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1                   Lansing, Michigan

2                   Monday, May 12, 2008 - 8:36 a.m.

3                   JUDGE PATTERSON: What do you have in store for me  
4 today?

5                   MR. EGGAN: More interesting facts from the world  
6 of the environment. So we are ready to go. Our first  
7 witness, your Honor, Dr. Glenn Miller.

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

10                  DR. MILLER: I do.

11                                 GLENN C. MILLER, PH.D.

12                  having been called by the Petitioner and sworn:

13                                 DIRECT EXAMINATION

14 BY MR. EGGAN:

15 Q     Good morning, Dr. Miller. Can you give your full name for  
16 the record, spelling your last name?

17 A     My name is Glenn Miller, M-i-l-l-e-r.

18 Q     And what is your occupation, sir?

19 A     I'm an environmental chemist, a professor at the University  
20 of Nevada-Reno.

21 Q     Let's begin by talking about your educational level. Tell  
22 the court what your educational history is after high  
23 school.

24 A     I got a bachelor of science in chemistry at the University  
25 of California-Santa Barbara and then went and got a Ph.D. in

1 agricultural chemistry at the University of California-  
2 Davis. I spent a year as a post-doctoral associate at the  
3 Environmental Protection Agency Research Lab in Athens,  
4 Georgia, and then I began teaching at the University of  
5 Nevada.

6 Q Now, I'm going to caution you that you should keep your  
7 voice up a little bit. Everything that we're saying is  
8 being recorded by our court reporting service, so it will be  
9 important to keep your voice up. Also, you're free to move  
10 about, but you are tethered a little bit by that -- by that  
11 cord that is a microphone. Okay? Now, tell me a little bit  
12 about your employment, your current employment.

13 A I've been at the University of Nevada for 30 years in  
14 various departmental affiliations but always associated with  
15 environmental chemistry, water and air quality and  
16 particularly some soil. I teach courses in environmental  
17 toxicology, environmental chemistry plus a variety of other  
18 courses on a special-topics basis.

19 Q Are you primarily a teaching professor?

20 A I have actually a slightly higher employment in research  
21 than teaching. It's about a 55/45 split.

22 Q 55 on the research side, 45 on the teaching side?

23 A That's correct.

24 Q Have you held any positions of leadership while at the  
25 University of Nevada?

1 A For ten years, up until about two years ago, I was director  
2 of the graduate program in environmental sciences and  
3 health. And I was also an interim director for the Center  
4 for Environmental Sciences and Engineering while it was  
5 transferring into a different organization called the  
6 Academy for the Environment.

7 Q The issues in this case focus on acid line drainage, water  
8 treatment issues. Do you teach courses that relate to those  
9 issues?

10 A The courses I teach in environmental analytical chemistry,  
11 how to measure things, and environmental chemistry and  
12 environmental toxicology all deal with transported fate and  
13 risk associated with environmental contaminants in the  
14 environment, including metals, a variety of other things. I  
15 have taught courses in mine waste remediation. We've had a  
16 special-topics course in pit lakes, which is a big issue in  
17 Nevada.

18 Q Talk for just a minute about pit lakes and why that may  
19 relate to this matter.

20 A Well, a pit lake is formed when you dig a hole that's deep  
21 enough and big enough that you intercept groundwater. And  
22 during mining that water is pumped out to keep the pit dry.  
23 When you're done mining you turn off the pumps and the water  
24 flows back in just from an underground source as the water  
25 table recovers. That pit lake -- those pit lakes are going

1 to be a very substantial portion of the water and --  
2 surface-water lakes in Nevada, and there's a fairly  
3 substantial concern that some of it will be contaminated;  
4 some that have been contaminated as they've evolved; some  
5 acidic, actually.

6 Q I see. And you've indicated you've taught courses that  
7 relate to treatment of waters?

8 A We had courses dealing with mine water treatment. I've  
9 written fairly extensively about that, focused on the area  
10 of research we have as a major component of my laboratory on  
11 sulfate-reducing bio reactors of treating acidic water.

12 Q Well, that would have been the next thing I wanted to ask  
13 you about, was the research that you have conducted. Has  
14 your research at the university focused on any particular  
15 area -- environmental area?

16 A We've been particularly interested over the -- since 1992,  
17 about 18 years, on acid mine drainage treatment and what are  
18 the various options for treating acidic water coming off the  
19 mine site. We have a site called the Leviathan Mine that  
20 we've been working on since that time, treating fairly  
21 acidic water and determining cost-effective methods for  
22 treating that water.

23 Q When we talk about acid mine drainage, what specifically are  
24 we talking about?

25 A Well, there's a lot of rock that has not experienced oxygen



1 or water, just a solid rock very deep in the earth. And as  
2 that rock is excavated and brought to the surface, it is  
3 exposed to oxygen and water and you get reactions occurring  
4 that generate sulfuric acid. And the sulfuric acid then  
5 dissolves a variety of constituents. So you have a water  
6 that's typically a pH of less than 4, so it's acidic and has  
7 a highly variable metal loading that can cause substantial  
8 impacts on receding waters.

9 Q And has that been a focus of your research?

10 A Yes. That has been the primary focus for the last 18 years  
11 -- 16 years.

12 Q And when we say your focus has been on acid mine drainage,  
13 has it also been on treatment of acid mine drainage?

14 A Right. It's been looking at methods that treat acidic  
15 water, which is considered one of the major environmental  
16 problems in the western United States in remote areas.

17 Q Why is that?

18 A Well, there's a lot of historic mines in the western U.S.  
19 when somebody with either a lot of equipment or not very  
20 much equipment digs a hole and penetrates this sulfide-  
21 containing rock and then walks away. The material that is  
22 left outside, as well as the underground workings, now are  
23 exposed to oxygen and can release acid. And that acid  
24 either goes into groundwater potentially or surface water  
25 and contaminates those sources and causes environmental

1 impacts.

2 Q Now, I think you said you've been at this since about 1992.  
3 Did your work involving mines begin prior to that?

4 A Well, we've been interested in mining issues in Nevada for  
5 quite some time because of Nevada's strong presence in gold  
6 mining particularly, silver and a little copper. There's  
7 been a lot of issues. Even though it's quite drier --  
8 quite a bit drier there than it is in Michigan, it's always  
9 a concern about how mining will affect surface water bodies.  
10 And so we've been interested in that for quite some time,  
11 having to do with cyanide, having to do with other  
12 constituents or at least at higher pH, alkaline pH, which is  
13 more typical of oxide mining of some gold ores.

14 Q Now, when you do this research, do you actually go to the  
15 mines themselves?

16 A Visited many mines over the years.

17 Q How many mines do you think you have visited?

18 A You know, I was thinking about that. Probably in excess of  
19 50 and maybe less than 100. I really never kept track of  
20 it, but it's been a lot.

21 Q Where have the mines been that you've conducted research in?

22 A I've gone to a lot of mines in Nevada as you might expect.  
23 I've been to mines in Idaho, several in Montana, British  
24 Columbia, Alaska, California we spent some time. There have  
25 been mines in Arizona; I've been to a mine in New Mexico,

1 Colorado, Utah. I think that's about it.

2 Q When you conduct research at a mine, how much time do you  
3 spend there?

4 A Well, it depends on what the situations are. We've worked  
5 at mines in Montana, Nevada. In Nevada we've spent a lot of  
6 time. That's been an ongoing project of this one area  
7 that's been funded extensively. Other mines you visit; you  
8 set up; you make recommendations and you don't spend much  
9 time there. And then others you go several times. And  
10 whatever the criteria, whatever the purpose of the visit and  
11 the research or the cleanup is, you spend the appropriate  
12 amount of time.

