

THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

convenes the

EXPERT PEER REVIEW PANEL
ATSDR'S HISTORICAL RECONSTRUCTION ANALYSIS
CAMP LEJEUNE, NORTH CAROLINA

VOLUME I

The verbatim transcript of the meeting of the Peer Review Panel, held at 1825 Century Boulevard, Room 1A/B, Atlanta, Georgia, on Monday, March 28, 2005, taken by Diane Gaffoglio, Certified Merit Court Reporter.

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C O N T E N T S

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March 28, 2005

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Legend of the transcript:

[sic]	Exactly as said
[phonetic]	Exact spelling unknown
--	Break in speech continuity
...	Trailing speech or omission when reading written material
[inaudible]	Mechanical or speaker failure
[microphone]	Speaker is off microphone

P A N E L I S T S

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P R O C E E D I N G S

8:38 a.m.

1
2
3 MR. MASLIA: Good morning. Welcome, everybody, to
4 our expert panel meeting. We're going to wait a few
5 minutes for some other people to arrive that are part of
6 the program this morning. But in the meantime, I thought
7 I would go through some housekeeping rules, if that's okay
8 with everybody. And just to our panel members and
9 everybody else that had to fly in, either yesterday or
10 this morning, through the weather, thank you for making
11 the effort. We appreciate it.

12 And -- so real briefly, for those not familiar with
13 ATSDR campus, we're right over here. And there's a
14 cafeteria here and down here as well is the restaurant in
15 the Century Center hotel plus some other restaurants
16 around. And so, on campus, there's two cafeterias and the
17 restaurant. There will be two buses for lunch from the
18 hotel. We've made arrangements to eat at the restaurant
19 or the dining area at the Century Center hotel.

20 And I'm going to ask for those other guests, the
21 nonpanelists, to allow the panelists to take the first bus
22 -- it holds 12 -- so they can get to the business of
23 eating and getting back. And then there's a second bus
24 that will take anyone else to that, or you're free to go
25 any place off-campus. There's a variety of foods and

1 other establishments.

2 Located on the first floor behind the guard station
3 through the metal detector that you passed through are
4 restrooms and candy machines and Coke machines, if the
5 bottled water or the candy that Ann brought will not
6 suffice.

7 Messages will be at a board near the registration
8 desk, if you need someone to -- if you've got messages.
9 And there's also a telephone out in the outer alcove for
10 you to use. And any copying, faxing, or other needs, Ann
11 Walker, who's staying by the door right there, and Joann
12 -- I don't see Joann. She's out in the hallway -- Joann
13 Flesner have been very gracious to stand by at a moment's
14 notice and at the panel's needs to do anything you need.

15 And you are being recorded, audiotaped. So we ask
16 you to speak into the microphones, primarily for the
17 purpose so ATSDR can have a transcript and a report of
18 your comments so we can deal with them directly after the
19 meeting. There will be a report published of this
20 meeting; not the transcript, but a summary report that
21 will be available to everybody. And we're asking you to
22 silence your cell phones. If you can, just turn them off,
23 which would be our preference. If you have it on vibrate
24 and you're at a microphone, everyone will hear the
25 vibration go off. And for those in the audience, the

1 microphones and the court reporter can pick up your side
2 conversation, even though you're not on mike. So I'll
3 just remind you of that, that it will be picked up.

4 And with that, that's -- any other questions or
5 housekeeping issues? If not, Dr. Sinks, are you prepared?
6 It's my pleasure to introduce Dr. Tom Sinks, who is our
7 director of science and acting administrator for ATSDR.

8 DR. SINKS: Thanks, Morris. Well, good morning to
9 all of you. It's a pleasure to be here. As Morris
10 indicated, I'm the acting director for both ATSDR and the
11 National Center for Environmental Health, a title I've
12 been -- I've had for all of three weeks. And as actings
13 go, that may be a record. Who knows? It could be two
14 more days; it could be two more months. But it's actually
15 -- it's been thrilling, embarrassing, exciting. It's been
16 -- it's been a good ride so far in three weeks.

17 This is a -- this is a great opportunity for us to, I
18 think, do what ATSDR wants to be doing in these very
19 complex sites that we deal with. And the three things, I
20 think, we really want to accomplish here is to make sure
21 that we challenge ourselves to do the best science that we
22 can in what, in this particular example, is a very
23 complex, difficult study that we're trying to conduct.

24 And in this case, it's the modeling of drinking water
25 supplied to people who were living at Camp Lejeune many,

1 many years ago and trying to recreate exposure scenarios,
2 which have occurred pretty far in the past; to do it in a
3 scientifically credible way; and make it as valid as we
4 can. And reconstructing these types of scenarios are
5 quite difficult, and we do need help in trying to do that.

6 So the first thing is the best science. The second
7 thing is trying to do this in a fairly transparent
8 process, to be open to criticism, constructive comments,
9 to let people know what it is that we are trying to
10 accomplish, and to give them that idea upfront so that
11 when we arrive at our conclusions, people have a good
12 understanding of what we were doing and how we were trying
13 to do it. And this panel is helping to play a role for us
14 and when -- to challenge ourselves to the best job that we
15 can.

16 The panel members here are nationally and
17 internationally recognized experts in the areas of
18 groundwater hydraulics, fate and transport analyses,
19 water-distribution systems, numerical-modeling techniques.
20 And we're delighted to have you-all here.

21 Again, our objectives are to secure from the panel
22 members, who are not ATSDR employees but are people from
23 outside of ATSDR, your critiques and your approaches and
24 your recommendations for what we're about to do. This
25 information will be made public.

1 Morris, will we put it on the Web site? Is that --
2 will the report be on the Web site?

3 MR. MASLIA: It's our intent to.

4 DR. SINKS: Okay. So it will also be open to the
5 public just beyond this meeting. And I presume we'll put
6 a response to the recommendations on there as well, how
7 we're going to handle that.

8 My next challenge is to introduce Dr. Barry Johnson.
9 Barry is sitting at the head of the table. He looks
10 younger every time I see him. I think it's because he
11 doesn't have to be the assistant administrator of ATSDR,
12 and I think a great weight has probably come off of his
13 shoulders. He's smiling. It's the first time I've seen
14 him smiling in years. I tend to be chasing Barry around.

15 Barry -- I've known of Barry since 1985 when I became
16 an EIS officer assigned to NIOSH. As soon as I arrived to
17 NIOSH, Barry took off. He left NIOSH, and he went to
18 ATSDR where he effectively really became the first
19 assistant administrator of ATSDR, pulling it away from
20 CDC, creating a separate agency and really building it to
21 what it is today. Barry retired in 1986 -- no. That's
22 the wrong date; 1999.

23 DR. JOHNSON: It depends on how you interpret
24 retirement (laughter).

25 DR. SINKS: Barry left ATSDR in --

1 DR. JOHNSON: 1999.

2 DR. SINKS: -- 1999 and has joined the Rollins School
3 of Public Health over on Clifton Road as an adjunct
4 professor there. He's currently working on a lot of
5 editorial boards. He's writing books. He has one in
6 publication right now, and it's his job to give you-all a
7 charge for this conference and to lead this throughout the
8 next couple of days. I do plan to stop in from time to
9 time during the course of the next two days. I won't be
10 able to attend the entire meeting, but I wish you-all
11 success in a fairly difficult and complex situation.

12 So thanks a lot and, Barry, I think it's all yours.

13 DR. JOHNSON: Thank you, Dr. Sinks, for those kind
14 remarks and sage advice to the panel. We have a full
15 agenda ahead of us over the next two days, building upon
16 the direction that Dr. Sinks has provided to us. As you
17 all know, I'm sort of a last-second fill-in for someone
18 else, and I certainly look forward to trying to be as
19 helpful as I can.

20 When Mr. Maslia called me about a week ago and said
21 he needed a Chair, I listened. And I then reminded him of
22 my retired status, my membership as a senior citizen, and
23 so forth and so on. I said, "Morris, I'm willing to
24 consider this, but there are many personal sacrifices I
25 have to bring to your attention and -- for example,

1 foregoing my morning, afternoon, and early evening naps;
2 my shawl; my warm cocoa; and, of course, the prune juice."

3 And he said, "Johnson, these sound more like excuses
4 than sacrifices." And with that unassailable logic, I
5 signed on. So I look forward to working with you over the
6 next couple of days. Perhaps, we can get it done in a
7 little bit less time.

8 The agency has asked me to present both a statement
9 from the Chair as well as the charge to the panel. I'm
10 assuming that you have the charge to the panel, but, I
11 will nonetheless go through it shortly. With regard to
12 the purpose and scope of this expert peer review panel, it
13 is to assess ATSDR's efforts to model groundwater and
14 water-distribution systems at the U.S. Marine Corps Base,
15 Camp Lejeune, North Carolina.

16 This work includes data-collection activities, field
17 investigations, and water-modeling activities that were
18 performed through -- from March through December 2004.
19 The panel is specifically charged with considering the
20 appropriateness of ATSDR's approach, methods, and time
21 requirements related to water-modeling activities. It is
22 important to understand that the water-modeling activities
23 are in the early stages of analysis; hence, the data and
24 interpretations are subject to modifications based in part
25 on information provided by members of this expert panel.

1 ATSDR expresses a commitment to weigh questions from
2 the public and to respond to public comments and
3 suggestions in a timely fashion. However, in order for
4 this panel to complete its work, it must focus exclusively
5 on water-modeling issues. Therefore, the panel will
6 address questions and comments that pertain to the water-
7 modeling effort. All other questions and statements will
8 be referred to ATSDR staff for consideration and response.

9 In particular are -- the ATSDR contact for nonwater-
10 modeling questions is Dr. Frank Bove and -- who will
11 handle questions related in particular to the
12 epidemiological work, and Mr. Morris Maslia and associates
13 will handle the water modeling and other water-related
14 questions.

15 Any reactions from the panel? Tread on any toes?
16 You okay with that?

17 (No audible response)

18 DR. JOHNSON: I think the bottom-line message here is
19 that this is a meeting for the next two days that's going
20 to be focused on the water-modeling activities. I
21 understand there have been other meetings that have
22 focused on other things and so forth. Do you each have a
23 copy of the charge to the panel?

24 (No audible response)

25 DR. JOHNSON: I will read most of that for -- just to

1 be sure that it's in the record and it's put before the
2 public and would suggest that you follow along as I go
3 through this.

4 The Agency for Toxic Substances and Disease Registry,
5 ATSDR, is requesting the panel's opinion with respect to
6 the following questions. ATSDR is seeking a majority
7 opinion with opposing views. First, will ATSDR's approach
8 of using "50-foot cell sizes" for groundwater modeling and
9 all pipes, networks for water-distribution system models
10 provide sufficient detail required by the epidemiological
11 case control study? Should coarser, variable-spacing
12 groundwater-model grids or skeletonized-pipe networks for
13 water-distribution system models be considered in an
14 effort to reduce the length or duration of modeling
15 activities?

16 Two, is the ATSDR approach of simulating monthly
17 conditions using water-distribution system models sound,
18 or should ATSDR consider using a continuous simulation for
19 the historical period; i.e., 1968 through 1985? If
20 continuous simulation should be used, does this approach,
21 A, increase or decrease the work effort with respect to
22 modeling activities? B, increase or decrease the level of
23 uncertainty and variability of simulated results?

24 Three, based on information provided by ATSDR to the
25 panel, are there modifications or changes that ATSDR

1 should consider making in its approach to modeling, A,
2 groundwater resources at Camp Lejeune; B, present day;
3 i.e., 2004, and historical reconstruction of water-
4 distribution systems serving Camp Lejeune? If, in the
5 panel's majority opinion, ATSDR should consider changes in
6 its approach, what specific changes does the panel
7 suggest?

8 And fourth, compared with other publicly documented
9 historical-reconstruction analyses, is the three-year
10 project schedule for completing all historical-
11 reconstruction modeling activities appropriate and
12 realistic for the amount of work and level of detail
13 required by the epi study? If, in the panel's majority
14 opinion, ATSDR should modify the project schedule, what
15 specific actions and activities does the panel suggest
16 ATSDR take to modify the project schedule?

17 That is the charge to the panel as developed by
18 ATSDR. Any questions or reactions at this time to either
19 the statement or the charge to the panel? It is the
20 Chair's intent on Day 2 to go through each of these four
21 charges, beginning at the "working lunch" on Tuesday. And
22 at minimum, I anticipate providing your reactions, your
23 advice to the first two charges at the working lunch.

24 If we work in, perhaps, an exceptionally, efficiently
25 way, then we might try to go through Charges 3 and 4. But

1 at least we'll do the first two charges tomorrow at lunch.
2 Charges 3 and 4, if they remain unaddressed, will be
3 subject to our discussion at the 2:30 period.

4 The take-home message to the expert panel is that we
5 will provide answers to our -- the best of our ability to
6 each of these four charges. Is that okay with the panel?

7 (No audible response)

8 DR. JOHNSON: At this time, I'd like to ask each of
9 the panel members -- and as Dr. Sinks said, it's truly an
10 internationally distinguished panel, and we welcome you to
11 Atlanta. Sorry the weather wasn't a bit better, but it's
12 that time of the year, folks, in Atlanta; pop-up storms.

13 I'd like to ask each of you to introduce yourself,
14 your affiliation, experiences related to this panel's
15 work. And I think I'll ask each of you, as you go through
16 your introductions, to give an initial but pithy, succinct
17 reaction to what you have read, the information that was
18 provided to you. I'm not asking you to pass judgment at
19 this time. That's going to be the product of our
20 deliberations, your deliberations in particular, but just
21 an initial reaction to what you have received. Okay.

22 Let's start to my right, if we could, with Dr.
23 Walski.

24 DR. WALSKI: Okay. My name is Tom Walski. I'm with
25 the Haestad Methods Group within Bentley Systems. I've

1 been doing water-distribution analysis work since the
2 seventies and have worked on systems ranging from
3 outhouses at rec areas to the New York City water-supply
4 system. I've done some reconstruction of water quality,
5 in one case with Ben Harding, who's showing up later on.
6 So I have some experience in doing this kind of
7 reconstructive work as well. And my initial pithy
8 reaction is: Gee, I wish I had the budget that these guys
9 had when I was doing my work.

10 DR. JOHNSON: Thank you. Dr. Singh.

11 DR. SINGH: Yes. My name is Vijay Singh. I am a
12 faculty member at Louisiana State University. I have been
13 involved for many, many years in hydrologic modeling, both
14 in surface water as well as groundwater modeling. I have
15 also been involved in this kind of analysis as well as
16 stochastic modeling, which has involved some
17 reconstruction work, more specifically in the area of
18 groundwater, particularly the area of surface water as
19 reconstruction codes.

20 My reaction, based on reading the reams of papers and
21 reports that we were supplied, is a very positive one. I
22 was much impressed with the level of effort and the
23 scientific rigor with which the work has been done.

24 DR. JOHNSON: Thank you. Please.

25 DR. POMMERENK: My name is Peter Pommerenk. I'm with

1 AH Environmental Consultants. We specialize in water
2 resources, water treatment, water distribution. In such,
3 we are involved in water master planning and treatment
4 studies and treatability studies. We also do some water-
5 distribution system modeling, although we don't use
6 Haestad methods at this time.

7 My particular expertise for this panel is that AH
8 Environmental Consultants has been consulting with Camp
9 Lejeune for several years in the water resources and
10 treatment-distribution system arena. And we have also as
11 such supported the Marine Corps in their efforts to
12 collect data for this ATSDR study.

13 My initial reaction, when I got first involved in
14 this project -- as I said, this is a huge effort. And
15 what has been collected today is really impressive. Thank
16 you.

17 DR. JOHNSON: Thank you. Let's just continue.

18 DR. CLARK: My name's Robert Clark. I spent 41 years
19 with the federal government in the U.S. Public Health
20 Service in the U.S. EPA as a public health service officer
21 for 30 years. And during that time, I was director of the
22 drinking-water research division -- water-resources
23 research division for EPA for about 14 years and then for
24 three years as a senior scientist in the agency and then
25 retired in -- about three to four years ago. And since

1 that time, I've been consulting and am an adjunct
2 professor at the university, which is keeping me busy as
3 well.

4 Very impressive. I had a chance to work with Morris
5 early on when he was working on the Toms River project.
6 They've come a long ways; very impressive technical
7 effort. I think the questions are even more challenging
8 in terms of how can you extend this now to exposure
9 epidemiology.

10 DR. DOUGHERTY: My name is Dave Dougherty. I'm from
11 Subterranean Research in Massachusetts. I spent 15 years
12 as a faculty member in civil and environmental engineering
13 in California and Vermont. My background started in
14 groundwater and moved to modeling and moved to
15 optimization and more -- slightly more on the IT side now.

16 I think the things that I bring to this particular
17 table are the integration of groundwater modeling and
18 optimization kind of activities, experience with a lot of
19 models in the past, and the most interesting connection is
20 when Roger Page and I, in 1985, I think, built the first
21 3-D model for Toms River; so just trying to connect the
22 loop.

23 My reaction is there's been a lot of -- there's been
24 a lot of good work here. It is in many ways, in many
25 ways, very far advanced in particular narrow areas for the

1 project. As a whole, I think we have a lot of
2 opportunities to make contributions to the directions that
3 need adjustment, and I'm looking forward to it.

4 DR. JOHNSON: Thank you.

5 DR. UBER: My name is Jim Uber. I'm an associate
6 professor at the University of Cincinnati in the
7 department of civil and environmental engineering. I'm an
8 environmental engineer. My research area is water-
9 distribution systems analysis. I've been working in that
10 area for about 15 years and have, kind of like David,
11 focused to some degree on optimization studies and
12 calibration techniques for models, particularly on water-
13 quality models for water-distribution systems and as well
14 as doing some fieldwork and tracer tests.

15 And my initial reaction is that I thought that the
16 data that was provided was very comprehensive and in
17 particular on the water-distribution systems' side. The
18 -- for example, the fieldwork is certainly very much state
19 of the art in that area, and I think a central question
20 for me is exactly how that fieldwork and those data link
21 back to the needs of the epidemiological study and how
22 they connect up in a logical way with the historic data
23 that is or is not available for what happened some years
24 ago.

25 DR. JOHNSON: Thank you.

1 DR. KONIKOW: My name is Lenny Konikow. I'm a
2 research hydrologist with the U.S. Geological Survey.
3 I've worked for them for over 30 years; to a large extent,
4 working on the development and application of solute-
5 transport models, contaminant transport models for
6 groundwater systems. One of the first applications I was
7 involved in was reconstructing the history of groundwater
8 contamination at the Rocky Mountain Arsenal in Colorado,
9 which was kind of the forerunner of the whole installation
10 and restoration program in the Department of Defense.

11 One of my concerns, reading through all the
12 documentations and thinking about this, is the lack of
13 historical data from the fifties, sixties, on into the
14 seventies. And I see that as presenting a very difficult
15 hurdle to overcome in trying to develop the quantitative
16 models. There's going to be invariably a lot of
17 uncertainty associated with the results of the very
18 quantitative models.

19 And as Jim said, I'm also a little concerned that I
20 don't have a firm feeling yet -- and I hope I get it today
21 -- for what -- how the models will be put to use. What is
22 needed by the epidemiological studies to come out of the
23 models? And for us to evaluate the models and the
24 approach to modeling, I think we need a clearer -- or at
25 least I need a clearer understanding of how the models are

1 going to be used in terms of the epidemiological studies.

2 DR. JOHNSON: Thank you. We have two other panelists
3 who will be arriving a little bit later: Mr. Harding and
4 Dr. LaBolle. Did I pronounce that correctly? We look
5 forward to their joining us. Any questions across the
6 table to each other?

7 (No audible response)

8 DR. JOHNSON: My hope is that this is truly an
9 interactive panel, and I encourage dialogue, questions
10 back and forth across the table amongst the panelists.
11 And to the extent that I can help clarify, I will try to
12 do that. But this is your panel, and this is your
13 opportunity, as we've already heard, to have some concerns
14 and some really important questions placed on the table
15 already. So keep that up.

16 I think, at this time, there's going to be an
17 introduction of the epi team and the water-modeling teams,
18 Dr. Bove, and Mr. Maslia.

19 DR. RUCKART: Good morning. I'm not Dr. Bove, by the
20 way. I'm going to be discussing a summary of ATSDR
21 activities at Camp Lejeune and hopefully answering your
22 question of how the water-modeling component will fit in
23 with epi study.

24 DR. JOHNSON: Would you introduce yourself, please.

25 DR. RUCKART: Yep; next slide.

1 DR. JOHNSON: We'd love to know who you are.

2 DR. RUCKART: My name's right there. I'm Perri
3 Ruckart. I'm the principal investigator of the epi study,
4 and my other team members include Dr. Frank Bove, Miss
5 Shannon Rossiter, and Dr. Morris Maslia, who I believe
6 everyone knows.

7 Next slide, please.

8 The base began operations at Camp Lejeune in the
9 1940s. Currently, there's a population of about 150,000
10 living or working on the base, including active military
11 personnel, their dependents, retired population, and
12 civilian employees. Almost two-thirds of the active
13 military personnel and their dependents are under age 25.

14 Next slide.

15 Because this is a military base, there has been
16 considerable in-and-out migration. It is estimated that
17 about one-third of the mothers receiving prenatal care at
18 the base hospital during the 1970s and '80s were
19 transferred off base before delivery, and the average
20 duration in base-family housing is two years. There are
21 15 different base-housing areas. And there are three
22 water-distribution systems serving the base-family housing
23 area: Hadnot Point, Tarawa Terrace, and Holcomb Boulevard.
24 And the dates they were constructed are shown here on this
25 slide.

1 Underground storage tanks were installed during the
2 1940s and '50s, which contaminated the Hadnot Point wells,
3 primarily, with TCE. And ABC One-Hour Cleaners began
4 operations on the base in 1954, and the cleaners were near
5 the supply wells for Tarawa Terrace, and that water system
6 was primarily contaminated with PCE.

7 ATSDR published a public health assessment for Camp
8 Lejeune in 1997. Because of the limited information in
9 the scientific literature on how chlorinated solvents in
10 drinking water might affect a fetus or a child, the public
11 health assessment recommended that we conduct an
12 epidemiologic study to evaluate whether maternal exposure
13 was associated with the higher risk of having an adverse
14 birth outcome or whether maternal or infant exposure was
15 associated with a childhood cancer.

16 As a first step in following up the public health
17 assessment recommendation, ATSDR published a study in 1998
18 which evaluated potential maternal exposure to drinking-
19 water contaminants on base and preterm birth, small for
20 gestational age, and mean birth-weight deficit. Only
21 available databases were used, such as electronic birth
22 certificates, which were available beginning in 1968, and
23 base family-housing records.

24 There was insufficient data available for the 1998
25 study to evaluate fetal deaths. The study did find an

1 elevated risk for SGA, small for gestational age, only
2 among male infants exposed to Hadnot Point water, which
3 was primarily contaminated with TCE. And the study also
4 found an elevated risk for SGA among infants born to
5 mothers who were greater than 35 years of age and mothers
6 with two or more prior fetal losses who were exposed to
7 Tarawa Terrace water, which is primarily contaminated with
8 PCE.

9 Because the 1998 study could not evaluate birth
10 defects or childhood cancers, the current study will look
11 at these outcomes, using a case control approach. It is a
12 multistep process, and the first step involved a review of
13 the scientific literature to identify specific birth
14 defects and childhood cancers that were associated with
15 drinking water contaminated with VOCs.

16 Next slide, please.

17 And this slide shows the outcome selected for further
18 study based mainly on evidence from the epi studies of
19 VOC-contaminated drinking water.

20 The second step in this process was to conduct a
21 telephone survey to identify the potential cases of the
22 selected birth defects and childhood cancers occurring to
23 mothers who were pregnant at any time during their
24 pregnancy and living at Camp Lejeune during 1968 to 1985.
25 And the survey needed to address the questions shown here.

1 Can you go back for a second. Okay.

2 And as part of the telephone survey, ATSDR surveyed
3 parents of 12,598 children. This is an overall
4 participation rate of approximately 74 to 80 percent. And
5 the survey identified sufficient numbers of neural tube
6 defects, oral clefts, and childhood cancers. 106 cases
7 were reported, including 35 neural tube defects, 42 oral
8 cleft defects, and 29 childhood cancers. And the
9 childhood cancers include leukemia and non-Hodgkin's
10 lymphoma.

11 Next slide, please.

12 The third step is to verify the diagnoses of the
13 reported cases. To date, 24 reported cases have been
14 confirmed as not having the condition of interest or being
15 ineligible or refused. That leaves us with 82 children
16 with pending or confirmed conditions. And by pending, I
17 mean we are still looking for evidence to verify they have
18 their condition. That includes, for the neural tube
19 defects, 15 confirmed as having that condition. Thirteen
20 are still pending. For the oral clefts, 20 confirmed as
21 having that condition and 16 still pending. And for the
22 childhood cancers, 14 confirmed as having that condition
23 and four still pending.

24 The study will include 818 controls, who were sampled
25 from the original survey population. This is a ratio of

1 about ten controls to cases. Interviews will begin in the
2 spring and continue through the summer of this year. And
3 they will be administered to parents of the cases and
4 controls to obtain information on maternal water-
5 consumption habits, residential history, and parental risk
6 factors. We anticipate a 90 percent participation rate
7 based on previous contact with this population and the
8 interest that they've shown in our work.

9 An important part of the current epi study is the
10 water-modeling component. There's a lack of historical
11 contaminant-specific data at Camp Lejeune. To provide a
12 quantitative estimate of exposure, a historical-
13 reconstruction approach is needed, consisting of modeling
14 the groundwater flow and present-day distribution systems
15 at Camp Lejeune and extrapolating backwards in time. The
16 water-modeling component needs to address the following
17 questions shown on this slide.

18 Next slide. Oh, go back. Can you go back, please.

19 DR. KONIKOW: Do you define "exposure" as just being
20 the presence or absence of a contaminant, or are you
21 interested in knowing the concentration of the
22 contaminant?

23 DR. RUCKART: We would like to know the
24 concentration, and our hope would be to group them into
25 some kind of high, medium, low exposure. But it's going

1 to be dependent on what is available. That's our ultimate
2 goal.

3 And the goals of the water-modeling component are to
4 determine when the contamination arrived at the wells and
5 the spatial and temporal distribution of the contaminants
6 by housing location. And I'd like to conclude with the
7 study time line.

8 Are there any questions? We'll be here throughout
9 the panel if things should come up.

10 DR. JOHNSON: Could you go back, please, to the
11 couple of slides previous; one more; stop. Thank you.
12 No; the one that says "Current ATSDR Epi Study; that one;
13 try again; stop. Thank you.

14 My question, I guess, is to Mr. Maslia. Are these
15 questions to be addressed in the water-modeling component
16 part of what has been put before this panel? Or are these
17 questions that are, maybe, new?

18 MR. MASLIA: Part of the -- some of the questions are
19 to be addressed by this panel. We've -- you want me to
20 speak into the microphone, I guess. Let me just come over
21 here and sit down.

22 Some of the questions have been put forth in the
23 discussion, for example, at Tarawa Terrace where the
24 source is located, the strength of the contaminant source.
25 Others, for example, like at the Hadnot Point, we

1 obviously have not addressed that issue at this point in
2 time. And that's an issue for us to discuss and to
3 address, both with information that we may present or
4 elucidate to the panel now in some of the complexities at
5 Hadnot Point, as opposed to Tarawa Terrace.

6 Which chemical compounds were supplied? Again, at
7 Tarawa Terrace, it is our intention -- and the data that
8 we have presented has at this point indicated that PCE,
9 PERC, is the primary contaminant, and that's what the
10 modeling to date has been done on. We have not looked at
11 modeling-degradation products, say, TCE to DCE and TCE.

12 Hadnot Point, again, presents a much more complex
13 issue because, as Perri has alluded to, it's primarily
14 TCE, but there was underground-storage tanks as well. And
15 we just have not -- I'll get into -- actually, when I give
16 an overview of the water-modeling activities as to our
17 rationale for going in one direction right now. But we
18 have not addressed that issue.

19 How was the contaminated water distributed is a main
20 focus of our investigation. And we start out -- our
21 approach is to try to understand what's going on today
22 simply because of the lack of historical data, and I will
23 get into a little bit later on our approach for
24 deconstructing the system, if that's the way, actually, we
25 proceed. That is, indeed, a required step that we go.

1 Lenny, did you have a question? Yes.

2 DR. KONIKOW: In terms of the water distribution and
3 the goals of that modeling, are you aiming to actually get
4 exposure down to the household level?

5 MR. MASLIA: We're aiming to get it down to the
6 street level. Now, at Camp Lejeune, it so happens -- and
7 we'll get into this -- the distribution is built such that
8 it's a looped system so that each house is serviced by a
9 pipe, as opposed to, say, an area like Dekalb County or
10 even Toms River, where maybe there was a 4-inch main
11 running down the street and we did not model any of the
12 attached or smaller diameter pipes.

13 But the way the distribution system is constructed at
14 Toms -- I mean, at Camp Lejeune, you really have a 2-inch
15 pipe going from the street to the house. So in essence,
16 by default, you've got houses attached or implied in your
17 distribution-system modeling.

18 However, I think it's important also to tell the
19 panel as well as the public is -- as with other
20 contamination sites that we have looked at, we are
21 actually blinded to the cases and controls at the site.
22 ATSDR people modeling the groundwater and distribution
23 system, we haven't been provided nor are we asking for any
24 specific information as to who resides, who's included in
25 the cases and controls so that it is our approach that any

1 models that we develop or any analyses -- let's make it
2 more general -- should be robust enough that if you say
3 you want Location XYZ, you should have as much confidence
4 in the results that we give you for Location XYZ as
5 Location ABC. And that is our approach, but we are
6 blinded. So hopefully, that's addressed your question.

7 DR. BOVE: I just want to say one more thing that one
8 of the questions earlier was: How are we going to
9 categorize exposure? And as it was done in Toms River and
10 Woburn, where they just focused on the percent of the
11 water coming from a contaminated well during a month and
12 then averaging over that for the exposure window, we'll be
13 doing something like that. They had three categories in
14 the Toms River study. Woburn was ever-never, and then
15 they did have three categories, again, of exposure, the
16 high one being the upper tenth percentile, if I remember
17 right.

18 But the numbers get small when you start doing that.
19 And I have some tables, and we can discuss the impacts of
20 exposure misclassification bias and some of that during
21 the panel discussion at some point during the day, if you
22 want.

23 DR. JOHNSON: Yes.

24 DR. WALSKI: I think just to put things in
25 perspective, you said there were about 80-some cases of

1 illnesses that are -- were determined in the study group.
2 About what would the number of illnesses be out of the --
3 like, an average population? Would it be, like, many
4 times above what we would expect? Or is it only
5 marginally, or what's the perspective?

6 DR. BOVE: Well, part of the problem here is the way
7 we had to ascertain cases. Ideally, you would like to
8 have a cancer registry, or you would like to do your case
9 ascertainment through hospital records. We had to do it
10 through a survey. So this is not the most optimal way,
11 but it was the only way to do ascertainment of cases.
12 That being said -- and all the comparison data is based on
13 medical records data or cancer registries, like the Sierra
14 Cancer Registry, or birth defect registries, like the one
15 in Atlanta.

16 It's hard to really compare the two. But if you
17 want, these are -- what we've -- both the reported
18 positive ones that we verified and the ones we're still
19 working on, if you combine those two, we have slight
20 elevations here in the -- I would say the realm of two
21 times what we might expect for some of the end points.

22 But, again, there are problems with that. Not
23 everybody was exposed at Camp Lejeune either. And the way
24 we ascertained them was different than the databases we
25 would compare them to.

1 DR. JOHNSON: Other questions? Dr. Singh.

2 DR. SINGH: So here the assumption was that the
3 increase was attributed to the water contamination?

4 DR. BOVE: No. We didn't want to do that. We wanted
5 to use the survey to ascertain cases and do the study with
6 the modeling that Morris -- and you're going to be
7 commenting on. We did not want to say straight off
8 whether the -- it was an excess, number one, because we
9 wanted to verify the cases. At the time of the survey,
10 it's only self-reporting -- or parent-reported cases. And
11 so we wanted to verify those cases.

12 And secondly, because of all the problems with the
13 water information, new information we've been getting over
14 the -- well, not so new actually, over the last few years
15 that things we thought we knew about the water system,
16 information we got about the water system was not quite
17 correct and that, in fact, the study that Perri mentioned
18 that we completed in '98 probably needs to be revisited.

19 Most definitely, it needs to be revisited because
20 assumptions made in that based on that information at the
21 time, but we find it was incorrect. So we didn't want to
22 do anything until the modeling was done, and we -- and
23 base whatever we do on better information.

24 DR. CLARK: Are we going to have a chance to look at
25 other compounding effects?

1 DR. BOVE: We -- well, as Perri pointed out, we're
2 doing an interview of the cases and controls. That's one
3 of the nice things about doing a case-control sample. You
4 have a small enough group so you can do extensive
5 interviewing and go over all the other risk factors that
6 are either suspected or known for these outcomes.

7 DR. JOHNSON: Do the members know the essentials of a
8 case-control epi study? Are you-all real comfortable with
9 that?

10 DR. BOVE: Well, we can -- we -- again, that's
11 something we can go into in-depth at any point during the
12 day.

13 DR. JOHNSON: Could you give us about two minutes
14 now?

15 DR. BOVE: Okay; two minutes? Okay. Well, I mean,
16 you have -- we're not sure how many pregnancies occurred
17 at the base between 1968 and '85 because many were
18 transferred. We had to guesstimate that about a third of
19 the people who were pregnant there migrated off-site --
20 transferred basically off-site before they delivered. So
21 we knew how many births on base. That was about 12,400
22 and some. And we assumed another 3,000 or so were
23 transferred off base and delivered elsewhere, so roughly
24 around 16,000.

25 Now, you have 16,000. You can't interview them all;

1 right? That would be an incredible undertaking. That's
2 one approach. Another approach is to take a random
3 sample. But when we have rare diseases, that's not a good
4 approach because you take a random sample and may not get
5 any of the cases in that random sample of 16,000. So the
6 approach you take within a disease that's rare, like this
7 situation, is what we call case-control sample.

8 DR. JOHNSON: You're speaking of birth defects;
9 correct?

10 DR. BOVE: We're talking about birth defects. We're
11 talking about, in particular, neural tube defects, which
12 is spina bifida and anencephaly. We're talking about oral
13 clefts, which is cleft lip and cleft pallet. And we're
14 talking about childhood leukemia and childhood non-
15 Hodgkin's lymphoma. And those are all rare events, those
16 diseases that we're focusing on.

17 And so the approach has been to gather all the cases
18 from that population at Camp Lejeune, keeping in mind that
19 the population at Camp Lejeune of births, both born on
20 site and born off site, some were exposed; some were not
21 exposed; right. That's the question we're going to be
22 asking you is hopefully is will the modeling be able to
23 tell us with some assurance who's exposed at least and who
24 wasn't exposed. If we can get that, that's one step.

25 And then, of course, we'd like to have -- be able to

1 define it better than that. But that's the first
2 consideration. So we have a population here, some of whom
3 are exposed, some of whom are not exposed during their
4 pregnancy. And we take -- we get all the cases from that
5 population, and then we take a random sample of that
6 population to give us a control series. And that's the
7 case-control series.

8 Now, in some methodologies, you sample your control
9 series irrespective of whether they were -- what their
10 disease status was. That's one approach. A lot -- most
11 often, though, you sample the nondisease, those people in
12 the population that did not have the case -- the diseases
13 you're focusing on. So that's basically what we're
14 talking about: a case-control sample, the most effective
15 way of doing these kinds of studies. It was also the
16 approach taken in Woburn, the approach taken at Toms
17 River.

18 DR. SINGH: So why do you have some people not
19 exposed if they were living on Camp Lejeune?

20 DR. BOVE: Well, we're -- see, that's the question.
21 We -- in the previous study, we thought that about half of
22 the births were unexposed because they were getting water
23 from the Holcomb Boulevard system. And at that time, we
24 assumed that the Holcomb Boulevard system was clean.
25 Okay? So that study, half -- about half the births were

1 unexposed.

