RESTORATION ADVISORY BOARD
FOR
NAS JRB/ARS WILLOW GROVE

Willow Grove, PA, September 13, 2000

Meeting held at the Naval Air Station Joint Reserve Base at 6:00 p.m. on the above date before Kimberly A. Overwise, a Registered Professional Reporter and Notary Public of the Commonwealth of Pennsylvania.
1 SPEAKERS:
2 JIM EDMOND
3 JIM COLTER
4 CHARANJIT GILL
5 SCOTT SHAW
6 RUSS TURNER
7 KEVIN KILMARTIN
8
9
10 PRESENT:
11 JOHN C. MARTIN
12 KAYE MAXWELL-MARTIN
13 LIZ GEMMELL
14 CDR. GILBERT VIERA
15 HAL DUSEN
16 COL. DANA MARSH
17 JEFF DALE
18 CARL REITENBACH
19 CARL HECKELMAN
20 JIM BARON
21 LCDR BILL SCHOEN
22 LT. JACQUELINE SICILIANO
23 APRIL FLIPSE
24 PAMELA REIGH
25 RON SLOTO
MR. EDMOND: We'll call the meeting to order. We were going to tour the sites tonight but since it's only the three of you or two and a half if we consider John, we're going to bypass the tour. So we'll move on with the agenda.

I'd like to welcome everybody. Thank you for coming again. Summer is almost over or I guess it is over but the weather is still nice. We're moving into fall. So thanks for coming this evening.

I'd like to give you a quick brief on the F-14 mishap. As you all know, over the Air Show there was an unfortunate accident with the F-14 where its two pilots went down right off Horsham Road killing both the pilots. The environmental side of it was about 6,000 gallons of fuel which spread along the ground in the trees, atomized. We went in, cleaned out all the trees, took out the stumps, took out contaminated oil, did furthering testing, sent it to Pam and April. They reviewed it. We were in regulation limits and right
now the site has been cleaned, leveled, regraded. The contractor just put 50 Japanese white pines to screen the site from the road. He will hydrosed it. This should all be done and completed by the end of this month.

In the spring of next year, we're going to go back and fill in where the trees were taken out with a public relations type plan. We're going to get some school kids and scouts help us plant some trees. Hopefully, that will be the end of our involvement in that site from that point on. But as far as the State's concerned, we're done. The site is cleaned. It was well within limitations of any contamination. What we're doing now is just basically to take the site out of people's minds by having the trees there. They don't see the open field and they don't relive that tragedy. That's basically what's happening with the F-14 mishap.

RAB MEMBER: I think on behalf of the community at large and the
small community of three that's here, we would like to express our condolences to the air base family. That was a tragedy and we think everybody's had you in their prayers as well as the two pilots.

CDR. VIERA: I can tell you the family of the pilot has been very grateful for the support I know the community has shown, especially to the daughter. A lot of funds have been put into a scholarship for her. As a matter of fact, they were out here not too long ago and we gave them a lot of the crosses and flags that were out there.

MR. EDMOND: The drawings the kids did.

CDR. VIERA: So thank you very much.

MR. EDMOND: Moving onto a little happier site, we'll let the Navy talk first since that was my agenda. I thought it was the other way around but, Jim, we're going to talk about Site 5. In the last few weeks, Tetra Tech, Mr. Russ Turner's crew was out here. They put in
some wells, did some rock core sampling and
water sampling and Jim and Russ and Kevin
Kilmartin, the hydrogeologist, will go over
that for us. Jim?

MR. COLTER: You might
recall at the last RAB meeting we announced
we had a presentation from USGS on their
water level studies that we did and we
finalized a work plan based on EPA and
State comments to do additional work out at
Site 5. I announced at the last RAB
meeting that we would begin implementation
of that work plan. We’ve been doing that
over the last three months and Russ and
Kevin are going to give a little brief
presentation on where we’re at and what we
have left to do.

