STATE OF MICHIGAN

STATE OFFICE OF ADMINISTRATIVE HEARINGS AND RULES

In the matter of:	File Nos.:	GW1810162 and MP 01 2007
The Petitions of the Keweenaw Bay Indian Community, Huron Mountain Club, National Wildlife Federation, and Yellow Dog Watershed Environmental Preserve, Inc., on permits issued to Kennecott Eagle Minerals Company.	Part:	31, Groundwater Discharge 632, Nonferrous Metallic Mineral Mining
_____/	Agency:	Department of Environmental Quality
	Case Type:	Water Bureau and Office of Geological Survey

D R A F T T R A N S C R I P T

HEARING - VOLUME NO. XXXIV (34)

BEFORE RICHARD A. PATTERSON, ADMINISTRATIVE LAW JUDGE

Constitution Hall, 525 West Allegan, Lansing, Michigan

Wednesday, June 25, 2008, 8:30 a.m.

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TABLE OF CONTENTS

NOTE: Page numbers may change on final transcript.

EXHIBIT INDEX

NOTE: Page numbers may change on final transcript. Full exhibit list for today will be included in the final transcript.

Lansing, Michigan

Wednesday, June 25, 2008 - 8:35 a.m.

MR. REICHEL: Ready to proceed, your Honor?

JUDGE PATTERSON: I am.

MR. REICHEL: At this time respondent calls as its next witness Michael Koss.

REPORTER: Raise your right hand. Do you solemnly swear or affirm that the testimony you're about to give will be the whole truth?

MR. KOSS: I do.

MICHAEL KOSS

having been called by the Respondent and sworn:

DIRECT EXAMINATION

BY MR. REICHEL:

Q Good morning, Mr. Koss. Could you please for the record state your full name and spell your last name?

A My name is Michael Koss; that's K-o-s-s.

Q Mr. Koss, you work for the Michigan Department of Natural Resources or DNR; is that correct?

A That is correct.

Q And where are you based in your work for the DNR?

A I work in the Western Upper Peninsula management unit, which is the whole western half of the U.P., roughly a line that runs from the town of Munising to Rapid River and I am stationed at the Gwinn field office.

Q Okay.

MR. REICHEL: I would note for the record that Mr. Koss's résumé, which was Respondent's Exhibit 11, has already been admitted by stipulation of the parties.

Q But I'd like to briefly go through your educational and work history. Where did you go to college, sir?

A I obtained a Bachelor of Science degree from Michigan State University.

Q And what was the subject of your degree?

A Fisheries and wildlife.

Q What year did you obtain that degree, sir?

A 1977.

Q After you completed your degree did you go to work for the Michigan DNR?

A Yes, I did. I started out as a seasonal park ranger and in the early years worked at Lake Port State Park under several different positions, seasonal positions primarily as a ranger. I also worked for wildlife division as a short-term worker on Port Huron State Game Area.

Q Okay. And did you subsequently assume different positions in the DNR?

A Yes. I got in permanently with the DNR in 1979 as a water quality specialist here in Lansing.

Q And what were your duties at that time, sir?

A Basically I worked in a construction grants program which

was to administer federal dollars to communities building wastewater treatment plants.

Q When did you first begin to work full time -- excuse me. when did you first begin in your work in the DNR to work in issues involving wildlife management?

A In 1981 I took a position as a wildlife technician at Point Mouillee State Game Area and worked at that game area in wetlands restoration on Lake Erie and also wildlife population monitoring at that time.

Q And when did you first have an assignment in the DNR in the area of wildlife in the Upper Peninsula?

A In November of '81 I was fortunate enough to get the wildlife biologist position at Gwinn, in which case I was the lead in terms of any issues pertaining to wildlife and wildlife division and my work area, which primarily was Marquette and Western Alger County.

Q Could you give the judge an idea of the -- more specifically of the range of duties that you performed with respect to wildlife management, wildlife habitat; the kinds of activities you were engaged in?

A A big part of the job was co-management responsibilities on over 28,000 acres of state land co-managing those lands with foresters and fisheries biologists. A big part of that position was going out and inventorying these state lands and jointly figuring out what we're going to do with these

lands, how we're going to treat them; whether we'll have timber sales or not, what we'll do after the timber sales; specific habitat projects, that sort of thing.

Q And did your work also give you occasion to keep abreast of wildlife populations, trends, things of that nature?

A Yes, a big part of the job was also monitoring wildlife: game, non-game, some threatened and endangered and using that information to set hunting regulations.

Q Did your responsibilities with the DNR wildlife division change or increase over time?

A Yes, they did. I was biologist from November of '81 to July of 2004. At that time I was fortunate enough to take a position as wildlife ecologist for the Western U.P. and that expanded some of my basic duties to a much broader level. Essentially as ecologist I evaluate and monitor habitat and also take a lead role in many different planning functions including writing a regional state forest plan for the Western U.P.

Q Could you elaborate a little more about what sorts of -- when you talk about planning functions, what kinds of activities would that involve?

A Well, we are working on a forest management plan for over 871,000 acres of state land in the West U.P. and kind of a broader perspective of what I mentioned earlier in terms of figuring out what we have and basically what we're going to

do with it on state lands to meet various goals. In addition to that I'm on numerous different work groups that deal with things like sylvaculture and regeneration; private lands issues, our private lands management program, work groups that deal with that. Plus special projects as assigned, like being a member of the mining team reviewing the Eagle project.

Q Okay. Before we get to that, I'd like to ask you whether during the course of your career in the DNR and the wildlife division in the U.P. that you just talked about since 1981; is that correct?

A That's right.

Q During that time period -- leaving aside this project -- have you ever had occasion or do you have occasion to look at Environmental Impact Assessments or reviews?

A Yes. That would come up on a regular basis. Some examples that come to mind are various right-of-way issues from recreation trails to overhead electric power lines, gas pipelines. probably the biggest project of that nature was Project ELF, which was a Department of Defense project for communicating with submarines that involved a good chunk of the U.P. and Northern Wisconsin. Also mine expansion of existing iron mines in Marquette County and Federal Energy Regulatory Commission relicensing of dams. That would have been another environmental assessment.

Q Okay. So in connection with those projects, if I understand you, some third party would have prepared an assessment of some kind of potential environmental impacts of a project and your role was to assist in reviewing that assessment; is that correct?

A That's correct.

Q And are there other occasions in your work where you as a DNR wildlife biologist or ecologist are called upon to offer input or comment on permitting decisions by other agencies or specifically the DEQ?

A Yes. We have a role in wetlands permits.

Q And what would that entail? Would there be a consultation process or how would that work?

A It can be. If we have a concern -- things have changed over time. Many years ago we would actually have to sign off on the permit itself. More recently if we have a concern we can just contact DEQ and voice it that way, but we don't actually sign off on the proposals at this time.

Q But would it be correct to say that in the wetland permitting context, for example, you would be notified if a permit is being proposed and given an opportunity to comment on it; is that --

A Yes; that's correct.

Q Now, let me ask you some questions about your experience, in particular geographic area. Now, again, you've -- if I

understand you correctly, you've had this geographic responsibility for the Central and Western U.P. essentially since 1981; is that correct?

A That's correct.

Q And that obviously includes Marquette County; correct?

A Yes.

Q During the course of your work for the DNR in the area have you become familiar with the Yellow Dog Plains area?

A Yes, I have. Two various activities were involved in -- I mentioned earlier that we inventory state lands and these lands come up -- we divide up the forest into compartments and ten percent of these compartments come up every year, so over the ten-year period you get through all the state forest lands in your area.

Q Can I interrupt you for just a minute? When you talk about a compartment, what are you talking about? Just a geographic block on a map?

A We're talking about a geographic block of state land. They can vary in size. The typical size is usually about three sections of land, but they vary. Sometimes if there's smaller parcels of state land you might have more sections of land involved.

Q But if I understand you correctly, they're typically organized around section lines; is that correct?

A Yes.

Q Okay. Go ahead. So with respect to the -- this compartment; what is it, an inventory process; is that correct?
A Yes.
Q How, if at all, has that process led you to get familiar with the Yellow Dog Plains area?
A It gets you out on the landscape in a systematic way. For instance, where this project is located is compartment 207 and that comes up -- the year of entry would be -- happens to fall on a even number, like 1990, 2000. And it's coming up again in 2010.
Q Okay. Just to -- maybe you said this but I just wanted to be clear. Are these compartments or areas reviewed on at least approximately a ten-year cycle? Is that what you're saying?
A Yes.
Q Okay. Go ahead, sir. I'm sorry.
A Yes. The field work would actually be done before the year of entry and then when the year of entry hits, then you go in and do the treatment.
Q Okay. When you talk about "field work," could you explain further what you mean in that context?
A Basically stand examination. We draw up maps of these compartments and we have a way of delineating different cover types through numbers and letters. Is it jack pine?

Is it white pine? Is it aspen? And size and age class information. And we go out and basically see what's there. It's not just the timber cover; it's all cover types: marshes, rock outcrops, that sort of thing. And we take a basic inventory of what's there, what its condition is. And then basically we sit around a table and decide what we're going to do with it, when.

Q So when you say that you're making recommendations, for example, about timber management, habitat management? Is that the kind of thing you're talking about?

A Timber management and habitat management primarily, yes.

Q In addition to these periodic inventory reviews during the course of your work at the DNR have you had occasion -- other occasions to be out on the ground in the Yellow Dog Plains area?

A Yes, I have. Outside of the inventory you have to do the follow-up. When timber sales are proposed on occasion we'll go out and inspect the timber sales, because we have to sign off on a proposal for that particular timber sale. If there's forest treatments proposed for an area outside of timber sales you have to go out and look at the area and draw up that forest treatment proposal. You also review forest treatment proposals that other divisions put forth, like forest management division. And so that gets me out in that area that way as well.

Q Could you explain what you mean by "forest treatment"?
A Anytime we do anything to the land we have to fill out a forest treatment proposal. And timber sales are their own special sort of forest treatment and they have contracts and a separate sort of proposal. Forest treatment proposals for other things would include like tree planting for wildlife. If fisheries division wanted to do something alongside of the stream, put in a sediment trap, that sort of thing -- anytime you impact the land a forest treatment proposal must be completed.
Q As a regular part of your work do you have occasion to participate in overseeing wildlife population surveys?
A Yes. We do quite an array of surveys specific to the Yellow Dog Plains. We've had numerous deer pellet courses, deer pellet surveys; very illustrious job of going out and counting deer droppings. It gives us a relative index of deer abundance. We also have -- other surveys that would directly impact the Yellow Dog Plains would be a bear tetracycline study.
Q Okay. Could you -- this is assessing bear populations?
A What it is, is we go out and place baits that are laced with the antibiotic tetracycline. Hopefully a bear comes along and takes that bait and ingests the tetracycline. When they do that that creates a biomarker. Bear put down a growth ring in their teeth just like a tree does when it grows

annually, so we know how many -- you know, we have these baits out there and we can assess how many have been visited by bears. With bear hunting it's mandatory registration, so when a hunter bags a bear they bring it into a check station, a tooth is removed and we take that tooth and cross section it and look at it under a black light and if it's a bear that's taken that tetracycline beat, that ring will actually glow. And so we know how many bears out there are marked; we know how many bear are in the bag and, you know, we can determine how many of the bears that were bagged are marked bears and we can come up with a bear population estimate that way.

Q But in terms of -- if I understand you correctly, as a part of this process the first stage is actually placing baits out in the field; is that correct?

A Yes. And there's a lot of them. In the Western U.P. there's a bait every fourth square mile, so you end up coving a lot of ground that way.

Q And to your knowledge have any of the -- during your experience have any of these baits that you periodically -- the agency periodically puts out, have any of those been placed in the vicinity of the project -- in the Yellow Dog Plains or in the vicinity of the project site?

A Yes. There's a couple in the Yellow Dog Plains. One is right about where the orebody is. And I used to hang that

bait personally for many years; probably from the late '80's to around 2000 or so. And that was just northwest of the orebody along the riparian edge of the Salmon Trout River.

Q So I take it then that the task of placing that bait meant that you had to actually go out to that location from time to time; correct?

A Yes, you had to seek out a smooth bark tree to put the bait in, let it set for two weeks, come back out and see whether it was visited by bear or not.

Q So is that another instance where you had occasion to be out on the Yellow Dog Plains?

A Yes; definitely.

Q Among the -- does your department or division also from time to time attempt to survey fur-bearing animals?

A Yes, we do. As a matter of fact, the Yellow Dog Plains is part of a rather large route that we have for fur-bearing animals. Typically I would take our wildlife technician out there in the wintertime to do that survey. When we do it, it was a very long day on a snow machine; it was about 120 miles. The actual survey points itself were divided up into five-mile segments. And one segment would have been the Northwestern Road kind of northeast a little bit of the proposed surface facility. Another segment occurred -- actually ended very near the surface facility east. There were others along -- further west along the AAA Road where

it meets the Ford Road, and there were a couple five-mile segments south of the Yellow Dog Plains as well.

Q When you talked about a "segment" of this kind of a survey what does that mean and what did it entail you or the other staff to do?

A It would entail when whoever's running the survey reaches that segment after an appropriate marker snow, some sort of fresh snows fall so we can see tracks and we wait a couple of activity periods to the six activity periods. An activity period would be either dawn or dusk, times when fur-bearing animals would be active. What you do is you start on the segment and you basically record the tracks of any fur-bearing animal and a couple of others as well. We would also keep track of snowshoe hare and rough grouse tracks as well, and basically document on a form what you saw, its distance from the end of the segment by an odometer reading and a complete survey for that five-mile segment of those tracks.

Q And in this context when you're talking about fur-bearing animals can you give an idea of what species you're referring to?

A Sure. It would wolf, bobcat, martin, fisher, coyote, fox, and that's about it.

Q Okay. So again, these would be occasions where you would from time to time go out into the Yellow Dog Plains area;

correct?
A Yes.
Q Now, just so we're clear, these kinds of surveys and activities that you've just described and the inventories, they're not unique to the Yellow Dog Plains, are they?
A No. No, we do many of them all over, state and private lands.
Q Now, you've just testified that you've been involved in this range of activities and your district responsibilities for some time. Could you give the judge an estimate on average about how many times per year you personally have been out on the ground in the Yellow Dog Plains area?
A I would say it would average out about four times a year where we would actually be there doing some sort of survey actually feet on the ground. In addition to that I would have occasion to pass through there in route to other areas in the northwestern portion of Marquette County, so I'd probably pass through there, driving through there another four times a year, say.
Q And when you say "driving through there," are you talking about driving along the AAA Road?
A AAA Road, yes.
Q And why would you be driving along the AAA Road?
A It's access point to the northwestern portion of Marquette County. Up to the north you take the AAA Road to the Ford

Road and proceed north to the Huron Bay grade and it gets you up on the west side of the Huron Mountains.

Q And could you estimate about how often you do that?

A I'd say that would be about four times a year where you're passing through.

Q Okay. So just to summarize then what you've said so far, you've been a wildlife biologist in this area for -- since 1981; correct?

A That's correct.

Q And you've been to the Yellow Dog Plains numerous times?

A Yes.

Q Let's turn now to your involvement in this project, sir. You've alluded to it already and there's already testimony in the record, but you referred to a mining review team. When, if you recall approximately, did you first become involved in that activity?

A I don't remember the exact date, but I would say it was early in 2006.

Q Okay. And how was it that you came to be involved?

A My supervisor asked me to be a member of this team, a team that DEQ was formulating to take a joint integrated looked at this proposal.

Q Okay. And what -- as you were assigned or immediately after you were assigned what did you understand the function of the team, number one; and number two, what your specific

role would be in it?

A The team is basically to put our heads together and communicate between our two departments about the proposal. I was given hard copies of sections of the application that were pertinent to my area of expertise and given information about where to get 632 rules, Part 632 rules so I could effectively evaluate the proposal. Joe Maki communicated to me that one of the major things he was -- well, a couple major things he was looking for was, you know, the wildlife assessment portion; did I feel that was adequate? Did I feel the baseline data that was taken, was that adequate? And then just the general thoughts about the proposal. And I was also told by my superiors to make recommendations about the proposal and pass them up through the chain of command.

Q Within DNR; is that right?

A Within DNR; that's correct.

Q And just so -- you talk about the "chain of command within DNR." You're at the wildlife division; is that correct?

A Right.

Q And so who do you report to?

A I report to my supervisor, Robert Doepker, who's the supervisor of the West U.P. management unit. And then in turn if it -- if, you know, he approves my work and then -- in this case it went straight to our division chief who at

that time was Bill Moritz.
Q That's chief of the wildlife division?
A Chief of the wildlife division.
Q Right. And so you were given access to the application; is that correct? The mining permit application?
A Yes.
Q And you were asked to look at sections pertaining to wildlife and I take it the Environmental Impact Assessment; is that correct?
A Yes.
Q And you were also given access to the Part 632 regulations; correct?
A That's correct.
Q And so were you being asked to look at what was provided and compare that to what you understood to be the requirements of Part 632?
A Yes.
Q And did you undertake that kind of review?
A Yes, I did.
Q And as you went through your initial review would that have been -- when would that have been, the first part of 2006?
A Yeah, it would have been spring of 2006. I solicited basically all of our staff in the West U.P.: my supervisor Robert Doepker, the current wildlife biologist for Marquette County, which would be Carrie McFadden. I involved Brian

Roell our wolf coordinator. I also involved Dr. Dean Beyer who's involved in our wildlife research and stationed in Marquette. And also we have a person in Lansing who does environmental reviews of these sorts of proposals specific to threatened and endangered species, and that would be Lori Sargent. And I contacted her and made her aware of the project and I believe DEQ in -- here in Lansing provided her with hard copies of the application.

Q So you undertook your review and you also consulted with other colleagues in the DNR; is that correct?

A Yes; definitely.

Q So once you'd gone through that process initially did you make any written -- reduced to writing any comments that you had based upon your initial review?

A Yes. In May of 2006 I did --

Q Go ahead. I'm sorry.

A -- I did put my comments in writing.

MR. REICHEL: Would you bring up Respondent's Exhibit 58, please?

Q Just for the record the first page of this document appears to be an e-mail dated May 9th, 2006 from you to Mr. William Moritz. Who is Mr. Moritz?

A Chief of the wildlife division at that time.

Q Okay. And what's the substance of this communication?

A Basically I was following the instructions. I had checked -

- got the okay to send these up the chain of command from my supervisor, and this was the cover e-mail to send it to our chief with copies to those people listed at the bottom. Jim Ekdahl was deputy director -- was a deputy in charge of the U.P. at the time. Jessica Mistak was another member of the mining team from fisheries division. Joe Maki, of course, was kind of the organizer of the team for DEQ. Lori Sargent, the threatened and endangered species coordinator who does environmental reviews. And Bob Doepker my supervisor, and William Brondyke who is a forester who was also on the mining team.

Q Okay. What is this document, sir? Could you explain what this part of the exhibit is?

A This is the general comments that we developed regarding the project. Shall I go bullet point by bullet point?

Q Yes, please. Well, first when you talk about general comments, just to be clear you testified that you were asked to focus on some specific aspects of the permit application involving wildlife and the Environmental Impact Assessment; correct?

A That's correct.

Q In addition to that did you also review some of the other more general materials in the permit application?

A Oh, yes. You know, primarily focused on the executive summary but got a feel for what was involved with the

project overall.

Q Okay. So yes, turning now to your general comments, could you just summarized or explain the first point here?

A Basically the first point is -- you know, as a wildlife biologist and a wildlife ecologist I'm no expert on air quality or water quality or general mining procedures, so this first bullet point speaks to that our support was contingent upon joint scientific review along with DEQ. And basically we went with whatever their views were on the environmental aspects of it. If they thought the project could move forward without significant environmental impacts that was good enough for us, but if they had a problem in some ways with the project moving forward then that would stop it dead in the tracks from our point of view.

Q Again, with respect to the issues that you and your colleagues were looking at, I take it wildlife issues -- you were looking at that independently in terms of the potential impact on --

A Oh, yes. Yes, in terms of wildlife specific we were looking at that.

Q And what's the substance of your next bullet here?

A Simply that we like the idea of having this mining team approach. It really helped to have experts in all the things we didn't know about available to answer any questions we might have. And --

Q Okay. And the -- go ahead.
A And we -- you know, in reviewing the Part 632 rules we felt that they were adequate for safeguarding the environment, particularly the water; because we felt any contaminants that might be -- that would be in the environment would end up in the water ultimately.
Q Okay. And the next bullet?
A This refers to especially the baseline data for the wildlife assessment. We felt it was adequate.
Q Okay. Your comment: "Baseline data collected for birds, mammals amphibians, threatened and endangered plants and animals and vegetative communities"; is that what you were talking about?
A That's correct.
Q Now, you touched on this before but I'd like to be clear on this. In offering this comment, were you taking into consideration what you understood to be the requirements of Part 632 and its rules with respect to Environmental Impact Assessments?
A Yes.
Q And specifically with regard to requirements as to the baseline data that was required?
A Yes.
Q And with regard to that, what was your understanding, at least generally, of the amount of how much baseline data was

required to be collected and over what period of time?
A The rule said that two years of relevant information on flora and fauna were necessary. One year of general literature review -- or literature review could count as one year and you needed one year of site-specific information.
Q Okay. And as you approached that, what was your understanding of one of site-specific information? Did you understand that to -- well, go ahead. Just give me your answer.
A Well, I understand that to be one year of when wildlife could reasonably be expected to be active, and that would be the snow-free time of the year definitely. And the ultimate time to do the surveys was when the consultants did them: the months of May, June and October.
Q Okay. Just to -- I'd like you to amplify that, because that's frankly been the subject of some contention here. Could you explain -- when you talk about those months: spring, summer, fall, why is it that you believe or understand that those are the appropriate times to make observations within a year?
A Well, a lot of wildlife species in the wintertime, particularly in that area of Michigan, migrate or become dormant, so there's just not a lot of activity going on in the wintertime. There are some animals active as our fur-bear routes would indicate, but, you know, if -- looking at

it in the wintertime you miss a lot of animals that would be there during the snow-free months.

Q And conversely the animals that -- some of the species that you talked about where you do independent of this surveys, would it be possible to observe those animals at other times of the year?

A Could you repeat that?

Q I'm sorry. You talked earlier about doing some surveys of fur-bearing animals in the wintertime; correct?

A Uh-huh; yes.

Q Is it possible to, as a part of a survey of an area, also to look for those animals in snow-free times of the year?

A Oh, yes. Yes, they would also be there during the snow-free times.

Q I want to come back later to some of the specific issues on species that have been mentioned in connection with this case, but I'd like to for now complete your discussion of this document. What is your next bullet point here?

A That's regarding the reclamation of the surface facilities to natural conditions post mining. All state owned lands should be restored with buildings and other amenities removed. We felt that was very important that the site upon completion would be restored to its natural state.

Q Again, recognizing your claim not to be an expert on mining, but based upon your review of the mining permit application,

did you develop some understanding of the projected lifetime -- operation lifetime of this mine?

A Yeah. It was -- yes, it was projected that once mining activities actually got underway they last about eight years or so; it will be shy of a decade.

Q Okay. And so when you talk about reclamation you're talking about activities after completion of the mining?

A Yes.

Q And when you talk about restoration to natural conditions, could you describe again, first, what you understood from -- what you understood would be required to happen at the end of the process?

A Complete removal of all of the infrastructure: all the rock storage areas, the water treatment plant, everything eventually. Obviously there's some monitoring that goes on long term and anything related to that would remain, but parking lots -- it all goes at the end.

Q And do you understand the applicant to have proposed that upon the completion as a part of this reclamation plan that areas that had been disturbed would be restored -- would be revegetated?

A Yes. The topsoil is stockpiled to be stockpiled and saved to put back in place and additional topsoil would be added if that was not sufficient. And the applicant would also be required to actually get jack pine from local stock and

replant the area.

Q And if you -- moving ahead in time, Mr. Koss. Have you had occasion to look at the mining permit that was ultimately issued in this case?

A Yes, I have.

Q And do you know whether or not the permit requires -- or has requirements regarding site reclamation and restoration consistent with your recommendations?

A Yes, it does contain that.

Q Could you briefly explain your next bulleted comment here?

A Yes. One of the -- probably the most common opinion I heard from wildlifers in the West U.P. -- or wildlife staff was concern about the offsite ore transportation route. This gets to be a tricky issue, because under the 632 rules the applicant must provide a route -- which they have, that route right there that's listed in that bullet point; however, they don't have to stick to that route. So I questioned as to whether we should even put it in there, but we decided ultimately to state our opinion about the transportation route even though it couldn't be regulated under the 632 permit. We would like to see the existing infrastructure used with the proposed route of the AAA Road, County Road 510 and the 550. We do realize and realized at the time we were submitting it up through the chain of command that this could not be mandated in the permit.

Q Could you turn now to -- under the heading, "Site-specific comment" could you briefly summarize what comments you offered and why?

A I noticed that there were the contact water basins as part of the wastewater -- or the mine treatment -- water treatment facility and I was concerned about the possibility that these basins could attract wildlife, primarily waterfowl and gulls. You see this a lot with -- or fairly often at least with municipal wastewater treatment facilities. I'm not sure what the chemical makeup of the water in the basins would be, but to be safe and to make sure wildlife gets no exposure to contaminants we wanted some plan in place for keeping wildlife from that pool of water.

Q Now, you mentioned a moment ago that you -- during the course of your career you've encountered other situations where other ponds or impoundment structured associated with some industrial or other activity sometimes attract wildlife; is that correct?

A That's correct.

Q And in situations of that kind where there is a desire to limit or discourage the exposure of wildlife to that water in the pond, are there techniques that in your experience can be and are used to make that kind of exposure less likely?

A Yes. there's a number of different techniques you can use from complete exclusion through fencing, various means, covering. harassment from sound is one technique. There's a number of scare devices that are visual devices that can be used, various things that flutter and potentially scare animals depending on what type of problem you're having. But the point was to have some sort of plan that you would use all these techniques including live trapping, non-lethal live trapping and removal; moving of animals to keep animals from this pooled water.

Q Okay. While we're on this document, you have what appears to be a footnote or a note at the bottom. Could you just read what that says and explain what you mean?

A Yes. I added this later in January of '07. "Please note that the site specific comment mentioned above was subsequently addressed to my satisfaction by Kennecott's October 2006 response to DEQ comments." There was actually a lag time -- well, several lags in review of this application. Not long after I submitted my initial comments in May of '06, I believe it was a court injunction that stopped the process. I don't even remember specifically what it was about. I think it was about whether the application was deemed complete or not, if my memory serves me correctly. But there was a delay, so I modified it when I sort of rather resubmitted my comments in January of '07.

Q Okay. And just following up on this, the chronology here. You indicated earlier that you had copied Mr. Maki of the DEQ on transmittal of this document; correct?
A That's correct.
Q If you know, did Mr. Maki subsequently take your site-specific comment we just talked about and include that in a communication to Kennecott?
A Yes, he did.
Q Okay. This document is already in the record; it's the June 21st, 2006 letter from Mr. Maki to John Cherry of Kennecott transmitting a list of comments. Number 1 says, "Provide a plan for non-lethal harassment or exclusion of wildlife to the contact and non-contact water basins." Do you see that?
A Yes, I do.
Q Okay. And again, you touched on this. Is it your understanding that Kennecott provided a response to that comment?
A Yes, they did.
MR. REICHEL: Could you please bring up Respondent's Number 69? Could you scroll down to, I believe, the third, fourth page?
Q Do you see this -- this is a response to those comments and they're -- on the first page in the main body of the document there's comment number 1 and a response to that?
A Yes.