2 Now we're not sure about anything, or at least I'm
3 not. I'm waiting to hear from the discussion. There may
4 be interconnections between Holcomb and Tarawa Terrace.
5 The -- before '73, the people who -- the residences that
6 got Holcomb Boulevard water got Hadnot Point before that.
7 And so we thought that they -- for some reason, we didn't
8 know what their exposure was. We assumed they were
9 unexposed. That was a bad assumption probably.

10 So we don't know the percent unexposed. I mean,
11 that's what the modeling effort's going to have to tell
12 us. That's why we have to revisit those previous -- that
13 previous study.

14 DR. RUCKART: There's another piece about those also
15 when during the pregnancy that the mother was exposed.
16 And we're hoping to have that information as well if they
17 were exposed in the first trimester or later. It depends
18 on when they were actually residing at Camp Lejeune.

19 DR. JOHNSON: David, you had a question.

20 DR. DOUGHERTY: It actually follows on that one, and
21 it is: You addressed the issue of the spatial resolution
22 desired. What temporal resolution of exposure is desired
23 from these studies?

24 DR. BOVE: Well, for neural tube defects and oral
25 clefts, the window of exposures is the first trimester.

1 And actually, for neural tube defects, it's Day 20 to 24,
2 roughly. So we're not asking for day. But we are asking
3 for a trimester with the idea that, you know, that the
4 exposure windows for neural tube defects and oral clefts
5 is quite small. Okay.

6 Now, childhood leukemia and childhood non-Hodgkin's
7 lymphoma, we are not sure. We -- from the studies I've
8 seen, the initial cause for the disease appears to be
9 prenatal. So again, we're interested in most often --
10 mostly in prenatal exposures for this study as a whole for
11 all the outcomes.

12 DR. JOHNSON: Other questions? Yes, please.

13 DR. UBER: Just to -- I think I know the answer to
14 this, but just to clarify. The study is not concerned
15 with any fetuses that would not have made it to a live
16 birth that might have had a cause from contamination?

17 DR. RUCKART: Right; because it's difficult to
18 ascertain that. If we could, that would be ideal. But
19 it's just not really possible here.

20 DR. JOHNSON: Yes.

21 MR. MASLIA: Just to help everybody get oriented, I
22 think during a subsequent presentation, I've got some maps
23 and some slides, so we're all calling the same parts of
24 the base the same names and things like that. And we'll
25 define that for everybody, so...

1 DR. JOHNSON: Thank you. Any more questions to Dr.
2 Ruckart or Dr. Bove? I have one last question to PI.
3 This isn't a question but a comment. The question will
4 follow. It looks like these five questions in the main
5 are -- have been in some way put before the panel. Do you
6 feel that that's true? I mean, are you okay?

7 MR. MASLIA: Absolutely.

8 DR. JOHNSON: Okay. I would --

9 DR. RUCKART: We work together.

10 MR. MASLIA: We even talk with each other.

11 DR. JOHNSON: Lord, the agency has indeed changed
12 since I left (laughter). I'm so glad I'm sitting down. I
13 would invite the epi team, starting with this principal
14 investigator, to place before this panel at any time
15 questions that you feel have not been addressed or have
16 not been addressed to your satisfaction because this work
17 in terms of the water modeling absolutely has to be vital
18 in support of your work. And now is an excellent time to
19 get things, you know, you always wanted to ask. Put it in
20 front of this group, and you will have profound answers.

21 Now my question: You mentioned work that's upcoming
22 in the spring of 2005. Has that work begun?

23 DR. RUCKART: We are actually traveling up to
24 Maryland this weekend to be part of the training for the
25 interviewers, and interviews are scheduled to begin Monday

1 night or Tuesday morning by the latest. That will be next
2 Monday and Tuesday.

3 DR. JOHNSON: Do you foresee anything that this panel
4 will do over the next two days as having impact for the
5 spring work?

6 DR. RUCKART: I don't believe so.

7 DR. JOHNSON: Okay. Well, thank you very much for
8 your presentation. Mr. Maslia, a summary of water-
9 modeling activities.

10 MR. MASLIA: Let me get the summary of water-modeling
11 activities. Actually -- no. Let's go to project staff
12 first; yes. Thank you. I've got it. I've got it.

13 DR. JOHNSON: And there are handouts here for the
14 panel.

15 MR. MASLIA: The panel, yes. Some of the handouts
16 are copies of this slide, and if any of the slides that we
17 show that you would like copies of, please let me know or
18 let Ann Walker know, and we'll try to provide those for
19 you.

20 DR. JOHNSON: Are these available to the public
21 outside?

22 MR. MASLIA: Some of them are. The ones that contain
23 actual model simulation and data are not because they have
24 not been cleared by the agency and subject, obviously, to
25 panel deliberations. And so those are not available to

1 the public. But we do have posters and maps, showing some
2 information that everyone's free to look at and peruse,
3 and we'll be pointing to.

4 Let me officially, I suppose, introduce myself. My
5 name's Morris Maslia. I'm a project officer of the
6 Exposure Dose Reconstruction Program at ATSDR. And I was
7 approached by Dr. Bove and his predecessor to take part in
8 the Camp Lejeune epidemiologic study and looking at some
9 of the techniques that we used for the Dover Township
10 analyses and seeing if those, in fact, could be used or
11 something similar to that could be used.

12 I've introduced myself. Also from ATSDR is Jason
13 Sautner over here. Jason did the bulk of the modeling
14 work at Dover Township and had his intentions on doing the
15 modeling here. But as things progressed, Jason has really
16 helped us developing some of the field approaches and
17 field protocols for the tracer tests on the water-
18 distribution system modeling and setting those up, setting
19 up the field type of analyses and data gathering. And so
20 he's been more involved in that respect up until this
21 point.

22 We also have -- we used the Oak Ridge Institute for
23 Science and Education to get postgraduate research fellows
24 to assist us. Claudia Valenzuela has unfortunately been
25 relegated to helping us with logistics on the slide screen

1 back there. I don't mean to point the laser at you,
2 Claudia. It's like *Star Wars*.

3 But Claudia has really done the lion's share of the
4 water-distribution system analyses that were presented in
5 the notebooks and also has done a tremendous job in
6 investigation in trying to figure out this issue of
7 classification of different types of consumption and
8 demand. We'll get into that. Obviously, being a military
9 reservation, we may not have a simple case of residential,
10 urban, industrial-type classifications.

11 Also just joining us this past October is Joe Green,
12 and Joe's background is in medical geography. And all of
13 the nice posters and the spatial analysis work, Joe has
14 helped us out. He goes back and forth between the
15 distribution-modeling results and the groundwater-modeling
16 results, helping us put together and pull different
17 aspects of the data.

18 And as far as groundwater modeling and fate and
19 transport modeling, we have Robert Faye, who is sitting
20 over there. And Bob spent -- and I had my notes. It's
21 probably on another slide here but -- I believe, 27-1/2
22 years in U.S. Geological Survey; 12-1/2 or so, he was the
23 regional groundwater specialist for the southeast region
24 at USGS. And he has been doing the groundwater -- not
25 only groundwater modeling, but the geohydrologic

1 framework, culling through the data files for the
2 groundwater aspect of the analyses.

3 And then finally, we also have Dr. Mustafa Aral, who
4 is sitting right at this table. And we have a cooperative
5 agreement with the multimedia environmental simulations
6 lab at Georgia Tech. They assisted us with our Dover
7 Township work and are involved -- I expect to be even more
8 involved when we start tackling this issues of uncertainty
9 modeling, operational cycles, and things of that nature.

10 And finally, not present -- and I'm not sure why Dr.
11 Grayman decided that he'd rather be on the beach at St.
12 Maarten than here -- but Walter Grayman, whose background
13 is in water-distribution system modeling, has been an
14 advisor to us, helping plan the tracer tests on the water-
15 distribution side as well as water-distribution system
16 modeling. And as I said, he's an advisor to ATSDR.

17 So that is the project team. I would like to just --
18 and we can revisit this, but I was -- in going through
19 some of the premeeting comments, which we really do
20 appreciate. It helped us focus more on the direction we
21 needed to go and some of the answers we're going to try to
22 at least provide you in a general sense at this meeting
23 and something to work on, obviously, after the meeting.

24 But a couple of questions came up with respect to the
25 charge on the work effort. Obviously, everyone's admitted

1 thus far this is not a small undertaking. And so I put
2 together a couple of slides just very quickly, and you
3 have -- there's a -- should be a packet. If not, we can
4 provide you these in your handout.

5 But this slide sort of shows -- the red bar is the
6 total work effort, the percent of effort. You see, for
7 example, groundwater, we're estimating thus far has taken
8 about 35 percent of the total effort. Water-distribution
9 system modeling is about 40, primarily because of the
10 field and us having to go out in the field and that
11 nature. Data discovery -- this is anything from going
12 through the Marine Corps base facility that they call "the
13 vault" to look through data to other -- finding other
14 sources of information. And then communication, whether
15 that's preparing reports for this meeting, preparing
16 presentations, or ultimately preparing final reports or
17 protocols as to what we did.

18 And just within each subject I subdivided. For
19 example, in groundwater modeling, you've got a data
20 discovery component and you've got a data-analysis
21 component, which would be both geohydrologic and modeling
22 and so forth.

23 You can see that in the water-distribution side,
24 we've got an extremely driving up until this part is the,
25 I believe, that's the data discovery. No. That's the

1 spatial analysis. I'm sorry; spatial analysis. And that
2 is the cause of the complexity, both present day as well
3 as historically, of exactly having documentation of where
4 the pipes were, which treatment plants were operating.

5 A lot of this information originally was on paper
6 copies, and we had to geocode it and all that sort of
7 stuff. Even conducting field tests, locating hydrants,
8 many, if not most, of the hydrants on base are not
9 numbered. And we had to physically send people out there
10 to actually locate and two different people locate two
11 different hydrants and things of that nature. So that's
12 what's driving that.

13 The final slide is more of a budgeting in terms of
14 staff. If you add up all the red bars, it adds up to
15 about four and a half equivalents, full-time equivalents.
16 And so within that, again, you can see the present day.
17 This refers to the present-day water-distribution system
18 modeling. It is really driving the time-consuming and
19 manpower-intensive aspect of the project. So that's just
20 a very quick overview of our staffing from the water-
21 modeling side.

22 And I believe that's all the project staff comments I
23 have, unless someone has any specific questions on those.
24 If not, I think next on is a summary of water-modeling
25 activities. Claudia, if you will -- and I think that's

1 number four; number four -- no. It's number five. Yeah,
2 yeah; right there. That's it. Okay.

3 I'm going to just give a very brief overview of
4 modeling activities, so hopefully you get -- if the
5 written documentation you were providing was confusing
6 enough and voluminous enough to sort of simplify it. And
7 you can go on -- I've got it right here. Okay.

8 Obviously, we're in coastal North Carolina, and we've
9 got some maps here, some aerial photographs. But as Frank
10 mentioned, there are actually seven water-distribution
11 systems. And historically, there have been eight
12 different water-distribution systems at Camp Lejeune. And
13 we are actually concentrating the discussion today in our
14 charge are the ones down in this area right over here.

15 So the ones, for example, at the air base, which is
16 over here, and Onslow Beach, while they have and we may
17 have information on them, they are not part of the
18 analysis that we are undertaking. Basically, Perri
19 reported this information; population of active duty,
20 100,000; and seven water systems supply groundwater at
21 Camp Lejeune.

22 Here are the names of the different systems, and as I
23 said, we're dealing with the Tarawa Terrace, Holcomb
24 Boulevard, and Hadnot Point systems. And in the next
25 slide, what I would like to do -- and we have the posters

1 up, that one over there, and I think if you want to move
2 the second poster. Okay.

3 We have sort of a nomenclature issue. As anybody
4 who's done any groundwater investigation or other
5 investigations, as you get later and later time away from
6 either when the wells were installed or the systems
7 operated, names change.

8 So this is the nomenclature that we are using for the
9 present discussion and for the present-day system. At
10 present, there are two operating water-treatment plants.
11 Water-treatment plants service areas that we are
12 analyzing. And these are the Hadnot Point, which is down
13 to the south here. And we're referring to that as the
14 Hadnot Point water-treatment plant service area. And then
15 there's the Holcomb Boulevard water-treatment plant
16 service area, which is this area.

17 Basically, there are two sets of shut-off valves
18 right along the Wallace Creek here that at present day
19 separates the two systems completely. They're shut off.
20 In terms of actual water-distribution systems, there are
21 three water-distribution systems within the two water-
22 treatment plant service areas. Hadnot -- could you back
23 up? Okay.

24 Hadnot Point happens to service the Hadnot Point
25 water-distribution system area. So it's coincident. The

1 treatment plant services the water-distribution system.
2 However, in this northern area, the Holcomb Boulevard
3 actually services two different distribution systems. One
4 is to the northwest here, the Tarawa Terrace water-
5 distribution system, which presently is combined with
6 service to Camp Johnson.

7 Historically, there was another treatment plant here,
8 which I'll get to in a minute, and then also the
9 distribution system at Holcomb Boulevard area. There is
10 one pipeline here that, once the water is treated at the
11 treatment plant, sends water to an underground reservoir
12 at Tarawa Terrace and based on demand and tank levels
13 would then distribute water just to the Tarawa Terrace
14 area.

15 So are there any questions with respect to
16 nomenclature that we're going to use for the balance of
17 the panel meeting at this point?

18 (No audible response)

19 MR. MASLIA: I'll get to a very brief chronology.
20 We've got some larger boards here. And as Frank said,
21 this chronology has been sort of at times chasing a moving
22 target. And so it remains sort of changing in flux even
23 as we speak. As we get new information or as we get
24 conflicting information, we start changing.

25 But very briefly, the Hadnot -- this is actually as

1 -- I put this together last week, so it's the most current
2 that we have. '43, Hadnot Point was the first
3 distribution system and first treatment plant on base.
4 And then in '51 to '52, the Tarawa Terrace treatment plant
5 was constructed. That's about the time that they also
6 built the housing complex at Tarawa Terrace. And then at
7 '50 -- in '57 was the Montford Point. And the Montford
8 Point actually serviced the Camp Johnson, which is the
9 northwestern-most part of the distribution system.

10 Then we have a big question, which we have not
11 resolved to date yet. We cannot get a month or year as to
12 when Holcomb Boulevard began operating. They've got a
13 picture on the wall that says '73. You know, one of those
14 architectural pictures that -- and we do have an accounts
15 book that we just received a couple of weeks ago that
16 lists when the information is filed into their system.
17 That sort of lists '73 as well. However, documentation
18 that we have just -- that we've just recently received
19 says '71, and that can be a very critical issue.

20 So all I can say is I'm at the panel's mercy. That
21 is a major issue, and, in fact, I think -- and I hope the
22 panel doesn't mind me mentioning names, if you've made
23 some comments. But Tom made a comment about putting some
24 effort into data discovery. I'll call it that. And that
25 still is ongoing and needs to be refined. We're planning

1 to do that some more, but we're going to have to obviously
2 get detailed into the files to figure that out. So I'll
3 just put that up there. We're not sure when in that time
4 frame. And obviously, if the epidemiologic study is
5 looking at months, that becomes an issue.

6 Tarawa Terrace -- when the water-treatment plant was
7 closed, again, we think March. We think 1987. It started
8 back in '85. We just recently obtained some information,
9 a report, that I'm asking for some more background on --
10 that I've asked the Marine Corps for some background on
11 that was written in '91 that makes a statement in there
12 that, "Two years prior," which would be at -- in '89,
13 "that Tarawa Terrace" -- and I'm quoting --- "supplied
14 water to Holcomb Boulevard." That, again, so -- and
15 that's in a consulting report. There may be other
16 information as well, but that's some of the issues we're
17 still dealing with.

18 And finally, in '87, again, we have some
19 documentation that says all the remaining wells were
20 closed. So we -- the issue is we are still in the midst
21 of this data discovery and coming up with a finalized or a
22 time line that, if you want to say, is cast in concrete or
23 stone that's fixed. We're not satisfied with some of the
24 components of the time line at this time. Okay.

25 Goals and objectives of the modeling. These were the

1 goals discussed with the epidemiologists when we first met
2 as to what they needed for the epidemiologic study;
3 arrival of contaminants at the well. And obviously, that
4 also means concentration values or ranges, not just when
5 they first arrived at the wells.

6 From the distribution side, the distribution of
7 contaminants by housing location. We've sort of -- and
8 housing location is taken to mean, like, Tarawa Terrace,
9 Holcomb Boulevard; not necessarily House, you know, 2103.
10 That's my interpretation, but as I said, the piping-system
11 network does go down to the street level.

12 And it's always been our intent to address
13 uncertainties. We understand their impact and the impact
14 they can have, especially on interpreting results from the
15 epidemiologic point of view and what sort of confidence.
16 Just as an example, when we were doing our Dover Township
17 work, the epidemiologist came back to us and asked, "Well,
18 now that you've given us that House A receives 10 percent
19 of the water, does that mean it's 10 percent plus or minus
20 50 percent, or is it 10 percent plus or minus 2 or 3
21 percent?" We had -- I don't know if it's luxury or
22 opportunity there to tell them, "No. It's 10 percent plus
23 or minus about 3 to 4 percent." We were able to reduce
24 that out by running different scenarios for them.

25 Whether that proves -- or whether we have the ability

1 to do that here based on data, we're still looking into
2 it. That's what we're looking for some of the input from
3 this panel to tell us. And so -- and we've got the
4 uncertainties on all sides: the groundwater analyses as
5 well as the distribution side.

6 So to finish up, again, and this, I suppose, is more
7 so for our public that's here but to go over a generalized
8 approach. We've got our site, Camp Lejeune, here. And on
9 the groundwater side, we're using the Modflow or one of
10 its derivatives, which will become eventually coupled with
11 a fate and transport analysis.

12 You have only been provided -- the panel -- with an
13 advective part up until this point in time. But it's been
14 our intent all along to go to the full-blown look at the
15 dispersive issues as well and then, on the distribution
16 side, an EPANET-type or its equivalent too. Again, we've
17 used EPANET and its equivalent for our present-day
18 analyses; actually to help us, guide us, in preparing some
19 of the field studies.

20 And I believe that's all on the overview of the -- of
21 the types of models. One point I wanted to make on the
22 report that the panelists were given -- I'm calling it a
23 report, and that's probably a misnomer. It's more
24 probably a collection of data collection efforts and some
25 background information.

1 And if we -- or if I implied that it was intended as
2 a final or finished product, that was probably a
3 miscommunication on my part. It was really meant to be a
4 working document, hopefully presented in some intelligent
5 form, that you could make sense out of it. So this is not
6 an intent for you necessarily to review that document as a
7 report but as the data contained in it.

8 And I believe that's it for the overview of the
9 modeling. At this point, Dr. Johnson, we've got two
10 options. I've got a brief overview on the groundwater and
11 then leading into detailed discussions and analyses with
12 Bob Faye. Or we had prepared some general responses to
13 some of the premeeting comments. I didn't know if that
14 was the opportunity -- if this was when you wanted me to
15 just give an overview of those.

16 DR. JOHNSON: No.

17 MR. MASLIA: Okay.

18 DR. JOHNSON: I think it is, though, the time and
19 opportunity to ask questions on what we've heard thus far.
20 Yes.

21 DR. UBER: Morris, this might not be the best time to
22 ask this question. So I don't -- I cannot speak myself
23 authoritatively at all on chemical or biological processes
24 affecting any of these contaminants, and so this question
25 also maybe then goes to some of the panelists who can.

1 But do you know: Right now, do any of those potential
2 chemical biological processes act in the distribution
3 system? And if so, are their kinetics effective over
4 residence time scales that are typical of distribution
5 systems?

6 MR. MASLIA: I have to plead ignorance to that. I
7 don't know if that's a question that Frank -- as far as
8 biologic processes with respect to the epi part of things.
9 I know that question came in other studies of biologic
10 plausibility, the fact that you can make an association,
11 say, between contamination of a water resource and an
12 apparent disease. Is there, in fact, a biologic
13 plausibility for that?

14 DR. BOVE: Oh, I didn't know -- I thought the
15 question was more on processes.

16 MR. MASLIA: Oh, was it? Okay. I think I can --

17 DR. BOVE: Yeah; because I can answer that one.

18 DR. UBER: I think I can -- I was probably too wordy.
19 I just want -- I'm basically asking: Does the team feel
20 right now that for purposes of transport in the
21 distribution system that they can model these contaminants
22 as tracers?

23 MR. MASLIA: Based on what we've seen with the
24 responses to the present-day system -- and that's all we
25 have right now -- the answer is yes. In fact, we've made

1 some, I think, some interesting, if not eye-opening,
2 observations based on how the present-day system is
3 operating. And from what we have been told to date, that
4 is a typical operation over the last 20 or 30 years with,
5 of course, obviously, changes in hydraulic and
6 infrastructure, removing treatment plants, starting up the
7 Holcomb Boulevard treatment plant, things of that nature.

8 But based on the preliminary tests that we've done to
9 date, we have been able to, I believe, do some acceptable
10 -- not maybe final, but acceptable model simulations.
11 And, in fact, it was the model simulations that led us --
12 and we'll get into this probably later this afternoon and
13 tomorrow -- that led us to suggest to the utilities' folks
14 at Lejeune that they, in fact, perhaps had some closed
15 valves while we were doing it, relying on some -- and it
16 turned out that that was correct.

17 So I believe -- to answer your question in a short
18 manner, I believe the models will -- based on what we've
19 seen to date will provide us the ability to provide some
20 answers on that. As far as the level of variability or
21 uncertainty, I think that's where we need to get back with
22 the epidemiologists and really sit down and see what level
23 they're willing to accept or can accept for their
24 analysis. And that, I can't answer you at this point in
25 time.

1 DR. UBER: Oh, okay.

2 DR. WALSKI: To give you a little answer to your
3 question, Jim, on the processes, most of the things that
4 happen to the VOCs in pipes don't really -- I mean,
5 there's not much that can happen to them. I mean, in
6 pipes, the only place where you could have much of a
7 process affecting them is usually in tanks where you have
8 a free water surface and they can volatize.

9 But when Ben and I did the work in
10 Phoenix/Scottsdale, we looked at that, then went back to
11 Henry's Law and looked at stuff like that. And we did --
12 you know, since you don't really -- it's hard to measure
13 these kind of things, and there's not a lot of literature
14 on Henry's Law in a perfectly still tank. Usually, if
15 it's for stripping towers and stuff like that, you have a
16 lot of literature data.

17 But going back and trying to reconstruct this, we
18 estimated 97 percent of what went into a tank came out.
19 Very little is really lost through the surface, and that's
20 about the only process that you lose VOCs is through the
21 surface of the tank.

22 So basically, assuming that it's -- what goes in the
23 system goes to the tap is probably, you know, a reasonable
24 assumption if there's not processes occurring. At least,
25 we couldn't figure out any processes that would knock down

1 the concentration significantly.

2 DR. POMMERENK: Yeah. I have some supporting
3 information on that. Because that question was asked by
4 Camp Lejeune to us as their consultants, we looked into
5 literature and tried to come up with a rough estimate of
6 would there be any removal within the treatment plant.
7 And since, you know, we had to review all of the drawings
8 of the existing plants, we knew the surface areas that are
9 available. We made certain assumptions: You know, is the
10 water quiescent in that tank, or, you know, is there any
11 agitation anywhere?

12 In all the tanks that we looked in -- and some of the
13 tanks are newer. There's more surface area available
14 today than there used to be early in the seventies. But
15 removal due to volatization was negligible. I mean, it
16 was less than a tenth of percent. The only location where
17 there would be some removal was in the spiractors that
18 were operated in all these Hadnot Point, Holcomb
19 Boulevard, and Tarawa Terrace plants.

20 And even there, there was a certain uncertainty,
21 depending on they had conditions downstream you would get
22 some agitation at the effluent pipe. So although we said
23 it's probably negligible, and I agree with Tom's number
24 here. At 90 percent, what's going in is coming out on the
25 other end.

1 One thing that had to be -- we were not able to
2 address. I believe the Hadnot Point plant used to have a
3 carbon dioxide contact basin. We could not find out when
4 this contact basin was operated because, obviously, that
5 process would agitate the water significantly. It was
6 also open to the atmosphere. It was not in a closed
7 building. And there could have been some significant
8 removal, but we were not able to be certain when this --
9 they ceased the operation of that unit at Hadnot Point a
10 long time ago. And even some of the older operators that
11 we talked to were not able to tell us when that was. But,
12 again, you know, what Tom said is probably accurate, that
13 you can probably use PCE and TCE as a tracer distribution
14 system.

15 DR. WALSKI: Which leads to the question, though, on
16 the measurements we have. We have only a handful of
17 measurements of VOCs in the system. Were these taken
18 before treatment or after treatment? When were they
19 taken?

20 MR. MASLIA: There are some -- from the health
21 assessment, there's some tap samples. So that obviously
22 would be after treatment. We've got some groundwater
23 wells with PCE and PCE measurements, so that's obviously
24 before treatment.

25 DR. CLARK: But there's a third class that's on the

1 schedule that says water-distribution system.

2 DR. JOHNSON: Step up to the microphone, please.

3 DR. CLARK: I'm sorry. The time line also has water-
4 distribution systems from neither tap nor well. And
5 that's what, I think, the question is.

6 MR. MASLIA: It's somewhere -- tap is at the
7 household.

8 DR. CLARK: No. Let me quote from it. It says,
9 "water-distribution system tested."

10 MR. MASLIA: Right.

11 DR. CLARK: Was that -- at which side of the
12 distribution system? I mean, at the tap?

13 MR. MASLIA: Oh, I see what you're saying.

14 MR. FAYE: I think that was on the treatment side.

15 COURT REPORTER: Excuse me. I can't hear you.

16 MR. FAYE: I believe it was on the treatment side.

17 DR. CLARK: Post-treatment.

18 MR. MASLIA: Post-treatment; post-treatment side.

19 DR. POMMERENK: Can I add to that? Thank you. As
20 far as I'm aware of -- and you, Morris, you probably
21 remember that too. The contamination of the drinking
22 water was first discovered -- there was -- a portion of it
23 was discovered in the early eighties when the -- after the
24 promulgation of the THM rule, the trihalomethane rule. So
25 these samples were taken in the distributions system at

1 consumers' taps, and I think in the course of the
2 analysis, the laboratory that analyzed had problems
3 resolving the peaks from, you know, from the THM compounds
4 because I believe TCE or PCE was masking those other peaks
5 on their chromatograms. So these early data may have been
6 actually tap samples in the distribution system.

7 MR. MASLIA: Yes. We've actually got documents with
8 the lab notation on there, specifically addressing that
9 particular issue.

10 DR. JOHNSON: I have a question. With regard to the
11 models, you indicated, I think, that they're both EPA
12 models?

13 MR. MASLIA: No. No, sir. Modflow was originally
14 developed in the middle to late eighties -- correct me,
15 Lenny, if I'm wrong -- by the U.S. Geological Survey.
16 It's a public-domain model. And now, of course, there are
17 any number of proprietary codes that use it as the engine,
18 more or less, with the data sets. Basically, if they say
19 they're Modflow compatible, then you can run them with a
20 plain vanilla code, which is publicly available from the
21 USGS Web site, and we have done that.

22 EPANET is the same issue. That was developed by --
23 can I say this? -- your shop, Bob Clark's shop, when he
24 was at EPA, by Lou Rossman. We've worked with it from
25 Dover Township days, and again, a lot of the commercial

1 codes for the water-distribution models use the EPANET
2 engine. We are actually using both a commercial or
3 proprietary code and EPANET. Some of the commercial
4 codes, as they do have nicer bells and whistles on the
5 front-end to make data input a little easier and things
6 like that. So there are two publicly available model
7 codes that have been vigorously and publicly tested.

8 DR. JOHNSON: What do we know about their validity?

9 MR. MASLIA: There -- we're convinced of their
10 validity. There's documentation. In fact, EPA has a
11 documentation ad for specific problems to test for
12 Modflow. And that's, again, available on the EPA Web
13 site, that if you want to -- if you make a modification,
14 if you will -- we have not made any modifications to the
15 models, by the way.

16 But if you do and you want to test its verification
17 or validity, then you can run those sets of problems.
18 EPANET 2 obviously is a second-generation version of EPA,
19 and it has gone through robust testing. And most of the
20 commercial codes, again, will carry the -- EPANET has a
21 set of problems that you can test your adaptation of it
22 against those benchmark -- if you want to call it those
23 benchmark problems.

24 DR. JOHNSON: Okay. Thank you. Why don't you
25 continue with the other material, please.

1 MR. MASLIA: Okay. Thank you. At this point, what I
2 want to do is give a very brief overview, more of a
3 generalized overview, of this morning's -- the rest of
4 this morning's session will be on groundwater. And then
5 throw it over to Bob Faye to really address step-by-step
6 technical issues.

7 So, Claudia, if you'll get the groundwater slide --
8 groundwater overview. Okay. There you go. Is that the
9 first slide? No. I need -- back up one. Okay; one more.
10 Okay. I've probably got them X'd out. Okay. I'll make
11 it short and sweet then. Okay. Okay. There you go.

12 Sources of contamination, we've -- as we spoke about
13 Hadnot Point being the first one leaking underground-
14 storage tanks and spills and other waste disposal and then
15 Tarawa Terrace, which is the dry-cleaning source. And
16 that's really why in discussions with Bob Faye and myself
17 and with some input from the epidemiologic side is where
18 should we attack first.

19 In other words, we were more sure or more positive of
20 Tarawa Terrace being as close to a single source as
21 possible, an identifiable source. And so we decided from
22 a project-management standpoint as well as initial results
23 to show the applicability of what we were doing to go
24 after Tarawa Terrace. So -- and that just gives you the
25 dates. And the Well 26, which you'll probably hear a lot

1 about and it is on our time chronology, is about 900 feet
2 from the dry cleaners. And that was the well -- one of
3 the wells that became contaminated at Tarawa Terrace.

4 And so the approach to modeling groundwater was to
5 assess Tarawa Terrace as a single source and a known
6 location, known location for the source and to develop a
7 geohydrologic framework. There have been some previous
8 work done -- Bob Faye will get into the details of that --
9 both from the U.S. Geological Survey in the middle to late
10 eighties being on site at Camp Lejeune as well as some
11 private consulting firms doing some work; construct the
12 three-dimensional Modflow model; calibrate the model for
13 study state or predevelopment; and then look at transient
14 conditions; and then conduct fate and transport. As of
15 today, we have done all but -- with Tarawa Terrace --
16 except the fate part. We've done the advective transport.

17 And that's really all -- I just wanted to give a
18 complete overview from the groundwater side to any members
19 of the public who are here or who want to see the big
20 picture. So that's the big picture on the groundwater
21 side. And at this point, again, I'd like to introduce Bob
22 Faye, who will give you the details of our groundwater-
23 modeling analyses.

24 DR. JOHNSON: Any questions to Mr. Maslia with regard
25 to the groundwater presentation?

1 DR. POMMERENK: I have one question.

2 MR. MASLIA: Oh, sure.

3 DR. POMMERENK: Morris, don't quote me on this. I
4 don't remember quite -- in one of the public health
5 assessments, I seem to remember there was another
6 dry-cleaning business to the east of ABC. Can you just
7 briefly state why this is not included in your talk?

8 MR. FAYE: Yeah. Is this on? Peter, I can address
9 that. The initial study that was done in 1985 by Shiver,
10 I think it's called Globa-something or other --

11 MR. ENSMINGER: Globarama.

12 MR. FAYE: Globarama; right; Globarama Dry Cleaning.
13 The initial study that was done by NCDEM by Shiver in
14 1985, he looked at that -- at that facility in detail and
15 decided that not only did their operations -- it was a
16 closed operation, apparently, where they completely
17 recycled their waste and handled their waste in a
18 responsible way by hiring a waste management -- a concern
19 to move the waste away from the site.

20 Also, there were groundwater samples taken near the
21 site, as I recall, and it showed that there was no real
22 opportunity at that site for groundwater contamination.
23 For example, I think the observation well that they
24 drilled right in front of the ABC facility, the
25 concentration in September of '85 was about 12,000

1 micrograms per liter of PCE. And the contamination at the
2 Globarama facility was minimal, was no comparison, if any.
3 Did that answer your question?

4 DR. POMMERENK: Yes.

5 MR. FAYE: Was that -- okay. And that has been
6 described and discussed in detail, not only in Shivers'
7 report, but also in the EPA Operable Unit 1 and Operable
8 Unit 2 reports that Weston --

9 DR. POMMERENK: Okay.

10 MR. FAYE: -- the Weston folks put together back in
11 the early nineties.

12 DR. POMMERENK: Thank you.

13 DR. JOHNSON: Okay. Any other questions?

14 MR. FAYE: Okay. My name is Bob Faye. I'm a
15 contract employee with the Eastern Research Group. And as
16 Morris said, my responsibilities for the most part have
17 been to construct and calibrate the groundwater-flow model
18 to date.

19 Dr. Johnson, am I allowed to suggest that if the
20 panel members have questions that they could just freely
21 interrupt me at any time?

22 DR. JOHNSON: Oh, absolutely.

23 MR. FAYE: Okay; great. Please do.

24 DR. JOHNSON: About how long is your presentation?

25 MR. FAYE: I think probably -- well, depending on

1 questions, to complete the framework and the contaminant
2 description as well as the flow-model description,
3 probably on the order of 90 minutes or so.

4 COURT REPORTER: I'm going to need to take a computer
5 break before then.

6 DR. JOHNSON: 90 minutes?

7 MR. FAYE: 90; as in 80, 90, 100.

8 DR. JOHNSON: Morris, we have a 10:30 panel
9 discussion and answers to questions. This appears -- a
10 90-minute presentation would appear to be a serious
11 overlap.

12 MR. MASLIA: Yes. Part of the answer to the question
13 is we were going to direct feedback.

14 COURT REPORTER: Excuse me. Please get a microphone.

15 MR. MASLIA: Our intent was, I guess, with direct
16 feedback during Bob's presentation, to start addressing
17 some of those questions and perhaps hopefully -- not
18 eliminate them, but have some discussion on specific --
19 those specific questions. Unless -- and the other
20 suggestion -- not that that shortens the length, but I
21 didn't know if you wanted to take the 15-minute break now
22 and go through the entire presentation and go forth,
23 rather than breaking it up for the scheduled break.

24 DR. JOHNSON: What does the panel wish to do? Take a
25 break now?

1 (Audible responses)

2 DR. JOHNSON: Okay. We'll take about a 15-minute
3 break and --

4 MR. FAYE: How do we resolve this, Dr. Johnson? Do
5 you want me to just describe the groundwater-modeling
6 effort? What does the panel -- well, I'm happy to
7 accommodate whatever the wishes are or try to accommodate.

8 DR. JOHNSON: What I heard Mr. Maslia say that the
9 idea here is to have the panel address some of the, what I
10 call, the eight questions that the agency has put forth on
11 groundwater and to try to integrate those into your
12 presentation. And that leads to them asking questions
13 during your presentation, and that seems to me to be quite
14 a good process. So does that answer your question?

15 MR. FAYE: Right. Well, I'll just -- then I'll just
16 continue with Plan A, and if somewhere in the interim we
17 need to switch, we'll go to Plan B and Plan C.

18 DR. JOHNSON: Okay. I will say that 11:45 we're out
19 of here as a stampede toward the lunch. So why don't we
20 take a 15-minute break? Be back at 10:30, please.

21 (Whereupon, a recess of approximately 17 minutes was
22 taken.)

23 DR. JOHNSON: Okay. Let's resume.

24 Let me suggest to the panel that you ask questions
25 during Mr. Faye's presentation, and I think it would be

1 useful if you could relate some of your questions to the
2 questions that have been provided by ATSDR that pertain to
3 groundwater. And specifically, these are some eight
4 questions that were provided to you in advance.