You might have gotten a time
line that I put together. This is in
response to Jim’s questionnaire where the
RAB said they’d like to see some time lines
for Navy work up here. So I put this
together for Site 5 only. And this kind of
gives you an idea of the steps that the
Navy has to go through to reach a
decision. You can see it is quite lengthy. We're out there today actually sampling the wells that were recently installed. It will take probably roughly two to four weeks to receive analytical results on that. You see that in Line No. 8. And then from there we have to incorporate the water level information that was gathered by USGS and basically incorporate the laundry list of items brought up by the EPA about a year and a half ago with risk assessment and water quality. The wells we just put in are in response to that laundry list. So we're in the tail end of that laundry list. Now we're going to start finalizing that draft RI report on a site by site basis starting with 5. As soon as we have that done, we'll put together a feasibility study of alternatives, what we think needs to be done out at Site 5 with the groundwater and that will go through a regulatory review period. We'll incorporate their comments and make a final decision. And that decision document will be published for
public review and comment. Once that's accepted, we move on to try to make an award to an environmental contractor for implementation.

That's in a nutshell the steps. If all goes well, and it usually never does, we may be able to see some type of construction at Site 5 next August of '01. That's how it looks today. I'll turn it over to Russ and Kevin. They'll give you an update on what we've found so far and what we've done at Site 5.

MR. KILMARTIN: All right. Well, as Jim mentioned, what I want to do tonight is just very briefly update and summarize some of the additional hydrogeologic work that the Navy currently is doing out at Site 5, the fire training area. As you know, this is a site where some solvents have been detected in the soil and a plume of solvents have been identified dissolved in the groundwater in this area. The RI, the draft RI, that the Navy completed and submitted defined this plume and concluded that the plume appears
to be contained on the base, that is, it is not migrating off site. EPA in reviewing the report has expressed some concerns and identified some areas that they felt some further work was required or needed. And in response, the Navy has been recently out there doing this.

Some of these issues, I’ll just discuss them briefly right now and talk about them in a little bit more detail as we go on. They felt that the plume needed to be delineated or defined a little bit better, especially in the vertical sense. And I’ll talk about that in detail in just a second. They felt that the effects of the geologic structure or the dip of the bedrock needed to be investigated further, that is, was there the potential for the plume to be flowing in response to the geology as opposed to strictly just flowing along in the direction that the groundwater is flowing. And, third, they asked that a little bit more work be done in the source area and specifically to investigate the potential
that some solvents were still existing in concentrated forms within the very shallow bedrock, in which case they would be acting as a continuing source of this plume.

Just to get everyone reoriented and on the same page, I think we’re all pretty familiar with this site by now. Here’s the base. This is Site 5 right here, the fire training area. North is up. We have Horsham Road and Norristown Road.

One of the concerns with Site 5 is the proximity to potential receptors or users of the groundwater in this area. And they include residential home wells along and off of Horsham Road and a public supply well, which we call Horsham well No. 26, which is right here. Some of the concerns or things we were looking at would be the potential for the plume to just be naturally flowing in response to groundwater in the general direction of these receptors or wells and also the potential for a high yielding well such as the public supply well to literally
pull the plume over towards it even if the plume itself was not going naturally to be flowing in that direction.

And in response to that concern, the USGS performed a rather long-term water level study where they looked at how the water levels on and off the base responded to the pumping of this well. And that was part of the presentation that Dan Goode of USGS gave to you at the last RAB meeting.

Now, before we get into the specifics of Site 5, I just want to very briefly talk about the difference between a supply well and a monitoring well because that led to some of the further work that we’re doing right now. The objective of a supply well such as the Horsham well No. 26 is pretty simple. It’s to gather as much groundwater as it can in response to the demand for that water. And in this area with this type of geology that we have here, typically what you’ll find in a supply well is that the well is cased or protected from the formation only up in the
very shallow parts of that well and that
the well itself is actually a very long
borehole that's open to the formation. So
it's actually not like what's illustrated
here. This shows a very long casing with
just a short interval exposed to the
formation. A supply well is going to have
a much shorter casing and a much longer
open interval. This, of course, is good
because it maximizes the production
capabilities of that well.

But in contrast, a
monitoring well, what you want to do is be
able to obtain a groundwater sample from a
very discrete vertical interval. If you
can imagine, if this was the supply well
and this whole interval here was open to
the formation, you could have water
entering from any number of vertical
locations. So when you took a sample from
that well, you really don't have a good
handle on what depth within the formation
or the aquifer you're actually testing.
And in reality what you're probably getting
is an average of many different levels.
What we need to do with the monitoring well, of course, then is limit the vertical length of where the water can get into that well so that way when we take that sample and analyze it, we know rather specifically what depth that water came from and what the water quality is at that particular depth.