13 Q The mine involved in this situation is going to be a sulfide  
14 mine. Has your research included study of acid mine  
15 drainage at sulfide mines?

16 A Yes. That's the primary source of acidic water and sulfide  
17 mineral deposits. And so we have investigated rock that is  
18 not exactly this kind of rock, but similar enough to make  
19 generalized statements about it.

20 Q So when we talk about acid mine drainage, essentially we're  
21 talking about sulfide mines?

22 A Yes.

23 Q They're almost synonymous?

24 A That's correct.

25 Q What kind of water treatment issues do sulfide mines

1 present? What kind of challenges do they present?

2 A There's three components I generally look at when you treat  
3 water from a sulfide operation. The first is the acidity.  
4 Sometimes the most environmental impact is just the acidity.  
5 You haven't raised the pH. Somehow you can somehow \*  
6 (8:46:14) some process which raises the pH. You've got  
7 metals to deal with, which are -- metals in the other more -  
8 - perhaps more toxic constituents at the mine. And you've  
9 got to make sure that they're removed appropriately. And  
10 then finally there's oftentimes a source of very water-  
11 soluble constituents that may not be as toxic but carry a  
12 heavy salt load. And this is usually sulfate that you've  
13 got to deal with also. And there's three separate issues  
14 that you deal with. Generally you've got to consider them  
15 separately.

16 Q I see. Have you written any peer-reviewed papers on water  
17 quality issues related to mines?

18 A Yes. We've had several publications on water treatment.  
19 We've had some publication on pit lake water quality. We've  
20 written on gold mine effluent \* peaks (8:47:05), several  
21 since 1992, 1993.

22 Q Now, when you say "we," who is "we"?

23 A That's my laboratory and associates in my laboratory, mostly  
24 graduate students, undergraduates and post-doctoral  
25 associates.

1 Q So this is work that you have supervised. Have you actually  
2 done the writing on these articles?

3 A Yes.

4 Q Now, have these been peer-reviewed articles?

5 A Yes, they have.

6 Q I think you told me about an EPA-commissioned study that you  
7 did recently related to how to treat water in mining. Was  
8 that an article that you --

9 A It was a study. It's actually on our website, so it hasn't  
10 been in a journal per se, but it was peer reviewed. It was  
11 co-authored by Linda Figueroa at the Colorado School of  
12 Mines; John Pantano, formerly of our Atlantic Ritchfield;  
13 and Houston Kempton, who is a former mining industry  
14 consultant. We got together and came up with a document  
15 that was EPA-commissioned to discuss water treatment from  
16 hard rock mines, looking at all the options that might be  
17 available for treatment of water at hard rock mines.

18 Q Have you been invited to lecture on acid mine drainage or  
19 the treatment of water from sulfide mining operations?

20 A Yes. We have -- or I have given several talks over the  
21 years, probably averaging two a year since -- certainly in  
22 the last eight to ten years. I gave one a couple weeks ago.  
23 I gave one in China last year. I've given some at EPA  
24 conferences on mine water treatment, on pit lakes over the  
25 years.

1 Q Were you -- I'm sorry. I didn't mean to interrupt. Were  
2 you finished?

3 A Yes.

4 Q Okay. Were you invited by the Environmental Protection  
5 Agency to speak at those conferences?

6 A Yes; yes.

7 Q Who are the attendees at those kind of conferences?

8 A They're a variety of people. But most of the mining  
9 conferences I've gone to there's an academic representation.  
10 There's a lot of consultants to the mining industry. The  
11 mining industry is very strongly represented as are  
12 regulators, both state and federal regulators, the idea  
13 being to better understand how to treat some of these very  
14 difficult water -- water from mining.

15 Q And how to treat those waters?

16 A Yes.

17 Q Have you been invited to serve on any committees or  
18 scientific groups considering the environmental issues  
19 surrounding mining operations?

20 A We've been on certainly some of these conference -- or I  
21 have been on these conference planning sessions.

22 Q Dr. Miller, can I -- I just want to interrupt you.

23 A Go ahead.

24 Q This is an area that I think we need to know what your  
25 direct participation is. So you said "we," and that makes

1 me a little nervous.

2 A Okay. I will say -- I will use "I."

3 Q Okay.

4 A I have been involved in planning some of these conferences,  
5 on the conference organizing committee. I've been on,  
6 certainly Environmental Protection Agency waste-handling  
7 groups. This was back in 1996 to 1998. I've been on a  
8 larger project that was actually industry-directed -- or  
9 industry-funded called the Mining Minerals and Sustainable  
10 Development, MMSD, Project from 2000 to 2002. Actually Rio  
11 Tinto was one of the -- took one of the strong leadership  
12 roles in making sure that got funded and directed.

13 Q And Rio Tinto's relationship to this case is --

14 A Rio Tinto -- I think Kennecott is a subsidiary of Rio Tinto.

15 Q And this Mining Minerals Sustainable Development Committee  
16 related to mine-related issues and the environment?

17 A It was related to sustainable development of mining or  
18 mining in a sustainable community with the idea of Sir  
19 Robert Wilson, CEO of Rio Tinto, who said it best. He said  
20 to determine how you obtain a license to mine -- a social  
21 license to mine does the community want you in that  
22 particular area, and how do you make sure that you have that  
23 license to mine but you have the reputation and the ability  
24 to develop a mine and distribute the wealth, at least a  
25 portion of that wealth, to the community and then close the

1 mine in such a way that it doesn't cause anything but a  
2 positive contribution to that community.

3 Q Other committees?

4 A I was on a United Nations Environmental Program Committee  
5 developed to understand the risks associated with cyanide  
6 and how to reduce those risks. There is now a cyanide code  
7 that came out of that committee that has I think been  
8 recognized as a very positive contribution. It's an  
9 industry committee that says we want to have cyanide less  
10 feared in these communities, and so we need to develop a  
11 code to make sure that cyanide is used in a safe manner, for  
12 those companies that buy into the code.

13 Q Any other committees? I think you told me about a research  
14 committee for the National Academy of Science?

15 A I've been on a National Academy panel looking at energy in  
16 mining. I was involved in a section on acid mine drainage  
17 prevention and remediation. I've also been -- testified in  
18 front of a couple of National Academy panels and the  
19 National Research Council having to do with mining and  
20 mining regulation.

21 Q Do you serve on any boards of directors or organizations  
22 related to mining-related issues?

23 A I do. I serve on three primarily environmentally based  
24 organizations. One is called Earthworks. It's a national  
25 organization based in Washington, D.C., that is concerned



1 about sustainable practices in mining. It's working with  
2 the industry, developing basically codes for sustainable  
3 practices in mining. It's been a critic of the mining  
4 industry, I might add. I'm also on a board called Center  
5 for --

6 Q Well, let me ask you that. The Earthworks has been a critic  
7 of the mining industry. Do you consider yourself on one  
8 side or the other of these issues?

9 A I've been certainly concerned about environmental impacts of  
10 mining in Nevada and have made those comments before. I  
11 certainly don't oppose mining. If I -- if that was my goal  
12 in Nevada, I would have failed miserably. I'm actually  
13 quite proud of the mining industry in Nevada. It has  
14 evolved quite extensively over the last 25 years. So I'm  
15 certainly not an opponent of mining, although I still -- and  
16 I think I would be recognized as somewhat of a critic of the  
17 mining industry.