Q And is this the response by Kennecott to your comment that you referred to earlier?
A Yes.
Q Outlining some measures that were proposed to be taken to prevent contact by wildlife with the surface water basins; is that --
A That's correct.
Q Okay. And from your standpoint did this plan address your concern adequately?
A Yes. Yes, it does.
Q Now, you testified earlier that it's your understanding that under Part 632 and its rules one of the kinds of issues that was required to be addressed in the Environmental Impact Assessment is the presence of threatened and endangered species and the possible impact of the proposed activity on such species; is that correct?
A That's correct.
Q And if you recall, based upon your review of the Environmental Impact Assessment, did it identify any threatened and endangered species as being present in the vicinity of the mine -- the proposed mine?
A Yes, it did. It specifically mentions narrow leaf gentian, which is a threatened plant that grows in wetlands and on the wetland fringe primarily and of the Salmon Trout River, and those plants are located, you know, very close to being

directly above the orebody.

Q Okay. Based upon your review of the Environmental Impact Assessment, did you under -- what did you understand about how the -- whether the mining plan and the proposed surface development did or did not propose to physically disturb the area where narrow leaf gentian had been observed?

A The plan called for no disturbance of these plants and in addition to that they called for annual monitoring of the plant; quite extensive looking at things like rainfall, insects, and that satisfied any concern I had for the most part of -- for that plant. However, again, just to add a margin of safety I requested that DEQ put into the 632 permit that the applicant leave a one-chain or a 66-foot buffer around any occurrences of narrow leaf gentian just to add a margin of safety.

MR. REICHEL: Could you please bring up Respondent's Exhibit 113?

Q What is this document, sir?

A That's an e-mail I sent to Joe Maki.

Q And what's the substance of it?

A Basically it proposed wording that I would -- that I wanted to see in the 632 permit about no major disturbance to vegetation within one chain, 66 feet of narrow leaf gentian occurrences.

Q And again, your purpose in this was -- you said a moment

ago, to what?

A Add a margin of safety. A number of things -- this is one of the positive things that came out of the public hearings I feel regarding this project. A number of citizens had expressed concern over the plant and it was actually something that Lori Sargent, who was copied of this, said that -- you know, she had mentioned to people that under the Threatened and Endangered Species Act she couldn't require a buffer and it was light bulb moment for me. I thought, "Well, under 632 we can." While there was no plans to disturb the plant, I envisioned all these scenarios of people potentially working very close to the plant and -- "Okay. You're not impacting it, but you're only one foot away from it. That's getting kind of close." So a buffer seemed to be a reasonable option.

Q Okay. And how did you arrive at the distance of this 66 feet?

A One chain would be typical of what we would use as a buffer zone around a threatened plant if it occurred on a timber sale on state lands.

Q So this is something you would do as a general precaution?

A Kind of a standard, yeah.

Q Okay. And to your knowledge, Mr. Koss, was the permit as issued, did it contain a condition consistent with your recommendation?

A Yes; that requirement was put in.
Q Again, with respect to threatened and endangered species, there's been discussion in this case about the Kirtland's warbler. First, by way of background, Mr. Koss, based upon your work as a wildlife biologist for the DNR over a number of years, do you have any understanding of the Kirtland's warbler's preferred habitat and areas where they are present in Michigan generally?
A Yes, I do.
Q And first, with respect to habitat; what do you understand to be the preferred habitat for that species?
A Kirtland warblers prefer young, densely stocked jack pine. We're talking about jack pine that's, depending on the site, usually five to 20 years old, maybe a couple years beyond that, depending on the site; very dense stocking of jack pine with a fair amount of well-scattered openings throughout it. When I'm talking "densely stocked"; in the core Kirtland warbler range where we're actively managing for those birds we plant jack pine at a stocking of 1600 stems per acres. Most other areas where jack pine is managed it's more like 900 stems per acre.
Q Can I interrupt you? When you talk about the "core Kirtland's warbler habitat," where do you understand that to be located?
A That would be in the Northern Lower Peninsula of Michigan is

the core range.

Q Okay. Go ahead. Did you have anything else that you wanted to add to your basic understanding of the Kirtland warbler's habitat and --

A Just that we've had Kirtland warblers in Marquette County since 1983 where they've been documented in modern times. Most of them are on other jack pine plains in the southern portion of the county, and that's where I'm most familiar with them. We've had most of our occurrences on the Sands plains and Voelker plains. And as a matter of fact, the only warbler we've had since '83 outside of those two areas was the one found in 2006 up in the Yellow Dog Plains.

Q Okay. And I want to get back to that in a moment, but based upon the -- your review of the initial Environmental Impact Assessment, if you recall, did that identify observations of Kirtland warblers in the area that it studied?

A No, the initial review did not encounter any Kirtland warblers.

Q Now, a moment ago you referred to a confirmed sighting of the Kirtland's warbler in about 2006; is that correct?

A That's correct.

Q First of all, do you have any understanding of where that occurred in relation to the proposed mine site?

A Yes, that sighting was in the northwest quarter of section 20, town 50 north, range 28 west and that would be roughly

two miles southeast of the proposed surface facility.
Q And based upon the available information, what did you understand -- strike that. Was the sighting that you referred to, was it of a nesting bird, or what was observed?
A It was a lone male.
Q If you know, as a part of the permit application review process, do you know whether consultants for Kennecott undertook any supplemental attempt to identify possible occurrence of Kirtland's warbler in the vicinity of the mine site?
A Yes, they did. They did a supplemental technical bulletin. I believe that was in May-June of 2006 to concentrate specifically on Kirtland's warblers.
Q And did you review that document?
A Yes, I did.
Q And first from the standpoint of have you based upon your training and experience as a wildlife biologist some familiarity with the techniques commonly used to conduct wildlife surveys, including bird surveys?
A Yes.
Q And based upon your review of the supplemental document provided by Kennecott's consultant, from your standpoint, were the methods that they used as part of their further investigation consistent or inconsistent with accepted practices?

A It was consistent with accepted practices.
Q And based upon your review, do you know whether or not that subsequent supplemental work identified observations of Kirtland's warblers?
A I am aware they did not identify any further Kirtland's warbler.
Q Now, you testified -- I guess you've touched on this, but just so the record is clear, there's other testimony in the record that the area in immediate proximity to the mine site does have some young Jack Pine; is that correct?
A Yes. There is an extensive of young Jack Pine in the Yellow Dog Plains.
Q Okay. And again, focusing on the Jack Pine stands that are closest to the mine site, based upon your familiarity with that, how does the density of the Jack Pine there compare to your understanding of what you previously said is considered the optimum habitat for Kirtland's?
A It would be light. It would be that standard 900 stems per acre roughly of stocking.
Q Okay. But to the extent that the Jack Pine in the vicinity of the mine site may conceivably or potentially provide habitat to Kirtland's warbler, to your knowledge, is that type of habitat unique to that area of Marquette County?
A No, it would not be unique.
Q Do you have any knowledge based upon your work with the DNR

with respect to how extensive areas of Jack Pine habitat there are of just in terms of state-owned lands in the Yellow Dog Plains area?

A Yes. We do keep records of that. Specifically, on our ownership and the management area we refer to as the Yellow Dog Plains, we own just over 3700 acres of state land. Of that 3768 acres, 2,612 would be typed as Jack Pine. That amounts to 69 percent of the land base would be Jack Pine.

Q To the extent you have knowledge of other non-state-owned lands and habitat in the Yellow Dog Plains area, do you have any understanding as to whether Jack Pine stands comparable to those that are near the mine site exist elsewhere in the vicinity on privately owned land?

A Yes. Plum Creek Timber Company owns a lot of land in that area, and Jack Pine would dominate their ownership as well.

Q Now, moving out beyond the specific area of the Yellow Dog Plains, to your knowledge, sir, are there other areas in Marquette County that would provide comparable or potentially better habitat for Kirtland's warbler?

A Oh, yes. The area where there's a history of warblers right now, the Sands Plains, has been really where most of the birds have been. That's a sandy outwash plain that's over 16,000 acres. And we have some state lands in there, but it's quite limited. A lot of the lands are Jack Pine owned by Marquette County. And that provides -- has traditionally

provided a lot of habitat for the warblers. It's kind of grown up out of their reach. What really spurred warblers in that area was a wildfire that occurred in 1986 called the Rice Lake fire. And secondarily to that our other second place finisher which is rapidly coming on first place here in terms of warblers as three have been found on -- this spring on the Voelker Plains, which is a little bit northwest of the town of Gwinn.

Q So to summarize, Mr. Koss, again, based on your training and experience and your observations of the area, do you believe that the Jack Pine that exists in the immediate vicinity of the proposed mine site provides any unique or rare potential habitat for Kirtland's warbler?

A No, it does not.

Q I want to turn now to discussion of some other identified endangered species. The environmental impact assessment -- did the environmental impact assessment contain any reference to the bald eagle, if you recall?

A Yes, it did. I believe they saw one soaring overhead.

Q And do you as a part of your work with the DNR have any understanding of where in Marquette County there have been documented bald eagle nesting sites?

A Yes. We keep track of that. We have for many years. Many years ago we used to do the surveys which you do by airplane ourselves, and now we have contractors do it for us.

Q And so, to your knowledge, is there any documented bald eagle nesting site in the immediate vicinity of the proposed mine site?

A There are no eagle nests that we're aware of in the proposed -- at the proposed surface facility or the mining site.

Q There's been some testimony about a bald eagle nesting site near the mouth of the Salmon Trout River in this case. Are you aware that such a nesting site has been observed there?

A Not right at the mouth of the Salmon Trout. Most of the nests in northern Marquette County are along the Lake Superior shoreline. We have them at various spots; Huron Island's National Wildlife Refuge, the mouth of the Huron River. We have one at Iron River at Lake Independence. I'm not aware of one at the mouth of the Salmon Trout, per se.

Q Okay. To your knowledge, what's the approximate -- how close -- what's the closest documented bald eagle nesting site to the proposed mine site, approximately?

A Roughly about -- there is one at Conway -- or wait a minute. There is one at Conway Lake; probably roughly eight to ten miles.

Q To your knowledge, Mr. Koss, does the area in the immediate vicinity of the proposed mine site, has it been documented to be any sort of a critical habitat for the bald eagle?

A No. Typically eagles like large bodies of water. They

typically nest, you know, large inland lakes, shores of the Great Lakes, large rivers.

Q And so the record is clear, you testified previously you've been to the Salmon Trout River and the immediate vicinity of the mine site?

A That's correct.

Q And would it classify -- would you fit that in as a large river in the sense that you just used?

A No, not at all. When I say large river, we're talking things like we have eagles nesting along the Escanaba River, which is quite, quite large.

Q Now, one of the other species that's been mentioned in connection with this site is the gray wolf. Again, based upon -- well, first of all, did the environmental impact assessment identify the proposed mining site or the area immediately surrounding it as critical habitat for the wolf?

A No. They noted wolf tracks in the general vicinity but, you know, they didn't mention any den sites or rendezvous sites or anything like that.

Q Okay. Independent of the environmental impact assessment, based upon your own observations and duties in the DNR, do you have any knowledge as to whether or not wolves walk through or transit through the area around the mine site?

A They definitely do. We have three packs of wolves in northern Marquette County. We have the Echo Lake pack,

which is two animals, we have the Huron Mountain pack, which is three animals, and we have the Northwestern pack, which is six animals. And we have a radio collar on one of the Echo Lake animals. And we know for certain that that animal goes through the Yellow Dog Plains. But really probably at some time or other, animals from each three of those packs are definitely using the plains during the summer months -- or the snow-free months, I should say.

Q Okay. And when you talk about the locations of these known packs -- and let me back up. To your knowledge, sir, has the DNR have over a number of years actively monitored or monitored the wolf incidents and locations in the Upper Peninsula?

A Oh, yes. Ever since the beginnings of their recovery in the early 90's, we do a winter census, a very specialized searching for presence of wolves.

Q And the three packs that you mentioned in northern Marquette County, you mentioned names. Were those associated with their, for lack of a better term, home turf or den areas? How do you identify them?

A That's an excellent way of putting it. Yes. The Echo Lake pack is centered around Echo Lake, which is up County Road 550 a few miles north of Marquette in a deer yard. The Huron Mountain pack is in the Huron Mountains. They move around. The Huron Mountains is also a deer yard, a place

where deer go to spend the winter months for protection from the elements.

Q Excuse me. But --

A And they move around depending on where the deer are in that yarding complex, most recently at the south end this year where around Ives Lake where there was some timber harvest. And then the Northwestern pack refers to the Northwestern Road. And they're really focused right on where the western portion of the Northwestern Road comes into the Huron Bay grade. And they're really centered around that point.

Q And how close are any of those identified pack locations to the proposed mine site, approximately?

A In the wintertime where they're concentrated would be about, again, eight to ten miles roughly from the proposed mine site.

Q Now, you've testified that both the EIA and your own observations indicate that wolves do transit through the Yellow Dog Plains in the vicinity of the mine site; correct?

A That's correct.

Q Based upon your understanding of the -- well, strike that. Based upon your review of the mining application, do you have an understanding of at least the approximate area that would be occupied by the surface facilities and disturbed directly by human activities?

A That's correct.

Q And what is the approximate size?
A The intensive infrastructure comprises of about 92 acres. The total fenced off area would be about 145 acres.
Q Assuming that the mine as proposed is constructed and operated consistent with the plans that are on the table, what is your -- what expectation would you have about whether or not that activity would impair or disrupt the wolf populations that have been known to pass through the area now?
A I don't believe it would disrupt or impact their activities. They would just go around the facility.
Q There's also been some -- it's been alleged by some of the Petitioners that the proposed Eagle Mine project would fragment existing wildlife habitat and in the vicinity of the mine site and thereby adversely effect or impair wildlife. Are you aware of that general contention?
A Yes, I'm aware that that's their concern.
Q Based upon your review of the mining permit application and your understanding of the scope of the activities that are proposed and where they're located, as well as your own knowledge of wildlife in the area, do you agree or disagree with the proposition that the proposed mine activity would fragment existing wildlife habitats so as to adversely or potentially adversely effect wildlife that are in the area now?

A I disagree with that idea. Obviously there will be impacts for the duration of the mine on that very specific impact area, 92 acres, 145 acres, how ever you want to characterize it. But it's a small area and it won't have a lasting or significant impact on wildlife in the area long-term.

MR. REICHEL: Your Honor, at this time I want to move for admission of Respondent's Proposed Exhibit 58, which was the first document I asked the witness about, his May 9th, 2006, communication of comments on the proposed permit application.

MR. WALLACE: No objection.

MR. PREDKO: No objection, Your Honor.

JUDGE PATTERSON: I'm sorry. The number of that was what?

MR. REICHEL: I'm sorry, Your Honor. It's --

JUDGE PATTERSON: I know you said it. I just --

MR. REICHEL: -- 58.

JUDGE PATTERSON: Okay. There being no objection, R-58 would be entered.

(Respondent's Exhibit 58 received)

MR. REICHEL: I would also like to move for admission of Respondent's Proposed Exhibit 113, which was the December 2007 communication regarding the narrow leaf gentian buffer zone.

MR. WALLACE: Also no objection.

MR. PREDKO: No objection.

JUDGE PATTERSON: Thank you. No objection, that too will be entered.

(Respondent's Exhibit 113 received)

MR. REICHEL: May I have just a moment to check my notes?

JUDGE PATTERSON: Sure.

MR. REICHEL: I think I'm done.

(Counsel reviews notes)

MR. REICHEL: Yes, I am, Your Honor. With that, I'll pass the witness.

JUDGE PATTERSON: Okay. We'll take a break.

(Off the record)

JUDGE PATTERSON: Mr. Predko, do you have any questions at this point?

MR. PREDKO: I just have a few, Your Honor.

JUDGE PATTERSON: Okay.

MR. PREDKO: Mr. Koss, my name is Chris Predko, and I represent Kennecott.

CROSS-EXAMINATION

BY MR. PREDKO:

Q And you said that you had experience with the state's timber sales in the Yellow Dog Plains?

A Yes.

MR. PREDKO: Well, and maybe the easiest way for

us to do this, if I could approach, Your Honor?

JUDGE PATTERSON: Sure.

Q I'm going to hand you a little stack of documents here. And if you could first take a look at 387?

MR. REICHEL: Counsel, for the record, what document is this?

MR. PREDKO: Intervenor Proposed 387.

Q Do you recognize that form of document? And we're going to try and put it up on the screen as soon as things warm up here.

A Yes, I do. As I go through the package here, it looks like our standard state forest timber sale contract plus a DNR state timber sale proposal, one which I signed in July of 2000.

Q And so those are the types of forms that are required to be filled out and kept by the DNR?

A Yes.

Q Okay. And we have up on the screen here I think that first page of Exhibit 387?

A Yes.

Q Are you able to tell the location of this particular harvest? It does say Yellow Dog Plains on it.

A Yes. It has the compartment number 207, and the stand numbers 016, 023, 027 and 028.

Q And for the rest of the exhibits that I've handed you, Mr.

Koss, if you wouldn't mind just flipping through those and verifying for me that those timber sale-related documents from the state are also of the Yellow Dog Plains and in and around the vicinity of the proposed mine?

(Witness reviews documents)

MR. PREDKO: And for the record, the packet that I handed Mr. Koss is Intervenor Exhibits 387 through 396.

A Yes, they are all of timber sale and related forest treatment documents all in the area of the proposed mine site.

Q And, Mr. Koss do those documents show the historic logging that has taken place in and around the area of the proposed mine?

A Yes, they do reflect what's gone on there in terms of management practices.

MR. PREDKO: Your Honor, I would just move for admission those public records, Intervenor 386 through 396.

MR. WALLACE: Probably the most -- I don't have a copy of this. Probably the most efficient thing is at the next break if I go through it and then while Mr. Koss is still here if I have any voir dire-type questions, I'll ask him then.

JUDGE PATTERSON: Okay.

MR. WALLACE: I mean, I could sit here and do it right now, but it seems like I should wait until a break, if

you don't mind.

MR. PREDKO: Yeah. Just to be clear, you do have a copy; you just don't have one with you?

MR. WALLACE: I just don't have one with me.

MR. PREDKO: Okay.

JUDGE PATTERSON: It's been disclosed?

MR. PREDKO: Yes.

MR. WALLACE: Yeah, it's got a number. It's been disclosed.

JUDGE PATTERSON: But you just haven't reviewed it today?

MR. WALLACE: I didn't necessarily anticipate that was the document I should have.

JUDGE PATTERSON: Unless you need it in now, that makes sense.

MR. PREDKO: No; no, don't need it in now. We can wait.

JUDGE PATTERSON: Okay.

MR. PREDKO: Thank you, Mr. Koss.

MR. WALLACE: Are you through with the witness?

MR. PREDKO: I am.

MR. WALLACE: Okay. Mr. Koss, my name is Bruce Wallace. I represent the Huron Mountain Club. I have a few questions.

CROSS-EXAMINATION

BY MR. WALLACE:

Q Could you give us an idea -- I'm going back to some of the things you've described from your, you know, past and experience -- what's involved in a forest management plan?

A Basically the way we write our plans, our template, what we go over first the forest history section and then we go over an assessment of what's currently there, and then we have a section on desired future condition for the state forest land, and then ultimately we get into subsections of recreation, special conservation areas, unique areas, that sort of thing.

Q Do forest management plans look into the wildlife of the area that's being planned?

A Definitely.

Q Okay. And what sort of -- what sort of investigation of the wildlife regime do you conduct in preparation of a forest management plan?

A We don't do a special study. It's kind of our cumulative knowledge of past practice and our inventories that we already have done.

Q So by the time you get ready for a given forest management plan, you are quite familiar with the area and --

A Right.

Q -- you know what lives there and what habitats are contained

there?
A That's correct.
Q Okay. And does the plan reflect that, typically?
A Oh, yes.
Q Would a forest management plan, for example, describe what specific wildlife you understand to live in the forest that's going to be managed?
A It wouldn't go -- other than something really unique, we would probably have an appendix listing all the various species. We wouldn't go compartment by compartment, per se, listing, you know, deer, bear, coyotes, et cetera. It would be more of a general broad-based approach.
Q Okay. And I likewise wonder about the private land management process that you conducted. Do you do studies of private lands from the standpoint of timber cutting or other human activity?
A In a sense we do. We've had numerous private land initiatives. Most recently our current private land initiative is called the Landowner Incentive Program. And we have an employee, Kevin Swanson, who deals specifically with that. And he does write management plans, usually for small landowners, although he also works with large landowners such as forest land groups on certain issues. For example, we have a disease that effects beech in the east U.P., and he works with that group in dealing with that

situation and mitigating that lost wildlife through planting other things such as oak and whatnot.

Q Okay. Do private landowners make application to participate in this program, or do you seek that out, or how does that work?

A Yes. They -- a little of both. They seek out Kevin and request that he come to their property and write plans. And, you know, he advertises and drums up business that way as well.

Q Okay. Is Kennecott involved in a private land management program with you?

A Not to my knowledge, no.

Q How about the logging companies that are reflected in those exhibits that you've just looked at, 386 to 396? Are they involved in the private land management programs?

A No. These would be contractors that harvest the timber that the contracts would go to.

Q And they're not the landowners; they're the harvesters?

A Right.

Q Is any of the land in the area of the proposed mining operation involved in the private land management program?

A I'm not aware of any. There's not a lot of small private landowners there compared to other areas of the west U.P., you know. He could have -- I know he has -- there's nothing in the immediate vicinity that I'm aware of.

Q What would you describe as your area of expertise? What label do you use for yourself?
A I'm a general practitioner. I guess my area of expertise would be applying ecological principles to the landscape.
Q Would you call yourself a wildlife biologist?
A Yes.
Q Do you consider yourself an expert in endangered species?
A No.
Q Okay. Do you consider yourself an expert in mining impacts on wildlife?
A Good question. I have knowledge of mining impacts on wildlife. Yes, I guess I would consider my expert, as I'm the one who's historically signed most of the metallic mineral leases and the one who has to respond to applications. So, yes.
Q And what -- other than what you've just told us is the basis for that expertise, what would you count among your experiences as rendering you an expert in mining impacts on wildlife?
A I would say the involvement with the iron mines in Marquette County, which are the only currently active mines we have, a long history of involvement on the Empire and Tilden Mines. I was also involved as a consultant on restoration of the Republic Iron Mine.
Q Okay. And why don't you give us -- first of all, I'm not

particularly familiar with those mines. Are those mining operations on a scale equal to, larger, smaller than this proposed mine?

A They're actually much larger, very large open pit mines. They're basically in an area just south of Ishpeming, very visible from the air. As a matter of fact, the highest point in Michigan would be the tailings from the Empire Mine if they didn't on purpose keep it pushed down, because they don't want that dubious distinction. But they take up a very large amount of land.

Q And do you have familiarity with underground mining?

A Only in a very general way. We had an active gold mine during my tenure as biologist at Gwinn, the Ropes gold mine north of Ishpeming. But we had no active involvement with that mine at all. It was all contained on private lands and had nothing to do with that mine.

Q Okay. Have you studied underground mining operations from the standpoint specifically of their impact on wildlife? I mean, academically or through courses or anything like that.

A No.

Q And how about sulfide mining operations? Have you studied sulfide mining for its impact on wildlife?

A No, I have not.

Q To your knowledge, has the proposed Eagle Mine been studied from the standpoint of measuring or predicting what noise

levels will be emitted from the mining operations through blasting, vehicular use and so forth in terms of decibel measurement, anything like that?

A Not to my knowledge.

Q How about emission of light, daytime, nighttime, in terms of how many lumens or what impact it might have predictably on wildlife?

A As far as I know, that wasn't looked at.

Q Okay. Are you familiar with any quantitative assessment of the various impacts of human activity predicted at this proposed mine on wildlife? Has anything been measured or assessed quantitatively that you know of?

A No.

Q You mentioned that I believe your early experience with environmental impact assessments included right-of-ways?

A That's correct.

Q And what are the impacts that right-of-ways -- creations of right-of-ways have on wildlife that you've had experience assessing?

A It certainly changes the landscape, opens areas up that were timbered to open lands, has an impact in terms of certainly changing habitat.

Q Okay. And this would include, for example, electrical easements, those kinds of right-of-ways?

A Yes.

Q And right-of-ways for passage of vehicles?
A Yes.
Q And it's recognized that the creation of these right-of-ways through forest, for example, can have an adverse effect on wildlife at the exact location and for some distance away from the right-of-way? Is that part of what's assessed?
A I wouldn't say routinely there's an adverse effect. There is an effect. It changes things. There's the potential for an effect if there was an endangered species that might be impacted, of course. But that's kind of why we review those projects for.
Q Would you expect that the introduction of -- I'll start with the ore trucks -- 40 ore trucks a day going back and forth on the roads near the proposed mining operation would have some effect on wildlife along the routes that they follow?
A There is the possibility of vehicle collisions. Usually we see most of that on primary roads where vehicles are traveling at a higher rate of speed. But probably there would be road kill for small animals certainly along the route, I would think.
Q Okay. Are you familiar with the spruce grouse?
A Yes, I am.
Q Do you know about its characteristic friendliness towards humans and human activity?
A Yes, I do.

Q I mean, it's one of the things that might happen here if there's a lot of vehicular traffic that doesn't currently exist is that the occasional spruce grouse might get run over?

A It's conceivable. But you don't, you know -- spruce grouse are a species of special concern. There's not a lot of them. I can't honestly say as I've heard of a spruce grouse being hit by a vehicle, although it could very well happen. More it's through deliberate illegal poaching or accidental misidentifying them as ruffed grouse and them getting shot. You don't see too many spruce grouse on the roads.

Q Okay. They are present in the Yellow Dog Plains area; correct?

A They are definitely present in the Yellow Dog Plains area.

Q And the fact that they're of special concern translates into what from the standpoint of your role working for the state as a wildlife biologist?

A There's not a lot we specifically change because they're on a special concern list. That means that their population is being monitored. They're not doing great, could do worse. There's nothing that we change in our operations specifically because of spruce grouse. To give them special consideration, a lot of changes in the landscape aren't necessarily positive or negative. They're just different. And when trees get cut, species that benefit from young

regenerating growth benefit were those that like the mature stuff like spruce grouse, they thrive in over mature Jack Pine is where they do best, don't do as well.

Q Are you familiar with other species of special concern in the area of the Yellow Dog Plains?

A Perhaps. I can't call the entire list of special concerned species off the top of my head, but there probably are some others.

Q Okay. Do you know that the wood turtle is a species of special concern?

A That sounds right.

Q Okay. And they're present in Marquette County; correct?

A I believe they are.

Q Would you expect that specific effort might be made to look for wood turtles in preparing an environmental impact assessment given that they're a species of special concern in the area?

A I would say a turtle survey would be unusual. Most surveys don't survey for everything that might conceivably be there. They're much more generalist in nature.

Q You looked at the environmental impact assessment here and saw that no surveying was done for turtles; correct?

A That's correct.