Therefore, what you'll often find and what we do here at Willow Grove is at any one particular location that you go out and take a tour and see the wells, you may say, well, why do you need three wells within 10 feet of each other. And the reason is because those wells are completed at different depths and that's giving us not only the horizontal water quality at that particular location but it's giving us what we call a vertical profile of the water quality. It's giving us water samples from these different elevations.

This is Site 5, fire training area. This is sort of a snapshot from a movie that we presented, probably about a year ago now that you probably
remember. This is basically an oblique view looking from the southwest towards the northeast. Here's the taxiway. Here's Horsham Road. And here's the road leading into the fire training area.

Some of the things I just want to point out on this map for review, again, the green represents the plume or the areas where solvents were detected in the groundwater. The direction of groundwater flow that we've defined in this area is generally to the south, southwest. It varies because we've taken several rounds of water levels and the direction of groundwater flow has seemed to vary from the south to the southwest. But what you see here then is that overall the plume is flowing with the groundwater. It's flowing in the same direction. That's because the solvents are actually dissolved within in the groundwater and, therefore, they're migrating or moving with the groundwater as the groundwater flows. It's very light here but I think you can still see you have these layers here that are dipping back
this way. These represent the dip of the bedrock in this area. This area here the bedrock is actually dipping to the northwest while the groundwater is flowing to the south or southwest or the plume is actually migrating in a direction different than the bedrock is dipping. Again, that is one of the things that EPA felt required some further investigation.

These sticks here represent monitoring wells with the balls here representing the depth that the screen is installed in the well or the depth that the water can actually enter that well. And what you see here, these are again what I discussed earlier, the monitoring well clusters. There are two or three different wells all at the same location on the ground but they're completed to different depths. And that allows us to sample the water quality at that location but at different depths to help define the vertical extent of that plume.

Now, the other thing that's noticeable here is that as I discussed
earlier, the plume is migrating with the groundwater and the groundwater generally flows to the south, southwest. And in that general direction, we have these two well locations here where you can see there's only one well. And the wells at that location are relatively shallow. This line here represents the surface. These are relatively shallow wells. So EPA felt that these were two areas where the vertical extent of the groundwater quality at these areas really wasn't defined because unlike here, we didn't have the wells completed at different depths. All we knew was at this particular location here we knew the water quality but we really didn't know if the plume could be migrating at deeper depths beneath these wells where we wouldn't be able to see it with the wells that currently exist.

So in response to that, the Navy just within the past couple weeks has installed deeper wells at each of these locations. They go down roughly I believe about 150 to 175 feet. So we will know the
quality of the groundwater in the deeper horizons at that location. And in that sense we will have better delineated the plume in that direction in response to EPA's comments.

Now, the next objective was, as I mentioned, to analyze whether this geologic structure that's dipping back to the southwest, is that in any way affecting the migration of the plume. Now, it's difficult to see on this particular slide because of the angle that it was constructed but I'm about to show you another slide. What it's going to be is a cross-section going right through here. Basically it would be similar to digging a big trench and climbing in and looking sideways at this plume. And when I do that, we'll look at -- south will be on the right and north will be on the left of that section.

Again, we're in that trench looking sideways at the plume. A couple of the features to point out, the brown lines here represent different beds or sequences
of beds that we were able to identify both
by looking at the rock chips as they came
up during the drilling of the borehole and
also through the geophysical logging of the
borehole that USGS performed on each of
these boreholes. What that is is after we
drilled the hole and there's just the bore
in the ground, USGS runs a series of
electronic instruments up and down the
borehole taking different measurements that
give us information as to, among other
things, the rock type that we see there.
So the brown here represents the different
rock layers that we identified. Just as we
saw before, you can see they're generally
dipping back towards the runway or towards
the north.