18 Q What other boards of directors do you serve on?

19 A I serve on the Center for Science and Public Participation.  
20 This is a board that is -- a group that is -- that provides  
21 technical advice to the non-governmental organizations at a  
22 reduced price, as well as various agencies; state, sometimes  
23 federal agencies; on mining issues primarily. Some other  
24 issues, but mining issues. I'm also a member of the board  
25 of the Great Basin Resource Watch, which is an organization

1 in Nevada that's similar to -- Earthworks has been, I think,  
2 a critic of the mine industry but not an opponent of the  
3 mine industry, but certainly providing -- expressing  
4 concerns about water quality issues and long-term legacy  
5 issues in some of the mines that have been created in the  
6 past.

7 Q That has been the essence of your research?

8 A Yes.

9 Q Have you ever designed a treatment system in a mine?

10 A We designed --

11 Q Now, you're going to say "we" again.

12 A Okay. I have -- well, I have designed, along with a post-  
13 doc in my lab, one system extensively with the system from  
14 EPA, but it was our design, as well as some engineering  
15 firms.

16 Q What was the name of that particular mine?

17 A It's a bio reactor at the Leviathan Mine, and it's actually  
18 in Alpine County, California. We've also been involved in  
19 design of a bio reactor system at the Nacimiento Mine, which  
20 is moving forward now. It's now in construction.

21 Q Where is the Nacimiento Mine?

22 A That's in New Mexico.

23 Q In New Mexico?

24 A New Mexico. We've developed pilot scale operations at the  
25 Equity Silver Mine in British Columbia for a mining company.

1 We've been involved in a variety of discussions on mine  
2 water treatment facilities in Montana, close to Helena,  
3 Montana, as well as systems in the Jamestown Mine in  
4 California. We did not exactly design those mines, but we  
5 were involved in discussions on appropriate design for some  
6 of those water treatment facilities.

7 Q That would have been a question I was going to go to next.  
8 In addition to the mines where you've actually participated  
9 in the design of the treatment system itself, have you been  
10 asked by others to review treatment systems at other mines  
11 in other parts of the country or the world?

12 A Yeah, fairly extensively, 'cause everyone wants to develop a  
13 water treatment system that is going to meet discharge  
14 standards. And I think everyone would like a magic bullet  
15 that does everything essentially for no price. And we've  
16 participated in extensive discussions with EPA state  
17 agencies on what the issues are at each of those sites.  
18 "Will this work? Maybe not, because of this reason," that  
19 sort of thing. "Or will this work? Probably it can be made  
20 to work if you do this extra thing." So we've been involved  
21 in extensive discussions of that sort.

22 Q Have you worked with state government regulators?

23 A Yes.

24 Q On water treatment and acid mine drainage issues?

25 A Yes.

1 Q Where?

2 A Well, in Nevada some of the earlier work we had was funded  
3 by the Nevada division of Environmental Protection as well  
4 as the California State Water Resources Control Board.  
5 We've worked in California on some -- again, at least  
6 discussions of operations. We have had reasonably good  
7 interactions with the State of Montana, certainly with the  
8 Environmental Protection Agency.

9 Q So you're used to working with regulators?

10 A Yes.

11 Q Have you ever been called upon to review and comment on  
12 water discharge permits in the course of your work?

13 A Well, that's something that I think everyone who looks at a  
14 mine plan is going to look at what those discharge  
15 requirements are. And so I've had, you know, many, many  
16 opportunities to look at discharge water issues, asking the  
17 questions, "Is this an appropriate level of treatment? Is  
18 it being treated at all? Are there any other options that  
19 we might have to improve the water quality in those  
20 discharges?"

21 Q I'm interesting in hearing whether you have worked with the  
22 industry. Have you consulted to members of the mining  
23 industry on mine projects and water treatment projects?

24 A We have. Our primary funder at the Leviathan Mine was  
25 Atlantic Richfield Company. They have the -- when they

1 bought Anaconda they had a lot of water quality treatment  
2 problems that they needed to deal with. We had a very --  
3 we've had a very close association with them for eight  
4 years. We've worked with Placer Dome (listening spot,  
5 8:59:38) now, a baric mining company.

6 Q So Placer Dome is the former owner of a mine and you worked  
7 with them?

8 A Yes.

9 Q Where is the mine that they --

10 A One was the Equity Silver Mine in British Columbia. Another  
11 one was Golden Sunlight in Montana. And in Nevada we've  
12 had, certainly, extensive interaction with mining companies,  
13 although the only funding we've gotten -- well, actually we  
14 worked with Placer Dome again at a -- one of the -- a mine  
15 called Bald Mountain where we looked at mercury issues.

16 Q Has your work on acid mine drainage and water treatment  
17 included -- has that work included a study of the various  
18 treatment systems involved at the Kennecott Mine Project  
19 here in Michigan?

20 A Could you repeat that?

21 Q Sure; yes. You've taken a look at the treatment system that  
22 is proposed by the Kennecott Eagle Minerals Company in this  
23 situation; the wastewater treatment plant and the various  
24 components of that particular treatment system?

25 A Yes.

1 Q And what I'm wondering is -- and we're going to talk about  
2 this in a minute. There are a number of components in that  
3 system that are kinds of treatment. And I'm wondering, have  
4 you worked with or are you familiar with those various kinds  
5 of treatment that are involved in the wastewater treatment  
6 plant system here?

7 A Yes.

8 Q Specifically precipitation systems?

9 A Yes.

10 Q You've worked with those and understand them?

11 A Yes.

12 Q Filtration systems?

13 A Yes.

14 Q Are you familiar with and have you studied membrane systems,  
15 reverse osmosis systems?

16 A Yes. These are uncommon, and these are not nearly as common  
17 as mine treatment systems. We've done some work -- we've  
18 actually published an article on membrane systems; not  
19 dealing with mining, but membrane systems. So I'm very  
20 acquainted with membrane systems.

21 Q And membrane systems are an integral part of reverse  
22 osmosis?

23 A Yes, they are.

24 Q Ion exchange?

25 A Again, very uncommon in a lot of mine treatments but to work

1 in a -- at a university laboratory dealing with water  
2 research, you very, very commonly use ion exchange for a  
3 variety of applications. So I'm very acquainted with ion  
4 exchange.

5 Q Evaporation systems?

6 A Again, those are very uncommon in most mine treatments  
7 because of the expense, but we have -- we have -- I've  
8 proposed those treatment systems for some mines in Nevada  
9 because I think that's the only thing that -- the only  
10 option they actually had.

11 Q Micro filtration?

12 A Yes.

13 Q Have you seen these components in action in mines or have  
14 studies them in your research?

15 A I've seen them in action and at least ion exchange I've  
16 worked with those in mining because they're so uncommon.  
17 But I have -- obviously am acquainted with them in looking  
18 at scale-up issues and feel very comfortable commenting on  
19 those.

20 Q Let's talk a little bit about what you did in preparation  
21 for your testimony today, in preparation for the work that  
22 you did. Did you review the groundwater discharge permit  
23 application submitted by the company?

24 A Yes.

25 Q Did you review the groundwater discharge permit that was

1           actually issued by the Department of Environmental Quality  
2           here?

3       A     Yes.

4       Q     And did you also review the permit modifications issued on  
5           December 5 of 2007?

6       A     Yes.

7       Q     What about the comments of the parties?  Have you reviewed  
8           those?

9       A     Yes, I have extensively.

10      Q     And did you review the response that the Michigan Department  
11           of Environmental Quality provided in response to the  
12           comments?

13      A     Yes.

14      Q     Did you review the Michigan Department of Environmental  
15           Quality Statutes and Rules related to groundwater and  
16           groundwater treatment issues?

