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PUBLIC MEETING

OPERABLE UNIT
NO. 2
PROPOSED PLAN
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

August 24, 1993
7:00 P.M.
TARAWA TERRACE I ELEMENTARY SCHOOL
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

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ORIGINAL

NEAL PAUL: I'd like to get everyone's attention to go ahead and begin the Public Meeting. I'd like to welcome everyone for the Public Meeting for Operable Unit Number 2 for Sites 6, 9 and 82. My name is Neal Paul and I'm the Installation Restoration Division Director for Camp Lejeune. Our program at Camp Lejeune is managed by what's called the remedial project managers. It's myself, Ms. Linda Berry from the Atlantic Division of the Naval Facilities Engineering Command in Norfolk, Virginia; Mr. Ray Wattras who is with Baker Environmental Corporation, he's our consultant; Mr. Patrick Waters with the State of North Carolina; as well as Ms. Gina Davis who is the RPM at EPA, Region IV.

Tonight is an opportunity for us, our program manager to actually discuss with you our Proposed Plan to clean up this Operable Unit Number 2. The public comment period will run from today to September 24, 1993. There are two information repositories, one being in the Marine Corps Base Library and one at Onslow County Library.

Now we have heard that our Administrative Records which holds all files and documents for our program are not in the best of order, so we've been made aware of that and we're going to work to, I guess, number one, get an index for you, and number two, maybe put them together, consolidate them and maybe take some stuff that shouldn't be

in there out of there and put some stuff that should be in. And in the coming months we'll be working to do that and if anyone here needs any of our filing reports that aren't in any Administrative Record, contact me--and I think my number is on the back of the Fact Sheet that you picked up when you came in--and we can get you a copy of the file.

AUDIENCE MEMBER: Cameron Lanier also said that you can contact him at the Public Health Department and he has the sanitized version and they have a conference room available but you must talk to the secretary so she can pencil you in.

NEAL PAUL: Okay. Cameron is a member of our TRC that you guys attended this afternoon.

Mr. Ray Wattras is going to get into the details of the Remedial Investigation and Feasibility Study as well as the Alternatives that we looked at to clean up the groundwater as well as six different Areas of Concern associated with soil. So if no one has any questions at this time, I'd like to introduce Mr. Ray Wattras and if you have any questions any time during his presentation, please feel free to raise your hand, state your name and ask the question.

RAY WATTRAS: Thank you, Neal. Okay. The purpose of this Public Meeting is to discuss the Proposed Remedial Action that the Department of Defense had us undertake and

what we refer to as Operable Unit Number 2. Operable Unit Number 2 consists of Sites 6, 9 and 82. The Operable Unit itself as I mentioned consists of those three sites. I'm going to first give you a little description of where these sites are located within Marine Corps Base, Camp Lejeune.

(RAY WATTRAS USES OVERHEAD THROUGHOUT PRESENTATION)

If you can, this is Route 24, this is the main boulevard, Holcomb Boulevard which goes through the mainside portion of the base. Operable Unit Number 2 is located right to the left hand side or to the east of Holcomb Boulevard near Wallace Creek. Site 6 is referred to Storage Lots 201 and 203. Site 9 is referred to as a Fire Fighting Training Area at Piney Green Road. And Site 82 is known as the Piney Green Road VOC Area. VOC is an acronym that stands for Volatile Organic Compound.

As I mentioned, the Operable Unit--and I'm going to hold this up so everybody can see it--it's located between Holcomb Boulevard and Piney Green Road. This is Site 6 right up in this area--what I'm outlining--and as I mentioned before it consists of Storage Lot 201 and Storage Lot 203. Site 82 is located to the north. It's bound to the north by Wallace Creek. Site 9, the Fire Training Pit is located in the southern portion of the Operable Unit, a very small site.

As I mentioned, Wallace Creek forms the northern border. We also have another body of water known as Bear Head Creek which cuts through a wooded portion of Site 6. Eventually Bear Head Creek joins with Wallace Creek before they discharge into the New River.

Now Storage Lot 201 is currently an active storage lot. There are military personnel as well as civilian personnel who work there and it's currently used for storage of military supplies, nonhazardous things such as lumber, vehicles, compressed gasses. These are typical gasses that are used for welding and things like that.

At one time PCB transformers and pesticides were reportedly stored at Lot 201. That's how Lot 201 became involved in the program. In general, Lot 201 covers a total area of 26 acres and access is restricted by a fence around a lot.

I'll just show you a couple of slides which give you an idea of what the storage lot looks like. That's a portion of Storage Lot 201. Right there, there's nothing, that's one area that we sampled. I believe it's the area where the pesticides were reportedly stored at one time. This is a typical scene of the storage lot. As I mentioned before, there is the compressed gas cylinders. In the background you might be able to depict a little bit of lumber but it's mainly nonhazardous supplies which are

stored there for military use. Let's just stop right there.

Storage Lot 203 is inactive. It's no longer used for storage of materials. Up until about 1989 it was previously used to store military supplies and there's a documentation that it was once used as a disposal area. This is Storage Lot 203. It is restricted access, it's restricted with a chain length fence. Wastes that were allegedly disposed of within the lot include pesticides, PCB transformer fluids, paints and solvents. We reviewed historical photographs dating back into the late 1940s. In the historical photographs you can see a number of trenches that were excavated in the lot.

The wooded areas are also part of Site 6. The wooded areas exist between the storage lots and to the east of the storage lots as well as south of Storage Lot 201.

The wooded areas in this area just north of Lot 203 as well as the area just south of Lot 203 did exhibit signs of disposal. If you walk across that area right now the ground surface is not flat. It's mounded and in fact in one area being just north of Lot 203 you can see fragments of drums coming up from the ground.

We also have a ravine which plays an importance here. The ravine is located in the northern part of Lot 203. It's very steep in this area. If you would walk down the ravine toward Wallace Creek it flattens out. Now, up

here at the steep portion, if you look over the side of the ravine, it's filled with miscellaneous debris as well as containers including some 55 gallon drums.

It appears that at one time, because you can get to this area with a vehicle, the vehicles appear to have backed up to this area and probably disposed of the contents right over the banks of this ravine. And I'm going to show you just a slide here depicting some of the drums. This is a figure here showing some of the sampling personnel taking a sample from the drum. It's very difficult to tell, but up here is the side of the ravine. You can see up in this area there are 55 gallon drums just laying on their side. A lot of the drums that we encountered we feel because of their age are empty. This one, of course, we are taking a sample from. But in many cases the drums are old and rusted. It's unknown whether there were ever any contents in them or the contents could have released from the drum after rusting.

This is another picture of a ravine. You cannot tell very well but what that fellow is pointing out are some battery packs that we've also found in the ravine. The battery packs were used in communication devices by the military. The actual number of battery packs is really hard to determine because the problem is you have a lot of debris in the ravine. Some of this debris I mentioned it's mainly construction debris. There are all sorts of things in there

such as lockers, wood, commodes, basically things that are related to some sort of demolition of a building.

To get a better count of battery packs and so forth, you have to physically take all the debris out first. But we do know that in some areas of the ravine, mainly toward the top, there are some of these battery packs that are located there.

This is just a figure of Wallace Creek, I believe that was taken from the bridge at Holcomb Boulevard looking upstream. This area, the width of that stream is roughly 60 feet. This is just another figure. We were doing some fish sampling and we'll get into that a little bit later. It's just a picture of I believe those are called gill nets.

That's a picture of a gar that they collected, ended up sampling that fish.