The very light blue lines
here represent lines of equal energy or
potential within the aquifer. Maybe an
casier way to think of it is almost
pressure, if you think of those lines of
equal pressure. And groundwater is going
to flow perpendicular to those lines. You
can see the numbers here, 345, 344, 343.
The water is going to flow from areas of high pressure to low pressure just like in the atmosphere, the wind blows from high pressure zones to low pressure zones. So what this is telling us is, just as we saw in the previous slide with the plume, the groundwater is generally flowing in a south, maybe southwest direction. And what we also see here is it's flowing rather steeply or the vertical gradient is steep. And what that means is the individual water particles for every unit they flow in a horizontal direction are flowing even more so vertically. So the water is flowing in a rather steep direction from the surface down into the deeper part of the aquifer.

The colors here represent the plume of solvents with the different colors being different concentrations going from higher concentrations to lower concentrations. Now, this figure here is from the USGS and it's modified from a figure that Tetra-Tech had earlier constructed. And the Tetra Tech figure, if
you just can remove this part of the plume for a second, the Tetra Tech figure depicted the plume originating in the area of well cluster 1. And as the solvents dissolved into the groundwater and started flowing with the groundwater, naturally the plume we found moved in this direction or perpendicular to these blue lines here. We also noted further back up towards the runway at this well cluster 3 we didn’t have any solvents up in the very shallow water but we did have a fairly low concentration, 47 parts per billion, of solvent down in this deeper well. We did have a well cluster here to identify the vertical changes in groundwater quality. We felt at that time what this was showing us was probably some other very small isolated source that if you just tracked the direction of groundwater flow backwards was probably originating maybe somewhere up in this area here but we didn’t feel that with the groundwater flow being in this direction that the solvents could be getting from the source area that we
defined back in towards that well location.

The USGS, Dan Goode, and EPA hypothesized that what could be happening here is that as the plume migrated downward, it could have encountered a more dense layer. This here says claystone, which is a very dense, more impermeable rock. It's much harder for groundwater to flow through that. And they felt possibly this plume encountering these denser layers rather than flowing with the groundwater, part of the plume may have been migrating along the individual bedrock layers in a direction actually that would be opposite of groundwater flow. This led to the EPA comment that this phenomenon did need to be investigated a little bit further.

In response to that, what the Navy recently has done is installed a third monitoring well directly down dip from the source area. Doing our subsurface correlations of the different rocks in the different areas, we were able to define precisely which direction the rocks were
dipping and at what rate. Was it relatively shallow or relatively steep? So what the Navy has done is they've gone from the source area in this general area, moved directly down dip back up towards the taxiway, and they recently installed another well right here at such a depth to intercept those finer-grained layers to see if, in fact, there is significant flow going in a northerly direction in response to the geology.

So just as a review, these are the three wells then that have recently been installed. We have the two deeper wells that were installed adjacent to the existing shallow wells in an effort to determine the deeper groundwater quality at those two locations and then this third well here that was installed directly down dip of the source area at such a depth to intercept those finer-grained layers to see if, in fact, any of these chemicals are actually migrating in this direction as opposed to that direction.

The third task that the Navy
has recently performed was in response to
the request that the source areas or the
source area be further investigated to see
if, in fact, some of the solvents could
actually still be trapped up near the
surface in the shallow bedrock. And in
response to that, USGS, Dan Goode, who
presented at the last meeting, discussed a
coring technique where rather than just
drilling a borehole and basically grinding
up the rock to bits and ending up with an
empty borehole, you put a coring device on
your drill rig and you actually go down and
retrieve a core of that bedrock that you
can then sample to test for the presence
and concentration of these solvents. That
core was done late last week and USGS has
taken the samples and those are currently
being investigated right now. The rock
core location is right here. This again is
at cluster 1, which we've identified as the
source area for the plume. This is what it
looks like. This is the drilling rig. It
was September 8. This is Site 1 right up
near the fence and this is the taxiway just
on the other side of the fence. This is a photograph of what
the core looks like. I believe approximately 20 feet of core was
obtained. I'm not sure exactly of that number. But what you can see here is the
different rock types that were encountered. It may be difficult to see
here but this is a claystone or a mudstone. It's a very, very fine grain,
dense rock. Below it here, this is a much coarser grain. This is a finer grain
sandstone. Actually, I have a piece of this I can pass around and you can actually
see what this sandstone looks like. But, again, this core has been sampled. Samples
were obtained near fractures and also away from the fracture site to determine has
some of this solvent actually moved into the matrix of the rock itself.