Q Do you know that the eastern box turtle lives in the general area of the Yellow Dog Plains?

A I don't know that to be true or not.
Q Okay. Are you aware that it is a species of special concern itself?
A Again, I don't have the list in front of me, but I'll take your word for it.
Q Okay. I guess I'm curious about this, and I don't know if you know the answer. But is there some qualitative difference between the value of, let's say, reptiles and amphibians from your standpoint as a wildlife biologist that would explain why certain of them don't get inventoried or haven't been inventoried in this environmental impact assessment while fur-bearing mammals maybe are inventoried?
A I don't really know of reason as to why they aren't specifically surveyed. I guess I don't have an answer to it, anymore than any conceivable species of insect.
Q Have you been involved in the FERC re-licensing of the Sturgeon River?
A Not of the Sturgeon River. I've been involved in the Autrain basin and the Cataract basin.
Q Okay. And you've seen the environmental impact statements that were prepared in connection with the re-licensing operation?
A Yes.
Q How would you compare those environmental impact statements with the environmental impact assessment that was done here

for this operation?

A They weren't nearly as comprehensive overall would be my assessment.

Q And did somebody else in your department have responsibility for the Sturgeon?

A Yeah. That would be Rob Aho, I believe, the biologist at Baraga.

Q Okay. Do you have any familiarity with the scope of the environmental impact statement and follow-up studies done for the Sturgeon River?

A I believe he made comments on it, and that's about as far as I know that he was involved in that process.

Q Would it surprise you, if you can answer this, to learn that the study of the Sturgeon River and that dam generated thousands of pages of wildlife and related studies before re-licensing was approved?

A That would surprise me, because it wasn't nearly as extensive on the other projects that I mentioned.

Q You talked about this 10 percent per year study cycle; is that right?

A Inventory cycle.

Q Inventory cycle. When, then, was the last inventory done of the Yellow Dog Plains in this particular cycle?

A The official last one would have been the year 2000, year of entry, which means the field work would have been done just

before that, probably 1998, 1999. That compartment is currently coming up again for review as part of the 2010 entry year. And the field work was just done the past few months and is still being done.

Q Okay. So the last -- and what's inventoried in this cycle?

A Basically land cover types.

Q It's not a wildlife study?

A Not per se. Obviously, we as biologists make observations on wildlife habitat. But typically unless there's something really unique, it's not written down. It would be quite redundant if we listed animals over and over again, common animals.

Q You know, back for a moment to what has shown up in the EIA here and what hasn't, is there any pattern, do you think, to what species are surveyed based on what species make detectable noises and which ones are silent or quiet? In other words, I'll just give you my own view of this. You can go out and listen for frogs, but you can't listen for salamanders, so no salamanders have been studied; correct?

A I believe they did do some searching for vernal pools of which you wouldn't really expect vernal pools in that country. But, yeah, salamanders are quiet and, you know, not finding vernal pools, I know that salamanders didn't go any further than that.

Q Okay. Do you have any doubt that there's salamanders living

in the area of the Salmon Trout River?
A I suspect there's salamanders.
Q Likewise, turtles?
A I expect that there are.
Q Okay. And no turtles have been inventoried in connection with this proposed mine, have they?
A No, they have not.
Q And beyond the box turtle and the wood turtle, we would expect Blanding's turtles in this area, would we not?
A It's possible, but we don't have data specific to turtles, so I couldn't really say.
Q How about the five-lined Skink? Do you know what that lizard is?
A I'm familiar with it but, you know, certainly not expert on its habits.
Q Okay. Are you familiar with its habitat description as being fragmented habitat living on the edges of woods and fields and cut-over areas? Is that familiar to you?
A I'm not real familiar with it, but it wouldn't surprise me if that were its preferred habitat.
Q Okay. In any event, were any lizards inventoried in this EIA?
A Not to my knowledge.
Q You saw that a very limited number of frogs were inventoried -- correct? -- number of frog species?

A Yes.
Q Okay. And which ones do you recall were found?
A Spring Peeper for sure. I'm not sure on the others.
Q Okay. Wouldn't you expect in this area to find, for example, leopard frogs?
A I'm not sure that you would. We do -- we have done singing frog surveys a lot. I've been involved in quite a few of those. And I'm not sure you would get leopard frogs there. I'm not --
Q I mean, you know they live in the Upper Peninsula and specifically in Marquette County; correct?
A Yes.
Q Okay. How about Pickerel frogs? Would you expect them?
A Not necessarily. Mostly what we get are Spring Peepers and wood frogs on our routes, predominantly. I'm not saying that you can't get others on occasion, but it's rare.
Q How about gray tree frogs? They're not rare up there, are they?
A They are on our survey routs.
Q Are they? Bullfrogs?
A Again, rare.
Q Mink frogs?
A Never had one on any of my routes.
Q But you know these all to be indigenous to Marquette County, do you not, sir?

A Well, they may be, but we certainly haven't picked them up on our routes, with the exception of bullfrogs. I have had bullfrogs a couple of times on my routes.

Q They're pretty unmistakable when they're making noise; right?

A Pretty unmistakable, yeah.

Q Now, you have been going out to the Yellow Dog Plains approximately four times a year for a number of years; is that correct?

A That's correct.

Q Okay. And you go out in the wintertime to survey, to inventory, fur-bearing animals; correct?

A Yes. Basically, our -- I didn't do those routes myself, but they transport our technician to run those routes.

Q And the reason you go out in the wintertime is because that's the best time to track fur-bearing animals; correct?

A Yes. In terms of seeing tracks, that certainly is.

Q If you're looking for a martin or -- well, let's see. You didn't mention -- let me withdraw that. You did not mention looking for either beaver or porcupine among the fur-bearing animals. Is there any particular reason for that, or just you stopped your list at some point?

A I just -- porcupines I don't think we take data on. Beaver I don't think they're listed because they're pretty confined to the lodge that time of year. I'm not sure of whether

it's on the list of species we look for or not. There's written codes, numbered codes. But we wouldn't really expect beaver to be really active during that time of year.

Q Okay. But certainly martin, fisher and bobcat?

A Martin, fisher, bobcat, coyote, red fox.

Q And as far as you know -- and you've seen all of those in the area that we're talking about -- correct? -- tracks at one time or another?

A Tracks. It depends -- are we talking about the area specific to the mine itself?

Q Well, the general area of the proposed mining operation.

A The general area would contain the bulk of those species, yes, very general area.

Q Martin, fisher, bobcat, moose?

A Moose not in the wintertime. And it depends on where you are. In the Jack Pine -- anywhere there's Jack Pine it's predominantly coyote is what we pick up for the fur-bearer.

Q And I asked a bad question, so I didn't really get an answer. On martin and fisher, they've been seen in that area. Tracks have been seen over the years by you probably?

A They've been seen in that area. But by meaning "that area," would be not specific to the mine site. It would have been other areas near the McCormick tract, for instance, or up the Northwestern Road away from Jack Pine plains.

Q In any event, this EIA that was submitted by Kennecott

didn't inventory martin or fisher or bobcat at all, did it?
A Not specifically. But I'm sure they would have been listed had they been encountered. But again, right specific to the mine site, I wouldn't expect those species, per se. Perhaps bobcat, but martin and fisher, not quite in that cover type I wouldn't expect them.
Q Okay. Isn't it also true that you wouldn't expect them to have shown up in this EIA because nobody went out in the wintertime and looked for anything? I mean, it makes it pretty hard to find Pine Martin tracks if all you do is go out from May to September; correct?
A It would make it a little bit more difficult. But, you know, you do -- you can detect what's there. I mean, there are tracks in sandy roads, you know. You do pick up coyotes and whatever else is out moving around.
Q It's not the best way to find out if a bobcat lives someplace is to go out in the summertime, is it?
A No, it's not the best technique probably.
Q And this EIA found no bobcat, found no martin, found no fishers; correct?
A That's correct.
Q Do you know what were the scientific criteria used in this mining application to define the affected area?
A I know they set up the study area. I'm not quite sure what -- I know it because it was immediately adjacent to the

mine. But other than that, I don't recall what specifically was written about that.

Q Okay. In fact, do you think you have read anyplace a description of how the affected area was determined scientifically?

A Not that I recall.

Q Do you know who Peter Kailing is?

A I believe I saw a transcript of some of his testimony.

Q Did you --

A He's a biologist, I believe.

Q I mean, he's sort of in your same field, is he not?

A I believe he is a wildlife biologist.

Q Okay. And did you read his testimony that he started out with direction as to what area to study as opposed to determining what the affected area was? At least that was his role.

A I don't recall that specific portion of his testimony.

Q In your visits to the Yellow Dog Plains at various times a year, how would you describe it in terms of, you know, how crowded it is with people?

A It's not -- I wouldn't call it crowded. That's for sure. It is not totally isolated. There is a hot dog stand along the snowmobile trail if you're ever looking for a good dog when you're out there. The Big Bay Snowmobile Club does -- has maintained a hot dog stand out there. But it's

certainly not wilderness, but it's not crowded.
Q You were a member of the mining team; correct?
A That's correct.
Q How did the mining team function?
A It wasn't a highly structured organization. It was basically folks involved in this review getting together, putting their heads together, sharing information.
Q And how was the activity of the mining team recorded?
A It wasn't recorded.
Q Okay. Was there a decision not to record it?
A Not that I recall.
Q And did you or anybody else raise a concern, you know, "If we're not keeping notes or minutes of the meetings, how are we going to remember what all we discussed and decided last time?"
A I don't recall anybody bringing it up.
Q Okay. Was it ever brought up that it would just be better not to make a record because then, you know, it could be obtained through FOIA or something like that?
A No. I don't recall that.
Q Did anybody take any notes of the meetings of the mining team?
A Not that I 'm aware of.
Q You didn't ever write down anything?
A It -- no.

Q And about how often did the mining team meet?
A Oh, it wasn't regularly scheduled. It was on an as need basis as deadlines would approach. I'm not really sure how many face-to-face meetings we had. I don't even know. Maybe a half dozen, something like that.
Q And over what period of time did the half dozen meetings occur?
A Oh, I would say from spring of '06 to just before the permit was issued probably, the 632 permit.
Q Do you know a gentleman named Wilson Blake?
A Doesn't ring a bell.
Q He was not on the mining team, as far as you know?
A As far as I know.
Q How about a David Sainsbury?
A Doesn't ring a bell.
Q Was there a time when it was brought to your attention that the mining application process was going to be stopped because some documents were missing?
A Yes, I do recall that.
Q Okay. And how did you learn about that?
A I believe we got that from Joe Maki. I can't remember whether it was by phone or e-mail or what. But I believe Joe told us about that.
Q Okay. And what do you recall that he told you?
A Just basically what you just said; that the process is

stopped. There's some concerns over some misplaced documents, and that's about all I recall about it.

Q Did you learn who was involved in the misplacement of the documents or how this had come about?

A Not really, not directly involved in that. I don't recall being involved in that aspect of it at all.

Q Have you ever met with, been in a meeting with Director Chester about this mining application?

A No.

Q Have you been in a meeting where he participated by phone?

A We had a meeting that there was some phone participation. I don't remember it as being Director Chester. I remember it as being Skip Pruss, I think. I think the director was supposed to be there, but had a conflict and couldn't make it, is my recollection of it. But I might be wrong. I'm not super familiar with DEQ personnel.

Q It sounded to me as if you were saying in your direct examination testimony that you were told that this mining operation was going to be done in a way that would not have significant environmental impact and that -- and that that was from your standpoint was good enough for you, approximately?

A In terms of environmental aspects, water quality, air quality, totally relied on the professionals in DEQ for that.

Q Okay. This was not any assessment you did yourself?
A No, definitely not.
Q Okay. Do you know one of the concerns about sulfide mining, maybe the leading concern, is acid mine drainage or acid rock drainage it's called sometimes?
A I understand that that's a pressing concern.
Q And that that's a pressing concern because other sulfide mining operations have leached sulfuric acid bearing heavy metals into the environment; correct?
A You know, I don't know that to be a fact, but I know that is the concern and that is the claim.
Q Do you know what mud puppies are?
A Sure; primitive kind of salamander that lives in the mud, bottoms of lakes.
Q Ugly looking, aren't they?
A Ugly looking; caught a few ice fishing.
Q And are you familiar with the fact that the populations of mud puppies have been declining in Michigan over the recent years?
A I'm not aware of that.
Q Are you aware of their particular sensitivity to the acidification of water lower pH?
A I'm not aware of that.
Q Were mud puppies inventoried in this environmental impact assessment, as far as you know?

A No, I don't believe they were.
Q You know that they live in Marquette County?
A It certainly wouldn't surprise me, but I have no data on mud puppies in Marquette County.
MR. WALLACE: Could we look at your first exhibit, which I think was 58?
MR. REICHEL: That's correct.
Q This is the comments document that you submitted; correct?
A That's correct.
Q Respondent's 58 and it's the second page. Tell us a little bit more, if you could, about what communications went on within the Wildlife Division reflecting their concern about the offsite ore transportation route.
A Most of our concern dealt with issues that were totally unrelated to the mine itself and the 632 permit. It was about general development in Northern Marquette County.
Q And what was that concern? That increased development would increase road usage which would have an impact on wildlife?
A Well, new roads might increase more development, more houses being built, that sort of thing, not at all specific to the mine site, mining operation per se.
Q Well, I mean, this comment is specific to the mine; right? It's your comments on the mining application.
A It's a comment on the transportation route that we knew wasn't covered under 632 rules, but we wanted to voice it

anyways.

Q Who told you that it wasn't covered?

A I'm not sure anyone told me per se. I guess it was my belief that it wasn't covered, and as a group on the mining team, I believe that was the consensus.

Q I mean, you recognized, as members of the Wildlife Division, that ore transportation could have an impact on wildlife -- correct? -- on the roads?

A It wasn't the ore transportation portion of it that was the concern. It was the new roads that was concerned, particularly if they were permanent.

Q Well, I guess I'm trying to get at what you meant when you said, "The Wildlife Division is concerned about the offsite ore transportation route." Were you concerned about the ore transportation?

A We were concerned about the route and whatever sort of traffic would be on that potential new road. In this case, the cause of the new road would have been ore transportation, but if it was some other issue, forest products related, whatever, we would have the same concern.

Q Is it of concern to you as part of the Wildlife Division of the DEQ that transportation of -- it could be wood, it could be ore, apparently, in your mind, will have an affect on wildlife along the route or it can? It has that potential?

A We don't have a concern about the transport of ore. We're

not concerned about the occasional road-killed animal or, you know, the fact that ore is moving down the road.

Q Who other than the DEQ, you know, is regulating any concern about wildlife effects along ore transportation routes as far as you know? Is there some other regulatory body that's looking out for the wildlife concerns when ore trucks are going back and forth on forest roads?

A None that I'm aware of.

Q It would be the DEQ, if anybody; correct?

A Well, I'm not sure -- DEQ isn't really regulating the route other than the rules say they have to have one. DEQ doesn't get to say, "No, you can't transport ore this way. They just have to provide a route, which they have.

Q And then what you look at is, is this going to have an effect on wildlife?

A We have some concerns over broad development in Northern Marquette County, and that's where our concern for the new roads come from. It's not specific to the mine or ore transportation.

Q But in any event, if anybody is to be concerned about the impact on wildlife along an ore transportation route, it would be the DEQ, not some other regulatory body that we could look to?

A I don't think anyone is regulating the ore transportation route and its effect on wildlife. I don't believe that's

covered under the 632 rules, from my understanding of the rules.

Q The Kirtland's warbler that was identified in 2006 was doing what when it was identified, if you know?

A It was singing.

Q It was a male; correct?

A That is correct.

Q Why do you think it was singing?

A Mating season.

Q It was singing because it expected a female to be there; correct?

A Yes.

Q It had looked at the habitat that it flew to and thought this was a good place to find a mate and to nest; correct?

A Yes.

Q And the females don't sing back, do they?

A No, they don't.

Q So typically if you're looking for a breeding pair, you're most likely to find the male. You're considerably less likely to find the female; correct?

A That's in general -- generally that is true. But where warblers in get in a high enough concentration, you can find females, and you can find nests. We have found females. We have found nests and Marquette County and we have banded young Kirtland warblers in Marquette County.

Q Did the EIA reflect that anybody -- well, let me ask you this: The nests of the Kirtland warblers occurred down at the bottom of the trees in the dense branches and needles of the jack pine; correct?

A Right. They're down at the ground level.

Q Ground level but well hidden?

A In general, they're not easy to find.

Q Is there any reflection in the EIA or the appendices to the EIA that anybody went around looking where you would expect to find the Kirtland's nest in the jack pine areas of the Yellow Dog Plains near this mine looking for such nests?

A No. You would have to find the birds first which would lead you to the nest. So, no, they didn't look for nest structures themselves.

Q And you haven't done that yourself in the Yellow Dog Plains?

A I haven't done it personally in the Yellow Dog Plains, no.

Q Is Ives Lake part of the Huron Mountain Club property, do you know?

A Yes.

Q And there's a wolf pack associated specifically with Ives Lake; correct?

A The pack is associated with the deer yarding complex of the Huron Mountain Club. And they move around based on timber cutting. This past winter they were in the Ives Lake area because of timber harvest in that area.

Q So there was some harvesting that made it amenable to use as a deer park by the deer --

A Deer were --

Q -- which made it a deer yard, which made it attractive to wolves to make that sort of their home turf for the winter?

A It's always been a deer yard. The cutting of trees provided a food source with concentrated deer which, in fact -- which attracted the wolves.

Q Okay. And you would expect these wolves, members of the pack based in the Huron Mountain Club property to be among the wolves that traversed the Yellow Dog Plains; correct?

A That would be reasonable.

Q The three packs you described are not all of the packs in the UP; correct?

A No, they are not all of the packs.

Q They are the three closest packs to this proposed mining operation; correct?

A That is correct.

Q And the closest of those three packs is the Huron Mountain Club pack; correct?

A Yes, it would be.

MR. WALLACE: Your Honor, could have a short break to look at the exhibit and gather my thoughts?

JUDGE PATTERSON: Sure.

(Off the record)

Q I just have a few more questions, Mr. Koss. Do you know William Taylor? Do you know who he is?
A Not that I'm aware of.
Q When I asked you a series of questions about the DEQ's responsibility for environmental issues along the ore transportation route earlier, would your answer apply equally to the DNR?
A In terms of?
Q Not having any responsibility or jurisdiction for wildlife protection along the ore transportation route.
A We have responsibilities for wildlife protection everywhere in the state, so --
Q Okay. But with respect to this mining statute?
A I don't -- I don't think -- you know, specific to the mining statute, no.
Q Okay. Are you at all familiar with the Flambeau Mine? Do you know what that is?
A I've heard of it.
Q Has it ever been brought to your attention that the principal contamination that's resulted from the Flambeau mining operation has been along transportation routes? Do you know that?
A I have not heard that, no.
Q In your direct testimony you mentioned -- in fact, I think I wrote down this quote accurately. Correct me if I'm

wrong -- that we felt that any contaminants would end up in the water. Do you recall saying that?

A Ultimately, yes.

Q And that's because contaminants, even if they don't go directly in the water, if they're going to land on the ground surrounding the mining operation, they're going to eventually wash into the creeks and rivers; correct, sir?

A That was our thought.

Q And you know that that's true based on your years of experience as a wildlife biologist and your concerns about contaminants in the water; correct?

A No, more previous work with the DEQ Water -- well, it was DNR Water Quality Division is where that came from.

Q Earlier on in your career?

A Earlier on my career.

Q Have you ever seen any snake eggs in the Yellow Dog Plains?

A Can't say as I have.

MR. WALLACE: That's all I have.

MR. REICHEL: Just so I'm clear, do Mr. Eggan and Mr. Haynes have questions for this witness?

JUDGE PATTERSON: That was my next question.

MR. HAYNES: No questions.

MR. EGGAN: No questions.

MR. REICHEL: I have just a couple of things I want to follow up briefly on redirect, sir.

REDIRECT EXAMINATION

BY MR. REICHEL:

Q One of the last questions Mr. Wallace asked you was about your understanding that any contaminants -- or paraphrasing, any contaminants would end up in the water. Do you recall being asked about that?

A Yes.

Q I just want to clarify something here. Based upon your review of the mine application and your understanding of what's being proposed here, do you have any reason to believe that, in fact, contaminants will be released from this proposed mine into the waters of the state?

A No, I have no reason to expect that.

Q So your earlier comment in that regard, if I understood it -- well, strike that. Was your earlier comment having to do with your observation that you understood the DEQ staff would be looking at potential air and water impacts?

A Yes, totally.

Q Mr. Wallace also asked you at one point to compare the environmental impact assessment that you reviewed in connection with this project to environmental impact assessments or statements for some dam re-licensing projects. Do you recall that?

A Yes.

Q Just to follow up on that subject a little more, I think you

testified previously that during the course of your career you have looked at various other environmental impact assessments; correct?

A That's correct.

Q In totality of the ones that you have had occasion to review, how would you compare the one that you reviewed in this case, first in terms of quality and scope and detail?

A Way more extensive, way more scientific methodology based than anything I've experienced in the past.

MR. REICHEL: I have nothing further. Thank you, sir.

MR. HAYNES: Your Honor -- I'm sorry. Mr. Predko, are you --

MR. PREDKO: I do have a couple.

RECROSS-EXAMINATION

BY MR. PREDKO:

Q Mr. Koss, Mr. Wallace had asked you some questions about turtles and salamanders; do you recall that?

A Yes.

Q And I put up on the screen here -- it is Exhibit 3.4 or Figure 3.4 to the Wetland Delineation Report. And I'm not going to ask you about wetland delineations, Mr. Koss. I just put this up here for a frame of reference. Do you recognize this as an aerial view of the Yellow Dog Plains in the general area of the proposed mine?

A Yes, I recognize it.
Q And with respect to turtles -- well, let me first ask you: I'm pointing with the laser pointer here to an area just above the outcrop which is this yellow figure here.
A Yes.
Q And is this (indicating) the area, just above that outcrop, the area of the 92-acre site that you said you believed would be disturbed by the surface facilities?
A Yes.
Q And you understand that this area to the right here is all cut-over jack pine; correct?
A Yes; that's correct.
Q And this darker area here to the left, that's mature jack pine?
A That's correct.
Q And the soils in that area here, the whole 92 acres, are very dry and sandy?
A Yes. It's a rubicon sand.
Q Now, does that make up, that area, preferred habitat for either turtles or salamanders?
A No, it wouldn't be.
MR. PREDKO: Nothing further. Thank you, Mr. Koss.
MR. HAYNES: Your Honor, if I may, Mr. Reichel's redirect went into an area that I'd like to explore with a

couple of questions with the witness I think.

JUDGE PATTERSON: Okay.

MR. HAYNES: Mr. Koss, my name is Jeff Haynes. I represent the National Wildlife Federation, one of the Petitioners in this case.

CROSS-EXAMINATION

BY MR. HAYNES:

Q In Mr. Reichel's redirect he asked you to compare the environmental impact assessment that you reviewed for this project in comparison to some other environmental impact assessments that you reviewed. Do you recall that question?

A Yes.

Q And you understand, don't you, that the environmental impact assessment that was prepared for this project was prepared -- it was supposed to have met certain statutory and rule or regulatory requirements for completeness; right? You understand that?

A Yes.

Q You're not expressing an opinion, today, are you, on whether or not the environmental impact assessment for this project meets those statutory and regulatory requirements, are you?

A I'm not sure I understand your question.

Q Okay. You compared the EIA in this project with others that you reviewed; right?

A That's correct.

Q And you compared the completeness, for lack of a better word, for his EIA compared to other assessments or impact statements that you've reviewed in the past; right?
A That's correct.
Q But you are not expressing an opinion today, are you, on whether or not the EIA on this project actually conforms to the statute, Part 632, and the Part 632 rules, are you? You're not expressing that opinion, are you?
A I'm suggesting that as part of my review and my knowledge of the 632 rules and the parts that I reviewed, it appeared that -- in the requirement of the 632 rules.
Q It appears, but you're not -- you don't have an firm opinion on that, do you, as to whether it meets the legal requirements?
A I'm not an attorney, and, no, I don't have a legal opinion as such.

MR. HAYNES: Good. Thank you. That's all I have.

MR. WALLACE: Just a couple questions.

RECROSS-EXAMINATION

BY MR. WALLACE:
Q Mr. Predko drew your attention to the area where the buildings and principal mining operations will be conducted -- correct? -- aboveground, surface --
A Yes.
Q -- and asked you if you expected to find turtles there;

correct?

A That's correct.

Q In fact, the two kinds of turtles we talked about, wood turtles and box turtles are terrestrial turtles; right? Correct, sir?

A Yes. They exist on the ground.

Q They don't spend their time in the water; they spend it up on dry ground; correct?

A I'm not sure that they never get near water. I'm not that familiar specifically.

Q But they mostly live up on high, dry land; correct, sir?

A I would suspect that they do.

Q And, in fact, box turtles, one of the turtles of special concern, its diet includes, unlike most turtles, berries and vegetation; correct, sir?

A I'm not sure.

MR. WALLACE: I have nothing further.

MR. REICHEL: Your Honor, two things: first, it's with some reluctance that I feel that I need to follow up on Mr. Haynes last question here.

FURTHER DIRECT EXAMINATION

BY MR. REICHEL:

Q I understand your testimony -- obviously you're not an attorney and you're not offering a legal conclusion; correct?

A That's correct.

Q But just to be clear, as a member of the mining review team, you were asked -- you were given access to Part 632 and its rules; correct?

A That's correct.

Q And did you look at those aspects of the statute and the rules that pertain to environmental impact assessments as they related to wildlife and threatened and endangered species? Correct?

A Yes.

Q And based upon your review of the information contained in the EIA, in your view, did the EIA in the areas that you focused on adequately address what you understood to be the requirements of the act and the rules?

A Yes. That was my conclusion.

MR. REICHEL: Just one other matter: Unless I missed, I believe there was no resolution of Mr. Predko's proffer of exhibits. So I don't know where we stand on that.

MR. PREDKO: You're right. We haven't heard from Mr. Wallace.

MR. WALLACE: I read through the exhibit with great interest in the break and I have no objection to it. I think it was mis-described at one point by Mr. Predko as being 686 to 696 or something. It's 687.

JUDGE PATTERSON: Yeah. He said both.

MR. WALLACE: He said both, yeah.

MR. REICHEL: Perhaps we should state the -- clarify Mr. Predko --

MR. PREDKO: I covered myself.

JUDGE PATTERSON: Okay.

MR. REICHEL: Yes. It is Intervenor 387 to 396.

MR. REICHEL: Respondent has no objection, your Honor.

MR. WALLACE: And then I misspoke apparently, but I have no objection to the exhibit proffered.

MR. EGGAN: No objection.

JUDGE PATTERSON: Okay. No objection, it will be entered.

(Intervenor's Exhibits 387 to 396 received)

(Off the record)

MR. REICHEL: Your Honor, at this time Respondent calls Edmond Eary -- L. Edmond Eary. Excuse me.

REPORTER: Do you solemnly swear or affirm the testimony you're about to give will be the whole truth?

MR. EARY: I do.

L. EDMOND EARY, Ph.D.

having been called by the Respondent and sworn:

DIRECT EXAMINATION

BY MR. REICHEL:

Q Good morning, Dr. Eary. Could you please state your full name and spell your last name for the record?