Site 9. Site 9 is used for fire training activities. It's still used today. Back in the 1960s it was constructed. In 1981 they actually lined the pit with asphalt. Right now there is an oil water separator that collects all of the product from the water that's left over in the pit. Within Site 9 there are some above ground storage tanks which contain jet fuel. The jet fuel is used to ignite the fires and keep the fires going as the fire fighters train to put out these fires.

It's been reported over time that as much as

30,000 to 40,000 gallons of jet fuels have been used at this pit in training. Just a note, Site 9 is located in the southern part of the Operable Unit; Bear Head Creek is located just north of this site. There is not a fence around this site. As I mentioned before, it's still an active fire training area; so therefore, access is unrestricted.

Let me just show a couple figures. This is a picture of the fire training pit, just another angle of the same pit. What you see there in the background is the oil water separator. Right in front of that pit is a monitoring well that is installed to test the groundwater quality. Those are some of the above ground storage tanks that I referred to as containing jet fuel. The samples were taken around these areas just to let you know, soil samples as well as groundwater samples.

The last site is Site 82, it's located in the northern part of the Operable Unit. It's basically right up against Wallace Creek. The site covers approximately 30 acres. The southeast portion of the site shows signs of land disturbance. This is the area that I mentioned before, that if you walked around this area you would see that the ground surface has some mounding and there's some drum fragments which are present on the surface. The situation with Site 82 is where there's really no documentation by

memorandum stating that any disposal ever occurred in this area. What we do know that by looking at historical photographs, we did note that the ground surface in this area was grated over at one time. It appeared to have been grated over. So we know something happened up in this area at one time.

Just let me show you the last slide we have and it just shows you, this is Site 82. This is the site that there is really nothing to note other than it's very heavily vegetated and overgrown. That's just a stake depicting one of the areas where we took some soil samples.

Now, just a brief discussion of the site geology. The soils from the ground surface to about 90 feet below consist predominantly of silty sands with minor amounts of clay. The soils below 90 feet consist of silty sands with interbedded sandy marly limestone of a formation of roughly 5 to 35 feet thick. There's a clay formation at a depth of approximately 230 feet to 252 feet. This clay formation is approximately 10 feet thick in most sections. The clay formation is the bottom portion of the main aquifer.

I'll talk a little bit about the groundwater. There are two aquifers underneath the Operable Unit and underneath most of the base. We have a surficial aquifer, you have a Castle Hayne aquifer. The Castle Hayne aquifer is the aquifer that's used by the base to obtain water for

potable supply. The surficial aquifer is not used by the base because the problem you have with the surficial aquifer, you can't pump at a high rate. After about 5 gallons per minute, you can't obtain anything more than that.

Now, groundwater flow across the site basically follows the drainage pathways. At Site 82 and Lot 203, groundwater flows towards Wallace Creek. Towards the southern part of the site, near Site 9 and Lot 201, shallow groundwater flow mainly toward Bear Head Creek. So in one sense you have up in this portion, you have groundwater which flows in this direction; down in this area you've got groundwater flows in this direction. What you have going across here is a groundwater divide between Lot 201 and Lot 203. In other words, somewhere in this area groundwater, it gradually starts changing direction. This is important to know from the standpoint that if we have a problem with groundwater, we need to know which direction it's moving so that we know where to place any type of containment wells or extraction wells. So we have to understand the geologic and the hydrogeologic characteristics at the Operable Unit.

Deep groundwater flow is very similar to the shallow groundwater flow. Deep groundwater flow flows mainly in a northwest direction at Site 82, but down here Site 9 flows primarily in a southwest direction.

Now, let me talk to you about the Remedial Investigation and that entire process. Remedial Investigation involves collecting samples from the soil, groundwater, surface water bodies. The purpose is to determine: Are there contaminants there, what type of contaminants are there, what level--concentration level--are present and all that data is used to perform a unified Risk Assessment and an Ecological Risk Assessment.

We started the Remedial Investigation August of 1992 and it was completed in April of 1993. We conducted soil investigations. The soil investigations focused on various areas where we knew through records the things were stored or we have some information saying some things may have been disposed of in certain areas. We did soil investigations, for example, at Site 9.

We took samples by the above ground storage tanks. We took samples near the fire training pit at Lot 201. For example, we took soil samples in three different areas. Areas A on this figure represent areas where pesticides were reportedly stored at one time. Area B is an area where transformers filled with PCB fluids were stored. What we did, we set up a sampling grid. I believe in each area at least 25 to 30 locations were identified and soil samples were taken or collected down to the top of the water table and analyzed for organic constituents as well as inorganic

constituents.

We also performed a Groundwater Investigation. The Groundwater Investigation was quite extensive. We established, I believe, 12 deep monitoring wells in as many as 30 shallow wells. The wells are as far north as, just north of Wallace Creek we have the deep well. We have another deep well which isn't shown on this map near Site 9. Most of the deep wells that we have installed are at Site 82 and there's a reason for that which I'll get into a little bit later.

The shallow wells are also located throughout this Operable Unit. Some of the shallow wells we put what we called upgrading of the site. This is suppose to give us an idea of what's the background conditions. Upgrading would be defined as, as I mentioned before, groundwater flows in this direction, so we purposely have wells upgrading of the site which should tell basically what background well water quality is like.

We also did a Test Pit Investigation. I mentioned before that in the historical photographs we noted a number of trenches at Lot 203. What we did, we subcontracted a surveyor. That surveyor took the historical photographs. He went out in the field, actually plotted the location of these trenches and we excavated a ditch perpendicular to where these trenches were located. That's called a Test Pit

Investigation. The purpose is to find out if no more trenches there, what was in the trench.

In this case all but two trenches contained what I would call military debris: A lot of communication wire, a lot of casings, rocket casings, some battery packs, basic bivouac debris from camping and military activities. However, two areas did show signs of waste disposal. One area, one of the trenches that we excavated down in the wooded area right here, we uncovered at least 100 small canisters, 5 gallon buckets. Also, we noted that when we were excavating there, there was a solvent like odor that is coming up from those buckets.

Another area just north of Lot 203 where I mentioned that you could see some drum fragments, we uncovered a number of 55 gallon drums. Samples taken from those drums were sent to a laboratory and analyzed and the results were that they contained heating fuel. This is referred to as Number 6 heating oil. Number 6 heating oil is very thick and it's used for heating.

In addition to the Test Pit Investigation, we studied the surface water bodies. We collected samples of surface water and sediment from Wallace Creek and Bear Head Creek. We took samples from the head waters of each creek to give us an idea of what is referred to as background water fall with background sediment quality.

Finally, we performed an Aquatic Survey. Aquatic Survey involved collection of fish, analyzed them, sent the fish to a laboratory, the fish is analyzed for organics and metals. We also performed what's known as a Benthic Study. That's the little organisms that live in the sediment which the fish eat. The purpose of the Benthic Study is to determine whether there's any stress to the aquatic community. There are ways to define that which Tom Biksey will get into a little bit later.

AUDIENCE MEMBER: There was a reference that sludge was found. Is that referring to that at 82?

RAY WATTRAS: Yes. Let me get straight for the record. We refer to that as sludge, but I'm not sure what you were reading. Can you be more specific?

AUDIENCE MEMBER: It was in your volume.

RAY WATTRAS: Okay. In that case we do refer to the sludge like material from that area, yes. See, when we uncovered the drums up at the Site 82 area, a lot of times the drums are corroded and you don't expect to find drums in a perfectly normal condition because over a time rust and things leak out. So what you have surrounding these drums are soils which are discolored and we refer to them as sludges.

Let me go over the findings of the Soil Investigation. As I mentioned before, we did an extensive

soil sample program and we collected over 1000 soil samples throughout this 210 acre area. We really went through the area. We went to areas we knew we had problems and areas we didn't have much information on, we set up a sampling grid which gives a random sampling of the area.