MR. SLOTO: I was the one that took the samples. Can I talk about
that for a minute?

MR. KILMARTIN: Absolutely.

MR. SLOTO: I'd take a
minute to introduce myself. Dan took a
two-year assignment in Israel and he left a
couple of weeks ago. It kind of happened
rather suddenly and so I inherited his
project. My name is Ron Sloto and I work
out in Malvern, Pennsylvania. I've been
working 11 years in the Stockton formation,
around here. I worked at the Raymark site
in Hatboro, Fischer & Porter site in
Warminster, and Naval Air Warfare in
Warminster also. I'm pretty familiar with
the area and rocks. The idea behind taking
this core was to see if the rock itself is
a significant reservoir for the solvents.
We drilled down 23-1/2 feet of weathered
material before we hit solid material. And
we drilled down another about 17 feet,
which is how long the core is. The upper
half is made up of the mudstone and the
lower half is the sandstone. I sampled
three different fractures. One fracture is
up at the mudstone. The second one is the
contact fracture, actually a fracture right
at the contact between mudstone and
sandstone. And the third one is fracture
in the sandstone. So from this we can look at the lithology and contact between the lithologies. I took a sample of the rock 2 centimeters below the fracture and a sample 4 centimeters below the fracture. They've been shipped off to our lab for analysis. In about two or three weeks, I should be getting some results back.

The mudstone is a fairly fine grain material which has little to no pore space and probably shouldn't be much of a host of solvents. The sandstone where some of the material has been removed by solution can be fairly porous and can serve as a reservoir. When I crushed up the sandstone, the fracture face 2 centimeters into it were fairly porous and crushed up rather easily. 4 centimeters into it it was quite hard and it was a rather difficult job to get it crushed up. So that work took place last Friday. I guess at the next RAB meeting I'll put together a little presentation and will show you what we found.

Thanks, Kevin.
MR. KILMARTIN: Just to summarize then, the remaining tasks of the phase of this investigation, one is to, as Jim has already discussed, do a round of groundwater sampling and analysis. We're presently out there even right now doing this sampling. We're sampling not only the new wells we've just installed but actually taking a comprehensive round of all of the monitoring wells at Site 5 so we can get a snapshot in time of exactly what the water quality is at this point. As Jim mentioned, probably within the next two to four weeks or so, we should start getting the results back from the lab on that sampling. When the results do come back, we'll evaluate these findings and prepare a Site 5 RI report. And as Ron just mentioned, USGS is evaluating the core samples and also will provide a report on that work.

Any questions?

MR. EDMOND: I have a question. It might be stupid. When you do the core samples, do you get like say a
17-foot piece of rock and there's fractures in it to show you where the fractures lie underground or is it like pieces, you know, how it breaks up and you get a piece and then another piece or is it one solid or three or four solid long pieces 3 or 5 foot?

MR. KILMARTIN: First off, the first limiting factor is the length of the core barrel. I believe they used probably a 10-foot barrel.

MR. TURNER: Ron, you should field this question. You were there.

MR. SLOTO: You saw the picture of the core sitting in the box looked like it was broken. Everywhere there's a break there's a fracture in the rock. The only exception to this is at the end of every 10 feet where it's mechanically broken when they pull it out. But everywhere you see a piece that's broken, that's a fracture. Now, some of these fractures are just, you know, natural breaks in the rock and some of them are water-bearing, hydrogeologically active
fractures. If you look at the fracture
surface, generally the fracture surface is
covered with black or brown iron manganese
oxide deposits. That usually indicates
there’s been groundwater flow and that’s
the hydrogeologically active fracture.
Thore were a lot of fractures in this core
and a lot of wells we imaged there were
literally hundreds of fractures in a single
well but there may be only one, two, or
three that are water-bearing and the
important ones.

MR. EDMOND: Is there like
erosion at the fractures? Would it be like
red or black, brown?

MR. SLOTO: Yes.

MR. TURNER: You can even
see them in the photographs. It’s a little
hard when it’s projected but it looks like
brown stain like water has been running
there leaving a stain behind.