17      A     Yes.

18      Q     Those are the so-called Part 22 Rules?

19      A     All 50 pages.

20      Q     Yes.  Did you visit the proposed mine site?

21      A     Yes.

22      Q     When you did that was Dr. Ann Maest with you?

23      A     Yes.

24      Q     And Dr. Robert Prucha?

25      A     Yes.



1 Q Have you conferred with other experts involved in this case:  
2 Dr. Maest, Dr. Prucha?

3 A Oh, extensively, yes.

4 Q Extensively?

5 A Yes.

6 Q Why?

7 A Well, the water treatment system is dependent, both in the  
8 inflow water quality which is Dr. Maest's area of expertise,  
9 and even more so to the water quantity, which is Dr.  
10 Prucha's area of expertise. So these have to be treated all  
11 in some understanding of all the aspects of the mine waters  
12 that enter that treatment system.

13 Q I understand. Now, what were you tasked with in this case?  
14 What were you asked to do?

15 A I was asked to look at the water treatment system for the  
16 mine as it was developed, primarily in the application for  
17 the discharge permit.

18 Q Given the material that you were asked to look at and your  
19 review of the issues in this case, what were the particular  
20 challenges involved in this particular treatment system?

21 A Well, first of all, there wasn't -- I have to say that the  
22 amount of information available in the permit was  
23 insufficient to make a complete analysis of it, because  
24 there were several things that were not included that  
25 perhaps could have been.

1 Q Now, just to make sure that we're on the same page, you said  
2 "the amount of information in the permit." Did you mean the  
3 permit application?

4 A Excuse me. The permit application.

5 Q Okay.

6 A But the site itself is a challenging site. It's remote;  
7 it's very cold. And the water quality has some specific  
8 attributes to it that make it a fairly difficult water to  
9 treat.

10 Q Why do you say that? What is it about the water that is  
11 going to be involved in this case that makes it difficult to  
12 treat?

13 A Well, first of all it's a fairly highly saline water,  
14 especially from those deeper water systems. So it has a  
15 high salinity. And the only way to treat that is probably  
16 by reverse osmosis, effectively. It has a high boron load,  
17 which is unusual and requires a special treatment. Plus  
18 because it requires reverse osmosis, you've got to do a lot  
19 of pre-treatment in order to remove a good part of the  
20 metals that potentially -- metals and gypsum that  
21 potentially could foul the membranes. And so it's a fairly  
22 complicated water. And the variability of the water; which  
23 was not discussed, I think, sufficiently; because of the  
24 different sources of water that will come to that treatment  
25 plant and make it a complicated water to treat.

1 Q Is this a site where there is a likelihood of acid  
2 generation?

3 A Oh, absolutely. This is a profoundly acid-generating  
4 system. I've discussed this with Dr. Maest and both of us  
5 were quite impressed as chemists with just how extensive the  
6 acid-generating this rock actually could be.

7 Q Have you seen a site in the work that you've done that has  
8 as high a potential for acid mine drainage as this one does?

9 A We've seen some sites that have had -- the Golden Sunlight  
10 Mine in Montana is very, very acid-generating, impressively.  
11 This site would equal or exceed that site.

12 Q Now, you mentioned the cold or severe conditions for water  
13 treatment. What impact does that have, or what kind of a  
14 challenge does that bring to this particular site?

15 A Anytime you have cold weather and have to move water around  
16 that -- especially surface storage of water, you're going to  
17 have variable temperatures. And temperatures can affect  
18 water treatment in a substantial way. Extensive snow,  
19 piping, valving, all those sorts of things in a water  
20 treatment system that is a temporary -- going to be a  
21 temporary system, it has fairly severe requirements in order  
22 to make sure that water is transported and treated and  
23 discharged in the manner that is consistent with discharge  
24 requirements.

25 Q So that creates a pragmatic problem in addition to just the

1 general water treatment issues?

2 A Very much so.

3 Q I see. Is there anything about the ecosystem in the  
4 environs of this particular site that pose a challenge for  
5 water treatment?

6 A This water treatment system is highly unusual from any I've  
7 seen because the water treatment requirements are extensive.  
8 They take -- they need to take the water and basically treat  
9 all of it. Usually there's an ability to partially treat  
10 and discharge. In this case they have to take the entire  
11 volume of water -- which we'll discuss later, but it's a  
12 large volume -- and remove all the constituents from it  
13 except for a small residue and then evaporate that residue.  
14 So it's highly unusual in how this water is treated because  
15 of the ecological issues of discharge that are mandated  
16 under the discharge requirements.

17 Q In terms of specifically the treatment, what kind of  
18 challenge does all this pose to the company in the design of  
19 its treatment system?

20 A Well, the complicated aspects of the water treatment;  
21 including the acidity, the metals, the boron and salts;  
22 require them to have developed a very complicated -- I think  
23 an unprecedentedly complicated water treatment system and in  
24 fairly severe conditions, to be able to operate this on a  
25 24/7 basis.

1 Q You indicated that you have reviewed the groundwater  
2 discharge permit for this site. Is the permit that you  
3 looked at consistent with permits you've seen in other  
4 places in the United States?

5 A No, it's not. And it was somewhat curious, in that many of  
6 the constituents I think that are commonly regulated,  
7 they're only required to be reported in the discharge. And  
8 this is unusual. There's, I think, depending on how you  
9 count them, six or seven or eight constituents that are  
10 regulated. The rest are simply reported.

11 Q Now, this is a nickel sulfide plant. Is there a limit for  
12 nickel?

13 A No.

14 Q Does that surprise you?

15 A It does. And the same thing with sulfate. There's not a  
16 discharge limit for sulfate either. Two of the major  
17 constituents -- one is actually fairly toxic ecologically  
18 and the other perhaps much less toxic but still a major  
19 constituent -- are not regulated in the discharge.

20 Q We're going to go to that point in a minute, but I want to  
21 go back to a point you made a moment ago. You said that the  
22 amount of information provided in the application was really  
23 insufficient. And I'd like you to tell Judge Patterson your  
24 thoughts on that issue.

25 A I would have liked to have seen some more extensive

1 development of exactly the type of membrane systems that  
2 were going to be used. I think that certainly the biocides  
3 that would be used were not defined. The cleaning agents  
4 where the --

5 Q Well, let's talk about each of those for a minute.

6 A Okay.

7 Q You said you'd like to know more information about the  
8 membranes. What do you mean? What are we talking about  
9 here?

10 A Well, there's several different kinds of membranes that are  
11 used in reverse osmosis.

12 Q So this relates to one of the treatment components that they  
13 have?

14 A Right.

15 Q And they haven't given you information about the kind of  
16 membrane they intend to use?

17 A No.

18 Q Tell Judge Patterson why that's important.

19 A Well, the membranes are kind of the heart of the treatment  
20 system. And there's a variety of different membranes you  
21 can use. They have different characteristics, and you  
22 generally use the recommendations from the water treatment  
23 system. But it would have been helpful to provide more  
24 information to evaluate how long they would last, what kind  
25 of cleaning that would be required to keep those membranes'

1 integrity, what the -- most membranes either end up plugging  
2 where they have -- they have to have higher pressures to get  
3 the water through, or they end up having small enlargements  
4 of the holes so they're less restrictive for some of the  
5 contaminants passing through.