What we found were six, what we call Areas of Concern. Let me describe them to you. Area of Concern Number 1 is located at Site 82, in the eastern portion of Site 82. So samples collected from this area had elevated levels of volatile organic compound primarily trichloroethene and 1-2 dichloroethene. Now, those compounds are related to solvents. So it appears that at one time solvents were disposed of in this area. This area is also believed to be the source of a groundwater problem that I'll get into a little bit later. But this is Area of Concern Number 1.

Area of Concern Number 2 is located in the steep portion of the ravine. What we found there were PCBs, what's known as polynuclear aromatic hydrocarbons and pesticides in the soil. As you walk down the ravine towards Wallace Creek, you didn't see that contamination. Most of the contamination was in the steep portion of the ravine where I mentioned before that you could tell the dumping occurred and you have all the construction debris as well as some 55 gallon drums along the bank or the sides of the

ravine.

Area of Concern Number 3 is located within Lot 203. We had elevated levels of PCBs and PAH contaminants in the soil.

AUDIENCE MEMBER: Would you define that, please?

RAY WATTRAS: Okay. In this case PCBs we refer to as elevated when we find at least one part per million. In this case we had 41 parts per million up in this area. PAHs. We found roughly in the range of 10,000 parts per billion of PAHs. You can find PAHs in a lot of places. They occur along highways and we've seen it throughout in various locations within the Operable Unit. But when we see levels like 10 parts per billion of PAH compound, that doesn't really throw up any red flags. In this area when we had levels 5,000 to 10,000 parts per billion or higher--and again, I don't have the exact numbers in front of me--that's an area to throw up the red flag. We know that's not normal. We know that has to be associated with some sort of disposal.

AUDIENCE MEMBER: Was vinyl chloride in there?

RAY WATTRAS: Not in this area, no. In fact, vinyl chloride, because it's so volatile, we only found it in the groundwater. It's very rare to find vinyl chloride in the soil because it is so volatile that as far as we know and to the best of our knowledge it's basically left the

soil matrix either through evaporation or combination of leeching through the soil matrix and groundwater.

Area of Concern Number 4 is located also on Lot 203. It had the same constituents as Area of Concern Number 3, mainly elevated levels of PCB and I believe in this area we had levels of around 26 parts per million and elevated levels of PAH.

Area of Concern Number 5 is located at Storage Lot 201. The actual depiction of this area on this figure here is a little bit misleading. The two locations that we detected elevated levels of pesticides are located right in the corner of the fence and what may have happened is that any left over pesticides in the canisters that were not used when they applied them around the base may have been disposed of in this corner because in this corner we had levels of pesticides, I believe in the range of about 100,000 parts per billion. So we knew we had a spill area or a disposal area.

The last Area of Concern is Area of Concern Number 6 located in the wooded area right next to Piney Green Road. In this area we had elevated levels of PCBs again.

Now, I'm just going to real quick since it's up on the screen, I'm going to mention the buried drums that were part of the Soil Investigation, that being down here in the wooded area as well as up here at Site 82 area. Now these

drums are being addressed right now by the Department of the Navy and the Marine Corps. Baker Environmental just completed putting together the specifications which will then go out to a remediation contractor and the plans are to remove those drums and any discolored soil surrounding the drums in the early fiscal year '94.

AUDIENCE MEMBER: You have in there a statement that I wish I had it, threatened releases are said to exist in the drums. Do I understand you are not going to disturb the drums to make it worse, but if they are taking the drums out, where will the threatened releases come from?

RAY WATTRAS: I'm not sure where you read that report, but what I would guess you mean when you say threatened release--

AUDIENCE MEMBER: Threatened releases.

RAY WATTRAS: We could be referring to the possibility of contaminants from the drum releasing to the environment. That's what I believe we would mean, but without seeing which part of the report you're talking about, because as I remember that report is pretty large. My guess is that what we're discussing in that part of the report would be future releases or ongoing releases from those drums. That's why the Department of the Navy wants to do something with those drums now. And that's why it's referred to as a Time Critical Removal Action because those

drums basically are a threat to the environment. They're a threat to the groundwater. They're not really a threat to humans but mainly it's a threat to the natural resources.

AUDIENCE MEMBER: What will they do with those drums once they remove them from this area?

RAY WATTRAS: Probably what they're going to do is take samples from them. If they're hazardous, they are likely to take them to an off-site incinerator. If you take the samples from them and they are nonhazardous, they could still take them to an incinerator or they could take it to a permanent landfill, it would have to be a landfill that can accept those types of waste. But they would be taken off-site and disposed of in accordance with all regulations.

Let's talk about the groundwater a little bit. The problem we have with the groundwater is that we have shallow and deep groundwater contamination. Now, this figure here--I'll try to move it up here--this hash mark that's in green shows the extent of shallow groundwater contamination. The other hash mark--and you can feel free to get up and look at this now or later on--shows the extent of deep groundwater contamination. This is a pretty big area. This figure, it looks like it's pretty close to each other, but one inch equals 500 feet. We're looking at a pretty big problem with respect to the groundwater.

The highest levels of VOCs or volatiles, and these were solvent constituents, were found in the eastern portion of Site 82 up in this area. These wells, and if you can't make out from where you're sitting, these little marks here depict monitoring wells. The highest levels were found in this portion of Site 82. It corresponds, if you recall, on the previous drawing with Area of Concern Number 1 where I mentioned you also have these same constituents in the soil. So we do know the soil contamination, the contaminants have migrated to the groundwater. Not only have they migrated to the shallow groundwater, but they've migrated to the deeper aquifer. This supply well right here, that's been shut down for a number of years. It's contaminated.

The shallow well water is causing a problem for Wallace Creek. Wallace Creek has detections of things like TCE and vinyl chloride in this stretch right here. In fact, I believe even one or two of the downgrading sampling stations showed some levels of TCE. But the cause of that TCE in the stream is from the groundwater which discharges into the stream.

What you also have here, I'll explain it a little in more detail, you have a lot of groundwater that enters this stream. The width of this stream by Piney Green Road is about 30 feet wide. The width of this creek by Holcomb Boulevard is approximately 60 feet wide. Then you have one

small intermittent tributary which is dry part of the year. Where all this water comes from for it to go from a 30 foot wide stream to a 60 foot wide stream is from groundwater. This is known as a gaining stream. A gaining stream is one which increases in volume because of groundwater and that's why you have the presence of these volatiles in the creek.

Now, deep groundwater contamination, as I mentioned before, the hottest area is up here. We have levels as high as 75 parts per million total volatiles up in this part. As you move away from the source area, for example, up here just north of Wallace Creek I believe there's less than 10 parts per billion. So you can see the big difference. You have 75 parts per million up here which is a pretty high number. You have less than 10 parts per billion down gradient of the source. So luckily, most of the contamination is confined to the Site 82 area and what has migrated away from the source area right now contains very low levels of volatiles.

The last item that I just want to bring out is that deep groundwater--I mentioned shallow groundwater is causing the problem to Wallace Creek. There is some information that we have that says that deep groundwater flow moves upward in some direction and is also adding to the contamination to Wallace Creek.

AUDIENCE MEMBER: Would you explain how the deep

groundwater can move upward? I've got it coming down. I saw in the--

RAY WATTRAS: Okay. I'm not any hydrogeologist, so bear with me. It has to do, as I can understand it, I'll show this to everybody here, this is a simple schematic of what happens when you have a spill and it enters groundwater. You have a spill on the surface. Somebody dumps drums or whatever or releases a spill. You have a portion of the ground surface below you which is referred to as the unsaturated ground, no water there, just soil. And this area you have anywhere from--it depends on where you're at, but a site in most cases you have about 5 to 8 feet of soil below you before you actually hit the water table. Anyway, you have a release of contaminants. Once it hits the water table, groundwater moves. Okay. It usually goes towards the streams or rivers. In this case, this example, groundwater is moving say left to right. Once those contaminants hit the groundwater, they start to dissolve within the groundwater, especially things like TCE, very water soluble. Therefore you'll have a plume that's migrating.

