.

Q. Okay. That question kind of came up with regard to one of the listed releases in your chart where there was a comment that that tank last had diesel. I think it's in release No. 65, and that the tank was empty during '94 to '98, so for there to be a reported '98 release, it's puzzling, right? If it was empty, there should be --

A. Yes, sir.

Q. But then even the product might --

A. Yeah, it depends on whether -- 'cause that tank, and I think I am familiar with this one because I've looked at it pretty closely, it had Navy special fuel in it one point, Navy distillate in at one point. It had diesel fuel marine, Navy diesel fuel marine in it one point, and I think, if my memory serves me correctly, the diesel fuel marine was last in that tank in 1994. So it is possible that that one could have occurred, you know, either before or after 1988. I mean, if it -- you know, I'll -- I guess I have to concede that fact, sir.

Q. Okay. Let's talk a moment about the chronic -- the concern over possible chronic low quantity releases. Some questions were asked of you about the possibility of 5,803 gallons being released in a year, and you said,

no, that would be unacceptable to the Navy, though you felt there was no evidence that it actually occurred. And I was trying to get a sense of how much fuel we are talking about and 5,803 comes out to about a gallon a day per tank. So I took the 5,803, I divided it by 18 tanks, I think, came out to 322 gallons per tank per year, and that's less than a gallon a day.

Now, you have said that your tank monitoring system can detect movement of fuel more than 1/16th inch, and I just wanted to ask you, do you have a sense of how much quantity we're talking about?

A. You know, sir, I should have those numbers memorized, but I believe the 1/16th of an inch is about 300 gallons.

But what I will tell you is the fact that when we do our tank tightness testing, we can get down to, you know, a half a gallon per hour. So that would identify that. If it was a gallon a day, you know, we would identify that in -- that would be a -- we can identify a gallon every two hours. So a gallon per day would be -- you know, I think we would be able to see that. I think I'm thinking about that the right way.

Q. It's less, because a gallon a day would be --

A. Oh, I see what you're saying, yeah. But I mean the other thing is like that's -- the tank tightness

testing is one thing, the Automatic Tank Gauging thing is another thing, the soil vapor monitoring will detect -- and we saw this in the 2014 release, we saw spikes in soil vapor monitoring following that release, right, so we can see that. The drinking water monitoring, the groundwater monitoring, like all these things worked together to help us identify these releases. So it's not just one system, it's all of these things working together, and we're trying to improve on each one of those systems to make it even better now.

Q. I have another question area. You had mentioned that Novolac epoxy?

A. Yes, sir.

Q. I was just curious, I know that you all are looking into alternatives, and is it an alternative to use an epoxy type of a component to line the entire tank, not just the bottom of the tank?

A. So we had actually identified that in our initial TUA decision document, and we started testing that. The problem is is that with that epoxy it doesn't -- it protects the inside of the tank, but it doesn't address the concerns with backside corrosion, so that's the part that -- you know, the part of the steel liner between, that's in contact with the concrete, we can't really do

that there. We can coat the front inside the tank, but generally as long as the tanks have fuel in them, you know, if you think about your car engine, as long as the tanks have fuel in them you don't have to worry about interior corrosion.

You know, and we've -- we coat that bottom barrel because of those, you know, issues I had talked about with seawater long ago, but we don't have those problems today. So the Novolac epoxy works great, but I don't think it necessarily addresses the problem on the back side, the backside corrosion problem.

Q. Is that epoxy confirmed as being compatible with the storage of fuel?

A. Yes, sir, very much so.

Q. Why can't you run the epoxy up the entire barrel?

A. We could, but again, that's only addressing corrosion on the inside of the tank, it doesn't address corrosion in the back side of the steel plate between the concrete. So that's the problem.

Q. No, I understand that, but I am envisioning the epoxy would itself serve as a membrane to hold the fuel?

A. Mm-hmm. We actually have tested that. I believe that -- I can't even remember when that was completed, but they did a -- we did a report, that Naval Expeditionary and Engineering Warfare Center, and we

looked at that like if you -- and they would drill a hole in a piece of metal and they would coat that plate with epoxy, and then they would cycle the pressure in and out of that tank and see if that epoxy could resist, you know, sort of replace the metal as a hydraulic barrier, and it wasn't -- they didn't feel comfortable using that approach.

HEARING OFFICER CHANG: All right. Thank you very much. Any questions from anyone, from others?

MR. BROWN: I've had a couple follow-up questions, Hearings Officer Chang.

HEARING OFFICER CHANG: All right. Did the Navy have some?

MS. MINOTT: No, I'd said that I had no other questions.

HEARING OFFICER CHANG: All right. Mr. Brown, please go ahead.

FURTHER EXAMINATION

BY MR. BROWN:

Q. I just want to make sure we heard you right, Commander Frame. So you had indicated that the fuel handling equipment at a tank could detect a change in level of 1/16th of an inch; is that correct?

A. That's the fidelity, yeah, sure. About the thickness of a nickel.

Q. And what does the full movement alarm, when does that go off to spur action?
A. I believe that is -- let me think about this now. There's a half inch one, and then there's -- it depends on whether fuel is being moved or fuel is not being moved. If fuel's being moved it's a half inch.
Q. And if fuel is being moved, do these level sensing equipment work like you're saying they do?
A. Yeah, there's the larger tolerance, but they continue to work, yeah.
Q. So it's just a more variability -- more fuel could be lost if fuel was moving in or out of the tank?
A. Certainly possible, yeah. I mean the alarm -- I guess I should say the alarm is set different, mostly because when there's turbulence inside the tank you can get a lot of false alarms in there if that tolerance is set too low.
Q. And we talked a little bit about tank tightness testing, and isn't it true that even if a tank tests tight, if it is leaking below that threshold it can release thousands of gallons per year?
A. If you're only relying on the tank tightness testing itself, that is true. However, as I've indicated before, with all of those systems working together, I don't believe you'd be able to lose that

much fuel without detecting it.

MR. BROWN: Thank you, Commander Frame. That's all I have.

HEARING OFFICER CHANG: Anyone else have questions?

MR. FRANKEL: I do.

HEARING OFFICER CHANG: All right. Mr. Frankel.

FURTHER EXAMINATION

BY MR. FRANKEL:

Q. You were asked about whether, I may have misheard the question, but about leaks of a certain magnitude you, talked about 1980, 25,000 gallons or so, and in 2014. Now, was there a release of a similar magnitude in 1971?

A. I don't -- I'd have to look at my -- you know, I have to look at your charts to figure that out. I don't remember. I mean I don't have all those releases memorized.

Q. Okay. What about 1949, was that a significant release?

A. That, I'm trying to remember which tank that was, but I mean to me they're are all significant.

Q. Yeah, I agree. Okay. And did the Navy detect petroleum products in our groundwater below the Red Hill

tanks prior to the 2014 spill?
A. Not petroleum products, I would say -- well, my understanding, that's more of an environmental question, but my understanding, there were byproducts. So the microorganisms in the soil that naturally degrade, natural product like petroleum, emit byproducts from their off-gassing or whatever like that, and that's what we detected, that's my understanding. But you'd have to confirm that with the environmental folks.
Q. Okay. But that suggests that some spills, we don't know which date, but prior to 2014, escaped from the facility and went down into the environment, into the groundwater, correct?
A. I don't know if we have evidence of the groundwater or -- I don't have knowledge of that. That's an environmental question really.
Q. Okay. I thought I read this one to you, but maybe I didn't. Exhibit B-8 which says -- which is from 2007: Three groundwater monitoring wells were installed within the lower access tunnel of the facility, and samples from each have consistently detected petroleum dissolved in the groundwater beneath the site.
Does that sound familiar to you?
A. That's not my understanding. I mean that might be what the report says, but again, I'm not an

environmental person. You'd have to bring that up with them. I don't really feel qualified to answer that. I mean it might be what the report says, I don't know.

MR. FRANKEL: Yeah, okay. No further questions.

HEARING OFFICER CHANG: Mr. Paige, anything?

MR. PAIGE: No questions.

HEARING OFFICER CHANG: Okay. Commander Frame, thank you very much. Appreciate your help with this.

THE WITNESS: Thank you, sir.

(Witness excused.)

HEARING OFFICER CHANG: All right, let's go off the record for a moment and plan for the next witness.

(A recess was taken.)

HEARING OFFICER CHANG: Let's go on the record. Mr. Stanley, thank you for being here and helping us with this. Let me ask you to take your oath at this time.

Whereupon,

CURTIS STANLEY,

called as a witness on behalf of the United States Navy, being first duly sworn by the court reporter, was examined and testified as follows:

HEARING OFFICER CHANG: Ms. Riddle?

MS. RIDDLE: Thank you.

Mr. Stanley, is a professional geoscientist and a hydrogeologist with GSI Environmental, a subcontractor to Aecom Technical Services, which collects environmental data and conducts environmental analyses at Red Hill.

He has worked in the environmental investigation and remediation field for 43 years.

DIRECT EXAMINATION

BY MS. RIDDLE:

Q. Mr. Stanley, could you please tell us what has been your focus at Red Hill since you started working on this project in 2017.

A. Sure. My focus since I started in 2017, along with my colleagues in GSI and Aecom is to help the Navy utilize state of the art technologies in investigating and evaluating subsurface conditions beneath Red Hill and in the surrounding area.

Q. Thank you. You have testified about the impacts to the groundwater aquifer underneath the tanks at Red Hill. Could you summarize for us what those impacts are?

A. Sure. Could you bring up the first --

Q. Yes. One moment, please. Is it visible?

A. Yes. Some of it's cut off, but --
Q. This is from the direct testimony of Curtis Stanley in the attached Facility Environmental Report. This is page 242 of the PDF file.
HEARING OFFICER CHANG: I have a hard copy. Is there any reference, any way to get to it from a hard copy?
MS. RIDDLE: Yeah, one moment. It is figure B-1, Groundwater Concentration Graphs, which is -- I apologize, I'm not sure if it is in -- which appendix it is. I'm sorry, Mr. Stanley, is this Appendix B of the FER, or --
THE WITNESS: Yes.
MS. RIDDLE: -- is it still in the main body?
THE WITNESS: Yeah, I'm not sure of the exact page.
MS. RIDDLE: In the set of Groundwater Concentration Graphs that look about like this with -- in several rows of analyte graphs?
HEARING OFFICER CHANG: I see it.
MS. RIDDLE: It's the one with RHMW2254-01 at the top. It's the first page in that set.
HEARING OFFICER CHANG: I found it. All right, thank you very much. I got it.
A. Okay. Thank you. So let me explain this graph

real quick, or these series of graphs. RHMW2254-01 is actually the groundwater in the pump area where Red Hill Shaft is pumping. So that's the water right before it goes into the pumps at Red Hill Shaft. And if you look at all these chemicals on the Y axis on the left side, you see TPH-g, that's TPH gasoline; TPH-d is TPH diesel; TPH-o is oil range; and then you've got benzene, ethylbenzenes, toluene, xylenes, and naphthalenes.

And so what these are is they're various chemicals that the DOH has developed screening levels for in the environment, and that's what these EALs are, these Environmental Action Levels. So like I said, they're risk-based screening levels, and if you exceed one of those risk-based screening levels, and that could be in groundwater, it could be in soil vapor, it could be in soil, if you'd see that, then that means there's a potential threat to human health and the environment, if I paraphrased DOH correctly.

But in addition to that, just because you exceed that doesn't mean that there's a threat. What DOH says, it might require further investigation. If you're below that blue line, breach those chemicals, what that means is there's no perceived threat to human health or the environment. So like I said, this is the water from Red Hill Shaft, the groundwater at Red Hill Shaft, and as

you can see, over time, which is as on the X axis, the EALs have never been exceeded.

So the point I'm trying to make here is that the groundwater at Red Hill Shaft, it's safe, it continues to be safe, and the same is true for Halawa Shaft with BWS, you know, if you look at their analyses and what they report, their water is safe as well.

Q. Thanks. Could you just, just for the basics, could you explain what Red Hill Shaft is and does?

A. Sure. Red Hill shaft is one of several water supply wells for the Navy, and it's not actually a well. It has a water supply tunnel that extends across the water table, and water flows into that tunnel at the water table, it is directed towards the pumping room where all the water pumps are which pumps it up into the Navy infrastructure. And the same thing is similar for Halawa Shaft, that's why they -- they're called Maui wells, that's why they call it shafts. So there's actually these shafts or water tunnels that extend along the water table, gather groundwater as it flows in at the water table, or slightly below it, and then directs that to be pumped out at the pumping rooms to wherever the infrastructure takes it.

Q. And is some of the water that it supplies used as drinking water?

A. All the water -- well, so for -- this is potable water, so both of these wells, the Red Hill Shaft and Halawa Shaft is potable water, so it's for domestic use, whether you're drinking it or irrigating your yards, or whatever you want to do with it.

Q. All right, thank you.

A. And that's the other point in all this, you know, we recognize the sole source aquifer is a critical resource for the people on Oahu, and the Navy utilizes that water just as does everybody else, and the last thing anybody wants to do is impact a drinking water supply, and what we're trying to say here is that supply has been safe and remains safe over time.

Q. All right, thanks. I'd like to pull up, this is figure 3 on page 9 of your supplemental testimony.

A. Yes. There's quite a lot of information to be gleaned from this, and there's a couple things I want to explain to help put some things in context here. The orange outline is the outline of the Red Hill Bulk Fuel Storage Facility. Those black dots are the tanks within the facility, and the round dots that you see, the different colored dots are monitoring wells; they are groundwater monitoring wells. And there's a difference here between groundwater monitoring wells and soil vapor borings that were used to put vapor probes in to monitor

soil vapor beneath the tanks.