6 Q So the membranes begin to wear out, it sounds like?

7 A They begin to wear out. And they do need to be replaced. I  
8 think everyone recognizes they do need to be replaced. But  
9 it would just help to -- another issue that wasn't really  
10 indicated was what the pH of the influent water would be.  
11 That has a major impact on the initial step, applying  
12 neutralization. And generally you hope that that would be  
13 predicted. It would have been helpful to have information  
14 what biocides were being used to control --

15 Q What are biocides and where do they fit into this treatment  
16 picture?

17 A They're used to kill microorganisms that may grow on the  
18 membranes. And this is a common problem in reverse osmosis.  
19 That is where you get biological fouling of the membranes,  
20 which affects the ability to treat water. And so you can  
21 add a small amount of specific biocides. But that was --  
22 exactly what biocides were being used was not revealed.

23 Q What difference does that really make, though, in terms of  
24 water quality or treatment?

25 A It depends on if it was a biologically active agent. There

1 are a variety of things that can be used. But if those are  
2 then discharged into the surface application system, you  
3 need to be concerned about what the biocides might do to the  
4 water infiltration system. Same with the cleaning agents.  
5 Sometimes they're proprietary. But I think in this case  
6 it's important to know what they are, to be able to evaluate  
7 whether they're going to be a water contaminating source.

8 Q I want to show you the effluent limits in the groundwater  
9 permit.

10 MR. EGGAN: This is from MDEQ Exhibit 118. And  
11 I'm going to show pages 6 and 7 of the groundwater permit.  
12 And we have those pages side-by-side here. It's pages 6 of  
13 32 and 7 of 32 from the groundwater permit.

14 Q We were talking a moment ago about the nickel limit. Is  
15 there a limit here for nickel that is noted?

16 A No, there's not. It's only required to report it. So it's  
17 only reports; it doesn't have a discharge requirement on it  
18 at all.

19 Q Well, what does that mean, though? What's the practical  
20 impact here?

21 A The practical impact is that they will not really have a  
22 limit. They are required, if you go down here, to discuss  
23 it if it's five times over what the expected water quality  
24 is. But there's no limit really on nickel, and it doesn't  
25 require any -- for example, you would not stop the mine if



1 this nickel violated any number, because there's no number  
2 to -- numb at that point. It's simply they're required to  
3 report it, which is different than regulating it.

4 Q I think you also mentioned there was an issue related to  
5 sulfate?

6 A Yeah. The sulfate is another one. Sulfate is right here  
7 (indicating). Again, they just report the sulfate and  
8 there's no discharge limit put on the sulfate. And you can  
9 see, as you go through all of these, there's a few where  
10 they've got actually numerical numbers. But most of them  
11 are just "report." And if they exceed some certain amount,  
12 then they have to discuss it with the agency, but there's  
13 other regulatory limit, which is usually what you see in  
14 discharge permits, is actually numbers on some of the  
15 constituents concerned.

16 Q So the permits that you're used to seeing are different than  
17 this?

18 A Yes.

19 Q And again, just to put a cap on it, in what respect?

20 A Well, they would have actually numbers for the discharge.  
21 Like, there would be a total dissolved solid discharge for  
22 example in a permit that would require them to -- so that  
23 they -- there may be some mixing values or something. But  
24 they may have a discharge that may be 800 milligrams per  
25 liter, for example, that would be -- that would require that

1 you can't discharge this, and if you do, it's a violation  
2 and then there's rather severe consequences if you have a  
3 reportable violation.

4 Q One of the things -- and I'm going to switch gears with you  
5 for just a moment. One of the things I'm interested in  
6 hearing you comment on is whether or not you see any  
7 evidence that the Department of Environmental Quality  
8 required pilot testing or even base scale testing of this  
9 system.

10 A No. And that was, I guess, one of the concerns as I started  
11 looking through; that there's quite a few numbers and  
12 sometimes as many as five significant figures, meaning --  
13 suggesting they have a very extensive knowledge of how well  
14 the water is being treated. But these were all based on  
15 expected -- like, a 95-percent treatment in, say, 1 R --  
16 reverse osmosis process. So there was, to my knowledge --  
17 and I don't believe there was any testing of the treatment  
18 facility at all. It was just based on manufacturers'  
19 expected water quality. There was no -- that I saw, any  
20 taking the waters and making a synthetic water and even  
21 sending it through any kind of experimental system. It was  
22 pretty much just using values that a water treatment company  
23 had given -- had provided, and then another -- the modelers  
24 had predicted what the water quality would be. Then the  
25 water treatment people predicted how that water would be

1 treated. And so there was really no even laboratory-scale  
2 testing of this -- of this specific water.

3 Q Why not just wait until the system is up and operating and  
4 sort of figure it out then?

5 A That's --

6 MR. BRACKEN: I object to the argumentative nature  
7 of the question.

8 MR. EGGAN: Well, I think it's --

9 JUDGE PATTERSON: Can you rephrase it?

10 MR. EGGAN: Sure.

11 Q Given the ecosystem there, does it make sense, in your  
12 expert opinion, to wait until the system is up and  
13 operating?

14 A No; no. And I don't --

15 Q Tell Judge Patterson why.

16 A This is probably -- no, this is certainly the most expensive  
17 water treatment system I've ever seen, and it's a very, very  
18 complicated system. I do not know of another system of its  
19 type that has used all these different components together.  
20 And it is -- it would be highly unusual to have all these  
21 components put together and work the first time out. I  
22 mean, it simply is unprecedented, I think, in the type of  
23 water they're treating using this type system with this  
24 severity of ecological impacts if they're wrong. So I  
25 suspect that certainly before designing the system, I

1 suspect there would need to be quite a bit more work before  
2 you can assume a system like this will work.

3 Q We're going to talk about the specifics of the system in a  
4 few minutes. But is there anything about the system and the  
5 proposal that has been made that leads them to believe that  
6 the company isn't certain whether it's going to work?

7 A Well, there's a --

8 MR. BRACKEN: I'm going to object to the fact that  
9 he's now going to speculate as to whether the company thinks  
10 it's going to work or not.

11 Q Well, I think if there's evidence in the materials that  
12 you've looked at that lead you to believe that the company  
13 may think it's an untried, untested system --

14 A Well, yeah, there was -- one specific example I saw is --  
15 boron is very difficult to treat. And the second reverse  
16 osmosis system may or may not work effectively on boron.  
17 The proposal is not unreasonable, but it may or may not  
18 work. And the company, in one -- I think it was Figure 6-1,  
19 basically said that "We may substitute an ion exchange  
20 system for the reverse osmosis system," which sounds like  
21 not a big deal, but that's a big change in how you would  
22 operate the water treatment system; "We may substitute an  
23 ion exchange system for the reverse osmosis system." And it  
24 suggests that they've never tried it exactly under this  
25 configuration and they're basically -- you know, at least it

1 is somewhat apparent to me -- and when I've done these  
2 things you'd say, "Well, if this doesn't work, then maybe  
3 we'll try this." And so -- but it does -- it does point to  
4 the issue that certainly this water treatment system has not  
5 been tested, and they're not completely sure how they're  
6 going to configure it yet either.

7 Q Let's take a look at the components of the system together  
8 and walk through the system a little bit, so that we all  
9 have an understanding of what we're talking about.

10 MR. EGGAN: Jan, could I have MDEQ Exhibit 118,  
11 MDEQ 010114?

12 Q Doctor, I wonder if I can get you to get up with your  
13 pointer and give us sort of an overview of how the system is  
14 going to operate; where the water is going to enter, where  
15 it's going to go and where it will end up?

16 A Well, there's a variety of components of water --  
17 contaminated water that the system is going to treat. These  
18 are the so-called contact water areas. And there's --  
19 certainly this is the underground workings that are going to  
20 be pumped up from underground, put in this contact water  
21 basin. And these (indicating) are the two where the water --  
22 - the contaminated water is going to be stored. So it's  
23 going to come from underground and some of the seepage and  
24 some of the water that comes up from there. You've got this  
25 temporary rock storage area which is going to receive rain.