Now, the best I can do, you have a lateral flow and at some point you're going to have pressure from beneath you, you're going to have some flow upgraded and that's a recharging of the stream, the rivers for example. If you

can imagine a river over in this area, you have groundwater flow. The groundwater has to come up at some point. It comes up in your streams and your rivers.

AUDIENCE MEMBER: There it is definitely upward?

RAY WATTRAS: Yes, groundwater just doesn't keep going down and down. It flows laterally and recharges or discharges into streams and rivers. And again, because I'm not a hydrogeologist, I'm sorry that I can't explain the physics of all of that happening, it's a matter of pressure and things like that.

Okay, next overhead.

(AUDIENCE MEMBER ASKS QUESTION. VERY DIFFICULT HEARING IN GYMNATORIUM)

RAY WATTRAS: Our best guess is that it's the shallow aquifer. But most of the shallow aquifer is going to discharge in the creek. Some of the deep aquifers are going to discharge into the creek. Some of the deep aquifers are going to go under the creek. So it depends which portion of the aquifer.

AUDIENCE MEMBER: If there's a sizable pump out from the deep aquifer, let's say for a golf course which is millions of gallons, would that suck the contaminants down into the deep aquifer?

RAY WATTRAS: That could happen. It depends on the geology. In this case, for example, if you had-- Let

me give you an example, but that's correct. If you had a shallow groundwater problem and it was a recent spill--maybe a year, maybe six months--and the contamination is just in the shallow and you had an operating supply well, yes, over time that supply well has what's known as a cone of influence. It's going to draw those contaminants toward that well. So yes, that could happen. Now, as I say, at this site that could happen. If you had a confining layer between the shallow flow system and your deep flow system--when I say confining layer, in this area will be a bed of clay--and if that clay was continuous and it wasn't discontinued, chances are that supply well can keep operating, there's no connection between that shallow. Now we've run tests, we could run tests where we could start a pump in a deep well and if we see our water levels start to change in our shallow wells we know there's a connection. At this site there's a connection. And the example you gave me about a golf course, I have no idea where you're talking about. If there's a clay layer, if you did have surficial contamination, the pumping of the deep well might not necessarily create a problem.

So your question relates to here because that's, you know, that could happen here. That's why the supply wells around this area have been shut down. Obviously you don't want to have contaminated water going through the

public system, that would cause a worse problem by keeping the supply wells in the nearby area operating.

AUDIENCE MEMBER: What kind in effect does the limestone layer have on filtering, any at all?

RAY WATTRAS: Filtering with respect to cleaning the groundwater?

AUDIENCE MEMBER: Yes.

RAY WATTRAS: I don't believe it would have any. Maybe from the standpoint of, it wouldn't remove organics. Probably very little to none.

AUDIENCE MEMBER: This is not in relation to this site, but I'm thinking of others you're doing, are you getting good soil profile samples off base?

RAY WATTRAS: From a contaminant standpoint?

AUDIENCE MEMBER: Well, just general.

RAY WATTRAS: You say soil profile? Yes, we know this area down and through the clay layer.

AUDIENCE MEMBER: Not just this one but all the sites.

RAY WATTRAS: All the sites that we study, when we drill a boring, we put together what we call a boring log. It's used independent to report and describe the soil conditions. That's important from the standpoint of just like the example I gave to you, if there's a confining layer or no confining layer, that's going to tell us how

contaminants might migrate.

AUDIENCE MEMBER: My real question is: Are you putting that together--

RAY WATTRAS: In a cross section?

AUDIENCE MEMBER: Yes, in a cross section so the (inaudible).

RAY WATTRAS: Well, we don't have a cross section that goes from one base to the other. That would create a lot of data. What we look at when we look at an Operable Unit, we will have a cross section that goes from one end of that Operable Unit past it to some degree to the other end. But there is no cross section--

Let me take that back. For example, USGS reports, USGS they do regional reports. They'll have a cross section of the geology that will cover several miles. But again, because your wells are safe pretty far apart, it's a very generalized process. But nevertheless, yes, there are cross sections out there that you have in the USGS reports.

AUDIENCE MEMBER: You're refining then?

RAY WATTRAS: Exactly. We're taking a certain area of that process. Are there any other questions on the groundwater before I move on to the surface water findings?

AUDIENCE MEMBER: Those wells were shut down in 1981?

NEAL PAUL: 1984 I want to say.

AUDIENCE MEMBER: '84? As I understand it there's a very long lag time in terms of human health ill effects for the liver and in particular some of the liver cancers. Have they any way of tracking the population that was exposed to that?

NEAL PAUL: ATSTR is a federal agency that's separate from EPA and they're in the process of putting together drafts on public health assessment. They have actually researched housing records of the people who lived there, how long they lived there, how long they drink from the wells that were supplied to their homes, and we are going to get the first draft I think in December. They will hold a public meeting similar to this and explain their findings. That's probably December or I would guess January.

RAY WATTRAS: Any other questions on the groundwater? Okay. We'll move on to the surface water. Again, going over the Wallace Creek situation, as I mentioned before we have low levels of volatile organic compounds in the creek of which the source of those compounds are believed to be groundwater discharge. We also have some elevated levels of metals in Wallace Creek. These levels exceed North Carolina water quality standards as well as EPA Region IV standards.

Now, the thing with the metals, there is no

consistent pattern. For example, there's a pattern with the TCE. We see that the TCE contamination starts in Wallace Creek up in this area and continues on down. The problem with the metals is that they're infrequently detected and in fact some of the upgrading stations show slightly elevated levels of these metals. So it's very hard to draw a conclusion on why we have elevated metals in this stream. It could be due to the groundwater, could be naturally high. There are a lot of times, for example, things like copper and zinc might be naturally high in the groundwater or in surface waters.

The sediment quality, now this showed a pattern, we found that the sediments just down from the ravine area were contaminated with the PCBs, the pesticides, and the PAH compounds. We believe that sediment contamination to be a problem related to surface run off from the ravine area. As it rains or as you have periodic flow of the ravine, those contaminants from the ravine will eventually migrate, and it appears that contaminants have migrated into Wallace Creek from the ravine.

AUDIENCE MEMBER: Again, do you have an index from the soil and the sediments that will exhibit or are typical to compare the elevated figures?

RAY WATTRAS: We have the background, when we say background, the pit water results are in there. We

collected sediment and surface water samples from the head waters of each stream. I believe they would be considered, the sample number for example for Wallace Creek would be labeled WC 1. And as we went downstream, we labeled it 2, 3, 4, and 5. So that result from WC 1 represents the head water which is the most pristine area. The same thing with Bear Head Creek. You look in the report under the code BH for Bear Head, BH 1, these are the samples taken at the head water.

Now, with respect to literature values, there are background literature values for soil which are regional. Sometimes they're talking about eastern United States soil. There's a range of zinc you would expect to find in eastern United States' soils. You have a pretty broad range when it comes to east and west, a range that is very broad. What we try to do is collect what we call background soil samples. We'll go to an area that we have no reason to believe that there are any disposal activities and we'll take some samples of that area to get the background concentration.