And let me explain that real quick. The groundwater monitoring wells are installed vertically down to groundwater approximately a hundred feet below the tanks, and they're screened across the groundwater because like as has been said here, fuel is less dense than water, so if there's any contamination it's going to be -- it's going to exhibit itself close to the groundwater surface, so that's why we try to screen and sample groundwater close to the groundwater surface or the water table.

Now, the difference here is if you look at some of the testimony that we've had, the borings that were installed, the near horizontal borings installed beneath the tanks that are now used for soil vapor monitoring purposes, they did see -- yeah, some of those did see contaminated soil, but those borings are something on the order of 10, 20 feet below the bottom of the tanks. They don't go anywhere close to groundwater. So if there was hydrocarbon indicated in the rock cores coming out of those borings, that hydrocarbon is constrained to that interval, right, and so it was found at a depth of 10, 20 feet below the tanks, not -- that is not what was in groundwater.

There's a couple of other things here. The

evidence of hydrocarbon in the shallow borings is consistent with our interpretation of the data, so we've got soil vapor monitoring data we've looked at. We've looked at the data from all the borings. And there's certainly indication of hydrocarbon in the basalt beneath some of the tanks, we're not contesting that, and it's consistent with our analyses.

So Hearing Officer Chang, you've talked about where did the 2014 release go, and if you look at some of our studies, especially the natural source zone depletion studies and the holding capacity studies, there's evidence that the hydrocarbon release from the 2014 release -- the hydrocarbons from the 2014 release is constrained to approximately 30 feet below the tanks in the basalt. We did not see an indication that that actually impacted groundwater.

And there's another thing I want to point out here, if you look at all these wells, the yellow wells and the orange wells are what we call near tank wells. And if you look at the blue wells, those are what we call perimeter monitoring wells. And evidence in the -- from groundwater monitoring we've been doing what's called a long-term monitoring study since 2005 in the groundwater, we do that every quarter, and all of that data, along with the soil vapor monitoring data beneath

the tanks, the shallow soil vapor monitoring probes, indicate that there hasn't been a release since we started this monitoring process. Yeah, there's no definitive release indicated either in groundwater or in the soil vapor monitoring since we started this process.

And that furthermore, none of these groundwater wells that we have here, these monitoring wells, have ever had evidence of what we call free phase hydrocarbon that floats on the water table and could potentially get into a well. There's never been any separate phase hydrocarbon discovered in any of those wells which are monitored, you know, quite frequently.

And so if you look at this orange dot here in the center, there is evidence of some fuel constituents over time in that well, and but most of that -- and so this gets to an analysis called TPH, total petroleum hydrocarbon, and TPH is sort of a misnomer because it's not necessarily hydrocarbon, it's not necessarily petroleum. What TPH is showing you is what carbon molecules are falling within sort of a carbon range in this analysis, and it doesn't give you specific chemical like a lot of analyses do, like for benzene, toluene, this just shows what are all the carbon molecules that exist in this analysis within a range of carbon.

So as an example, TPH-g for gasoline might have a

carbon range of something like C6 to C10. TPH-d might be C10 to C24, and TPH-o for oil might C24 to C40. So jet fuel is middle distillate, as is diesel, so we're really focused on the TPH-d range, the diesel, TPH-diesel, because that's the range of carbon that you would expect to see a fuel release.

But like I said, just because you see something in TPH, especially in low concentrations, doesn't mean it's fuel related. It could be related to well construction, greases and stuff used on the casing for a well. It could be related to how you sample the well, contaminates getting in from the sampling. It could be related to what we call artifacts when it's being analyzed in the lab. There are certain chemicals, like siloxanes and Accepta, or there contaminants in the solvent that's used that can evidence itself as TPH, which is totally unrelated to fuel.

And in addition, there are naturally occurring in man-made chemicals that may also cause this to happen. So as an example, there are halogenated hydrocarbons that we see in some of these TPH analyses, something like you might see from a dry cleaner, something like that, totally unrelated to what would be expected from a fuel release. So when we talk about TPH, you got to be really careful on how analyze it, and even DOH

recognizes that, and in their guidance they say, especially for low concentrations, if you see this, you know, you ought to take additional steps to further characterize it, just to make sure you know what you're looking at, and that's what we've done.

So the bottom line is we do see evidence of groundwater impacts beneath the tanks, especially at RHMW2 which is that orange one, and there are evidence of impacts in 1 and 3, but to put that in perspective, 2, what we see in 2, maybe 70 percent of that is what we call polar material, it's from biodegradation of hydrocarbons, or it could be a naturally occurring polar material. In number 1 we see very little fuel constituents, mostly polar material, and in number 3 we see almost completely degraded material, and it's almost all polar with no fuel constituents left.

So the bottom line in looking at all this data over the years is the fuel, the groundwater plume, the constituents in groundwater are confined beneath the tank farm, and there's no indication of fuel constituents in any of the perimeter monitoring wells that are indicated in blue here, or in Red Hill Shaft. And there's three reasons that get to this, and we'll probably end up talking about this more, there's a holding capacity of the basalt or any soil beneath a

fuel release.

And to put that in layman's terms, if you had a bottle of vegetable oil and you had a sponge beneath it, and you turn that bottle up and you start dripping into that sponge, a couple of drips it's not coming out of the sponge, it's retained in the sponge. Couple more drips it's still retained, and finally if you put enough vegetable oil in the sponge it I will start leaking out. So the amount of oil that's held in that sponge is sort of equivalent, before it leaks out, is sort of the same concept as what we would have for holding capacity. So it's just a scientific fact, all soils, rock have a certain range of holding capacities that may verify between different types of rock and different types of soils, but they all have the ability to contain hydrocarbon and absorb it.

And then the next part of this equation is what we call natural source zone depletion, and what natural source zone depletion is, it is the, pretty predominantly the biodegradation of these steel constituents that are held above the water table and the rock. And so we've done studies at Red Hill to demonstrate that.

As a matter of fact, one of those studies is in a Peer Reviewed Journal, and it's very consistent with

what we would expect, and if you think about a compost pile as an example, you know, you put all this stuff in a compost pile and it starts heating up over time. Well, we see the same thing in the basalt beneath Red Hill, we see a heat signature that's indicative of natural source zone depletion, along with some other things that also back that up.

And then finally, the third component of the equation is what we call natural attenuation in groundwater. So as these fuel -- as fuel or hydrocarbon gets to the groundwater, if it gets there, then some of it dissolves. The more soluble constituents dissolve into groundwater. And most of those things are easily biodegradable in groundwater, and the way you evaluate that is called monitored natural attenuation.

So we've done that as well, and so what I'm saying is that the combination of the holding capacity of the basalt, the combination with natural source zone depletion of the unsaturated zone above the water table, along with monitored natural attenuation is serving to basically stabilize the contaminate plume in ground water and actually cause it to recede over time.

I think that's all I want to say there.

HEARING OFFICER CHANG: Before you ask the next question, Ms. Riddle, you're showing us the

supplemental testimony thing. I have Mr. Stanley's testimony, I have his responsive testimony. Where is the supplemental?

MS. RIDDLE: That should have been filed on the 19th of January, I believe. I apologize if that somehow didn't make it to you. I can't imagine it, but --

HEARING OFFICER CHANG: I'm only looking at a hard copy, so if you sent it to me digitally, I may have it in the file. Okay. I won't be able to look at it, so I'll have to track it down. If I don't find it, I will send you an e-mail asking you to send it again to me.

MS. RIDDLE: Okay. Or we can do that right now probably, just make sure it's top of in box.

MR. MCKAY: Mr. Chang, it was hand-delivered in a three-ring binder on the 19th, if you have a --

HEARING OFFICER CHANG: Yeah, I have two three-ring binders and I'm looking at the exhibits there, and I don't see one listed for Stanley, unless it's not tabbed. Hold on, maybe that's why.

It does reference Mr. Stanley, so maybe I just missed it, because I -- it was not tabbed, so I added tabs, and apparently I did not see Mr. -- is Mr. Stanley or Dr. Stanley? I'm sorry.

THE WITNESS: Mister.

HEARING OFFICER CHANG: I now see it, thank you. Okay, not a problem, I got it.

MS. RIDDLE: All right.

Q. (By Ms. Riddle) Mr. Stanley --

A. May I make one more point real quick? So when I talk about the holding capacity, natural source zone depletion, monitored natural attenuation and their ability to degrade hydrocarbons and stabilize anything that gets into groundwater, depending on how much fuel gets in there, we're not saying that that is an allowable release. If something got into groundwater, nobody is saying that the holding capacity is allowable, that relates to an allowable release rate or anything else. We're just saying the science tells us that these are the properties in the rock and the ground water, and the chemicals within the groundwater.

Q. Okay. Can we talk about the differences between the soil vapor probes and the groundwater monitoring wells? And I can bring up a figure if that would be helpful.

A. No, I talked about that earlier. I mean you can bring up the figure if you want, I don't know if we need it. But just, again, to put that in perspective the groundwater monitoring wells are drilled vertically into

groundwater that's approximately 100 feet below the tanks, right? And they're screened across the water table.

The soil vapor monitoring borings that were installed years ago are near horizonal borings that extend under the tanks, and which basically show shallow -- they indicate hydrocarbon in the shallow soils beneath the tanks. But it doesn't mean that got to groundwater. So here's a figure showing that if you'd like.

Q. And this is on page 15 of your supplemental testimony, the same document as before.

A. So what was done years ago was these basically horizontal borings were installed under the tanks, something with an 11-degree incline or in that area. So they range from basically 10 to 20 feet in depth below the tanks. And when they were installing those borings they were coring the rock, and in some of those there was evidence of hydrocarbon or fuel. And across the entire tank field if you look at all these borings, some of the borings had a stronger indication of hydrocarbon or fuels than others did. And as part of our report, we've shown figures that indicate where those are beneath the tanks and what level of residual fuel was in there.

And as you can see here, there's a significant difference in the depth from what you would see in one of these borings to groundwater. So you can't equate what you see in a boring, especially with hydrocarbon in the rock, with what you see in groundwater, they're two different things.

Q. All right, thank you. Are there any corrections you'd like to make to the written testimony you submitted in this case?

A. I think I have one more figure on the soil vapor monitoring.

Q. All right, yeah, we can bring that up. One moment, please. This is from page 26 of your supplemental testimony?

A. Yes.

Q. Figure 9.

A. So this is from the soil vapor monitoring wells beneath the tanks, and if you look at the top you see the color that indicates the concentrations that were detected at various times and for various tanks. And on the left side, so this was what the photo ionization detector -- and the Navy's been doing this on a monthly basis -- and you can see the concentration ranges on the Y axis, but what this shows you is prior to the 2014 release, you know, there's a couple little blips and

stuff in there, and that might be within natural variability, but right at the 2014 release, those concentrations shot way up.

So this graph tells you a couple things, that if you look at the purple line, which is Tank 5, those concentrations shot up to 450,000 ppb. Very high concentration, clearly indicative of a release. As a matter of fact, there's a red line that's sort of buried behind that, you saw evidence of high concentrations in that tank, and significantly less concentrations in other tanks at Red Hill.

So what this says is soil vapor monitoring can be a very effective technology for assessing releases at Red Hill. And as a matter of fact, while this happens, while they currently do monitoring on a monthly basis, we're working closely with DOH, and EPA, and U of H to develop a pilot test, a pilot program to do this on a continuous basis beneath Red Hill.

And that pilot program is being discussed with the agencies, like I said, right now, and we hope to get that underway in the near future, and it's going to tell us a lot. Not only can we use it for leak detection, but we can use it to assess what's going on with some of these residual fuels. So as an example, if you look at that purple line on the left after the 2014 release, you

see the concentrations have gone down significantly over time, and that's a result of this natural source zone depletion we talked about. If there was no depletion in the subsurface, that would just be a horizontal line across the graph, but you can see all this is degrading, the concentrations are depleting, just, you know, related to what we would expect for natural source zone depletion.

Q. All right. Is there anything else you want to go over?

A. No, not here.

Q. Then are there corrections that you'd like to make to the written testimony you submitted?

A. Yeah, there are a few, please.

Q. All right. I'm going to start with PDF page 25 of your director testimony, in footnote 3 on page i of the facility environmental report that's attached to your testimony, after the text I've highlighted here, which reads "the laboratory reported elevated TPH in" -- and I'm actually going to zoom in on that to make sure people can see it -- after that highlighted text you would like to add the phrase "3 samples from RHMW05 after it was installed (below EAL since 2010)"; is that correct?

A. Yes, that's correct.

HEARING OFFICER CHANG: Again, please, the insert?

MS. RIDDLE: The insert, yes. He would like to insert the phrase "3 samples from RHMW05 after it was installed (below EAL since 2010)."

HEARING OFFICER CHANG: Thank you.

MR. FRANKEL: Do you think if there's a bunch of these, and I don't mind going through them, but could you send them to us in writing as well? That would be easier. Thank.

MS. RIDDLE: Yeah. There are three, and I was going to ask if you'd like us to submit just an updated version that incorporates these three corrections after the hearing, Mr. Chang?

HEARING OFFICER CHANG: That would be good, for everyone.

MS. RIDDLE: Thank you.

Q. Page 42 of the PDF, which is page 12 of the facility environmental report, and the highlighted text reads: "to monitor quantities of water deeper in the aquifer (not aquifer chemistry)."

Mr. Stanley, you'd like to add the words, quote, "and a few early samples from RHMW05 (subsequently identified as lab artifacts)"; is that correct?