5 I know you also provided premeeting comments, and at
6 some point, Mr. Maslia is going to provide kind of an
7 overarching response to that. But feel free to blend in
8 your premeeting questions and comments during the
9 presentation here by Mr. Faye.

10 We will continue the groundwater discussion after
11 lunch to some degree, to the point where we feel satisfied
12 with it. And if we finish a bit early, then I'm going to
13 push up the water-distribution systems questions to later
14 in the day.

15 So I need, also, as a matter of courtesy and respect
16 to introduce Dr. LaBolle. Would you introduce yourself,
17 your affiliation, and I asked each of the other panelists
18 to give kind of an initial reaction to the materials that
19 you received.

20 DR. LABOLLE: Yes. I'm Dr. LaBolle from University
21 of California, Davis, department of hydrologic sciences.
22 And my initial reaction: I was quite pleased with the
23 level of detail and work that's being done with the
24 distribution system. My expertise is in groundwater, but
25 I have some experience with distribution-system modeling,

1 in particular, models that are similar in construction
2 with this groundwater linkage to the distribution-system
3 model with the fate and transport involved as well.

4 And my greater concern is with the variability and
5 uncertainty in the groundwater system, and I'll be posing
6 some questions with regards to that.

7 DR. JOHNSON: We look forward to those questions.

8 DR. LABOLLE: Thank you.

9 DR. JOHNSON: And welcome to the panel. Okay.

10 MR. FAYE: You ready?

11 DR. JOHNSON: Yes.

12 MR. FAYE: Okay. Just to start out, I want to
13 clarify one thing. You may hear me -- and I know in my --
14 in my papers that I wrote for the document, I use the term
15 "Montford Point," but that's equivalent to Morris' Camp
16 Johnson. Okay? So if I say -- if I slip and say
17 "Montford Point," just think Camp Johnson.

18 The rest of the areas, he's already talked
19 about: Tarawa Terrace area and the Holcomb Boulevard area.
20 And those are the three areas that feature in the
21 framework discussion. The Tarawa Terrace area features
22 exclusively in the model discussion and in the description
23 of contamination.

24 The purpose of the framework was to describe and
25 quantify the geometry, hydraulic characteristics, and

1 potentiometric levels of the aquifers and confining units
2 at Tarawa Terrace and vicinity at a scale and level of
3 detail suitable for application to groundwater flow and
4 contaminant fate and transport models.

5 As far as data are concerned, these -- this is
6 inclusive of the Camp Johnson area, Tarawa Terrace area,
7 and the Holcomb Boulevard area. Elogs, that stands for
8 electric logs. We have a -- we have a poster with the --
9 with several examples of electric logs for your benefit.

10 There's two parts to an electric log: the resistivity
11 side, the spontaneous potential side. Both are important
12 and useful in terms of defining the various layers that we
13 -- that we're dealing with in terms of the framework.

14 There were 100 boring logs that were available to us
15 from a variety of sources. There were -- there are two
16 reports that address -- or three reports, actually, that
17 address the contamination relative to ABC One-Hour
18 Cleaners. There were -- and then -- many, many boring
19 logs associated with those reports. There's also a large
20 number of boring logs associated with RI/FS investigations
21 that are ongoing in the Tarawa Terrace area.

22 Claudia, could you move back to the previous slide;
23 and the next one, please.

24 These boring logs, unfortunately, are not spatially
25 well distributed in the study area. The boring logs

1 almost exclusively refer to -- I'm sorry, almost
2 exclusively refer to RI/FS studies that are ongoing in
3 this very southern part of Tarawa Terrace and, of course,
4 in this northern area, just north and south of Lejeune
5 Boulevard, between ABC One-Hour Cleaners and Supply Wells
6 TT-26 and TT-25. And we'll be talking about those in just
7 a second.

8 That's a picture of a typical Elog that we have to
9 deal with. The spontaneous potential curve, which is the
10 left-hand -- the left-hand curve, is not very useful at
11 Camp Lejeune because it's a -- it's, more or less, an
12 industrial area. You've got a lot of ground currents, a
13 lot of current loss in the subsurface, which causes
14 reversals of the spontaneous potential curve.

15 Also, you have cycling going on; 60 cycles per second
16 in the subsurface. You have bleeding out of the -- out of
17 the electrical conduits that are buried, which also
18 confuse the resistivity side. But for the most part, all
19 of these analyses were based on areas or zones of low and
20 high resistivity and not related back to the spontaneous
21 potential.

22 This is typical of a boring log, one of the hundred.
23 I think this extends to a depth of about 20 feet or less.
24 Just a couple of points: This is the detail. These are
25 mostly logs from augering, hollow-stem augering. So you

1 have a lot of smearing in the lithologic descriptions
2 going on, probably plus or minus half of a logger stem,
3 which is typically 5 feet. So any of these depths that
4 you identify as perhaps a top of an aquifer or a top of a
5 confining unit have to be identified in that context, that
6 we're looking at something that might be accurate to only
7 within plus or minus several feet.

8 A number of the boring logs were created using split-
9 spoon samples at different intervals. Those, of course,
10 are accurate to the identified depth, and they're very
11 accurate. Many of the logs -- many of the boring logs in
12 the Tarawa Terrace area, the northern part of Tarawa
13 Terrace area, the ABC Cleaners' area, identified a feature
14 called "running sands." And this -- this was -- shows
15 universally as the top of the Tarawa Terrace or the -- top
16 of the upper Castle Hayne aquifer. And I can tell you --
17 I can explain the rationale for that at some time later.

18 This is typical of the drillers' logs that we had
19 available to us. In fact, that's quite a good one
20 compared to many. That's the kind of detail that we
21 looked at; the lithologic descriptions. Most of the time,
22 I use the drillers' logs just to identify the occurrence
23 of what was called limestone or Copena.

24 There was a major, major problem in locating
25 accurately the various points of well-data collection, of

1 monitoring wells, particularly for the many RI/FS studies
2 that were -- that were conducted there relative ABC
3 Cleaners and these other places. That was the 100 boring
4 logs that we -- that I discussed.

5 Virtually, the reports did not -- we used the state
6 plain coordinate system for North Carolina in 1983,
7 9-AD -- NAD. Virtually, none of the reports use that
8 system, so we had to convert the coordinates that were
9 available to us. Many of the coordinates in the report --
10 in some of the reports were not correct. They were --
11 even on their own system -- whatever arbitrary system they
12 devised.

13 So basically, what we did was just go back to the
14 old-fashioned way of measuring distances on the maps that
15 were provided. And we were able to identify -- you'll see
16 this -- the little building there, TT-47. We would take
17 intersections of roads or identified buildings or whatever
18 and use that as the -- we would find the state plain
19 coordinates for those places and then extrapolate those
20 coordinates to the rest of the map, basically just using
21 hand measurements. So you need to keep that in mind as
22 well as you think about the accuracy of the location data.

23 Finally, the end product of the geohydrologic
24 framework analysis was the development of 11 or 12 --
25 actually 11 -- 11 units as part of the framework, aquifers

1 and confining units. Now, as far as the Tarawa Terrace
2 area is concerned, the Brewster Boulevard aquifer and the
3 Brewster Boulevard confining unit do not occur at Tarawa
4 Terrace except perhaps as a -- just a thin mantle of
5 sediments at the surface that are -- that are smeared with
6 every -- with everything else and really not of use to be
7 identified or not even -- they're unsaturated almost
8 always. And they're not dealt with in the Tarawa Terrace
9 area.

10 I might say two things about the correlation effort.
11 The U.S. Geological Survey produced two reports exclusive
12 to the Marine Corps base Camp Lejeune back in the late
13 eighties. And both of these reports had long, detailed
14 sections, using various Elogs and drillers' logs and
15 whatever; published these sections.

16 They identified a number of units that they would
17 track on these sections across almost the whole entire
18 base from well to well or Elog to Elog. And essentially,
19 below the Tarawa Terrace confining unit, our geohydrologic
20 framework conforms very, very closely with a few
21 exceptions here and there to the framework analysis that
22 was -- that was performed by the U.S. Geological Survey.

23 Relative to the Tarawa Terrace aquifer, Tarawa
24 Terrace confining unit, and the Brewster Boulevard and
25 Brewster Boulevard confining unit, we sort of did that on

1 our own. And some of our results at certain places differ
2 from the USGS interpretations regarding these two
3 aquifers.

4 One thing that I -- one thing that I like to do when
5 I develop a conceptual framework like this is to constrain
6 my results using chronostratigraphic boundaries. That --
7 that would be like actual geologic unit times.
8 Unfortunately, for this particular study, that type of
9 information was very limited. But I did use the
10 distribution of the top of the Castle Hayne formation,
11 which I identified with the top of what I call the local
12 confining unit. That is the top of the Eocene. And I
13 identified also the top of the Beaufort confining unit,
14 which the US -- USGS has identified as the top of
15 Paleocene.

16 And what you do essentially is you look at the -- you
17 look at the strike, the distribution of those particular
18 units. That helps you to understand the depositional
19 cycles that occurred, that you're trying to identify as
20 aquifers or confining units. That helps you identify the
21 depositional cycles that occurred within that particular
22 time frame.

23 And that's important because if you're just
24 correlating a clay to a clay from Well A to Well B, you
25 could just very easily be missing a facies change;

1 whereas, if you can -- if you can correlate it as well
2 with a chronostratigraphic line, you have some confidence
3 that you're looking at a spatially continuous unit in the
4 subsurface. And we did that. We did that as well as we
5 could with the limited amount of chronostratigraphic
6 information that we had.

7 And then there's just a whole series of maps that you
8 have in your report. This is the top of the upper Castle
9 Hayne aquifer. This is one of the time units that I just
10 spoke about that I used to sort of keep me on track in
11 terms of the spatial distribution; orientation to the
12 north, south, east, or west; dip and strike that I would
13 apply to units below that and also actually to the River
14 Bend unit, which was above it. And there's the thickness
15 of the upper Castle Hayne.

16 Almost all of these surfaces that I've identified as
17 either the top of a confining unit or the top of an
18 aquifer are erosional surfaces. Okay? So you would
19 expect some degree of irregularity in the -- in the
20 altitudes at the top as well in the thickness and
21 formation. And I wasn't disappointed at all in that
22 regard.

23 Another feature of the geohydrologic framework
24 analysis was the -- was the computation, the analysis of
25 aquifer-test data. We probably had -- between Camp

1 Johnson, Tarawa Terrace, and Holcomb Boulevard areas, we
2 probably had close to five dozen aquifer tests. Almost
3 all of these invariably were single well tests, and almost
4 all of the single well tests were step-drawdown tests.

5 And what I used -- what I used in for almost all
6 these analysis is the public domain U.S. Geological Survey
7 aquifer test analyses worksheets, Excel worksheets. And
8 the real advantage to those is one -- it has one of the
9 best approaches and methods to analyzing step-drawdown
10 data, which was the majority of my data. And this is just
11 an example of one of the output sheets.

12 Now, there was a question -- somebody addressed the
13 notion of preferential zones of high permeability within
14 the -- within the various units -- within the various
15 identified aquifer units. We had no opportunity to do
16 that except in the context of the resistivity curves on
17 the electric logs. We could identify, perhaps, where
18 there may have been a relatively thin lensoidal clay
19 within the overall sand that we identified as an aquifer.
20 But there was no way to, in my opinion -- and if folks
21 here on the panel have some suggestions, I'd be happy to
22 hear it. But we did attempt to quantify. That was just
23 strictly a -- that would be strictly just a qualitative
24 analysis, and frankly, it didn't really occur that much.

25 Another feature of the -- of the geohydrologic

1 framework analysis was the spatial mapping of the
2 horizontal hydraulic-conductivity data that we determined
3 from the aquifer-test analyses. That's the -- such as it
4 is, that's the spatial distribution of the data for wells
5 that were open to the upper and middle Castle Hayne
6 aquifers.

7 The last thing that we did with respect to the
8 geohydrologic-framework analysis was try to -- try to
9 create a picture of what the prepumping conditions or
10 predevelopment conditions were in the -- in our areas of
11 interest, which were Camp Johnson, Tarawa Terrace, and the
12 Holcomb Boulevard area.

13 And the way we did this was to identify the -- at a
14 particular well site -- excuse me, was to identify the
15 earliest measurement that we had available to us in terms
16 of a water level. And in particular, in the Holcomb
17 Boulevard area, we were quite fortunate to have a lot of
18 -- quite a good number of measurements that were -- that
19 were obtained in the early 1940s when the first supply
20 wells were drilled.

21 We either chose the earliest measurement at a site,
22 or we took the highest measurement at a site. If we were
23 fortunate enough in a very few cases to actually have
24 multiple measurements, multiple water level measurements,
25 at a site, it was -- I could probably count those on one

1 hand -- but except for the Tarawa Terrace supply wells.
2 But we chose either the highest measurement or the
3 earliest measurement, and we just spatially plotted those
4 data. And the data almost completely refer to either the
5 upper Castle Hayne aquifer or the -- and the middle Castle
6 Hayne aquifer.

7 But the notion here was just to look at possible
8 boundaries that might be indicated as a predevelopment
9 condition as well as flow directions. And what we find is
10 that -- what we find is, as expected, Northeast Creek is
11 an obvious boundary at least as far as these aquifers
12 where the water-level information was obtained is
13 concerned. And we have flow directions in Tarawa Terrace,
14 generally either east or south, toward Northeast Creek.
15 And in the Holcomb Boulevard area, we have flow directions
16 north, west, and somewhat northwest, toward Northeast
17 Creek.

18 And what this tells us is that, at least as far as
19 those upper four aquifers or so are concerned, Northeast
20 Creek is probably a major flow boundary. What this does
21 as well -- and we have one site just north of Wallace
22 Creek, I believe, right in this area here where there is a
23 -- there's one -- there's a cluster site.

24 There's a series of wells there that are open to
25 several of the units that we identified as aquifers here.

1 In particular, there's a well open to the Tarawa Terrace
2 aquifer and intermediate to the middle Castle Hayne and
3 also to the lower Castle Hayne. And that's just north of
4 Wallace Creek.

5 And interestingly there, there's only about a 2-foot
6 head difference between the head in the lower Castle Hayne
7 aquifer and in the -- and the Tarawa Terrace aquifer. And
8 I know that's not a lot to go on, but, as far as the
9 conceptual model, which we'll talk in terms -- we'll talk
10 in a minute about in terms of the model.

11 The conceptual model that we developed for guiding
12 our approach to the flow-model analysis is that the
13 predevelopment of potentiometric surfaces in all of the
14 aquifers were relatively similar, in fact, very highly
15 similar, so that, as far as the River Bend unit and as far
16 as the lower Castle Hayne aquifer, the flow directions and
17 the distribution of head in the aquifers was highly
18 similar. And that tells us that Northeast Creek, indeed,
19 would have been -- well, it is a boundary for flow for all
20 of the aquifers that we're dealing with.

21 And I'll just take a minute to explain the reasoning
22 there. You have groundwater flow -- pick your aquifer:
23 River Bend unit or Tarawa Terrace aquifer, whatever. You
24 have groundwater flow heading down gradient toward
25 Northeast Creek from Tarawa Terrace, and that's heading

1 generally south. You have groundwater flow heading east
2 and north in the Holcomb Boulevard -- Holcomb Boulevard
3 area toward Northeast Creek. Well, this flow has to meet
4 in the middle somewhere at Northeast Creek. And at that
5 point, you have vertical upward flow in the vicinity of
6 the creek. And that was the rationale behind us selecting
7 the midline of Northeast Creek -- the midchannel line as a
8 flow boundary -- as a no-flow boundary for the
9 groundwater-flow model.

10 Also, in these USGS reports that I mentioned earlier,
11 there were some seismic studies that were conducted in the
12 water of New River and Northeast Creek, right around this
13 Paradise Point area. And what they -- what they
14 discovered was that there were buried subsurface channels
15 that were relic -- relic river channels that were now
16 under water. And probably, these relic channels manifest
17 themselves inland as well as zones of relatively high
18 hydraulic conductivity.

19 But our -- the distribution, the spatial
20 distribution, of our well data are not sufficient that we
21 can actually identify what that old relic channel would
22 have -- where it is and what it would have been. And that
23 may be one of the reasons that we have some irregularities
24 in our -- in our surface well data as well as in our
25 thickness data and also in our hydraulic-conductivity data

1 where, just by chance, one of these wells may have been
2 developed in part or all of an old river channel, which
3 would have been now filled with sand and would be an area
4 of relatively high hydraulic conductivity.

5 DR. KONIKOW: Bob, what was the -- what's the
6 rationale for the northern limit of your contouring on all
7 of these maps?

8 MR. FAYE: We have a -- we have digital elevation
9 models, Lenny, of this larger area. Let me show you. We
10 have digital elevation models of this whole large area
11 here. Actually, I think, probably of most of Camp
12 Lejeune, but I was just looking at this. And that is
13 interpolated to 2-foot contour intervals. And so using
14 the -- using that, I identified the divide that ended up
15 as the northern boundary, the no-flow boundary, in the
16 groundwater flow-model.

17 I identified that as a hydraulic divide that
18 generally sweeps up like this and down like that, and
19 that's a hydraulic -- that's a topographic divide that is
20 translated to a hydraulic divide in the groundwater-flow
21 model. As I said -- and, of course, those are 2-foot
22 contour intervals on the DEM, and they're interpolated as
23 well. But that's the best information that we have.
24 Okay?

25 DR. KONIKOW: Okay. I was looking at the topo maps.

1 It looked like there were -- I mean, I couldn't see the
2 divide that close.

3 MR. FAYE: No, you can't. You can't, Lenny. There's
4 a -- I can show you later, when we get into this, a much
5 larger map specifically of the Tarawa Terrace area.
6 There's -- you might have noticed that just north of this
7 road that runs parallel to Lejeune Boulevard, there's a --
8 there is a closed 35-foot contour right north of that
9 road, and that sits on that -- that sits on that divide.
10 That is mapped on the topographic map. And that coincides
11 with -- that coincides with that -- with the divide, as
12 recognized on the digital-elevation models.

13 DR. LABOLLE: Are you going to -- this is Eric
14 LaBolle here. Are you going to get more into the
15 simulation of the predevelopment heads?

16 MR. FAYE: Yeah.

17 DR. LABOLLE: Okay.

18 MR. FAYE: Yes. This is just the framework.

19 DR. LABOLLE: Okay.

20 MR. FAYE: It'll show up very well, Morris, in the
21 next couple of slides. Okay. Claudia, let's go to the
22 description of the PCE contamination at Tarawa Terrace.
23 There we go.

24 Okay. The next major area of responsibility that I
25 had was a description of just what is this PCE

1 contamination at Tarawa Terrace. Where is it relative to
2 the source area? Where is it relative to the supply
3 wells? How deep within the subsurface does it go? What
4 are the quantities; i.e., concentrations in the water?
5 What are the concentrations in the unsaturated materials?
6 So let's try to address that.

7 The purpose of the study, again, for the record, is
8 describe the occurrence and distribution of PCE and
9 related contaminants within the Tarawa Terrace and upper
10 Castle Hayne aquifers at and in the vicinity of Tarawa
11 Terrace housing area, Marine Corps base, Camp Lejeune.

12 And a number of comments in the premeeting notes were
13 related to degradation products of PCE, and, yes, to the
14 best of our ability -- and we're severely limited by the
15 data here. But to the best of our ability, we did -- we
16 addressed trichloroethylene, which is the immediate
17 degradation product of PCE, as well as dichloroethylene,
18 the immediate degradation product of TCE,
19 trichloroethylene. We addressed all of that as well as we
20 could, but the data are very limited; very, very limited.

21 Okay. Here's a map. Maybe we can see that 35-foot
22 contour. There you go. Can you go back, Claudia. There
23 you go, Lenny; right here.

24 COURT REPORTER: Please get on your microphone.

25 MR. FAYE: Thank you. There you go, Lenny. That's

1 that -- that's the contour I was talking about right
2 there. And that's right on the line as shown on the DEM
3 and comes down to -- it splits the difference between one
4 of these two little tributaries right in here, I think. I
5 think it's that one. It could be that one.

6 DR. KONIKOW: You also have a 35-foot contour a
7 little further north.

8 MR. FAYE: Yeah; right; right. And there are
9 differences between the DEM and the topo map, as you would
10 expect. Actually, some of that is fairly significant,
11 substantial. The differences are somewhat substantial. I
12 can't recall now exactly what -- what's going on up here
13 with respect to the DEM. But I looked for the major
14 divide between here and there, northeast and southwest,
15 and selected it.

16 Now, that may not be the -- from a groundwater
17 modeling point of view, that may -- and particularly a
18 fate and transport point of view, that may not be the best
19 -- the best boundary. But, really, if we try to extend
20 that north beyond the hydraulic divide, then we're stuck
21 with a general head boundary, probably, for all of the
22 units that we're modeling. And it just seems to me that
23 would introduce more uncertainty into the -- into the
24 analysis than selecting the hydraulic divide as the
25 topographic divide. But let's -- let's -- go ahead.

1 DR. KONIKOW: I'm not convinced of that. Plus
2 another problem is that during pumping conditions that
3 predevelopment divide -- if that's really where it is and
4 I'm not convinced of that either -- that the divide is
5 going to migrate under pumping conditions.

6 MR. FAYE: It will. I don't think -- I don't think
7 the -- at least as far as -- we don't really know. We
8 have no data at all, field data, relative to -- relative
9 to any kind of notion of radius of influence of the supply
10 wells; no data whatsoever, so --

11 DR. KONIKOW: That could be computed --

12 MR. FAYE: We did.

13 DR. KONIKOW: -- more accurately than a lot of the
14 other things.

15 MR. FAYE: Yeah. We looked at that. It just depends
16 on where you want to go with the minimum drawdown out at
17 some radius that you're looking at, whether it's .01 feet
18 or .1 feet or something like that. I mean, that bounces
19 your radius of influence all over the place. And right
20 now, I'm fairly comfortable with the notion of using that
21 hydraulic divide not only as far as the predevelopment
22 situation is concerned, but as far as the transient.

23 But I would certainly welcome any kind of
24 qualification or criticisms, comments of that notion. I
25 mean, we're open to all that, absolutely. But I wanted

1 you just to be aware of my reasoning, you know, as far as
2 the decision was concerned to identify it as such.

3 DR. JOHNSON: David, you have a comment?

4 DR. DOUGHERTY: No. I think we can proceed.

5 DR. LABOLLE: Well, I have a question here, actually,
6 regarding the -- not the hydraulic divide. But since
7 we're on the subject of boundary conditions here --

8 MR. FAYE: If we could -- if we could just be patient
9 just for a minute and let me get through the
10 contamination, then we'll be into the heart of the
11 groundwater model. Okay?

12 DR. LABOLLE: Okay.

13 MR. FAYE: And that might be the best place to
14 discuss that. I didn't mean to --

15 DR. LABOLLE: No. That's just fine.

16 MR. FAYE: Okay.

17 DR. LABOLLE: That's probably an appropriate
18 opportunity.

19 MR. FAYE: This slide just identifies all of the
20 Tarawa Terrace supply wells that we know of. There
21 actually may be several more that we don't have knowledge
22 of, but this is all of them from the beginning of time,
23 which is -- it'd be about 1952 up to the time in 1987 when
24 all the wells were shut down. And, of course -- and, of
25 course, some of these were taken out of service long

1 before 1987. And as part of our plans, we have identified
2 various data reports that we plan to produce.

3 And, of course, in the final report, there will be
4 data reports, and all of these data will be tabulated and
5 identified in terms of well-construction information, when
6 the wells were placed in service and removed from
7 services, et cetera, et cetera. We do have that
8 information for most of these wells. We have good
9 information regarding that, not only from our own data
10 discovery, but the AH people have been very forthcoming
11 and helpful in that regard.

12 Claudia, I'm going to go one more slide, just to
13 orient myself here; just a second.

14 All right. Let me talk a little bit -- and I think
15 this is very important to understand. Let me -- even
16 though we're a little pressed for time. But let me talk a
17 little bit about the contaminant data collection at ABC
18 Cleaners and vicinity as well as the Tarawa Terrace supply
19 wells that were affected in terms of timing, in terms of
20 concentrations, in terms of quality of information.

21 What this slide represents is a summary of several
22 series of data that were collected between 1991 and 1993.
23 And I went into some detail in this in the report, but I
24 want to say it here as well for the record.

25 The vast majority of these data that you see

1 portrayed here -- summarized here actually -- relate to
2 DPT data, hydrocone data, direct push technologies. We
3 all familiar with that? You know what I'm talking about?
4 Okay. There were probably like 40-some -- almost 50 of
5 these DPT points where data were collected at -- in an
6 upper zone, generally between about 15 and 25 feet, and
7 at the same site in a lower zone, generally between 35 and
8 45 feet.

9 And what you see here is a -- is the -- if it happens
10 to be one of those dual sites, this is the highest
11 concentration that occurred at that site, whether it was
12 the upper shell or the lower shell, the upper zone or the
13 lower zone. Several comments about those data: There was
14 an analysis done from a field mass spec operation at the
15 site when the DPT operation was ongoing, and there were
16 results obtained from that.

17 The -- Weston, the folks that conducted that site,
18 also collected a number of duplicate samples and sent
19 these off to a qualified laboratory for analysis. The end
20 result of that was that there was very poor agreement
21 between the laboratory analyses and the on-site analyses
22 for a particular bore hole or whatever. So we have that
23 particular problem. By the way, the points that were used
24 to construct this map were all the laboratory analyses
25 where they were available. Where they were not, we used

1 the field -- the field site data.

2 Several -- okay. Let's look at -- here's ABC
3 Cleaners. A point that I'll make later in our advective
4 transport analysis when I describe that -- and, again, I
5 apologize. I'm talking about a model here. But it'll be
6 clear in a minute. The Well TT-26 is right here, and at
7 least as far as our model is concerned now, under normal
8 operation, the operation of TT-26 would capture every bit
9 of the PCE that was introduced into the subsurface and
10 into groundwater at ABC Cleaners.

11 But we have fairly large concentrations of PCE north
12 and west of ABC Cleaners. And in addition, we have
13 respectable concentrations of PCE south of -- south of the
14 well here, TT-26. And this is near another supply well,
15 TT-23. But as you can see, PCE values or concentrations
16 values at this time, now 1991 to 1993 -- you have to
17 remember this is four to five years after the Tarawa
18 Terrace wells were shut down -- there's zero
19 concentrations here. And these points I'm making now
20 because they'll occur prominently in the discussion of the
21 groundwater-flow model.

22 Okay. We had these data, as I mentioned, of the PCE
23 concentrations and other contaminant concentrations that
24 we could assign to an upper shell and a lower shell. So
25 given that, we created -- is that it? I'm going to go for

1 this now. We created a map. Thanks, Claudia.

2 We created an average or a midconcentration map,
3 using the aerial distribution, the spatial distribution
4 from the upper shell and from the lower shell. With that
5 midconcentration shell, we also computed the volume of
6 aquifer material between the two shells. And in doing
7 that, the DPT data we actually used the depth they
8 identified. If it happened to be a well, we used the
9 midpoint of the screen interval to put a limit on the
10 volume -- on the depth.

11 We computed the area-weighted PCE concentration
12 between the average shell-concentration contours. That,
13 in a sense because it's the midconcentration shell, is the
14 volume-weighted PCE concentration. Once we had that, we
15 multiplied that by the volume adjusted by effective
16 porosity. And we ended up with a PCE mass of about 2500
17 pounds between those two shells or 185 gallons of PCE.
18 And this analyses, I think, is described in pretty good
19 detail in the report.

20 DR. KONIKOW: Bob, why do you use effective porosity
21 rather than total porosity?

22 MR. FAYE: Yeah. Well, if you recall, Lenny, there
23 was a -- there was also a description in the report of the
24 movement of the mass of concentration, the center of mass
25 of the PCE concentration, from the doorstep of ABC

1 Cleaners, in '85, down to some point midway between ABC
2 Cleaners and TT -- Well TT-26.

3 Well, the reasoning there was that that movement had
4 to occur through connected interstices in the porous
5 media. And where it ended up in 1991 to '93, the volume
6 that that PCE was occupying was only connected
7 interstices, not the -- not the total interstices in the
8 porous media. So as a consequence, we used effective
9 porosity.

10 DR. KONIKOW: Well, you know, I think if you have the
11 contaminant in the connected interstices, it's going to be
12 in the -- I don't see any way to have uncontaminated water
13 adjacent to it in the disconnected pores, even if there
14 are. And I find it hard to believe there are disconnected
15 pores there. You used a specific yield value of 20
16 percent, I believe.

17 MR. FAYE: In Layer 1 in the Tarawa Terrace aquifer,
18 that's right. The rest of -- the rest of the layers --
19 like, the River Bend unit is 15 percent, and that's where
20 the vast majority of the contaminant is. Now, we don't
21 have any measurements of effective porosity. We don't
22 have any point measurements.

23 Two of the studies that -- the Weston study and, I
24 believe, the Bragg's report as well, used effective
25 porosity depending on the on the unit they were -- of 15

1 percent and 10 percent. And I kind of qualitatively
2 looked at the lithologies and assigned a slightly higher
3 effective porosity to the Tarawa Terrace aquifer.

4 It looked to me like that was a cleaner, sandier
5 unit. The 15 percent, I accepted for the River Bend unit.
6 And I really couldn't see a whole lot of difference in the
7 lithologies between that unit and the other aquifer, so I
8 assigned a 15 percent effective porosity to the -- to the
9 rest.

10 But the one point would be that, you know, this is
11 just a preliminary calibration. Okay? We really haven't
12 -- we really haven't had an opportunity to do all of the
13 tests and provide all of the simulation results that we
14 want to, so...

15 DR. KONIKOW: It's in my comments. But I looked at
16 -- there was one part in your report where you say the
17 center of mass migrated at about .3 feet per day.

18 MR. FAYE: That would have been an average, yeah,
19 given the distance.

20 DR. KONIKOW: But if you used that information,
21 together with the other information, you would estimate an
22 effective porosity of about 28 percent.

23 MR. FAYE: At a retardation factor of one.

24 DR. KONIKOW: If there's no retardation.

25 MR. FAYE: Yeah. And if there is retardation, which

1 I do believe there is, your effective porosity then would
2 -- to maintain that same average velocity, your effective
3 porosity would have to decrease from that number. And
4 really, I think the way to address that, Lenny, is to, you
5 know, take your comment and the notion of the analysis,
6 which I thought was really on target, and just do a range
7 of computations and look at -- look at the various
8 alternatives. And that's what -- we'll definitely do
9 that.

10 DR. DOUGHERTY: Is there information from the
11 split-spoon samples that you referred to earlier that
12 gives total porosities that would provide some boundary
13 information on where we are with respect to those?

14 MR. FAYE: You know, I won't say no. If there -- if
15 there are, they would be -- there would be very, very few.
16 And they would be probably only related to the Tarawa
17 Terrace aquifer or the River Bend unit. Okay?

18 DR. DOUGHERTY: Okay.

19 MR. FAYE: Okay.

20 DR. LABOLLE: Can you define how you're using
21 effective porosity in this context?

22 MR. FAYE: Only in terms of the advective transport.

23 DR. LABOLLE: That's not what I mean. I mean, are we
24 talking about effective porosity at the pore scale, or are
25 we talking about some macroscopic effective porosity to

1 scale the velocities in the contaminant transport model?

2 MR. FAYE: Yeah. Well, the correct answer to that is
3 yes (laughter). And I'm not trying to be a smart-ass.
4 I'm just saying that, you know, we're sort of stuck with
5 -- when you do the advective transport modeling,
6 obviously, it's a macro-scale condition. Okay? But if we
7 have any data at all, it would be -- it would be data only
8 on a -- it would be like a laboratory test that you could
9 probably relate to the pore scale itself. Conceptually,
10 we're dealing with the pore-scale concept. Okay? But in
11 practical application, it's a macro scale. Okay?

12 DR. LABOLLE: Okay.

13 MR. FAYE: And let me go back now. We'll look at
14 some temporal -- are there any questions at all about the
15 PCE mass? I want to make one other comment about that
16 computation. Pankow and Cherry, not only in their text
17 but also in at least one journal article, they address
18 this particular methodology. And they have some comments
19 about the results.

20 One comment that they -- that they make is the fact
21 that that particular result of 185 gallons -- actually,
22 they give several examples, like seven or ten examples in
23 their work. It sort of fits midway into their -- into
24 their volumes that they've computed for -- at various --
25 various places and various studies. Also, they make the

1 point that this is very likely just a very small
2 percentage of the total PCE that's actually out there in
3 residence in the aquifers themselves, and we believe that
4 as well.

5 MR. MASLIA: Am I on here? I believe -- and Bob
6 brought this to my attention -- there, either through
7 some verbal information or a report that quantified that,
8 they estimated that the ABC Cleaners were using
9 approximately 100 gallons a month of PCE historically in
10 their dry-cleaning process. So again, the 185 is an
11 extremely small --

12 MR. FAYE: Yeah.

13 MR. MASLIA: -- percentage of what potentially could
14 be out there.

15 MR. FAYE: Yeah. I hate to waste 60 seconds on an
16 anecdote, but I am because it gives you a -- just
17 clarifies the kind of things that we're dealing with.
18 Wouldn't you believe that if someone is conducting an
19 RI/FS investigation twice relative to ABC Cleaners that
20 one of the things they would at least do would be to ask
21 those folks how much PCE they're actually using during
22 their operations or did use during their operations? No.
23 Nowhere in the RI/FS reports, the detailed technical
24 investigation reports, nowhere do you find any kind of
25 reference at all as to what was happening at the source in

1 terms of PCE use.

2 The report Morris referred to is something I ran
3 across fairly recently. It was a report from the National
4 Oceanic and Atmospheric Administration, who were looking
5 at the impact of this PCE loss into the groundwater on
6 wildlife and wildlife habitat in Northeast Creek. And
7 those folks actually had enough sense to go and talk to
8 the ABC Cleaners and ask them, "How much PCE do you folks
9 actually use a month in your operations?" And it turned
10 out to be about 380 liters or 100 gallons a month.

11 MR. MASLIA: Dr. Johnson, there's a question from the
12 public.

13 DR. JOHNSON: Please. Go ahead. State your name,
14 please.

15 MR. ENSMINGER: (Off microphone) My name's Jerry
16 Ensminger. I was a resident there.

17 COURT REPORTER: Can you state your name again,
18 please.

19 MR. ENSMINGER: Yes. My name's Jerry Ensminger. I
20 was a resident there. I lost my daughter to leukemia.
21 When you're talking about historical data, and especially
22 ABC Dry Cleaners, there are a lot of variables in that
23 site that need to be considered. And one thing is the
24 historical information: What took place between 1965 and
25 1970 which involved the Marine Corps and increased the

1 population of the Marine Corps almost two-fold, and that
2 was Vietnam.

3 From 1965 to 1972, that was the heyday for dry
4 cleaners in Jacksonville. Did anybody get the tax records
5 from these people because PCE would have been an expense
6 which would have shown how much they actually used? And
7 knowing the amount of people -- every Marine that went in
8 the Marine Corps east of the Mississippi River ended up at
9 Camp Lejeune to go to their infantry training school at
10 Camp Geiger.

11 These dry-cleaning services had trucks that went
12 aboard base, collected these kids' uniforms at the chow
13 halls in the morning and brought them back that night or
14 the next morning. They picked them up. But every Marine
15 east of the Mississippi went through Camp Lejeune. These
16 people made a fortune during those years, and the PCE use
17 was elevated. Thank you.

18 DR. JOHNSON: Thank you. Thank you for your comment;
19 absolutely.

20 MR. FAYE: Claudia, could we go back a few slides to
21 the -- there we go. Keep going and maybe one or two more;
22 one more. All right.

23 These slides represent what we have at the wellheads
24 in terms of contaminant concentration through time.
25 Beginning in late '84 or early '85, these are our data

1 points that we have. This is Well TT-26. This is
2 probably the main culprit in terms of providing PCE to the
3 water-distribution system, far and away, probably. But
4 you can see the poor distribution of data.