Now, with respect to sediments, we don't have any, the background concentration that we use for surface water area sediments would be the upstream samples. As we do more and more work at Camp Lejeune we, back at Baker, are compiling information to give us an idea of what is-- The metals are found in the environment. Just because you have

metals doesn't mean you have a problem. Obviously the human body has metals in them also and minerals and so forth. But we're doing that back at our office trying to compile a list of background, typical background concentrations of things like surface water, sediments and surface soil.

AUDIENCE MEMBER: When would that be made available?

RAY WATTRAS: What we'll probably do in the next report is state what the background value is that we generated to date. We're not planning to put it out in a separate report and say call it background soil concentrations. I'm sure there would be no problem if you desired that information to make it public.

AUDIENCE MEMBER: I just was curious so that others might have access to it.

NEAL PAUL: In reference to your question, we're going to do a comparable water sampling and we have additional sampling plans to further investigate Wallace Creek. And then we are going to take a similar type tributary off of the White Oak River to have a comparison of complete bodies of water.

RAY WATTRAS: People at our firm, we submit papers to journals and that's the way the scientific and the engineering community shares with the transfer of information. A lot of information that we get that might

discuss what is the average level of mercury in fish, it's either published data from the Food and Drug Administration or studies done in other areas.

AUDIENCE MEMBER: Has the PH in the rain water changed in this part of the country? For example, acid rain leeches heavy metals out of natural soil.

RAY WATTRAS: To be quite honest with you, because I don't reside in North Carolina, I don't know a whole lot about acid rains. I'm from the Pennsylvania area where we have an acid rain problems in our streams and rivers. I don't know whether you have that problem in this area or not. I don't know the answer to that question.

AUDIENCE MEMBER: But it changes the amount of this stuff?

RAY WATTRAS: Of course, it makes sense. If you have more acidic rainfall, that will cause--is that right, Tom--that would cause metals and other things to leech at a quicker rate? Yes, but I don't know whether this part of the country has an acid rain problem. Tom may be more familiar with that.

TOM BIKSEY: It has natural acid conditions because that's where you get your sort of black water and a lot of organic buildup. So you have more of an acid condition based on just the nature of all the decomposition that occurs of the use of tannic acid and things like that.

So there is that natural acid just because of the vegetation, but I'm not aware of any of what's the trend of acid rain in this area.

AUDIENCE MEMBER: Maybe this is the time, and I don't see my fishermen friends here, but they report that they having been pulling in the nets sometimes and pull in military batteries out of the New River.

RAY WATTRAS: I have no knowledge of that. I can tell you we found the batteries in the ravine and there must be a lot of them. I have no knowledge of that.

Okay. Go ahead to the next slide. I'm going to turn this part over to Tom Biksey who is a marine biologist who conducted our Ecological Survey for the Ecological Risk Assessment. He could briefly go over the findings of the aquatic survey and fish sampling.

TOM BIKSEY: As Ray mentioned, part of the Aquatic Study was to go out and actually catch fish and crabs and the different types of worms and insects that live in the mud to see what was there. One of the findings that we have is that there were low levels of PCBs, pesticides and TCE, a solvent, that was found in the tissues of the crabs and fish that we sampled from both Wallace Creek and Bear Head Creek.

The Food and Drug Administration has established allowable doses or allowable levels that you can have in tissues that they deem as action levels that if you do not

exceed these levels there will be no potential for adverse health effects. In this case the PCBs, pesticides, there was no exceedents of the FDA criteria. The TCE does not have an FDA criteria.

I'll skip down to the third one first. The fish population that we looked at, not only did we do the tissue analysis, but we looked at a number of fish and looked at what type fish they were; did they have any lesions or anything like a fungus growth or a bacteria on them that would indicate that they were under some type of stressor condition; how many different types of species were there. The more species you have, generally the better health of the community of the fish you have.

And by looking at the fish population and diversity, diversity being the number of species that were present, it indicated that the fish and the insects and the worms that live in the mud appear to be healthy for estuarine or estuary conditions.

As I said, there were no lesions or abnormalities noted on the fish. Because of the levels of PCBs, pesticides, and volatiles that we found in the fish, EPA has established guidance in terms of how you tell whether you need a fish advisory or how do you tell if this is a potential risk to adults or children eating the fish. We go out and we do a limited number of sampling, basically a

Phase I sampling, and if you do detect some elevated levels of these contaminants, then they say that it would be in the best interest and would warrant doing a Phase II investigation where you take more samples and you take them from different areas to find out how widespread is that contamination in all the fish.

So what we're going to do in September is take additional fish samples and crab samples both from Bear Head Creek and Wallace Creek where we first found the elevated tissue levels, but also in White Oak River. White Oak River is an area that is relatively development free. There's some farming activities, there's a national forest over there. There's not a lot of activities, man's activities, that pollute the area. So we'll take fish and crab tissues over there and compare them to what we found in Wallace and Bear Head because these two river systems are pretty much the same. They are very close, they are right on the coast, North Carolina type tributaries, estuaries.

AUDIENCE MEMBER: I need some help with this and maybe you can explain it to me. It was in the Preliminary Risk Evaluation session. What I'd like you to explain is why this is: It said if concentrations greater than the criteria by a factor of 10, then a potential risk to aquatic life would exist. How is that? Is it because it's found in the sediments? Why does it have to be a factor of 10?

TOM BIKSEY: The criteria you're referring to are the NOHA, the National Oceanographic Hemispheric Administration. They have established what they call a 10 percentile and a 50, a median value representing the halfway point of a variety of studies that they looked at across the United States, both fresh water and salt water. They went out and looked at what type of contamination was found in the mud, how much lead was there, mercury, PCBs. Then they looked at what was the levels in the fish. Did the fish have lesions or were there worms living in the mud and was it too toxic for it. So they did all these different studies and they could rank these studies based on those effects.

On some studies they found no effects; and very contaminated, polluted studies, they found out that, yes, there was a problem. So when they ranked all these studies and they ranked the concentrations, they find in the sediments in what type of results they get. What they're saying is, based on this range of values, if your concentration is within the first 10 percentile, what they're saying is there's probably no adverse effect to the aquatic life. If you're between 10, the 10 percentile and the 50 median value, there's a likelihood that there can be an adverse effect and you should do some type of additional studies if all you did was just take sediment

concentrations.

If you were over this median value, then there's a high likelihood that there's potential risk to the aquatic life. So that's where the 10 percentile and the 50 median value comes. So there was two values in the report: The ERL and the ERM and that's where those numbers came from. We compared those numbers to the levels we found in the sediments and determined whether there could be a potential problem. We discussed that in relationship with the fish populations that we found and the tissue levels to see if there was any relationship.

AUDIENCE MEMBER: But it does not have any affect on the vegetation? The sediment doesn't involve--

TOM BIKSEY: We only sampled the mud to find out what type of levels there were; however, the levels of the contaminants in the mud could not only affect the fish and the worms and the insects, but also could affect vegetation because plants could uptake that to bring it into their stems and their fruits and different things like that and potentially adversely affect them also.

AUDIENCE MEMBER: Would it increase the plants, vegetation, the plants being brought up--

TOM BIKSEY: Would it increase them to the plants compared to what? There is a potential of what they call bioaccumulation or bioconcentration factor. If you have 10

in the sediments and you look at a fish tissue level, then that could be maybe 20 or 30 because of bioconcentration. Then you get into the fact that if a bird eats the fish or man eats the fish then it would be concentrated further.

Something similar can happen to plants and can also happen just on soil, too. If you have soil contamination, you have plants growing on the soil, there can be an increased level in the plant because of the bioconcentration. But it's dependent on what type of chemical that is. The organics would bioconcentrate more than most of the metals.

RAY WATTRAS: Let's go to the next slide.