A. That's correct. That's consistent with the prior

one as well.
Q. All right. And then finally, on page 3 of the supplemental testimony I've highlighted this parenthetical which reads: "as well as in RHMW01 and RHMW03," and that second well reference, RHMW03, should actually be RHMW02; is that correct?
A. That's correct.
Q. All right, thank you.
MS. RIDDLE: Mr. Chang, we would like to present Mr. Stanley for cross-examination now.
HEARING OFFICER CHANG: Thank you very much. For the Board, who will be examining Mr. Stanley?
MS. GANNON: I will, Hearing Officer Chang.
HEARING OFFICER CHANG: Please proceed, Ms. Gannon.

CROSS-EXAMINATION

BY MS. GANNON:
Q. Good afternoon, Mr. Stanley. Thank you for joining us and answering some questions. I represent the Board of Water Supply, and had some discussions that I'd like to have with you about your testimony and your supplemental testimony.
First off, just as a background matter, you were just discussing with Ms. Riddle, and you have your written testimony that you have a background both in

education and in training in geology and hydrology; is that correct?

A. Geology and hydrogeology, and a little bit of engineering.

Q. Do you also have experience in the study of corrosion?

A. I've had experience with it, but I never studied it.

Q. So you haven't had any educational training or specific training in it?

A. No, ma'am.

Q. And how about in the studies of like metals, have you had experience or education and training in that area?

A. I had a course on materials engineer long time ago, but that was it.

Q. You wouldn't consider yourself an expert in that area?

A. No, ma'am.

Q. Most of my college courses I wouldn't consider myself an expert either, so I appreciate that. How about with regard to tank integrity, you have education and training in that area?

A. I have some experience with that in my prior lifetime, but no formal education in that regard.

Q. How about tank tightness testing?
A. Again, I have some experience with that, but no formal education. I wouldn't be an expert in that.
Q. How about risk assessment?
A. I do have experience with risk assessment, but mostly related to human health and the environment, not so much from an engineering standpoint.
Q. Would you consider yourself an expert in like engineering risk assessment?
A. I would not consider myself an expert in engineering risk assessment. I know -- you know, I have experience with some factors related to that, but I wouldn't consider myself an expert.
Q. Okay. So in your testimony when you're talking about the requirements of the AOC and how the Navy's complied with them, and what the agencies' response have been and what this all means in this proceeding, what's the basis for your assessment?
A. I don't understand the question.
Q. Well, you have testimony that speaks about all of the improvements that have been made as part of the AOC process, for example. You talk about the tank tightness testing, you talk about the benefits of that, and all the levels of protecting that come from all these different operational measures that are being given, and

I'm just wondering what's the basis for you to be able to assert that you have experience to say that this is something that can be relied upon and that you've assessed and you can speak to.

A. Well, I think what I'm saying in my report is that I'm relying on the testimony of others to put into context what the Navy is doing today versus what they were doing in 2017 and prior years.

Q. So but it would be appropriate for the Hearings Officer and the Department of Health to actually rely upon the experts who work on that, who are trained in those areas to make those assessments, right? So if they said one thing, you said something else, you'd probably go with the person who has training in that area, right?

A. Yeah. I'm only saying what I've seen in those reports.

Q. Okay, right. So that you're just kind of summarizing other people's words.

A. Yes, ma'am.

Q. Essentially. Okay, I appreciate that. I'd also like to ask you a general question about your involvement in the studies that appear in a reference in your analysis, and you state in your opening testimony on page 3 that you are one of the primary authors of all

the reports submitted under the AOC since you were brought on this project. Is that true?
A. Well, it is true. We have a group of specialists, like within GSI and with ACOM, and they're responsible for their technical sections, and then what I and others are responsible for is combining all that together into a cohesive report.
Q. So like when the destructive testing report was submitted in the AOC, you were a primary author of that?
A. No; no, ma'am. Only on the Section 6 and 7 reports for the department.
Q. Oh, so when you say all the reports, you meant all the reports related to 6 and 7; is that correct?
A. Yes, ma'am.
Q. Okay, that's a helpful clarification. Then you go on to talk about some of these reports that you worked on, and I assume those are the ones that you're saying that you're a primary author on. So one of those was the conceptual site model. Can you explain to us, we had a discussion this morning with Commander Frame about some of the problems with models, right, is that it's kind of garbage in, garbage out, right? So you're only as reliable as the data that's used to make them. Is that your understanding?
A. Right, but I think you're misinterpreting what

the conceptual site model is. It's not a numerical model or a mathematical model. What the conceptual site model is, it's a compilation of everything related to the site that we have, so topography, geology, hydrogeology, and what we do is we take all the information we've gleaned from the investigations we've done in the subsurface and describe that and integrate that into the conceptual site model.

And the other thing I would say about a conceptual site model is they're what I call evergreen, so they continue to improve over time. So as we get more information about the geology, as we get more groundwater information or contaminate information, then over time we will continue to improve that conceptual site model. So it's really the basis for everything we do at the site.

Q. Sure. Totally understand that. But it still has to rely on data, right? So when you're talking about there's things about like groundwater movement, that's mathematical data. There's also data that goes, as you said, the geology, the surface, that's still data, right? So if you had, let's say you put in the wrong numbers for the groundwater measurement, that would impact the quality of the model, right? And I'm not suggesting that you did, I'm just saying if there was a

mistake made in some of the data that was relied upon, that would affect the quality of the model; is that right?

A. That's possible, but we don't look at just any one -- not just one data point, we look at data points all around to make sure that does this really make sense, because from time to time you're right, there might be, you know, there might be a problem with what a lab did or with what was done in the field, and we try to put that in perspective.

Q. Yeah, completely understand. And, but my point is, so the data is really important, like you have to see the data to be able to testify to this and to say this model is a good representation of the data that we've gathered and our conclusions that we've made, and all of the things you're testifying to about how the subsurface of the site works. Like you have to know that that data is good, right?

A. Yes.

Q. And so you had to have looked at it at some point?

A. Yes, ma'am.

Q. Okay, thank you. The same would be true for the groundwater flow model, right?

A. So that's --

Q. Not the one you were primary author on, I think according to your testimony.
A. Well, Dr. Pandey was the primary author, but I was one of the authors. But that's a different type of model, that's a numerical model. It's not related to what you would have -- well, it's related to the conceptual site model, but it's not the same thing. The conceptual site model is integrating what we know about the site, and that information then becomes part of the numerical groundwater flow model that Dr. Pandey and others developed.
Q. So again, though, then this would be maybe even more applicable to what Commander Frame was worried about, is if you have garbage data in, you'd get a garbage model out; is that right?
A. Yeah, and I'll give you a good example of that. We had two modeling sequences here, we had what was known as the interim groundwater modeling program, and then the 2020 groundwater flow model report. And during the interim groundwater flow model study there was a lot of data that was really iffy, because the elevations of the water levels were not up to par, we didn't have good transducer data like we had for the final report, and so a lot of the data that we were -- or some of the data that we were looking at in the interim model wasn't

nearly as precise as what we evaluated for the final groundwater flow model.

Q. So, again, but you're very familiar with this data then, you've looked at this data?

A. Yes, ma'am.

Q. And you can attest to its accuracy and its validity?

A. We've done everything we could for the water level elevation data. We did a very highly precise, or ACOM did a very highly precise elevation survey for all the wells. They did gyroscopic studies to understand what the three-dimensional aspects of the wells were, and a bunch of other things to ensure that we were trying to get the best data we could.

Q. Right, okay. I appreciate that. It's been one of our difficulties is without that data it's been hard for us to assess some of this, so that's just one thing. So I just wanted to make sure that you've seen it, because as I said, we've had a hard time because we haven't been able to see the data.

A. You should have all that data. All the data that we utilized has been provided in previous reports.

Q. There's not the underlying data. The analysis we have seen, but not the underlying data. We've never been able to access that. We've asked for it a number

of times, but we've never been able to access it.
A. The raw data?
Q. Mm-hmm.
A. As far as I understand, it's in those reports.
Q. All right, we'll have to go through that because we have not -- we don't have it.
But let's go on with our discussion for the moment. So have there -- I think you said in your opening testimony that you recognize there's been releases of fuel into the environment at Red Hill; is that correct?
A. Yes, ma'am.
Q. And we all know, and we've talked a lot about over the last three days the release from Tank 5 in 2014, but there have also been historic releases; is that correct?
A. That's correct. And what I would say is what the evidence from the data we've looked at from the groundwater monitoring wells, from those horizontal wells that were used for the soil vapor probes and for the soil vapor monitoring all indicate that with the exception of the 2014 release, what we're seeing in the subsurface occurred prior to 2005, 2008.
Q. So when those releases happened, both historically and in 2014, I think you just testified to

this and I know it's in your testimony, you recognize it's reached the groundwater?

A. There are fuel constituents that we continue to see at a small, a very slight level in RHMW02, some in 1 from time to time, and for those constituents to persist over the timeframe that they persisted, we think it's likely that hydrocarbon, some fuel actually got very close to or into groundwater up-gradient of RHMW02 at some time in the past. Not with the 2014 release, but prior to that.

Q. And in order for the fuel to be able to get there historically, or if they were in 2014, it would have had to have gotten through the liner of the tank, right?

A. So I can't attest to how it got out of the tank or toward the liner.

Q. No, but my point is if it comes from any of the facility, it would have had to have left the tank, and the concrete, and the grout, and the gunite, right, and then gotten down into the ground.

A. Somehow, and I don't know, and I don't think anybody knows the exact way it made its way from the tank, on a holistic basis if you think about that as the concrete with the steel liner, somehow it made its way from that into the basalt below.

Q. Yeah, it's just we've had a lot of discussions

this week about whether that's possible, and it's just -- I think it's helpful that since you have evidence about it being in the environment, so I'm just trying to track it back to show --

A. Yes, ma'am.

Q. I understand that you don't know how it happened. I don't know how it happened, but there's clear evidence it happened.

So when you're talking about there's been some constituents that have been observed in the groundwater, that means that they've been observed in the sole source aquifer beneath the tank farm, right?

A. They've been observed in the groundwater beneath the tank farm. They're very stable. It is part of the sole source aquifer, but that plume is stable and doesn't appear to be moving, and certainly hasn't impacted any of the perimeter walls.

Q. Yeah, but it's part of the sole source aquifer?

A. Yes, ma'am.

Q. Yeah, okay. And you said earlier that, and I appreciate this, and we're certainly on the same page on this issue, is that there's no release to the sole source aquifer that's acceptable. That's what you said, right?

A. I live over a sole source aquifer, you know, and

it's -- you know, I understand that the same thing that the people in Honolulu have, and it's not acceptable. But what I'm saying is, you look at the science, the impacts to an aquifer are fairly well constrained beneath the tanks and don't extend to the perimeter wells.

Q. So how much can be released before it becomes considered not be protective of the environment?

A. So here's the way I look at that, from my risk based perspective. What I'm most concerned about is an impact to the drinking water supply well. Whether it's Red Hill Shaft or Halawa Shaft, the last thing I want or anybody else wants is to impact a water supply that people are drinking from. And so while we do have releases that are evidenced in groundwater beneath the tanks of Red Hill, it's clear that those have never impacted either Red Hill Shaft or Halawa Shaft, and based on the current conditions it's clear they never will.

Q. Well, we'll have some discussions about that, but I was just trying to understand like so how much -- so you would consider it protective of the environment unless one of these 14 perimeter wells happen to detect fuel constituents. Is that basically the summation of your assessment?

A. No, ma'am. What I'm saying is that the thing we are most worried about is an impact to a drinking water supply well, and the past releases that have occurred at Red Hill don't indicate they -- you know, they're stabilized and there's no indication that they're going to impact a natural drinking water well.

Q. What I'm just trying to get to is the summation, the ultimate conclusion of your testimony is, right, that these are being operated in a way that's protective of human health and the environment. And so what I'm trying to understand is when would that line be crossed? Where is that line between adequately protected and not adequately protected? Is it when the groundwater -- the drinking water is impacted, or is it before that?

A. Well, I think the Navy's intent is to not to have any release, and I'm not saying, you know, like I said earlier, I'm not saying that the holding capacity, the natural source zone depletion is what the Navy should rely on for an allowable release. That's just the science. That's how much the subsurface can attenuate. As far as I know, the Navy's doing everything they can to prevent these types of releases from occurring.

Q. I completely agree with you that I'm sure the Navy does not want to release fuel, and I don't think they wanted to release it in 2014, I don't think they

wanted to release it 1940s, I don't think that they've ever wanted to release it, but the fact of the matter is it's happened. And so what I'm trying to understand is, just to be able to put a real frame around your testimony, is where would you say the line is between when it's adequately protective of the environment and when it's not. Where is the risk line for you personally?

A. So if you look at ASTM and standards called risk based corrective action, what ASTM does is they look at is it going to have an adverse impact on the environment or human health, and DOH has the same type of approach. And so what we're doing, what we would do is, if it's going to impact human health it's got to get to a drinking water well where people are exposed to it. Nobody is drinking the water out of one of these monitoring wells. And so --

Q. Would it be safe to drink the water out of those monitoring wells?

A. They're not designed to drink from.

Q. No, I understand that. But I'm just saying -- I'm just, again, I'm trying to assess what kind of level of impacts we're talking about, what's protective or not of the environment. Would it be safe to drink the water from right under Red Hill?

A. From all the perimeter wells it would be, but --
Q. But how about from the monitoring wells? Monitoring Well 2, we know that's the most impacted, so how about that?
A. Nobody would ever do that. It's just -- it's not something that would ever happen.
Q. But I'm just trying to get an assessment of where your level of risk -- because you very confidently state that this facility is absolutely being operated in a way that's protective of the environment, and so I just want to understand where that line is for you. When would that line be crossed?