A My full name is Lory, L-o-r-y, Edmond, E-d-m-o-n-d, Eary, E-a-r-y.

Q Okay. And Dr. Eary, what is the nature of your professional work?

A I am an aqueous geochemist.

Q An aqueous geochemist?

A Yes.

Q Doctor, were you contracted by the Michigan Department of Environmental Quality to participate in a review of certain aspects of the mine and permit application of the proposed Eagle Mine as they relate to issues of geochemistry and mineralogy?

A Yes.

Q And, Dr. Eary, have you previously provided us with a copy of your Curriculum Vitae or resume?

A Yes, I did.

MR. REICHEL: Your Honor, I would note for the record that we did previously disclose to the other parties some time ago Dr. Eary's resume which, through an oversight, was not previously assigned an exhibit number. We have now assigned the Exhibit Number -- proposed Exhibit Number Respondent's 215. And just to clear up the record, at this time I would move for admission of that document.

MR. YOUNG: No objection.

MR. EGGAN: No objection, Judge.

JUDGE PATTERSON: That wasn't part of the original stipulation?

MR. REICHEL: Well, it was in the sense that it want a resume; we stipulated to them. But the probation, your Honor, on my part, I neglected to assign an exhibit number to it, so --

JUDGE PATTERSON: Okay. If there's objection, it will be entered.

MR. EGGAN: None.

MR. HAYNES: No objection.

JUDGE PATTERSON: Okay. thank you.

MR. HAYNES: We took Mr. Reichel to task for that earlier, your Honor.

MR. REICHEL: I'm still bleeding, your Honor.

(Respondent's Exhibit 215 received)

Q And, Dr. Eary, in preparation for your testimony here today, have you prepared some slides to outline some of the topics that you anticipate testifying about?

A Yes, I have.

MR. REICHEL: Your Honor, we have marked for identification as Respondent's proposed Exhibit 214 solely for demonstrative purposes, as has previously been the case, a series of slides that Dr. Eary prepared.

Could you please bring up 214, the first slide?

Q Dr. Eary, is this the first in a series of slides you prepared?

A Yes, it is.

Q And what is the point of this slide?

A This is an outline of the topics I have in this set of slides.

Q Okay. So that includes qualifications and experience, permit review, purpose and approach, conclusions and comments on Petitioners geochemical review; is that correct?

A Yes, those are the main topics.

Q Okay. In terms of qualifications and experience, let me first ask you -- well, first of all, your academic and professional experience are detailed in your resume; correct?

A Yes, they are.

Q but let me first ask you about your formal educational background beginning with college.

A I have a bachelor's of science from -- and geology from the University of Michigan, 1978, and then a master's and Ph.D. in geochemistry and mineralogy from Penn State University, 1981 and 1983.

Q Okay. Let me just stop you there. Could you -- the court has already heard a fair amount of testimony from various people about geochemistry, but could you just explain

briefly the range of subjects that you've studied in pursuing your master's and Ph.D. in geochemistry and mineralogy?

A the range of subject ranges is from basic geology and structural geology to mineral identification and characteristics. And also a fundamental part is thermodynamics and kinetics in geochemical processes and their use in interpreting geochemical processes either numerically or in models or by observation.

Q And in pursuing your Ph.D. in geochemistry and mineralogy, what was the subject of your doctoral dissertation and research?

A My Ph.D. thesis was a numerical model of mass flow and transport for the leaching of uranium in pyrite during in situ mining operations.

Q That's not intended as a criticism, but that's quite a mouthful. Could you please describe what -- in a little more detail what that detailed and how, if at all, that sort of research is relevant to some of the issues that you expect to testify to today?

A The thesis was a combination of experimental studies on reaction kinetics specifically for uranium minerals and also iron sulfides and then the conversion of those experimental data into a mathematical model which described the movement of the leaching products through a groundwater system.

Q So in other words, it had to do with geochemical processes and the transport of certain chemicals into a water system. Is that --

A Yes, a groundwater system.

Q And did that involve or is it -- to any extent involve leaching caused by sulfide-containing compounds?

A That was a part of the study, yes.

Q And since completing your academic degrees, after you completed your degrees, how were you first professionally employed in the fields of geochemistry and mineralogy?

A Directly after graduate school I worked at Pacific Northwest National Laboratory in Richland, Washington. And I worked there as a senior research scientist, and I did fundamental and applied research in geochemistry specifically aqueous geochemistry, and topics range from chemistry of metals in the environment, surface water and groundwater systems. I also worked on nuclear waste-related aqueous geochemical issues. I worked on uranium mining reclamation. I worked on projects on molecular dynamic modeling of chemical systems. And then I spent a number of years working on modeling the effects of acid rain on water quality and watersheds in the northeastern U.S.

Q And let me ask you to describe in more detail to what extent your work involved the use and application of numerical models.

A I worked on the development of a few geochemical codes that are in common use today. One is called MINTEQ, which is now used by the EPA. I worked on part of the -- development of that, the internal workings of that geochemical model. Another model called CTM, which stands for Contaminant Transport Model, is another model that I worked on the development of. And I also developed the thermodynamic databases and kinetic databases that went into those models as well.

Q And after you completed your tenure as a research scientist at the Pacific Northwest National Laboratory, how were you next professionally employed in the field of geochemistry or mineralogy?

A I worked in the consulting industry as a geochemist, working primarily on geochemical issues at industrial cleanup sites and also mining geochemistry, mining environmental geochemistry.

Q And as a consultant in that area, was that -- have you specialized in geochemical model development and application?

A It's been a big part of what I've done in the past and continue to do now. Also the collection and interpretation of testing data from environmental sites as well, something that feeds into the models and also involves interpretation of geochemical processes.

Q And you touched on this a moment ago, but you've indicated that you've worked as a consultant on industrial sites. Could you explain or give examples of the types of industrial sites where you've worked as a geochemist either in the collection or evaluation of data?

A Yes. I've worked at sites that have contamination problems in the groundwater or surface water systems relating to metals concentrations. And these are oftentimes sites that were in Superfund status. I worked in the characterization of the fate and transport of the metals within those systems and interpret of the fate and transport using both models and test data and field data.

Q And approximately how many such industrial site projects have you worked on as a consultant over the course of your career?

A I think it was on the order of about 20 that I could specifically recall.

Q And, again, during the course of your career -- you touched on this a moment ago -- have you also worked on mining site geochemical projects?

A Yes. Most of what I've done has actually been in mining, probably 60 percent and probably more the last few years as the mining industry has increased in frequency and occurrence here in the U.S.

Q About how many mining site projects have you worked on as a

consultant prior to your involvement in this case?

A I believe it's approximately 30.

Q Could you please tell the judge by of example, some of the types of mining-related geochemical projects you've worked on?

A I've worked on the front end of new mines in the permitting process which involves a baseline characterization of the geochemistry of the systems and prediction of what geochemical processes are likely to be important in controlling groundwater and surface water chemistry. I've worked on similar types of things for the expansion of existing mines, permit-related studies. I've worked on environmental impact statements as well, also for mine sites. And I've also worked on a number of sites on the closure of mines that have gone beyond their lifetime and are no longer in operation but are now going into the closure stage.

Q Have these projects -- to what extent have these projects involved issues of either -- involved acid rock drainage?

A Almost all of the mines that I've worked on have been hard-rock mines, sulfide mines, so acid rock drainage is a consideration I think in almost every single one of them.

Q And again I think we touched on this, but I'd like to be clear. Some of your mining projects have involved being involved in, as you put it, at the front end; that is,

evaluating potential impacts of proposed but not yet implemented mining activities; is that correct?

A That's correct, yes.

Q As is the case here; correct?

A Yes.

Q But you also have been involved in issues where mining has already commenced and there are issues associated with characterizing or responding to acid rock drainage that already exists?

A Yes, primarily in the closure phase of those mines where some sort of reclamation or remediation process has to be done to get the mine closed out.

Q And again, in terms of the type of mines, have those -- you indicated that a number of them have been hard-rock mines. Have they been open-pit mines, underground mines or a combination of the two?

A It's been mostly open-pit mines. Some have been a combination of both underground and open pit, and a couple cases they were specifically just underground mines.

Q And again, leaving aside for a moment your involvement in this project, during the course of your consulting career, have you been involved in looking at or reviewing geochemical issues in connection with either the proposed development or expansion of underground hard-rock mines?

A I've worked on the expansion of aboveground mines but not

underground mines.

Q And what about the -- have you looked -- strike that. Do you have any professional licensing credentials?

A One license as a professional geologist from the State of Wyoming.

Q During the course of your career in geochemistry and mineralogy, have you had occasion to review and analyze documents put together by others in the geochemical and mineralogy field?

A Yes, I've done that on a number of occasions.

Q This slide contains a reference to -- it indicates that you are an associate editor for Mine Water and the Environment, a journal of the International Mine Water Association. Could you explain what that association is and what the nature of the publication is?

A The Association of -- the International Mine Water Association is a scientific association. It's a multidisciplinary group of people involved in mining environmental issues, and they are interested in transferring technology and data and scientific knowledge and understanding issues like acid mine drainage and generally mind water chemistry. They --

Q Well, what is the -- oh, go ahead. I'm sorry.

A They sponsor a journal called the Mine Water and Environment. And that journal publishes scientific peer

reviewed papers on topics related to mine water and environmental issues.

Q And what is your role with respect to that publication?

A I'm an associate editor so I receive papers, I organize reviews of those papers and also do the peer reviews myself and then do the acceptance or rejection of those papers for the journal.

Q Your slide also refers to the Acid Drainage Technology Initiative Steering Committee. Could you explain what that is and what your role in it is?

A That organization is a group of basically volunteers that have technical backgrounds in environmental issues related to acid mine drainage. And it's comprised of people from consulting companies like myself, also academics, mining companies and also a number of people from regulatory agencies. The whole purpose of that group is to try to improve environmental management of mines that have the potential or existing problems with acid rock drainage.

Q And the slide also makes a reference to your role as co-chairman of the Pit Lake Committee. Could you explain what the Pit Lake Committee is or what the focus of that is?

A The ADTI, the Acid Drainage Technology Initiative, has a series of workbooks that they are constructing which provide sort of state-of-the-art information on different aspects of mining. One of those aspects is pit lakes. Pit lakes are

the bodies of water that form in an open pit after mining is done. Just to back up a little bit, during mining the groundwater and surface water will be diverted away from the open pit so that it can be mined; in other words, it will be dry. But after mining ends, those dewatering systems are ended, and the open pit will fill up with water. Because the water is in contact with rocks that were exposed at the surface and some of which may be sulfidic, the chemistry of those pit lakes can be an environmental issue.

Q And so this pit lake committee addresses issues of how -- does it address issues regarding the environmental fate and transport of contaminants in those lakes?

A Yeah. The Pit Lake Committee is involved in the development of a workbook on how to predict water chemistry in pit lakes prior to their formation, also how to reclaim or remediate the water in a pit lake if it needs that type of process and also to interpret geochemical and also biochemical processes that occur in a pit lake which regulate its water composition. That workbook will be published by the Society of Mining Engineers later this year.

Q Do you have any professional affiliations beyond those you've already mentioned?

A I belong to a few other scientific organizations that are listed here: Society of Mining Engineers, International Minute Water Association -- that's the same as the journal

mentioned above, and also the International Association of Geochemistry and Cosmochemistry which is sort of a general geochemical scientific organization.

Q Do you have any scientific publications in your fields of expertise?

A Yeah, published a number of papers primarily on metal chemistry and mining-related subjects in peer reviewed journals -- I think I list -- I found about 32 of those -- a number of related abstracts on similar types of subjects, and also when I worked for the Pacific Northwest National Laboratory I worked on a number of governmental sponsored projects on which I published reports or was a coauthor on reports.

Q And does your resume more specifically identify papers that you've published?

A Yes, it does. I think it gives a list of --

Q Without going into all of so in detail, could you perhaps give the judge some examples of peer review papers that you've published that relate to -- that are pertinent to the subjects of acid rock drainage at mine sites and methods of predicting, making predictions with respect to that?

A The first three that you see listed are papers that will be in this pit lake workbook which I mentioned previously. These have to do with the interpretation and prediction of water quality in mine pit lakes. If we skip down to the one

Eary and Williamson, 2006, this is a paper specifically on the neutralization capacity of silicate rocks in acid mine drainage environments, something which is a topic of particular relevance to the Eagle Project. Eary, Runnells and Esposito, 2003, Geochemistry and the Cripple Creek Mining District, that's a sulfidic gold mine in Colorado. One particular -- the next one, Eary, 1999, Geochemical Equilibrium Trends in Existing Mine Lakes is a comparison of how models -- geochemical models, how well they do against what's been recorded in pit lakes in terms of water quality. There's a number of others, I guess, as you go further.

Q That's fine. My question was just for some illustrative examples. With respect to reports prepared for government agencies, you're slide here contains a reference to something for the EPA -- US EPA. What did that involve?

A The projects I referred to on acid rain effects on watersheds were sponsored by the US EPA and also the State of New York. And then more recently I did a project for the US EPA for technical oversight of the geochemical modeling done for the waste isolation pilot plant in New Mexico, which is a defense nuclear waste repository.

Q And the issues you were looking at there related to the potential fate and transport of materials that would be stored in this repository?

A Yes. It was related to the models -- geochemical models

used to predict release in fate and transport in that system their evolution over time as that repository was buried and basically compressed by the confining rock layers.

Q During the course of your career have you also had occasion to develop or present short courses on mining-related topics?

A Yeah. I've worked on the two that are shown here. Predictive modeling of pit lake chemistry was a short course on development and application of models, geochemical models, to predict water quality in pit lakes. The other one was using geochemical models and interpretations to improve reclamation during closure of hard-rock mines.

Q And I think we touched on this before, but have you also during the course of your career -- professional career been involved in doing critical reviews of documents prepared by others in the field?

A Yes. I've done that for a number of different journals.

MR. REICHEL: Bring up the next slide, please.

A Yeah, I think the next slide has some of these things. I've also done -- the US EPA, to review some of the documents related to some of the Department of Energy geochemical modeling studies, and that's specific to those nuclear waste sites. And then I've also reviewed -- or worked as a reviewer for research proposal for grant funding for a number of different agencies as well which are listed here,

USDA, National Science Foundation, State of California.

Q Have you also done peer -- been a peer reviewer for scientific journals?

A Yeah. The second bullet on the bottom there gives a list of journals that I've done peer reviews for over the years.

Q I'd like to turn now to your involvement in this project.

MR. REICHEL: Your Honor, I know we're approaching lunch. I can go on a little farther, or this sort of a logical break here.

JUDGE PATTERSON: Okay. Why don't we do that?

(Off the record)

MR. REICHEL: Ready, your Honor?

JUDGE PATTERSON: I am.

Q Dr. Eary, one question I neglected to ask you this morning was the name of the company for whom you currently work, the consulting firm?

A I currently work for a company called MWH Americas, Incorporated.

Q And where is that located?

A My office is one of many offices for MWH. It's located in Fort Collins, Colorado. The headquarters is Broomfield, Colorado.

Q And what is the range of the services that that company provides?

A Its primary areas are in water treatment, mostly for

municipalities, water treatment systems in engineering design and construction. Also large construction projects such as hydroelectric dams, dams for mining facilities as well, things like tailings dams, and also sort of a broad range of environmental services to both industrial and mining clients.

Q Okay. And how long have you been with that company, sir?

A I started there in March of 2007.

Q And at the time you first became involved in this project, what company were you working for?

A At that time I worked for a company called MFG, Incorporated.

Q And where was that based?

A That was also in Fort Collins, Colorado.

Q And what was the nature of MFG's business and your role in that business?

A MFG is a subsidiary of a company called Tetra Tech, Incorporated, and they offer sort of a full range of environmental services; characterization, remediation and monitoring.

Q I would like to turn now to your direct involvement in this project. Dr. Eary, if you recall, how do you first become involved in working for the DEQ in connection with this proposed mine?

A There was an inquiry to our company at MFG, to one of my

colleagues; Joe Maki.
Q Okay.
A My colleague was not able to do the work, and he referred me to Joe Maki. And I then talked to Joe Maki by telephone.
Q And what did Mr. Maki indicate to you about the nature of the technical assistance that the DEQ was looking for?
A He said that there was going -- they were expecting a mine permit application to be submitted, and that permit included geochemical studies. And Joe asked me to do a -- if I was interested in doing a review -- a technical review of those geochemical studies.
Q And did you understand from your conversation with Mr. Maki that you would be one of a number of people asked to review various aspects of the anticipated mine permit application?
A Yes. There were other people that looked at other areas, and I was focused on geochemistry.
Q And in connection with -- and so I take it you or your firm entered into a contract with DEQ to provide consulting services to the agency?
A Yes.
Q And once that was done, among other things, were you -- were the State of Michigan mining statute regulations; that is, Part 632 and the Part 632 Rules made available to you?
A Yes, they were.
Q And what was your understanding as to whether or not part of

what you're being asked -- did you have an understanding as to whether or not you were being asked to perform your technical review of the anticipated mining permit application with respect to the requirements of the state mining statute and rules?

A Yes, I understood that I needed to keep those in mind as well as my own professional judgment on these types of studies.

Q Okay. After the mining permit application was submitted to the Department of Environmental Quality in February 2006, were you provided a copy or access to the mining permit application?

A Yes.

Q And were there particular parts of the mining permit application and supporting materials on which you were asked to focus?

A Yes. I was asked to focus on the geochemical studies which were involved in Phase I and Phase II studies I think as how they were termed. And those were appendices to the main permit.

Q And have you prepared a slide that identifies key documents that you reviewed in connection with that?

A Yes.

MR. REICHEL: Can you go to slide 5, please?

Q And under heading "Documents Reviewed," are these the --

could you just briefly walk through the principle documents you looked at in your initial review?

A The initial review was focused on the Appendix D-1, D-2, D-3, D-4 and D-5. Those were the specific geochemical studies that were done as part of this permit.

Q That was the first five bulleted items there?

A Yes, the five bullets.

Q Okay. Let me just stop there. In connection with your review of those documents, did you read any other aspects of the mining permit application to give you an understanding of the context in which the mining was proposed to be implemented and associated activities including storage and management of development rock?

A Yes, I also read these reports listed under "Related Permits" reports. One was the geological description of the deposit; then also the main permit application as well just for general background.

Q Okay.

A I also went through some parts of the groundwater quality calculations. And I think that was part of the groundwater permit portion of the set of documents.

Q And just so this clear, was it your understanding, sir, that at the same time that Kennecott applied for a mining permit to the DEQ under this Part 632, it concurrently applied for a permit to discharge treated water to the groundwater under

another state statute?
A Yes, I remember Joe Maki telling me that.
Q In the course of your initial review of these documents, what did you -- first, you read the documents; correct?
A Yes.
Q And in the course of your initial review, did you attempt to identify any areas where you desired additional information or clarification of what was presented?
A Yes. I prepared a list of questions that I wanted answers for that would -- points of clarification I think in the geochemical studies.
MR. REICHEL: Could you please bring up proposed Exhibit 48?
Q Could you identify for the record what this is, Dr. Eary?
A This is the list of, I think, 20 or 21 questions on the geochemical studies that I -- areas that I wanted clarification or further explanation.
Q Okay. Just a couple of details about this document. It's addressed to Mr. Mark Logsdon, Geochimica. Why did you send this to Mr. Logsdon?
A Originally after I talked to Joe Maki, I asked if I could communicate with Mr. Logsdon -- or Dr. Logsdon directly or if I should go through DEQ. Joe Maki said, well, cc him on all communications. Then that changed about the same time that I sent this. Actually this date should be 2006.

Q Okay. Just so the record -- there's an apparent typographical error in the date of the letter?

A Yes. And at that time, Joe said that he was compiling a large list of questions, and he wanted to submit those all at once. So he asked me to send it actually straight to him.

Q So I don't want to --

MR. REICHEL: Could you scroll down a bit because this --

Q Does this letter have an attachment to it, a list of questions; is that correct?

A Yes. That's the list starting right there.

Q Okay. That's fine. After you sent this initial list of questions, did you ask for any further clarification of information contained in the mining permit application appendices you were looking at?

A Yes, it was -- I came up with one more question after this one, and that's in a separate letter.

Q Okay.

MR. REICHEL: Could you please bring up Exhibit 49?

Q Dr. Eary, is this the supplemental or the transmittal of one additional request for clarification?

A Yes.

Q And this was sent in -- dated April of 2006; is that

correct?
A Yeah. The date here is correct.
Q Okay. And again, if you know, was this also made available by you to Mr. Maki?
A Yes. I sent this to Mr. Maki.
Q Okay. And you touched on this a moment ago, but you indicated it was your understanding that Mr. Maki or the DEQ around approximately this time period was putting together a compiled list of questions, request for information from various other participants in the review process, is that your understanding?
A Yes.
MR. REICHEL: Could you please bring up Exhibit 67? If you could scroll down a little bit?
Q Exhibit 67 as has previously been identified was a June 21st, 2006, letter from Mr. Maki to Kennecott. Directing your attention, can you read that, sir, or do we need to make it bigger?
A Yes, this is fine.
Q Okay. Directing your attention to a series of questions that begin with numbered paragraph 2, do you recognize any of these as reflecting or reiterating questions or request for clarification that you had?
A Yes. Starting with number 2, those look like my questions.
Q Okay.

A Number 1 is not.
Q Okay.
MR. REICHEL: And could we go to the next --
Q Starting with 2, would that be down through that first page?
A Yes.
Q And what about on the second page, sir?
A Everything there that I see looks like my questions down to number 19, also number 20.
MR. REICHEL: Could you scroll down a little further?
A 21. It looks like they stop at 21.
Q So if I understand you correctly, questions 2 through 21 contained in this document reflect questions that you had raised where you were seeking additional information about the application?
A Yes, I think -- yes.
Q If you know, did Kennecott ultimately respond to Mr. Maki's correspondence with responses to these questions?
A Yes. I received a -- the response which I think contained the answers or responses to all of the questions, and I think there were 90 odd total.
MR. REICHEL: Could you please bring up Exhibit 69? And I'd like you to scroll down to I think it's the 4th or 5th page in where the main body of the attachment is.
Q There's a number-by-number response beginning with --

MR. REICHEL: Could you scroll down a bit more, please? Thank you. Just stop there, please.

Q Beginning with comment number 2 and continuing down through 2, if you recall, sir, did Kennecott provide a response to each of the items 2 through 21 that have been incorporated in Mr. Maki's letter?

A Yes.

Q And if you recall, did any of those responses refer to another document that was attached to or sent contemporaneously with this letter?

A Yes. Along with these responses, they also sent me a set of test data for the kinetic tests that they had run which had a longer time period than the tests that were referred to in the permit documents.

MR. REICHEL: Could you please bring up Exhibit 76? I'm sorry. I misspoke. Just one moment, Exhibit --

A It should be a list of -- or just I think three tables.

Q Yes. I believe it's -- just one moment, please.

MR. REICHEL: I believe I was looking for number 71.

A No, I don't think that's it.

MR. REICHEL: I apologize, your Honor. Please go back up to number 70.

Q Okay. Do you recognize this document, sir?

A Yes. I think this is the document.

MR. REICHEL: Could you scroll down, please? Pause there, please.

Q Dr. Eary, does this appear to be a copy of the supplemental information that was provided to you?

A Actually could you scroll down to the bottom of this page -- to the bottom of this table? And a little bit more, please. Yes, this is it.

Q Okay. And again this compiles some data from kinetic tests?

A Yes.

Q We're going to get into that in a little more detail, but these are tests that were conducted in connection with the geochemical characterization supporting the permit application; is that correct?

A Yes.

Q And I believe these data -- excuse me -- the responses to your questions 2 through 21 and the tables that we just looked at in Exhibit 70 were provided to the DEQ in late October of 2006. Did you receive a copy of that same information around that time or shortly thereafter?

A I think that's about the right time frame, yes.

Q After you received that information, did you then proceed to complete your initial review of the geochemical information submitted by Kennecott in support of the permit application?

A Yes.

Q As a part of your contract with the DEQ, was it anticipated

that upon completion of your review you would put together a written report or technical document summarizing the results of your review?

A Yes. That was in the scope of work which I submitted as part of the contract.

Q And so after you had gone through your review including the supplemental material submitted by Kennecott that we just talked about, did you in fact put together a report or a memo summarizing your review and your conclusions about the nature of the information that had been submitted and its relationship to the proposed mining plan?

A Yes.

MR. REICHEL: Could you please now bring up Exhibit 76?

Q This has the title "Review of Geochemistry Studies for the Kennecott Eagle Project Permit Application" dated November 30th, 2006.

MR. REICHEL: Could you scroll down, please?

Q And this indicates you were the author of this document; correct?

A Yes.

MR. REICHEL: Okay. Could you scroll to the next page on Table of Contents and just hold it there, please?

Q Does this Table of Contents summarize the discussion that you provided and the different aspects of it?

A Yes.
Q And so that included a review of the mine plan summary and the areas that you were asked to review; is that correct?
A Yes, that's correct.
Q And did you also look at the characterization of the geological materials that were present at the proposed mine site?
A Yes.
Q And did you also look at the predictions of potential for acid drainage and metal leaching made in the permit application document?
A Yes. That was a large part of it based on these different types of tests and modeling that would be done as well.
Q And did your report or memorandum also address the subject of mitigation and monitoring programs that you understood to be proposed as part of the permit application?
A Yes.
Q All right.
MR. REICHEL: Could you go to page 4?
Q There was a summary of your report at the beginning; correct?
A Yes.
MR. REICHEL: Could you scroll down a bit or the introductory section, I should say? Keep going down, please. Okay. Could you hold it there and, if possible,

enlarge the bottom paragraph? Thank you.

Q Was this your general summary of what you looked at and what you concluded in this document?

A This is the general summary based on the various points above; yes.

Q Yes. And I'll ask you a series of questions related to those substantive points in a moment. But could you read into the record that summary paragraph that I've directed your attention to?

A As written?

Q Yes, please.

A "In summary, it is concluded that the geochemical studies follow industry practice and provide a thorough characterization of the rock types that would be mined at the Kennecott Eagle Project and their potential reactivities. The proposed mitigation plans are expected to be adequate for minimizing the potentials for acid drainage and metal leaching and preventing the dispersal of leachates in the groundwater and surface water systems surrounding the mine site assuming that they work as described in the mine plan."

Q And is that -- recognizing it's general, is that an accurate summary of your overall conclusion in this report?

A Yes.

Q Now, in preparation for your testimony today, have you --

you've already indicated this, that you prepared a series of slides to illustrate or help explain the approach that you took to your review in this project; is that correct?

A Yes, that's correct.

Q And do those slides describe some of the key topics that you've considered and addressed in this report that we just looked at here?

A Yes. They are something of an expanded summary of the conclusions.

Q Okay.

MR. REICHEL: Could you bring up slide 6, please?

Q Okay. What are you attempting to summarize or outline in this slide, Dr. Eary?

A This was my approach for reviewing the geochemical studies. It was based on sort of the general areas that are recommended in industry technical guidance documents. And those guidance documents focus or recommend that these studies be focused on three main areas. One is the characterization of the geological materials. Second is the prediction of the potential for acid rock drainage and metal leaching based on the characterization. And then based on this prediction is to identify or develop mitigation and monitoring programs. These are all done within the main context of -- the purpose for actually doing the geochemical studies is to guide management decisions in the mine plan as

how to deal with any issues related to acid generation and metal leaching that could occur as a part of mining. This is one of the main precepts in this reference right here, MEND, 2005. The next line actually gives that complete reference.