TOM BIKSEY: This is for Wallace Creek. We did a similar study for Bear Head Creek. Here we saw that the sediment quality was in fact due to low levels of pesticides, PCBs and PAHs. PAHs again are the products of combustion, the fuels, the coal tars and things similar to those.

The fish analysis revealed low levels of pesticides, PCBs, and zinc. And again, none of these levels exceeded what has been established by the Government as a level that would indicate potential adverse health effects to anybody eating the fish. Again, we looked at the fish population. We collected a number of fish either by gill nets or we used electroshocking techniques and based on what

type of fish were there, how many fish were there, and compared it to normal estuary fish. Estuaries typically are areas that are, because you have a salt water and a fresh water interface, it's more of a natural adverse environment. And we found that both of those fish population number diversities indicated that the fish in the benthic communities, the insects and the worms and that appeared to be healthy and we did not find any lesions or abnormalities on the fish collected.

One thing I'd like to note about the atypical type of season it was last year, I think there was more of a higher than average amount of rainfall and this caused more fresh water to come down into the New River estuary, the Wallace Creek, the Bear Head Creek. Talking to some of the people that ran the docks there, they remarked this is the first year they didn't find any barnacles, barnacles being more salt water type organisms. That meant there was a lot of fresh water through there.

Whenever you have this happening, you typically have salt water coming in and it's more heavier. You have fresh water rain on top and that salt water becomes trapped on the bottom. Normally you have a mixing in an estuary. That causes your oxygen to become mixed throughout the water from top to bottom. What happens here, and this is something that naturally happens in an estuary that you have

this water caught on the bottom, the fresh water on top and the bottom because of all the fish and everybody using all the oxygen at the bottom, it uses up the oxygen and you have an area on the bottom where there's no oxygen. Then we take a sample through the water. At the top we would show that there would be very low salinity or no salinity but a lot of oxygen. You went down and you can see just basically--say two and a half feet--just a real sharp increase in the salinity and maybe 2 parts per 1000 to 10 parts per 1000 and then that decrease in oxygen. Again, this is something that naturally happens with these type estuaries.

If you look, some of the benthic communities we found there were very few individuals down at the bottom of the tributaries. What we believe this is due to that salt, the natural stress that's occurring on the benthic population.

RAY WATTRAS: As I mentioned before, the purpose of collecting all this information-- The purpose of collecting all this information is not only to find out what kind of contaminants we have and what levels and the volumes that might have to be dealt with, but a performance called Human Health Risk Assessment as well as an Ecological Risk Assessment.

I'm going to have Tom again go over the results of the Human Health Risk Assessment.

TOM BIKSEY: Just to quickly go over what a Risk Assessment is, when we go out there we sample the soils, we sample the groundwater, the service water and sediments, and we find out that yes, there is something there. We could detect something. The next thing to know is at that level, is that a potential risk, a potential adverse health effect if anybody were to come into contact. So we have exposure scenarios.

One of the exposure scenarios would be any military personnel working on site in those particular areas. So we would have an exposure in terms of this person coming in contact with it on their hands and may have dermal absorption being absorbed into their body. Perhaps they would accidentally touch their mouth so they may be ingesting a little bit of the soil, things like that. We also go through this same scenario in the future sense that perhaps after this base was closed, if it were closed then maybe someone would give it a residential area there. So you may have kids playing in the dirt or you may have adults landscaping or gardening or something like that. So being kids get a lot more dirtier than adults, they're going to have a lot more potential for ingesting that soil.

So what we do, we go through these different scenarios and determine based on standard EPA assumptions of how much of that soil, how much of the groundwater, how much

of the fish they're coming in contact with that will actually get inside their body. And just as the Government has established recommended daily allowances for vitamins--they say you need this much Vitamin C and you need this much Zinc, you need this much anything to maintain your body for growth and everything--they have established levels that they feel would, if you exceed these levels of some type contaminant coming into your body that would present an adverse health effect or a risk. It may cause cancer, or maybe it will cause a liver disease or some type of learning disorder. Everybody has heard that from lead.

So we go through and do these scenarios and calculate what is the amount of contaminant that can come into our body. And we compare this to these allowable levels that the EPA has established. What we came up with is that--and whenever you look at these exposure scenarios, you have to look at the potential for someone to be exposed. Now on this site, we saw there wasn't really any current risk to human health associated with groundwater because no one currently is drinking from the supply wells. All the contaminated wells have been closed. However, in the future use, if someone would come on site, build a house there, put a well down and start drinking water, we start going through this exposure scenario in estimating how much of the TCE and how much of whatever they potentially get, incidentally

ingest or have dermal contact with, this will result in unacceptable health risk.

However, in our exposure scenario we're going through calculating the risk, we find that there was really no significant risk associated with either the contact of the soil, with the sediments, or with the surface water.

I think the next one is the ecological. Okay. Is there any question on what we looked at in terms of human health and what potential risk that would be with someone coming in contact?

We do the same thing to look at what is sometimes called the birds and bunnies out there and fish and different things like that. We go through and again, we took everything we found: What were the levels in the sediments, what were the levels in the surface water, what did the fish look like, how many fish were there, what were the contaminant levels in the fish. We put this all together and came up with a conclusion and what we concluded was that the past disposal practices potentially put impact on the ecological integrity or ecological health of both Wallace Creek and Bear Head Creek. Because of the presence of the contaminants and sediments there could be a potential problem. Whenever going through the same type of scenario where we took deer, had them eating certain amount of vegetation that was growing on site, and that vegetation

observing some of those contaminants and the same thing for a rabbit and the same thing for a quail, being on-site having a certain amount of assumed ingestion of soil, assumed ingestion of surface water, we determined that there was no hazardous impact to the mammals that we studied of the three animals that I just mentioned.

And again, I mentioned this before, we are recommending that additional sampling analysis be conducted on the fish. Again, in line with guides by EPA there was a potential problem but we did sample a very small amount of fish. The PCB levels that are slightly elevated came from two fish that were positive or combined and tissue analysis showed that there was a slight elevation of PCBs although below the FTA level. So we went out there collecting more fish, collecting it from a reference site over at White Oak and do a better comparison to attempt an analysis.

AUDIENCE MEMBER: Were any of the animals that you used in this study tagged so they could be followed in future studies?

TOM BIKSEY: No. What we did not do for this site was go out and actually collect deer, collect quail or collect rabbit and do basically tissue analysis on them. What we did was basically what they call desk top or office type of calculations where we took the amount of the contaminants in the soil, the amount of contaminants that

were in the surface water, and we went into the literature and looked up how much grass does a rabbit eat. And using some equations, how much of the contaminants in the soil would be absorbed by the grass. So knowing how much was in the grass, then we've got a rabbit that might eat say five ounces of grass a day--I can't remember exactly what it was--and he drinks a half a liter of water a day; giving that, he's going to have some type of uptake of those contaminants. And the same way we compare adult humans, how much they're allowed to EPA levels, we compare how much in the literature was found would result any adverse effect of a rabbit or quail or deer and compared that with the same level. And that's how we determined there was no problem.

AUDIENCE MEMBER: Is there any plan in the future to conduct a different type of test that would follow how this affects humans?

RAY WATTRAS: Do you mean bioaccumulation from humans?

AUDIENCE MEMBER: Right.

RAY WATTRAS: It's not normally done. The closest thing to that would be something which ATSTR would do.

TOM BIKSEY: I think that ATSTR will follow up in that line. What we do is calculate a base line risk, the risk currently based on the site conditions. Now we have looked at potential recreational users or fishermen eating

the fish and what risks those are.

RAY WATTRAS: That's very difficult to do, too.