Because I think we all agree, right, we don't have to wait until our groundwater or drinking water resources are destroyed, right? So it's some place short of that, and for us it's really short of that. But for you, so when you say it's protective of the environment, so again, is it that the plume has to not reach the perimeter wells, is that good enough?
A. No. Again, if you look at the standards that most states utilize and the federal government utilizes called risk based corrective action, these types of releases happen from time to time at a range of facilities, and it doesn't mean you're going to shut them down, it doesn't mean it's an acceptable thing, but

agencies like Hawaii DOH have guidance in place to assess and deal with that if it occurs.

And so what we're saying is, just because you've got an impact below the tanks of Red Hill doesn't mean you're going to impact actual drinking water wells or a large portion of the sole source aquifer, it's contained underneath Red Hill.

Q. I understand that that's your assessment.

So let's just talk a little bit more about the release from 2014. There was the estimate it's like 27,000 gallons was released, and you just discussed with Ms. Riddle, and it's in your written testimony that you're confident it's all being held in that 30 feet below ground. Is that an accurate assessment of what you've said in your view?

A. So we have no indication of it impacting any of the monitoring wells we have. And if you look at the natural source zone depletion studies we did with that thermal signature in the monitoring wells within the tunnel, we see that signature indicating biodegradation of fuel up to 30 feet below the tanks. So based on that, it looks like most of that fuel is constrained to, you know, to the -- to a 30-foot horizon below the tanks. Now, there could have been some pathways where it got a little deeper, but we see no indication of it

having gotten to groundwater.
Q. Have you actually found it in the subsurface?
A. Well, indirectly we see the heat signature that's associated with the nature source zone depletion of that material.
Q. But you haven't found it directly?
A. No, ma'am.
Q. But we've heard a lot of testimony about all the studies that were done immediately following, and all the time subsequent to it, and one of the big efforts was to find the fuel, and my understanding was it was actually never really found. So you said that, if I understand it, there's some indirect evidence that you've made some conclusions based upon -- again we'll talk about those -- but no one's found the fuel; is that right?
A. Well, we've seen it in two ways. We've seen it in the soil vapor monitoring, and we did chemical analysis of that soil vapor, which is indicative of a fresh release, so we know it's in the vapor below the tanks, in the soil vapor below the tanks, and then indirectly we see the heat signature generated from the biodegradation of that fuel in the subsurface as part of our studies.
Q. Did you see that heat signature before 2014?

A. No. We didn't do that study until couple years ago.
Q. Okay. You don't have any way of calculating how much fuel was released before 2014 that was found in the subsurface?
A. No, ma'am.
Q. But you indicate in your testimony that you think it might have been a great amount, right, because you read the numbers as declining, even with the 2014 release added to the subsurface?
A. I'm not sure I understand your question.
Q. The way I read your testimony, and as you say, that you believe that it wasn't like the 2014 release happened and we saw a big spike in all the constituents in the subsurface, right? That you talked about the declining trend, which would seem to me to indicate that prior to the 27,000 gallons coming in there must have been a lot more than that, right? Because if it's going to decline even with the addition of 27,000 gallons -- and maybe I'm misunderstanding this -- but that's the way I'm trying to put it together.
A. Yeah, I don't see it that way. If you look at the soil vapor probes, that graph I had up there earlier where you saw that charge spike of soil vapor concentrations, immediately after the 2014 release,

that's what's indicative of that release, and then you see the declining concentrations over time, which is indicative that wherever that release went in the basalt is now degrading in the subsurface.

Q. Okay. And just you talk about the lessons learned from the 2013-'14 release and how all these actions are being taken in response to this. What's the basis of your testimony on that subject?

A. Just the reports that the Navy is putting out.

Q. Have you seen a root cause analysis that went into the reasons for the leak?

A. I've seen some documents. I assume you're referring to the 2014 release?

Q. I am, yes.

A. I've seen some documents that have sort of described what caused that, but I'm just relying on what was published in the Navy documents.

Q. Okay. So, again, your testimony shouldn't really be the testimony we're looking at for that. That part of your testimony, we really shouldn't be relying on?

A. Yeah. So I'm not an expert, I'm just -- again, my summary of that is evidenced in those documents.

Q. Okay, I appreciate that. Then I want to go on. When you start talking about your work with the AOC and under the AOC you say, to date neither the EPA or the

DOH have alleged that conditions at the facility pose such a risk -- you're referring to that you define a risk public health and the environment -- which is a further indication that the facility is safe.

My question is, so if the regulators had identified a problem either with like the documents that you had submitted or with things that were being done as part of the AOC process, would that factor into your assessment of whether this is safe or not?

A. I'm not sure what you're referring to there, what part of my testimony you're referring to.

Q. Well, I'm sorry, I don't have the exact quote. But you say, to date neither the EPA nor the DOH has alleged the conditions at the facility pose a risk, which is further indication that the facility is safe.

Do you remember that testimony, or do you need me to find that?

A. If you could find that that would be helpful.

Q. Okay. But that's the whole quote, but I can find it I'm sure. Do you see my screen now?

A. I see a Zoom --

Q. Maybe I have the wrong screen. Do you see it now?

A. Yes, ma'am.

Q. Okay. And is that -- is that legible to you or

you need me to make it bigger?
A. Yeah, if you could, that would be great.
Q. How's that?
A. That's good.
MR. FRANKEL: Page 4 of his report.
MS. GANNON: Oh, of his report? Okay, thank you. Actual 4?
MR. FRANKEL: Yes, the very bottom.
Q. (By Ms. Gannon) Okay. Yes, so it's in here, and it's right -- "Furthermore," do you see it starting there?
A. Yes, ma'am.
Q. So you just want to read that? So we actually -- I was just doing the part here: To date, neither EPA nor DOH have alleged that the conditions at the facility pose such risks, which is further indication that the facility is currently safe. That was your testimony. Do you still agree with that testimony?
A. Well, if we put it in context with what's above, both DOH and EPA -- the AOC reserves both DOH and EPA's authority to take -- authority to take direct or order any and all necessary actions necessary to protect public health, any source of drinking water or the environment, or to prevent, abate, or minimize the actual or threatened release.

And to date I don't think that's -- I don't think they've alleged that they've needed to do that.

Q. So, but my general question is, so if the EPA and the DOH have found problems with documents under the AOC, would that call into question your view on the safety of the site?

A. Not necessarily. It would depend on what the specific concerns were.

Q. Okay. Well, let's turn to some of the concerns. What I'm going to pull up here is Navy Exhibit 75. No, not showing up on the screen.

MS. GANNON: If we could just take like a two-minute pause. I'm going to get one of my colleagues who is going to be able to handle these documents better than I to open them up for me, if everyone doesn't mind just taking a second.

HEARING OFFICER CHANG: Yeah, let's go off record for a couple minutes.

MS. GANNON: Thank you. I apologize.

HEARING OFFICER CHANG: No problem. Don't worry about it.

(Off-the-record session.)

Q. (By Ms. Gannon) Thank you for the indulgence. Mr. Stanley, so what we've pulled up here is Navy's Exhibit 75, which is the letter from the EPA and

Department of Health, dated October 26, 2020. Do you recognize this letter?

A. I believe I've seen that, yes.

Q. So first off I just want to start to set the frame of what this letter is. So this is the letter where, as the first highlighted sentence says, right, that the Regulatory Agencies disapproved the submittals that were made, and this is for the TUA document. Do you recognize this?

A. Yes, ma'am.

Q. And you see in the second sentence there the reasons why the TUA Decision Document was denied, and maybe you can just read this last sentence.

A. The sentence that you've outlined in yellow?

Q. Yeah, please.

A. Okay. The Regulatory Agencies have determined that the TUA Decision Document lacks detail, clarity, rationale and justification to demonstrate that the actions described in the decision document are the best available practicable technology, BAPT in parens, for the tanks and operations at the Red Hill Facility.

Q. Thank you. So does that impact the way that you feel about the operations and all the improvements and everything that you're relying on to make your conclusion that this facility can be operated in a safe

manner?
A. I don't think that necessarily impacts my conclusions. What it does point to is the need to -- for the Navy to do a better job of justifying and demonstrating what they're proposing in the TUA is the right course of action.
Q. Because at this point we don't know if it's the right course of action, right, because it hasn't been explained or justified or clarified, at least not to the satisfaction of the regulatory agencies who are making the decisions about what's necessary; is that right?
A. Yeah, I think the regulatory agencies here are saying that we're not, you know, we're not saying that what the two aspects of the TUA document are right or wrong, they're just saying that they don't have enough information to make that determination, and they need more information to back that up.
Q. All right. And then if we can just scroll down. And attached to this letter was this Attachment A which goes into more details about this. Can you read the highlighted portion of the first paragraph?
A. Could you move that up just a bit, please. There you go, thank you. The Navy in the proposed TUA Decision Document has not demonstrated to the Regulatory Agencies that the proposed alternative is most

protective of groundwater and drinking water resources and other options are either less protective or impractical; and that the proposed alternative adequately mitigates risk.

Q. It says "the proposed alternative adequately mitigates release risk."

A. Oh, yes, ma'am. Sorry.

Q. So that last statement to me is concerning when we're evaluating the ability to operate this facility in a manner that's sufficiently protective of the environment and public health because it hasn't been demonstrated at least to the satisfaction of the Regulatory Agencies that this proposed alternative adequately mitigates release risk.

Is that a concern to you?

A. Again, it's not a concern to me right now because the agencies aren't saying it's either not appropriate or appropriate, what they're saying is the Navy hasn't demonstrated that those are the appropriate alternatives, and the Navy needs to do more work to make that demonstration.

Q. Okay. We had talked about earlier that what you've been involved in really with the AOC process is what's being done on your 6 and 7; is that correct?

A. Yes, ma'am.

Q. And just briefly, just to make sure, I don't know that Hearings Officer Chang is as familiar with these sections as the rest of us may be, if you can just briefly say what is done under 6 and 7, what they're meant to address?

A. So together they're meant to address the subsurface components, the environmental components of what's going on at Red Hill. I believe, Section 6 references the investigation and remediation components of that and the modeling; and 7 gets more into the groundwater protection plan and some of these other things. But altogether, you know, what we're doing in these sections is doing the work to assess -- we're trying to use the best available technology we can to assess the subsurface conditions, and evaluate that to make sure that drinking water remains safe.

Q. Thank you, I appreciate that. That's helpful for setting the stage. In my understanding, as I've been monitoring this process, is that there's been a number of issues related, starting off with the scope of the work to be done on your list. Is that a fair representation?

A. I think, I don't know if that was before my time or not, but we have a good working relationship with the agencies and their subject matter experts, and we've

even worked with BWS and their subject matter experts, and everybody provides valuable input into what we're doing, and experts may agree or disagree on some things, and that's why we continue to meet and talk about this stuff so we can reconcile and come to some agreement.

MS. GANNON: Sure. If you can pull up B-328 for me, please.

Q. What I'm going to have pulled up for us now is the letter that was given to the Navy in response to the initial scope of work for 6 and 7 that was provided. And again, for the record, this is the Board of Water Supply Exhibit 328, and it's a letter from the U.S. EPA and the State DOH, dated September 15, 2016, and again, it's a Disapproval of the Red Hill Administrative Order on Consent, Attachment A, Statement of Work, Deliverables under 6 and 7.

Are you familiar with this letter?

A. You know, I think I've seen it. I'm vaguely familiar with it.

Q. We can walk through it. If we can go down, the letter, just to summarize, and we can look at this if you need to, but basically it summarized all the comments that had been made about it, and they have a number of things that they've addressed that were deficient in the initial scope of work, and I'd just

like to quickly walk through these and we can just talk about how they've been addressed.

The first comment, do you want to read that for me, the comment 1 there that's highlighted. The highlighted part, you don't have to read the whole thing.

A. Okay, sure. "The work described in the Work Plan is not structured in a manner that supports an iterative and scientifically robust approach for achieving the AOC objective of adequately understanding subsurface conditions to characterize the consequences of releases from the facility."

Q. So that's a pretty big deal, right? Like understanding the subsurface conditions to characterize the consequences of releases from the facility, that's kind of what the whole purpose of 6 and 7 was, right?

A. That's, in a nutshell, that's sort of the purpose.

Q. So the fact that the first scope of work wasn't structured in a manner that supported a scientifically robust approach to this issue was probably a pretty big deal.

A. I can't attest to what was going on at that time. You know, I came into the project probably as a result of this to help utilize, you know, I and my colleagues

to work with ACOM and my colleagues there to use the best state-of-the-art technology in further assessing things, so this is what was happening in 2016. I think we made a lot of improvements and we've had a lot of work plans since then, most of which have been approved.

Q. Yeah, well, we'll talk about those that come up. But, again, if you were involved, if you drafted a workplan and you got this back, this would be a troubling comment, wouldn't it?

A. I would not be happy.

Q. I wouldn't either. Can we go down to the next one. Okay, if you could just read the highlighted portion of the next one.

A. Sure. "The conceptual site model presented in the Work Plan is an incomplete representation of existing data and does not adequately acknowledge uncertainty related to the conditions around the facility."

Q. And again, understanding and acknowledging uncertainty, that's probably a pretty big factor that has to be taken into to get models and plans in place that you can rely on, is that accurate?

A. I think that's generally an accurate statement, and that's why in the reports I've been involved with since this time we have sections that discuss the

uncertainty related to the work we've been doing.
Q. Let's go down to the next one. Okay, if you can just read 3, please.
A. Number 3?
Q. Yes.
A. The conceptual site model needs to evaluate NAPL -- I can explain NAPL real quick, it's --
MS. GANNON: I was about to say, yeah, Hearings Officer Chang, would you like to hear a brief description of what NAPL is? We'll probably talk about that several times here.
HEARING OFFICER CHANG: Yes, thank you. That would be helpful.
MS. GANNON: Okay.
A. So NAPL is an acronym for non-aqueous phase liquids, and that's what you have when you have a fuel release that might get into ground water, right? So the fuel is less dense than water and floats on top of water from a layman's perspective, and it really doesn't mix much, so that's that non-aqueous phase liquid, it's not necessarily dissolving into water, at least most of it's not.
So to evaluate NAPL movement in the saturated and unsaturated zones for the purposes of risk characterization.