Q Okay. And before we get into that next line, is it your testimony that as a professional working in this field you are aware of some guidance documents that -- prepared by various parties that attempt to identify issues that should be considered as a part of a geochemical review in a situation such as this where there is concern about acid rock drainage?

A Yes. There's no one single recipe for doing these sorts of studies, but there are a series of technical reports which I refer to as guidance documents put out by either governmental agencies or the people in the field. Those documents have evolved over time, but they generally have the same sorts of recommendations within them how to -- what types of information are needed for a geochemical assessment.

Q Okay. And have you prepared a slide identifying some of the guidance documents of that nature that you've looked to?

A Yes. The next slide lists the documents which I referred to as reference.

Q Could you elaborate on the first one, this M-E-N-D which

appeared in your previous slide? First, what is that, and why did you consider it useful to refer to it?

A "MEND" refers to "Mine Environment Neutral Drainage. This is a program in British Columbia, Canada which provides information on acid rock drainage problems and mitigation procedures at different mine sites. And they also have -- in this case this document gives a list of potential requirements in metal leaching and acid rock drainage assessment, which is specific to sulfide hard rock mines. This is one of the best documents or summaries around that contains this sort of information. It actually is an outgrowth of the work by Price and Errington also at -- in British Columbia, who have done a lot of work in this field.

Q And this slide identifies some other documents or reports that, if I understand you correctly, you referred to and believe helped to identify relevant information to be considered in a geochemical review of this type?

A Right. One of the older documents -- it's somewhat outdated -- is this USEPA report. It's still a reasonable reference with some things. I looked at that. Another related report from Region 10 of the USEPA on mine characterization and a more recent document by Maest, et al, 2005 which is entitled, "Predicting Water Quality at Hardrock Mines: Methods and Models, Uncertainties and State of the Art." This is a summary of a lot of the concepts

which are also in MEND and Price and Errington, which is also a useful document.

Q And again, if I understand you correctly, these documents help to focus on the kinds of information that people in the field who are doing these kinds of analyses should or could consider in analyzing a potential for acid rock drainage and metal leaching?

A Yes.

Q Okay. As a result of the work that you did in the -- your initial review on this project that I think you testified was further described in your November 2006 report, have you reached some principle conclusions or opinions as to some major geochemical issues relating to this project?

A Yes.

Q And have you prepared a slide summarizing those?

A Yes. Those should be on the next slide, or at least an outline of those issues.

Q Okay. We have up slide 8. What are you stating here, Dr. Eary?

A In my review I thought that there were four main areas that were geochemical issues. The first one which relates to the two slides previous is, "Is the characterization of a geological system adequate in terms of sampling and analysis?" By "analysis" I mean determination of the chemical properties of the rocks. Second, what is the

predicted leaching chemistry for the TDRSA, the development rock storage area? What went into the data that was used to make that assessment, and also the modeling methodology? Number three, "What is the water chemistry exiting under the underground mine during mining?" is another issue.

Q And before we leave it, when you talk about "water chemistry of mine drainage during mining" are you talking about, as you understand it, water that would be under the mining plan be pumped to the surface for treatment?

A Yes. Yes, water that is collected in the underground workings and brought to the surface.

Q Okay. And the fourth major issue?

A The fourth, "After mining is done what is the chemistry in those underground workings as the groundwater system recovers back to its natural state?"

Q That is, after the completion of mining?

A Yes, after the completion of mining.

Q And getting ahead of ourselves a bit. After the mine is reflooded; is that correct?

A Yes.

Q So have you prepared a series of slides then going into greater detail about your review on each of these major topics?

A Yes.

Q Okay. Before we get into the details of this, Doctor, I

think the record is already clear and the court has heard some testimony that as a part of the permit application process efforts were made to use samples of different types of rock from the mine site and subject them to various screening and testing procedures; is that correct?

A Yes.

Q Okay. And so is that what this major topic is dealing with?

A Yes. Referring to the technical guidance documents; they give recommendations on what should be sampled and characterized. The primary focus of that sampling is materials that will be stored aboveground primarily for extended periods of time or be exposed due to mining. In this case that would be the underground mine surfaces.

Q And focused on these it would be exposed because?

A Because they would be subject to weathering by rain and air and surficial processes which are different from their natural state underground. Now, they are specific -- excuse me. For the Eagle project this includes the development rock, which goes into the TDRSA, and the underground mine surfaces within the mine itself.

Q Okay. So in other words, this goes to the issue of what types of rocks are going to be analyzed and what the -- what sort of tests would be applied to them?

A Yes, this refers to the initial screening types of tests that are going to be analyzed and also the rocks that

actually will be stored for some extended period of time at the mine site.

Q And you indicated that for the Eagle project these would include development rock and underground mine surfaces; correct?

A Yes.

Q Would that rock to be subjected to the screening process, would -- in your understanding of the appropriate procedure, would that include samples of the orebody itself?

A No; not in general. My understanding is, is that the ore will not be stored but will be shipped off site as soon as it can, I guess.

Q Okay. And could you elaborate further about what other considerations you understand go into the kind of sampling program that should be done; that is, are you -- just putting your first bullet there at the bottom of the slide, you -- could you explain what you mean by that statement?

A All geochemical assessments when they collect data have to address all of the major rock types. In this orebody we have country rock; we have intrusives, which are not ore; and then we have ore. It's a -- the rocks that we want to characterize are the ones that are going to be stored aboveground, which includes primarily the non-ore materials, and this includes, as I said, the country rock and also the peridotite which is the intrusive, which is not ore grade.

The samples that were collected characterize all of those major rock types in terms of their acid potential and their neutralization potential, their chemical composition, and also their leaching potential.

Q So you're now talking -- does this represent your conclusion as to whether or not the samples that were screened here were in fact represented of all the major rock types and --

A Yes; yes. And secondarily the number of samples sort of on a per-unit mass basis appear to be adequate compared to most ranges of numbers of samples per unit mass of rock that I've seen in technical guidance documents.

Q Okay. And your slide references EPA guidelines?

A EPA is one of the few places that gives a few ranges of recommended sampling frequencies. It's generally sort of a site-to-site difference depending on the amount of variability in the rock. In this -- at this site we don't have a lot of different rock types, so the number of samples per type is actually fairly high. If a deposit has a large number of rock types then it requires more sampling.

Q Okay. But if I understand the point of your slide correctly, you're indicating that in your judgment the number of samples at this stage on a per-mass basis of the development rock met or exceeded what you consider to be relevant guidelines?

A Yes.

Q Okay. Have you also prepared a slide summarizing what you understand to be the -- commenting on the sampling approach that was used in this project?

A Yes.

MR. REICHEL: Can we go to slide 10, please?

Q Could you walk us through the principle conclusions that you've reached with regard to the approach used for sampling on this project?

A The initial screening types of tests that I refer to in the previous slide in terms of numbers of samples includes tests like static tests which include measurements of the acid potential and neutralization potential of the different rock types. Also its chemical composition, the whole rock chemistry, the paste pH.

Q What do you mean by "paste pH"?

A Paste pH is a measurement of the acidity of the surficial materials on the surface of the rock itself. It's an indication of sort of incipient oxidation of the rock that happens to be sulfidic.

Q And what is the next point that you refer to?

A The next one is short-term leaching. This is -- refers to procedures like the synthetic precipitation leaching procedure, which is a very quick wash-off type of test where the sample of rock is inundated with a volume of water. The water is allowed to sit there I think overnight, and then

the water is collected and the chemical composition of that water is determined.

Q Okay. In summary, are you indicating here that this reflects your understanding of some of the sampling analyses approaches used by Geochimica in documents it prepared in support of the mining permit application?

A Yes, these are the tests that they have done and these are all standard tests that are recommended in technical guidance documents, and one of the key things is that the purpose for doing these screening tests is actually to select representative samples for the long-term kinetic tests, which is another part of the testing program.

Q So this is sort of a first screening exercise; is that correct?

A In large part it is.

Q Your slide also refers to detailed mineralogical analyses. Could you explain what you gleaned from the permit application materials that -- provided by Geochimica and what significance they have?

A Yes, they did a number of different mineralogical analyses including x-ray diffraction, which is a procedure to determine what minerals are present; transmitted light microscopy and also reflected light microscopy, which gives you an idea of mineral textures and also identity; scanning electron microscopy is a procedure which gives you a

simultaneous image of the morphology of the rock as well as its chemical composition. For this particular deposit which has somewhat uncommon mineral rock composition compared to many sulfidic deposits, these mineralogical studies were quite important for interpreting the long-term leaching trends that were observed in those kinetic tests.

Q Could you explain why that's the case?

A This deposit is hosted in a type of rock called peridotite which is within a classification called ultramafic, which refers to its high iron and high magnesium content and these are iron and magnesium silicate minerals. Now, generally silicate minerals would not be expected to provide much neutralization potential which the exception of those found in ultramafic rocks, in particular the minerals olivine and one of its hydrated forms called lizardite, a serpentine type mineral. There is types of silicates that actually do provide some neutralization potential. In this case they were identified in these different sorts of mineralogical tests which provides some explanation why in the long-term tests rocks, which we would expect to produce acid either never did produce acid in the tests or took a long time for them to do so.

Q A moment ago you referred to, I believe it was neutralization potential?

A Yes.

Q Could you -- the court has heard some testimony on that, but could you explain briefly again what you mean when you talk about neutralization potential?

A Yeah, it might be best if I give it in context of acid potential.

Q Yes, please.

A Acid potential is, as it sounds, the potential for the rock to generate acid if it's exposed to oxygen and water. It's based on the sulfide content of the rock, which because when the sulfide oxidizes and dissolves it creates acid. Now, conversely the neutralization potential is the ability of the rock to buffer or neutralize that acidity that is generated. Based on the balance of those two values, we would make a prediction or a conclusion that the rock either has a net surplus of acid potential or a net deficit of acid potential. If it has a surplus, then you might expect it to produce an acid leachate. If it has more neutralization potential than acid potential, then we would expect it to be the opposite; it would produce a neutral leachate. There are exceptions in either direction, but those are sort of the general types of information you can get from that sort of screening tool.

Q Okay. And again, talked about these mineralogical analyses using these different techniques, but if I understand you correctly the point of this is to specifically characterize

the different mineral types that are present in the rock samples; is that correct?

A That's correct. There are different minerals which neutralize acidity and it's important to identify those precisely as possible. And these tests or these analyses in terms of numbers of samples and detail are some of the best that I've seen in terms of pinning down exactly what the mineral compositions are and their sort of habits and morphologies within the rocks themselves.

Q Okay. I'd like to turn now to the second major -- second issue, the temporary development rock storage area leaching chemistry.

MR. REICHEL: Could you go to slide 11, please?

Q Dr. Eary, could you please summarize the main points that are reflected on this slide?

A The first bullet refers to the static test data. This is the acid potential and neutralization potential types of tests. The results from those indicate that about 75 percent of the rocks that would be put into the TDRSA have more -- have a greater acid potential than neutralization potential; in other words, we would expect them based on those potentials to produce an acidic leachate.

Q And just to interrupt you for a moment, sir. Is that conclusion particularly surprising in the context of this case?

A No, it's not. This is a sulfidic mine. There's no or very little carbonate content in most of the rocks, which is a major neutralizer, so it's not tremendously surprising given the type of rock that we have here.

Q Okay. Could you turn to your next point, please?

A Now, the second type of tests which are the long-term kinetic tests, samples for these tests are selected based on the ranges of acid potentials and neutralization potentials that are defined in the screening tests. In other words, you could do a large number of screening tests and then you pick representative samples for the long-term kinetic tests to determine if a rock that we would say has the potential to produce acid does it actually do so when it's subjected to leaching types of conditions. So that's the purpose of these long-term tests. Now, one of the generally accepted things about these laboratory tests is that they are expected to accelerate the acid production process by about an order of nine to two or ten times.

Q Compared to?

A Compared to natural conditions in the field. And the reason for that is that if we're doing a laboratory test we want to see if there's a result in some reasonable time frame. So the tests are designed to optimize or increase as much as possible the oxidation of the sulfides and the production of acidity if it's going to occur, or the opposite if it's

going to be neutralized.

Q So in other words, to create test conditions that would again make it easier for the leaching potential to manifest itself?

A Yes.

Q Okay. And have you during the course of your review -- how would -- have you developed a slide that summarizes the interpretation of these kinetic test results?

A Yes.

MR. REICHEL: Could you go to slide 12, please?

Q These long-term kinetic tests, there's already been testimony in this case about them by various other witnesses. I think they're sometimes referred to as "humidity cell tests"; is that correct?

A That's another name for them.

Q But that's the same thing or you're talking about the same kind of test?

A There are some differences in the setup of the test between what is often referred to as a humidity cell test versus a column test, but the procedure is the same.

Q Okay. In this case as you proceed with your discussion of the interpretation of the results you're talking about the long-term kinetic test that Geochimica performed as documented in the appendices that they provided in support of the permit application?

A Yes.
Q Okay. And how would you summarize the test results with respect to different type -- rock types?
A There were sort of three main things which I noticed in the data and these are based on the 50 to 70 weeks data which they sent to me in response to that list of questions that we sent as part of the review process. I mention that because that's a longer time period than the data that was in the original permit.
Q Okay. The original application?
A Yeah, the original application. What I noticed was that country rocks -- these are the siltstone, sandstones and hornfels. If they have an NNP -- an "NNP" mean net neutralization potential; this is that difference between the acid potential and the neutralization potential. Now, if that value is less than zero, that means we've got more acid potential than the neutralization and we would expect an acidic leachate. If it's greater than zero, we would expect the opposite potential --
Q That it would neutralize?
A Neutralize or a neutral solution of the leachate. So what I noticed was country rocks with this net neutralization potential with less than minus 20 produced acid. There were actually a few tests which had negative values, but over the time frames which I looked at as shown by these three tests

here, the leachates had neutral pH's and they also had positive values of alkalinity. But the alkalinity is important because that represents the capacity of the water to neutralize acid. So if that's being produced, that means we're producing -- the leachate has an excess capacity to consume or buffer acidity. Now, we would expect all of these rocks based on these negative values to produce acid, but in fact only if they're less than about minus 20 do they actually produce an acidic leachate.

Q Okay. Just to make clear, I mean the normal expectation using this net neutralization potential is that if it's less than zero the expectation is that would -- rock would generate acid; correct?

A Yes.

Q And you're saying that for this category of rock there's only the country rock with the NNP that were less than minus 20 actually in fact produced acid; is that --

A Yes, it -- for the time frames that I'm talking about you're now -- some of these could potentially, if you went over very long time frames, may eventually produce acid, but --

Q Just with reference to the data covered by this table?

A Yeah, with reference to this, which actually, you know, represents probably a ten-fold increase over the natural system, we don't see acid being generated. The -- okay. The second point: country rocks with NNP's greater than

minus 20, as I mentioned before, produced neutral types of pH's and also produced positive values of alkalinity. The third point is that the intrusive rocks -- these are the ones I referred to as peridotites or ultramafic rocks -- over quite a wide range from negative -- 41.2 was the most negative one -- over to its positive range. None of these produced acid over the time frames of the test data that I looked at. These are summarized down here in this (indicating) bottom table, the rock types are referred to as peridotite, there's one called a pyroxonite and the other four are peridotites.

After 50 weeks of testing the pH values were all above neutral and also they generated fairly significant amounts of alkalinity. Now, this is -- was a little bit surprising, because these negative values -- we really would have expected to get some acidic leachates out of these; and yet, they -- and yet this does not happen, at least in these test data. Now, the explanation for that goes back to the fact about the mineralogical composition of the rocks themselves and the fact that these peridotites are comprised of the two minerals which are known to react quickly with acid, which are olivine and lizardite; two minerals which are generally accepted to actually provide some buffering capacity are major components of these two rock types. So that explains why when we would expect to get acid we don't.

Q Just to clarify something on this slide, there are two separate tables there -- is that correct? -- on this slide? Is the -- does the first table refer to test results for country rocks or intrusive rocks?

A The first table is country rocks, and the second table is the intrusives.

Q Okay. The peridotite?

A The peridotite, yes.

MR. REICHEL: Can we go to the next slide, please?

Q And I believe you just touched on this, but could you -- what's discussed on this slide 13? Is this essentially what you just said a moment ago?

A This is basically the same thing as I previously said. In the country rocks the silicates are not doing the buffering because they are not the types that can do that, but they do contain some calcite, calcium carbonate, which is the major component of things like limestone which do produce rapid and effective buffering of acidity. Now, these rocks have a small amount of this within them and apparently it's enough to prevent acid generation in many of these country rocks. Now, the ones which are -- have very negative NNP values do indeed produce acid; in other words, the calcite is not great enough to stop that. But in the rest of them apparently it is, at least over that 50- to 70-week time frame.

The second point which I touched on is those magnesium silicates. This is the olivine type minerals which I referred to. These are the components of that peridotite rock which are causing the buffering of the acidity; in other words, the neutralization of any acid that's being generated and also the positive production of alkalinity.

Q And again, the -- you touched on this a moment ago. The data that you've just been discussing was from these long-term kinetic tests that -- for the data you discussed extended over a period of 50 to 70 weeks; is that correct?

A Yes.

Q I believe you indicated that because of the nature of the test procedure it's intended to induce leaching; correct?

A Yes.

Q Induce acid formation?

A They are designed to speed it up to a rate which could be observable in sort of a laboratory time frame.

Q Okay. And so -- and you spoke earlier about what's the generally -- to your knowledge, what's the generally accepted relationship in terms of the amount of acceleration that occurs as a result of this test procedure in relation to what would be expected to exist in the field?

A The most -- well, probably the best description I've seen of that is in the ASTM standard for humidity cell testing.

ASTM is the American Society for Testing of Materials, which provides methods for testing of things like geological materials. Their description of the test says that it will accelerate the leaching or oxidation process by at least one order of magnitude, so that means a minimum of ten times. It could be higher than that. How much higher is difficult to say, but bottom end would be ten times beyond natural conditions.

Q So in this case if you're looking at long-term kinetic test procedures conducted in the range of 50 to 70 weeks, how would that relate to anticipated behavior of the rocks in the field?

A Well, if we take that literally then 10 times 50, 500 weeks; that's about ten years. So we're talking about a test period which is equivalent in the field to about a ten-year time frame.

Q And again, this is just sort of a rough relationship; correct?

A It's a rough relationship, yes.

Q Going on with the interpretation of the results of these tests that you've just described. Have you reached some implications or interpretations of those results as they relate to decisions about how the rocks in question should be managed at this site?

A Yes.

MR. REICHEL: Could you then go to the next slide, please?

Q There's a reference here to, "Management decision has been to our" -- what are you referring to as -- is this reflecting what is proposed in the permit application?

A Yes, it is.

Q And could you summarize the points that you've indicated on this slide in that regard?

A Yes. Well, the reason I put this in is because the purpose for doing a geochemical decision is to guide these types of decisions. Now we know that the rock that will be stored in the TDRSA will have an average NNP value of about minus 10. Now, none of the tests indicated acid generation at -- with rocks of that value of NNP, but there is the potential that they could do so if we get a different mix of rocks in there than what we might expect based on the test data. And also to insure that there's even less possibility of generated acid one of the procedures that the mine planning incorporates is to add limestone. Limestone is comprised of calcium carbonate predominantly, which is a strong and fast acid-buffering mineral.

Q Or neutralizing?

A Neutralizing, yes. And that will give the overall NNP to the TDRSA a positive value of a plus 10 value. Now, this is high enough that it is within the realm based on the test

data where acid generation was never observed in any of the tests. So this is something of an insurance factor to make sure that the TDRSA rocks not generate acid over their -- I think it's a seven-year lifetime. Now, the second bullet is the fact that water that is collected in the TDRSA will not be allowed to infiltrate or be disposed or discharged but instead it gets sent to a water treatment plant. The actual flow rate out of here is actually fairly low. I think the water balance shows something on the order of 10 to 14 gallons per minute, but that water will be collected and sent to a water treatment plant.

Q You're talking about the liquid projected to be collected from the TDRSA collection system?

A Yes; yes. And then the third point is that the TDRSA lifetime is identified as being about seven years before it is all used as backfill in the underground. And this seven-year time frame as we talked about before, if we compare that to our time frame for generating acidity, if we just say, "Well, if our test for 50 weeks is reflective of 500 weeks or ten years, we're now beyond the lifetime of the TDRSA." And based on our tests, long-term kinetic tests we would not expect acid to be generated within that seven-year time frame based on those tests. Now, this is all done within the context of some of the mining regulations which require a liner beneath the TDRSA, a leachate collection

system, a leak detection system, and also a cover. It's my understanding based on the mine plan that at about year four approximately 90 percent of the TDRSA will be covered on the top side preventing the inflow of water into the system.

So I think what I'm trying to summarize here is that there's a number of engineering and design considerations in the TDRSA that are all focused on either preventing or collecting the water from this system and making sure that it is not either acidic, or if it is -- or no matter what it is, it gets sent to a water treatment facility.

Q Okay. And again, it's your understanding that these various management decisions that you talked about for the TDRSA had some additional level of protection in the event that the --

MR. EGGAN: Objection; leading.

MR. REICHEL: I'm sorry. I'll restate it.

Q If the -- Dr. Eary, if the extrapolations from the kinetic tests that are reflected in the Geochimica analysis that you've been discussing, even if there is a greater leaching potential than we predicted based upon those results as you've interpreted them, does the mining plan as you understand it provide additional protections for that situation?

A Yes. I think all of these measures are all designed to protect or guard against the generation of acidic and metal

leaching within this TDRSA.

Q Doctor, I'd like to turn now to the third of the major -- four major issues that you identified earlier.

MR. REICHEL: Could we go to the next slide, please, number 15?

Q The heading on this slide refers to, "Water chemistry of mine drainage during mining." Could you summarize what you are attempting to convey on this slide?

A Yes, there's a conclusion in one of the geochemistry studies is that the -- or an analysis done based on modeling and extrapolation of the testing data that during mining the water that is collected in the underground workings will be in part derived from rocks which contain large amounts of sulfide. And this is the ore rocks referred to as semi-massive and massive sulfide. Those rocks are shown in the kinetic long-term test to produce acidic leachates; and therefore, within the mine we would expect that that drainage from the mine will likely be acidic, and along with that acidity will likely contain elevated concentrations of metals and also probably sulfate. Now, the -- one of the considerations in a geochemical assessment is what is the mitigation effort that will address a problem like this. And within the mine plan there is a description that indicates that this drainage water will be collected, pumped to the surface and then to the water treatment plant.

Q And we turn now to the fourth major issue regarding water chemistry of groundwater in the mine areas after mining ends.

MR. REICHEL: The next slide, please.

Q And how would you summarize your conclusions in this regard?

A After mining has ended and the system has been backfilled, there will still be some exposures of sulfides that have not been mined out. The mining, I think, will take out the vast majority of the sulfide, but there will still be some left in place. Now, that -- those sulfides would have weathered and oxidized during the mining time period. If there are any salts that were accumulated on those surfaces, when the mine is reflooded those salts will be flushed into the groundwater system and released. In combination there will also be alkaline salts from the backfill; that's from the limestone that was added to the TDRSA rock. And also the backfill, which is meant -- mixed with cement; the cement is also a strongly neutralizing agent because it's comprised of lime. In this case lime plus flyash, both of which are acid neutralizing.

Now, those salts will be released to the groundwater during reflooding; at least we would expect some amount of them to be released. And this will result or is predicted to result in fact that there will be some elevations in some solutes. In particular nickel and

sulfate I think are probably prime species that will be elevated. There may be others, but I think these are the ones which are the most likely to be released and not taken back out of solution by the neutralization processes.

Q In light of that, what do you understand the mining plan and the permit to contemplate in terms of management decisions to address those contingencies?

A My understanding is that after the mine has reflooded that there will be --

MR. REICHEL: Can you go to the next slide, please?

Q I'm sorry.

A Well, I'll back up a little bit to get into this slide. There's a couple of different -- a number of different things that are part of the management decisions that are incorporated into the mine plan. First of all, the reflooding. To continue the oxidation process of sulfides oxygen is required and this is oxygen which is dissolved in water, which is the only way for it get there after the mine has been reflooded. Now, there's a couple of different considerations going on here. One is that there is a considerable amount of neutralization capacity in the limestone that was added to the TDRSA rocks. There's also a fair amount in the cement that's been added to the other parts of the backfill. These neutralizers will likely

prevent continued production of acid in the short term at least, and probably also in the long term.

While there is still oxygen in that flooded water there should be some oxygen, at least initially, in that water until it's consumed by the oxidation processes. Also the water that comes into the system also contains concentrations of alkalinity which range from on the order of 30 to 80 milligrams per liter. Not tremendously high, but sort of moderate conditions which will also neutralize acidity. Now, the oxygen -- or the water which is flooded into the mine, as I said, will initially contain some oxygen. That will be consumed fairly quickly I would expect. And that will -- and once it is consumed there's no process which can continue the oxidation process of the sulfides.

And there a couple of indications that this should work well for this deposit based on its geologic and geochemical configuration. One is that data that I've seen from the deep groundwater and also the deep alluvial water is that they are oxygen deficient; in other words, as you go down in depth the waters become inoxic. What this means is that there are no paths or -- let me back up; one more point. When we look at the detailed mineralogy that was done as part of the geochemical studies there was not one instance where a weathering product was found in those

mineralogical analyses. By "weathering product" I mean an oxidation product of the sulfides. What this means; if there's no rapid conduits of oxygenated water through this system when it's in its natural state of hydrologic equilibrium, --

Q Let me interrupt you there just to elaborate on that. You're referring now to the detailed mineralogical analysis -- correct? -- that was part of the support for the geochemical review; is that correct?

A Yes; yes.

Q And you indicated that there is no -- it doesn't indicate weathering. Could you explain further what that means or -- in terms of -- could you explain that further?

A "Weathering" is a general term referring to the process of -- when minerals are exposed to air and water the original minerals are converted to a second form of mineral. That second form are what we call "weathering products" or secondary minerals; in other words, they formed from the alteration of the original minerals into this second type. Now, those types of processes are called "weathering" because they generally occur at the surface on the Earth down to some depth that water can penetrate. Now, in the case of this rock -- the peridotite in particular, but also the country rock as well to a lesser extent -- they contain a lot of iron in the form of silicates and iron oxides, and

none of these minerals, these primary minerals show any indication that they had been altered to secondary minerals by these weathering processes.

What this means is that the hydrologic system is not conveying oxygenated waters into the system at any rate that could bring the oxygenated water down into the orebody. And this orebody is somewhere between one and one and a half billion years old. It's had plenty of time to oxidize if it possibly could, but it never has. So this --

Q So based -- go ahead. I'm sorry.

A This tells me that oxygen just never penetrates this system. So the point is, is that once it's reflooded and that natural state is reestablished, then I would expect the same conditions to continue in the future.

Q And the first point of that, the fact that the rock has been there -- I think you said in excess of a billion years and shows no sign of weathering, what, if any, inference do you as a geologist draw from that about whether or not there exists features that provide conduits for infiltration of -- extensive infiltration of water from the surface to those rocks?