1 It will be covered, but there will be water that comes off  
2 this site; that will be pumped in here (indicating).  
3 There's other areas around here that -- truck washing, for  
4 example, where they're going to have water that comes from  
5 some of these area down here that are also going to be  
6 contaminated because the trucks will have gotten dust on  
7 them that are perhaps sulfenic and fairly reactive. That  
8 will all be pumped over here.

9 So this will be the -- all the contact water that  
10 comes from the mine as well as the surface facilities. It  
11 will go into these two contact basins here, and then there  
12 it's going to be treated in this water treatment system and  
13 then ultimately pumped around --

14 Q You call that the water treatment system. We'll be  
15 referring to that as the wastewater treatment plant?

16 A The wastewater treatment plant is right here (indicating).

17 Q Okay. Very good.

18 A And then it comes around and it goes into this (indicating).  
19 This basically is a land application system for infiltrating  
20 water into this array here, which then is infiltrated into  
21 surface water -- excuse me -- into the surface soils.

22 Q Very good. And we talked about -- we talked about this land  
23 application system. I believe that the wastewater treatment  
24 system plan submitted by Kennecott referred to that as the  
25 treated water infiltration system?

1 A Yes. TWIS.

2 Q TWIS. Very good. I want to talk for a minute about some of  
3 your basic conclusions. Okay? If you want to sit down --  
4 if you're more comfortable standing, you can stand.

5 A I'll sit down. Thank you.

6 Q Okay. Is the design of this system as a whole dependent  
7 upon predictions that the company has made with respect to  
8 inflow volumes -- the volume of inflow of -- the volume of  
9 the water? Is it dependent upon that?

10 A Absolutely.

11 Q Is it sensitive to that?

12 A Very sensitive to that.

13 Q And tell the judge. When we talk about its sensitivity to  
14 the volume, tell the judge what we're talking about.

15 Q Well, the system is designed for a maximum inflow of about  
16 350 gallons per minute. And I think it's designed for 250  
17 with an uncertainty of another 100, so they could  
18 accommodate 350 gallons a minute for water treatment.  
19 Beyond that, though, there's not much flexibility. It's not  
20 as though you can add more chemicals or vary some parameter  
21 that's easy to change. This system is pretty much going to  
22 be fixed at 350 gallons a minute, primarily because the ion  
23 exchange -- or excuse me -- the reverse osmosis system as  
24 designed -- you can't push more water through it than what's  
25 its design capacity. So it's pretty much fixed at 350 or

1           thereabouts.

2           Q     What will be the impact on the wastewater treatment system  
3           as a whole if the water exceeds -- if the amount of inflow  
4           exceeds the company's prediction and the permitted level of  
5           350 gallons a minute?

6           A     It just simply will not be able to accept that volume of  
7           water, and it will not be able to treat that volume of  
8           water.

9           Q     Will there be a need to redesign at that point?

10          A     Well, absolutely. You'd need to redesign and design it for  
11          the amount of water that would be flowing in.

12          Q     Now let me move on to another question. The wastewater  
13          treatment system that has been designed by the company, is  
14          it also dependent on predicted water quality?

15          A     Yes.

16          Q     And is it sensitive to that?

17          A     It's sensitive to it in a couple of constituents that are  
18          critically important.

19          Q     And what are those constituents?

20          A     Well, the -- I think the most sensitive one, based on what  
21          we've seen here, is probably copper. We can come back to  
22          that, but it's -- boron doesn't vary by all of the  
23          predictions, both of the company as well as Dr. Maest.  
24          They're generally consistent for boron. But it's very  
25          sensitive to boron concentrations because it -- there's not



1 much difference between what the expected effluent  
2 concentrations will be and what the discharge requirements  
3 are going to be. So I think copper and boron are two of the  
4 ones where there's a critical issue of how well that  
5 treatment system will treat them.

6 Q Now, you've indicated that it is -- the system is apparently  
7 based on predictions that the company made in terms of water  
8 quality?

9 A Yes.

10 Q If the water quality that arrives at this system is worse  
11 than that -- or poorer, I should say, than that predicted by  
12 the company, what will be the impact on the system?

13 A Well, there's operations considerations of the system in  
14 terms of fouling issues.

15 Q When you say "fouling issues," describe what you mean.

16 A That's a good point. Fouling occurs when you get  
17 precipitation occurring, meaning crystals formed during the  
18 process. And when you have -- in reverse osmosis what  
19 you're doing is pushing water through the membrane.

20 Generally very good quality water goes through the membrane  
21 and all the salts remain behind. And when those salts  
22 exceed what is called the solubility product, they form  
23 small crystals. And as projected certainly by Dr. Maest,  
24 the concentration of calcium and sulfate are such that they  
25 will form calcium sulfate crystals called gypsum. And that

1 tends to be one of the major fouling processes of membranes.  
2 And so the water -- input water quality is going to be very  
3 important for this fouling issue on that particular  
4 membrane.

5 Q And we were talking about what the impact would be if the  
6 water that arrives at the wastewater treatment system is of  
7 a poorer quality than predicted by the company. What is  
8 that impact specifically? Is the system going to work?

9 A It certainly is not going to work as designed. Now, how  
10 well it works, there's -- there are always cleaning things  
11 you can do with membranes, but the amount of effort that's  
12 going to be put into these cleaning and basically  
13 anti-scaling agents, which they're called, to get rid of  
14 these materials are going to have to be monitored. What's  
15 going to happen is the treatment system is going to be under  
16 more duress. And as complicated as this system is, the  
17 performance is going to -- you know, I would predict it  
18 would go down in a significant way.

19 Q If the water treatment -- excuse me. If the water quality  
20 is worse than as predicted by the company, do you have a  
21 recommendation to the company as to design?

22 A I think they would have to go back and redesign it.

23 Q If the water quality is worse?

24 A Right.

25 Q Okay. Let's cover both of these points with information

1 that has been presented to the hearing officer in this  
2 hearing already. Let's look again at the inflow rate issue,  
3 and I'm going to ask you to look at -- look to your left at  
4 Petitioner's Part 31 Exhibit Number 44.

5 A Right.

6 Q In the left-hand column, you see the estimated inflow rate,  
7 upper bound inflow, the rate used to design the wastewater  
8 treatment plant. That's "C." "D" is the treatment  
9 capacity, and "E" is the rate used to size the treated water  
10 infiltration system. All right? The figures under "KEMC"  
11 are figures that come from the KEMC permit application and  
12 from the -- yes, from the permit application. Have you  
13 looked at the permit application Can you confirm that those  
14 are the numbers?

15 A Yes, they are the numbers.

16 Q Okay. Good. And when Dr. Prucha was here, he wrote in on  
17 the right-hand side of Exhibit 44 his predictions as to what  
18 those inflows actually will be.

19 A Uh-huh (affirmative).

20 Q And you can see that his estimated inflow rate was 280  
21 compared to the company's 75 gallons per minute -- 280  
22 gallons per minute. And "B" is -- upper bound inflow was as  
23 high as 3,000 compared to the company's 215. The rate used  
24 to design the wastewater treatment plant was 250 by the  
25 company, but Dr. Prucha was 3,035. The treatment capacity

1 of the system -- and this is the wastewater treatment plant  
2 actually -- is 350 gallons per minute under the KEMC  
3 prediction, but Dr. Prucha thought it would be somewhere  
4 near somewhere near 3,135 gallons per minute, and then this  
5 last column, the rate used to sign the treated water  
6 infiltration system was 400 gallons per minute, and Dr.  
7 Prucha predicted 3,185. Given the figures on Exhibit 44, if  
8 the water is coming to the system at rates predicted by Dr.  
9 Prucha, what is your conclusion on the impact of the  
10 system -- excuse me -- on the impact to the wastewater  
11 treatment system?