Q. Okay. So again, understanding NAPL movement is again a pretty big, big -- a big deal when you're looking at this kind of constituent of concern, right?
A. It is one of the considerations when we're taking everything into account.
Q. Okay. Let's go to number 4, please.
A. "The Work Plan needs to include a deliverable that adequately describes the existing data available to be used for the modeling effort and assess the adequacy of the data to achieve the objectives of the AOC."
Q. It has to be that -- it has to, and it's found not to adequately describe the existing data available for modeling, and to assess the adequacy of the data that's needed.

Again, this is a pretty critical part of the work plan, wouldn't you think?
A. I think so, and that's why the Navy undertook considerable effort to improve the data that was going into the models, the subsequent models after this time.
Q. Let's go down to the next one, number 5.
A. "The Work Plan does not describe how groundwater flow paths will be determined since groundwater gradients and groundwater flow directions are not always coincident." And again, as part of our ongoing modeling efforts, we've made a lot of effort to help describe how

all this fits together.
Q. Because my understanding is particularly with this site and the complexity and all the different constituents -- of which again we'll talk about a little bit more -- but so understanding the groundwater flow and the gradients is pretty important, right?
A. Yes, ma'am.
Q. And this isn't like a lot of very simple sites. You know, I'm originally from Michigan and water just kind of flows in one way, and like gets in the ground, you know where it's going, it's not a big deal. I mean it's a big deal, but it's not like this. I mean, so in this kind of environment and site, this is a pretty essential thing to figure out and make sure you get it right, isn't that correct?
A. Yes, ma'am. In Hawaii they have some terminology, they say mauka to makai, which in general is flow from the mountains to the ocean.
Q. Right, and I understand it's -- again, we'll talk a little bit more about this -- but then there's all of these other fractures and things, and sometimes things don't just go the way that you would expect them to as well, right?
A. Yes, ma'am, and that's called anisotropy, which is mentioned right below.

Q. Yeah, yeah. So let's go down to number 6.
A. "The Work Plan does not adequately describe how the groundwater flow model will be updated, recalibrated, assessed for sensitivity, and ultimately utilized as a tool to inform future work to be performed." And again, since this time we had developed additional modeling plans and ways to obtain very precise data, and a lot of that was integrated into the latest flow model that we've reported on.
Q. Okay. And then number 7?
A. "The Work Plan does not adequately describe how the assessment of attenuation rate of fuel in the vadose zone and saturated zone will be evaluated as part of this effort." And again, we've tried to undertake those assessments in our subsequent reports.
Q. But again, this is a pretty critical factor in making determinations about what's going to happen on this site, right, with all these releases that have happened?
A. At that time. But like I said, since then we have undertaken studies to evaluate those types of conditions.
Q. Sure. Again, we'll talk about that. And number 8?
A. "The Work Plan does not sufficiently describe how

an adequate sentinel monitoring well network will be established for early detection of contaminants from the facility that may threaten drinking water production facilities."

Q. I think and you spoke a little bit about the importance of sentinel monitoring a few minutes ago and in your report. So we can go on to number 9.

A. No, actually I haven't talked about that yet.

Q. Oh, I'm sorry, it was just in your written testimony.

A. Right. I could put that in a little more context for you if you would like.

Q. Sure.

A. So we have the wells, the near tank wells beneath the tank farm, and we have the perimeter wells, and the intent of the sentinel monitoring network is to provide an indication if a release occurs, is it going to impact -- you know, what's it going to impact, especially is it going to impact Red Hill Shaft or Halawa Shaft. So some of the wells, or many of the wells that we put in place will eventually become part of the sentinel monitoring network, and that is a component that comes later after we do fate and transport modeling as part of the AOC.

Q. So that still hasn't been done?

A. No, that's -- that effort is slated to be done as part of the AOC after we get some other task completed.
Q. Yeah, it sounds like it's a couple tasks away, but it's a pretty critical part of eventual analysis and conclusions that have to be made, right?
A. Yes, ma'am. I think that would eventually go in and to be part of the groundwater protection plan.
Q. Right, okay. Let's go on to number 9.
A. "The Work Plan does not describe how the results of the groundwater investigation and resulting modeling will be used to establish risk based decision criteria."
Q. And we talked a little bit about how important that is and to be able to make these sort of risk based decisions, and you had spoken to that, so I think we all kind of had some sense of what -- the importance of that analogy was. So let's go on to 10.
A. Yes, ma'am, and -- sorry to interrupt, but --
Q. Oh, no, no, no. Sorry. Go ahead.
A. Just to put that in perspective, once we have the contaminant fate and transport modeling done, we'll be able to better undertake that component of the effort.
Q. Okay. And that's, again, a future effort to be undertaken?
A. Yes, ma'am.
Q. Number 10?

A. "The Work Plan does not present an adequate process to assess the quality, sensitivities, and potential uncertainties of the current groundwater model that Navy and DLA are proposing to update in order to satisfy the objectives of the AOC."

And after that time we have undertaken the interim groundwater modeling effort which describes some of that, and in the 2020 groundwater flow modeling effort, working with all the stakeholders, including BWS representatives, subject matter experts, USGS, University of Hawaii, DOH, DLNR, and so we've had discussions with all the stakeholders and have tried to integrate these components into our current modeling effort.

Q. And that interim plan is the one that you talked about that you found out there was all kind of those mistakes that you had to try to correct in the final one, right?

A. Well, they weren't mistakes, it was just data that was questionable.

Q. Right, okay.

A. And so like you early said, garbage in, garbage out, I think what that earlier modeling effort did was help us understand what was really driving some of the key issues related to groundwater flow, and we took that

and integrated that into our current modeling effort, which is a multi-modeling approach. We have multiple models we've developed to represent different perspectives from different stakeholders so that we can try to bound what the flow conditions are.

Q. Okay. Then number 11?

A. "The Work Plan does not adequately describe the content and organization of deliverables, protect schedules, and opportunities for Regulatory Agencies and external subject matter expert review of assumptions and information used to develop deliverables."

And like I said, after I became involved, or maybe right before that, we started having groundwater model working group meetings with all the stakeholders, and we continue to have technical working group meetings with the regulatory agencies to talk about the various issues that come into play in the subsurface.

Q. So in the summation, and again, I realize you weren't the recipient of this letter and you didn't draft the scope of work, but the overall assessment is they really -- the agencies really didn't accept any of the major underlying components that are necessary for the deliverables under 6 and 7 to meet the requirements. Isn't that what you take is the totality of this?

A. I wouldn't say they didn't accept everything. I

mean there might have been some things they accepted. Certainly they had significant concerns as are outlined in this letter, and those concerns are what I and my colleagues at GSI and ACOM and the Navy have been trying to address in our subsequent efforts.

Q. Okay. And when did -- I'm sorry, I think you maybe mentioned it but I forgot -- it's been a long day so far, I think you've been listening to most of it so you probably agree -- but when did you get involved in the project?

A. During my honeymoon in the summer of 2017.

Q. Your wife must have loved that.

A. She did.

Q. So could we now turn to Exhibit B-330. What I'm pulling up now is another Board of Water Supply Exhibit No. 330, which is another letter from the U.S. EPA and the Hawaii Department of Health, dated December 2nd, 2016, which is the conditional approval of the statement of work. Have you seen this letter?

A. That doesn't look too familiar.

Q. Okay. Well, there's really only one kind of important provision in here which I've got highlighted, if we could go down to the highlighted section. I mean there's other important things, but the thing I just wanted to talk to you a little bit about, if you can

just read the highlighted section in the penultimate paragraph.

A. Sure. Much of the detailed comments we provided in the enclosure to our September 15, 2016 letter, as well as comments provided by the Honolulu Board of Water Supply in their June 3rd, 2016 letter, parens, attached to our September 15, 2016 letter, close parens, remain outstanding and will need to be addressed in the appropriate deliverable as the Navy completes the tasks described in the revised Section 6 and 7 SOW.

Q. Thank you. So the way I understand this is that they had to get the statement of work approved. They gave all of those comments, the attachment is what we just went through from the September 15th letter, and I didn't walk you through at Honolulu Board of Water Supply's comments that were also attached with even more detail. But this says, okay, we're going to let you go forward, but you still haven't addressed most of those comments, is the way I understand this. Is that your understanding?

MS. RIDDLE: Objection. The document speaks for itself and he's not familiar with it.

Q. (By Ms. Gannon) But you are familiar with the statement of work, right?

A. Well, there's statement of work associated with

the AOC, but I can't attest to the context of this without looking at the entire letter.

Q. Okay, sure. So when you did the work on your 6 and 7 did you just stay within the statement of work that was approved by this letter on December 2nd of 2016?

A. No, ma'am. We did additional efforts outside of the statement of work as well.

Q. And did you go back and make sure that all of those additional measures addressed all of the measures that were identified in the September 15, 2016 letter and its attachments?

A. That was our intent. That's what we were trying to do, and like I said, we had quite a bit of communication with the agencies, you know, to make sure we were considering their thoughts as we were developing the process going forward.

Q. I understand. So but if it was -- again, I understand you undertook the work, and there was a statement of work which was guiding it, and there were still all these problems with the statement of work, so there was never -- let me ask it as a question. Was there ever a subsequent statement of work that was sent to the agencies and that they approved and said, yes, this meets all of our conditions?

A. Well, we had work plans. I'm not sure -- I'm not sure if there was a subsequent statement of work, you know, that pertains to the AOC, but we certainly had work plans for different aspects of the work we were doing that were approved by the agencies.

Q. I understand that. My question was, because I certainly haven't seen it in the records, so if it existed I'd be interested in knowing, and I assume you would know because you've been doing the work, that if there had been another work plan that had been shown to meet all of those deficiencies, that the agencies said that, yes, this addressee our concern. That document doesn't exist, right, as far as you are know?

A. You might be confusing a couple things, or maybe I am. But the statement of work as I understand it was developed as part of the AOC, and then -- and that's what the Navy's sort of obligated to go by in addressing some of these things. But in addition to that, there are work plans that are developed for all the tasks associated with the statement of work, and that's -- you know, we basically develop those work plans and get approval before we proceed, and that's what we've been doing since I've been involved.

Q. That's helpful. Maybe it will be helpful if I explain what I'm concerned about. What I'm concerned

about is that there was this letter that identified a huge number of deficiencies in all the major areas what needed to be done in 6 and 7. We just went through them, right? And then we got a conditional approval that says you still haven't met them. So I'm just wondering, has anybody gone back said, with putting all of these work plans together and whatever else you have formal approval from the agencies, you can say with confidence we've addressed all of the concerns that were identified by the agencies, so we know that we have a good plan when we went -- and we'll talk in a second about the final document -- so that you know when you were putting those final documents together, that you were addressing what was required?

A. I think that was our intent as we developed those work plans to go forward in an effort to address the issues that had been raised in some of these earlier documents that you're showing here.

Q. Yeah. Yeah, and I understand that's the intent, I was just trying to see if there was anything in writing that says that the agencies, and we could look at and say, yes, we agree that they've all been met. But if that doesn't exist, we can stop discussing it. That was what I was just concerned about. But I appreciate you going through that. I think we can stop

showing the screen right now.

So where do the deliverables under 6 and 7 stand right now?

A. Well, the conceptual site model is not a deliverable, but it's the basis for a lot of the deliverables we've developed. We have written a Groundwater Protection and Evaluation Considerations Report, we have written the Final Groundwater Flow Modeling Report, and we have written the Investigation Remediation of Releases Report.

Q. Okay. And things have been submitted, but not to the agencies; is that correct?

A. No, they have been submitted to the agencies.

Q. Okay, yes. But they have not been approved yet.

A. No, we're still waiting approval.

Q. So I'm going to turn to a discussion on monitoring. So you need a break? Sounds like you might -- your voice might be getting tired, you might want water or something?

A. Yes, I would appreciate that.

MS. GANNON: Hearings Officer Chang, is it okay if we take like a ten-minute break?

HEARING OFFICER CHANG: Certainly. Let's do that.

THE WITNESS: Thank you, Ms. Gannon.

(A recess was taken.)

HEARING OFFICER CHANG: Let's go back on the record, and then Ms. Gannon, you can pick up where you want to.

Q. (By Ms. Gannon) Okay. I did have a couple more questions about the scope of the work and the discussions with the agency. I just wanted to go over other portions of this document again. We had already looked at this N-75, which is the projection of the proposed TUA decision document. If we can go down to page 11, I believe, on the PDF.

And in making the decision on the TUA document there were some discussions about the way that the groundwater modeling in some of the other documents that we've been discussing were handled. I just wanted to go over these with you. The first is under here where it says "A Detailed Release Response Action Plan Needs to be Included in the Decision Document." Can you read the highlighted portion of that language for me?

A. Sure. "Ability to identify and respond rapidly to indications of a release is critical to effective risk mitigation. In the event of a confirmed release, the Navy will need available ullage to quickly drain the tanks and prevent more fuel to release into the environment. The decision document mentions having

available ullage, but is silent on how this response process will be implemented."

Q. And I know this is a little bit outside of your bailiwick, I believe, but this is sort of just about -- you do speak to sort of the mitigation that is being considered as part of the TUA, and so I just wanted to highlight this provision to see if you had any response to it.