5 Now, enter -- let's go -- let me see what we have
6 here. That was PCE. This is the daughter product, TCE.
7 Virtually, the analyses are for the same time. And you
8 can see there was -- you can make a pretty good case there
9 that biodegradation of the PCE product was going on.

10 DR. JOHNSON: And what's the source of these data?

11 MR. FAYE: Who asked that?

12 MR. MASLIA: Dr. Johnson.

13 DR. JOHNSON: What's the source of the data?

14 MR. FAYE: Dr. Johnson, there are a variety of
15 sources. Some of it came from LANTDIV, the Marine -- the
16 Navy lab. Some of it came from EPA. Some of it came from
17 the North Carolina EPA equivalent.

18 DR. DOUGHERTY: Do we have any information on
19 sampling protocols?

20 MR. FAYE: Only in the -- only in the latter reports,
21 the latter analyses, which would be in 1991. We think --
22 have to assume that if NCDEM, North Carolina Department of
23 Environmental Management, did the analyses or the LANTDIV
24 people did the analyses that it probably was a respectable
25 representation of the protocols at that time. And they've

1 changed a lot. The protocols have changed a heck of a lot
2 in the last 20 years, so...

3 DR. DOUGHERTY: Just to clarify, at that point in
4 time, there were pumps still in these wells?

5 MR. FAYE: Oh, yeah. Yeah. The wells were actually
6 abandoned formally; and that is, grouted up, pumps
7 removed, everything like that in 1991.

8 MR. MASLIA: David, I have a document, again, just
9 received. I hate to keep saying "just received," but you
10 know the story. And, in fact, it lists many of the TT
11 wells, and it will say "Well closed but pump still
12 installed in the well," and TT-26, TT-23, and so on. And
13 this is a nine -- I believe it's a '91. I believe I left
14 it on the desk there; a '91, '92 report. It's handwritten
15 notes. It's a document released by the Marine Corps to
16 us. But it does indicate whether the well can be operated
17 and whether it still has a pump or the well does not have
18 a pump and can be operated.

19 MR. FAYE: You know, and that was a note from the --
20 from the folks at the facilities -- in charge of
21 facilities at Camp Lejeune to the EPA contractor, who was
22 inquiring whether or not these wells were sampleable. And
23 almost immediately, as far as I can tell, after this
24 contractor obtained those July 1991 analyses, those wells
25 were history. They were grouted up. They were done.

1 Now, also, recently -- we keep referring to these
2 recent revelations that we get. We have -- actually down
3 to the -- down to report numbers, dates, sample numbers,
4 the whole thing. We have information regarding monthly
5 samples at Well TT-25, which was not -- which was actually
6 right about here. And this -- in July of 1991, there was
7 an indication that Well TT-25 was beginning to show
8 contamination in its discharge.

9 And North Carolina DEM recommended that monthly
10 samples at TT-25 be collected over the period April --
11 actually until the well was shut down. But the samples
12 were collected from April of '86 to April of '87. And
13 we're making major, major efforts now to obtain the
14 results of those analyses. The Marine Corps doesn't seem
15 to know anything about them. But we know -- we know the
16 samples were collected. We know the analyses were made.
17 We have sample numbers and report numbers. So we're
18 trying to -- and that will fill in some of that, some of
19 that gap.

20 Yeah. Also at the -- in the same documents, there
21 were weekly samples taken on the downstream end of the
22 Tarawa Terrace WTP at the same time, which would -- which
23 would help Morris' efforts to -- and the network
24 simulation efforts immensely. Again, we're trying to find
25 those data. We know they exist, but no one seems to know

1 where.

2 MR. MASLIA: Let me just qualify. Those data were --
3 there was a panel in September or October, convened by the
4 commandant of the Marine Corps, and it's a published
5 report. It's on the Marine Corps. And in Appendix or
6 Attachment K, they list some of those data. The issue
7 that both Bob and I have with that is that the Marine
8 Corps commandant's panel left out -- and I'm not sure why
9 -- any qualifiers on the data and any of the nondetects
10 based on their interpretation.

11 I have requested that, and there was a letter from
12 the U.S. Navy to U.S. EPA Region IV, transmitting the data
13 weekly for a various number of wells with these
14 attachments. EPA doesn't have that -- the attachments,
15 and apparently, my last communication with headquarters
16 Marine is they're working on finding the attachments. But
17 that would, again, supply us with what appears to be, on
18 the surface, very needed information because it goes from,
19 I believe, the first week in December of '84 through about
20 '86.

21 DR. JOHNSON: Bob, if I could go back to your
22 contamination --

23 MR. FAYE: Oh, yes, sir.

24 DR. JOHNSON: -- data. I didn't see any error bars
25 for each of the data points. And is that not done for

1 this kind of data? If it were a tox study, you would
2 expect to find it.

3 MR. FAYE: When you say "error bars," you're --

4 DR. JOHNSON: Standard errors, standard deviation;
5 some sense of variability at each data point.

6 MR. FAYE: Well, at the very -- at the very most, Dr.
7 Johnson, except for those supply wells that we have, that
8 I showed you through time, the spatial maps like that at
9 the very, very most, we have only two samples.

10 DR. JOHNSON: Okay.

11 MR. FAYE: And those are for different levels.
12 Remember, I talked about the upper shell and the lower
13 shell, and that's all we have there. There were -- we
14 could do some sort of cursory analyses like that for the
15 half a dozen samples that we have at a single site like --
16 but that's so dynamic, you've got biodegradation going on.

17 DR. JOHNSON: I understand.

18 MR. FAYE: I don't know what that would show.

19 DR. LABOLLE: How do you explain the region between
20 the two plumes with the zero concentration? What's your
21 interpretation of that?

22 MR. FAYE: That, I'll talk about in the model. Okay?

23 DR. LABOLLE: Yeah.

24 MR. FAYE: Yeah. That's after a lot of aspirin,
25 believe me. Okay. We've got a few minutes left to talk

1 about the model. Let's get going. I'm not going deal
2 with the introductory material. Let's do the purpose of
3 study.

4 Construct and calibrate a groundwater-flow model
5 sufficiently representative of the geohydrologic framework
6 and groundwater-flow conditions at Tarawa Terrace and
7 vicinity to support fate and transport simulations.
8 You've already seen the well locations. You know what the
9 aquifers are and confining units.

10 Let's describe the model grid very briefly: 270
11 columns, 200 rows. That's the complete model domain.
12 That's the inactive and active areas, 24,000 active cells.
13 All of the active domains are spatially equivalent. The
14 cell dimensions are 50 feet by 50 feet.

15 There's nine layers, and they correspond exactly to
16 the geometries of the aquifers and confining units that
17 we've identified. Frenchman's Creek -- could we -- could
18 we go back to that; Frenchman -- Frenchman's Creek is a --
19 sorry. Frenchman's Creek is a small drain in the western
20 part of Tarawa Terrace, and that's -- that's accommodated
21 in the model as a drain in Layer 1, which is the Tarawa
22 Terrace aquifer.

23 Northeast Creek, the whole area -- sorry, Claudia.
24 Northeast Creek, this -- the whole area down to the
25 midchannel line, which is our no-flow boundary, is a

1 specified head boundary, zero altitude, in Layer 1. In
2 the other -- in the other eight layers, it's just an
3 active layer or an active part of it -- of the model.

4 DR. KONIKOW: Is that salt water at Northeast Creek?

5 MR. FAYE: Yes. Yes. It's not seawater, Lenny, but
6 it's tidal. And it's definitely -- it's definitely --
7 it's definitely saline. Okay? Whatever that boundary is
8 in terms of TDS or whatever you want to call salt water, I
9 don't think it -- I don't think it quite meets that. But
10 it's definitely saline.

11 DR. LABOLLE: I had noticed that the previous map
12 you'd put up with hydraulic-head measurements, the
13 hydraulic heads along Northeast Creek that have been
14 measured -- or on boundaries of it --

15 MR. FAYE: Mm-hmm.

16 DR. LABOLLE: -- range from 14 to about 4 feet. And
17 now you're putting the boundary condition on the creek of
18 a zero head in Layer 1. How -- what kind of
19 correspondence does that have to the elevation mapping
20 along the Northeast Creek as far as the actual heads in --
21 on the creek itself, and how is that influencing the flow
22 model?

23 MR. FAYE: Okay. Let me try to understand your
24 question, which I don't completely. Are you asking: Do we
25 actually have measurements within the various aquifers

1 within the Northeast Creek area or on shore at wells that
2 were --

3 DR. LABOLLE: Either.

4 MR. FAYE: We don't have any measurements in that --
5 within the creek area itself.

6 DR. LABOLLE: I'm referring to a map you showed in
7 the previous presentation where we were looking at
8 hydraulic heads that shows them from --

9 MR. FAYE: Yeah. The estimated potentiometric
10 surface?

11 DR. LABOLLE: Exactly.

12 MR. FAYE: Yeah. Okay.

13 DR. LABOLLE: And I'm looking at a contour map here
14 in one of the reports that shows a predevelopment
15 simulation, and now I'm hearing you describe this boundary
16 condition of a zero head along the creek. And I'm asking
17 how does that boundary condition influence the model
18 because there appears to be some potential inconsistency
19 there between the 14- to 4-foot head difference along
20 Northeast Creek in the measured potentiometric heads. And
21 I say along Northeast Creek --

22 MR. FAYE: Mm-hmm.

23 DR. LABOLLE: -- I mean, they're interpolated from
24 measured heads --

25 MR. FAYE: Mm-hmm.

1 DR. LABOLLE: -- taken at wells, you know --

2 MR. FAYE: Mm-hmm; right.

3 DR. LABOLLE: -- in the land nearby and the heads
4 plotted, for example, in the potentiometric contours in
5 one of these predevelopment simulations. And this refers
6 directly to the boundary that you just discussed, the --

7 MR. FAYE: Right; right.

8 DR. LABOLLE: -- zero-head boundary.

9 MR. FAYE: Right. The -- I think the map you're
10 referring to, the actual loop contour is 4-feet upstream
11 of -- that shows flow toward Northeast Creek. The actual
12 loop contour is a 4-foot contour, not a 14-foot contour.
13 And then there's -- you're going to have to remember now,
14 this is an interpolation, so --

15 DR. LABOLLE: Well, I think it was four on the
16 downstream and then --

17 MR. FAYE: That's right.

18 DR. LABOLLE: -- 14 feet if you go up the creek, I
19 think, if you go to the far end of the creek. Is that --
20 am I correct, or...

21 MR. FAYE: Well, that -- yeah. That's an
22 interpolation from a point onshore at Tarawa Terrace to a
23 further point, further offshore -- onshore at Holcomb
24 Boulevard. So --

25 DR. LABOLLE: Okay.

1 MR. FAYE: -- this is just an estimated -- remember,
2 I said this was a map that we were --

3 DR. LABOLLE: There we go.

4 MR. FAYE: -- we would try to put in the highest
5 water level so that we could just kind of define for our
6 own purposes what we thought the major flow directions
7 were in the system as well as what the major boundaries
8 were.

9 DR. LABOLLE: I can see these Xs on here are --
10 or the plus signs are the actual data points used in
11 creating --

12 MR. FAYE: Yes.

13 DR. LABOLLE: -- this map.

14 MR. FAYE: Yes.

15 DR. LABOLLE: So effectively, what I'm hearing is
16 that you don't -- actually, you don't have enough data
17 near the creek to --

18 MR. FAYE: No.

19 DR. LABOLLE: -- just to --

20 MR. FAYE: No. No.

21 DR. LABOLLE: Okay.

22 MR. FAYE: This was -- this was a kriging exercise.

23 DR. LABOLLE: Which explains the inconsistently.

24 MR. FAYE: Yeah. Yeah.

25 DR. LABOLLE: Okay. Thank you.

1 MR. FAYE: We were just there trying to -- well, for
2 example, this shows up very nicely here; this Loop 4, I
3 mean. It definitely shows that you're looking at -- as
4 far as the extant data are concerned and as far as this
5 particular interpolation is concerned, you definitely
6 have, you know, a gaining stream. And you have --
7 definitely have a flow toward it from the north to the
8 south and the south to the north.

9 And there's, you know, an inconsistent -- this is --
10 this shows the inconsistency between -- you know, caused
11 by interpolation very well. You've got, you know, this
12 data point here. Obviously, this contour in the real
13 world doesn't cross the river like that. But this is all
14 of our dirty laundry, you know, that we're laying out
15 there, I mean. And this is just for estimating and
16 interpretive purposes. This is nothing that we would put
17 forth as a real potentiometric surface map.

18 Okay, Claudia, let's go to the modeling.

19 DR. JOHNSON: Bob, take about five minutes, and then
20 we will adjourn for lunch and come back and continue with
21 what you are presenting.

22 MR. FAYE: Okay. I'll try to finish as much of it as
23 I can in that five minutes, Dr. Johnson. Thank you.

24 That's a picture of our grid. That's the active
25 model domain. This is the now infamous northern boundary

1 that we talked about earlier. This is Layer 1 -- yeah,
2 Layer 1. This is Frenchman's Creek. And that's an old --
3 this is an old map, by the way. This was before I filled
4 in the rest of Northeast Creek as a -- as a specified head
5 boundary.

6 There's your -- I forgot I had the map with me here.
7 There you go -- layer tops or cell-by-cell arrays that
8 equate directly to the corresponding geohydrologic unit
9 arrays. And I just showed some examples that we've
10 already seen. We're not going to repeat that.

11 I did play around with the horizontal hydraulic-
12 conductivity distributions a little bit and try to
13 differentiate a hydraulic-conductivity array for the
14 Tarawa Terrace aquifer and then possibly -- and the River
15 Bend unit and then possibly a different array for the
16 middle Castle Hayne aquifer. But you can -- you can take
17 your pick. It's, basically, I think, if you used all the
18 data and assigned it to all the layers as far as the
19 aquifers were concerned, you probably would not be far
20 off.

21 Let's see. The horizontal hydraulic conductivity of
22 Layer 9, I reduced strictly to 5 feet per day. And that
23 was just based on a qualitative evaluation of the few
24 descriptions of lithology of that unit that I had. I
25 assigned a hydraulic conductivity of .2 feet per day to

1 all of the confining units, and that was somewhat
2 arbitrary but not completely.

3 I had a -- I had a -- one aquifer test, a good
4 aquifer test actually using an observation well. Where
5 the observation well was -- actually both the observation
6 and pumping were partly screened across the Tarawa Terrace
7 confining unit. And it came out to be a very low
8 horizontal hydraulic conductivity, and so -- I think of
9 like 2 feet per day. So I just took an order of magnitude
10 less than that and assigned it.

11 And I want to make a comment, too, about the model
12 that I hope you'll keep in mind through the rest of the
13 discussion. This is just -- this is a preliminary
14 calibration that we got to where we thought we were
15 actually getting some reasonable results.

16 We haven't really been able to completely test the
17 flow model or for sensitivity or the advection transport
18 model for all the results that were -- that we'd really be
19 interested in. You could look at it on the other side.
20 There's not a lot of sense spending time on that if we
21 have a fatally failed model, so that will -- hopefully,
22 we'll find things like that out from your panel comments.

23 And I think the vertical anisotropy of -- was 10
24 percent that I assigned to all layers. The specific yield
25 of the Tarawa Terrace aquifer, I assigned as .2. The rest

1 were -- was point -- well, the rest doesn't -- don't
2 count. That's the only unconfined aquifer.

3 The storativity of the model, Layers 2 to 9, I
4 assigned as five times ten to the minus four. I have no
5 storage coefficient data for any of the aquifers, okay,
6 with the possible exception of one or two measurements
7 that I kind of wonder about in the Tarawa Terrace aquifer.

8 But as far as the -- as far as the other layers are
9 concerned, two to nine, the storativity is constant at
10 .0005. The specific storage of all the model layers is
11 simply the thickness determined from the layer geometry
12 divided into that number, and that's our specific storage
13 that we assigned to the model in a cell-by-cell array.

14 Okay. The calibration strategy. Dr. Johnson, you
15 ready?

16 DR. JOHNSON: Let's stop right here.

17 MR. FAYE: Okay.

18 DR. JOHNSON: And we will resume with your
19 presentation because it's really important that we
20 understand what it is that's been done and what you're
21 proposing to do. Also, Mr. Maslia has prepared some
22 responses to your premeeting comments. And following
23 Bob's presentation, Morris, I'd like for you to put that
24 in front of us.

25 Following that, we will then begin discussing -- and

1 it may be simply something that reflects my own
2 personality. But they gave us eight questions to answer,
3 and I propose to drag us through one by one because they
4 took the time to prepare them. And they really need your
5 advice and insight on many of those questions, it seems to
6 me.

7 So that's kind of how I see -- how we proceed after
8 lunch. Does anyone want to do it differently, or...

9 (No audible response)

10 DR. JOHNSON: Okay. Well, be back here promptly at
11 one o'clock because that's when we will resume. And,
12 Morris, any questions, any announcement about the lunch
13 arrangements?

14 MR. MASLIA: Again, if you want to eat at the Century
15 Center motel or hotel where you're staying -- I've eaten
16 there before. It's fine. I'm still around. The bus is
17 there. I would ask that the panel members get the first
18 bus out there because the bus seats 12. We're going to
19 make two trips and then anyone else. Or there are other
20 establishments around here. But we've allotted 11:45 to
21 one -- an hour and 15 minutes or so.

22 Obviously, I know Dr. Johnson would prefer to get out
23 by five today. Today's not as critical as I'm sure people
24 who are catching a plane tomorrow afternoon, so we'll just
25 play it by ear then. But do try to get back as promptly

1 as we can.

2 (Whereupon, a recess of approximately 73 minutes was
3 taken.)

4 MR. FAYE: All right. Let's continue with the
5 discussion where we left it off. Let's talk about the
6 model-calibration strategy, if we could, for just a
7 minute. The first -- the first effort was to develop a
8 conceptual model of groundwater flow. Then we wanted to
9 define a predevelopment condition as well as we could,
10 knowing that it was, at best, an estimate of
11 predevelopment conditions -- and when I say
12 "predevelopment," that's prepumping -- and simulate that
13 as well as we could, but knowing that we would have to
14 iterate back and forth between a transient simulation and
15 a predevelopment simulation in terms of changing arrays
16 and whatever; but any -- to see if the simulations that we
17 -- that we obtained for the prepumping condition would
18 generally support the conceptual model and then attempt to
19 do the same thing basically with transient simulations.

20 And we would have to choose the period of interest
21 for the transient simulations as a period when we had as
22 many water-level data as we possibly could to give us some
23 insight into how good or how poor our transient
24 simulations were or are. And essentially, that's -- with
25 a few sort of rather cursory advective transport

1 simulations, that's -- that is where we are now in the
2 modeling effort, groundwater-flow modeling effort.

3 The conceptual model that we came up with -- and I've
4 already alluded to all of -- to most of this. Your
5 groundwater flow occurs as -- groundwater recharge occurs
6 in the highland areas and flows down gradient toward
7 Northeast Creek and Frenchman's Creek and New River. The
8 long-term average annual recharge is 12 inches, and that
9 is -- that's borrowed strictly from several North Carolina
10 State and USGS reports. That seems to be the favorite
11 number that folks -- that folks apply to this part of the
12 North Carolina coastal plain in terms -- could you go
13 back, Claudia -- in terms of recharge to the water table.

14 The Tarawa Terrace area is not dissected to a large
15 degree with drainage, with streams. Frenchman Creek is
16 essentially the only prominent creek in the area. And my
17 particular feeling is that recharge could probably range
18 from 12 -- net recharge could probably range from 12 to 16
19 inches per year in that area. If you look at the maps of
20 long-term average annual rainfall and potential
21 evapotranspiration for this part of Onslow County in North
22 Carolina, you're looking at a difference between the two
23 numbers of about 16 inches.

24 So somewhere between 12 and 16 inches per year is the
25 number that we'll probably end up with as an estimate of

1 long-term average annual recharge, and that's one of the
2 things that we want to continue to -- one of the issues
3 that we need to continue to address in the modeling that
4 we haven't done yet.

5 And the other third element of the conceptual model
6 is -- and I've already suggested that previously -- that
7 the potentiometric surfaces in all of the aquifers are
8 relatively similar. And if you'll recall, that large area
9 map that I showed earlier that we had some discussion
10 about here, if we just take the piece out of that that
11 reflects Tarawa Terrace, you can see the data points. You
12 can see the contours, and now these represent -- these are
13 data points that represent the highest water levels at a
14 particular point or the oldest. And for the most part,
15 they're the highest.

16 Okay. All of these points here in the western part
17 of the study area, these relate to us; fairly coarse and
18 crude studies of underground-storage tank removals. And
19 we selected these water levels regardless of season,
20 regardless of -- regardless of season. There's probably
21 some fairly inherent inaccuracies in there because of the
22 lack of data that we had at a particular point. But to be
23 honest with you, I was just so happy to have a data point
24 in a particular place, I just -- I selected it and just
25 kept in mind the caveats regarding the accuracy of the

1 point.

2 But that's the map in detail for Tarawa Terrace that
3 we generated, our estimate of the prepumping
4 potentiometric surface. And if you recall, I mentioned
5 earlier in the context of the framework discussion, that
6 the monitor wells and bore hole logs that we had were
7 concentrated in the southern part of the Tarawa Terrace
8 area. That's actually in a shopping center area there
9 where there's a -- probably a half a dozen or so RI/FS
10 operations going on. And then here, of course, are the
11 monitor-well data and -- related to the ABC problem.

12 So that's our conceptual model, the hydraulic
13 characteristic data that we described earlier, and the
14 arrays and whatever. We applied that to Modflow, Modflow
15 2000. We have the drain -- is that the upper Castle
16 Hayne? That is -- that's either -- well, that could be
17 the River Bend unit or the lower unit. It's probably the
18 River Bend unit. There's our simulation. You'll recall
19 now that -- darn it. Claudia, can we go back, please;
20 forward one. There we go.

21 Recall that in the uppermost layer that Northeast
22 Creek out to the midchannel section is all a specified
23 head of zero elevation. You can see that, for the most
24 part, at 12 inches a year recharge, with Frenchman's Creek
25 in there as a drain -- and this is -- this is three or

1 four layers below the Layer 1. You can see that the
2 discharge to Frenchman Creek is still occurring. It's
3 well defined. You can see that the -- that the head
4 declines from the highland areas toward Northeast Creek
5 and toward New River, toward Frenchman's Creek.

6 The flow lines are just as we had hoped in the
7 conceptual model down toward the southeast and the south
8 toward Northeast Creek. So for all intents and purposes,
9 given the sort of cursory data and approach that we used,
10 the simulation of the prepumping conditions, I think,
11 supported our conceptual model quite well, and we were
12 satisfied with that.

13 So let's take another look. No. That's the
14 simulated potentiometric surface in the lower Castle Hayne
15 aquifer. So we've essentially gone from Layer 1 to Layer
16 9. And as you can see, just as the conceptual model
17 indicated, we're dealing with a very similar -- very
18 similar directions in terms of flow lines and a relatively
19 similar potentiometric contours and slightly higher heads;
20 slightly lower heads in the highland areas; slightly
21 higher heads in the discharge areas.

22 This is a scatter diagram of those data points that I
23 just told you about, wherein -- which we used to construct
24 our prepumping surface. This is just a direct one-to-one
25 comparison between the simulated head and the observed

1 head with -- and the observed heads, as I said, they have
2 some bit of baggage associated with them. But it's not --
3 I think that's quite good actually. The variance on this,
4 I think, was slightly less than one; the comparison
5 between the observed and the simulated heads, .96.

6 There we are. Okay. There's our simulated
7 predevelopment budget, the recharge -- Claudia, please.
8 Thank you. She's getting used to me.

9 The recharge was 1.9 CFS, and if you want to
10 distribute that to the 1400 acres for a year, you'll find
11 that you've got 12 inches a year. Discharge to Frenchman
12 -- we want to distribute that then as discharge.
13 Discharge to Frenchman's Creek was .6 CFS, and discharge
14 to Northeast Creek was 1.3 CFS. And this is nice and easy
15 in the model. It tells you what you're discharging to
16 drains, and it tells you what you're discharging to
17 specified heads. So it's sort of a no-brainer after the
18 computation is done.

19 All right. We'll talk about the transient
20 simulation. I went into some discussion in the report
21 regarding the quality of head data that we were dealing
22 with, with respect to creating a transient simulation,
23 developing a transient simulation. The vast, vast, vast
24 majority of those head data occur between 1978 and 1985.
25 And as best as I can understand it -- and I would be the

1 first to admit I don't completely understand where the
2 head data come from or how they were measured, I guess, is
3 a better way to say it -- these are air line measurements.

4 And there was apparently a monthly requirement at
5 Camp Lejeune to obtain what they called a static level and
6 a pumping level at each of their supply wells. And we
7 have data, as I said, from Tarawa -- for Tarawa Terrace
8 for almost all of the supply wells. There's data gaps,
9 but all of the supply wells are in the mix from January of
10 1978 to about April of 1986.

11 And -- so we used the static-water levels as a
12 calibration standard, and we didn't try to adjust them.
13 We just took them as they were. And you'll see in a slide
14 here that, basically, these levels -- you know, for static
15 levels, they're sort of all over the landscape. We don't
16 have any notion of the accuracy of the gauges that they
17 used. I made some -- I made some estimates of that in the
18 report. We don't have any notion of the accuracy of the
19 gauges that were used to obtain these measurements.

20 We do know that the gauges were calibrated to the
21 depth of the air line in the well. We don't know if there
22 was a standard. For example, when you obtain a water-
23 level measurement, you repeat the measurement until you
24 get a consistent result within some predetermined error.
25 We don't know if that was done. We don't know whether

1 this measurement was just a one-time shot. We don't know
2 how much time elapsed between turning. If it was indeed a
3 static measurement, we don't know how much time elapsed
4 between terminating the pumping at the well and collecting
5 the so-called static level. We don't know any of this.

6 We're on track to answer some of those questions when
7 we have some discussions with the folks at Camp Lejeune.
8 But I just want to outline the uncertainties related to
9 these data. So -- and we selected -- because Morris and
10 Mr. Bove are -- you've already heard this morning of the
11 time reference that they're interested in, we selected
12 one-month periods as stress periods.

13 So between -- and we extended the transient
14 simulation through 1994 because, in '91, '92, '93, and
15 '94, we had several dozen accurate water-level
16 measurements that were obtained throughout the Tarawa
17 Terrace area in various monitoring wells that were related
18 to several RI/FS investigations, ongoing investigations.
19 So rather than stop the transient analysis at, like, when
20 the wells shut down in 1987, we extended the analysis
21 without pumping at Tarawa Terrace up through the end of
22 1994 to take advantage of those additional measurements.

23 Let's go through a number of details. So that
24 results in 204 monthly stress periods. Because I think
25 the 12-inch standard -- the recharge of 12 inches per year

1 is somewhat on the low side -- I had some difficulties
2 with cells drying up in the upper two layers of the model,
3 and this caused some convergence problems during the
4 transient simulations.

5 So I just tweaked the recharge for that particular
6 stress period; just would start it at 12, and I'd increase
7 it to 13 inches a year, maybe 14 inches a year to maintain
8 a continuance convergence for each stress period. And I
9 had, ultimately, a range of recharge rates between 12 and
10 16 inches per year that I ended up using for a month.
11 Those were monthly rates. I think the average recharge
12 that I ended up with between -- for the period January '78
13 to March -- or December of '86 was like 12.7 inches per
14 year.

15 We had data from a consultant's report that listed
16 the well capacities, the active supply wells, in 1979.
17 And those are the capacities that we identified and used
18 throughout the transient analysis. We also had annual --
19 annual average daily pumpage rates. Actually, these were
20 -- these were treated-water rates from the Tarawa Terrace
21 WTP on an annual basis, so -- that were reported by the
22 USGS in one of their reports.

23 So, for example, in 1982, for example, we would --
24 we had a number of, like -- I don't know. I'll shoot at
25 it -- maybe, like .93 MGD. So for the whole year, 1982,

1 the average pumping rate was like .92, .93 MGD. So we had
2 that number, and we had well capacities.

3 We also had a crude idea of how Tarawa Terrace
4 operates their well systems. It's called a rotating
5 system. They would -- at a particular well, they might
6 pump for eight hours a day, and the well then would be on
7 standby for like 16 hours a day. And they would rotate
8 that type of a schedule through their whole active supply
9 well network. And, of course, we don't have -- we have no
10 data indicating the period of pumping for any particular
11 well for any particular day.

12 So -- but I did know -- I did -- unless these
13 operational records that had -- that we have copies of
14 that include these static water-level measurements.
15 Unless they indicated that, say, for example, Well TT-26
16 pumped all month or Well TT-52 was down for two months for
17 maintenance or something like that, I made sure that the
18 actual rate that I used for simulation in the model was
19 less than the capacity and also that all of the wells
20 pumped for a particular stress period for a particular
21 year equaled the rate -- the average daily rate reported
22 by the USGS. Those were the only two constraints that I
23 had.

24 And a secondary constraint were the operational
25 records. So if a -- if the records told me that a

1 particular well did not pump for a certain three months in
2 1984, I honored that. I took that pump off-line. I
3 didn't -- that well off-line. There was no water
4 discharge for that.

5 So those are basically the three constraints that I
6 used to put together a pumping schedule for 1978 through
7 1986. And then, of course, when the wells were all shut
8 down in March of '87, then all the wells were turned off.
9 And the Tarawa Terrace -- then the aquifer basically
10 recovered to pretty much its simulated predevelopment
11 condition in a very short period of time.

12 Okay. I think that covers that all.

13 DR. WALSKI: I have a question.

14 MR. FAYE: Sure.

15 DR. WALSKI: On the monthly recharge rates, did you
16 take into account anything about whether it was a wet
17 month? dry month? Like, some --

18 MR. FAYE: No.

19 DR. WALSKI: -- months you had hurricanes hitting
20 with --

21 MR. FAYE: No.

22 DR. WALSKI: -- huge flows --

23 MR. FAYE: No.

24 DR. WALSKI: -- and some with none.

25 MR. FAYE: That's a great question, Tom. No. We

1 haven't had time to do that. We're in the process of
2 having discussions, actually. And that's something that
3 we would very much like to hear from you -- from you-all,
4 from the panel. What we have in terms of meteorological
5 data: We have pan evaporation data so -- and on a monthly
6 basis. We have rainfall data on a monthly basis for our
7 whole period of interest, basically from 1950 to 1995,
8 something like that, as much as we want. Okay?

9 So we have that all on a monthly basis. And once we
10 can make a decision about a long-term average rainfall --
11 rather long-term average recharge, whether it's 14 inches
12 or 13-1/2 or 15 or whatever it is, we're trying to devise
13 a scheme to use this meteorologic record to adjust our
14 recharge on a monthly basis. That's clearly, clearly on
15 the radar screen, but as I said earlier, these simulations
16 were pretty basic. I mean, we're just trying to get a
17 handle on things, and we haven't done that. Okay?

18 And that's kind of why I felt free to just kind of
19 tweak recharge during a stress period when I had a
20 convergence problem, just boost it a little bit to a
21 particular higher rate -- a little higher rate and achieve
22 convergence and go on because I wanted to see what the end
23 product was. Okay?

24 DR. KONIKOW: Did you give any thought to the
25 possibility that recharge may be greater than the natural

1 recharge in urban areas where you have lawn watering
2 and --

3 MR. FAYE: Yeah.

4 DR. KONIKOW: -- leaks and --

5 MR. FAYE: Leaky pipes --

6 DR. KONIKOW: -- car washing and --

7 MR. FAYE: Yeah, we have; we have. And any comments
8 that you-all have about how to deal with that -- there's a
9 really good paper -- I can't quote it right now to you --
10 that really goes into a tremendous amount of detail on
11 this and using GIS to look at the lawn areas and the paved
12 areas and everything else and --

13 DR. KONIKOW: Are they on septic tanks, all the
14 houses --

15 MR. FAYE: They were.

16 DR. KONIKOW: -- housing developments?

17 MR. FAYE: They were originally on septic tanks.

18 DR. KONIKOW: That's a source of recharge.

19 MR. FAYE: Oh, absolutely; for quite a while. And
20 they're on a collection system now, but for --

21 DR. KONIKOW: A leaky collection system, no doubt.

22 MR. FAYE: Probably; yeah. And the water supply, the
23 pressurized pipes are probably leaking as well in
24 different places. Yeah. Yeah. Yeah. We've thought
25 about all of that. We haven't really acted on it. We're

1 in the process of trying to find -- figure out how to act
2 on it.

3 DR. KONIKOW: Now, you have a lot of cells going dry,
4 I saw, in your simulation --

5 MR. FAYE: In the -- in the -- yeah --

6 DR. KONIKOW: -- if you're concerned about that.

7 MR. FAYE: In the -- in Layer 1 and Layer 2 in the
8 highland areas; yes. And that -- and I know for a fact
9 that that actually is true in the real world. These --
10 those cells would only be wet, seasonally wet. Okay?

11 DR. KONIKOW: Yeah.

12 MR. FAYE: The water table --

13 DR. KONIKOW: Did you -- did you run Modflow with the
14 rewetting?

15 MR. FAYE: I did, and it just caused a tremendous
16 amount of convergence problems. I'm going to revisit that
17 again.

18 DR. KONIKOW: Have you thought -- you were using
19 monthly stress periods, but I believe you're also using
20 monthly time steps. Have you thought of cranking down
21 your time-step size?

22 MR. FAYE: Oh, to a smaller size?

23 DR. KONIKOW: Yeah. In other words --

24 MR. FAYE: Yeah.

25 DR. KONIKOW: -- you could have monthly stress

1 periods but --

2 MR. FAYE: I did that. I did that. I did that when
3 I rewet it, when I played around with the rewetting
4 feature. And it just -- I was not -- I spent a lot of
5 time. I was not successful. I'm hoping -- I'm hoping --
6 well, I very strongly believe that the baseline recharge
7 that we come up with, this long-term average annual, is
8 going to be somewhere probably around 14 inches or so.
9 I'm hoping that when we're dealing with that extra
10 recharge plus, you know, we'll be starting out as a
11 prepumping condition. So we'll have antecedent conditions
12 taken care of pretty well, right from the get-go, in early
13 1950s.

14 I am hoping that we -- we're still going to have dry
15 cells. I'm hoping it's not going to be a big issue. And
16 I hope, maybe, we can try to do some rewetting in that
17 context, but the rewetting was not at all successful, not
18 at all.

19 DR. KONIKOW: Maybe, with smaller time steps, it
20 would work better.

21 MR. FAYE: It could. It may. I definitely did try
22 that, but I'll definitely try it again.

23 DR. KONIKOW: Yeah.

24 MR. FAYE: I'm open for any -- I'd like to have that
25 rewetted. I really would.

1 DR. LABOLLE: My experience has been, like Lenny's
2 suggesting, decreasing the time step --

3 MR. FAYE: Right.

4 DR. LABOLLE: -- but you can also -- if you want to
5 get that to converge, another helpful item is to use a
6 solver with a dual-convergence criteria. So in other
7 words, you'll have convergence criteria for the outer,
8 nonlinear loop, in which things are --

9 MR. FAYE: That's the PCG solver.

10 DR. LABOLLE: -- which you can -- which you can --
11 no; not the PCG. It will be the -- actually, it will be
12 one of the latest solvers that Mary Hill released. I
13 forgot which one it was. It's the only one with the dual-
14 convergence criteria.