A If there was extensive infiltration and rapid flow of oxygenated water into this system, then we would either not have a deposit because it would have weathered away, or we would have a thick zone of these secondary weathering

products enveloping these sulfide minerals. This is commonly what's found in most volcanic types of deposits and is a common configuration. In this case we don't have that.

Q And so again I interrupted you there. The bottom line -- well, so the effect -- what would be the effect of the rapid reflooding of the mine in terms of leachate potential?

A The rapid reflooding of the mine will, first off, reduce the amount of air that's in the mine, which is a source of oxygen. The amount of oxygen that can be dissolved in water and actually then react with the sulfides is greatly diminished; in other words, the capacity of the system to cause oxidation of sulfides is greatly reduced compared to during mining when air is circulated through the system so that miners can work and have good air. Once it's reflooded if they reflood with water from a shallow system, that water will have some amount of oxygen dissolved into it. That water -- or that oxygen will be consumed. Once it's gone there's no mechanism to bring in more oxygen into the underground system, because the natural water in the water -- in the bedrock and also the deep alluvial doesn't contain any oxygen, so there's no way to get it into the mine.

Q Okay. And just to complete the discussion that you've outlined on this slide -- and this is addressed in your report as well, I believe -- what other management decisions are embodied in the mining plan and the permit as you

understand it with respect to this issue of water chemistry after the completion of mining?

A As I mentioned before, there is still some potential that some of these salts which washed off during the reflooding process -- nickel in particular I think is one that came out of the Geochimica studies, and sulfate I would expect as well -- those will be in solution. Now, even if oxygen is gone they probably will stay in solution. If they are in exceedence of whatever the water quality criteria are, there has been a management decision that there will be a monitoring program in place -- actually, that's probably part of the regulation as well -- and if the water quality criteria are exceeded then they will do a groundwater withdrawal and water treatment of that water and then reinjection of that water back into the subsurface. And that will continue, as I understand it, until the applicable criteria for water quality are met.

Q And with respect to these management decisions as you've described on this slide to address this issue of potential acid rock drainage and metal leaching in the underground water after the mine is -- ends, have you formed any opinion based upon your knowledge and experience as to whether or not you believe these mitigation -- excuse me -- these management measures that you've just described are likely to be effective in achieving their intended purpose?

A All of the management decisions that I've seen in the mine plan are logical alternatives and they should be effective, in my opinion.

Q Dr. Eary, have you prepared a slide that summarizes your overall conclusions in your permit review -- permit application review?

A Yes.

MR. REICHEL: Can we go to slide 18, please?

Q Could you walk us through those briefly?

A This is a summary of many of the points that we just went through. These are also sort of basic points of conclusion. The first one is that the geochemical characteristics of the rocks -- and that means development rock and underground rock exposures have been characterized by standard methods and these include chemical and physical testing and those are the things like the static tests, the pace pH, the whole rock chemistry, the mineralogy, et cetera. They've also done modeling to extrapolate the results from long-term kinetic tests to what might be expected in the future for leachates.

And this has been done for the TDRSA, the mine during mining, and also the mine underground after mining is -- has ended. The basic reactivities of the different rock types have been identified in the testing program. This is one of the major points that needs to be addressed

in a geochemical assessment and it's my opinion that this has been adequately done. The results of the testing have been incorporated into the mine plan and these are the management decisions which I referred to in the previous slides.

There are procedures to monitor and mitigate sources of acid production and these include what I call "passive types of systems, such as the addition of limestone. And active mitigation, which I would refer to as water collection, water treatment and then the mine reflooding; in other words, things that you actively do to manage the system. There is also a monitoring program outlined, which is also another part of the recommended and technical guidance documents for conducting geochemical assessments.

And finally, as I said before, the findings from the program are consistent with the major purpose of doing a geochemical assessment program, which is to guide the management decisions on how to deal with any environmental problems that might be predicted to occur and to have those within the mine plan so that they're laid out prior to mining.

Q And in that regard, your understanding of the primary purpose of this geochemical assessment; is it your understanding that the primary purpose of the geochemical

assessment is to precisely quantify --

MR. EGGAN: Your Honor, --

MR. REICHEL: I'm sorry.

MR. EGGAN: Again, we're leading here and --

MR. REICHEL: All right, Counsel.

Q Do you understand -- do you have any understanding, Dr. Eary, as to whether or not the primary purpose of the assessment -- geochemical assessment of this type is to precisely predict the concentrations of the -- numerically predict the extent of acid rock drainage and metals leaching?

A The purpose is to make those predictions with the understanding that there's a fairly high level of uncertainty in the actual numerical values which come out of those predictions. The real result that comes out is, is there a preponderance of information that indicates that certain solutes or dissolved components, would they be elevated or not. What that really comes down to is will acid conditions occur or will they not occur? If acid conditions are expected to occur, then we would expect to have elevated concentrations of metals. If they don't occur, then there's a much lower possibility of having elevated metal concentrations. Precisely what the numbers are is not so important as the recognition that those conditions could occur. And if they do occur, then the mine

plan needs to address those in terms of mitigation and monitoring programs.

Q In your opinion has the approach followed here in this mining permit application and the permit issued appropriately considered the potential for acid rock drainage and metal leaching?

A Yes.

Q And in your opinion do the -- does the approach taken here include the implementation of steps to reasonably minimize the potential of adverse environmental impact should acid rock drainage occur?

MR. HAYNES: Objection; lack of foundation. The witness has not been qualified to testify about the environmental effects of all of this. He's a geochemist. He's not been qualified to opine on whether there would be adverse environmental effects from acid rock drainage.

MR. REICHEL: Well, let me break this into two parts. Let me restate the question.

Q Dr. Eary, do you -- have you formed an opinion as to whether or not the management decisions and requirements that you talked that are embodied in the mining plan and the permit will reasonably minimize the potential for the release of sulfates and metals that might leach into groundwaters or surface waters outside --

MR. HAYNES: Same object --

Q -- outside the mine?

MR. HAYNES: I'm sorry. Same objection. The question of whether the management decisions which the witness has testified about in terms of groundwater, withdrawal water treatment systems -- he's not qualified to testify about those things and whether they will reasonably minimize adverse environmental effects. He isn't qualified to testify on those quite detailed and specific subject matters.

Q Dr. Eary, as a regular part of your work are you called upon and do you perform assessments of environmental fate and transport of contaminants that may be generated from sources such as this mine?

A Yes.

Q And have you -- do you have professional -- excuse me. Do you have educational training in -- relevant to that sort of analysis?

A Yes; that was a part of my training.

Q And have you in fact developed methods used to assess environmental fate and transport or evaluate environmental fate and transport of contaminants that -- of the type that could potentially be generated at this mine?

A Yes, I've done geochemical modeling studies which are directed at fate and transport of metals and acidity in groundwater systems.

Q Do you have -- how long have you been working in -- as a geochemist and mineralogist on mining related projects?
A I worked on a few mining projects when I worked for Pacific Northwest Laboratory, which was starting in 1984. But it's been mostly the last ten to twelve years that I have worked primarily on mining related projects.
Q And in the last ten to twelve years, if I understand you correctly, the bulk or the majority of your professional work has been involved in mining related projects?
A In the most recent few years, yes. Prior to that it was also industrial metals chemistry as well.
Q During the course of your professional work in this field have you had occasion to become familiar with the types of management practices and mitigation measures that you've discussed here and that are projected to be employed at this mine?
A Yes.
Q Have you had during the course of your career an opportunity to review the -- or look at the actual use of such systems? Restate the question. Have you had occasion to look or evaluate the ability of these kinds of management decisions, such as we're talking here, to achieve their desired purpose with respect to controlling releases of acid rock drainage and metals?
A Yes, that's been a part of a few studies. Yes.

MR. REICHEL: Your Honor, I believe there is a sufficient foundation for this witness to answer the question I posed.

MR. HAYNES: On the other hand, your Honor, we've had testimony from Dr. Miller -- Dr. Glen Miller who is a water resources engineer, water treatment engineer about the efficacy or lack thereof of the water treatment system that's proposed for this site, for this mine. We've had testimony from consultants for Kennecott concerning the -- or the relative efficacy of those systems to treat the water coming out of the mine. We've heard days of testimony about that by people who have qualifications much different from this witness. This witness may have qualifications as a geochemist, but I haven't heard any qualifications that he has expertise in how these water treatment systems work and that's the systems I think counsel is referring to in asking the question, on whether these systems will adequately reasonably minimize the pollution that's going to come from this mine. Fate and transport are one thing, but the systems to treat the substances coming out of the mine is quite a different thing. So I don't think the witness is qualified to opine on this issue.

MR. REICHEL: Well, your Honor, if there was some imprecision in my question I apologize, but it was not my intent to focus this on the efficacy of the wastewater

treatment itself. I recognize in retrospect that that is one of the mitigation measures, but the thrust of my question was not directed to the engineering aspects of the wastewater treatment, but rather to the practices including adding limestone to the development rock -- first characterizing the materials, adding limestone to them, storing them in a lined facility with a leachate collection system, a system to collect the -- any liquid that results and conveying it to a wastewater treatment plant. Similarly, the techniques of rapid reflooding and monitoring. I believe this witness -- there's an ample foundation for this witness to express his opinion, if he has one, on those subjects.

MR. HAYNES: Well, again, your Honor, if we're talking about whether the liner system for the TDRSA will work, this witness hasn't been qualified to testify about that. If the question is whether the management decisions which include the treatment of the acid water that's going to be generated by this mine is going to reasonably minimize the pollution that's going to occur, whether counsel meant that in his question or not, it's in there. And so we are going far beyond the expertise of this witness to opine on the geochemistry of the site and whether the tests that were performed and that continue to be performed are adequate to characterize the geochemistry of the site, which is what

this witness's expertise appears to be in.

MR. EGGAN: I would add, your Honor, we haven't even identified what is meant by the term "management decisions."

MR. REICHEL: I believe the prior testimony specifically identified a series of measures that he was referring to. But in the interest of moving this forward let me just restate a slightly different question.

JUDGE PATTERSON: All right.

Q Dr. Eary, in your -- based upon your professional training and experience, do you have an opinion as to whether the use of the systems for the use of the limestone addition to store development rock is a recognized technique in this kind of application for minimizing or reducing the potential for formation of acid rock drainage?

A Yes.

MR. HAYNES: Now I have a -- now I have an objection to the form of the question, because counsel has now asked a compound question: "Is the limestone going to minimize or is it going to reduce the formation?" And so I think counsel needs to break those questions into two parts; or at least break up the question.

Q Dr. Eary, do you have an opinion as to whether or not the use of limestone addition to stored development rock such as this is a recognized technique for reducing the potential

for the stored rock to generate acid and leach metals?
A Yes, it's a standard way to do that.
Q Do you have an opinion as to whether the technique of containing potentially acid-generating rock in a lined facility with a leak detection and leachate collection system is a recognized technique in the are for reducing the potential for releases of acid rock drainage or metals into the environment?
A Yes, I believe it is a standard engineering design for minimizing or preventing leakage.
Q Do you have an opinion as to whether or not the technique of rapidly reflooding mineworks after closure with water is or is not a recognized technique within the industry for minimizing the -- strike that -- for reducing the potential for continued long-term acid formation and metals leaching?
A Yes, that is a standard approach based on the theory that the exclusion of oxygen is a way to prevent sulfide oxidation.
Q Dr. Eary, in terms of -- I'd like to turn now to related subjects. You are aware and it's been alluded to that testimony has been presented in this case from other witnesses regarding an assessment of alternative assessment of the -- excuse me -- a geochemical review of the Eagle project mine permit application, specifically one done by Stratus Consulting? Are you aware of that?

A Yes.

Q And have you at our request reviewed that review or assessment and compared that to the geochemical work that was undertaken by Geochimica here?

A Yes.

Q I'd like to turn to slide 19 now. Does this outline some topics that you are prepared to discuss about the comparison of the modeling framework developed by Stratus or Dr. Maest to the geochemical review -- excuse me -- the geochemical analysis that was provided in support of the mining permit application?

MR. EGGAN: Your Honor, at this point I would like to interpose an objection to this testimony. Again, this is one of those issues that was not addressed in the recitation that was offered for this witness either by the MDEQ or by Kennecott. And so from our perspective this is yet another example of information that we would have very much benefitted from discovery on; and secondly, it is a matter of surprising us with testimony. Now, I will note that Mr. Reichel did provide an outline of this testimony to us and I don't know if it was yesterday or the day before. Was it Monday or Tuesday?

MR. HAYNES: Yesterday.

MR. EGGAN: Yesterday. And so I -- and I thanked him for that and I do thank him for that. However, it was

not part of the recitation. It was not understood by us that this witness would be offering this testimony and it comes as a surprise to us.

MR. HAYNES: Join in the objection.

MR. REICHEL: Your Honor, if I may respond. Our disclosure of witnesses did indicate that his expected testimony would be review of geochemistry studies characterizing the potential for acid rock drainage and metal leaching in the materials that would be mined in the Eagle project. This testimony -- it was clearly disclosed that he was an -- proffered as an expert in geochemistry and mineralogy. His testimony is within the scope of that description and clearly, your Honor, is my way of rebuttal to extensive testimony that was offered by the petitioners in their case in chief. I don't think there's any legitimate claim of surprise here.

MR. LEWIS: I agree with that, your Honor. Fairly disclosed of course in the DEQ's witness list that Mr. Eary, again, would be testifying as to -- it doesn't say just the geochemistry studies submitted with the mine permit application. It says "geochemistry studies." And at that time we should keep in mind that the so-called public comments had already been submitted to the DEQ; in fact sometime before these lists were presented. So I think any argument that there -- number one, that there wasn't some

kind of fair disclosure is disingenuous; and number two, certainly I don't think it's a fair argument also to say that they can bring Dr. Maest in here and criticize not only Geochimica's work but by inference Mr. Eary's work and not allow Mr. Eary to respond to that criticism.

MR. EGGAN: With respect to the recitation, your Honor, having looked at the recitation the title of Dr. Eary's report that was submitted on November 30th, 2006 was entitled, "Review of Geochemistry Studies for the Kennecott Eagle Project Permit Application." And so from that we gleaned that his testimony in this matter was going to relate to that report. The fact that he is now offering a much broader perspective than the title of his report would indicate really shouldn't auger against us; it should auger against the DEQ. Again, what's going on here is new information being provided to us again at the last minute in an effort to make it impossible for us to really prepare for a witness's cross-examination. That's our concern.

MR. REICHEL: Your Honor, with all due respect, I represent to the court that this is not new information. The testimony that we expect to offer from this witness does not reflect some new study conducted by this witness. There are no new data here. What he is prepared to discuss are data that are already in the record that everyone understood would be in the record, and to provide his expert review of

the analyses in question, and to -- in part to rebut testimony offered by the petitioners.

JUDGE PATTERSON: I agree and I'll with Mr. Reichel. This is proper rebuttal of testimony on the record of, I assume, principally through Dr. Maest which was presented by the petitioners. So I'll overrule the objection.

MR. EGGAN: Thank you, your Honor.

JUDGE PATTERSON: But before we do that, can we take a short break?

MR. REICHEL: Absolutely.

(Off the record)

Q Dr. Eary, before we took a break, we were starting onto a different topic where I was going to ask you some questions about your assessment of the geochemical review done by Stratus Consulting where the principal author was Dr. Maest. We have up on the screen slide 19. Does this slide identify the principle areas in which you were comparing the modeling framework used by Stratus with that used by Kennecott's kinetic consultants?

A Yes. There's four main areas that I looked at, which are listed here.

Q Okay. Could you please state what they are?

A The first one was the assumptions made about the types of rock which would be stored in the TDRSA. The second was a

comparison of the selection of leachate data which was used by Stratus and Kennecott in their modeling studies. Third is the effects of limestone on the leachate chemistry from the TDRSA. And fourth is the comparison of the results from those two studies -- two modeling studies.

Q Okay. I'd like to ask you to turn now to the first of those topics, the assumptions used in both analyses about the TDRSA rock types.

MR. REICHEL: Could we go to slide 20, please?

Q Could you briefly summarize your comparison of the assumptions that each -- were made in each study?

A In the Stratus model of the TDRSA, they included 5 percent in that total as semi-massive sulfide ore. This would mean that they would have to be -- Kennecott during its mining operation would have had to have misplaced somewhere between 19,000 and 33,000 tons of ore grade material. That's based on that maximum storage in the aboveground of 378 or 663 total. The Geochimica study assumes that there is no ore placed in the TDRSA and that it's comprised entirely of non-ore rocks which are the country and intrusive rocks, --

Q What is your -- go ahead. I'm sorry.

A -- which are not ore grade material.

Q What is your assessment of those differing assumptions?

A It seems unlikely to me that the miners would misplace this amount of rock. There's no incentive to do that, because it

represents a lot, you know -- a large amount of money. And secondarily, the ore is quite distinctive from the development rock, either both the country rock and the intrusives. The ore has sulfides in it which have a brassy metallic appearance, which is distinctly different from rocks which do not contain sulfide. So I think -- and also the boundaries between ore and non-ore are described in the geologic report as being quite distinct. So I think that it's unlikely that there would be a misplacement of ore into the TDRSA. The reason this is important is that including the assumption of all of this semi-massive sulfide ore in the model of the TDRSA by Stratus we -- the Stratus model uses solution chemistries from those long-term leaching tests which are strongly acidic. So that causes the results to be substantially different from the Geochimica model, because of the inclusion of this assumed amount of rock type; that is, the ore material.

Q And in your professional opinion, is that assumption made by Stratus a reasonable one?

A It does not seem reasonable to me for this type of ore deposit.

Q Let's go to the next sub-topic, the "Selection of Leachate Data and Effects on Water Quality Predictions."

MR. REICHEL: Can we go to slide 21, please?

Q Now, in this -- you testified previously that the process

used in the geochemical analysis by Geochimica involved a question of using certain screening tests to then identify what types of information to use in the kinetic test data or kinetic test; is that correct?

A That's correct.

Q Could you explain or compare the approaches taken by Stratus on the one hand and Geochimica on the other with respect to which data -- leachate data they included in their respective analyses?

A The purpose of these modeling studies, both the Stratus and the Geochimica studies, were to predict the composition of the leachates from the TDRSA. Those predictions are based on the long-term kinetic test data. Now, the approach taken by Stratus was to select leachate data from a sample of in particular of country rock, which contained 1.4 percent sulfide. If we look at the distribution of data for country rocks, this represents 10 percent of the rocks that we would expect to be in a TDRSA. The other 90 percent of samples which have less than 1.4 percent were not included in the Stratus modeling approach, even though there are test data for those types of rocks.

Similarly for the intrusives, Stratus used one data from one test containing 2.4 percent sulfide or substantially more than median of 1.56. Data from all of the other tests which have lower sulfide contents, data from

the long-term tests, from all of those other experimental studies were not used in the Stratus model. In contrast, Geochimica used the averages of all of the testing data for both the country rocks and the intrusive rocks from samples which contained the range of sulfide contents that we would expect to be in the TDRSA. The next slide has a little bit better detail on this point.

MR. REICHEL: Could we go to slide 22, please?

Q Could you explain, Dr. Eary, how you put this slide together or how it relates to any previous graphs that are already part of the record?

A The background of this slide, this bar chart with the vertical it looks like sort of a gray-blue bars, this is a plot of the frequency distribution of different samples in terms of the sulfide content which is in this case called ST class. This background chart is from the phase two Appendix D-2 Geochimica report, and I believe it's page 24. Now, on top of this chart I have overlain these green bars reflecting the sulfide contents of the samples of country rock which were used in long-term leaching tests to illustrate the differences between the two approaches for selecting data for the models.

Q Okay. And what was the approach or what have you added to this slide to summarize or highlight the approach taken by Kennecott's consultant?

A The parts that I've added are these green vertical bars which represent the sulfide contents of all of the kinetic tests that were done on country rocks. I've also put these brackets indicating the classifications which -- excuse me -- Geochimica used to classify the different types of country rock. They classified them as either low sulfur with less than 1 percent or high sulfur with greater than 1 percent. In their modeling selection of data, they took the average of the compositions of all of the low sulfide tests and then they also averaged together four samples of high sulfide rock, which we used in the long-term kinetic test. So they have seven sets of data from the long-term kinetic tests, which is all of the kinetic tests for the country rocks. They, as I said, have an average for high sulfur and an average for low sulfur, and then they averaged those two averages to come up with a final solution composition. So the Kennecott selection of data is based on seven tests covering the bulk of the sulfide contents of the country rocks. The difference is that the Stratus test selected one sample shown by this vertical red line which contained that 2.- -- excuse me -- 1.4 percent sulfide content.

Q Based upon this comparison of the approaches taken by Geochimica on the one hand, Stratus on the other, what effect would this data selection or differing approaches to selecting data to use in the modeling projections have?

A By selecting only one data, one set of data from this column leaching test, the leachate has been -- that's used by Stratus ignores all of the other compositions that would actually be produced in the TDRSA from country rock leaching. So this biases the model to use only one set of data. And because this particular sample had the highest sulfide content, the results are biased to be more acidic and higher metal content than if the entire set had been used.

Q And these two approaches, which, in your professional opinion, provides -- in which of these two approaches which are better representative of the data as a whole?

A I think Geochimica's approach which considers all of the data is a better representation of what you would expect to be for the leachate, because their samples cover the vast majority of the rocks that we would expect to be in the TDRSA in terms of sulfide content, which is a major control of what the leachate composition would be expected to be.

Q That is, the predictions of each model?

A Yes.

Q Okay. I think you may have touched on this.

MR. REICHEL: Could we go to slide 23, please?

Q Could you explain what you've stated here?

A This is what we just talked about. This was my assessment. Geochimica used all of the relevant test data. And

remembering that the kinetic tests are designed to represent the rock leaching characteristics, and so samples are used in those tests which span its level of variability. Geochimica used all of that data and I believe that that gives a more thorough representation of all of the leaching characteristics of all rock types and sulfide contents that we would expect to be in the TDRSA. The net effect of that on the modeling results is that the Stratus model produces only results based on one leaching test, and it's a leaching test which represents only 10 percent of the rocks -- country rocks in the TDRSA, which I don't think is a representation of what we would expect to have and is not supported by considering all of the test data available.

Q Dr. Eary, I'd like to turn now to another topic where you indicated you compared the two modeling efforts, and that is with respect to the effects of limestone.

MR. REICHEL: Can we go to slide 24, please?

Q Could you summarize here your comparison of the approaches taken by the two documents?

A The Stratus model for the TDRSA did not include the acid neutralizing effect of limestone in its calculations. This contradicts what is actually stated in some of the guidance documents, in particular Maest, et al, 2005. One of the documents I referred to earlier, "Predicting Water Quality at Hard Rock Mines: Methods and Models, Uncertainties and

State-of-the-Art," which indicates clearly at this place and I think one other part of the report that the efficacy of the mitigation measures should also be tested using predictive models and later confirmed with active monitoring. What this means to me is that the mitigation measure of adding limestone should be considered in the modeling approach in terms of what its effect would be on the predicted water chemistry.

Q And again, Dr. Maest and Stratus did not do so here?

A No. They did not consider this within their model. The Geochimica model did include this process, the reactions with limestone in its water quality model. And this helps greatly to assess the effect of that sort of mitigation.

Q And so how would you summarize your overall assessment of the comparison of these two approaches?

MR. REICHEL: Could we go to slide 25, please?

A As outlined in the technical guidance documents that I looked at, the Geochimica model followed their recommendations. In contrast, the Stratus model represented only a small part of what we would expect to be in the TDRSA in terms of country rocks. And it ignores a known geochemical effect of limestone for mitigating acid generation and metal leaching.

Q I'd like to turn now to your comparison of the "Water Chemistry Model Results" predicted by Stratus and

Geochimica.

MR. REICHEL: Could we go to slide 26, please?

Q Could you, Dr. Eary, outline some of the points that you've noted in comparing the model results from Stratus with those from Geochimica?

A In tables three and four of the Stratus report, they provide the results of their modeling effort. One of the -- these points summarize my assessment of those results, and these are standard ways to assess a water quality prediction. First point is that the Stratus compositions were not complete. They had no pH, which is one of the primary indicators of acidity or not. There are no major cations. By major cations I refer to calcium, magnesium, sodium, potassium, key components of any water quality composition. Secondarily, the effects of solution speciation and mineral equilibria are not considered. By this I mean known processes of reactions between minerals, water and carbon dioxide in the air. These are known to effect water quality, but they were not included in the Stratus model. The third point is the Stratus results, when you look at the composition and compare the sum of the positively charged components of solution to the negatively charged components and solution, they differ by substantial amounts. And this is true for both the TDRSA solution and also the end of mining solution compositions.

Q And why should -- why does that matter?
A Looking at the charge balance is a standard way to assess the validity of a water quality and water chemistry. By definition, for reasons of thermodynamics and just by common sense, a solution could not have a positive or a negative charge. So the sum of the positively charged species have to equal the sum of the negatively charged species. You could expect there to be some small difference in those values like when you get it back from the laboratory, but generally we want to see those less than 10 percent. If they're greater than 10 percent, that means that the model has something wrong either in its inputs or something wrong in its calculation. Because it either has too many positively charged species in solution or too many engine, you know, one or the other. There's something missing. So this is a standard way to determine if a water composition is valid and chemically possible.
Q In other words, from a chemical standpoint, if you looked at the projections of the Stratus model, could the solution predicted by that model be expected to actually exist?
A No.
Q Now, you indicated earlier that there is some recognition that calculations of this kind with the positive and negative may not always be completely even; is that correct? To your knowledge, are there any recognized standards in the

literature for what a goal in terms of achieving this charged balance -- a reasonable goal would be?

A The general thought is about 10 percent or less. Sometimes maybe up to 15 percent if it's a concentrated solution, but generally less than 10 percent is the ideal. At that level, we can expect there to be some imprecision between different parts of the -- or different components of the water chemistry which probably don't make a big difference to its overall composition. In other words, we're not missing too much. If it starts to get greater than that, then we have to question the model and the model that's producing those types of results. And generally the procedure then is to go back to the model and try to figure out what part needs to be corrected.

Q And again, in this issue of sort of a standard or frame of reference as a goal, 10 to 15 percent, can you provide a citation to literature where that's reflected?

A Yes. Actually, I listed one down here. This is from Alpers and Nordstrom 1999, geochemical modeling of water-rock interactions in mining environments. Alpers and Nordstrom's are scientists with the U.S. Geological Survey. And they are leaders in the general field of geochemical modeling.

Q How would you -- have you compared the approach on this water chemistry of the model results performed by Stratus versus those of Geochimica?

A Yes.

MR. REICHEL: Could we go to the next slide, please?

Q How does that compare -- how does the water chemistry results predicted by Geochimica compare to those of Stratus?

A The Geochimica approach included pH. They included these known processes of solution speciation and mineral equilibria, which I referred to. These are the known reactions between minerals and water and carbon dioxide. When we look at its results, the charge imbalances are 2 percent for the TDRSA, which is quite good, 13 percent for the end of mining water, slightly higher than the 10 percent ideal, but not tremendously out of bounds for what we might expect. Overall assessment based when we compare the Stratus to the Geochimica results from their models, the key point is that the Stratus model produces a water chemistry which is incomplete. It's missing large parts of its probable chemistry composition and produces an invalid chemical -- invalid chemistry. And that refers to the charge imbalance. Now, when you see those sorts of things, it's extremely difficult to interpret how well that model could actually do a prediction, because we know there's something wrong with the result. And that's what I meant here by difficult to interpret the validity of its inputs and its calculation methods I think have to be called into

question.