A. And, again, I didn't write this. This is just my perspective, but I think what's being asked for here is the Navy to outline what they're going to do if they see certain events taking place. So as an example, if they get a high level alarm in a tank, how are they going to respond to that. If they see a certain vapor concentration in the subsurface, how are they going to respond to that. That's my take on this.

Q. Right. And again, so the fact that that hasn't been presented to the satisfaction of the agencies played into the rejection of the TUA decision; is that correct?

A. I believe so. And it doesn't mean that the Navy doesn't have all that, it's just they didn't document that to the satisfaction of the agencies.

Q. Right, I wasn't explained clearly, or the data wasn't presented satisfactorily, et cetera, the reasons

we went over earlier.

Can we go down further in the document, the next highlighted portion. I'm sorry, I don't know what page it's on. Okay, so then this next -- this is again another reason for the rejection of the TUA decision. It's related to "Evidence is Needed to Support the Claim that Minimal Contamination will Result from a Minor Release." Can you read the highlighted portion?

A. Sure. "The Navy claims that even in the unlikely event of a minor release, the multiple layers of release detection listed in the decision document will be able to detect releases and, because of their response action plans, there will be minimal contamination allowed into the environment. The decision document does not provide sufficient information to make this case and should be revised to provide quantitative analysis and evidence of this risk mitigation achieved through these improvements. Bounding estimates of possible release volumes based on the release response plan for various release scenarios, as mentioned in the previous comment, can help with this illustration. In addition, if damages occur, what plans are in place to address potential resource damages."

Q. So the way I'm reading this section is that they're saying that they haven't seen evidence, which

shows that the Navy has quantified how they're detecting releases, what's going to happen if these releases happen, the minimal releases happen, and how it will be mitigated in order to protect resources from damage. Is that consistent with your reading?

A. Again, you know, I'm not exactly familiar with all this. But I do know the Navy has a system of systems, as they call it, and in the industry what we'd call that are multiple barriers in place so that you got barriers for release prevention, and you've got barriers for release detection after release occurs.

I think what this is referring to is, do you have multiple barriers in place to detect the release early and deal with that before it becomes a major problem, and I guess what they're asking for is, how do all these fit together, and what's the documentation for that.

Q. Right. So what it seems to be saying is that all the documentation that the Navy has presented, which is the same documentation before us here, doesn't demonstrate that to the satisfaction of the Department of Health and to the EPA. Is that consistent with your reading?

A. I think it's the same issue we discussed earlier where the Navy just needs to do a better job in documenting all the factors behind what they're

proposing for their TUA, so that it satisfies the agencies going forward.

Q. Yeah, and it seems that the problem is that what they do have -- how they presented it, what they've explained hasn't been sufficient. So it's hard to discuss what could be provided and to ask you questions about that because it doesn't appear that it exists, is the way I'm reading this. At least that seems to be the view of the Department of Health and EPA.

We can go down to the next one. Think there's just one more maybe. No. I guess I marked up more than I thought I did, sorry. So the next one is "Response Actions and Related Environmental Impact From a Significant Release is Needed." So again, before we were talking about identified deficiencies in the TUA document related to the minor releases. Now, this is related to significant releases, and if you can just read this provision.

A. Sure. "The document does not attempt to quantify potential volume of release based on release response measures but relies on a water treatment system at Red Hill to ensure available drinking water. Because of this reliance, the RD decision document should include specifics about the timeframe for evaluation, design, and construction of the water treatment system. If the

Navy cannot proceed directly to design of a system, the decision document must adequately describe the uncertainly related to the ability to design and construct a treatment system that justifies the need for a feasibility study, and discuss the related impacts for not having a water treatment system in response to a release."

Q. And this kind of goes to part of your testimony that I'll talk to you about later, which does go to this identified mitigation measure about being able to treat water in the event of a major release. What's your understanding of the status of that, of the approval or construction of that treatment facility to be able to do that?

A. Well, I haven't had discussions with the Navy about that recently, but it's my understanding as part of doing this we've talked about creating a capture zone, and what the capture zone does, when you pump Red Hill Shaft it induces groundwater flow from beneath the facility, the Red Hill Shaft, so that if there was a release, any contaminants would be entrained in that flow and go to Red Hill Shaft and then not go anywhere else. So Red Hill Shaft would contain that contamination hydraulically.

And what we said in the IRR was, if there was a

large release and it was going to impact Red Hill Shaft, you'd have to have a water treatment system in place to -- that's available to turn on because it flows so quickly. But I don't know if -- how the Navy's going to proceed with that until the flow model's approved and everybody agrees that Red Hill Shaft can create an adequate capture zone. Because we outlined the elements of the treatment system in the IRR, I'm just not sure where the Navy's at. I know they've made some commitments to evaluating it, I just don't know how far they've been taking that.

Q. And you just stated that the IRR has not been approved, so is it correct that the conclusion that the Red Hill Shaft can capture all of that zone has not been verified or approved yet by the agencies; is that correct?

A. Yeah, and that's the funny thing about the statement of work. Normally you wouldn't do an IRR until the flow model had been approved and the contaminant fate and transport model had been approved, but for some reason, you know, in setting this process up they put the IRR sort of ahead of the horse so, you know, we based it on what the flow model shows us without being approved, and that's all we could do. And, you know, if the flow model needs to be added on or

adjusted, then the IRR may need to be adjusted in the future.

Q. It sound like there's still a lot of uncertainty here and a lot of questions that still have to be resolved.

A. Yes, I think so. And like I said, it's unfortunate that they scheduled the IRR so soon in the process. Really, this is one of the last things you would do.

Q. Right, right. This one is "The Overall Strategy Needs to Provide a Fail-Safe Plan for Water Protection." Like I said, this is a very critical component about what we're talking about here today. Can you read the highlighted portion here?

A. Sure. "Given the importance of the aquifer below the Red Hill tanks as a major source of drinking water for Honolulu, the Navy needs to establish a contingency strategy to assure no impairment of drinking water quality and no disruption in drinking water availability. This fail-safe protection strategy should be presented in the TUA and Released Detection Decision Documents."

And as I read that, I would think one element of that would perhaps be utilizing Red Hill Shaft as a containment system for any significant releases from Red

Hill.

Q. Do you agree a fail-safe protection strategy, that's a very high standard to have to meet, right? Is that because its resource is so critical?

A. The sole source aquifer is a critical resource, and like I said, nobody wants to impact a drinking water -- you know, a water supply well, and what we're being tasked with here is to do the very best job we can to put elements in place to ensure that that won't happen.

Q. And you agree, though, we don't have enough information right now to do a fail-safe protection strategy?

A. I think we have components of that, but there's still additional work that needs to be done to finalize how all this fits together. We can come up with a strategy, but at the end of the day how it all works together is going to rely on some work that has yet to be done.

Q. Right, thank you. I wanted to talk about the monitoring program now. Can we go to back Mr. Stanley's supplemental testimony, page 9. So this is from your supplemental testimony, and this is the figure that you were discussing in your direct testimony with Ms. Riddle, correct?

A. Yes, ma'am.
Q. I just had a couple questions of kind of setting the stage for this. It's one of these funny things, you know, when you look at these kind of maps and figures because the way they get superimposed, right, it looks like the monitoring wells are actually bigger than the tanks. And so I'm just trying to get that in perspective when you're looking at this. So what is the size of these monitoring wells?
A. Well, it depends on the well. Within the tank farm they're typically 2 inches. I think RHMW1 might be slightly smaller, but it's being replaced. The normal monitoring wells are typically 4 inches in diameter, which is typical with industry standards, and then we have multilevel Westbay wells which monitor different zones vertically in the subsurface. There are four of those out there as well.
And I might add one thing here, that this figure's actually out of date now. Since this figure was developed there are two additional monitoring wells that are now in operation, one between 10 and 9, and the other, I think, north of number 11. And in addition to those two additional wells that are now operational, there are three more wells that are in progress that are going to be installed -- well, two of them will be

installed along the northwest flank, and then one of those will replace RHMW01. So there's a lot of work going on to continue to improve the density of monitoring at this location.

Q. And I understand that, and we'll talk a little bit about RH1 in just a second. But I was just -- and it does go to the density because, again, just to put it in perspective when you're looking at these maps and -- and I'm actually a person who loves maps, so I kind of like play with them, think about them, and figure -- but you look at them, and so again these are two-inch wells, the three, the yellow, the orange -- two yellows and the orange, right, and the tanks are, my understanding is the field where the tanks are is 13 acres, right? About 13 acres; is that correct?

A. I'm not sure about the acreage. Each tank is, I believe, a hundred feet in diameter.

Q. So, yeah, so each tank is a hundred feet in diameter, so the little black dots are a hundred feet in diameter, and big orange dot is 2 inches.

A. Yes, ma'am, that is 2 inches.

Q. Okay, right. So again, just so when you're looking at this and thinking of the density, I just think that's important just to point that out so when we're talking about it we're all kind of having the same

scale in our minds to understand what we're looking at.

When did the monitoring program begin at Red Hill?

A. I think, as I recall, RHMW1 may have been installed, oh, maybe in 2001.

Q. Okay.

A. And then Wells 2, 3, and 4, there were -- oh, and I think Red Hill Shaft as well, the well there, those were operational in the 2005 timeframe, and that's when the long-term monitoring program started with those five wells to start with, and now it's up to 20.

Q. Okay. So that was my understanding, and maybe I just misheard what you said when you were talking to Ms. Riddle this morning, or afternoon, or whenever it was. I thought that you said that there have been no releases since the monitoring program started. Is that what you said?

A. I think what I said was if you look at the data from the monitoring wells, and you look at the data from the soil vapor probes that, I think, were started in 2008, there's not an indication of fuel impacts in those wells, other than 1, 2 and 3. And 1, 2, and 3 we haven't seen any additional fuel impacts, even including the 2014 release. They were all preexisting prior to this time.

Q. But, okay, just so I can clarify this again, and maybe I misheard you, but I just want to make sure that we're clear for the record. So there has been a release since the monitoring wells were installed, at least one, the one we know of is 2014; is that right?
A. Correct. But there was no evidence of that impacting groundwater.
Q. Right. I just wanted to be clear about, you know, the timeline, and we can talk about the impacts a little bit, but -- and then again, so that -- and then there has been evidence in 1, 2 and 3 throughout the whole time you've been monitoring --
A. Yes, from all --
Q. Since the program began, right. And it still continues today.
Okay. So you said that Well 1 was installed, I think, in 2000. Or you said 2001. I think I read 2000, but it doesn't matter. It was installed early in the 2000s, right?
A. About.
Q. Was that properly installed?
A. Well, you know, again, I wasn't there when they installed it, but the screen for that well is somewhat below the water table, and so if there was free phase hydrocarbon coming across that well, it may not see it,

but the thing to remember about that is, you know, chemical constituents dissolve out of that hydrocarbon, so even if it didn't see the floating hydrocarbon, you would see it evidenced in the dissolved phase constituents in that well.

Q. And the problem with the well again is that it doesn't come in direct contact with the groundwater, is that the -- at the level that it's found regularly, is that an adequate description of the problem?

A. Not quite. What you do when you install these wells, because we're dealing with LNAPL, which is light non-aqueous phase liquids, like fuel, that from a layman's perspective float on top of the water and migrate with the groundwater flow typically. Then what you have to do is you'd have -- and so that's right at the water table, right? So if there's a fuel, it's migrating on top of the water table. And so what you do is you want to screen the monitoring well, ensure that the screen is cutting across the water table so that fuels on the water table, you can see it in the monitoring well. It would go in the screen, and then can you can measure the thickness of hydrocarbon in the monitoring wells.

Q. And that's not the way that monitoring well is installed?

A. It appears that that screen was a little deeper than the water table.
Q. And when was this problem identified?
A. I don't know.
Q. But it's been known for awhile?
A. I assume so. We've known about that since I've been involved, and I'm sure they knew about it before that, but -- we've been talking to the regulatory agencies about replacing that with an updated well, which we're now in the process of doing.
Q. I understand that that updated well is now anticipated to go in sometime in the next couple of years, some time like 2023; is that right?
A. No, it's in progress right now. It should go in within this year or next couple months.
Q. I thought in your -- in the FER it showed it as going in in 2023. So it's been updated since you gave that testimony?
A. I'd have to go and see what the FER said, but --
Q. We can pull it up if you like.
A. Sure.
Q. I think it's Figure 4, right? One second we're pulling it up. There it is. So when we look over here at the last in 2023, isn't that showing that that's when it's going to be done, that it's still in the plan

phrases?
A. There are wells constantly going in, you know, between now and then. I think what that figure was trying to convey is that by 2023 our intent is to have all these other wells in place. So you've got 2021, 2022, up to 2023, and our intent is to have these additional wells, you know, operational by that time.
Q. Okay. And in Dr. DeNovio's testimony that was submitted in these proceedings, and I know you're familiar with it, you responded to her testimony, so you know what I'm talking about when I refer to Dr. DeNovio's report, correct?
A. Well, might have been awhile since I looked at it, but yes, I'm familiar with it.
Q. Okay. Then if we need to pull up anything, just let me know and I'd be glad to have somebody else find it for me so you can look at it.
But that she noted that the short screen length for some monitoring wells limit the utility of the data that is gathered, and I believe you responded by saying that the DH monitoring well guidance, they said that should be a screen length of 10 feet. Does that sound accurate?
A. Yeah, so let me see if I can put that in context. In her report it seemed like she was describing that

there were quite a few wells that were improperly screened across the water table, and we produced a figure that show that all the wells are properly screened across the water table to take into account this potential LNAPL migration. RHMW3 sometimes is slightly below, but most of the time it's above, and that's what we were getting at. It's all the wells, with the exception of one, appear to be properly screened, and I think that's what we were trying to get at.