12 A Well --

13 MR. BRACKEN: I want to preserve an objection for  
14 the record, your Honor, about Dr. Prucha's numbers and lack  
15 of foundation for them. I think we made that objection. I  
16 was in the courtroom that day, and I want to continue that  
17 objection.

18 MR. EGGAN: Well, I don't recall whether there was  
19 or wasn't, but that is an exhibit that has been admitted  
20 into this case, and so I think we're beyond that point.

21 MR. BRACKEN: Well, I don't think we're beyond  
22 that point. I think it's an exhibit, and it's been admitted  
23 for the purposes and for the weight that might be given to  
24 it by the trier of fact in this case. And whether there's a  
25 foundation for it in the record is another issue. It's

1           been -- the exhibit speaks for itself on whether --

2                   MR. EGGAN: I would agree that the exhibit does  
3 speak for itself, but it is an admitted exhibit so --

4                   JUDGE PATTERSON: But I think it was admitted over  
5 objection.

6                   MR. BRACKEN: It was.

7                   MR. EGGAN: It was.

8                   JUDGE PATTERSON: And you're just reaffirming  
9 that?

10                   MR. BRACKEN: I'm reaffirming that, trying to --

11                   MR. EGGAN: Very good.

12       Q       What will be the impact on the system if Dr. Prucha is  
13 right?

14       A       These are -- this (indicating) is Dr. Prucha's estimate of  
15 inflow from the mining system. There's also another 100  
16 gallons per minute added on there from the meteoric water,  
17 just dealing with all those sorts of things. So this would  
18 be 380, I believe, from -- if you include the water from --  
19 if I'm not mistaken, from all the various -- so even this is  
20 going to be --

21                   MR. BRACKEN: Can I have a -- I'm sorry.

22                   THE WITNESS: Go ahead.

23                   MR. BRACKEN: I'm sorry. I apologize for  
24 interrupting, Doctor. It's --

25                   THE WITNESS: No problem.

1                   MR. BRACKEN: That was not nice. It was impolite.  
2 This is -- I want to make sure that the record's clear that  
3 this is not any testing or -- that you've done again.

4                   THE WITNESS: No.

5                   MR. BRACKEN: Okay. I just wanted to --

6                   MR. EGGAN: No. This is Dr. Prucha's. This is  
7 Dr. Prucha's testimony, yeah.

8 A Yeah. If you add --

9 Q Dr. Miller, what I'm really asking is, if Dr. Prucha's  
10 numbers are correct, what is the impact on the system?

11 A The system simply would not operate. I mean, there would  
12 be -- the maximum amount of water that would be treated  
13 under that system is 350 gallons, and none of these,  
14 including this (indicating) one -- if that does not include  
15 the water -- the surface water treatment from the contact  
16 area on the surface, none of these would -- the water  
17 treatment system would certainly not be able to treat this  
18 volume of water. And obviously, at this three -- ten times  
19 higher water flow, it would certainly not be a successful  
20 treatment of water.

21                   MR. EGGAN: Bear with us, your Honor.

22                   JUDGE PATTERSON: Sure.

23                   MR. EGGAN: This is an exhibit that was presented  
24 by the Petitioners in the groundwater permit but which has  
25 already been offered into evidence. I want to make sure I

1 get the exhibit number correct.

2 JUDGE PATTERSON: Okay.

3 MR. EGGAN: Your Honor, this is an exhibit that  
4 has been previously admitted and -- as Exhibit Number 66.

5 Q Dr. Miller --

6 MR. BRACKEN: Is this one of -- I'm sorry, your  
7 Honor. Is this one of Dr. Maest's?

8 MR. EGGAN: It is; it is. I was just about to say  
9 that. Your Honor, this is an exhibit that was offered  
10 through Dr. Ann Maest.

11 JUDGE PATTERSON: All right.

12 MR. EGGAN: And what it purports to be is the  
13 predicted wastewater treatment plant influent concentrations  
14 during years four and seven of operation.

15 Q Do you understand what this purports to represent, Doctor --  
16 Dr. Miller?

17 A Yes; yes.

18 Q As you can see, Dr. Miller has offered some predictions as  
19 to her own -- I'm sorry -- Dr. Maest has offered some  
20 predictions as to what the influent concentrations are going  
21 to be to the wastewater treatment plant in years four and  
22 seven. Have you seen this exhibit before, and have you  
23 looked at it?

24 A Yes; yes.

25 Q If Dr. Maest's predictions as to water quality in years four

1 and seven are accurate, what will that do to the -- what  
2 impact will that have on the wastewater treatment system at  
3 this mine?

4 A Well, I might mention, first of all, that, since there is no  
5 discharge requirements for several of these constituents,  
6 they only have to report them if the discharge is unaffected  
7 because there is no requirement. For some things like zinc,  
8 which is -- zinc and nickel which are particularly a  
9 problem, there is no discharge requirement for those. The  
10 one where there is a discharge requirement is copper. And I  
11 might point out, copper here, Dr. Maest is assuming at this  
12 year four of about two orders of magnitude, a factor of 100  
13 higher concentrations. And this would make the discharge --  
14 monthly average discharge requirement for copper is 10  
15 micrograms per liter.

16 And even if you used this (indicating) number, it  
17 would be on your 700 micrograms per liter in the discharge  
18 water. But I also might mention that this one is very close  
19 to the discharge requirement, having the water quality at  
20 .14. If they -- if this went up to .2 micrograms per liter,  
21 if they were only off very, very slightly by this, it would  
22 violate that -- and that was the amount of water, using  
23 their assumptions and their analysis, it would violate a --  
24 the discharge requirement. And this is the only one of  
25 these that is really -- I think cadmium was on here too.



1 Cadmium was not violated.

2 But I think copper is the only one of these that  
3 is actually on the discharge permit. And copper would be  
4 way violated if it stands. But if it's only even .2  
5 milligrams per liter here, it would also violate that  
6 10-microgram-per-liter discharge.

7 Q Okay. I want to simplify this just a little bit. Okay?

8 A Okay.

9 Q If Dr. Maest's predictions as to the influent water quality  
10 are accurate, what impact will that have on the wastewater  
11 treatment system? Will it need to be redesigned?

12 A It will have to be redesigned.

13 Q Why is that?

14 A Well, for two reasons. One, I think that the treatment  
15 system was designed for a specific kind of water and just  
16 normal operation characteristics; how long -- how many  
17 redundant systems you've got to have; how many times you  
18 have to bring it down and clean it; a whole variety of just  
19 operation considerations. But then, more importantly, if  
20 you assume everything is going to work, you have to look at  
21 discharge limits. And for copper particularly -- and if Dr.  
22 Maest's numbers are correct or even close to being  
23 correct -- then it will fail the discharge standard.

24 Q Thank you. I want to talk for a minute about the contact  
25 water basins, which are an element of this system. Let's

1 talk for a moment about the wastewater -- excuse me -- the  
2 contact water basins, which are an element of the wastewater  
3 treatment system. What are those contact water basins  
4 intended to do?