15 MR. FAYE: Okay.

16 DR. LABOLLE: I can send you one for the PCG if you
17 want. I have one.

18 MR. FAYE: Oh, that'd be great.

19 DR. LABOLLE: But the nonlinear loop, you set its
20 loose convergence criteria, and you can set the linear
21 solver. You know, it's a very strict convergence
22 criteria, and the combination of the two allows you to --

23 MR. FAYE: To rewet?

24 DR. LABOLLE: No. What it allows you to do is to
25 solve a confined flow problem as an approximation

1 essentially is what you end up doing because really you're
2 solving a confined flow problem --

3 MR. FAYE: Mm-hmm.

4 DR. LABOLLE: -- at some point in time. And you're
5 looping nonlinearly, but you --

6 MR. FAYE: Mm-hmm.

7 DR. LABOLLE: -- at every point, you're making a
8 confined approximation, essentially. Anyway, that allows
9 you to converge. That's one issue. And another comment I
10 have is on your calibration, recognizing that it's
11 preliminary, but I noticed that if I were to probably fit
12 a line through the scatter points there that it would
13 probably have showed less of a gradient. And I think
14 that --

15 MR. FAYE: You mean the scatter line?

16 DR. LABOLLE: Yeah; exactly --

17 MR. FAYE: Yeah.

18 DR. LABOLLE: -- and then the one-to-one.

19 MR. FAYE: It would --

20 DR. LABOLLE: And so the implication being that your
21 heads up here --

22 MR. FAYE: Mm-hmm -- are too low?

23 DR. LABOLLE: -- out in front are lower than --

24 MR. FAYE: Yeah.

25 DR. LABOLLE: -- you expect, and --

1 MR. FAYE: Yeah; yeah.

2 DR. LABOLLE: -- bringing them up --

3 MR. FAYE: Yeah.

4 DR. LABOLLE: -- relates to this --

5 MR. FAYE: And that's the --

6 DR. LABOLLE: -- wetting and drying --

7 MR. FAYE: And that's the recharge problem too.

8 DR. LABOLLE: Exactly.

9 MR. FAYE: That -- I know that, and I'm hoping,
10 again, like I say, that the baseline recharge, whatever we
11 actually end up with is going to be more than 12. And
12 it'll take -- and you'll see on the -- you'll see on the
13 scatter diagram for the transient analysis the same kind
14 of thing, I believe, although it's only the latter part of
15 it up toward the top where we have some really decent data
16 that it shows up. But I'll point that out.

17 Here's the capacity data that we used. This is from
18 the consultant's report, that I mentioned, in 1979. And I
19 violated this with respect to one well. After like 1980
20 or something like that, I violated that with respect to
21 TT-53 or 52, I believe -- it's in the report -- just
22 because I couldn't find any water anywhere else. I needed
23 water to match the USGS criteria.

24 It was one of those several periods -- several month
25 periods where several well -- two wells were down. And I

1 just needed that extra water to match that annual rate,
2 and so I violated that criteria at that time for Well
3 TT-53, I believe it was, or 52. But that was the only
4 time.

5 All the other times, those capacities were honored to
6 the limit. In other words, unless I had a note that the
7 well was being pumped for 24 hours, all of the capacities
8 that I used in the model to pump were less than those
9 recorded there and in many cases substantially less.

10 DR. POMMERENK: Bob?

11 MR. FAYE: Yes.

12 DR. POMMERENK: The map shows a lot more wells than
13 you indicate here.

14 MR. FAYE: Yes.

15 DR. POMMERENK: Do you have the data for the other
16 wells as well?

17 MR. FAYE: A lot of them we do, Peter.

18 Can we go back to that one, Claudia. Is it in -- is
19 it in this module where I showed the -- yes. Keep going.
20 There it is.

21 Yeah. Yes. Yes, Peter. These TT-45, TT-29, TT-28,
22 2-A, TT-55, TT-27 were all out of the -- out of operation
23 by 1978. Okay? These are some of the original wells
24 along with TT-26 that originally supplied the Tarawa
25 Terrace network water supply treatment plant: TT-27,

1 TT-55, 2-A, 28, 29, and 45. And in the very beginning of
2 Tarawa Terrace, from about 1952 to 1961, there were
3 actually two wells, and Tarawa Terrace call -- or Camp
4 Lejeune called them six and seven that were off the
5 reservation. They were off-campus. They were about a
6 mile and a half or so up Bell Forks [sic] Road.

7 And what the operation was there, I have no idea how
8 the water was actually connected to the network at Tarawa
9 Terrace. I don't know. But they're officially listed as
10 Tarawa Terrace supply wells in the records, numbers six
11 and seven. And they're actually located on Bell Forks
12 Road, and I have a crude map showing where they were
13 located.

14 So there's another actual two wells that actually
15 don't show up here for the very early supplies. Now, you
16 have to remember those -- all of these wells were off --
17 out of the system by about 1961 -- those ones. Except for
18 TT-26, all of those wells were out of the system by 1961
19 or '62. Okay?

20 DR. KONIKOW: Why were they out of the system?

21 MR. FAYE: Pardon?

22 DR. KONIKOW: Why were they taken out?

23 MR. FAYE: The early wells, Lenny, the way they were
24 constructed had a tendency to sand up. The maintenance
25 was a horrible situation. They had that, plus, I believe,

1 there were some network problems because of the lack of
2 proximity to the wells, to the WTP. The WTP is located
3 about right there.

4 And so they just -- they took those wells out of the
5 system. They were low producers. I have records in 1959,
6 indicating that they were very low producers and -- except
7 for TT-26. And so in '61, they came in and put in a
8 number of additional supply wells and took those all
9 off-line, abandoned them.

10 Thank you, Claudia.

11 DR. POMMERENK: I have another question on that table
12 that you showed earlier.

13 MR. FAYE: The Von Oesen table?

14 DR. POMMERENK: No; the capacity table.

15 MR. FAYE: Yeah. Could you go back.

16 DR. POMMERENK: According to those numbers, they
17 would have to meet their one MGD daily demand to
18 operate --

19 MR. FAYE: Easily; easily.

20 DR. POMMERENK: -- three wells for 24 hours?

21 MR. FAYE: Mm-hmm; easy.

22 DR. POMMERENK: Or let's say six wells for 12
23 hours --

24 MR. FAYE: Yeah.

25 DR. POMMERENK: -- because the state of North

1 Carolina doesn't allow you to run your --

2 MR. FAYE: Right.

3 DR. POMMERENK: -- wells 24 hours a day.

4 MR. FAYE: Right. Well --

5 DR. POMMERENK: So how did you determine in your
6 model which out of those seven wells -- did you just have
7 them all run at a, you know, prorated capacity?

8 MR. FAYE: No. What we had, Peter -- we actually had
9 copies of tables from Camp Lejeune of their operational
10 records. Okay? And the various columns of these records
11 would show a pumping level, a static level, a pumping
12 rate, operational notes about the well, whether the well
13 was down, whether the well was -- where the pump was being
14 replaced, things like that. And we have those on a
15 monthly basis from January '78 through March of 19 -- or
16 April of 1986.

17 So the pumping schedule that is used in the model for
18 each of the 204 stress periods honors those operational
19 records 100 percent in terms of what wells were operating,
20 what wells were not. I could see that what I just said is
21 bothering you. What is that?

22 DR. POMMERENK: No. I'm just wondering. So that's
23 in the simulation. And I'm not a groundwater modeling
24 person, but the simulations of those wells that you
25 determined according to that operating schedules were

1 operated --

2 MR. FAYE: Mm-hmm; at that month.

3 DR. POMMERENK: -- for the whole month.

4 MR. FAYE: Yeah. I had to. Yeah.

5 DR. POMMERENK: Okay.

6 MR. FAYE: That's our -- that's our minimum --

7 DR. POMMERENK: And at that capacity?

8 MR. FAYE: No, no, no, no; because, I just said, the
9 wells rotated. They were, like, on-line eight hours a day
10 and off like 16. So if you -- if you use that capacity --

11 DR. POMMERENK: You were just --

12 MR. FAYE: -- you're assuming a 24-hour pumping
13 period.

14 DR. POMMERENK: No. It's understood. Thank you.

15 MR. FAYE: Okay. Okay. So that's what I said. The
16 pumping schedules in the model honor those capacities,
17 such that the rate was always less --

18 DR. POMMERENK: Okay.

19 MR. FAYE: -- than that capacity.

20 DR. POMMERENK: It's understood. Thank you.

21 MR. FAYE: Okay. And I mentioned that the USGS gave
22 us average daily rates for various years. And the -- our
23 -- the pumping schedule, Peter, also honors those rates
24 from 1978 to '86. And then '87, you know, everything went
25 to hell, and they shut it down.

1 And I mentioned the static water-level data. This is
2 -- this is Well TT-26. This is what these data look like.
3 These are the static measurements, unvarnished. That's
4 what they are, and that's typical of all of the so-called
5 static measurements for all of the supply wells.

6 Okay. Given the schedules, given the data that I've
7 talked about, that's the scatter diagram for the transient
8 analysis. And these data here -- oh, why do I do that?
9 Thank you, Claudia.

10 These data here are -- for the most part, a lot of
11 these or the majority of these are the monitor-well data
12 that we had for the early nineties in various parts of the
13 -- of Tarawa Terrace. Almost -- and these are all of
14 these so-called static water levels that we just
15 discussed.

16 These are the accurate measurements here. And we
17 have a situation where, for example -- and I don't
18 understand this at all. Like, for example, like, at
19 TT-30, which is near TT-26 and TT-25, all of a sudden in,
20 like, about 1980, the static water levels just go up and
21 stay there. And the well is running. The well is
22 operating, and I don't know what happens. Then it just --
23 water levels rise, and it stays there. Not only is that
24 pump -- is that well operating, but it's near two other
25 operating wells. And yet -- but those numbers are in

1 there. We didn't -- I didn't selectively disregard any of
2 the data at all. It's all there.

3 DR. JOHNSON: Bob, you need to kind of wrap this up,
4 please.

5 MR. FAYE: Okay. We're almost done. And I'll just
6 show you a couple of the results. This is TT-26. That's
7 the observed -- so-called observed static and the
8 simulated. There's TT-31, -52, -67. And there's the
9 stress period '84, when TT-23 was operating and just very
10 rapidly that -- and we've just done some very preliminary
11 advective transport simulations. And let me go through
12 that.

13 There's our water budget for the stress period '84.
14 There's our recharge. It was 12.8 inches a year, what
15 went into storage. That's induced recharge from Northeast
16 Creek, which would have been brackish water; our well
17 pumpage, and that honors the USGS rate for 1984; the
18 discharge of Northeast Creek; discharge of Frenchman's
19 Creek; and change in storage.

20 Advective transport, I just basically did several
21 things. We -- I seeded the cells or one or two cells
22 right next to ABC One-Hour Cleaners to see where they
23 would end up. Because of the -- because of the
24 contaminant extent that went north and west of ABC
25 Cleaners that we saw on the maps before lunch, I put

1 particles in 600 feet west of ABC Cleaners along Lejeune
2 Boulevard. That's State Route 24, and I looked at the
3 time of travel to the Tarawa Terrace supply wells of
4 interest. And I came up with an explanation for the
5 occurrence of PCE at Well TT-23, which is that isolated
6 section to the south that we looked at in the maps
7 earlier.

8 When we seeded the particles right in the immediate
9 vicinity of Tarawa Terrace -- of the ABC One-Hour
10 Cleaners, all of them were captured at TT-26; everything.
11 The -- none of the other supply wells captured anything
12 for this particular stress period '84, which relates to
13 December of 1984. When we went a little bit west of ABC
14 One-Hour Cleaners -- and this is after 10,000 days, by the
15 way -- indeed, TT-23 captured particles that were seeded
16 west of the ABC Cleaners.

17 DR. LABOLLE: Bob, are you running the hydraulic
18 static then? Because you keep mentioning the stress
19 period in '84, but then you run it for 10,000 days.

20 MR. FAYE: Yeah.

21 DR. LABOLLE: Can you elaborate? So steady-state
22 hydraulics, transient?

23 MR. FAYE: The gradients, velocities, and whatever
24 relate to that one stress period, stress period '84.

25 DR. LABOLLE: That would explain probably the sole

1 capture of contaminants in a single well.

2 MR. FAYE: Well, actually --

3 DR. LABOLLE: If you consider all the pumpage, you
4 tend to have things --

5 MR. FAYE: Yeah. It could bounce around. Yes, it
6 could; in reality, yeah. I also did it for other stress
7 periods, but I came up with slightly different
8 configurations in terms of drawdown from the, you know, in
9 the system. And TT-26 captured everything, always
10 captured everything when -- but, again, that's a simulated
11 of continuous pumping. But it captured everything that I
12 put in right in the immediate vicinity of ABC Cleaners.
13 It captured everything. It always went there.

14 DR. DOUGHERTY: Were these all seeded in the top
15 layer?

16 MR. FAYE: Some of them were. One experiment seeded
17 Layer 3, which is the River Bend unit. And that's where a
18 lot of the contaminant was -- has been observed. And I
19 also seeded Layer 5, which is the lower unit of the upper
20 Castle Hayne aquifer. And there was a little bit of
21 contamination observed in that layer as well from the
22 field data. So I seeded both layers.

23 DR. KONIKOW: Why didn't you seed layer -- the top of
24 Layer 1? That's where the contaminants reached the water
25 table.

1 MR. FAYE: Yeah. The -- that's a good question. The
2 -- at that time, the Tarawa Terrace, when the data were
3 collected, all of the -- all of the contaminant was below
4 that particular layer. And that was -- that was when I
5 was having problems with the cells drying out too, Lenny,
6 in Layer 1. And that's up in the highland areas with
7 Layer 1 and Layer 2. So I ended up -- I ended up seeding
8 Layer 3.

9 DR. WALSKI: The fraction of the time was 26 on? Is
10 it run like 80 percent of the time, or did it run 70
11 percent of time on average?

12 MR. FAYE: That, I really don't know, Tom. All I
13 know that it probably rotated --

14 DR. WALSKI: Okay. So --

15 MR. FAYE: And so didn't run 100 percent of the time.

16 DR. WALSKI: So therefore, you can explain possibly
17 some of this water getting past it by the fact that, if
18 you took real, like, hourly time steps for a change, the
19 hydraulics would then shoot past it and --

20 MR. FAYE: And that's right; that's right. That's
21 right. And there's even a better explanation, I think.
22 Okay? And that's this right here. If you seed -- there's
23 another well down here, TT-54, right here. And TT-23 is
24 actually right here, and if you look at the capture zones
25 of TT-26 and TT-54, you can see right in this area that

1 they're very close to one another. So when the well --
2 when TT-26 is shut down for any reasonable period of time,
3 probably the capture zone for TT-54 moves over into part
4 of the capture zone for TT-26.

5 Also, this is a highly contaminated area right in
6 here. This is a much less contaminated area here. So
7 even if this situation here persisted through time
8 constantly, I think you may also have had some exchange of
9 mass along concentration gradients from the highly
10 contaminated area to a lesser contaminated area. And it
11 would end up in the capture zone of TT-54.

12 Now, you say, how did well -- well, this -- you have
13 to understand that TT-23, at best, only operated for about
14 a year. And TT-23 is right here. And in the DPT analyses
15 that we have, there was a low-level PCE contamination
16 throughout all of this area here.

17 So my conclusion was that one possible explanation
18 for the occurrence of PCE at TT-23 was not that TT-23
19 pumped for six months and was able to capture PCE that was
20 in the general vicinity of ABC Cleaners, but rather over a
21 period of time -- TT-54 began operation in 1961. But
22 rather over a period of time, you had intermittent capture
23 of PCE by TT-54 that ended up creating this low-level
24 contamination in this particular area of the Tarawa
25 Terrace campus or housing area.

1 And then in 1984 when TT-23 was actually turned on
2 for a short period of time, there was a resident PCE in
3 the aquifer that was induced into the well. That's one --
4 that's my explanation, and I'm sure there's others. But
5 that's my explanation for the occurrence of PCE in Well
6 TT-23.

7 DR. DOUGHERTY: Quick question. In terms of -- I
8 want to connect this one to the pumping capacity chart
9 from Van Oesen. Looking at those capacities for the late
10 seventies, it appeared that if I summed up the capacities
11 for the TT-26 area, there are the three wells up there --

12 MR. FAYE: Mm-hmm.

13 DR. DOUGHERTY: -- and then for the cluster that's
14 down in the development that there was a significantly
15 larger net capacity for the southern cluster than the
16 northern cluster --

17 MR. FAYE: No.

18 DR. DOUGHERTY: -- is that accurate? I mean, it was a
19 partial record.

20 MR. FAYE: It's as accurate as I know it.

21 DR. DOUGHERTY: No. What I'm saying is my
22 assessment, since I only saw this table rather than the
23 entire simulation set of data. In terms of what you
24 simulated, did you actually have twice as much pumping
25 from the southern cluster of wells than from the northern

1 cluster? Is that roughly the division?

2 MR. FAYE: Oh, I see; because of the -- because of
3 variations that I made in the pumping schedule to honor
4 those two criteria that we talked about; yeah.

5 DR. DOUGHERTY: Because of capacity --

6 MR. FAYE: Yeah. Mm-hmm. And -- but, again, now,
7 Dave, you have to understand that there would be months
8 when these -- some wells were out of --

9 DR. DOUGHERTY: Sure.

10 MR. FAYE: -- operation. So I had to increase the
11 pumpage at other wells to make sure I could maintain that
12 rate.

13 DR. DOUGHERTY: No. I understand. I've got that
14 right. I got how it worked.

15 MR. FAYE: Great; okay.

16 DR. DOUGHERTY: But I'm just trying to get a sense
17 for -- a simplified sense because there's an awful lot of
18 material here.

19 MR. FAYE: Okay.

20 DR. DOUGHERTY: Basically, you're pumping twice as
21 much down here, generally speaking --

22 MR. FAYE: Right.

23 DR. DOUGHERTY: -- than up there?

24 MR. FAYE: Right. But if you -- and I -- what I also
25 looked at the simulated capture zones for all of those

1 wells. And they're all deflected up to the northwest
2 except for TT-54. Okay? These wells down in this,
3 they're all deflected up here --

4 DR. DOUGHERTY: Mm-hmm.

5 MR. FAYE: -- rather than giving any competition to
6 TT-54 or TT-26 up there.

7 DR. DOUGHERTY: Mm-hmm.

8 DR. LABOLLE: Did you look at the sensitivity of the
9 simulated capture to vertical hydraulic conductivity at
10 all?

11 MR. FAYE: No; haven't done that at all. It's on the
12 radar screen; just there's all kinds of sensitivities that
13 we need to deal with.

14 DR. LABOLLE: Yeah. It's been my experience in
15 situations like this that it tends to be highly sensitive
16 because what will happen is that if your source is seeded
17 in Layer 1 and your vertical hydraulic conductivity is
18 decreased, then the contaminant's going to migrate along
19 more -- not in the ambient gradient, but more of an
20 ambient gradient --

21 MR. FAYE: Right.

22 DR. LABOLLE: -- than is affected by the --

23 MR. FAYE: Right.

24 DR. LABOLLE: -- by the actual pumpage in the deeper
25 layers, assuming these wells are screening deeper.

1 MR. FAYE: Right. Well, also, too, we're dealing
2 with, in the real world, a heck of a contrast in
3 densities. I mean, 1 to 1.6 and that -- none of this
4 shows up in any of that simulation there. I mean, that's
5 just strictly advective transport.

6 Thank you very much. And I'm sorry that -- oh.
7 Okay.

8 DR. KONIKOW: When you talk about a density contrast,
9 you're talking about --

10 COURT REPORTER: Please get on your mike.

11 DR. KONIKOW: When you're talking about a density
12 contrast, you're talking about pure phase?

13 MR. FAYE: Yeah; absolutely; yeah.

14 DR. KONIKOW: But we're not looking at the movement
15 of the pure phase, are we?

16 MR. FAYE: No. No. But, I mean, that's just -- I
17 know it's a DNAPL. Okay? And that's what -- that's what
18 the -- that's what it is: 1.6 in the laboratory.

19 DR. LABOLLE: But not at these concentrations.

20 MR. FAYE: No.

21 DR. DOUGHERTY: I wonder if the hydrodynamics will
22 drive it.

23 DR. LABOLLE: Only near the source --

24 MR. FAYE: Right.

25 DR. LABOLLE: -- might we have some kind of density

1 effects.

2 MR. FAYE: And most of that is actually in the -- I
3 mean, there is no -- the almost free product stuff is in
4 the unsaturated zone at the source. And there's a map in
5 your report that shows that.

6 DR. JOHNSON: Well, thank you very much for your
7 presentation, and --

8 MR. FAYE: Well, thanks for your forbearance.

9 DR. JOHNSON: -- also thanks to the questions from
10 the panel. Let's proceed. Morris, you had prepared some
11 responses. Yes, please.

12 DR. CLARK: I had one question.

13 DR. JOHNSON: Of course.

14 DR. CLARK: We had a side conversation before,
15 earlier today, about the other sources of groundwater
16 contamination that existed in the Camp Lejeune area, and I
17 thought it might be useful for the panel to hear about
18 some of that.

19 MR. FAYE: You mean, like, in the Hadnot Point area?

20 DR. CLARK: Well, in the Hadnot Point area.

21 MR. FAYE: Am I going to steal your thunder on that,
22 Morris?

23 MR. MASLIA: No; no.

24 MR. FAYE: Okay. Yeah. I'd be happy to as long as
25 -- the -- as Morris mentioned this morning when we first

1 started the program, we deliberately chose Tarawa Terrace
2 because, believe it or not, it's the simplest system that
3 we had to deal. Okay? As he said, there's one source,
4 and it's an identified source as far as the contamination
5 of the groundwater is concerned.

6 If you go south to the Hadnot Point area, you're
7 dealing with dozens and dozens of sources of
8 contamination, some relatively small, some off the radar
9 screen, that have contaminated groundwater in a big way.
10 A number of these sites have RI/FS operations ongoing
11 right now in terms of remediation. We're looking at a lot
12 of TCE, a lot of BTEX. It's kind of a mess. Okay?
13 You're looking at -- you're looking at surface sources.
14 You're looking at buried sources.

15 You face the possibility of -- you face the
16 possibility of a particular supply well capture zone
17 collecting contaminants from several sources very easily.
18 So that's an exceedingly complex condition to try to do
19 what we're trying to do. And you sort of have to crawl
20 before you can walk. And our thought was if we can be
21 reasonably successful, create a technically defensive --
22 defensible product at -- ah, a Freudian slip -- product
23 for Tarawa Terrace, then we may have a shot at doing
24 something similar for the Hadnot Point area. Does that --
25 does that cover --

1 DR. CLARK: But the chances of actually being able to
2 do that, I gather, are marginal at best; right?

3 MR. FAYE: I really -- I don't know one way or the
4 other on that. I would just -- in fact, I don't even know
5 how we would approach that, maybe just a single supply
6 well at a time. Okay? I don't know. It's just -- we're
7 just going to have to deal with that when the time comes.

8 MR. MASLIA: Let me, if I might, qualify that because
9 when Bob and I got together, again, we made the decision
10 based on, you know, consulting work, the USGS work, and
11 all that, that we had the best chance from -- for
12 developing a framework and either before you even get to
13 the modeling at Tarawa Terrace. And so that's some of the
14 -- I guess one of the questions we've posed is: Do we
15 extend that? And, again, it means going back to
16 developing the geohydrologic framework again for Hadnot
17 Point, which we -- I don't believe we've done at this
18 point --

19 MR. FAYE: No; just for Holcomb Boulevard.

20 MR. MASLIA: -- at this point yet. And so that's one
21 of the issues we really want to discuss. Or is it just
22 going to be so completely uncertain and variable that we
23 may not be able to narrow any of the uncertainties, stuff
24 like that? So Tarawa Terrace, we felt, was our best shot,
25 given the time frame, given agency constraints, budgets,

1 and time lines for the epi study. Dr. Bove can address
2 the study time frame and some of the pressures associated
3 with that to try to get some answers in a reasonable
4 amount of time.

5 Am I on?

6 DR. JOHNSON: Yes, you are.

7 MR. MASLIA: Okay. Okay. I'm a little shorter than
8 Bob. It's happened all my life. I even have to look up
9 to my son, so...

10 In reviewing the premeeting comments and, of course,
11 I've had a few days to look through them and hit more of
12 the salient points. And they do bring up some gaps, if
13 you will, that we need to address. But I wanted to give
14 the panel a sort of a feeling that, again, we take these
15 very seriously. Some of them may, in fact, change our
16 approach or change our direction.

17 So I wanted to try to see what general areas the
18 comments from the panel got into and, you know, what our
19 response -- obviously, in a generalized, given the time
20 frame that we've put these in. So I will go through here,
21 and I'm not sure if I've included that in your handouts or
22 not, in your packets. If not, we can get the panel a copy
23 of our generalized responses.

24 But from the groundwater side, and, Doctor, did you
25 just want me to end on the -- for the groundwater for this

1 morning and then --

2 DR. JOHNSON: Yes.

3 MR. MASLIA: -- tomorrow we can or --

4 DR. JOHNSON: Yes.

5 MR. MASLIA: Okay. On the groundwater, a lot of
6 comments resided in the area of uncertainty of geologic
7 and aquifer parameters as we've discussed thus far and
8 what -- it looks like some mention of probabilistic
9 methods, such as Monte Carlo, looking at realizations.
10 And I know Dr. LaBolle has a lot of expertise in that area
11 and has worked on some sites for ATSDR in that area.

12 And that is something, I think, would be the next
13 step. The question, I think, for the panel would be: In
14 taking that as the next step, should that be the next step
15 prior to doing any more refinement of the Tarawa Terrace
16 model? Should we jump into probabilistic uncertainty
17 methods now, rather than doing any more refinement on the
18 Tarawa Terrace model?

19 Secondly, some parameter estimation methods to look
20 at sensitivities like vertical hydraulic conductivity
21 relative to other parameters. Again, that is a direction
22 we definitely need to go in and anticipate going in. As
23 far as modeling boundaries and sources, source conditions,
24 I think the best way may be to look at use of sensitivity
25 analysis to assess the nearness or the impact of moving

1 that northern boundary further away from the source and
2 seeing how much change it provides to the model, adjusting
3 the boundary.

4 Again, we have the contradiction, if you will, that
5 you've got the DEM that I didn't get to mention. The DEM
6 data that was contoured for us -- actually, North Carolina
7 district office is who we sent it up to, to pull it off
8 the DEM site and provided us with the 2-foot contours,
9 but, again, based on that and the topo maps. But I think
10 that would be an area of -- that we could at least try to
11 address and looking at the sensitivity of the northern
12 boundary with relation to what impact it may provide on
13 the model.

14 And the one question is: Would we see a bigger impact
15 or a more pronounced impact if we go to the full fate and
16 transport as opposed to just looking at the advective
17 flow, which we're doing right now? In other words, you
18 may find a changed impact when you go to the full fate and
19 transport where you're looking at dispersive properties
20 and start moving boundaries away from the ABC Cleaners'
21 source.

22 The other approach -- and I think this comes into if
23 you want to put in the area of sensitivity analysis -- is
24 we do have techniques. Actually, there have been some
25 papers on that, developed out of the multienvironmental

1 media simulations lab at Georgia Tech, but they -- where
2 they have taken observed concentration values and backed
3 out source locations through use of genetic algorithms.

4 And that's, again, maybe an avenue to explore, taking
5 some of the observed values that we have, historical in
6 nature, and seeing if, in fact, it backs out the source
7 location that we are assuming to ABC Cleaners. And I
8 don't know -- I don't want to put Dr. Aral on the spot
9 there. But we've had some preliminary discussions on
10 that. And as I said, that's another area that we may --
11 that perhaps, we should explore is using the observed
12 data --

13 (Projection screens withdrew to the ceiling.)

14 MR. MASLIA: I didn't -- is it time? You may have to
15 touch the touch screen, Claudia. The touch screen may
16 have timed out (laughter). Either that, or it didn't like
17 the answer I gave. Okay. I don't know. Okay. You may
18 have to hit "dual projector" to do that. And if not, I
19 don't know if Ann Walker or somebody out in the hallway
20 can hear us. They may have to call somebody to come get
21 us. But I'll proceed in talking as we go on.

22 So those two areas of doing -- I'm not sure --
23 inverse modeling is not the correct nomenclature, but
24 reverse modeling of going from the source, observed
25 source, backing out. And that may also give us an

1 indication if, in fact, that source -- where we think ABC
2 is too close to a boundary.

3 The next groundwater, I've got fate and transport
4 issues. And I know, Lenny, you brought that out that we
5 mentioned fate and transport only provided advective, and
6 it's been our intent all along to do a full fate and
7 transport. And again, in the Tarawa Terrace area being
8 PCE is the only known source that would give us a single
9 constituent model. So we are -- definitely, that's on the
10 plans. That's always been on the plans to do that.

11 One of the issues I want to bring up -- and Bob
12 mentioned -- some of the data that we get in pieces as far
13 as production and things like that, although we've been at
14 this for over a year, I think, more or less. For example,
15 last week, I just got a pile of information: month-by-
16 month, raw water, finished water, production data from
17 Camp Lejeune from 19 -- what was it?

18 MR. ASHTON: 1980.

19 MR. MASLIA: 1980 through 1986.

20 MR. ASHTON: '84.

21 MR. MASLIA: '84; month by month. And, of course,
22 we've been asking for all data, so I'm saying it's slowly
23 filtering in. It may take a more direct involvement of,
24 you know, giving ATSDR staff or whatever to going into the
25 vault, locating contract numbers, and things like that.

1 But this is new data that we just were provided with from
2 the folks at Camp Lejeune. So again, that's in that
3 critical period. What we really still need is the prior
4 to the '78 information; '68 to '78. We're still looking
5 for that.

6 Let's see. So again, the advective transport were
7 viewed as preliminary estimates; get the model working;
8 any issues with -- as far as not model code, but
9 implementation of the code that we could take care of at
10 this end and then taking comments, feedback, from the
11 panel. Again, at least we've got some basic parameters
12 and basic numbers to then go into uncertainty areas, go
13 into other more refinements of the model.

14 So that's really the groundwater issues; a quick
15 preliminary perusal from your comments that I saw, and
16 that's the direction we're going in. And we will try to
17 answer, you know, anything else.

18 DR. JOHNSON: Did anything you just heard raise
19 concerns, or is there anything that you heard for which
20 you would give a strong endorsement? What I've heard from
21 Mr. Maslia is a series of considerations, and all that's
22 good. But is it something that really that you've heard
23 you'd say, "This really ought to be something you pursue,"
24 based upon his responses?

25 DR. DOUGHERTY: I think you should move the northern

1 boundary and skip the sensitivity.

2 MR. MASLIA: Okay.

3 DR. DOUGHERTY: Just do it. Topography does not
4 define hydraulics, unfortunately.

5 MR. MASLIA: And would you then just use a
6 generalized, head-type boundary or inflow boundary
7 since --

8 DR. DOUGHERTY: I'd have to look further north than
9 the maps that I have here show me --

10 MR. MASLIA: Okay.

11 DR. DOUGHERTY: -- so I can't answer it really.

12 MR. MASLIA: Okay.

13 DR. WALSKI: Are there municipal wells, other things
14 up north?

15 MR. MASLIA: Oh, yeah. There's the city of
16 Jacksonville is, you know, pumps the wazoo out of
17 groundwater. And I think we uncovered some -- did we not
18 uncover some documents when we first went to Raleigh about
19 discussions back and forth between Camp Lejeune and the
20 city of Jacksonville about --

21 MR. FAYE: For the period of time that we're
22 interested in, the pumping at the city of Jacksonville is
23 not an issue. They have for decades pumped from the
24 Cretaceous aquifer system, which is well below the Castle
25 Hayne units that we're talking about here and with no

1 effect on the Castle Hayne.

2 Just most recently, they've applied for permits
3 within the last year or so to develop wells in the Castle
4 Hayne. But for the period of time we're involved in,
5 Jacksonville pumping would not be an issue.

6 What would be an issue would be a lot of older
7 subdivisions and industrial areas and business areas north
8 of there that back in the fifties and sixties and
9 seventies, the period of time that we're interested in,
10 would have been self-supplied. And I don't -- it would be
11 just -- we could certainly look, but I wouldn't be too
12 hopeful of determining or of finding out what kind of --
13 we would know less about those situations than we would
14 about the Camp Lejeune pumpage.

15 So that's the situation there in terms of the -- and
16 that self-supplied pumping was almost invariably from the
17 same aquifers that we're dealing with because they were
18 shallower and they were good. They yielded good water to
19 wells, and, of course, the businesses and the residences
20 and everything loved that because it was much cheaper than
21 going deeper. So that's what we're dealing with.

22 MR. MASLIA: I've got half a screen -- half a room
23 screen working, and we've got a number for the room
24 operator. So we're trying to...

25 DR. JOHNSON: Based on what's on the screen, we've

1 had one comment from David in terms of his view and strong
2 recommendation. Does the panel have other recommendations
3 based on what's on the screen or what you have heard?

4 DR. KONIKOW: Well, I would look again closer at the
5 vertical hydraulic conductivity, its relation to the
6 horizontal, and also the hydraulic conductivity of the
7 clay layers of the confining units. The values that you
8 or Bob gave earlier just seem a little too high, relative
9 -- you were talking about .2 feet per day, as opposed to,
10 you know, maybe 10 or 15 in the aquifer.

11 That -- for a clay confining layer, that just seems
12 too high. And one of the things that might -- what you
13 might find is that, as you make the vertical hydraulic
14 conductivity lower and the hydraulic conductivity of the
15 confining layers lower, your cell drying problem may go
16 away.

17 MR. FAYE: Yeah. That's a good point, and you easily
18 could be right. But the fly in the ointment there, Lenny,
19 two things: The, admittedly, very limited lithologic --
20 good lithologic descriptions that we have of these
21 confining units, yeah. They're clay, but they are very,
22 very sandy. They are definitely sandy. And they're not
23 real competent clays there, texturally.

24 I mean, when you look at the drilling times and the
25 drilling records, pha-phoook, I mean, it's -- you know,

1 there's no -- there's no slowing down at one -- at a clay.
2 So they're leaky. They are very definitely leaky. We
3 haven't done any kind of sensitivity analysis at all on
4 the anisotropy or the horizontal hydraulic conductivity.
5 But this is not, you know, this is not a -- these are not
6 real competent confining units at all. Okay?

7 MR. MASLIA: I, actually -- and this is part of our
8 question, so I don't know if you want me to pose that now.
9 Dr. Johnson, I'll let you go down the list. But I'll just
10 throw it out there, and then you can decide. I'm not
11 usurping your power as the Chair.

12 DR. JOHNSON: I have no power as the Chair, nor do I
13 want any. But I am fully committed at some point today to
14 start down this list of questions, and we will do that in
15 the not-too-distant future. Are there any other points
16 here of emphasis from the panel on Morris' presentation?
17 Yes, Vijay.

18 DR. SINGH: I think it was pointed in prepanel
19 meeting discussion as well as during the presentation. I
20 think that there has to be a better accounting of
21 recharge, especially when you are doing the transient
22 groundwater modeling because recharge constitutes the
23 input. And if your input is not properly accounted for, I
24 don't think -- I don't think you will be able to do as
25 good a job in groundwater modeling. And I think that may

1 also partly explain the problems that you're encountering
2 in the convergence.

3 Dr. FAYE: You're exactly right. I mean, we have
4 recognized that, and I know it sounds kind of lame. But
5 the actual truth is that we just haven't had a chance to
6 really address that issue in a lot of detail, but I fully
7 agree with you. And hopefully, that will solve a lot of
8 these problems.

9 DR. SINGH: And the other point that I think it will
10 be important to also evaluate the reliability of the model
11 results, and this is particularly useful from the
12 standpoint of giving the information to the public.

13 MR. FAYE: The reliability of what, sir?

14 DR. SINGH: The reliability of your model result, how
15 -- what level of credence can you really put, given all
16 the uncertainty associated with your hydrogeologic
17 description, your parameter estimation, you know,
18 groundwater conceptual assumptions, and a whole host of
19 other things. I think it's very important to --

20 MR. FAYE: To qualify.

21 DR. SINGH: -- give the level of confidence --

22 MR. FAYE: Right.

23 DR. SINGH: -- or the confidence bends to the model
24 results so that -- so that the public can have some
25 confidence --

1 MR. FAYE: Absolutely.

2 DR. SINGH: -- in the results that you are giving.

3 MR. FAYE: And that should not be a qualitative
4 assessment. That should be a quantitative assessment as
5 much as we can do, and I fully agree with you.