AUDIENCE MEMBER: Is it something that is a long term explanation or just how contaminated?

RAY WATTRAS: I don't know if you would be able to draw a conclusion that if you took a quail and you analyzed the tissue and it had some contaminated, because quail aren't in one place, it would be very hard to draw conclusions like that. It's not normally done. I honestly don't know if one case--there may be a few cases, I don't know of any personally.

AUDIENCE MEMBER: A lot of migratory birds died of lead poisoning from eating the slugs. There's an awful lot of lead dumping. I don't think the agency of toxics and disease (inaudible) people, not bunnies.

TOM BIKSEY: Well, we went through the calculations. These are the same type of calculations that are currently being used, for instance, up in the Great Lakes to determine what would be allowable levels of surface water if ospreys and eagles and otters or minks are eating contaminated fish or come into contact with water. It's those type of exposures.

Now, one of the things, whenever we're looking at Human Health Risk Assessment, that has been around for a time. Guidance by EPA has been out for almost 10 years now

on how you go about developing those risks. Whenever we're looking at ecological risks, the risks to the bugs and the bunnies, that hasn't been developed this far. It's still, there's a lot of uncertainty about that. It's the question about, do you protect for an individual or do you protect for a population. It would be dependent on whether it was a rare and endangered species. If it were an eagle, you'd be worried about protection of an individual. If it's a population, there's a lot more uncertainty with it and it's really a sign that is really developing a lot now.

But a lot of those type questions that you're bringing up are things that a lot of people are wrestling with. Trying to come up with a standard to address it. And I think we have a lot better handle on how to address human health risk. We've done the work for a long time, we have a lot of experience with it.

We don't have a lot of experience--for instance, if you would have 10 out of 1000 quail die, is that because it was a draught or less vegetation that grew in the area? Is that something natural? The salt wedge that moves up and down in the tributaries, how is that affecting fish moving in and out? The natural system is a lot harder to study than the human system, I think.

RAY WATTRAS: So when you reference we, do you mean the scientific community in general does not have the

experience within the whole scientific community is limited to the ecological, it's a growing area that maybe in 5 years from now the standard would be to do something similar to what you're mentioning. Right now it's almost what's called the infancy stage. Like, how do you evaluate--

AUDIENCE MEMBER: It's still in the experiment of what's norm?

TOM BIKSEY: Norm, yes. EPA hasn't come out with a standard guidance. They've recently come out with a framework for conducting Ecological Risk Assessment. But it really is a framework that's concepts. These are the things you should look at, problem formulation, exposure effects, risk characterization. But they haven't let out the equations that we have for Human Health Risk Assessment that we can really have less uncertainty with it. Probably why it's an exciting field for me as an ecologist is because it's something that really is developed a lot right now, it has potential to do a lot of work in that area.

RAY WATTRAS: Okay, back to me. Another purpose of collecting all this data and the most important one is what we call purporting the Feasibility Studies. We look at the problems. We look at what kind of impact there might be to human health and the environment and we identify, how are we going to deal with these problems. The result is what we call Feasibility Study.

For this Operable Unit, we evaluated Remedial Action Alternatives for the contaminated groundwater that I referred to before as well as the 7 soil Areas of Concern. Now the surface water sedative problems will not be directly addressed. In other words, there are no plans to go in there and dredge Wallace Creek or Bear Head Creek, the reason being those areas are in a very sensitive environment, wet land area. Dredging sediments would most likely cause more of a problem than what we have right now which is what we would consider a minimum problem and that's why we're still studying. We're not even sure what effects these contaminated sediments are really having on the fish.

So the surface water and sediment will be addressed indirectly. For example, surface water would be addressed by dealing with the groundwater. We know the groundwater is the reason why the surface water is contaminated so therefore we're going to focus on cleaning up the groundwater that over time surface water will obviously, if there are no more loading of contaminants, then the surface water will clean itself up.

Same thing with the sediment. We know that the sediment problem is due to the ravine area, and therefore we're going to focus getting rid of the contaminants in the ravine so that over time the sediments will eventually not become as much of a problem.

I'll start with the groundwater first: We identified five alternatives for dealing with the groundwater. The first alternative is what's referred to as No Action. You always have to consider the No Action Alternative. The No Action Alternative means you won't do anything. You walk away from the site. If we did that here, we walked away from this site, that means that the groundwater would continue to be contaminated and most likely migrate further than what we see right now. It would continue to be a problem.

I'm also going to go over the costs that it's going to take to all these alternatives. Of course, with the No Action Alternative means that there would be no money spent. It wouldn't cost the Government anything to walk away from the site.

The second alternative is called Limited Action. What Limited Action involves would be to maintain monitoring the operator supply wells, would involve the wells that are shut down in the area to remain shut down; it would involve monitoring of some of the monitoring wells to see how the groundwater is changing over time. This alternative is kept because there really is not risk to groundwater. You have to remember there is no migration that way. So this alternative of Limited Action would actually cost the Government $600,000 and all that money is involved with

sampling and analysis over 30 years.

We always use a 30 year period when we do cost estimates. That's kind of a standard and we also give cost of what's known as a present net value, or net present value. A net present value, for example, when I say $600,000, that's the amount of money the Government would have to set aside today at an interest rate of 5 percent so that they could draw upon that money that over a 30 year time frame they would have zero (0) dollars left in that account. It's almost like, if you can imagine you have a checking account and you want to say to yourself, I'm going to put away a lump sum of money that's going to pay my electric bill from now for the next 30 years so that at the end of 30 years when I make that last electric payment I have zero (0) dollars left in my account. That's referred to as a net present value.

Now, the third alternative involves some remediation. The first two don't. The third one involves what we call Containment. What we would do in this alternative, we would put in extraction wells along the edges of the plume. We have an idea of where the extended contamination is. We'd install extraction wells. Those extraction wells, and I've talked about this cone of influence, would mitigate the migration of groundwater. Once we would take out the groundwater, we would treat it,

there would be a treatment plant that would be built up at Lot 203. We would remove any of the heavy metals and suspended solids, the water would be treated to remove the volatiles and that's normally done with air stripping. Air stripping is a technology that basically is all forced air through water where you basically volatilize the contaminants from the water and those emissions are then captured with an air pollution control device. A lot of times this involves carbon and that carbon collects the emissions and then that part is disposed of or regenerated. That's the Containment Alternative.

The Containment Alternative, the objective for that alternative is to spot migration. The objective is not to remediate that plume for future use. That alternative, the net present value to do something like that would be $7-million. It would cost the Navy $7-million just to contain it.

The fourth alternative is referred to as Intensive Groundwater Extraction and Treatment. This alternative is the alternative preferred by the Navy. The Navy, the plans are to install deep extraction wells as well as shallow extraction wells in the heart of the problem. In other words, I keep mentioning this area of Site 82 where you have these very high levels. The groundwater would be extracted at approximately a rate of about 300 gallons per minute and

treated at the treatment system at the open storage lot, cleaned up to meet standards for discharging it into Wallace Creek.

Over time and with the cone of influence expected by some of these deep wells to capture the edge of the plume, over time this aquifer may be reused for beneficial uses. But in the engineering community, it's pretty well known it's a difficult problem because here we have a pretty significant problem. We cannot estimate at this time how long it's going to take. We know it's going to take a number of years, we get the costs based on 30 years. This is not uncommon to find a lot of problems throughout the nation. It's just a very difficult thing to remediate.

The net present value that the Department of Defense plans for this alternative which is the proposed solution, is $4.9-million. This alternative, as well as Alternative Number 3, involves monitoring. Over time we will take samples from the monitoring wells to see are things working, are their levels decreasing, how much of it is decreasing, has the plume stopped migrating. I mentioned, we have a cone of influence that's expected by these deep wells. We hope that plume eventually will stop the migration. Every five years you have to do this under the law. You have to go back and do a very detailed study of how long this alternative is working.