Q. But, well, you did reference the DOH's screen length is -- guidance is 10 feet, right?

A. Yes. They say, you know, you should try to keep the screen length at 10 feet, but what we did here, and this is all -- all these wells are developed with the approval of the regulatory agencies, including DOH. What we're trying to do is ensure we got a long enough screen interval so that we can intercept that water table because it's, depending where you're drilling, you know, it's relatively deep, and the water table fluctuates over time. So what we're trying to do is have enough screen to ensure that the water table is always within that screen interval.

Q. Okay. That makes sense. But what's the expected screen length for monitoring well 1R?

A. I am not sure.
Q. I believe it said it was 30 feet. Does that sound accurate?
A. That's possible. I don't know right now.
Q. Okay.
A. You're talking about the replacement well for 1, right?
Q. I'm talking about the replacement well for 1, yes.
A. Yeah, I'm not sure.
Q. And if I could pull it up, if it was 30 feet that would still be acceptable?
A. Yes, ma'am. Because, again, we're trying to make sure we intercept the water table so that if it fluctuates, we're able to see free phase hydrocarbon or LNAPL if it occurs there. And again, all these wells are designed under the -- in conjunction with the DOH and DLNR, and they approve everything we do before we do it.
Q. Okay. And then maybe if we could just talk a little bit about groundwater modeling, if everyone is still with us. And maybe just to kind of help set the stage again to make sure that all the parties sort of have the same understanding about the importance of this and how it's done, I think it might be helpful just for

us to kind of walk through the basic process a little bit. What are the attributes of a groundwater system that determine the flow direction of the groundwater?
A. Well, I mean there's a couple things. There's the groundwater gradient that you measure in monitoring wells, it's sort of -- it's the elevation of the water level in those wells relative to other wells establishes a gradient. And then what you had shown in a previous document relates to anisotropy, and that's the preferential flow direction as a function of the geology. So as an example, the basalt flows at Red Hill from the Koolau Range, flow in a -- the basalt flows, not groundwater -- flow in a southwesterly direction.
Q. So the water level data is pretty important to being able to form a groundwater model; is that right?
A. Yes. Yeah, that was the first thing I said.
Q. And just before we go on to the rest of this subject, when we started talking this afternoon we were talking about some of the data that we didn't have and that that would be critical for us to be able to understand this, and one of the things that we don't have is water level data. Can you tell me where I could find that?
A. Should be in the modeling report.
Q. Well, maybe if we're going to meet again

tomorrow, maybe you can look at that tonight and then you could tell us, point to us where it is directly?

A. And I would also mention that a lot of the gradient work we did was in conjunction with the USGS, and this is called synoptic groundwater monitoring effort. So BWS, the Navy, and the USGS all work together, they have transducers in the monitoring wells which give a very precise reading of water levels, and all that data is available through the USGS.

Q. If you can, again, if you can just give us the reference where we can find it, because we've looked and we can't find it. And we really believe it's pretty critical that everybody here can evaluate that. So, again, I don't expect you to have the reference here, but since we have the advantage of we're going to be back together tomorrow, maybe you could provide that to us when we next meet.

But, then we can go back. I'm sorry, I didn't mean to interrupt you, it's just I wanted to raise that point. So you talked about two of the attributes for the groundwater flow direction is the water level and then the gradient, right? Is there anything else that you're measuring?

A. So the gradient, right, which gives you an idea of the potential flow direction, and the anisotropy,

which is a function of the geologic formation, and so here these basalt flows are oriented in a southwesterly direction, so there's a preferential flow down the access of those basalt flows, and we've integrated that into our model, and so the combination of the anisotropy and the gradients ultimately determines the groundwater flow paths.

Q. How do you measure the gradients?

A. You measure that -- well, you look at the water level elevations in various wells relative to one another.

Q. Okay. And again, just to set the stage, we're going to go back to some of these things in detail about this particular model, but again, I think it's helpful just to have the stage set.

But what is meant by a confined or an unconfined groundwater flow system?

A. So an unconfined groundwater flow system is basically where the water table is at atmospheric pressure. So if I put a well in the subsurface, the water level's going to come up to atmospheric pressure, there's nothing confining it above. If I have a confining level like a clay lens or something like that, and I go through that and the water beneath it's under pressure, because it's being recharged to the higher

level, let's say it's recharged higher up in Koolau, right, so it's got a lot of pressure underneath it and it gets under that clay layer, it's under pressure and it can't go up, so if you put a well in that you'll see the water rise above where you found the water above that clay layer till it reaches some equilibrium point where the recharge happened.

Q. And are there both confined and unconfined conditions under Red Hill?

A. In some areas we do see some confined conditions potentially, yes.

Q. And in the 2019 CSM did you have which wells were in confined and which ones were in unconfined?

A. Well, there's a point here, it's possible RHMW1 might have encountered some confining conditions, and it's possible some other wells may have encountered what we call perch conditions. And so by perch conditions we're talking a relatively impermeable layer above the water table that's holding water at a higher elevation above the basal aquifer.

Q. Okay. So the way I read 2019 CMS was that RHMW07, OWDFMW01, and Halawa deep monitoring well were all in confined aquifers -- or confined conditions, does that sound accurate?

A. Yeah, so let me try to put that in context. The

oily waste -- the well at the oily waste disposal facility that's on the down gradient side of the facility, that is a completely different release site that's being studied under a different process by the Navy and the agencies, but we're using that monitoring well there to understand, you know, heads and things like that in the geology, and there's potentially confining conditions there.

And then some of the other wells you talked about we think are perched, and then the Halawa deep monitoring well you referenced was initially installed by Sea Worm, is part of DLNR, I believe, to -- it's an open borehole, it's pretty much an open borehole down to the saltwater/freshwater interface, that's approximately 800-900 feet below mean sea level here.

Q. Okay.

A. It was never intended to be the type of monitoring well we've installed elsewhere, but it does have some information we can use, so that -- and that's what we've been using if for.

Q. And I think we talked a little bit about this, but the water levels in a well in an unconfined aquifer will respond differently than water in a well in a confined condition, is that accurate?

A. Well, they only respond to -- assuming they're

connected -- assuming the confined aquifer is connected to the overall groundwater system, you might see a response on that as well, it's just a different type of response.

Q. How about to changes in barometric pressure, would it be different?

A. Excuse me?

Q. If there was changes in the barometric pressure would it be different?

A. So the barometric pressure does have an effect, just like tidal influences, recharge and things like that, and that's why we did this transfer function noise analysis on the data to deconvolute what the signals are in these monitoring wells. So what we were able to do with this was to isolate the signal just from pumping relative to barometric pressure relative to earth tides and tidal influence and recharge from precipitation and things like that.

Q. And has the Navy's approach to that, the studying those effects changed recently, or was it changed during your time when you've been working on this modeling effort?

A. Well, we implemented that type of analysis after I got involved with some of our experts, and that has facilitated our efforts for groundwater modeling.

Q. And the models that are involved in that, have you looked at those?
A. I don't know what you mean by looked at those.
Q. Well, I mean as part of your work have you been involved in developing and assessing those particular models?
A. So we have groundwater flow modeling expert, his name is Dr. Pandey, he was primarily responsible for developing the models. My responsibility was sort of ensuring we had the right type of information going into it and that we were assessing the models in a way that we can understand, capture, and the importance of pumping different conditions either at Halawa Shaft or Red Hill Shaft.
Q. That makes sense. And again, to be able to assess those models you've got to look at the underlying data, make sure everything was good, right?
A. Yes.
Q. That's helpful. We talked a little bit about this, that knowing the groundwater, that the measuring the water levels is critical to knowing the groundwater flow direction, right?
A. It's part -- it's part of the analysis, yes.
MS. GANNON: So if I can pull up the B-83.
Once we get through this exhibit I'm going to

still be talking about models and things, but it's kind of going to a slightly different subject, so if this was a place where people wanted to assess again how they're feeling, I know it is getting late for you, Mr. Stanley.

I'm sure you guys all want to stay up and talk about groundwater modeling all night long, but I do want to be considerate of everybody's time and energy, so we can do this exhibit, and then if, I don't know if, Hearing Officer Chang, you want to just do a check-in with anybody and see if I can go on to the next kind of subject matter.

HEARING OFFICER CHANG: I thought people are comfortable to go for an hour, and that would be until 6:00, and it's about a half an hour from now.

MS. GANNON: Okay, great. While we're pulling that up, I can go on to just a more limited question, then we can come back to it once the system isn't crashing.

Q. (By Ms. Gannon) So are you familiar with the ASTM Standards for Developing Groundwater Models?

A. No, but Dr. Pandey is.

Q. Do you know if the Navy has complied with these standards?

A. Dr. Pandey has indicated that he has.

Q. So the way I understand it, what we're talking about here is ASTM V5447, which is the standard guide for application of groundwater flow model to a site specific problem. Would that be consistent with your understanding what standard we should be looking at?
A. I'm not sure, I'm not familiar with that.
Q. Okay. So you can't testify to the ASTM Standards and the compliance with that associated with this?
A. No. I would have to rely on Dr. Pandey.
Q. Okay. He's not going to be available for cross-examination, I don't believe; is that correct?
A. I don't know.
Q. Okay. So there's nobody we can talk to about whether the groundwater modeling meets the standards; is that right? I appreciate you -- I really appreciate you saying where your area of expertise lies, I just don't -- I don't want to waste time asking you questions that you just have to keep saying I don't know, I don't know, so I just wanted to clarify that.
A. The only thing I recall is during some of our technical meetings he's been asked that question, and he's indicated that it does comply, but I am not in a position to opine on that.
Q. I really appreciate your transparency on that. I thank you.

MS. GANNON: So I'll just set that aside, then just note for the record that apparently there isn't any witness for us to discuss the compliance with the standard with relation to the groundwater model.

Q. So has the Navy provided a contour map of the water levels -- that's from the ASTM Standards, so I'm sorry, I'll move on.

I guess you do know about the contour maps, though; is that correct?

A. I know what they are, yes.

Q. Do you know if they've been provided in either the interim or the final groundwater flow model report?

A. So in the 2020 flow model report we provided particle tracks, and what that is is remember we were talking about the flow of groundwater as a function above the gradient and anisotropy. And those particle tracks show the direction of ground water flow, how particles in groundwater are going to flow considering both the gradient, the hydraulic gradient and the anisotropy, and those were provided in the reports.

Q. Okay. And you talked about this this afternoon a little bit with Ms. Riddle, and you talked about it in your testimony about the natural processes, such as natural source zone depletion, and monitored natural attenuation which had worked to prevent the numerous

releases from impacting drinking water, and you said that that conclusion is based on several studies, such as flex site model and groundwater flow models, et cetera; is that correct?

A. So I believe the CS -- the GPAC report, the Groundwater Protection and Evaluation Report, first discussed certain aspects of that, and then the CSM and the IRR dealt further into that, and so in those reports we have discussions about -- well, the GPAC was really about holding capacity, and then the CSM and the IRR go into more detail on natural attenuation and natural source zone depletion.

Q. Okay. And I'd like to just try to understand this a little bit better because this is a pretty complex subject for lawyers like me. So in your testimony, I conclude what you're saying is that in order to make predictions about how much of this can be handled for the size of a release and a potential for that to contaminate, you kind of have to look at it from each tank's perspective, right, because the environment is slightly different around each tank, right? Is that correct?

A. And I will add one thing, in our analysis of the holding capacity and things like that, just as you said, we put in a correction factor, and that correction

factor applies to if there's preexisting contamination under the tank, then you would have to subtract that from what we have calculated, and that's all tank specific, so that's --

Q. That's all tank specific.

A. Yes, ma'am.

Q. Okay. So you recognize, yes, it's going to vary across the site.

A. Yeah, it will vary across the site as a function of how the geology changes, how that thickness of basalt, because you could go further uphill, you've got a thicker range of basalt above the water table, and then things like that.

Q. Okay. And again, the couple of factors that you're looking at that, one of the main ones is the holding capacity, right?

A. Yes. So that's not an attenuation process, that's just a function of the soil types, and the properties of those, and the water content, and the hydrocarbon content, so it's purely a function of the type of basalt and material beneath the tanks.

Q. But it's going to relate, right, because if the water isn't held, if this -- the process takes awhile, right, it wouldn't be table to affect it if it wasn't held in something; is that right?

A. Yeah, so the holding capacity relates to if there's release and it's migrating through the basalt, it starts retaining itself in the pore space in the basalt, and in certain types of basalts, like clinker, it's going to hold a bunch of stuff. Pahoehoe is going to hold it. A'a, massive a'a is going to hold it to a lesser degree. So we tried to figure that into our analysis and determine what a range of holding capacities were beneath the facility under different conditions.

Q. And based on the zone retention capacity calculations, what data did you have to be able to determine that?

A. So there's quite a bit of data. There's geologic data that we have as we were drilling the wells beneath the facility, so we have the barrel logs that were installed with the tanks, the geology from that. We have the borings from the wells that are installed in the tunnel. We had additional work in the surrounding area where we put together sort of a geologic model of what's beneath the facility and the surrounding area, and so there's a range of properties for each of those rock types. So we put a -- in our analysis we utilized a range of those properties, and in addition, we sent some of the cores off site to be analyzed for

petrophysical data to help us understand potential retention capacities and things like that, and we utilized literature values for that as well, and that was all integrated into the analysis that we did for the holding capacity.

Q. And was that data provided as part of these proceedings, do you know?

A. It's all provided in the reports we reference.

Q. It's provided where?

A. In the reports that we reference in the Facility Environmental Report.

Q. The actual data is?

A. Yes, ma'am. That's part of the -- the data is shown in the holding capacity analysis.

Q. Okay, I'll have to -- we'll have to go back and look at that again. It appears to me it was more of a description of it, but not the actual underlying data. But, again, we have the advantage, we get to talk again tomorrow, so we can look at that.