6 DR. JOHNSON: In that same vein, I asked a question
7 earlier about validity of the EPA models, and to my
8 knowledge, they're quite good. So I'm not -- I don't have
9 any agenda here other than the fact to say to you that the
10 National Academy of Sciences has begun a very serious
11 study of the EPA system of modeling and validity of
12 specific models. Now, I do not know how far into that
13 study they have gotten, but I surely do know that they are
14 doing that at the request of EPA, which is quite
15 commendable.

16 MR. FAYE: Well, let me just say that, first of all,
17 the USGS, the mother and daughter of Modflow here, which
18 is our simulator, they have exceedingly rigorous standards
19 for qualifying their codes, number one. And typically,
20 Dr. Johnson, the way this is done, they -- you recognize a
21 standard groundwater problem that can be solved
22 analytically. And then you pose that problem to the
23 numerical code and see -- and compare that result against
24 the analytical results. And I can tell you that that was
25 done with a great deal of rigor by the USGS, and the

1 results were highly successful.

2 DR. JOHNSON: I have a couple of administrative
3 questions, Morris.

4 MR. MASLIA: Yes.

5 DR. JOHNSON: The panelists have provided a set of
6 written comments, premeeting comments. My question is:
7 Will these be made part of the public record?

8 MR. MASLIA: They will be in the -- in a refined --
9 and when I say "refined" -- grammar and otherwise --- as
10 part of the report -- the report about the meeting
11 summary. Our past experience has been, like in Dover
12 Township, they were included as an appendix to the report.

13 DR. JOHNSON: This is going back to Dr. Singh's
14 comment this morning about the transparency of all of this
15 effort. It would seem quite meritorious to have these
16 part of the public record, whether it's the record of this
17 meeting or some other source. Does any panelist object to
18 having his comments made part of that record? Do you want
19 time to "correct your premeeting comments," knowing now
20 that it looks like they'll be in the public record? You
21 should be given that privilege.

22 DR. DOUGHERTY: I'd like the opportunity to go back
23 and just check. I don't have a problem with the
24 principle.

25 DR. JOHNSON: Okay.

1 MR. MASLIA: Well, what will happen, based on our
2 modus operandi from the past is that a draft meeting
3 summary report will come out with your comments in the
4 appendix. And each panelist will be given a copy of that
5 draft meeting summary to correct their comments, see if
6 it's misquoted, or anything else through our contractor,
7 Eastern Research Group. And then once they hear back from
8 you -- yea or nay or change page so-and-so -- then that
9 will become a final meeting summary report. And that will
10 be published and, as Dr. Singh's asked, put on the Web as
11 well.

12 DR. JOHNSON: Does ATSDR plan to provide an answer to
13 each of these questions?

14 MR. MASLIA: As closely as we can. In other words,
15 some of the questions were -- the same questions were
16 asked by multiple panelists. That's what I'm trying to
17 say. I have not thought out yet -- if you're asking me
18 going down each comment, you know, Panelist No. 1, you
19 know, has ten questions. Do we answer those specifically,
20 then go to Panelist No. 2, even though there's a
21 repetition -- may be a repetition.

22 DR. JOHNSON: All right. That's just an
23 administrative detail, you know. It's called "ditto" or
24 something like that.

25 MR. MASLIA: Right.

1 DR. JOHNSON: But do the panelists feel the need for
2 having an agency response to what would strike me as
3 rather seriously thought-through questions? What are your
4 expectations? I don't want to push something forward
5 that's not palpable.

6 DR. POMMERENK: For me, personally, if I see that my
7 comment has been addressed in a follow-up report -- you
8 know, this is obviously a draft. If the final has those
9 questions addressed because, you know, some of the
10 questions were simply due because I could not find the
11 answer immediately. If they were addressed now, for
12 example, that would be fine, but if it's something else,
13 or...

14 DR. JOHNSON: But there's another group of people who
15 might profit from a reply, and that's the public.

16 DR. POMMERENK: Yeah.

17 DR. JOHNSON: I mean, here's a serious question from
18 Dr. Clark. Number 5, what kind of errors might be
19 inherent in these assumptions? Should that be answered
20 and made part of the public record?

21 DR. WALSKI: I think that as long as they have
22 addressed the substance of the comments, I don't think
23 it's really a good use of resources to be going through
24 question by question. It seems like that's excessive. As
25 long as they substantially respond, I think, and

1 incorporate it in the report, that would be satisfying to
2 me.

3 DR. JOHNSON: Okay.

4 DR. DOUGHERTY: For myself, they weren't -- were not
5 prepared for the expectation of a point-by-point response
6 because they were prepared to inform the agency about some
7 of the issues that were on my mind that would be useful to
8 hear about here. They were to prompt discussion as
9 opposed to elicit responses. There are some that,
10 certainly, are in that other category, but I think we've
11 heard many responses; not all, but many.

12 DR. JOHNSON: I would offer the opportunity at 2:30
13 when the public addresses us to make comments on that same
14 subject. But I think you have a sense from the panel that
15 it might be -- it might be an overreach to provide a kind
16 of point-by-point response to their premeeting questions.

17 MR. MASLIA: I thank the panel for clarifying that.
18 Tom, your point is well taken about agency resources in
19 general, but I think there are some points specific, like
20 the boundary issue. I think that's a specific answer or
21 approach that we've discussed here. But others will be
22 generalized, and as Peter said, if he sees it in the final
23 report --

24 DR. POMMERENK: Yeah. I'll --

25 MR. MASLIA: That's sort of the approach that we used

1 in Dover Township. We used a similar set-up with several
2 panels. And the final report did either allude directly
3 to some issues that were brought up.

4 DR. POMMERENK: Yeah. Many of my questions were --
5 they're clarifications questions --

6 MR. MASLIA: Right.

7 DR. POMMERENK: -- where I was not clear --

8 MR. MASLIA: Right.

9 DR. POMMERENK: -- and you --

10 MR. MASLIA: We appreciate -- I appreciate another
11 set of eyes or ten sets of eyes looking over our shoulders
12 to help us see the light of day.

13 DR. JOHNSON: Well, thank you. Let's take a 15-
14 minute break, and when we return, we will start with the
15 specific issues and questions for discussion.

16 (Whereupon, a recess of approximately 11 minutes was
17 taken.)

18 MR. MASLIA: One issue: For our working lunch
19 tomorrow and -- we're going to this place called -- or not
20 going to, but we're going to order several platters of
21 Roly Poly sandwiches, which include anything from monster
22 veggie, California turkey, roast chicken, and all that
23 sort of stuff; a variety of that. And so what the ladies
24 up -- well, there's Ann right there -- need to know by the
25 end of this afternoon is how many people want to

1 participate in that. It's a volume thing. And the price
2 is based on the volume of whatever we order so -- and then
3 they'll -- based on that, then tomorrow morning, they'll
4 pass around envelopes to everybody, and you can put your,
5 you know, five or six bucks in there.

6 DR. DOUGHERTY: When we do that, do you want us to
7 raise our -- just raise our hands and get a head count
8 now?

9 MR. MASLIA: Well, this afternoon, maybe, sometimes
10 -- I don't know if we're taking another quickie break or
11 whatever at some point. Ann.

12 MISS WALKER: Tell me if you're not going to do it.

13 MR. MASLIA: Oh, well, that's -- who doesn't want to
14 do it? And that includes any people in the audience and
15 public as well.

16 DR. JOHNSON: Thank you.

17 MR. MASLIA: Okay?

18 MISS WALKER: Okay.

19 MR. MASLIA: Okay.

20 MISS WALKER: I don't see any no's, so we'll just
21 count. And then tomorrow morning, you can see Joann and
22 give her some money.

23 MR. MASLIA: Okay. It's all yours, Dr. Johnson.

24 DR. JOHNSON: Well, let's turn to the questions that
25 the agency posed that are specific to the groundwater

1 presentation. As I count them, there are eight questions,
2 and there may be others that arise during the course of a
3 discussion.

4 First of all, based on groundwater-modeling results
5 presented, what modifications, if any, should ATSDR make?
6 Who wants to take the lead on answering that, as I look
7 around the panel? Let me warn you, I teach, so I know how
8 to pick them (laughter).

9 DR. DOUGHERTY: I'm in the front row.

10 DR. JOHNSON: I know when I see people hunkering
11 over. Robert.

12 DR. CLARK: Okay. I guess one of the -- one of the
13 questions I had goes back to the relative importance of
14 the work that's being done now versus the other
15 contamination sources in the system. And would it be
16 better to devote some resources to understand the relative
17 impact of that, particularly on the epidemiologic results,
18 as opposed to spending a lot more resources in refining
19 the existing model? And I'm not clear on that. I don't
20 have a clear feeling. It's a very impressive technical
21 effort, but I'm not sure that it gets us very far as far
22 as understanding what the other sources might be and what
23 the impact might be.

24 DR. JOHNSON: Eric.

25 DR. LABOLLE: Yeah. I would like to add to that.

1 it's not clear to me yet the role of the groundwater model
2 in the whole simulation process. And what I mean by that
3 is some of the discussions we've been having over lunch
4 and such and looking at this time-line chronology that's
5 presented here and I'm looking at when the Tarawa Terrace
6 wastewater treatment plant came on-line and when it was
7 closed down.

8 And it looks like, you know, the contamination from
9 the various wells is mixed at a single point, and it would
10 be useful, actually, to have some kind of discussion at
11 some point -- maybe perhaps tomorrow or something -- on
12 the ranges of concentrations within these different wells
13 and how much we really gain with additional detail in the
14 groundwater model.

15 So I think -- I think any recommendations should be
16 preceded with some further understanding of its role and
17 how much is going to be garnered from additional work in
18 that regard.

19 DR. CLARK: Another variation on that, too, is the
20 amount of resources that are available to do the study and
21 how does it take away from other type -- other parts of
22 the study, which might actually have more impact, more
23 importance.

24 DR. JOHNSON: Morris; Bob; whomever.

25 MR. FAYE: The objective of the groundwater model --

1 flow model is to form the basis of a fate and transport
2 analysis using numerical models that will ultimately
3 result in a monthly value of concentration of contaminant;
4 i.e., PCE at certain wellheads. I mean, that's from --
5 for the period -- was it 1968 to '85? That's the
6 objective. I think that was clearly stated several times.
7 Now, if that's not a tenable objective, it would be nice
8 to know that in your opinion. But that is the objective.

9 DR. KONIKOW: Based on your groundwater modeling so
10 far, you're really starting in 1978 or '79 --

11 MR. FAYE: Right.

12 DR. KONIKOW: -- and so what's -- how do you hope to
13 cover the period back through 1968 or so --

14 MR. FAYE: Good --

15 DR. KONIKOW: -- when the epidemiological data is
16 starting?

17 MR. FAYE: Good question. The reason we did the '78
18 to '94, as I said, was because that's when we had some
19 water-level data that we could actually pay attention to.
20 Probably between 1952 and 1978, we may have a grand total
21 of two or three dozen water-level measurements in
22 comparison. Okay?

23 We also only have discrete -- a discrete window for
24 about, oh, six or seven years, periodic nonconsecutive
25 years; a discrete window in terms of a published value of

1 the -- of the quantity of water, the total quantity of
2 water treated. We have another half a dozen references
3 for different years in that interim, relating to well
4 capacities and what wells were operational. The well
5 capacities do change with time.

6 The flip side of that is that for most of that period
7 -- and certainly the USGS data there for the -- for the
8 pumping information from '75 to '86 indicate that within
9 plus or minus 10 percent of about -- of .95 MGD that the
10 average annual rate doesn't change that much. And that's
11 because Tarawa Terrace, the housing units, were occupied
12 just about 100 percent all of the time, 90 to 100 percent
13 all the time. So we shouldn't be looking for a lot of
14 variation.

15 We do have enough data now with the additional
16 information that Morris discussed a few minutes ago. We
17 do have enough data now, I believe, to make some sense out
18 of monthly variations and pumping over a long period. And
19 we can apply that information backwards in time as well.
20 And that's kind of the summary of the suite of information
21 that we have available to us, Lenny.

22 DR. KONIKOW: As far as exposure goes, though,
23 there's no --

24 MR. FAYE: No. That -- that's historical
25 reconstruction. I mean, that's -- we do know -- we do

1 know the -- within a year of the beginning of operations
2 of ABC Cleaners, we know that they used only PCE during
3 their whole period of operation. That's it.

4 MR. MASLIA: Based on suggestions also -- and this
5 gets into, I think, Bob's question about resources and
6 staffing. But, actually, I think another part of our
7 effort or a more intense effort will be on data discovery.
8 That appears to be a key factor, and I think going back
9 to, like, tax records, maybe trying to refine the actual
10 use of the PCE at ABC Cleaners.

11 And that calls into, as far as an answer in terms of
12 agency resources, that's a two-part answer, and I think
13 you can appreciate this being a former government employee
14 yourself. As far as the, how shall I say, funding-part
15 issue, I believe the funds are there. Okay. They've been
16 there this past year while we've been doing fieldwork and
17 that. The other side of the equation is the staff of
18 personnel. That is not there. Issues of do we have
19 enough staff -- and let me get into that.

20 As we discussed at lunch, unlike with other state
21 programs that ATSDR has, we have no cooperative agreement
22 with the state of North Carolina. We used that very
23 heavily in Dover Township, New Jersey being a state. So
24 that alleviated the need if we needed people to go and do
25 some historical record search or do some detailed sitting

1 on site, so to speak. We actually had a field office over
2 there.

3 So that assisted us. We don't have that option in
4 this situation. So that means if I want to spend the next
5 month, which maybe I'm just taking a month out of my hat,
6 and doing "data discovery," going into the files at Camp
7 Lejeune or something, somehow our project has to come up
8 with a warm body to do that.

9 So while the funding may be there, the people are not
10 there. And that's a consideration, I think, with
11 recommendations, obviously, from the technical staff that
12 management may need to look at that. If we say it appears
13 to be a consensus of the panel -- I haven't taken a vote.
14 That's -- Dr. Johnson probably will try to do that later
15 on.

16 But if data discovery, refining our chronology, our
17 operational history, and things of that nature to pinpoint
18 specific lack of information that we have now is a --
19 should be a focus of our continued effort, then that's
20 something we have to address, I think, as a division, as
21 an agency. So hopefully, that's addressed your question.
22 Is there a follow-up, or is there...

23 DR. JOHNSON: Well, what I hear is a strong
24 commitment on the part of the agency to continue the
25 groundwater modeling and activities associated with that

1 effort. I also am hearing from the panel some concern as
2 to whether that, perhaps, the depth of that should be
3 pursued. Am I misstating the case here? Please, Tom.

4 DR. WALSKI: What I would want to do as a starting
5 point would just sort of do an overall classification of
6 which areas we know were contaminated with this chemical,
7 which ones we know were safe, and then which ones were --
8 and those you just sort of say, you know, these people
9 were exposed, period, and these people were not exposed,
10 and concentrate the modeling on areas that we're gray on.
11 Do we have a marker for this easel here?

12 MR. MASLIA: I've got -- these are drawing markers,
13 but you can --

14 DR. WALSKI: Here. Oh, here's one. Okay. How am I
15 going to operate this thing? Okay. There we go.

16 (Drawing) It's sort of a thing like this with, you
17 know, Terrace, Hadnot, Holcomb, 1952, 1972. You know, I
18 have separate rows. 1971, 1987, and just draw these in.
19 This one here is a -- this area where we know was bad
20 here, we know it's cleaned up here because they shut the
21 plant down, and we know that ABC Cleaners wasn't in
22 existence before some date, possibly. So this we know,
23 and we just want to focus the modeling in here to areas
24 we're not sure.

25 And like, Holcomb, we knew was pretty good most of

1 its life, but there are some periods where we were
2 uncertain of. And this might be where you'd look at some
3 modeling where it was unsure. And Hadnot, we know was
4 pretty bad throughout all time and you know, until they
5 went to some type of -- what ended the -- they put some
6 more treatment in, right, some pump and treat?

7 MR. FAYE: No, they didn't. They just took the wells
8 off-line.

9 DR. WALSKI: They took the bad wells off-line at some
10 point. So we know that after this point you're okay. But
11 here we were in pretty bad shape. And then just focus in
12 on the places where the models could tell you, you know,
13 where it's critical because here you knew there was
14 exposure. So you might want to do some kind of matrix
15 like this as the next step before you got into, you know,
16 doing -- just trying to model every single month of this
17 thing where you know there's contamination in some of
18 these areas. So why bother beating that when -- or you
19 know that some of these weren't contaminated at that time,
20 so why bother modeling those periods?

21 MR. MASLIA: My -- I guess, at least, my experience
22 and knowledge would be in a numerical model, such as
23 Modflow or any of its varieties. We have to step through
24 time. So we're going to have to time step whether we --
25 whether we use the information or not, we're still going

1 to have to time step it to get to the period of interest.
2 Is that --

3 MR. FAYE: And also, in terms of the periods of time
4 when no exposure was occurring, your point's well taken.
5 But it would be so much more convenient -- say, for
6 example, we know that Tarawa Terrace -- I mean, the ABC
7 Cleaners, for example, they probably started operations
8 around 1955. We know that. And the Tarawa Terrace wells
9 went on-line in 1952. From a modeling standpoint, it
10 would be so much better to start your -- to start your
11 simulation in 1952 because you're starting out from a
12 prepumping condition, rather than begin things in 1955 and
13 try to guess at what the antecedent conditions were.

14 So, you know, that's a decent trade-off. Three years
15 is not a big deal. And we wouldn't have to do that, say,
16 for example, on a monthly basis; those three years. So I
17 think -- in certain context, I think your comments have a
18 lot of merit. In that particular case, I'm not sure.

19 DR. UBER: I think that I'm taking Tom's comments as
20 more metaphorically, maybe, not exactly literally, on that
21 -- on that matrix. Just to -- what I hear some of the
22 panel saying is that we might like to hear the objectives
23 of the groundwater modeling explained more in the context
24 of the ultimate goal of the investigation, meaning the
25 epidemiological study and the needs for that.

1 So, for example, if you knew that these nine wells --
2 I'm not saying this is the case. But if you knew that
3 these nine wells were all blended together and served
4 Tarawa Terrace residents during a certain period, then
5 that means that the groundwater model is really predicting
6 the blended sum of those waters from those nine wells.
7 And the -- and if you do sensitivity analysis, such that
8 it doesn't really affect very much the blended water over
9 time from those wells, then you -- you know, if that's the
10 case, if that's insensitive to those assumptions, then
11 those assumptions are not necessary to nail down any
12 further.

13 Whereas, those same assumptions might have impacted
14 significantly the individual arrival times at certain
15 wells or individual captures zones. So, I mean, that's
16 just an example. I'm not saying -- you don't need to
17 comment on that particularly. But if that were the case,
18 then that would be one example of making the objectives of
19 the groundwater modeling, in my mind, closer to the needs
20 of the epidemiological study because it brings it into the
21 context of the exposure. Does that make any sense? I'm
22 thinking not.

23 MR. FAYE: Yes, it does. The fly -- well, yes, your
24 comments do make a lot of sense. The situation as it
25 exists is that the results of the groundwater-flow model,

1 which would provide monthly concentrations at the
2 wellheads -- those are one step removed from the exposure
3 at a street or a house in the -- in Tarawa Terrace because
4 that -- those results are linked to the network, to
5 EPANET, to the network model, which provide the exposures
6 at the individual residences or streets or whatever.

7 DR. UBER: Mm-hmm.

8 MR. FAYE: So the results of the groundwater flow
9 model are one step removed from where you're getting to.
10 But that's the linkage that the network -- the network
11 analysis is the linkage.

12 DR. LABOLLE: So expanding on that -- Eric LaBolle
13 here -- if one looks at the groundwater model and its
14 results today, even though they're still in preliminary
15 stages, can you make an assessment that some of these
16 wells saw contamination for all time, for all the entire
17 study period?

18 MR. FAYE: That's a really good point, and I was
19 hoping somebody would ask that. My gut feeling right now
20 -- and I could be wrong. But my gut feeling right now is
21 that TT-26 is the major player in the whole -- in the
22 whole event from the time that there was a breakthrough at
23 TT-26 of the PCE from ABC Cleaners until the times that
24 the wells were shut down. I think most of the PCE
25 produced at ABC was captured at -- only at TT-26 with

1 maybe some residual amounts at TT-25.

2 There were -- we have that migration to the
3 northwest. That was probably caused by local pumping
4 there that we know nothing about as well as dispersion.
5 But for all intents and purposes, the capture of PCE
6 occurred at TT-26, and I think, you know, that that's
7 going to be the end result.

8 DR. LABOLLE: And is it -- can you state an opinion
9 at this point in time as to a range of times that you
10 think the contamination might have arrived at TT-26? Not
11 to pin you down, but my point here is this. My point is:
12 If you're dealing with a study period in which TT-26 saw
13 contamination during the whole time, that might change the
14 role of the groundwater model versus a study period in
15 which the groundwater model is expected to predict an
16 arrival curve to TT-26. The level of detail necessary to
17 predict an arrival curve would be significantly different
18 than one needed to predict, say, maybe just a boundary
19 range of concentrations --

20 MR. FAYE: Yep.

21 DR. LABOLLE: -- in which assumes --

22 MR. FAYE: Yes. That's good.

23 DR. LABOLLE: -- inherent uncertainty.

24 MR. FAYE: Yeah. That's very good. You have -- you
25 have several issues to address, okay, in that whole

1 context. If you have the arrival time -- I made an
2 estimate with the advective transport simulation. It
3 occurred about -- in about three years. Okay. So if we
4 assume that PCE entered the -- got -- was actually being
5 discharged to the septic tank at ABC Cleaners some time in
6 1955, probably made it to the water table maybe a few
7 months or a year later, you're looking at something around
8 1959 when PCE started to -- and that's not accounting for
9 dispersion. It might have gotten there earlier when
10 dispersion effects are taken into account.

11 Now, having said that, you have these other issues of
12 retardation, biodegradation, and whatever that are going
13 on in that interim -- in that whole period of time, say,
14 from 1959 or whenever up to 1985 when that particular well
15 was shut down and taken off the -- taken out of the
16 network.

17 So what the model would be attempting to do, okay,
18 would be to address those issues of retardation,
19 dispersion, biodegradation, whatever, decay; and in that
20 interim period of time for that particular -- for that
21 interval.

22 DR. LABOLLE: The sense that I'm getting then is that
23 the 15 years roughly -- or, say, 10 to 15 years that have
24 elapsed there between the introduction of a source to the
25 system and/or probable introduction of a source to the

1 system and the beginning of the study period sounds like
2 sufficient time for the contamination to have arrived --

3 MR. FAYE: Oh, yeah.

4 DR. LABOLLE: -- at TT-26.

5 MR. FAYE: Oh, yeah; absolutely; absolutely. We
6 would not begin -- or at least I would not think it would
7 be appropriate to begin the model simulation -- the
8 groundwater flow and fate and transport simulations in
9 1965, which is the beginning of the period of interest to
10 the epi study. We would want to be there before. We
11 would be simulating conditions before that and then all
12 the way through it.

13 MR. MASLIA: One other issue because Bob and I have
14 discussed this, and that's the issue of Well TT-23. And
15 that, again, I think this is where the model can help
16 refine our understanding. Well TT-23 was drilled after
17 the shutdown or in anticipation of the shutdown of TT-26.

18 MR. FAYE: No. It was '84. Well TT -- we have a --
19 we have an actual step-drawdown test for TT-23. I think
20 it was in March of '83. So TT-23 was sitting there
21 available. That was part of Tarawa Terrace's routine
22 operation of bringing a new well on-line and probably
23 taking an older well that had reduced yield off of line.

24 And then all of a sudden, when they did the sampling
25 while TT -- there was PCE that showed up in TT-23. So PCE

1 -- TT-23 never got a chance to be in operation probably
2 for more than a year. But -- and frankly, I don't know
3 how much importance the contribution of TT-23 had to the
4 -- to exposure because it was only operated for such a
5 short period of time.

6 But I will say that it's been on everybody's radar
7 screen as a point of interest, and I do believe that the
8 only way you're really going to understand whatever the
9 contribution was from TT-23, if it remains a major point
10 of interest as it seems to be, would be through a --
11 through numerical simulation.

12 DR. JOHNSON: Well, I think we've had a good
13 discussion and some suggestions as to how the modeling
14 work might be modified. It's certainly for the agency's
15 consideration and final determination. But some
16 interesting ideas were placed on the table, and we would
17 ask that they be seriously considered by the agency.

18 As an aside, I have not forgotten about the public
19 session, and I plan to do that at 3:30. So those of you
20 who wish to speak at 3:30, be prepared to do so. We will
21 need your name, et cetera. To the extent possible, focus
22 on what we're discussing today: the water-modeling issues.
23 But anyway, at 3:30, we will do that.

24 Let's continue on to Question 2, and, again, we can
25 come back to any of these questions. I'm just trying to

1 get us through these series of significant issues. Number
2 2: Should ATSDR use the same level of detail; i.e.,
3 50-foot cells and expand the groundwater model to include
4 the Holcomb Boulevard and the Hadnot Point areas? If so,
5 what level of increase in effort does the panel envision
6 for this effort? Lenny, please.

7 DR. KONIKOW: Well, a 50-foot grid spacing seems, you
8 know, reasonable, but I think the approach that, you know,
9 I would recommend and probably other people would
10 recommend is do some grid-sensitivity testing. I heard
11 someone mention that this morning. Try a 100-foot cell,
12 and see if there's any difference. Try a 25-foot cell
13 spacing, and see if there's any difference. If it doesn't
14 make any difference, stick with the 100 foot.

15 UNIDENTIFIED SPEAKER: Right.

16 DR. KONIKOW: If it makes a difference, depending on
17 the nature of the difference, you probably want to go to
18 the finer grid spacing. So it's hard to say if 50-foot
19 spacing is the right one without looking at some
20 sensitivity tests. So somewhere along the line -- and,
21 again, this is one of the nice things about a graphical
22 preprocessor based on a GIS-type system is that you can
23 very easily change your grid spacing. And that's one of
24 the things we'd certainly recommend doing.

25 As far as expanding it to the Holcomb Boulevard and

1 Hadnot Point areas, I think it depends do you want to
2 apply a transport model there or not. Do you want to, you
3 know, look at the -- I mean, you're starting in just the
4 Tarawa Terrace because that's simpler. So if you can't
5 succeed there, then maybe there's no point going to the
6 other systems.

7 MR. FAYE: And that's -- that was the whole idea.

8 DR. KONIKOW: Yeah. So I think you have to kind of
9 see what the results are after a little more time.

10 MR. FAYE: Good. Thank you.

11 DR. JOHNSON: Other comments on this question?
12 Vijay.

13 DR. SINGH: I think you may also want to look at
14 variable grid size. You may want to consider finer grids
15 near the source and coarser away from the source.

16 MR. FAYE: Yeah. That's clearly -- that's clearly
17 something that we intend to do. And as Lenny said, when
18 you're using a GIS conditioner for your input arrays, why,
19 it's really easy to do. It's not a problem, and that's
20 something that we very definitely would look at or intend
21 to look at.

22 DR. JOHNSON: Any sense on what extra level of effort
23 would be required?

24 MR. FAYE: Not a whole lot.

25 DR. JOHNSON: I'm not sure -- I'm not sure that's the

1 kind of thing a panel is equipped to come to grips with,
2 but I speak only for myself. I haven't a clue as to how
3 efficiently you work and other -- what equipment you have.

4 MR. FAYE: My response was just to the specific
5 notion of changing the grid dimensions. Okay? I mean, I
6 didn't know you were touching on the overall issue.

7 DR. JOHNSON: It's part of the question.

8 MR. MASLIA: Let me just address this. The reason
9 that question came up is looking at the, I guess,
10 experience and expertise and different type of analyses
11 that some of the panel members have been involved, I
12 suppose we were looking at it based on their experience of
13 saying, "Oh, no. That's going to take a completely
14 separate project team. You know, that's going to take
15 another three years, five years, or whatever based on our
16 experience."

17 And that's something -- an input that we need and to
18 discuss with the epidemiologists as whether that increase
19 in effort is warranted for the type of results that we may
20 obtain. It clearly has been referred to on a number of
21 occasions now. If, in fact, we're having some difficulty,
22 although maybe success, in Tarawa Terrace in this level of
23 effort now, expanding that difficulty at least an order of
24 magnitude because of uncertainty and unknown in Hadnot
25 Point and the variety of nonpoint specific sources, that

1 may be an area that we may say that the level of effort
2 will not warrant the refinement in the answers that we
3 need for Hadnot Point area. And that's really why that
4 was posed, not looking for a specific person number or
5 hour -- labor hours or anything like that.

6 MR. FAYE: Could I say something?

7 MR. MASLIA: Yes.

8 MR. FAYE: With regard to the additional complexity
9 that we're fairly certain that we would see at Hadnot
10 Point, perhaps, an intermediate step or even a final step
11 to simulating various concentrations at a great number of
12 wells with numerous source areas would be analytical,
13 rather than numerical, which would greatly simplify the
14 situation in terms of analysis. But what would also be
15 somewhat limiting in terms of the results that we would
16 provide -- be able to provide for the epidemiological
17 study. But it may be a very useful intermediate step.

18 DR. JOHNSON: Yes.

19 DR. CLARK: The answer -- it seems like the answer to
20 this question somewhat answers the concerns I had on the
21 first question. In effect, what you're doing with Tarawa
22 Terrace, that's basically a pilot study to validate,
23 develop groundwater-transport model; right?

24 MR. FAYE: It's -- I would say it's perhaps a little
25 further than a pilot study. We know that these things

1 have been done before. There's not a lot of mystery about
2 it. More the issue is, yeah, we can do it, and we can
3 give you an answer, but just how damn good is the answer?
4 Okay?

5 DR. CLARK: And so if you have success at Tarawa
6 Terrace, then the potential for applying it to other areas
7 increases, I suppose, significantly.

8 MR. FAYE: Yes; sure.

9 DR. CLARK: And so that basically is kind of the
10 reason that you're taking that approach on the project.

11 DR. JOHNSON: Yes, please.

12 DR. UBER: Could I just follow up on that real quick?
13 Could you clarify for me: Is the proposal -- I know we're
14 talking about just the groundwater analysis now. But is
15 the proposal to use Tarawa Terrace really, truly as an
16 advanced pilot study but moving it from the groundwater to
17 the water distribution through to the epidemiological
18 conclusions prior to moving significantly or changing
19 directions drastically for some of the other areas?

20 MR. FAYE: That's yours, Ace.

21 MR. MASLIA: That is -- our intent is to hopefully --
22 I don't want to say wrap it up -- but put some finality on
23 our state of knowledge and conclusions we can make from
24 the effort at Tarawa Terrace in terms of the groundwater
25 fate and transport and the distribution side. That is the

1 -- as we've alluded to, we know we've got one primary
2 well, TT-26. We've got some data gaps in historical or
3 chronology.

4 But as far as the hydrogeologic framework, we've
5 defined that as far as modeling. When I say "boundaries,"
6 not the physical model of the boundaries, but where we
7 should start our timing, stuff like that. We've got --
8 we're getting more well-production records. As I said, we
9 just got some more in the middle eighties to fill in some
10 gaps. So that's pretty much further along. I can't speak
11 as far as the cases and controls. Dr. Bove can probably
12 speak more on that if he thinks it's appropriate to
13 discuss that issue.

14 MR. FAYE: And there's also another major issue
15 implicit in that -- in that question. And that is the
16 actual linkage between the models. The results of the
17 groundwater flow model I used as input into EPANET or some
18 similar thing. And we want that to be as transparent and
19 as fluid as -- no pun intended -- as fluid as possible.
20 We don't want that to be a stop-and-start, really hard-
21 nose mechanical-type of operation. And so there's some
22 issues there to be dealt with in terms of refining that.

23 DR. UBER: So that's good. That actually reinforces
24 the point, perhaps, of making a decision to try to do it
25 all with Tarawa Terrace. It sounds to me like maybe the

1 team is not quite committed to doing that because there's
2 some, maybe, uncertainty, reasonably, about the time
3 frames of the, you know, getting all the control group
4 together and doing all of that work.

5 But I -- personally, I would be very much in favor of
6 that approach, if it is feasible at all, because I think,
7 you know, well, you always learn from doing it. And I
8 think bringing this -- bringing that study to the end
9 conclusion, even on a first-order basis -- end, meaning to
10 some kind of integration with the epidemiological
11 conclusions -- would be a good thing to add going into the
12 other areas.

13 MR. MASLIA: The other thing, if I might just jump
14 the gun for either this afternoon or tomorrow's
15 presentation on the water-distribution side, I alluded to
16 earlier in my opening remarks that we do have an analysis.
17 Claudia did a very good analysis on building use and
18 building type and, you know, whether it's residential,
19 family housing, industrial, car wash, and so on. And I'll
20 show that later on either tomorrow or this afternoon,
21 depending on the time.

22 But what you will notice is obviously Tarawa Terrace
23 is 90-plus percent family housing. Holcomb Boulevard is
24 90-plus percent family housing with elementary schools and
25 high schools. When you get down to Hadnot Point, it's

1 just the opposite. It's 90 percent plus industrial and
2 other things and bachelor housing with maybe 5 percent
3 family housing. Would that be about right, Claudia,
4 somewhere around that?

5 MISS VALENZUELA: Yeah.

6 MR. MASLIA: Yeah; about like that. So that's the
7 other -- we haven't gotten into that, but you'll see some
8 maps on that. So that's the other consideration really
9 from our standpoint.

10 DR. WALSKI: When the distribution system
11 measurements for PCE were made in Tarawa Terrace, what was
12 the range of values at the tap?

13 MR. MASLIA: PCE or TCE?

14 DR. WALSKI: PCE at Tarawa Terrace, like, the range.
15 Was it a huge range? Did it show tremendous variability,
16 or was it basically, once you got it, you got it?

17 MR. MASLIA: We've got a map with the chronology on
18 them.

19 MR. FAYE: Yeah.

20 MR. MASLIA: Here. We've got a chronology here.
21 Here we go. Actually --

22 MR. FAYE: The concentrations at the tap were
23 probably somewhat less to greatly less variable than the
24 concentrations that we observed at the wellheads.

25 DR. WALSKI: Because everything gets blended, and

1 so --

2 MR. FAYE: Right.

3 DR. WALSKI: -- it seems like, basically, once the
4 system gets contaminated water in it, the people get
5 contaminated water, and, you know, the amount that the
6 model is going to tell you is, well, maybe they got 52
7 instead of 54. But the fact is that once the plume hits
8 the wells and they use the wells, everybody got the same
9 thing in that system. That, you know, I'm just
10 questioning how much more you're going to get by really
11 refining the models.

12 MR. FAYE: Don't know; don't know. I can't -- I
13 couldn't -- I know that the concentrations at the
14 wellheads vary by orders of -- by an order of magnitude at
15 least. And I'm not -- I'm not sure that I'd be
16 comfortable in going into detail even about a cause and
17 effect of that. I don't know that. I haven't reasoned
18 that out that well. I just -- that's it. I -- you know,
19 that's the extent of the information.

20 DR. LABOLLE: Particularly with regards to the
21 distribution system model, I think that what's been raised
22 here is quite important. If you're putting in a source
23 and everybody has to drink that water because there's only
24 one source in the system, which is the wastewater
25 treatment plant, at least during a significant portion of

1 the time, if not all the time in the study period, then
2 how does refining the model increase one's information on
3 exposure?

4 MR. FAYE: Well, for one thing, when we -- when we
5 finally get to the point where we're able to deal with
6 monthly recharge and we have some decent confidence that
7 we're doing a good job there, you're looking at -- you're
8 looking at orders of magnitude change and recharge from
9 month to month. Okay?