If they come back in 5 years and they see that the levels of the groundwater have a nice decrease and that the plume is not migrating, chances are they will leave it as is. On the other hand, if they come back in 5 years and they find that the plume has migrated or that the levels haven't really decreased, then they consider altering the design and possibly putting in more extraction wells.

The last alternative, Alternative Number 5 is somewhat similar to this alternative with the exception that it involves monitoring wells. Monitoring wells under this last alternative would involve 12 deep wells as well as 12 shallow wells. It would generate a flow of about 1200 gallons per minute and be at a cost of $8.9-million.

The primary reason why Alternative 4 is selected over Alternative 5 has to deal with the flow rate that's manageable as well as the fact that over time we feel that Alternative 4 would possibly allow reuse of the aquifer.

So the main differences between the two alternatives are the pumping rate; and the problem with 1200 gallons per minute would be where do you discharge 1200 gallons per minute?

Right now 300 gallons per minute at the discharge point would be Wallace Creek because we feel that size creek, that flow rate would be able to handle it without any problems in the quality or the flow of the stream.

Are there any questions about the groundwater alternative before we get into the soil?

AUDIENCE MEMBER: Are you saying you don't think the pumping in the stream is going to change the value?

RAY WATTRAS: No. That's the professional judgment we got from doing the ecological impact. You have to remember, right now in the (inaudible) treatment of groundwater discharge, we already receive a tremendous amount of groundwater. With this 300 gallons a minute really isn't expected to be a significant impact. Plus, the water that's discharged into it will be cleaned up with all the treatment that would be going on. Basically we feel you would be able to drink it, it would be cleaned up to that level where you could really drink the water.

Go ahead on to the slides.

Now, I mentioned before there was 6 Areas of Concern that were identified with respect to contaminated soils and in the Feasibility Study we identified 7 alternatives for dealing with the soil problem.

Alternative Number 1, as I will repeat, always has to be considered as a base line. You compare the No Action Alternative with the other alternatives. Under No Action, very briefly, nothing would happen. The Navy will walk away from all of these problems and there would be no costs involved.

Under the second alternative, we refer to that as Capping--I need to get my dollar values here--under the second alternative, what would be proposed would be to excavate all of the soil from these Areas of Concern. We will deal with the landfill at Lot 203, place some soil in the landfill, and cover it. That would cost the Department of Navy approximately $3.4-million to do that.

The third alternative involves excavation, it's called On-site Treatment. Again, we will in this case we would employ a vapor extraction which is a technology that extracts contaminants, the volatile contaminants from the soil, it's collected in carbon and disposed of. It's a process which is referred to as an in situ technology. In other words, you don't have to excavate anything. You can put these, they almost look like valves except that you're suctioning out air. This air is taking contaminants out of the volatile, out of the soil matrix and collecting them for disposal.

It would also involve treatment either by bioremediation or another technology such as incineration. But all the treatment would be done probably within the Lot 203 area with the exception of in situ technology. This alternative would cost as much as $6.6-million.

The fourth alternative is a combination of really Alternatives 2 and 3. The PCB soils would be capped. In

other words, we excavate the areas of the contaminant with PCB constituents, we build an on-site landfill of Lot 203, we cover up the PCB soils. The rest of the soils would be treated by either vapor extraction or possibly incineration or bioremediation. This alternative would cost about $1.6-million.

The fifth alternative is referred to as Off-site Treatment. In this case none of the treatment would be done on base. All the soil would be excavated, would have to be taken to what's called a treatment storage disposal facility, and that firm would possibly incinerate the soils and contaminants or if they were below a certain level they would just strip and take them to a licensed waste disposal site. This Alternative Number 5, depending on how much treatment would be needed, ranges anywhere from $5.5 million to $20-million if everything is taken off the base and possibly incinerated.

The sixth alternative involves, is called Capping an On-site Treatment for Areas of Concern 1, 4 and 5. The result behind this alternative is that only Areas of Concern 1, 4 and 5 would remediated. These were the areas that had the highest levels of contamination in terms of the biggest risk to human health environment whereas if the Marine Corps wanted to use this area as an open storage lot for the protection of the military personnel, they would have to do

something with Areas of Concern 1, 4 and 5. So under this alternative we look at 3 of the 6 Areas of Concern. And this alternative would cost $1.4 million.

The last alternative is the preferred alternative. This is what the Department of Navy and Marine Corps is planning to do. Area of Concern Number 1 would be left in place and be treated in situ with vapor extraction. Vapor extraction is a proven technology especially with volatiles. It's good sometimes not to excavate them especially when it comes to the health and safety of the people doing the excavation. But this technology of vapor extraction would be employed at Area of Concern Number 1.

All the other Areas of Concern, the soil would be excavated and taken to a Subtitle C landfill. The waste is not hazardous by definition. You hear a lot of times people talk about hazardous waste. In this field, hazardous waste has to have certain characteristics: It has to possibly be corrosive; it has to be ignitable; it has to be reactive; or it has to come from a certain process. We've taken samples and they're analyzed with a certain (inaudible) of contaminants. The samples came back with, the waste itself is not a hazardous waste by definition. That's important from a standpoint of where do we take this waste. Since it's not hazardous by definition, the waste can be taken to what's called a Subtitle C type landfill.

Also, this is important here: The landfill, because we have PCBs in the soil, the landfill would have to be licensed to accept PCBs. It would have to have that sort of permit to accept PCBs. This alternative would cost the Department of Navy roughly $1.5-million.

The plans to go forward with this again, you have a public comment period that lasts for 30 days. Following the public comment period, the Record of Decision would be signed with possibly both of these alternatives unless there's an exception from the public. After that, the project goes into a design phase. After the design phase is completed which should not last more than 15 months, actual remedial construction would begin.

Are there any questions on the soil alternative?

(NO RESPONSE)

That concludes the meeting here. Neal, do you have any closing remarks?

NEAL PAUL: I don't have any remarks but if there are any comments that you feel were not addressed, on the back of the brochure you can either send them to Ms. Linda Berry or you can send them to me here at Camp Lejeune and I'll make sure that she gets them.

RAY WATTRAS: The comments that are submitted is known as what's called the Responsiveness Summary which will be part of the Record of Decision and the Administrative

Record. There is a formal response to comments that were submitted.

AUDIENCE MEMBER: Is it possible to get a copy of the Proposal?

RAY WATTRAS: Of the Proposed Plan?

AUDIENCE MEMBER: Yes.

NEAL PAUL: I think the best way to do that, I know they're in both admin records.

AUDIENCE MEMBER: Could they make a copy of that at the library?

NEAL PAUL: I'm sure they can make you a copy at the library or at Camp Lejeune.

RAY WATTRAS: Thank you very much.

(THIS MEETING CONCLUDED AT 8:45 P.M.)

C E R T I F I C A T E

STATE OF NORTH CAROLINA

COUNTY OF ONSLOW

I, Terry S. Warner, a stenotype reporter and notary public in and for Onslow County, North Carolina, do hereby certify that the foregoing 60 pages are an accurate transcript of the Public Meeting taken by me in machine shorthand and transcribed by me personally.

I further certify that I am not financially interested in the outcome of this action, or am I a relative, employee, attorney, or counsel of any of the parties.

This 14th day of September, 1993.

Terry S. Warner

TERRY S. WARNER
Court Reporter
Notary Public
200 Mike Loop Road
Jacksonville, NC 28546
(919) 346-6739

My commission expires:
7-13-97