MR. EDMOND: That would help
us determine where fractures are and thusly
which way contamination and/or groundwater
is flowing.
MR. SLOTO: The fractures they sampled, I made sure they had the oxide coatings.

MR. EDMOND: Thank you.

MR. TURNER: We're all set then unless there's further questions.

MR. EDMOND: Anybody else?

RAB MEMBER: I'd like an explanation. You said that the EPA wanted a little bit more investigation?

MR. KILMARTIN: Yes.

RAB MEMBER: What's your understanding of that? What's the limit to this thing? A little bit means what? Dollarwise or timewise? Anybody got any limits on this thing or we got a blank check or what?

MR. COLTER: Well, like I said, back in '97 we did a full round of sampling at all four sites presented in that thick report you got. And what we're doing here is in response to basically the EPA's comments on that report.

RAB MEMBER: I understand that but I want to know what the comments
MR. COLTER: We feel that we've done that round. Once we get these results, we're going to submit that to them. Yes, that could result in another set of comments that they think need to be done.

RAB MEMBER: We could go on forever on this thing.

MR. COLTER: Yes, we could. until the Navy and State and EPA kind of feel together we have delineated the groundwater problem.

MR. EDMOND: I don't know. More or less EPA's mandate is to protect the environment and health of the residents of that environment. Sometimes they err -- they like to err to the good. We don't care how much money you spend but prove to us what you're saying is true. That's basically their position right now. We have a lot of information but there was some data gaps or holes they saw that it could be flowing in this direction or could be doing this. They wanted those options
taken out so we could better define the situation and they feel more confident of the situation on and off the air station are safe.

MR. COLTER: Their comments were genuine in the fact that we were making conclusions based on one or two data points and in their eyes they didn't want to see the Navy put in a 2 or 3 million dollar treatment plan and miss a significant portion of contamination. So it's not always their intent just to make people do more work. They're looking at making sure that the Navy doesn't go waste money on a system that's going to have to run a lot longer because it wasn't designed properly. So their comments were in that respect pretty good. We think we have a handle on it now. We shouldn't have any more data gaps that we can't fill as part of the design of the system but we have to submit this to the EPA and State and see what they think.

MR. EDMOND: Any other questions for the Navy? Well, then I'd
like to turn it over to Gill and we’ll do the Air Force. Instead of having a break, we’ll move on through and may be able to get out of here a bit early even though you’re not drinking much of my coffee, John. You might have to stick around.

RAB MEMBER: It’s almost gone now. A couple hours, I’ll have it finished.

MR. GILL: As most of you know, my name is Charanjit Gill. I’m the project manager on the Air Force side. Today we’re going to give you the status on the remediation and pilot study that is going on at the POL site, which is Site 1. I’m going to have Mr. Scott Shaw from Geotrans give you the current status of the site and also discuss the recent sampling that we did at the site, which was done in August. Scott?

MR. SHAW: As geologists and hydrogeologists like to do, I’d like to reorient you to the site. Once again, my name is Scott Shaw. It seems like I’m getting to know all of you pretty well.
This is the POL area down here at the bottom. I want to quickly call your attention to a couple features, the bracketed lines here and at the other end of the POL area where we installed ROC about a year and a half ago and then about four months ago, the various monitoring wells that we used to keep track of the system and determine what's going on as well as the tanks that are in the area where we believe the leak took place and the ponding basin and the stream. As we'll see in a few slides, the role of the stream and the ponding basin is pretty critical to where things are flowing in the area.

One of the most recent tasks we've completed that we've been working on is the development of a groundwater model very similar to what Kevin was describing earlier to predict groundwater flow in the area. To do that, we aerially take a map and divide it into small blocks over which we perform a series of mathematical calculations, i.e., the groundwater flow equation. In this particular case, the
area has been divided up into 81 rows and 76 columns. And depending on the amount of detail we want in a particular area, we vary the size of the blocks, the grid blocks. In the area right around the POL area, the grid blocks are 20x20. As you move further out, the largest is about 100x100. Those are feet.