10 DR. LABOLLE: My question was with regards to the
11 distribution-system model though.

12 MR. FAYE: Oh, I'm sorry.

13 DR. LABOLLE: But I have one for the groundwater too.

14 MR. MASLIA: Let me -- if we assume that you've got
15 several wells and they're all blended in at the treatment
16 plant and then they go out into the distribution system
17 and are up in the tanks and equally mixed and all that,
18 then your point is everybody gets the same blended
19 concentration of water; no question about that.

20 We found a couple of things, and again, this is
21 probably something we'll get into tomorrow or this
22 afternoon. But we are finding, at least in the storage
23 tanks, that it's not a complete mixed situation. This is
24 based on some field testing that we did this past year.

25 We're not sure if you're seeing last-in/first-out or

1 a compartmental-type issue in the tanks. We're testing
2 that out, doing some sensitivity runs right now, so that,
3 if you had in one given month one well running more than
4 the other, either contaminated or not contaminated, and
5 pushing that out through the treatment plant and then
6 stored up in the tanks or whatever, you may not
7 necessarily see that water coming out into the
8 distribution, depending what's going on in the mixing in
9 the tanks.

10 DR. LABOLLE: Then in that case then, the study, you
11 know, the detail would then focus on a very restricted
12 portion of the system, that being the tank and one of the
13 sources --

14 MR. MASLIA: Mm-hmm.

15 DR. LABOLLE: -- which wells the sources were coming
16 from?

17 MR. MASLIA: That's correct.

18 DR. LABOLLE: But then the rest of the distribution
19 system, the detail and the level of analysis would have
20 little effect then on exposure. Am I missing something in
21 that?

22 MR. MASLIA: Well, the only thing we're -- or we're
23 trying to understand right now is we're still in the
24 process, at least for present-day, trying to understand
25 exactly how the tanks are mixing. We've instrumented some

1 tanks, and it's raised some additional questions. And I
2 really can't, at this point, answer: Can we make some
3 either simplifying assumptions or assume, given a certain
4 input from the treatment plant, that this portion of the
5 system received this slug of water or not?

6 I think, perhaps, maybe the panel will see some
7 insights from some of the data, more detail that we'll
8 present either this afternoon or later tomorrow. Those
9 are some good issues to bring up.

10 DR. CLARK: Depending upon the variability on the
11 input side, you could get blending in the system that
12 would cause different levels of exposure to individual
13 households too. So I guess it's those issues that you
14 have to resolve.

15 DR. LABOLLE: Yeah. Particularly if the treatment
16 plant doesn't. You know, the treatment plant is
17 delivering water out into various pipes into the system at
18 that point, then the detail -- I could see the
19 distribution system would become important.

20 MR. FAYE: On the groundwater side, you would have an
21 expectation of variability. We don't know how much.
22 Depending on your rainfall, which would translate -- the
23 way we're looking at recharge now would translate directly
24 to recharge. You would have periods of time when you'd
25 virtually have no recharge, probably extended periods of

1 time. And then you'd have other times when you would have
2 just an excess of recharge.

3 How this affects the -- would affect the variability
4 of concentrations at the wellhead, we just don't know.
5 And it -- is that the reason of the order of magnitude
6 change in contaminant concentrations at the various wells?
7 We don't know. But we do know that there is a great deal
8 of variability in concentrations at the wellhead, just
9 based on observations.

10 DR. DOUGHERTY: I have one question for -- actually
11 your comment and Eric's. Since you're preparing, planning
12 to perform a fate and transport model --

13 MR. FAYE: Ultimately.

14 DR. DOUGHERTY: -- ultimately. And this is a
15 question about your preliminary thinking, and so it's
16 subject to draft and revision and all these things as the
17 project evolves. But the question is: How do you think
18 you're going to handle the source? How is it going to be
19 represented?

20 MR. FAYE: Well, as Morris said, one thing that we
21 have in the works is to use Dr. Aral's expertise at
22 Georgia Tech. Are you familiar with CXTFIT?

23 DR. DOUGHERTY: Sure.

24 MR. FAYE: Okay. It's kind of a simplistic notion,
25 but, you know, it's the same idea where you would actually

1 look at your observed concentrations in a "plume" and then
2 be able to compute backwards and estimate a source
3 concentration for a limited period of time relative to
4 those observed conditions.

5 We have data in 1985 that probably -- early 1985,
6 that probably represents, goodness, for want of a better
7 term, routine operating conditions, okay, at the -- at ABC
8 Cleaners. And we're looking at 12,000 micrograms per
9 liter there. The gentleman earlier made the point that
10 there may have been a greatly increased rate of input into
11 the system during Vietnam.

12 And hopefully, hopefully, through the data discovery
13 that Morris was talking about with the tax returns and
14 whatever, we can get something of a handle on that.
15 Obviously, it goes without saying, I mean, the source term
16 is the -- is -- it's not all the eggs in the basket, but
17 it's a good number of them.

18 DR. DOUGHERTY: My question in particular was: Is it
19 going to be treated as a specified concentration, or is
20 there going to be -- or are you anticipating a process
21 model for --

22 MR. FAYE: No.

23 DR. DOUGHERTY: -- some dissolution process?

24 MR. FAYE: I -- that, we haven't thought of yet. My
25 -- right now, my thinking would be basically just a rate

1 at a -- at some concentration. Okay?

2 DR. DOUGHERTY: Some of mass loadings?

3 MR. FAYE: Yeah; right.

4 DR. JOHNSON: Okay. Let's stop at that point. I
5 think we've -- the panel's given you some excellent advice
6 and some perhaps new directions to consider: grid
7 sensitivity, testing, et cetera, other ideas. Again, we
8 can always come back to any one of these questions.

9 The third question, before we have the questions from
10 the public: Rather than developing three distinct
11 groundwater-flow models, should ATSDR considering --
12 should consider developing one model?

13 DR. CLARK: It sounds like the answer to that has to
14 be no, given the complexity of trying to do that.

15 DR. JOHNSON: The answer is no.

16 UNIDENTIFIED SPEAKERS: It may be later.

17 DR. DOUGHERTY: And then you have the choice of
18 whether you do two and three or whether you expand one and
19 two or incorporate two and three or whether it's a similar
20 approach at that point.

21 DR. LABOLLE: Where does the third one come in?
22 That's actually where I'm confused. We have Tarawa
23 Terrace. We have Hadnot Point. It's my understanding
24 that the community in the middle wasn't receiving much
25 contamination; is that correct?

1 MR. MASLIA: Actually, correct, unless we find any
2 other information to the contrary. That was probably a
3 rush to write questions down, but I suppose one -- when I
4 was thinking also of three models, one way I was thinking
5 back to my USGS days is where you have an overall model
6 and -- one model for the whole area, which may be a
7 coarser grid, or define some boundary flows or whatever
8 and then you have the two refined areas.

9 But from what our discussion this morning and this
10 afternoon is going is, I believe, we'll be doing good to
11 get at narrowing uncertainty or addressing uncertainty
12 with the Tarawa Terrace area. I mean, I think there's
13 some issues there that may, in fact, tell us, you know,
14 don't go down the direction of the numerical model to
15 Hadnot Point.

16 MR. FAYE: Accept no.

17 MR. MASLIA: What?

18 MR. FAYE: Accept no.

19 DR. JOHNSON: Okay. I think you got a clear
20 answer on that one. We need to take about a five-
21 minute pause or so, so that our recorder can
22 recalibrate her recording equipment. And then after
23 that, we look forward to comments from the public,
24 and then we'll resume with the rest of the questions.
25 So take a brief break of about five to ten minutes.

1 (Whereupon, a recess of approximately seven minutes
2 was taken.)

3 DR. JOHNSON: We are at the point where we would be
4 pleased to hear comments or observations from the public,
5 and please come forward to the dais. Tell us your name.
6 To the extent possible, we would ask that you summarize
7 the significant points that you wish us to hear.

8 MR. ENSMINGER: Good afternoon.

9 DR. JOHNSON: Good afternoon.

10 MR. ENSMINGER: My name's Jerry Ensminger. I told
11 you who I was earlier. I lost a child due to this
12 contamination, and I have been deeply involved in this
13 since 1997. Likewise, a retired major, Thomas Townsend,
14 who I work very closely with and have worked with him for
15 many years on this, and this following statement is a --
16 and questions is a combined effort between Mr. Townsend
17 and I. And without further ado:

18 Construction of the Tarawa Terrace housing area
19 commenced in 1952 and, at that time, was owned by Spangler
20 Real Estate Company. My family lived at Tarawa Terrace,
21 3442 Hagaru Drive, from January 1955 to May of 1956, as
22 cited in CLW-2982. In 1958, TT-26, the first of eight
23 water supply wells, was constructed in Tarawa Terrace.
24 The year 1961 saw the construction of an additional three
25 wells: TT-52, 53, 54. Wells 27, 31, and 25 were

1 constructed in 1972, 1973, and 1980, respectively.

2 Well 23 was constructed in 1984. However, this well
3 was never put on-line or in -- never put into production,
4 as PCE was discovered immediately following construction.
5 This well is also described as TT-NEW WELL in the same
6 documents.

7 I provided you with a list of the supporting
8 documents that support this statement. TT tap water was
9 tested 27 May 1982 from seven wells less TT-23. PCE was
10 found at 80 parts per billion and on 27 and 28 July '82
11 retested with PCE at 76 parts per billion, 82 parts per
12 billion, and 104 parts per billion. TT wells were sampled
13 in July of 1984; TT-23 at 37 parts per billion; TT-25,
14 trace amounts; and TT-26 had 3.9 parts per billion. No
15 TCE was detected.

16 Tap water in Tarawa Terrace was tested again on 5
17 February of 1985. The analysis indicated PCE at 80 parts
18 per billion, TCE at 8.1 parts per billion, and DCE at 12
19 parts per billion. All Tarawa Terrace wells were
20 disconnected from the water-distribution system on 8
21 February 1985, and Wells TT-23 and 26 were closed.

22 Four days later, on 12 February 1985, and again on 19
23 February of 1985, water from the TT system was tested and
24 determined to contain no VOCs. Unable to meet the
25 increasing water demand without these wells, the Tarawa

1 Terrace water-distribution system was supposedly closed.
2 None of the TT well data, installation or operational
3 date, and contamination testing results can be confirmed
4 by this reporter since Marine Corps base Camp Lejeune has
5 not provided same after many FOIA requests submitted; no
6 responsive documents.

7 Question: If the TT water-distribution system was
8 closed in February of 1985, where did the potable water to
9 support some 1843 housing units and commercial
10 establishments come from to fill that void?

11 DR. POMMERENK: Can I answer that question? I
12 believe, in 1984, there was a pipeline constructed from
13 the Holcomb Boulevard treatment plant, and that pipeline
14 connected directly to the raw-water tank. So you received
15 treated water from the Holcomb Boulevard area.

16 MR. ENSMINGER: In 1984?

17 DR. POMMERENK: I believe so. I would have to check
18 the numbers, but that's the approximate time frame that I
19 recall from the...

20 DR. JOHNSON: Come to a microphone, please.

21 MR. FAYE: The records that I'm familiar with that
22 we've obtained from Camp Lejeune and other sources
23 indicate that only Wells TT-23 and TT-26 were taken
24 off-line in February of '85, that the other wells in the
25 system at that time continued to operate, probably,

1 through all of '85. We know for sure that the water-
2 treatment plant was operating and processing water at
3 least up to March of 19 -- 1987. There's a real question
4 about 1986. My gut feeling is that the ex-TT-23 and
5 ex-TT-26 at the Tarawa Terrace wells probably operated all
6 through 1986 as well.

7 Just with some corrections here to what this
8 gentleman has said about TT-26, we have copies of notes
9 from Mr. - a Mr. R. E. Peterson, who was an employee of
10 the Lejeune facilities at that time in May of 1951, where
11 he describes the construction and -- the drilling and
12 construction of Well TT-26, TT-27 and 2-A. At that time,
13 they were called Number 1 and Number 2-A and 2-B; 2-B was
14 TT-27. So that's just a few comments there.

15 Thank you.

16 MR. ENSMINGER: And if you would, in your supporting
17 documentation that I've provided you, CLW No. 1129 through
18 1131 was an action brief prepared by the Chief of Staff of
19 Marine Corps base and is dated 1 March of 1985. That's
20 Colonel M. G. Lilley, who I have spoken with personally.
21 And he gave a -- his action brief was -- the subject was
22 "Alternatives for Providing Water to Tarawa Terrace Area."
23 So if a pipeline was installed in '84, why are they having
24 an action brief in '85?

25 DR. POMMERENK: That's a good question. I was just

1 aware of the construction date of that pipeline.
2 Obviously, my conclusion was that there was water supplied
3 which may have not been started at that point.

4 MR. ENSMINGER: Well, while we're speaking about
5 that, the next part of the question: Action brief for the
6 commanding general of 1 March 1985, which I just referred
7 you to, had seven alternatives, ranging from hauling water
8 in tankers or construct a new 8-inch line from the Holcomb
9 Boulevard water-treatment plant, which was being upgraded
10 from 2 million gallons to a 5 million gallon per day
11 capacity, or turn on the contaminated wells that have been
12 shut down if required to maintain adequate water levels;
13 estimated cost: none. New water -- new line was
14 installed, temporary auxiliary line, in June of 1985 from
15 Holcomb Boulevard water-treatment plant to the TT
16 distribution center.

17 Question: Definitive criteria for describing --
18 describing operation of well status at Marine Corps base
19 is confusing by using active, inactive, closed, abandoned,
20 on-line, off-line, et cetera. CLW-2963, which you have
21 there in your references, wells are taken off-line or out
22 of service for short periods for maintenance; pumps are
23 replaced; screens are cleaned; new data loggers installed.

24 Too many reports from Marine Corps base will show X-
25 well closed in 1965, then in operation again in 1967, shut

1 down in 1968, operational in 1969. Having run water
2 systems, I consider a sequential pattern: One, electricity
3 turned off, pump in well, et cetera, et cetera.

4 Wells are either on-line or off-line; active or
5 inactive; temporary nonfunctioning for service or long-
6 term nonfunctioning, which can show as permanent non-
7 serviceable; to be abandoned. Is there a sanctioned set
8 of rules -- state, federal, American Water Works -- that
9 can demystify this melange of terms, which are chaotic, at
10 Marine Corps base?

11 DR. JOHNSON: Does anyone know?

12 (No audible response)

13 DR. WALSKI: Well, unfortunately, I think the
14 terminology is whatever the person who wrote it down felt
15 like writing that day. That's unfortunately the case.

16 MR. ENSMINGER: And another thing is, especially over
17 in the Hadnot Point system, when you look at the Marine
18 Corps' chronology, you would find wells that were taken
19 off-line for contamination. And later on in the events,
20 you'll see that it was taken off-line again for
21 contamination, which tells me it was back on-line.

22 DR. POMMERENK: I guess the only state regulation,
23 current state regulation, in North Carolina that I recall
24 that would relate to that is that you have to, I think,
25 file a record of abandoning a well if you take it

1 completely out of service. But otherwise, I wouldn't know
2 of any, you know, regulatory issues regarding this
3 terminology.

4 The other issue that you just addressed, and I'm just
5 -- one problem could be -- and we have observed it in Camp
6 Lejeune -- that sometimes a new well is drilled and it
7 receives the same well number as the old well. That may
8 have not happened in Tarawa Terrace, but I'm just throwing
9 this out as a thought.

10 MR. ENSMINGER: You said at Lejeune there were wells
11 -- new wells that were drilled that had the same number as
12 the old one?

13 DR. POMMERENK: Yes. This has happened.

14 MR. ENSMINGER: Where?

15 DR. POMMERENK: I can't cite the exact numbers.

16 MR. ENSMINGER: Which well numbers?

17 MR. FAYE: Peter, I think, you know, your statement
18 may be only partially correct. What happens in the --
19 when the contract -- at least as far as the documents that
20 we have, when Lejeune turns loose of a contract, either
21 for bidding or whatever, they'll -- there's a note on that
22 "Well Replaced." Okay? And the old well number goes in
23 there because there is no new well yet. Okay?

24 And so what happens then is the driller comes along
25 and creates that suite of documents, like the drillers'

1 log or Elog or whatever. And they'll put in new HP-645 or
2 something like that or new HP-647, which is what you're
3 referring to. But that number, in my experience -- and
4 I've looked through dozens of these records -- that number
5 doesn't actually stay in the system. Okay? That new
6 something or other gets a new number. Okay? Ultimately,
7 as far as I can tell from the Camp Lejeune records, that
8 well gets a new number. It doesn't -- it doesn't stay the
9 old number very long.

10 DR. POMMERENK: Okay.

11 MR. FAYE: Okay?

12 DR. JOHNSON: Please proceed.

13 MR. ENSMINGER: When were the wells or the eight
14 wells at Tarawa Terrace taken 100 percent out of service
15 and abandoned? When were they taken out? When were they
16 absolutely abandoned, closed, pumps pulled?

17 MR. FAYE: May I address that?

18 DR. JOHNSON: Would you stay up there, please.

19 MR. FAYE: I think that's a really critical,
20 critical, critical question. The only -- what I can say
21 with relative certainty is that TT-26 and TT-23 were
22 removed completely from service in February of 1985. We
23 have records in January and February and March of 1987
24 that indicate that the Tarawa Terrace -- and also, I think
25 if you look at the plant capacities, you would really have

1 some bit of difficulty believing that Holcomb Boulevard
2 could supply all of its needs, its original service area
3 needs, and Tarawa Terrace needs during 1985 and 1986.
4 Okay?

5 Maybe it could, but I think there would be some real
6 serious operational difficulties. Unfortunately, the
7 records that we have, like, for example, for monthly
8 discharge -- monthly water-treatment plant operational
9 records that give flows for a particular month that are
10 exceedingly complete from 1980 to 1984 and then again
11 exceedingly complete from 1987 to 1989. For some reason,
12 these records for 1985 and '86 have just up and
13 disappeared. No one seems to know what happened to them,
14 but I believe they certainly existed.

15 My own feeling, as I expressed a few minutes ago, is
16 that ex-TT-23 and ex-TT-26, the remaining wells at Tarawa
17 Terrace that were operational in 1984, probably continued
18 -- most of them -- in operation in 1985 and 1986. But we
19 really -- and we do know that something was going on at
20 the WTP in early 1987. But we really cannot say what was
21 going on with the wells, what the well operations were in
22 '85 or '86. The records for that period of time have just
23 fallen into a black hole somewhere.

24 DR. JOHNSON: Okay. Let's continue. I'm going to
25 ask ATSDR to provide answers expressly to each of these

1 questions. I don't think that's an imposition on the
2 agency. To the extent that we can provide some feedback
3 today, we will try to do that. But if you're looking for
4 complete, satisfying answers, this isn't -- this isn't the
5 forum for that. But please continue.

6 MR. ENSMINGER: Well, in response to what Mr. Faye
7 just said, you have there in your package CLW-1914, which
8 is a handwritten memorandum and it's dated in 1991. And
9 it stated in this handwritten memorandum that TT-23,
10 TT-25, and 26 has pump, will run. However, the well was
11 closed. I mean, they weren't 100 percent decapacitated.

12 MR. FAYE: That's a note from, I believe, Daniel
13 Sharp, from the facilities branch at Camp Lejeune. And
14 that was written in a -- in specific -- as a specific
15 response -- as a request from either EPA or Weston
16 Engineers as they were preparing the Operational Unit 1
17 project to study the contamination caused by ABC Cleaners.
18 That was a note to Camp Lejeune and a response, asking
19 which wells were operational so that they could prepare to
20 sample them.

21 MR. ENSMINGER: Well, there are means of pulling the
22 pumps and putting a -- and still taking samples.

23 UNIDENTIFIED SPEAKER: But it may be more convenient.

24 MR. ENSMINGER: Okay. All right. If the TT well
25 fields were not incapacitated in 1985 and an auxiliary

1 line to Tarawa Terrace, back and forth from Tarawa Terrace
2 to Holcomb Boulevard, was in place in June of 1985, how do
3 we know if Holcomb Boulevard water-treatment plant did not
4 receive raw water from the Tarawa Terrace well fields?

5 MR. FAYE: We don't, and we actually have just the
6 opposite information, a report from Geophex -- was it
7 1991, Morris? There is a -- there is a consultant's
8 report that we have that we've recently referenced from a
9 firm called Geophex out of Raleigh, North Carolina, that
10 indicates just what Mr. Ensminger has said, that indeed,
11 perhaps in 1989, the Tarawa Terrace wells were used to
12 supplement the water supply to the Holcomb Boulevard
13 water-treatment plant and perhaps for even an extended
14 period of time in that -- within that year or maybe
15 several years.

16 DR. DOUGHERTY: Did you say '89?

17 MR. FAYE: Yeah.

18 DR. WALSKI: But wouldn't they have to construct
19 another line to go across, then, a raw-water line because
20 you can't send the raw water over and treated water back
21 in the same pipes. So they had to put in another line, so
22 there'd be some record of that.

23 MR. FAYE: Yeah. One of those -- the report
24 continues to say that whatever those operations were, Tom,
25 that they ended when the -- when a freeze occurred and the

1 pipe collapsed into Northeast Creek. So whatever was
2 happening there, it ended when the pipe collapsed. Okay?
3 But I agree with you, and perhaps, there were dual pipes
4 there. But we don't have the details.

5 MR. MASLIA: Let me just, if I may, qualify that
6 again in terms of data discovery and all that. We just
7 came across this report, actually, a couple of weeks ago,
8 maybe less than that. It's a report that's dated 199 --
9 March of 1991. And on page 23 it makes the specific --
10 apparently the author of the report, who we're trying to
11 find out still who the author is, makes the statement
12 going over historical issues with different well fields,
13 and it talks about the Tarawa Terrace well field.

14 And it says two years ago, which would make it '89,
15 that the Tarawa Terrace wells supplied Holcomb Boulevard
16 with water. That's almost a verbatim quote. I've got the
17 report with me. I have called the Geophex office in
18 Raleigh. They are no longer doing environmental report,
19 and I'm on my third contact, trying to actually pinpoint -
20 - if I can pinpoint the author of the report, as well as
21 we've asked -- we do have a contract number, Camp Lejeune
22 contract number, for that particular report. And we have
23 asked and I think the folks from Camp Lejeune are
24 preparing some documents for us on the entire contract
25 that generated that report. So we may find out more

1 details, but that's what we have that's come to our
2 attention within the last couple of weeks.

3 MR. ENSMINGER: If you'll take a look at the 1 March
4 1985 action brief by the Chief of Staff, Colonel Lilley,
5 go to the last page, which is 1131. Please note under
6 advantages, Item No. 5: Potential future use to return raw
7 water from Tarawa Terrace wells. And I'd like you to look
8 at Number 2 as well: Availability of water. Can draw from
9 Holcomb Boulevard and Hadnot Point system, which leads me
10 to believe that that interconnecting valve between the
11 Holcomb Boulevard system and the Hadnot Point system was
12 being opened, just by that statement in Item No. 2.

13 DR. JOHNSON: Any reaction, Bob or Morris?

14 MR. FAYE: That could easily be a --

15 MR. MASLIA: I'll only address one of the issues that
16 has been brought to our attention previously, and this is
17 by a different -- a congressionally mandated panel that
18 occurred what? In February, Frank? Yeah, in February.

19 And we were repeatedly -- I was repeatedly asked the
20 question: Would we and could we model the interconnection?
21 Because, again, the understanding or the statements have
22 been made previous to our investigation that the
23 interconnection was only for emergency purposes, meaning,
24 you know, neither short supply and by definition emergency
25 -- and we've had this discussion with the present-day

1 operators of Camp Lejeune -- would be, you know, a day --
2 maybe a day or two if either something broke or needed
3 extra supply of water.

4 That panel specifically wanted to know if we could
5 model, you know, several weeks to several months at a time
6 of interconnection on that. And my answer to them, just
7 to complete the answer, would be that's where we would
8 need distribution-system models to model that
9 interconnection.

10 DR. CLARK: It sounds like Tom's point --

11 COURT REPORTER: Microphone, please.

12 DR. JOHNSON: Use the microphone, please.

13 DR. CLARK: I'm sorry. Could we turn -- it sounds
14 like this pipe was designed to do both things:
15 potentially, to return raw water from Tarawa Terrace as
16 well as provide treated water from Holcomb Boulevard and
17 Hadnot, which is very unusual to do that.

18 MR. FAYE: Don't forget now, you're dealing with two
19 pipes, okay, one connecting Tarawa Terrace and Holcomb
20 Boulevard and the other connecting Holcomb Boulevard and
21 Hadnot Point.

22 DR. CLARK: Yeah. But this talks out -- oh, I'm
23 sorry. Yeah. This talks about one pipe: construct 8-inch
24 line from Brewster Boulevard to Tarawa Terrace. And then
25 it has advantages, and I assume that refers to the --

1 MR. FAYE: That's --

2 DR. CLARK: -- 8-inch line.

3 MR. FAYE: That's the one from -- that's the one that
4 apparently froze up and fell into Northeast Creek.

5 DR. CLARK: Okay.

6 MR. FAYE: If they actually built it, which we don't
7 know.

8 DR. CLARK: But they're talking about a potential use
9 of both supplying raw water as well as --

10 MR. FAYE: That refers to what Tom was talking about.

11 DR. CLARK: That was Tom's point.

12 COURT REPORTER: You need to be at the microphone.

13 UNIDENTIFIED SPEAKER: Sorry.

14 DR. JOHNSON: Okay. Shall we move along?

15 MR. ENSMINGER: All right. How do historical water-
16 system operations, assessment, monitoring, treating, and
17 distribution at Camp Lejeune relate to systems of
18 comparable size of population served during the same
19 general time frame from 1950 to 1985 in the United States'
20 civilian world? In other words, how does -- did the
21 operation of Camp Lejeune and presently how does it stack
22 up against its civilian counterparts?

23 MR. MASLIA: Could I give you a brief answer now, and
24 then, since we haven't got into the distribution side of

1 things, give you a more detailed answer tomorrow? Because
2 I do want to answer that, so -- but I didn't want to go
3 off on a --

4 MR. ENSMINGER: No.

5 MR. MASLIA: -- tangent right now, if that's okay
6 with the Chair.

7 Briefly, based on our experience, it's -- and I'm
8 talking about Camp Lejeune, not other military
9 installations, but it's night and day. There's almost
10 basically an intent to make it demand independent; in
11 other words, so they maintain constant pressure, constant
12 level in the tanks.

13 They don't empty the tanks out, as opposed to, say,
14 our work where we saw in Dover Township where there's more
15 of a sinusoidal, a filling of a tank during periods of low
16 demand, you know, midnight through four a.m. and then
17 using that supply of water in the tanks and draining it
18 out as people take showers or restaurants come on.

19 At Camp Lejeune -- and I'll admit our understanding
20 still is not complete as total operation -- even for
21 present day, we still have questions. They basically
22 almost maintain a constant pressure, maintain a constant
23 level in the tanks with the exception of one controlling
24 tank per service area. And based on the water level in
25 that controlling tank, which, based on our present-day

1 information, may only fluctuate from a -- from half a foot
2 to maybe 6 feet at most. It's in a paper we prepared.
3 That's the maximum fluctuation we have -- we have seen
4 based on data for present day.

5 Then trigger high-lift pumps to turn on, say, at
6 Tarawa Terrace to push water through the system. So it is
7 a totally different way of operating, and that's one of
8 the lacking pieces of information is specific diurnal
9 demand. You know, the military personnel, enlisted
10 people, you know, may get up at four or three a.m., and
11 that's when, maybe, your maximum use may be. And then it
12 may trail off six, seven a.m.; whereas in a more urban
13 setting, like Dover Township, you may not see a peak in
14 demand until eight -- seven or eight o'clock in the
15 morning. And then it levels off, and then another peak at
16 six p.m. when people come home. And we're still trying to
17 understand it, but typically it's a vastly different way
18 of operating.

19 DR. CLARK: But they do -- they do meet the
20 requirements of the Safe Drinking Water Act. I think
21 that's a commitment on the part of the military to do
22 that.

23 MR. MASLIA: Oh, I wasn't referring to Safe Drinking
24 Water Act.

1 DR. CLARK: But in terms of treating water, they meet
2 the requirements of the Safe Drinking Water Act.

3 MR. MASLIA: Right.

4 DR. WALSKI: Yeah. I wouldn't say "night and day"
5 either. I mean, there's a wide range in the way systems
6 are operated around the country, and they're somewhere in
7 the band. You know, they're more conservative though.
8 From what I've been reading here, they're more
9 conservative. Like, they try to keep raw water in storage
10 for fires and emergencies than the average system, which
11 allows more fluctuation.

12 MR. MASLIA: Yes.

13 DR. WALSKI: But it's -- so they're a little more on
14 that side of the curve. But there's a wide range of
15 operations. If you go -- every time I say I've seen it
16 all, I go to the next water system. I see something
17 totally different.

18 DR. CLARK: That includes civilian water systems
19 too; right?

20 DR. WALSKI: Yeah; civilian and military.

21 MR. FAYE: I don't -- I don't mean to belabor the
22 situation, but it is really important. Going back to the
23 use of the wells at Tarawa Terrace during 1985 and '86, we
24 do know that from Naval records that water samples,
25 specifically to identify any contaminants, were collected

1 at the water-treatment plant at Tarawa Terrace weekly from
2 March 1986 to March 1987, which certainly lends [sic] me
3 to believe that -- that the wells were operating during
4 that period.

5 And monthly samples were collected at TT-25 during
6 that same period, so there was this continuing concern on
7 the -- and these -- this sampling program was recommended
8 by North Carolina DEM and, I believe, implemented by the
9 Navy, by the Marine Corps.

10 So it just seems rather incongruous, if the wells
11 were not operating and if there was still a not a concern
12 about contamination, that none of this sampling program
13 would have been implemented. And that's the main reason
14 that I believe that the Tarawa Terrace supply Wells
15 ex-TT-23 and ex-TT-26 were operating during 1985 and 1986.

16 MR. ENSMINGER: I know that flow meters have been
17 installed during the conduct of this study. It's been
18 published in the newspapers down at Camp Lejeune. What
19 results can be made public at this time, and do they -- do
20 they match your expectations?

21 MR. MASLIA: Again, we'll get into the specifics this
22 afternoon and tomorrow, but basically, flow meters were
23 recommended -- or requested to be installed by ATSDR
24 because we could not just, based on system records

1 available to us, get a handle on flow to different areas
2 and trying to establish a diurnal and demand pattern.

3 We located 16 areas -- or 16 points, not areas, 16
4 points where we wanted the flow meters installed. This
5 discussion took place initially with representatives from
6 environmental management division from headquarters,
7 Marine Corps and Camp Lejeune staff in July 28th -- on a
8 July 28th meeting at Camp Lejeune. And headquarters said
9 to proceed with that.

10 As of -- in January, towards the end of January, all
11 the flow meters were installed. It was ATSDR's technical
12 staff, meaning myself and my staff, that a performance-
13 based contract be used to install those; that is, install
14 one and see any issues that may arise with it, how useful
15 it may be. And then proceed to the next one or not
16 proceed, as the case may be.

17 We were in a position that to let a contract of that
18 size -- for ATSDR to let a contract would have required us
19 to, at the minimum, advertise in the *Business Commerce*
20 *Daily*, and you would have seen that taking six months or
21 longer -- eight months. So at the time, it was decided
22 that the Marine Corps would handle the procurement.

23 Apparently, they had a contract in place that would
24 not require such a long time to get the flow meters
25 installed for procurement. That was already in place,

1 whereas ATSDR would've had to advertise to the world
2 basically on a size of that, 16 meters -- a contract
3 containing 16 meters.

4 So that's why. The Marine Corps offered, and we
5 accepted their offer for them to do the procurement and
6 installation. So we were in the recommendation stage. We
7 did recommend that it be performance based. All 16 were
8 purchased, and all 16 were installed.

9 As of this past March, while they are operating, they
10 are not calibrated. And we're still working on that. We
11 have submitted a report, a detailed report, on every flow
12 meter on what needs to be done to calibrate the flow
13 meters so we can get reliable information. So the short
14 answer to your question is: We have not obtained any
15 reliable or useful information to date from the flow
16 meters.

17 MR. ENSMINGER: What's the holdup with the
18 calibration?

19 MR. MASLIA: Some technical issues. Number one, in
20 the calibration process, certain valves have to be shut
21 off to zero the meters out. And on the other side is
22 ATSDR not having -- or I not having staff to actually --
23 as I alluded to, we don't have a field office there. So
24 when questions need to be answered, we are not on site to
25 specifically direct the work to do that.

1 We are not on site there full-time, and so it's a
2 combination of installing field equipment and so us making
3 trips back and forth. We have been told on a number of
4 occasions that the flow meters have been calibrated. We
5 have made trips up there, and when we try to QAQC them,
6 they're not calibrated.

7 DR. JOHNSON: Let me digress and ask if anyone else
8 from the public plans to make a statement.

9 (No audible response)

10 DR. JOHNSON: Seeing no hands raised, please,
11 continue.

12 MR. ENSMINGER: Historical documentation: pumping
13 records as to quantity, quality, distribution-system
14 problems, well-field problems, infrastructure data on well
15 construction, depth output, locations are by necessity to
16 be furnished by the environmental management division of
17 Marine Corps base Camp Lejeune or by their utility
18 section.

19 Has ATSDR received all the materials it has specified
20 that it would require? And if not, what is the
21 explanation? And has ATSDR brought this matter of lack of
22 cooperation to a -- to the attention of anybody else, such
23 as headquarters of the Marine Corps?

24 MR. FAYE: Well, first of all, let's not make the
25 presumption that there's been a lack of cooperation

1 because I wouldn't go that far. In a number of areas that
2 are very critical, the Marine Corps has been extremely
3 forthcoming and provided very useful information.

4 As far as the well data are concerned, between the
5 information that we have obtained from the Marine Corps
6 and from the U.S. Geological Survey, who, as I mentioned
7 earlier, did two very comprehensive studies there in the
8 late 1980s, we've got a -- we have -- ATSDR has a very --
9 what I would say a very substantially complete record of
10 all of the wells that have been drilled at either Holcomb
11 Boulevard, Hadnot Point, or Tarawa Terrace, or Camp
12 Johnson, starting back in the early 1940s up to about 1987
13 or '88.

14 We do have additional -- well, several additional
15 well records that have been completed at Camp Lejeune;
16 very extensive records with contract numbers and whatever.
17 Now, we have asked Camp Lejeune if -- we've asked them for
18 some location data and other information about these wells
19 that they've not provided yet. But in that regard, you
20 know, that's only a half a dozen records.

21 Another thing I'd like to point out is the records
22 provided to us relative to RI/FS studies and underground-
23 storage tank removal studies at Tarawa Terrace have been
24 very, very useful. And as far as I can tell, the records

1 provided by Camp Lejeune, which are in the dozens --
2 dozens of reports, are complete.

3 We would really like to have a similar contribution
4 of those RI/FS and underground-storage tank removal
5 reports, et cetera, from the -- for the Holcomb Boulevard
6 area and the Hadnot Point area, and we've asked for that.
7 But that's a large volume of information, and we haven't
8 received it yet. But we hope we will in the future. In
9 fact, very soon, I hope.

10 But as far as the well data are concerned,
11 specifically, I think we have a very substantially
12 complete record of what's available, of the data
13 available.

14 MR. ENSMINGER: Listening earlier --

15 MR. FAYE: No. That doesn't -- that includes the
16 well data in terms of, like, construction. That does not
17 include operational information.

18 MR. ENSMINGER: Yeah. That's what I was just going
19 to ask because earlier you stated that you didn't have
20 near the information for, say, Hadnot Point that you did
21 for Tarawa Terrace. I mean, that's the same organization.
22 The same outfit that's running Tarawa Terrace is running
23 Hadnot Point. So if they had good records for Tarawa
24 Terrace, they should have good records for Hadnot Point
25 water system as well.