Q And did you prepare a slide summarizing your overall comparison to modeling efforts by Stratus and Geochimica?

A Yes.

MR. REICHEL: Could we go to slide 28, please?

Q How would you sum up your opinions or assessment of the two competing approaches?

A Well, these -- this summary is directed at the major points that were in the first part of this presentation. The Stratus model includes incorrect assumptions about the rock types that will be stored in the TDRSA by assuming that there's some amount, a fairly large amount, of ore that would be misplaced in the TDRSA. In contrast, Geochimica included only non-ore rock types in the TDRSA, which I think is the correct approach. The Stratus model used only a selected subset of the leaching data and ignored most of the leaching data. And it produced an incomplete and invalid water chemistry as we talked about in the previous slide. In contrast, the Geochimica model included leaching data for all of the sulfide contents for both country rocks and intrusives. In other words, all of the long-term kinetic tests were used. It included some known processes of mineral water reactions, including the reaction with limestone and also the solution speciation, which is the dissolution of carbon dioxide into water. And it produced a

complete invalid water chemistries in terms of looking at its charge balance and overall chemical composition.

Q So in summary, which of the two modeling prediction efforts do you believe is more reliable and defensive?

A I believe the Geochimica model is more reliable based on its approach, its input data and its results.

MR. REICHEL: Your Honor, at this time I'd like to move for the admission of some exhibits. The first would be Respondent's Proposed Exhibits 48 and 49, which were the communications by Dr. Eary in April of 2006 where he identified some additional requests for clarification.

MR. EGGAN: No objection, Your Honor.

MR. HAYNES: No objection.

MR. LEWIS: No objection.

JUDGE PATTERSON: All right. No objection, those would be entered.

(Respondent's Exhibits 48 and 49 received)

MR. REICHEL: Next, Your Honor, I'd move for admission of Respondent's Proposed Exhibit 76, which was -- I'm sorry. I did it again. Respondent's Exhibit Number 70, which included the attachment supplemental information provided by Kennecott to the information request made by the DEQ as it relates to the questions; that is, questions two through 21; in Exhibit 67.

MR. HAYNES: Your Honor, I object to the admission

of this exhibit through this witness. The attachment is the testing program samples for phase one and phase two prepared by Geochimica, not prepared by this witness, prepared by Geochimica for Golder Associates. It's 207 pages long, 207 pages of tables of data. And the data were not prepared by this witness. They're not compiled by this witness, were not -- the tables weren't prepared by the witness. So I don't think there's been a proper foundation laid for this exhibit being admitted through this witness.

MR. REICHEL: Your Honor, as I think about it, it is possible that I don't need to offer this. I believe this exhibit with a different title may already be in evidence through Kennecott's witnesses. So I'll just move on from there.

JUDGE PATTERSON: Okay.

MR. REICHEL: I would move for admission of --

MR. EGGAN: Can we just clarify what just happened in terms of that Exhibit 70? Is it being withdrawn or --

MR. REICHEL: Well, I'm withdrawn my proffer of 70.

MR. EGGAN: Because you think it's admitted as a different exhibit?

MR. REICHEL: I believe it is.

MR. EGGAN: Okay.

MR. REICHEL: I'm not --

MR. LEWIS: I think that's identified as Attachment 1, is it not?

MR. REICHEL: Yes.

MR. LEWIS: And I believe that is, according to my records, admitted as Intervenor Number 18 just for reference, Counsel.

MR. HAYNES: Right. And I think it may have been admitted only for the limited purposes of showing that it was filed with the DEQ and not for its substance.

MR. LEWIS: No, I don't believe that's true. I think that was offered and admitted through Mr. Logdston separately.

MR. REICHEL: Yeah, I believe -- I believe that's correct. In any event, --

MR. LEWIS: In any event.

MR. REICHEL: -- to answer Mr. Eggan's question, I am now withdrawing my proffer of Respondent's 70.

MR. EGGAN: Thank you.

JUDGE PATTERSON: Okay.

MR. REICHEL: I would now move for admission of Respondent's Exhibit 76, which is the November 2006 report prepared by this witness.

MR. HAYNES: No objection.

MR. EGGAN: No objection.

MR. LEWIS: No objection.

JUDGE PATTERSON: Okay. No objection, that will be entered.

(Respondent's Exhibit 76 received)

MR. REICHEL: Finally, I move for admission solely for demonstrative purposes of Respondent's Exhibit 214, which is a series of slides that have been the subject -- or about which Dr. Eary has just testified.

MR. EGGAN: I'll restate the objection I've had to demonstrative evidence or documents being offered for this purpose.

JUDGE PATTERSON: Okay.

MR. HAYNES: And I'll join that objection.

JUDGE PATTERSON: And I'll make the same ruling I did before.

(Respondent's Exhibits 214 received)

MR. REICHEL: And with that, I will pass the witness.

JUDGE PATTERSON: Okay. Mr. Lewis, any direct?

MR. LEWIS: I will defer. Thank you, Your Honor.

JUDGE PATTERSON: Okay.

MR. EGGAN: Your Honor, on cross I think I'm going to lead off followed by Mr. Haynes.

JUDGE PATTERSON: Okay.

MR. EGGAN: Doctor, my name is Eric Eggan, and I represent some of the Petitioners in this matter primarily

on groundwater-related issues. But I do want to ask you some questions about your analysis in this case, even though some of them may relate to Part 632 issues.

CROSS-EXAMINATION

BY MR. EGGAN:

Q As we begin, I would like to ask you about the consultant work that you've done in the past. You've indicated in your outline and among your resume that you have worked for various companies on industrial projects in the past. What I'm curious about is, have any of those matters involved litigation?

A Yes.

Q Have you testified previously?

A Yes.

Q And in the cases that you've testified on, in how many of those, if you can give us some rough percentage, have you testified on behalf of the industry client versus an enforcement agency?

A They were -- I've testified once before, and it was for a mining company.

Q It was for a mining company?

A Yes. I'm sorry. Not industrial.

Q And what about the consultant services that you've provided in the past? Have they been primarily for -- and we'll break it -- we'll break it into two chunks, industrial and

then we'll go to mining. But in the industrial matters that you have consulted on, have they been primarily for industry or have they been for governmental entities?

A It's been a combination. it's been primarily industrial clients. If you put acid rain on the industrial side, then that was for a governmental agencies.

Q Okay. But if we leave out the acid rain, then it's probably primarily for industrial clients?

A Yes.

Q And does that relate to pollution that has occurred or allegations that there has been an impact on the environment?

A That was always part of it, yes.

Q Okay. And in the majority of those matters, you have provided consultant services to the industrial clients versus the government agency or the party impacted?

A That's true. I guess the exceptions to that was the work that I've done for the U.S. EPA for the nuclear waste site that I referred to early on.

Q Okay. Now, let's talk a little bit about the mine experience that you had. How much consultancy -- how much consultant work have you done in your career in mining matters? Was it 30? Is that what you said? Some 30 matters?

A About 30 different projects, yes.

Q And of that 30, how many of those would have been on behalf of the mining company?
A All of them.
Q Have you in the past worked for or done any consultant services for any Kennecott-related company?
A I currently have one project with Kennecott.
Q So in addition to this one?
A Yes. Well, that's one's with DEQ.
Q Good point. Good point. This one is for DEQ, but you also have currently ongoing another project for Kennecott?
A Yes.
Q And what is that project?
A It is a modeling project for a Kennecott Utah Copper for their tailing system at their Bingham Mine in Utah. This project started about one year ago, shortly after I joined MWH.
Q And was that an issue that you discussed or disclosed to the DEQ at the time you undertook that assignment, that consultancy?
A At the time that I took the --
Q At the time you undertook the consultancy with Kennecott Utah, did you disclose that to the Michigan Department of Environmental Quality?
A Yes.
Q Okay. And did you receive an opinion from them as to

whether or not there could be a potential conflict of interest?

A They indicated they did not think so.

Q So no one raised a concern that at the same time you were analyzing this matter for the MDEQ involving the Kennecott Eagle Mine project, no one raised a concern that you were at the same time being paid by Kennecott on another project?

A The work I did for the DEQ preceded this other Kennecott work.

Q Yeah.

A They did not -- they did not coincide.

Q I understand that. But you are here today and you are testifying on behalf of the MDEQ in a matter that you are to be independent on; am I right?

A I am testifying for DEQ, yes.

Q Yes. In a matter in which the MDEQ needs to at least evidence some form of independence; am I right?

A I believe so.

Q Okay. And yet you are presently under contract or involved in a consultancy with another Kennecott project?

A Yes; Kennecott Utah.

Q And that issue was never -- there was never a conflict of interest question raised about that by anyone at MDEQ?

A No.

Q No one said to you that may be an issue?

A When I raised it, they said they told me they did not believe that was a problem because of the separation in time and different companies.
Q How about MHW Americas, Inc.? Does that entity have a relationship in any other matter with Kennecott?
A I think we have one other project scheduled to start later this year. I'm sorry. Actually it's with Rio Tinto and not Kennecott.
Q Okay. But you and I understand that Rio Tinto is the --
A Yes, the owner; yes.
Q -- parent company of Kennecott Eagle?
A Yes; yes. That's why I lumped them together in my head, yes.
Q I understand. And what is that project to be?
A That is a baseline study for a proposed mining project in Arizona.
Q Was that issue disclosed to the MDEQ?
A No. I'm not involved in that project.
Q Okay. But the company that pays your salary is?
A Yes.
Q Do you have a process at your company for identifying potential conflicts of interest?
A We do.
Q And was the -- was your relationship with MDEQ on this project run through that conflict of interest check process?

A It was in part. The fact was is that I had done the work for DEQ when I worked for MFG prior to starting this other work with Kennecott. So I had already been involved with the Eagle project review prior to doing this other work. So I was, as I understood it, involved no matter what as to any potential conflict of interest might have been.

Q You have continued to have a contractual relationship with the State of Michigan since the beginning of your consultancy with them, I take it? You've signed a contract with them?

A I signed a contract specifically for this hearing.

Q You signed a contract I believe specifically for your consultancy to prepare the report and analyze the things that you analyzed, but it continued on until the time of this hearing; am I right?

A No. Actually, the contracts ended. The original one that I had with MFG ended back when I left or sometime before that when the work for that report preparation was completed. The work that I have done for this hearing was initiated I believe in April of this year.

Q So you have a separate contract now with the MDEQ?

A Yes; two contracts.

Q You have two contracts with MDEQ now?

A Yes.

Q What is the other one for?

A One was for preparation and testimony here. The second one was for the preparation of these slide presentation materials. I was told -- I asked if I could do a change request on the original contract. They said, no, it was actually more expeditious to have a separate contract.

Q And when you engaged in those contracts, was the issue re-raised about either the relationship that you have working as a consultant to Kennecott, was it raised in that context?

A Yes.

Q Okay. Was the relationship that your company has, MWH, with Kennecott raised at the time that you signed those contracts?

A Yes.

Q Who did you receive an opinion from?

A I think I talked to originally to Joe Maki and then secondarily with Mr. Reichel.

Q And both of them offered the opinion that there is no conflict of interest?

A I don't remember them saying that there was no conflict of interest. But basically since I had prepared the report, I was pretty much drawn into the procedure no matter what.

Q Well, it was apparently too late for them to go back and get somebody else. That's the problem; right?

A I don't know.

Q Okay. Your outline, in spite of -- in spite of being fairly detailed, offers no reference to the matter that you presently have pending with Kennecott, does it?
A The current project, you mean?
Q The current project.
A No.
Q In the mine projects that you've worked on -- and I think you said 30, and I apologize if I've asked this question previously. But in the mine projects that you have worked on, how many of those have been on behalf of the mine company?
A I think all of them.
Q I want to talk to you for a minute now about the rock at the Kennecott site. We can agree, can't we, that the rock that comes from the mine, all of it, whether it is ore or whether it's going to the TDRSA, all of it has to be managed as special handling?
A All the rock has some potential to create acid, which I think puts it into this special handling category.
Q Okay. So the answer to my question would be that all of the rock has to be handled as special handling, doesn't it?
A As it's termed in the reports, yes, in the mine plan.
Q Okay. And the reason that we're doing this is to manage the risk of acid rock drainage and metals leaching; am I right?
A Yes.

Q And even the waste rock, the rock that's going to go to the TDRSA, even that has to be managed as special handling, doesn't it?
A Yes. It goes into a special facility.
Q Okay. And again, this is to manage acid rock drainage and metals leaching; correct?
A The potential for those to happen.
Q In fact, Geochimica -- and I'm talking about Mr. Logdston now -- found that in two independent lines of testing -- and this is his testing -- 75 percent of all the rock tested has to be -- has to be handled as special handling waste rock; am I right?
A 75 percent of the rock has the potential to produce acid, so it falls into that category, yes.
Q Has to be managed as special handling waste rock in order to manage the risk of acid rock drainage and metals leaching; am I right?
A Yes; yes.
Q Okay. Now, as I listened to your testimony today, you offered some opinions related to acid rock drainage potential in the TDRSA and the neutralization that could come from the addition of limestone. I heard that?
A Yes.
Q That's what you talked about today. Now, we can agree really that -- and a lot of your testimony focused on acid

rock drainage, but there really is another issue here. In addition to acid rock drainage, we also have a concern about metals leaching. It's really a two-prong problem, isn't it?

A They're generally related.

Q They are related, but really it's two environmental problems we're talking about. We're talking about acid rock drainage as a critical issue; am I right?

A Yes.

Q And metals leaching; that's a separate concern, isn't it, when we're talking about the constituents that could potentially generate from the rock going into the TDRSA?

A For these particular rocks, no. The metal leaching is really related directly to the acid rock drainage.

Q So your contention, your testimony would be, that really they're not separate issues; that they're just one environmental problem in a single -- in a single issue that has to be managed as just a single issue?

A Yes. Because the potential for acid leads to the metal leaching.

Q Okay. Now, let's talk for a minute about the limestone treatment that you've discussed. You're familiar with the concept of armoring, aren't you?

A Yes.

Q Armoring in the context of the TDRSA and these particular rocks, armoring will limit somewhat the effectiveness of the

limestone addition to -- of the solution you offer, which is limestone?

A Not in this system, no.

Q Not in this system?

A No.

Q Explain why.

A Armoring most commonly occurs when the acid drainage is generated in one location and the limestone is in a downstream location. Probably the best example would be a drainage from a mine adit, which is acidic, and a limestone bed or drain is put someplace downstream to intercept it. At the point where the acid hits the limestone, you could have precipitation of minerals which armor the limestone. It's not an immediate effect, but it can take place over time. So in this case the TDRSA has the limestone in the same place as the rocks which have the potential to have acid drainage; in other words, they're not displaced in time and space. The second point is that when armoring occurs it effects both the sulfide and the limestone itself; in other words, the armoring can occur on the sulfide mineral faces as well as the limestone, so it's something of a counteracting effect on the armoring. And third, if we look at the long-term kinetic tests on the rocks which contain sulfide and yet produce alkalinity and neutral pH's for extended periods of time, the fact that we get positive and

large amounts of alkalinity being generated indicate that armoring is not effecting the efficacy of the neutralization process; in other words, the test data do not indicate that armoring occurs in these TDRSA-type rocks.

Q All right. I do want to ask you about that testing in a minute. Let me ask it a different way. We know from the testing that Geochimica did that limestone won't decrease the concentrations of some contaminants; am I right?

A That's true.

Q Okay. For example, did you see the -- did you see in Tables 2 and 3 of the Geochimica testing there were a couple of tables where they compared the development rock stockpile and the addition of lyme versus no -- versus no addition of lyme? Did you see that? I wonder if I showed these to you it might help you.

A I'm sorry. You said lyme or limestone?

Q Limestone. Yeah, limestone.

A Yes. Okay. I think I know what you --

Q Do you recall those questions? Let's make sure that we're talking about the right thing.

A I think I know what you're referring to.

MR. EGGAN: What I'm showing the witness is from page five of 11 of the November 7 of '05 report prepared by Geochimica, five of 11 and eight of 11.

Q And the first page, five of 11, is titled "Development Rock

Stockpile Model Results." And you've seen this?
A Yes.
Q And this shows Results with no limestone addition; am I right?
A That's correct.
Q And then there was some testing done where they actually added limestone to see what the impact would be on the constituents; am I right?
A Yes.
Q Okay. And if you want, you can have the charts but, as I look at the charts, it shows us that there was the additional of lyme had actually -- had no effect on potassium; is that right?
A Yes.
Q Correct?
A Yes.
Q Just say correct or not correct. Correct?
A Correct.
Q Okay. And likewise, there was no effect on sulfate; correct?
A Correct.
Q And there was no effect on aluminum; correct?
A Well, aluminum is so low that it doesn't really matter.
Q Okay. We'll skip aluminum. Antimony; no effect on antimony?

A Same thing; it's detection level.
Q Okay. Arsenic; no effect on the level of arsenic; correct?
A Correct.
Q No effect on barium; correct?
A Yeah. Once again, it's so low it doesn't matter.
Q Well, that's your opinion. But I guess from my perspective I'm just asking you if there was any impact on the addition of limestone in the amount of barium?
A No. It's so low it really doesn't make much difference in this case.
Q Boron?
A No. Boron would not be effected.
Q Okay. Cadmium?
A Again, these are detection levels. They don't really matter.
Q Okay. Cobalt?
A Again, so low it really -- they're really not high enough to have a chemical process effected.
Q Well, then why are they on the chart?
A Because this is the way to come up with a complete water chemistry.
Q I see. Lead, no impact; correct?
A Yeah. Lead, once again, we just don't see much leaching of lead out of these rocks.
Q No impact by the additional of limestone?

A No.
Q Manganese, no impact from the addition of limestone?
A It looks like there's a ten-fold increase -- or decrease.
Q In manganese?
A Yeah.
Q Oops. You're right. My mistake. Nickel?
A No change there.
Q This is a -- this is a nickel mine; no impact on nickel with the addition of limestone?
A Correct.
Q Selenium, same thing?
A Once again, yeah, it's really low.
Q It's very low but, again, no change based on the addition of limestone?
A Correct.
Q Okay.
MR. EGGAN: Barb, I wonder if you could project slide number 20 for me?
Q This is the slide that talks about how -- well, I'm looking at the assessment of assumptions, "The mine plan does not include placing ore in the TDRSA." Do you see that assessment of assumptions and the bullet point there?
A Yes.
Q My question is, let's talk about how ore ends up being taken off to a processing plan as ore versus how it ends up going

into the TDRSA. How is it that that process is actually accomplished in a mine like this?

A Well, rock coming from the mine is either termed to ore or non-ore, and it goes its appropriate places then.

Q I think that's the essence of my question. How is it -- is there some sort of scientific test that occurs with all of the rock to determine what is ore and what is waste rock?

A Depends on the mine. In some cases there is.

Q Well, let's talk about the mine that you're here testifying about. Do you know what the plan is at Kennecott at this particular mine?

A The plan that I've seen or the parts that I've read about indicate that it is done -- it'll probably be done based stope by stope visually.

Q So what we have is a human standing there pointing at that which is ore versus that which is waste; right?

A Is that a question?

Q Yes, it is. Is that what it is is we have a human standing there eyeballing it and deciding what is ore and what is waste?

A Yes. The mine geologist would have that.

Q Well, is there going to be a mine geologist standing as every stope is blown out and pointing to every single rock and saying, "This is ore and this is waste"?

A I don't know if they would be or not.

Q You don't know whether it's a geologist or not? It may be?
A Usually it would be a geologist that would mark out the ore zones prior to blasting.
Q Okay. But when the rock falls down into a big pile, who decides that?
A In this case it would be whoever's mining it.
Q Okay. It could be --
A The mine --
Q It could be one of the mining workers who's down there and he's got a -- what does he use? Does he use a hand shovel or does he use some other mechanical means?
A No. It would be equipment, I mean, machinery.
Q Probably something like a pay loader?
A Could be, yeah, one of the low profile ones.
Q Okay. So just to make sure you and I understand, this is not a surgical process, is it?
A I think in this case it probably is close to that because of the difference in the appearance of the ore versus non-ore.
Q I see. So we're going to have a human being standing there eyeballing it. We're going to have a pay loader picking it up. And you call that -- you call that a surgical process?
A I think in terms of extracting as much resource as possible, they will get as much ore as they can. And if they have --
Q Oh, it's certainly in their economic interest to take --
A And if they err in one direction or another, --

Q Sir --
A -- they will probably collect more non-ore than ore.
Q Just to make sure you and I are on the same page, I'm sure that it is in the mine's economic interest to collect as much ore as possible. That's how they make their money; right?
A Yes.
Q But we're not going to -- you're not going to sit here and tell the hearing officer that this is some sort of precise surgical process that is going to mean that some varying grades of ore or some high sulfate material isn't going to -- sulfide material isn't going to end up in the TDRSA, are you?
A We expect based on the rock data --
Q When you say "we," do you mean you and Kennecott, or what do you mean "we"?
A I'm talking in general.
Q I see.
A Based on -- I'll say, in my opinion, looking at the sulfide contents of the rock, there will be probably 10 percent of the country rock, which has a sulfide percent that is -- I don't know -- 1 ½ to about 2 ½ percent that's non-ore material. For the peridotite, there may be some non-ore grades that go up to a few percent, sulfide as well. I think when, if there is any direction in terms of mining,

that's likely that there is some non-ore that goes to the ore side rather than the other way around in order to make sure that they get as much resource as possible.

Q So with the surgical process, the surgical process is always going to end up with non-ore going to the place where the ore is, but it never ends up that ore ends up in the TDRSA? Is that what you're suggesting?

A I'm suggesting that I think that's unlikely.

MR. EGGAN: Barb, may I see slide number 16, please?

Q Doctor, I'm looking at the second bullet point on this particular slide. What it says is that,

"Acid salts from sulfide oxidation and alkaline salts from backfill mixed with cement and limestone will be released to groundwater during re-flooding, potentially resulting in elevated concentrations of some constituents, e.g., nickel and sulfide" -- excuse me -- "nickel and sulfate."

A couple of questions about that. Is it your testimony that when the backfill goes into the mine that there will at least initially be some potential releases?

A No. This is on the -- during the time of re-flooding.

Q Right. And that is what I'm -- that's what I mean.

A Okay.

Q I apologize if I'm being inartful. When the waste rock is

put back into the mine and the mine is being re-flooded -- okay? --

A Yes.

Q -- you were suggesting in this paragraph that there is at least the potential for some release of contaminated water?

A Yes. I think there's the potential for the wash off of salts from the mine walls themselves and alkaline salts from the backfills.

Q Do I understand your testimony to be that, after a certain time period there will be no more oxygen in the water and so there will be no more potential for acid mine drainage?

A In the re-flooded system, yes.

Q Okay. Were you asked to consider that issue by DEQ?

A No.

Q Okay. Did you consider whether the substances that are going into the mine as part of the re-flooding plan, as part of the closure plan, are inert? Will they be inert?

A Not -- do you mean the backfills?

Q I mean the backfill, yes.

A I would not call them inert.

Q What would you call them?

A I would call them -- they would have a leachate composition probably similar to what was predicted for the TDRSA.

Q Okay. Have you considered whether there is any potential for any of that material to escape the mine area after re-

flooding?
A No.
Q You haven't considered that at all?
A I've not read the hydrologic reports and I don't think I can.
Q You can't offer an opinion on that?
A Yeah, I can't offer an opinion on that.
Q Do you know anything about the surrounding aquifers on there, whether they're usable or not?
A I've read a little bit from the bedrock groundwater report which indicates it's probably not potable.
Q Well, you say "potable," but do you mean by humans, or do you mean by other species?
A I mean by humans. Those were the criteria that I remember seeing.
Q Did you consider that? Did you analysis that issue and reach any ultimate scientific conclusions?
A The only part of that which I considered was the alkalinity which is in that water and also its oxygen content.
Q I see. Okay. So you didn't reach any ultimate conclusions about the usability of those aquifers or --
A No.
Q At the time the mine is re-flooded, there's going to be some reactive rock in the walls of the mine, isn't there?
A That's what I meant by the potential for acid salts, yes.

Q Would there also be the potential for metals leaching?
A Yes, in association with those acid salts; yes.
Q Okay. And that goes back to that issue that you and I had about whether it's two problems or just one?
A Yes.
Q But in any event, as the mine is re-flooded, there's likely to be some reactivity from the walls of the mine itself?
A Yes, I believe there will be a wash-off process, what we're really talking about is the water coming, the flooding water coming in and washing the walls of the potential -- it would be acid-generating rock generating some acid and generating some metals leaching, I take it.
Q Those processes would have occurred while the mine was open. and the wash-off occurs as it's closed up and re-flooded, yes.
MR. EGGAN: Can we go to slide 12, please?
Q Doctor, in the upper table that you have here -- there are two tables here on slide 12, but in the upper table, don't we have 3 of the 7 samples producing acid?
A Yes, we do.
Q Okay. And how do you define acid? Is it a pH above 6.5?
A No. In this context, it's a pH less than 5.
Q I'm sorry. That's right; pH less than 5?
A Yes. And may I continue?
Q You may.

A Also generally associated with elevated sulfate.
Q Associated with elevated --
A Yes.
Q Okay. I'm curious as to the number of weeks of testing that you utilized in your study and -- or excuse me; the weeks that were utilized in this particular chart or these two charts. You used 50 to 70 weeks, but we know now we have much longer term testing, don't we?
A I saw allusions to that in some other testimonies, yes.
Q But you did not consider that additional testing period?
A I didn't have the data to consider.
Q You didn't have the data?
A No.
Q It wasn't provided to you?
A No.
Q So the additional data related to testing that occurred after that 70-week mark -- and my understanding is it goes up to almost 200 weeks now. You haven't seen that and don't have access to it?
A I do not.
Q Okay. Now, this particular -- these two particular charts, they really provide no information on metals leaching at all, do they?
A Metals leaching is related to the pH primarily so that it gives an indication of which solutions would have the

elevated metals and which would not.

Q Okay. Does it provide information on sulfate?

A Same; same relationship. The sulfate is derived from oxidation which is driven by sulfite oxidation.

Q Now, my understanding is that you didn't do any of your own modeling; is that correct?

A That's correct.

Q Okay. Essentially what you did was you looked at the data and looked at the modeling that was done by others and offered a critique of those -- of the models done by others.

A Yes.

Q And obviously you didn't collect your own data.

A No.

Q I take it you've never been to the mine site here.

A No.

Q So essentially your charge in what you did was you analyzed the work of others?

A Yes.

MR. EGGAN: I don't have any additional questions. Thank you, sir, but I believe my colleague will have some questions for you.

MR. HAYNES: Dr. Eary, my name is Jeff Haynes. I represent several of the Petitioners in this action. I have a couple of questions for you.

CROSS-EXAMINATION

BY MR. HAYNES:

Q Before we get there, Dr. Eary, you testified that you're a member of the Acid Drainage Technology Initiative Steering Committee; right?