Once that’s done, once we’ve set up our grid, we calibrate the model to determine what’s commonly called the water table remembering that water flows downhill. The water table can be expressed as a series of elevations of the water in a monitoring well or along a stream or in a pond. You can see as you get closer to the pond the water table flattens out. It is not as sharp as it is as you move away. The thing to remember here is we’re dealing with jet fuel. In their case, they were dealing with trichloroethylene. Jet fuel floats on water. Trichloroethylene sinks through the water and dissolves as it goes.

The next step is we created
something called particle tracking where we have a series of programs that predict where a particle in the water, dissolving groundwater will flow across the system based on the location of the water table. Lo and behold, the same calculations here, calibrated model, we’ve gone out and measured water levels in the wells, we know the elevation of the stream. Those particles flow from the POL area downgradient as we thought and discharged close to the stream.

Now, putting a little bit different face on the same data you’ve been seeing or the data we’ve been updating you with on a frequent basis, beginning back in 1996, we have a series of data that show the concentrations of four compounds that we refer to as BTEX: benzene, toluene, ethylbenzene, and xylene. The circle you see here, the pie, represents two things. They represent the total of those four compounds added together plus what portion of that total each of those different compounds represents. So, for instance, at
this well, DM-11, we have a total concentration of BTEX of about 3000, but benzene, which is this blue portion, is about 1,200. Those are micrograms per liter. The other wells that are closer to the site, closer to the discharge area, the concentrations were approximately a thousand, 800, with a quarter of that being benzene -- actually about a third of it being benzene.

That kind of brings us up to the current year. We conducted a round of sampling in January and February or about four years after -- three years after that last set that you saw. We found that while the concentration of total BTEX was still the highest at the DM-11, the concentrations we're seeing is now around 1,400, about half of what they were before. Interestingly enough, benzene still represents a third of that total concentration.

Our most recent sampling event took place in August and we have a continued further reduction in
concentrations where the total
composition of BTEX in DM-11 is about
875. And even more encouragingly, as you
get closer to the site, these numbers are
reducing. The total amount of BTEX here
was about 310 and a little less than 200
there. We’re starting to see reductions of
those compounds closer to the site as we
would expect. As the plume moved away, you
start to see higher and higher
concentrations downgradient. But all in
all the levels are decreasing at the site
for the entire site.

Now, to sort of put all of
those into perspective, we can overlay all
three of those time frames and you can see
that even for DM-11 here where the
concentration was somewhere around 1
believe 3,000, it’s now reduced noticeably
down to what you see here. Our next step
is to measure that trend, put together
drafts similar to this to determine what
that trend is, see if there’s a discernible
trend there, and using other parameters,
determine why that’s happening or how it’s
happening and if it can be enhanced to continue the process.

So from our perspective, two points that we want to bring out, in light of the historical data the most recent sampling results continue to be encouraging. I think that's pretty evident by that last slide. And evidence suggests that intrinsic remediation is ongoing and perhaps a significant process at the POL area that may be enhanced to improve the rate of remediation.

Are there any questions?

MR. EDMOND: Thank you, Scott.

RAB MEMBER: I got a question. What thought has been given to the oil industry and their way of getting the last hydrocarbons out of the wells, in other words, a pumping motion of some type now?

MR. SHAW: Usually the hardest thing to get out of the wells is that last little bit. And that's exactly what we're trying to figure out. The
RAB MEMBER: You tried this stuff like the oil industry uses?
MR. SHAW: Well, the problem with using a solution like that is actual delivery of the compound that you're using so it affects a wide enough area.
Unfortunately, because of from what I understand -- now, I don't know that much about the compounds you're talking about but delivery is usually the biggest problem. You can't guarantee from the price of what you're trying to do you're going to actually get it to where it has to be to remove the additional product from the system.

RAB MEMBER: The way I understand it is the first thing they do is crack the rock.

MR. EDMOND: John, this is our resident petrol engineer right here, Lieutenant Commander Schoen. That's what he did for a living before he came to the Navy.

RAB MEMBER: Oh, he found a
better job?

LCDR SCHOEN: You're right.