1 MR. ASHTON: I'd like to --

2 COURT REPORTER: I need you to get to a microphone.
3 Please identify yourself.

4 MR. ASHTON: I'm Brynn Ashton, and I've been really
5 spearheading the effort from our environmental management
6 division to provide the information. And in all cases, I
7 think we've given -- we tried to provide you whatever we
8 have. Recordkeeping is not consistent across Camp
9 Lejeune. And there's been times where we might have some
10 information in certain plants. We might not have as good
11 information or organized as well in other plants.

12 So what we've tried to do is provide whatever we
13 have, and, you know, the Commandant has made it very clear
14 to us that we shall provide you with whatever information
15 we have in as timely a manner as possible. If, at any
16 time, it appears that we are not providing that
17 information, it's just because it's not available or it's
18 not organized. Or in some cases, we've scoured our
19 records. We've found records that we did not realize were
20 in existence. So in summary, we have the charge, we have
21 the mission, to provide as much information as you ask in
22 as timely a manner as possible.

23 MR. ENSMINGER: I have another question for you while
24 you're up here. If that's the case, the plant account
25 records --

1 MR. ASHTON: Yes.

2 MR. ENSMINGER: -- I know that EMD has a listing of
3 all and has pulled all the well data and all of the water-
4 system data off the plant account records, all the
5 historical data. I know it exists because I used to call
6 Rick Raines and get certain information from him when he
7 was here. Why hasn't that been provided to them?

8 MR. ASHTON: Now, I think -- I think they will verify
9 that we've provided them what we have. The plant account
10 data is very minimal. It -- what it has is it has square
11 footage of the buildings. It has years of construction.
12 It has, you know, numbers of the facilities. It has
13 certain category codes, and that -- you know, that is
14 available through our plant account organization.

15 MR. ENSMINGER: I know.

16 MR. ASHTON: Some of it was not computerized. Some
17 of it's in hard copy.

18 MR. ENSMINGER: I know.

19 MR. ASHTON: I think we've provided you what you've
20 asked for on the plant account. And we've -- we actually
21 have a point of contact that runs that section, and what
22 we've done is we've provided the point of contact so you
23 can get whatever information they have.

24 Again, you know, I'm not always proud of their -- the
25 level of recordkeeping that we've done in the past. You

1 know, we've already alluded to some gaps in the knowledge.
2 Whatever we have, whatever we can locate, we provide.
3 And, you know, that's our charter. That's our charge from
4 the highest level, from the Commandant, is that we be
5 fully cooperative, that we provide whatever information we
6 have. And we're routinely -- we're going through records
7 as we speak. We've got volumes of records.

8 Morris will verify to the facts that we have this
9 vault with, probably, 70,000 different drawings in it.
10 And the vault dates back from the forties because,
11 for example, Tarawa Terrace was built by a private
12 contractor --

13 MR. ENSMINGER: Mm-hmm.

14 MR. ASHTON: -- the records are very spotty because
15 we -- they weren't government records when the development
16 was initially constructed. The air station, for example
17 -- this isn't part of this study. But, you know, we had
18 virtually no construction drawings from the early fifties
19 from the air station. It was just discarded by somebody.
20 That's the unfortunate environment that we're working
21 with. But the one thing that, I guess, I'm here to say is
22 that whatever support we can provide, whatever information
23 we can provide, we try to provide that as soon as -- in as
24 timely a manner as possible.

25 MR. ENSMINGER: Thank you.

1 DR. JOHNSON: Well, thank you for your comments. Do
2 you have one more question, Mr. Ensminger?

3 MR. ENSMINGER: No. I have some -- I have some
4 statements. The reason I am a bit skeptical of the Marine
5 Corps or their personnel, as far as their involvement in
6 this thing -- and you have to admit, Camp Lejeune, that --
7 or the people that represent Camp Lejeune now, today, what
8 was done in the past at Lejeune regarding this situation,
9 there's -- there have been some real atrocities committed
10 down there by some people that provided ATSDR with
11 incorrect water-system data, purposely. And when they
12 were told to correct it, they did not do it.

13 And there was a repeated request by headquarters
14 Marine Corps for you to correct it -- or not you, but your
15 predecessors: Mr. Neil Paul to be exact. And he did
16 nothing. And ATSDR went from 1993 to 2003 under the
17 assumption that the Holcomb Boulevard water system
18 provided water for all those housing areas on the main
19 part of the base for the entire study period, which was
20 '68 through '85 when, in fact, Hadnot Point provided that
21 water up until 1973, August of '73. And that's by
22 statement from Carl Baker from the plant account records.

23 So can you understand my skepticism? And you've got
24 to understand that I lost a child. And I wish -- there's
25 no way that I can relay to you what I feel and what my

1 daughter went through. And damn it, I want to know, and
2 there's a lot of other people out there that want to know
3 what happened to their kids. I want to know why my
4 daughter went through the hell she went through. And if
5 there's anybody that's withholding information or not
6 providing correct information, I swear to God, if I find
7 out about it, I'll do everything that is possible to make
8 sure that they are dealt with.

9 DR. JOHNSON: We appreciate your comments, and we
10 offer, certainly, our condolences in the loss of a child.
11 We cannot fully appreciate your feelings, but we certainly
12 commiserate with you and offer you our sympathies.

13 I have asked your comments and those from Mr.
14 Townsend might be made part of this public meeting's
15 record. I have suggested, Dr. Cibulas, that the agency
16 provide a response to what are serious and important
17 questions. And I hope that you feel that you've had a
18 fair hearing and response to your questions today.

19 MR. ENSMINGER: Well, we'll see by the end of
20 tomorrow.

21 DR. JOHNSON: Okay.

22 MR. ENSMINGER: Thank you.

23 DR. JOHNSON: Thank you again. I'd like to return to
24 these eight questions and ask first of all, Mr. Maslia,
25 we've got four through eight. Is there any priority here

1 in these -- priority of importance in these questions that
2 remain?

3 MR. MASLIA: Okay. Let me reorient myself here; not
4 really. They're of equal importance.

5 DR. JOHNSON: Okay. Let's turn to Question 4:
6 Should ATSDR consider using a parameter estimation
7 approach to assess parameter sensitivity? And I suggest
8 that you -- that we ignore the second part of that
9 question: when such a process should begin. Anyone want
10 to take a bite on parameter estimation? Eric.

11 DR. LABOLLE: Are we referring to the distribution
12 system model or the groundwater model at this point?

13 DR. JOHNSON: Groundwater.

14 MR. MASLIA: Groundwater.

15 DR. LABOLLE: Well, my primary concern would be with
16 dealing with the uncertainty and variability in the
17 subsurface with regards to parameter estimation. At this
18 point in time, there is some preliminary characterization
19 done and a model constructed. And the construction of the
20 model -- and I think I voiced some of this in my
21 premeeting comments -- kind of constrains one's
22 characterization of the subsurface, which is considerably
23 more variable. And the uncertainty in that is great. We
24 have samples at locations, wells, borings, and such, but

1 no information between other than what we know of the
2 geology.

3 And so the parameter estimation that you do is going
4 to allow you to vary these parameters within the cells
5 based upon the constraints of the model. And my concern
6 -- not -- that's not a bad idea, but my concern would be
7 that the model response is still constrained by the
8 characterization that's in place and that there
9 potentially be, in addition to, depending on the role of
10 the groundwater model, of course, and the level of detail
11 that it requires in order to improve the answer.

12 But my concern would be that not only there would be
13 some parameter estimation, but also a way of addressing
14 the uncertainty and variability in the subsurface beyond
15 the constraints imposed by the current characterization,
16 if necessary.

17 And that's going to be driven by the epi model,
18 whether or not one needs to essentially get at multiple
19 exposure scenarios in order to tease out the dose
20 response. So if the epi model is very weak in a sense in
21 terms of its correlation, the actual dose response, then
22 one might need multiple exposure scenarios in order to
23 find that. There's my primary concern. But, certainly,
24 parameter estimation, I think, is a necessary step if,

1 indeed, one needs to refine the arrival curves to these
2 wells.

3 MR. FAYE: I have no argument or really even any
4 comment to say except that I agree with you, and we've
5 always planned to use parameter estimation to the greatest
6 extent that we possibly could. We've only done it
7 recently -- or not recently. But with respect to the
8 prepumping model, I spent quite a bit of time using PEST
9 and UCODE to estimate -- to estimate that recharge rate.
10 And frankly, I didn't get any better answers than just
11 using the estimate that's published in several -- several
12 papers. So -- but it's something that we definitely plan
13 to deal with in the future.

14 DR. LABOLLE: There is one additional concern
15 actually with regards to parameter estimation that I've
16 been meaning to touch on at some point here which is: What
17 data do you calibrate to? And I've noted from some of the
18 slides you had up there that parameter estimation or the
19 focus on the calibration has been on the hydraulic model,
20 and that's used in the transport model. Now, to the
21 extent that the parameter estimation could be used in
22 combination for both the hydraulic and the transport
23 model, I think that's quite important.

24 And the more recent data that's available on
25 concentrations, unfortunately, probably doesn't overlap

1 with the time frame of interest and the time frame in
2 which the model's been developed.

3 But if there was any plan to extend the model period
4 forward over the later periods over which you have better
5 information, there may be something to be gained from
6 calibrating the transport model to probably the better
7 data on concentrations in later time periods.

8 MR. FAYE: Oh, yeah. We would definitely be remiss
9 if we ended our calibration in 1985. We would extend the
10 calibration for the fate and transport to 1991, which is
11 the last period that we actually have contaminant
12 information at several supply wells. That's always been
13 on the books to do that. I had another comment. It
14 slipped my mind.

15 DR. LABOLLE: Is there --

16 MR. FAYE: The -- pardon?

17 DR. LABOLLE: Is there additional data after '91
18 also?

19 MR. FAYE: No; no; no. As Mr. Ensminger said and as
20 I reiterated later in some of my comments, apparently,
21 right after the wells were sampled during Operable Unit 1,
22 the Operable Unit 1 study at ABC Cleaners, the Marine
23 Corps destroyed the wells, literally. It grouted them up,
24 took the hardware out, pumps, and grouted them up.

1 DR. LABOLLE: And there's no monitoring at the
2 monitoring wells after that time period? Or is there?

3 MR. FAYE: No; no. I think actually the monitoring
4 wells are gone as well.

5 DR. LABOLLE: Okay.

6 DR FAYE: Except for the immediate vicinity of ABC
7 Cleaners because they have to -- they have to have some
8 means of determining the efficiency of their remediation
9 activity there at ABC Cleaners. So that's pretty much it.
10 The -- as you saw, we would -- in order to -- in order to
11 do some parameter estimation during this transient period,
12 we would probably do some additional refinement on those
13 so-called static water levels.

14 You saw the shotgun scatter diagram there, so that
15 makes -- that makes the notion of parameter estimation a
16 little -- a little difficult when you're trying to match
17 that number of water levels plus that type of variability
18 in the water levels. But it's definitely something that
19 we -- that we'll deal with. And that was a good comment.
20 Thank you.

21 DR. JOHNSON: Any further comments on that question?

22 DR. CLARK: One comment.

23 DR. JOHNSON: Yes; please, Bob.

24 DR. CLARK: It seems to me that, in addition to
25 having data for parameter estimation, it would be nice to

1 be able to create an independent data set for validation
2 of predictions. And I think that would be an essential
3 part of the protocol for doing the regression estimations.

4 MR. FAYE: The only -- the only way we could do that
5 would basically to be randomly select data from the --
6 from the -- from the total population of the database that
7 we've got. We could do that.

8 DR. SINGH: I would like -- since it says no linear
9 regression approach, you know, I think you should consider
10 using more efficient and powerful parameter estimation
11 techniques, such as GLUE, and especially in conjunction
12 with the generic programming, your load times. I think
13 that would be a better approach than only the regression
14 approach, especially when you have such limited data.

15 MR. FAYE: Thank you.

16 DR. DOUGHERTY: One other comment is that, at least
17 the way the language is usually used, parameter estimation
18 assumes a model. And it seems to me that the model
19 estimation, at least the submodel for source terms -- and
20 getting ahead of our current topic -- tanks is perhaps
21 more significant than some of the parameters that one
22 might first think of going off and estimating. And my
23 initial reaction is that the model estimation process,
24 particularly at the source term, is more significant.

1 DR. JOHNSON: Okay. Let's move on to the next
2 question. Should ATSDR consider using probabilistic
3 analyses to assess the variability and uncertainty of
4 model parameters and variability and uncertainty of
5 contaminant concentrations at public supply wells? Are
6 there public domain codes available that the panel would
7 recommend using? Anyone want to bite on that one?
8 Please.

9 DR. CLARK: I'll take a shot at it. Yeah. I think
10 the idea of using probabilistic analysis and so forth is a
11 good idea, but I'm wondering: You're having enough trouble
12 dealing with just the -- with the deterministic model
13 you're working with is -- wouldn't that add a level of
14 complexity that goes way beyond where you could possibly
15 go at this point?

16 MR. FAYE: That was your question, Morris. You
17 answer it.

18 MR. MASLIA: Yes. Yes. That was a question posed in
19 the early stages of the formulation of this panel, and we
20 were trying to consider any and all topics that might be
21 brought to the table. And obviously, the panel has sort
22 of narrowed our focus into certain areas. And it may be
23 just more than we can bite off at the present time. And I
24 think, as David already appropriately pointed out, we may
25 be talking more into model estimation as opposed to

1 parameter estimation, given the limited data that is
2 available, and really find out how our model -- the effect
3 on the performance of our model.

4 If I could just go back for a second when -- Eric,
5 you were speaking about calibration for -- from the water-
6 quality standpoint or from the transport standpoint in
7 addition to the hydraulic. And I think we've taken -- and
8 this gets into the distribution side.

9 But we've taken that approach, and that's one of the
10 ideas that has driven us on the water-distribution side --
11 once we saw some of the hydraulic parameters of the
12 distribution side -- to do tracer tests, realizing that if
13 we were going to ever calibrate a distribution model that
14 we would have to calibrate it to water-quality parameters,
15 rather than just on the hydraulic side.

16 We would probably end up, at best, with a nonunique
17 hydraulic solution; at the very best if we did not. So we
18 are aware of that. Your point is well taken. We're
19 probably at that step on the distribution side, and that's
20 a step we need to look at from the groundwater side.

21 DR. LABOLLE: I think it might be important here to
22 define what we mean by calibration to some extent because
23 the previous question was with regards to parameter
24 estimation for calibration. But in my mind, when I speak
25 of calibration, I think we're talking the big picture,

1 including the source term, as David brought up, then
2 including the recharge and everything else --

3 MR. MASLIA: Oh, absolutely.

4 DR. LABOLLE: -- that comes into play here, so...

5 And with regards to the use of specific models, I'm
6 reluctant to advise ATSDR to necessarily embark on, for
7 example, a geostatistical approach to -- although that's
8 kind of what I was implying by my previous answer. I'm
9 reluctant to specifically recommend that at this point in
10 time until I understand more the role of the tanks, the
11 mixing, and the distribution-system model, the time frame
12 at which we know contamination was present at some of the
13 wells relative to, you know, some of the uncertainty, and
14 how much uncertainty can be tolerated in the epi model. I
15 think that's going to become apparent over the next day
16 and a half.

17 DR. WALSKI: Instead of using the word
18 "probabilistic" analysis, I would just think in -- more in
19 terms of sensitivity analysis. Find out what is the model
20 sensitive to and focus on that parameter and not try to
21 figure out every cell's hydraulic conductivity or anything
22 like that. And you know, focus on the one or two things
23 that really make a difference. And it's probably going to
24 be source.

1 DR. DOUGHERTY: And the answer is -- focusing on the
2 last part of the question, rather than the first part, the
3 answer is yes. You should you use some probabilistic
4 analysis for the impact at the -- it's not clear yet
5 whether it's the individual wells or the blended well
6 concentrations but on that metric. Yes.

7 DR. LABOLLE: Yeah. The answer -- if I can elaborate
8 on what I said -- I was reluctant to provide
9 recommendations for using geostatistics but certainly some
10 sort of probabilistic analysis is going to have to be
11 employed to consider the uncertainty in these arrival
12 curves to the wells regardless of how well you know the
13 source because although the source terms -- and the
14 uncertainty in that is going to, you know, directly affect
15 the arrival to these wells and the concentrations at which
16 the PCE arrives.

17 The hydrogeologic uncertainty is an additional
18 component that will make that highly uncertain as well and
19 possibly on the order of a magnitude, an order of
20 magnitude or more, maybe even two orders of magnitude,
21 uncertainty in concentrations that arrive to these wells,
22 even from the hydrogeologic uncertainty. And so
23 constraining that, to the extent that you can, from the
24 models, I think, is important.

1 DR. JOHNSON: Okay; moving on. How should ATSDR
2 address the issue of lack of observed water-level data
3 prior to 1974, reminding us that the epi study is from
4 1968 -- or covers 1968 through 1985?

5 MR. MASLIA: That should have been from '78. If
6 you've been following the discussion all day, we don't
7 have the data prior to '78.

8 MR. FAYE: Very few.

9 DR. JOHNSON: So that becomes a moot question.

10 MR. FAYE: No. But I think we've already addressed
11 it in terms of the uncertainty discussions and the
12 parameter estimation discussions. I think we just sort --
13 it would be a lot of repetition in response to that
14 question, but that's no reason not to respond.

15 DR. JOHNSON: If you're happy, I'm happy. Any
16 comments on --

17 MR. FAYE: Okay. I'm happy.

18 MR. MASLIA: The only comment I will -- I will make
19 and I've had this initial discussion with Frank Bove, and
20 he's actually prepared some, I guess, iterations or some
21 initial analyses. And the discussion went along the line
22 is: How much uncertainty or variability could the epi
23 study tolerate in terms of if our arrival times are plus
24 or minus a couple of months versus plus or minus six
25 months versus plus or minus a couple of years?

1 And that's an issue. As I said, he's just prepared
2 some preliminary analysis on, but that's something we need
3 to sit down and discuss with them. That's the exact
4 issue. So the fact that we don't have very many data
5 prior to '78 brings that again to the forefront since
6 they're starting the study in '68.

7 DR. KONIKOW: Do you have pumpage data from prior to
8 1978?

9 MR. FAYE: Yeah, we do, Lenny. We have periodic
10 information for, perhaps -- well, not perhaps, for a
11 particular year. Maybe, I think we have data for '71. We
12 have data for '62. And, of course, the USGS, their data
13 go to '75. I think we also have some '68 data, but these
14 are just, you know, snapshots.

15 And -- but the point is -- and I think I made it
16 earlier -- that because of the -- because of the utility
17 of Tarawa Terrace, the housing was occupied 90 percent to
18 100 percent all the time. And that's borne out in the
19 USGS data as well. I mean, we're looking at point --
20 averages of .95 MGD plus or minus 10 percent for, you
21 know, well over a decade. And I think that was probably
22 the case, you know, from the get go.

23 DR. KONIKOW: So really what you're saying is that if
24 you can calibrate the model adequately for the times when
25 you have water-level data --

1 MR. FAYE: Right. That's --

2 DR. KONIKOW: -- you could then run the model --

3 MR. FAYE: That's the whole plan.

4 DR. KONIKOW: -- impose the stresses --

5 MR. FAYE: Yep.

6 DR. KONIKOW: -- for the earlier time.

7 MR. FAYE: Right. That's the plan.

8 DR. KONIKOW: -- and that still leaves you with the
9 issue of concentrations though.

10 MR. FAYE: Exactly; exactly. And the thing that we
11 hope to be able to do is to have some good estimate of
12 mass loading through time. It should be fairly constant
13 except for the periods there that, like Mr. Ensminger was
14 discussing during Vietnam, when there was -- when it was
15 probably somewhat to greatly accelerated, the activities
16 at ABC Cleaners.

17 But for all intents and purposes, it is a single
18 source, and hopefully, maybe, perhaps from these tax
19 records or other information that we'll be able to
20 discover in the reasonably near future. We should be able
21 to -- or we'll hopefully be able to get or to obtain some
22 notion of the use at the source. That still doesn't
23 really address what the loss -- what the percentage of
24 loss was from their actual total use. So we'll just have
25 to start out, make some estimates, do alternative

1 simulations, and hopefully arrive at a defensible,
2 reasonable answer.

3 DR. KONIKOW: Well, I think what you're going to come
4 up with is that there was some contamination there from
5 the beginning of this --

6 MR. FAYE: Right.

7 DR. KONIKOW: -- epidemiological study.

8 MR. FAYE: Oh, yes.

9 DR. KONIKOW: And --

10 MR. FAYE: No question.

11 DR. KONIKOW: -- you may not be able to refine it
12 down any more than we just said.

13 MR. FAYE: Maybe we can't; yeah. I don't know
14 whether that precludes the attempt or not. That's
15 hopefully what -- where we'll get -- gain some insights
16 from you-all.

17 DR. JOHNSON: Okay. How should ATSDR address the
18 issue of lack of monthly groundwater production data when
19 monthly data are required for the epi study?

20 MR. FAYE: Well, let me say a few words about that
21 too. We now have good monthly data back to 1980. All
22 right? And we have -- prior to 19 -- 1980, we probably
23 have, maybe, three, four, five snapshots in time of the
24 well capacities because the well capacities have changed
25 through time.

1 So what we can ultimately do -- what we possibly
2 should be able to do, using the monthly data that we do
3 have now from 1980 through 1984 and the well capacity data
4 that we have for that time, possibly rate the -- that use
5 as a factor of -- as a factor of capacity. And then, as
6 the capacity changes back through the historical record,
7 adjust that on a monthly basis. And knowing what the
8 annual record is -- we know what monthly variability is
9 now from the -- from the detailed records that we have for
10 those four, five, six years -- develop a model of
11 activity. Okay?

12 MR. MASLIA: One of the pieces of information that
13 we've just recently obtained, which has been referred to,
14 is this plant accountability record. I actually have a
15 copy with it, and it goes from 1990 backwards 'til they
16 started keeping the records.

17 What's in it is it lists -- for example, it lists the
18 pump house or well house and treatment facility and
19 anything by all the different water-plant areas at Camp
20 Lejeune. It references a card number, which is my
21 understanding how records are referenced to or kept in the
22 vault at Camp Lejeune. That should -- at least, we'll
23 make the attempt at going back there and pulling whatever
24 information is in there.

1 Up until we got that information telling us or
2 suggesting that we go into this storehouse of information
3 and start looking someplace, it was like looking for a
4 needle in a haystack. You don't know where to turn to
5 look. At least now we have some directed means. Whether
6 that yields useful information or not, I can't answer, but
7 that may -- in fact, just this last week -- I think it was
8 last Thursday or Friday -- I received from the EMD folks
9 at Camp Lejeune the -- was it from the '80 to '80 --

10 MR. ASHTON: '84.

11 MR. MASLIA: '80 through '84 monthly production
12 records by every water system. So this information is
13 still coming in. And as we have -- as we refine -- excuse
14 me -- our approach based on recommendations from this
15 panel -- also I think that goes hand-in-hand with
16 hopefully obtaining additional data we may find. In other
17 words, we have not given up on trying to locate the
18 earlier information.

19 DR. JOHNSON: Okay. Anything else? Lastly, Question
20 8: Is it sufficient to use an annual average recharge or
21 infiltration rate and assess climatic conditions to derive
22 monthly recharge rates? Are other methods or techniques
23 available to derive monthly recharge data? Does anyone
24 know?

25 DR. CLARK: [off microphone]

1 COURT REPORTER: Sir, I need you to use the
2 microphone.

3 DR. CLARK: I'm sorry. Could one use some of the
4 meteorological data we discussed to get estimates?

5 MR. FAYE: Yes. That's our plan now. We have
6 monthly rainfall, pan evaporation records for the entire
7 period of interest, starting in the early fifties and
8 going up into the nineties. And once we can decide on
9 this baseline annual recharge, whatever it is -- 14
10 inches, 13 inches, 15, something like that.

11 Whatever that is, then we can use that -- and we
12 compare that then to the -- we have -- what we'll have
13 from that -- from that long period of meteorological
14 record, we'll have an -- a long-term average annual
15 rainfall as well. So we can equate that 14 inches of
16 recharge to the long-term average rainfall. And then,
17 using the monthly data, we can prorate that out.

18 We can say, well, for 1963 the recharge -- the annual
19 recharge was only 10 inches and prorate that out on a
20 monthly basis, using the meteorological record. 1975, it
21 was 16 inches and prorate that out, using the
22 meteorological record. And hopefully, we can develop a
23 recharge schedule for the various stress periods that way.
24 It's not -- it's not, you know, it's not rocket science,

1 but it is somewhat practical and common-sensely and
2 straightforward. So hopefully, it might work.

3 DR. CLARK: Can you get an estimate for changes in
4 soil permeability over that period of time?

5 MR. FAYE: There may be some agricultural records at
6 an experiment station somewhere down there in the coastal
7 plain where they -- where they collect those -- that
8 information, I guess, almost daily, particularly during
9 dry periods. We haven't looked for it.

10 DR. DOUGHERTY: The only comment I have with respect
11 to using the preset and then generating the variations of
12 the record is that that may be excessively rough compared
13 to the infiltration function at -- as it accretes to the
14 groundwater system. So it may be useful to -- basically
15 the unsaturated zone acts as a buffer and --

16 MR. FAYE: Sure.

17 DR. DOUGHERTY: -- and a smoother, so it may be
18 useful to use a very simplistic, one-dimensional model,
19 representative of characteristic depths to groundwater --

20 MR. FAYE: Oh.

21 DR. DOUGHERTY: -- to reduce the roughness.

22 MR. FAYE: Mm-hmm. And then what would you -- you
23 would -- you would bleed off the rainfall with some
24 estimate of ET or loss, using, what, pan evaporation data
25 or something like that?

1 DR. DOUGHERTY: That's one approach. The other
2 approach may be to do a simple, straightforward extension
3 of what you're doing now.

4 MR. FAYE: Oh, okay.

5 DR. DOUGHERTY: You have an average --

6 MR. FAYE: Okay.

7 DR. DOUGHERTY: -- from the average prorate. That's
8 the loading to the top of your reactor.

9 MR. FAYE: Right; right. And the advantage of what
10 you're saying just because we think we got 14 inches of
11 recharge or maybe the 1 inch of recharge during a
12 particular month -- because of the thickness of the
13 unsaturated zone, the water table may not see that for
14 another month or another two months.

15 DR. DOUGHERTY: Right. The unsaturated zone acts
16 as --

17 MR. FAYE: Yeah.

18 DR. DOUGHERTY: -- as bank storage.

19 MR. FAYE: Yeah. And the advantage of what you're
20 saying would allow us to look at that antecedent condition
21 pretty nicely.

22 DR. DOUGHERTY: Perhaps. The other advantage is that
23 it may smooth out some rewetting problems that you may
24 have because it's smoother rather than rougher.

25 MR. FAYE: Oh, yeah; right; okay.

1 DR. LABOLLE: You might try -- with regards to that,
2 you might try the -- I think it's been released. But one
3 of the researchers in our office was developing --

4 COURT REPORTER: Can you get nearer your microphone,
5 please.

6 DR. LABOLLE: -- the sat/unsat package for Modflow.
7 And it's not a full unsaturated code, so it doesn't have
8 its complexities that you'd -- that you would normally
9 associate with that --

10 MR. FAYE: Well, that's good.

11 DR. LABOLLE: -- an enigmatic wave --

12 MR. FAYE: Okay.

13 DR. LABOLLE: -- approach.

14 MR. FAYE: Yeah.

15 DR. LABOLLE: And it will provide the buffering that
16 you're looking for. It's essentially, you know, a
17 modified recharge.

18 MR. FAYE: Oh, that would be nice. What's this
19 person's name?

20 DR. LABOLLE: That's the -- Dave Prudic is working on
21 that with Richard --

22 MR. FAYE: Oh, yeah, I know Dave.

23 MR. MASLIA: Oh, we know Dave.

24 MR. FAYE: He's a personal friend of mine.

25 COURT REPORTER: One at a time, please.

1 DR. LABOLLE: Rich and Dave are the two --

2 MR. FAYE: Okay.

3 DR. LABOLLE: -- that have been developing that,
4 so --

5 MR. FAYE: Oh, okay.

6 DR. LABOLLE: I think it's either been released or
7 it's in testing, one or the other.

8 MR. FAYE: All right. Well, it's time to harass
9 Dave.

10 MR. MASLIA: Lenny, would you know anything -- would
11 you know anything about if that's been officially released
12 by the survey?

13 DR. KONIKOW: To the best of my knowledge, it's not
14 officially released yet.

15 MR. MASLIA: Okay.

16 DR. JOHNSON: Okay. We have plodded through these
17 eight questions, and I offer the panel the opportunity to
18 further elaborate on any point, something you, maybe, have
19 forgotten and wished you had brought up as an earlier
20 discussion. But this is going to be pretty much the
21 conclusion of comments on the groundwater modeling.
22 Anything that any panelist wishes? Please, James.

23 DR. UBER: Well, I just -- I'm no groundwater modeler
24 at all, but I've heard a few people talk about source
25 terms. And I just offer this as an idea for it to be shot

1 down, I guess. I wonder whether some more time should be
2 spent on working your way back to the source, to your, you
3 know, your hardest number, which I guess is your estimate
4 of how much PERC they used on a monthly basis.

5 So in other words, I mean, I don't know how a dry-
6 cleaner operates and how much they lose --

7 MR. FAYE: Well, we don't either.

8 DR. UBER: -- and how much is diluted with other --
9 with water as it goes into the septic system and whatnot.
10 But should more effort be spent on modeling that process?

11 MR. MASLIA: I think -- if I can do that one.

12 MR. FAYE: Have at it.

13 MR. MASLIA: That's really -- and this may be an
14 inappropriate term, but I'm going to use it anyway. I can
15 get shot down. That's really a facilities management-type
16 question that you're asking. How was the facility
17 managed, and can we glean any information as far as how we
18 classify or quantify the source that goes into our
19 groundwater model?

20 In other words -- and that, I think, goes back to
21 this data-discovery issue. Can we pull tax records? Can
22 we perhaps find -- and I don't know the issue. But if you
23 look at deliveries, deliveries to the dry-cleaner on how
24 much they use, we should see an upswing during the Vietnam
25 period, obviously.

1 And then perhaps through the -- there's a dry-cleaner
2 -- National Dry-Cleaners Association. Because my dry-
3 cleaners -- I asked him once about PERC, and he gave some
4 handout from them. So I know they have a national
5 organization. They may, in fact, have some information we
6 have not looked on on typical uses, historic uses. That's
7 an area, I agree, I think we need to really look at.

8 DR. WALSKI: So related to this, we're doing all this
9 sophisticated stuff, going back through tax records and
10 all that, why don't we just talk to the guy that ran ABC
11 Cleaners? I mean, get somebody who was the manager and
12 interview that person and find out what they did, I
13 mean --

14 UNIDENTIFIED SPEAKER: Because he's dead.

15 COURT REPORTER: Either at the mike, or (laughter)...

16 DR. WALSKI: If he's dead, then I think one of his
17 employees or somebody should know what went on there.
18 There should be somebody who worked there that's still
19 alive.

20 MR. FAYE: I think we're also dealing with, Tom,
21 something you pointed out a few minutes ago with regard to
22 the operation of these water-treatment plants. And that
23 is, you know, there's a broad spectrum of the way folks do
24 things, and I think -- and we had two -- we have two
25 examples right there.

1 We have the ABC Cleaners, who were, obviously,
2 exceptionally sloppy, to put it kindly, and we have this
3 Globarama place, who was very -- they were very efficient
4 in their operations and how they -- how they tracked their
5 and collected their PCE waste. So, yeah, we need to try
6 to find out as much as we can about that. And all of that
7 affects the source term, and there's just no denying --
8 and we wouldn't that -- the source term is a critical,
9 critical, critical feature of the fate and transport
10 model.

11 DR. LABOLLE: You might want to look at one of these
12 other simple models for looking at a dissolving source
13 like that, you know, a DNAPL, like we're dealing with
14 here.

15 MR. FAYE: Mm-hmm.

16 DR. LABOLLE: And I've actually run some of these in
17 the past. I forgotten the names if it. Something called
18 3-D? Does that sound --

19 MR. FAYE: There's something called Fate 5. There's
20 a number of them out there.

21 DR. LABOLLE: And, you know, that may be helpful, I
22 think, in --

23 MR. FAYE: Mm-hmm.

24 DR. LABOLLE: -- because, you know, what's been
25 mentioned is one aspect, which is facilities operation.

1 But then below that, you know, you've got the unsaturated
2 zone. You've got the source entering in there. And
3 you're looking at the saturated zone, not the unsaturated
4 zone.

5 MR. FAYE: Right.

6 DR. LABOLLE: So it might be useful in helping to
7 refine what the source may have looked like once you get a
8 handle on how much is entering the subsurface.

9 DR. JOHNSON: Mr. Ensminger.

10 MR. ENSMINGER: I just wanted to add one thing. I
11 know that depositions were taken prior to Mr. Meltz's
12 death by the EPA and some different law firms. And those
13 are available.

14 MR. FAYE: Do you know where?

15 MR. ENSMINGER: Yes. I'll tell you.

16 DR. JOHNSON: Okay. Thank you for your comment.
17 Anything else on groundwater?

18 (No audible response)

19 DR. JOHNSON: Looking at tomorrow, let me bring to
20 your attention that we begin at eight a.m., not 8:30. So
21 there's a time change, so be here a few minutes before
22 eight. We will begin, Morris, with your presentation on
23 the water-distribution system, an update on that work, and
24 then go from there into the set of questions that the
25 agency has brought forward.

1 As a matter of, perhaps, a take-home assignment to
2 the panelists, we're going to be talking about these four
3 charges. And clearly, we've already discussed some of
4 this. And tomorrow at the working lunch, we need to begin
5 formulating some specific responses to these four charges.
6 And I would ask that you simply look at these four charges
7 tonight, maybe put a few notes in the margin. And that
8 will help us perhaps go through these in a more efficient
9 fashion tomorrow.

10 With regard to the hotel, is there transportation
11 provided this evening as well as tomorrow? It's a very
12 accommodating hotel.

13 MR. MASLIA: There probably is. If there's anyone
14 out in the lobby -- you mean going back to or going out to
15 a restaurant?

16 MR. MASLIA: Going --

17 DR. JOHNSON: All of the above; yes.

18 MR. MASLIA: The hotel is very accommodating, and I
19 will see if anyone's out in the hallway to answer that
20 question.

21 But if I -- if I might just -- about a 60-second
22 point here is, again, on behalf of the technical staff --
23 and I assume I won't get beat over the head by agency
24 management for speaking for the agency, although Bill's
25 backing his chair up right now, so maybe I shouldn't. We

1 do very much appreciate your input. It's very useable.
2 It's from people who've seen a variety of cases, both
3 public and private contamination cases.

4 One of the things we take into consideration -- for
5 example, if we modify or go down a different path, taking
6 the information that you have provided us, we still need
7 to provide our other audience, the public and others, a
8 technical reason why we have chosen to change direction.
9 In other words, so that may still require us to say,
10 "Well, we did a cursory review of Hadnot Point, and, based
11 on recommendations from the panel and what we're seeing
12 right now, we're not going there any longer."

13 And that's just, for those who are not familiar with
14 the way ATSDR operates, we do have this other audience to,
15 at least, you know, address or at least acknowledge their
16 questions. So that's the other side to that. You're
17 obviously not charged with, but our mission is charged
18 with. So while some of these questions may seem like why
19 did they ask these questions or why are they posing it,
20 the answer may be obvious. We do -- we're posing them
21 because we have another audience to acknowledge and to
22 provide respectful answers for. So we do appreciate your
23 contributions and look forward to continuing down with the
24 distribution side tomorrow.

1 DR. JOHNSON: May we leave our materials in this
2 room?

3 MR. MASLIA: Absolutely. It'll be locked up.

4 DR. JOHNSON: Okay. Anyone want to say anything?

5 (No audible response)

6 DR. JOHNSON: If not, thank you for a good day.

7 (Whereupon, the proceeding was adjourned at
8 approximately 5:08 p.m.)