And how does the -- and I think you made some mention of this, but I just want to make sure I understand it, how does the retention capacity calculation account for impermeable clinker zones?

A. Ah, good question. So as we were studying the geology beneath the facility, we see different types of

basalts, right? So we have massive a'a, which is sort of like a concrete type of basalt, you know, if you look at it, and there might be some fractures in it, but it's pretty massive, so as I recall, I don't think we ascribed retention in the massive a'a.

And then there's pahoehoe basalt, which is that ropy lava, and that has a significant retention capacity. And then there's clinker, which is sort of a rubblized -- if you go like to the Big Island during a lava flow, or after a lava flow, you see all this gravelly stuff on the sides, and at the end of the flow and on top, that's called clinker, and that's really permeable, and probably has a very high retention capacity. And sometimes that clinker gets weathered over time, and so it turns -- it sort of turns in more of a clay material. Sometimes it's welded by heat when it's formed, and so we identify the areas beneath Red Hill as best we could where we had weather clinker zones and less permeable clinker zones, and that was considered in the analysis as well.

Q. So you did calculate that as some of them being impenetrable and some of them being very penetrable; is that correct?

A. Yes, ma'am.

Q. And one of the things you described was the

holding capacity as like a sponge, and you were talking about that with Mr. Riddle about you dropping oil onto the sponge, you know, would continue to hold it, right, and but if more things flow into the sponge there comes a point where it's not going to hold it any more, right? So that's what we're talking about when we're talking about the holding the capacity. Is that an accurate understanding? Do I have that right?

A. Yeah. Generally the basalt beneath the tanks, and this is -- again, we're not saying that's an approach to dealing with the releases, it's just the science of the site -- that basalt has a certain holding capacity that will basically absorb fuel, and then at some point, if there's additional releases or a very large release it will overcome that holding capacity and potentially get to groundwater.

Q. Right. And that could be affected by like if there was rainwater coming down through the surface, right? That could also help move thing through it. If there's any other fluid coming through, would that impact it?

A. Well, it probably isn't going to impact the actual hydrocarbon moving down, but if there was rainwater coming down, which I think is pretty minimal at this site because the whole top of the hill was

overlain by weathered basalt, which is a saprolite, it's like a clay cap over the top of the hill, but if there was water coming down at some point it could dissolve constituents out of that and potentially get to groundwater.

Q. And what you were just describing was part of my confusion when I'm trying to put all these pieces together that's described in your report, is you've got these sponges that can absorb everything, hold everything, but then you also have these layers that you kind of described as barriers, right, that they're there and they're stopping everything.

So I have a hard time figuring out, and how you've been able to really accurately map where the barriers are, where the sponge is, and how those relate, and again if there are -- sometimes there's the discussion of there could be lava tubes that go through them, there can be -- I mean there's a lot of different things, I think in your testimony at some point that we're going to talk about, you talk about this as being a very complex system, right?

So again, just if you can just help me to understand a little bit how we work these impenetrable and these sponges together?

A. Sure. So from a layman's perspective think of a

layer cake, right? So you've got a release coming down, and let's say it hits a massive a'a, you know, like a concrete layer, right? There's some fractures in there, but then there's these clinker bridges and stuff, too. And so it migrate or sort of spread out on top of some of these layers, and then eventually go through the fractures, go through these clinker bridges to underlying layers, and then the same process sort of repeats itself.

So it is complex, and what we tried to do was take our best understanding of the geology and these different types of geologic units that occur beneath Red Hill and integrate that geologic model into our holding capacity analysis.

Q. That makes sense. If you were able to kind of map this, is what you're -- sounds like you're describing, and make predictions about where it would be held and where it would be, you know, held up, essentially, is it kind of surprising that you couldn't find the fuel under Tank 5? Would it seem -- it appears to me if we had that kind of mapping we'd have a pretty good idea about where to go look for fuel under Tank 5.

A. Well, we think we did find it in -- you look at the NSCD study where we did those thermal profiles, there was that heat signature in RHMW2 outside of Tank 5

that is evidence of biodegradation of NAPL taking place in the unsaturated zone.

Q. But again, it has to be held for awhile, right, in order for the biodegradation to actually be working on it and breaking down the fuel. It's not a fast process, is it?

A. Well, so there's different constituents in the fuel. Some of those constituents are going to degrade quicker than others. Some of the heavy constituents in the fuel are going to take a longer time. Some of the lighter constituents are going to degrade more more quickly.

Q. But we never actually -- again, we found these indirect sense, we never actually found the fuel.

A. It's -- well, I mean the problem is when, and this is my understanding, that there were discussions with the agencies early on about not putting a lot of additional wells or any additional wells in the tunnel. So the only -- because they're worried about that creating a direct pathway if there was a large release getting into a well and going down to groundwater, so there's a limitation on the wells we can put in in the tunnel around those tanks. We don't want to impact the infrastructure and we don't want to cause a potential pathway to the basal aquifer.

Q. I remember reading that in your testimony and I think that other witnesses have talked about that, that the DOH said, and maybe the EPA as well, said don't put in wells, monitors, don't do that. But when I asked the other witnesses about this and said, you know, can you show me where those letters are, I was told that there is no written confirmation. Nobody knew about it. That's just surprising to me, because this seems a -- like everybody said we were investigating this and says that so aggressively, and yet this -- what you normally would do as standard measure is put in a bunch of wells to understand what's going on, and when the agencies are saying don't do that, but it's not in writing, there's no documentation of those conversations, as far as I understand, unless -- do you know? Can you point me to where that documentation is?

A. That was before my time. That's just my understanding based on conversations I have had with various folks. But we do have an aggressive monitoring system in place. We're replacing 1, we've got those wells, those three wells beneath the tanks, and we're continuing to install wells around the facility to help ensure we understand the extent of contamination and groundwater flow.

Q. But based on our conversation that we just had, I

was understanding, and this has been my understanding, just again my layperson's understanding from reading the information, is that if we really wanted to try to find the wells, we probably would have had to go and get more data. I mean not find the wells, we know where the wells are, find the fuel.

And again, the reason that's been given is this DOH direction, and I just -- and I haven't seen it and apparently you haven't seen it, so I guess I'll just continue to remain confused about that.

MS. RIDDLE: Objection. Counsel's mischaracterizing previous testimony that's been issued in this hearing.

MS. GANNON: No, I did ask -- I asked another witness, and I'm sorry, it's been a long day, so I'm forgetting which witness it was, but I can pull that up. I said there's another witness who testified to this statement from the DOH that they should not drill extra wells, and I was told that they did not have that communication. I think it was Whittle. So we could certainly go back and pull up the testimony, and so I do not believe it's a mischaracterization, but we could certainly look at it and read it back into the record to make sure that I'm not mischaracterizing it. That's what I heard.

Q. (By Ms. Gannon) But anyway, you can say that you don't know where that communication is, is what I just heard you say, if I'm not mischaracterizing what you said.
A. Are you talking to --
Q. I'm talking to you now, Mr. Stanley, sorry.
A. Oh, sorry. No, I don't know if that's been written down or not, that was just my understanding. But I would say at any site where you can put wells or not put wells differs. You know, it's a function of infrastructure, it's a function of terrain. Like we can't go on the steep flanks of Red Hill and put in a well, there's just no way to get to that. So we're putting wells with as much density as we can in the areas that we have access to.
Q. Yeah, I understand that, absolutely. It's just, again, just three 2-inch wells in a 13 acre field, that's just what I was wondering about for the characterization issue.

And you have testified that one of the sort of mitigation measures, I can't remember if you --
A. Can I make one more point?
Q. Oh, sure. Go ahead.
A. So in addition to those wells there's been a lot of other work to understand the geology. There are a

bunch of soil borings on top of the facility, around the facility that we've used to help develop our geologic model. We did seismic profiling, which is sort of an oil field type of a thing where you basically put an energy source into the ground, and with this it was using a sledgehammer, hit a steel plate, and that energy is reflected off or refracted off, depending on which approach you take, different geologic media, and picked up in geophones. And so we get a bunch of transects to help us understand the subsurface structure using that technology.

So the combination of all these borings, all the seismic work, all the cores we have from our monitoring wells all were integrated into developing this geologic model.

Q. But all of that effort, like when you get the soil borings and the other work that you just described, again, you never found the fuel from the 2014 spill?

A. No. No, there's no indication of fuel, like I said, in the monitoring wells. The only indication we see is in the thermal profile in RHMW2 as part of the NSCD study.

Q. I appreciate that. But you had identified as one of the, can't remember you call it a mitigate measure or an improvement, but you talk about the importance that

expanding the groundwater monitoring network is to the ongoing efforts. Can you explain to me why it's important?

A. Sure. So what the Navy's trying to do is to expand the network so that we have a higher density of wells in areas to help us better understand potential flow paths. So as we have our technical meetings with the regulators and folks, sometimes people have a difference of opinions and they think, well, it could be going this way or that way. So what we're trying to do is install monitoring wells in areas to identify if those potential flow paths are valid or not.

Q. And has any of the -- have you gotten any additional information from the new wells installed that has changed any of your initial thinking?

A. Yes, we have. Especially with the multilevel Westbay wells I was talking about, and in some of the newer monitoring wells, we're seeing a very thick saturated zone above where the basal aquifer should be in some of these wells, and not on all wells, but in some wells, and that will have significant repercussions on how hydrocarbon can migrate, because in these valleys on each side of Red Hill, they're underlain by valley fill and saprolite, and so those are relatively impermeable systems. And on tap of that you've got a

saturate -- in some areas you've got a saturated thickness above that, and that water saturation on top of the low permeability of that stuff is going to act to limit how, if there was a massive release, say, it's going to have to limit how actual fuel hydrocarbon can migrate. Think of a bowling alley, if you ever go bowling, with bumpers in the gutter.

Q. I'm from Michigan, of course I do.

A. Yeah. So these valleys on each side of Red Hill with the saprolite and the valley fill are -- it's sort of like your bumper guards in the gutters, right? So it's going to channel -- it's not going to let the hydrocarbon continue to go, it's going to confine that. But the dissolve phase flow of groundwater is somewhat different than that, and that's what the multilevel wells are helping us understand.

Q. Again, that's going to be -- having that data is pretty important being able to understand it so that these additional monitoring wells you're anticipating may significantly impact your understanding of the area; is that correct?

A. It will help improve our understanding of the area.

HEARING OFFICER CHANG: Is this a good place to break, Ms. Gannon?

MS. GANNON: Sure, this is a fine place to break, yes.

HEARING OFFICER CHANG: Okay. Why don't we end the testimony. I'd like to spend a few minutes with counsels to talk about the schedule. So --

MR. FRANKEL: Can we talk about a couple things while we're still on the record? I know that we want to let Donna go, but I have two items about the schedule.

Ms. Gannon talked about the modeling report, and Mr. Stanley was going to look at it overnight. Good bedtime reading. But can we know what exhibit number that is? The Hearing Officer might want to look at it, others might want to look at it. Can we get a reference so we know. And I didn't catch the exact title of the report, so that might help.

MS. GANNON: Sorry. It's B-352.

MR. FRANKEL: Okay. And the second issue, which is not related to Mr. Stanley's testimony, but I kind of -- I'd like clarification, I know Hearing Officer Chang you want to kind of have a conversation with us and a mutual understanding of these confusing issues, and you've said twice now something that I've gone back to look at the documents and I don't see it, and so I'm very confused about it. You've talked about

a 30-year gap in incidents, and I'm trying to find out what document that is. I don't see that anywhere, and I want to be able to respond to that at some point.

HEARING OFFICER CHANG: Actually good question, because I was trying to think of where I saw it. Maybe counsels will know. I'm going to call it a bubble chart. It's a time flow chart and it shows incidents of releases with a circle, the bigger circle indicating the larger releases, and so that's what I'm thinking about, and I can't tell you where I saw that yet at this point.

MR. FRANKEL: Okay.

MS. GANNON: I think that that is part of Dr. DeNovio's testimony, and so we can pull that up when she is testifying and we can talk about it at this point, if that makes sense, because it's part of her direct testimony.

HEARING OFFICER CHANG: Okay, that will help.

MR. FRANKEL: Okay, good. I think that's it. The other thing is just procedural off the record, so that's fine.

MS. RIDDLE: While we're on the subject of exhibits, I just wanted to clarify the model report that is Exhibit B-352 is the Conceptual Site Model Report, but the Groundwater Flow Model Report is Exhibit B-361,

and that the Facility Environmental Report that's been discussed is appended to Mr. Stanley's direct testimony. I know we've discussed some other exhibits, but those are the three named reports that have come up so far.

HEARING OFFICER CHANG: That's helpful. Thank you.

Okay. Mr. Stanley, thank you very. It's 10 o'clock your time. Appreciate your gumption to stick with us that long.

(Whereupon, at 6:05 p.m. the hearing was recessed until 8:00 a.m. on Thursday, February 4, 2021.)

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C E R T I F I C A T E

I, DONNA N. BABA, a Certified Shorthand Reporter in the State of Hawaii, do hereby certify:

That I was acting as shorthand reporter in the foregoing matter on Wednesday, February 3, 2021.

That the foregoing proceedings were taken down in machine shorthand by me at the time and place stated herein, and were thereafter reduced to print under my supervision;

That the foregoing represents, to the best of my ability, a correct transcript of the proceedings had in the foregoing matter.

I further certify that I am not counsel for any of the parties hereto, nor in any way interested in the outcome of the cause named in the caption.

Dated: Honolulu, Hawaii, February 28, 2021.

*/s/ Donna N. Baba*

DONNA N. BABA, CSR #103