When you start looking at doing a flood, be it water flood or some other chemical flood, you're right, one of the things that is typically looked at is doing a fracture of the formation depending on what the formation is. But like you indicated, one of the very fundamental problems is getting a volumetric sweep. And typically what you'll see is because of the differences in permeability from place to place, what you actually end up with is what they call fingering and actually end up bypassing sections of the formation. It's rare -- in the oil industry in particular it's very rare that you'd ever get all of the oil out of the rock. Typically they're happy -- they're ecstatic if they get 73%. Typically they'll get 50%. And that's actually what's recoverable. Just because of what you're pushing the oil with, the oil saturation gets so low that its relative permeability drops to zero and just don't flow any more.
MR. SHAW: It would rather stick to the soil.

LCDR SCHOEN: It would rather stick than flow and whatever you end up with is whatever you’re pushing with is what actually flows toward and the rest of the oil in that oil-bearing formation actually just stays in place. And the person who comes out to figure out how to get that last 25 to 40 percent or whatever is left behind, get that out economically is going to make a mint. Historically, that’s been the oil industry’s problem is how to get that residual oil out at a price for them that is economical.

RAB MEMBER: We got the same thing working here; right? We need something that’s economical?

RAB MEMBER: The difference here is this isn’t necessarily hard rock like an oil well would be. It’s in the upper part of the water table, which is broken up rock, which is even more porous and has more places for the jet fuel to stick and hide.
MR. SHAW: If you took that core we were passing around and that was one end of what you're looking at and crumbled it up, this is closer to the other end.

MR. EDMOND: Any other questions on petrol geology? Any other questions on anything we've talked about this evening?

I'd like to give you a quick update on what we're doing on the Air Station environmentally and communitywise. In the very near future, three to six months, Russ and I, the environmental division and Russ, Tetra Tech, have been working on the Internet. The fact sheet will be on the Internet, copy of the minutes will be on the Internet of all the meetings and eventually, which will take a little bit longer, the administrative record, i.e., all of the documentation we've done up until this time from the preliminary assessment up until the reports that Russ and Kevin are getting ready to put out in the next few months will be on
the Internet, will be publicly accessed by anybody that has a computer.

RAR MEMBER: What's your address?

MR. EDMOND: www.nasjrbwillowgrove.

MR. TURNER: I believe that is right. It's correct.

MR. EDMOND: Mine is bookmarked.

RAR MEMBER: Yours I have.

MR. EDMOND: You have mine. Not my E-mail address. That should be the next three to four months we'll have it. We should be up in like a month and a half with preliminary.

MR. TURNER: Yes. We're going to purchase the equipment. We just got funding yesterday. It shouldn't take us more than a few weeks. It's just going to be moving the site. We already have it put together on a site that's not available because it's inside the Navy's firewall.

MR. EDMOND: That's our last obstacle to get across. What we'll do is
when we put out the minutes, I'll have it on the minutes.

We're breaking ground within the next week for our new haz mat building out by the fire department.

RAB MEMBER: What building?

MR. EDMOND: Out by the fire department, hazardous and flammable material storage, building designed just for that.

The nature trail, as you all know, anybody interested call the PAO at 443-1776. We give tours of the nature trail, boy scouts, family groups, whatever. Also, tours of the Air Station are also available.

Country Fair is September 30. That weekend will be the Country Fair on the Air Station with the chili cookoff, which we could enter my coffee in maybe. I don't know. Fireworks to follow.

Finally, I came up with the 6th of December as a next meeting day for the RAB. That's a Wednesday.

RAB MEMBER: The answer's
MR. EDMOND: You are a forebearer of good news. Then we'll make the 6th of December as the next meeting. Wish you all a happy fall going into winter, Christmas, and all the other holidays, merry, happy. We'll see you then. Anybody have any questions, problems, please feel free to call me. You have my phone number. I will promptly answer your calls or E-mails.
TO: JIM COLTER (NAVFAC North Div)
FROM: RUSS TURNER (Tetra Tech, NUS)
SUBJECT: NASJRB Willow Grove, Stenographers Transcript of September 13, 2000 RAB Meeting

Jim,

A copy of the subject stenographer's transcript is enclosed for your use. The original and the electronic copy have been sent to Jim Edmond at NASJRB Willow Grove.

Please call or leave a message if you have comments or questions.

Thanks.

Russ

Copy. Jim Edmond (NASJRB Willow Grove)
Garth Glenn (Tetra Tech NUS)
File