A Yes.

Q And that's made up of people who have some either scientific or business interest in figuring out what's going on with acid drainage; correct?

A Yes.

Q So it seems to me that acid drainage, then, is a pretty significant problem for hard-rock mines; is that right?

A Yes, it is.

Q It is. We can all agree on that, can't we?

A I think we can.

Q You would agree with Dr. Maest and with Mr. Logdston that it's a serious problem?

A It is.

Q By the way, I noticed in your slides that on slide 5 you identified Mark Logdston as Dr. Logdston. He actually doesn't have a Ph.D., does he?

A Actually I think you're correct; he does not.

Q I just wanted to make sure that the record's clear on that. Dr. Eary, Exhibit 76 is your November 30, 2006 report prepared for the State; correct?

A Yes.
Q Now, I noticed that, at least on the copy I have, the exhibit or the report is dated November 30, 2006, but on some of the pages, at least in the printed copy I have, the footer shows a date of March 18, 2007. Which date are we dealing with here? Is it November 2006?
A Yes.
Q Okay. The report was updated in March of 2007?
A No, I think that was an auto --
Q That was a printing --
A -- auto date field --
Q Auto date? Okay. Good.
A -- or something like that when I opened it back up again to look at it.
Q If we could go to page 4 of this exhibit, and go down to the bottom of the page, I think page 4 is the end of your summary of your report, is it not, Dr. Eary?
A Yes.
Q And in the last paragraph you summarize your view of Mr. Logdston's work, and at the end of that paragraph you talk about "mitigation plans are expected to be adequate for minimizing potentials for acid drainage," et cetera, et cetera. And then you say, "Assuming that they will work as described in the mine plan." Do you see that?
A Yes.

Q So when you say that the mitigation plans are expected to be adequate, your assumption is that all of the mitigation plans will, in fact, work.
A In this context I meant the parts of the mitigation like water treatment and also liners and covers.
Q Right. So in order for those mitigations to be effective, they have to work. And that's not part of your expertise; you're just assuming that; correct?
A That's correct.
Q So for the serious problem we have of acid drainage here, we have to have systems above the ground that are going to work --
A Yes.
Q -- in order to prevent pollution, impairment or destruction of the air, water and other natural resources; right?
A Yes.
Q Let's go to page 5 of this report, section 1.1 in the third paragraph. And I just want to make sure that we're all dealing with the same proposal here. In the third sentence that starts "Below ground" -- do you see where I'm starting Dr. Eary?
A Yes. Right here (indicating)?
Q "Belowground mining will remove nearly all of the massive-sulfide ore, leaving behind only support pillars in small areas of unmineable ore." What's your basis for

saying that there are going to be support pillars left belowground?

A That I believe was my recollection from the mine plan.

Q I see. And, in fact, we know that there will be no support pillars there left; right? This is not a room and pillar mining project; right?

A I guess that you are probably correct. I don't remember seeing that exact terminology.

Q Okay. So when you say "support pillars," that's, in fact, incorrect.

A Okay.

Q and when you say "small areas of unmineable ore," when you say "unmineable ore," is that ore that's left around the sides of the mine cavity?

A I would assume that those are pockets of ore which are somewhat displaced from the main orebodies.

Q I see. And pockets of ore that have groundwater moving through them -- correct? -- presumably?

A They could have eventually, yes.

Q And so they would provide -- if they're ore, they have high sulfide content; correct?

A Yes.

Q And they would provide, in a sense food for the reaction that creates acid drainage; correct?

A No. The groundwater has no oxygen, so this can't happen.

Q Oh, the groundwater has no oxygen?
A Yes.
Q Zero?
A Yes.
Q Your opinion is that the groundwater at this site had zero dissolved oxygen?
A Based on the data I've seen, yes.
Q Now, let's -- Dr. Eary, I may be flipping back between various exhibits that are the Logdston studies and your slides. And so for purposes of ease of doing that, I'm not going to put the slides up on the screen, but let's just go -- I've got the pages and so do you, so let's walk through this as we need to. I'm looking at slide 7 which is your technical guidance documents. Do you have that?
A Yes, I've got it.
Q The fifth bullet there lists the -- or identifies the "Predicting Water Quality of the Hardrock Mines" paper that was authored by Ann Maest and others; correct?
A Yes.
Q So do you consider that paper to be one of the technical guidance documents for purposes of predicting acid mine drainage?
A Yes.
Q Now, you've reviewed, haven't -- you say you've reviewed the various reports prepared by Mr. Logdston including

appendix -- what is not appendix D-5 which is the "Post Re-flooded Mine Water Chemistry"? I'm sorry. Do you remember that? That's on side 5?

A Yes.

Q and in that document Mr. Logdston attempted to predict post-mining water quality. Is that a fair -- is that an accurate statement?

A His prediction is actually incremental change in water quality.

Q All right. But, I mean, he was -- the purpose of preparing the document was to try to predict the water quality after the mine was re-flooded, --

A Yes, that's the general idea.

Q -- irrespective of what the conclusions were; right?

A Yes.

Q And you understand, don't you, that in preparing that prediction, Mr. Logdston did not -- well, he used various portions or the mine and the rock around the mind to try to predict post-mining water quality; right?

A Yes; yes.

Q But you know that he didn't use any development rock in that calculation; is that right?

A I believe he used the mine wall --

Q The mine walls?

A -- as the basis for the calculation.

Q But not the development rock?
A Yes.
Q Now, on slide 6 which Mr. Eggan asked you about a few months ago, one of the things you say on slide 6 is that the primary purpose of a geochemical assessment program is to guide management decisions; right?
A Yes.
Q That is, the work you're doing is going to be used by others to figure out how they're going to fix this problem with acid drainage; correct?
A Yes. It's directed at designing those mitigation efforts.
Q At least that's what you would expect anyway; correct?
A Yes.
Q Now, if there was a prediction of acid drainage that predicts small exceedances of water quality standards, would the management decisions for mitigating those exceedances be different from management decisions that would have to deal with large exceedances of water quality standards? That is, if you have a small exceedance here (indicating) would the management decisions for that small exceedance be different from the larger exceedance of water quality standards?
A Are we just hypothesizing here or --
Q I'm asking -- yeah, we're hypothesizing.
A They would be different, I would think, in some ways at least.

Q And if you again -- again, in a hypothetical sense, if a mine exceeded standards, say, by orders of magnitude over -- in one prediction versus another prediction where you had maybe a tenfold increase, would that again tend to change the management decisions?

A Not necessarily. There would still have to be a decision made that something would have to be done to mitigate the effect. The extent of the steps taken might be different.

Q I see. But there would be a change, obviously, in how the really heavily contaminated water would be managed versus the lightly contaminated water?

A Potentially, yes.

Q One slide 9, Dr. Eary, you say in the first bullet the samples that Mr. Logdston took were representative of all major rock types and ranges of sulfide contents. Do you see that?

A Yes.

MR. HAYNES: Could we put up, please, DEQ Exhibit 25?

Q Well, Dr. Eary, we may have to do this the old-fashioned way. DEQ Exhibit 25 is the mining permit application Volume I which you've reviewed, haven't you?

A Yes, I've read that.

Q Okay. I have a copy that has some markings on it, but I don't think the markings are going to change my question.

Just so that everybody can follow along, this is DEQ Exhibit 25. It's the 35th page electronically of the 183 pages in this exhibit, but it's page 16 of the document. Dr. Eary, on page 16 -- this is the mining permit application, Volume I.

A Yes.

Q And the page 15 of the text starts in section 4.2.5, "Geology and Ore Resources." Do you see that?

A Uh-huh; yes.

Q And then page 16 has, in my copy at least, a black and white version of the orebody with various boreholes around it. Do you see that?

A Yes.

Q And then the text immediately beneath that illustration which is illustration 4.1 says:

> "The sulfide mineralization is divided into massive (greater than 80 percent sulfide), semi-massive (30 to 80 percent sulfide) and disseminated (less than 30 percent sulfide) types." Do you see that?

A Yes.

Q All right. And "disseminated" means the peridotite; correct? Is that your understanding of that?

A All of the ore is contained within peridotite.

Q Oh, okay. But we have the massive sulfide, which is greater than 80 percent sulfide; right?

A Yes.
Q And the semi-massive is 30 to 80 percent; right?
A Yes.
Q And then the remaining peridotite is less than 30 percent sulfide -- or up to 30 percent sulfide; right?
A That's what it said there, yes.
Q You have no reason to disbelieve that, do you?
A No.
Q So the peridotite contains up to 30 percent -- the peridotite that's not the massive or semi-massive sulfide contains up to 30 percent sulfide; right?
A Yes.
Q And that would translate, wouldn't it, to up to 10 percent sulfur content?
A Sulfide's sulfur; yes.
MR. HAYNES: So, now, can we turn, I hope, to DEQ Exhibit 27?
MR. REICHEL: Excuse me, Mr. Haynes, it would be of assistance, we could probably project it.
MR. HAYNES: Can you project it?
MR. REICHEL: 27?
MR. HAYNES: Yeah. That would be great.
(Off the record)
Q DEQ Exhibit 27 is the Appendix D-1, if can just go to the next page just to identify this for the record, the Phase I

Eagle Project Geochemistry Study, you've reviewed this, haven't you, Dr. Eary?

A Yes.

Q And this Appendix D-1 is Mr. Logdston's initial testing; right?

A Yes, the Phase I testing.

Q If we could go to the 22nd page of this document which is page 14, and if we look at -- if we look at section 3.3 in third paragraph in the last two sentences, the second to the last sentence of that paragraph says, "The four mineralized peridotite samples reported total sulfur values of a few percent, 2.4 to 3.7, weight percent." Do you see that?

A Yes.

Q Now, if we agree that the peridotite contains up to 30 percent sulfide and therefore up to 10 percent sulfur and the four samples reported by Mr. Logdston show a percent from 2.4 to 3.7, we, in fact, don't have a representative range of sulfide contents of all the major rock types, do we?

A There were tests done on peridotite samples with higher sulfide contents, but they were classified as ore.

Q Classified as ore?

A Yes.

Q I see. So -- but we don't have any tests on peridotite that contains up to 10 percent sulfur, do we?

A I think there's one at 12 percent.
Q At 12 percent?
A Yeah, I --
Q But it's not reported here.
A I think it's Phase II. It was listed as a semi-massive sample.
Q Not peridotite?
A The semi-massive is contained within a peridotite host.
Q All right. Well, let's mince words here 'cause we have to be careful. There's massive sulfide which is one rock type; correct? Right?
A That's an ore type, yes.
Q But you say "all major rock types" here. I'm talking about -- this is your language.
A Yes.
Q A major rock type is the massive sulfide; correct?
A Yes.
Q Another major rock type is the semi-massive sulfide; correct?
A Yes.
Q Another major rock type is the peridotite not contained in the first two; correct?
A The first two are comprised within a matrix of peridotite.
Q I'm talking about the leftover peridotite not in the massive but the semi-massive.

A Okay. Yes. I agree.
Q That's a major rock type; correct?
A Yes.
Q And then there's the development rock which is another major rock type?
A Yes.
Q Right? So what we don't have here is testing of the peridotite, the leftover peridotite, if we can use that phrase, that contains anything higher than 3.7 percent sulfur.
A No. This leftover peridotite is ore material.
Q Oh, I see. They're going to mine all the peridotite.
A No, only of the high sulfide.
Q And we don't have any tests of that, do we? We have tests that go up to 3.7; correct?
A No, there were tests that would -- I'm sorry. Which type of tests are you talking about? AVA tests?
Q You say the samples were representative of all major rock types.
A Yes; that's correct. All major rock types that will be stored in the TDRSA.
Q Oh, I see.
A Screening-type tests like this are specific to materials that will be stored for extended periods of time.
Q So we should amend your statement on page 9 of your slides

to say, "Samples are representative of all major rock types that will be stored in the TDRSA"?

A Yes.

Q That's a more accurate statement than what you said here?

A That's correct. The first paragraph --

Q I'm done. Thank you.

A -- gives the specifics on that --

Q Wait. Wait. I'm done with my question.

A -- on that problem.

JUDGE PATTERSON: You can only respond to questions, Doctor.

Q You've answered it. I'm going to go on to the next question. Now, Dr. Eary, again on page 9 of your slides, the second bullet says, "The numbers of samples on a per-mass basis of development rock" -- I'm not going to go in that direction. All right. Let's go now to slide 11. Do you have that?

A Yes.

Q The long-term kinetic tests, the second sentence you say: "It is generally accepted that laboratory kinetic tests accelerate the acid-generation process by at least ten times compared to most field conditions." Do you see that?

A Yes.

Q When you say, "It is generally accepted," to whom are you referring that it's generally accepted? By whom?

A Geochemists and people who carry out these type of tests and design them.
Q Is that general acceptance published somewhere in the literature? Could I go somewhere and look at up?
A Yes. You could look that up in the procedure for the testing itself. It's ASTM Method D5744-96(2001).
Q And I think you testified that in your view the ASTM standard specifies that the kinetic tests have a floor or ten times compared to the field; right? That is, it's ten times or more?
A The words used in the ASTM say "at least" or something to that effect, "at least one order of magnitude."
Q And is it your view that the ASTM standards are accepted by all geochemists in the field?
A I'd say in general, yes.
Q If we can turn to slide 12, Mr. Eggan asked you about the additional data that has been compiled on Mr. Logdston since the data that you reviewed here, which is the 50 to 70 week tests. Do you remember those questions?
A Yes.
Q And you're aware that we now have data that stretches into 200 weeks or so; correct?
A I believe I saw a slide indicating that in one of the previous testimonies.
Q Have you asked to see that more recent data?

A I never knew that it existed.
Q Nobody from the DEQ has given it to you?
A No.
Q Nobody from the DEQ has asked you to evaluate it?
A No.
Q In your view, would it be important to evaluate that additional data in order to testify today?
A I don't think it matters a tremendous amount because the 50 to 70 weeks is actually much longer than usual. And if we consider the order of magnitude of 10 times, then we are already talking about a very long time period.
Q Right. And if the order of magnitude is -- if a responsible geochemist were to consider the order of magnitude to be less than ten times, then the additional data might be -- would be important, wouldn't it?
A Yes, if that were the conjecture.
Q Or the opinion of a responsible geochemist?
A Yes.
Q If we can turn to slide 15, Dr. Eary, you say in slide 15 that:

"The exposure of the semi-massive and massive sulfide in the underground workings will results in production of acidic leachates"; in other words, contaminated water; right?

A Yes.

Q When you prepared your November 30, 2006 report, DEQ Exhibit 76, that report evaluated the work by Mr. Logdston which assumed a certain height of the crown pillar, didn't it? Well, let me back up. Do you know what I mean by the crown pillar?

A Yes.

Q The crown pillar is the portion of the rock that sits above -- is above the mine; correct?

A Yes.

Q And do you know what the height of the crown pillar was when Mr. Logdston was doing his tests?

A I don't remember the numbers.

Q Do you know that the height of the crown pillar has changed over time?

A No, I'm not aware of that or how much.

Q If the height originally was at -- well, if the elevation of the crown pillar that was originally proposed was at 353 meters --

A Okay.

Q -- and now it's a 323 --

MR. LEWIS: 327, Counsel.

MR. HAYNES: Thank you, Counsel.

Q -- 327; that is, the crown pillar height was increased by some 20 -- about 30 meters give or take; right?

A Okay.

Q Do you understand that?
A Yes.
Q I mean, have you seen that somewhere?
A I know there was some discussion of that in something that I read, but I don't remember the precise numbers, but I --
Q But as far as know, Mr. Logdston's tests dealt with a mine that had a crown pillar at the height of 353 meters?
A Yes. It would have been specific to the original mine permit application.
Q Yes. Okay. And so when the -- and the crown pillar's now -- the height has been increased by, give or take, 30 meters.
A Uh-huh (affirmative).
Q And the crown pillar contains, as you know -- with that increased height, the crown pillar contains more of the ore than it used to with that increase in height. Is that a fair assumption?
A In volume, yes.
Q In volume. So now, with an increased crown pillar we will have more ore exposed to weathering; correct? Water coming through it, exposed to -- groundwater coming through it, groundwater that presumably had oxygen in it; right?
A No, I don't believe there would be any oxygen in the water that comes through it. There would be oxygen within the mine workings.

Q Okay. But more -- but the crown pillar with its increased height will have more ore exposed to groundwater flowing through it; right?

A I'm not certain because that would depend on the mine's plan to intersect the crown pillar on how it meets up.

Q I see. Would it be important, nevertheless, to conduct tests or to perform a model based upon the new crown pillar height of purposes of predicting water chemistry in the mine?

A One could do that, but I believe it would come up with the same net result.

Q If we could turn to slide 20, slide 20 talks about the assumption of the TDRSA rock types. And in this slide you criticize Stratus for assuming certain amounts of ore that would be, at least in Dr. Maest's view, contained in the TDRSA. Do you see that slide?

A Yes.

Q Mr. Eggan asked you some questions about how the ore is going to be separated from the waste rock in the mining process. Do you know that -- are you aware that the ore when it's going to be, for lack of a better word, shoveled out of the bottom of the stopes, it's going to be done remotely, with remote vehicles?

A No.

Q You don't know that?

A No.
Q And if it's going to be taken out with remote vehicles, there's going to be no humans standing down there in the stope areas telling the vehicles which portion of the rock to take as ore and which to take as waste rock. If it's done remotely, that's not going to happen, will it?
A It doesn't sound like it, no.
Q So if that's the way the ore is going to be taken out of the mine, who is going to decide and where will they decide which portion of this material that's been taken out of the blasted stopes and which will be development rock?
A I assume that would have been decided at the point of blasting where the blast positions are made and whether it's ore or not ore.
Q Okay. And, of course, the blasting will, when the blasts occur, will take out only ore or will take out only waste rock -- right? -- and the two won't mix. Is that what you're saying?
A I don't know about that.
Q It's certainly conceivable, in fact, probable that you'll have some -- that the operations here will have some mixing of the waste rock or the development rock and the ore during the blasting process. You would agree with me on that, wouldn't you?
A That could be a possibility, yes.

Q A probability. More likely than not?
A That?
Q You will have mixing of the waste rock and the ore during the blasting process when this material is removed by remote machines?
A I can't really comment on whether the blasting technology would do that or not.
Q So now there -- in other words, you really don't know whether there will be mixing of the waste rock and the ore during the blasting?
A I would presume there would not be, but I don't know for certain.
Q If we can go, Dr. Eary, to slide 26, slide 26, Dr. Eary -- excuse me. In slide 26 you criticized the Stratus geochemical model. Do you see that?
A Yes.
Q And is it your view that Mr. Logdston performed geochemical modeling in his work?
A Yes.
Q You understand that a great deal of what he did was mass balance modeling; right?
A Yes.
Q Which is not geochemical modeling, is it?
A It is.
Q You're saying the mass -- all right. Let me make sure we're

talking about the same thing. The mass balance model really is a spread sheet model where there are certain inputs that are modified numerically; right?

A It would be a spreadsheet based on the geochemical kinetic testing, yes.

Q Okay. Based upon the test results?

A Yes.

Q And a geochemical model would have chemical equations involved in the modeling, wouldn't they?

A Yes, certain types of geochemical models, yes.

Q And the type of geochemical model that you're criticizing Stratus for not having conducted would involve those kinds of equations; right?

A Yes.

Q But, in fact, Stratus didn't do that kind of geochemical modeling here, did they? Did Dr. Maest?

A Not that I can tell, no.

Q And neither did Mr. Logdston?

A Yes, he did.

Q The kind of geochemical modeling with chemical equations --

A Yes.

Q -- rather than a mass balance?

A He did both.

Q Let's turn to DEQ Exhibit 29, and if we could go to the 22nd page of this exhibit, and if we scroll down, please, to the

paragraph right before the title that starts -- by the way, Exhibit 29 is the -- I think it's Appendix D-5, yes, which is the "Post Re-flooded Mine Water Chemistry." Do you remember reading this document, Dr. Eary?

A Which appendix is this?

Q Appendix D-5.

A Yes.

Q Okay. And we're on page 2 of this document which is the technical memorandum from Mark Logdston to Jon Cherry dated January 19, 2006. And on the second page of this document which is this 22nd page of this exhibit, the first line of the paragraph before the title "Leachate Chemistry and Model Input" says, "The computational model begins with a mass-balance calculation." Do you see that?

A Yes.

Q So at least here Mr. Logdston is doing a mass-balance calculation rather than the geochemical modeling that you were talking about; right?

A Yes. I would still call that a geochemical model, but it does not involved chemical equations.

Q Dr. Eary, at the close of your direct examination Mr. Reichel asked you a series of questions about whether various management techniques would reduce the potential for acid generation. Do you recall those questions --

A Yes.

Q -- generally? One of them was whether limestone addition would reduce the potential for acid generation, and you said it would reduce it; correct?
A Yes.
Q The limestone addition, in your view, may reduce the potential for acid drainage, but it doesn't eliminate the potential, does it?
A No, it does not.
Q Mr. Reichel asked you and I believe you testified that containing the development rock in a facility such as the TDRSA will reduce the potential for acid drainage; correct?
A Loss of that drainage to the outside, yes.
Q Reduce the loss of drainage; right? But it doesn't eliminate that potential, does it?
A That would depend on the liner design which I don't feel qualified to give an opinion on.
Q You also said that the rapid re-flood of the mine will reduce the potential for continued long-term acid formation, if my notes are correct.
A Yes.
Q That's what you testified to?
A Yes.
Q But the rapid re-flooding of the mine does not eliminate the potential for long-term acid formation, does it?
A I believe it does in this case.

Q It reduces the potential for continued long-term acid formation to zero?

A Yes.

MR. HAYNES: Thank you, Dr. Eary. I have nothing further at this time.

REDIRECT EXAMINATION

BY MR. REICHEL:

Q Dr. Eary, at one point in your cross-examination by Mr. Haynes I believe he was asking you a question about one of your slides and whether or not -- let me look at my notes here. Just a moment.

(Counsel reviews notes)

Q I believe it had to do with one of your slides having to do with sampling and analysis and -- okay. It's slide 9 -- and a statement on that slide, the second bulleted item that states, "Samples are representative of all major rock types and ranges of sulfite contents." Do you recall that?

A Yes.

Q And there was some further discussion about what you intended to refer to, and I believe you indicated you intended the reference to be to rock types stored in the TDRSA. Do you recall saying that?

A Yes; that's correct.

Q But in responding to that question or an immediately following question, you attempted to elaborate on your

answer and were not given an opportunity to do so. Recognizing this was some minutes ago, can you recall --

A Yes.

Q -- what else you wanted to add on that point?

A Actually it was exactly what you just said. These sampling numbers and representation of the rock types is specific to the rocks which will be stored in the aboveground facility there, the TDRSA. It does not apply to ore materials which will not be stored on site.

Q During Mr. Eggan's cross-examination he asked you a series of questions relating to -- I believe referring -- he actually approached you and showed you what I believe was page 5 of 11 of the November 7th, 2005 report from Geochimica and asked you a series of questions about what that table or spreadsheet there indicated about whether or not a test run that involved the addition of limestone -- whether a column for certain parameters did or did not show an effect. Do you recall that?

A Yes.

Q To the extent that you indicated that -- in response to some of Mr. Eggan's questions that there was not an observed effect, does that in any way alter your basic conclusion about the effects of limestone in terms of the ability to reduce acid rock drainage?

A No, it doesn't.

Q Can you explain why?
A The effect of limestone is to provide a source of alkalinity and buffer the pH at a high level. Those are the major controls on what metals and what metal concentrations can be achieved in solution. For most of the metals, they don't actually reach concentrations high enough that the limestone has a strong effect on them. But the importance of the limestone is to maintain the neutral pH condition so that conditions of acidity which are the initial step in metal leaching don't occur. So it's really -- pH control is the importance of limestone.
Q During cross-examination, Mr. Eggan asked
A Yes series of questions about whether you individually with the firm with which you're now employed have ever been under contract to perform work for either Kennecott or Rio Tinto. Do you recall that line of questioning?
A Yes.
Q Let me ask you this, sir: First of all, in performing the review or contract to the DEQ, it resulted in the report that you prepared which has been admitted at Respondent's Exhibit 76, your November 30th, 2006 report. Was any of the analysis and conclusions you reached on that document affected in any way by any potential employment by you by Kennecott or any Kennecott-related entity?
A No, it wasn't. At the time I did the review I had never

worked for Kennecott on a contractual basis.

Q and moving forward in time to the work that you've done under contract in terms of appearing as a witness for the DEQ in this proceeding and preparing related documentation, has either your -- whatever contractual relationship you testified to that you have with a Kennecott-related entity, has that affected in any way the conclusions you reached or the opinions you've offered here today?

A No. My conclusions were reached during my review which preceded my work on the current Kennecott contract. They're also completely different systems in terms of chemistry. The current contract is with an existing operation, and the people are not any way connected that I know of.

Q And I believe he also asked you a question about a contractual relationship between the consulting firm for which you currently work and some Kennecott or Rio Tinto-related entity?

A Yes.

Q Again, has that relationship in any way affected either the analysis you performed for the DEQ or the opinions that you testified here to today?

A No. Again, my basic opinions were formed during my review which preceded all of those events.

MR. REICHEL: I have nothing further at this time.

MR. LEWIS: I don't have any questions, your

Honor.

MR. HAYNES: Nothing further.

MR. EGGAN: Just a question or two, Judge.

RECROSS-EXAMINATION

BY MR. EGGAN:

Q You are presently under contract with the State of Michigan, are you not?

A Yes.

Q And you signed a contract in April of this year, I take it?

A I think it was April, yes.

Q And that contract provided that you were to prepare this outline summary; am I right?

A No. That was to prepare -- actually, to review my materials from my review in preparation for this hearing.

Q So you were preparing for the hearing?

A Yes.

Q Okay. And that included review of materials that were prepared by Dr. Maest and Stratus?

A That came along later, but that was part of it as well.

Q But it was part of your contract and part of your agreement?

A Yes, it was.

Q And you only got the materials related to Ann Maest when?

A That was this spring as well. I think it was April or May.

Q Okay. And all during this time period, April or May, you had a contract with Kennecott -- a consultancy arrangement

with Kennecott Utah?

A Yes, it was in place at that time.

Q Very good. And your firm has this arrangement with Kennecott on another -- or with Rio Tinto on another project?

A Yes. I don't know if it's actually started yet, but I believe it will soon.

Q Okay. Well, there are certainly contract negotiations going on and people talking back and forth between the two entities?

A They must be.

MR. EGGAN: Very good. Nothing further, your Honor.

MR. LEWIS: Nothing further.

MR. REICHEL: Nothing further, your Honor.

JUDGE PATTERSON: Thank you, Doctor.

MR. REICHEL: Your Honor, as I indicated earlier in response to your inquiry, for scheduling reasons that we previously discussed, the next witness that we anticipate calling, James Janiczek -- he is James Janiczek. He is not available until Friday.

JUDGE PATTERSON: Okay. That was going to be my question. So I get a day off tomorrow?

MR. REICHEL: you're, from my standpoint, your Honor.

MR. HAYNES: So we're off for tomorrow.

MR. EGGAN: Sounds great.

JUDGE PATTERSON: Okay.

MR. EGGAN: Thank you.

(Proceedings adjourned at 4:59 p.m.)

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