5 A The contact water basins are a critical component of this  
6 water treatment system, because they will allow water to be  
7 stored during high events, so it'll basically buffer the  
8 water treatment that is going to be required so that, in a  
9 high water event, they could collect water so that the water  
10 treatment system could then maybe increase it's capacity  
11 from what was predicted -- not capacity -- increase the  
12 amount of water being predicted so it could drain those down  
13 so you don't have to design the exact water treatment  
14 operation for maximum flow. This allows a capacity storage  
15 to allow the water treatment system to work.

16 Q It's my understanding that the water that is coming out of  
17 the mines will initially go to the contact water basins?

18 A That's correct. And it'll be stored there and then treated  
19 in a manner that gives the water treatment system a  
20 little -- reduces the pressure of high-flow situations.

21 Q Understood. Now, we're talking about inflow issues, and one  
22 of the issues that we just talked about was inflow. Are  
23 there issues pertaining to capacity of the contact water  
24 basins?

25 A Well, you know, I think one can put together a scenario,

1           although I would admit that it's perhaps unusual that the --  
2           where the --

3                       MR. BRACKEN: Well, your Honor, I'm going to  
4           object. If he's going to speculate as to scenarios, I don't  
5           think that's an appropriate basis for testimony.

6                       MR. EGGAN: Well, I think that's --

7                       MR. BRACKEN: It's just hypotheses, and it  
8           lacks --

9                       MR. EGGAN: From our part of the case, your Honor,  
10          I think we've already had testimony that people need to  
11          considered worst-case scenarios. That's what you do when  
12          you're designing a system. And so part of the problem with  
13          the company's approach to this is they didn't do any  
14          hypotheses. They didn't do any speculating. They didn't do  
15          any sort of analysis as to worst-case scenarios, and  
16          that's -- I just want to talk to the doctor about the  
17          capacity of this system.

18                      MR. BRACKEN: I think we not only did -- I think  
19          that's untrue. I think there's not only been hypothesizing,  
20          there's been built-in -- it's been built into the system.  
21          The question is whether a person's expertise is to guess is  
22          helpful to this court to assist this trier of fact. I mean,  
23          this is an expert witness, and all he's going to do is be  
24          hypothesizing. It seems to me that the scientific method  
25          requires him to test and make findings and conclusions, not

1           just guesses.

2       Q     The process of hypothesizing in terms of the development of  
3           a system like this, is that an element that goes into what a  
4           prudent or a good wastewater treatment plant designer might  
5           do?

6       A     Certainly I think anytime you -- we -- that's exactly what  
7           we did when we design water treatment systems. We look at  
8           the highest flow and how we handle those high flows. In  
9           this case we designed -- we didn't design quite enough for  
10          the high flows that the mine we had in Leviathan. We had to  
11          make some changes in the system because of that. So I think  
12          very definitely you need to plan for high flows and give  
13          enough additional capacity in order to meet the variability  
14          of precipitation and water inflow events that need to be  
15          determined. It's not -- at least in our case, it was not  
16          acceptable to have discharges that required that we violate  
17          some discharge standard.

18                   MR. EGGAN: Your Honor, I think the witness has  
19           lade a foundation for this question. We're not going to  
20           spend much time with it, so I think the witness ought to be  
21           able to offer a scenario where the capacity could be  
22           exceeded.

23                   MR. BRACKEN: I'll just stand on my objection as  
24           to foundation.

25                   JUDGE PATTERSON: Okay. Well, I'm sure there is

1 one.

2 MR. EGGAN: I wouldn't have asked if there wasn't,  
3 Judge. As it turns out, yes.

4 JUDGE PATTERSON: Okay. I'll overrule the  
5 objection.

6 MR. EGGAN: Thank you.

7 Q Go ahead, Doctor.

8 A Well, the -- certainly I might make the comment that, if the  
9 flows are higher than what the water treatment can handle --  
10 say if they're 380 gallons per minute and the water  
11 treatment system can handle 350 maximum, there will be a  
12 steady increase -- and 30 gallons a minute -- that  
13 ultimately will overwhelm the system so that the capacity of  
14 the water treatment system itself, all the reverse osmosis  
15 and all that sort of thing does have to be such that it  
16 could handle the flows. But what these are designed for and  
17 appropriately is designed to have sufficient capacity to  
18 take care of the unusual events. There's two issues I think  
19 that need to be considered there is, how these water basins  
20 are managed. If they're managed in such a way that the  
21 water is essentially completely gone under normal scenarios,  
22 under normal situations, if you have a full capacity to deal  
23 with, that's an advantage. So if they're managed -- but if  
24 they're managed that you have one of them, say, half full,  
25 for example -- and I don't want to speculate on what the

1 management criteria would be for the company. But if they  
2 are managed and it says they're half full so they can  
3 deliver water and then you get a couple of major events and  
4 then some minor events after that, you can certainly put  
5 together a scenario where these basins would be not -- would  
6 not be large enough, period.

7 Q Do you have an understanding of the capacity of these  
8 systems in terms of days?

9 A Well, they're designed to stand somewhere around ten days of  
10 average annual flow --

11 Q Okay. They're designed --

12 A -- not average annual flow -- average flow over a ten-day  
13 period.

14 JUDGE PATTERSON: I'm sorry. What period?

15 THE WITNESS: Ten-day.

16 JUDGE PATTERSON: Ten-day.

17 Q They've got essentially a ten-day capacity?

18 A Right.

19 Q And that capacity is based upon the estimated inflow that  
20 the company utilized to design the system?

21 A Yes.

22 Q My question is this: Is there a plan to put the contact  
23 water somewhere else if they -- if those basins are full?

24 A Yes. There is some -- a fair -- actually, a fair amount of  
25 capacity in this temporary rock storage basin that they

1 would allow the water to flow in if these contact basins  
2 were full.

3 Q Do you have any concerns about storing water in the  
4 temporary development rock storage area, the TDRSA?

5 A I think that would be a fairly substantial problem with the  
6 water treatment system, because this rock, from what Dr.  
7 Maest has indicated, is still fairly acid generating. It's  
8 not as acid generating as the ore, but it's very -- still  
9 very acid generating. So that water quality would be  
10 severely degraded. And if that water had to be treated in  
11 the water system too, there would be a whole lot of  
12 complications they would need to deal with with treating  
13 that water. It would also, if they got everything wet in  
14 that temporary rock storage basin, effectively a humidity  
15 cell, which is what you do if you're trying to make rock  
16 generate acid. You put in what's called a humidity cell,  
17 and that's where the microorganisms can basically consume  
18 the -- the sulfide materials grow and generate. That's when  
19 the real problems start, is when you get a nice microbial  
20 community growing on the rock. You generate copious amounts  
21 of acid.

22 Q What is it about the temporary development rock storage area  
23 that leads you to believe that it would become like a  
24 humidity cell? What would the conditions be?

25 A Well, it's certainly covered, and it would be warmer because

1 of the reactions that would go on. Because you -- when you  
2 get acid generation, that's what's called an exothermic  
3 reaction, so it'd be warm. And so you'd have very nice  
4 conditions to -- for the microorganisms to generate very  
5 large amounts of acid. So that would be something that  
6 would be -- certainly I suspect -- and I don't want to  
7 speculate. But I suspect the company would not want that to  
8 happen either, but it could be a very poor way of managing  
9 excess water.

10 Q Talk for a moment about variability. And would -- the  
11 water, if it were stored in this temporary development rock  
12 storage area, would that affect variability? And then what  
13 impact will that have on the system?

14 A One thing about reverse osmosis treatment systems is you  
15 want to have -- I mean, they're used commonly and very  
16 successfully in desalinization of ocean water, for example;  
17 a very constant source of water. In other applications,  
18 even in mining, you want to have as constant of a source of  
19 water quality.

20 Q That would have been my question. When we say "a constant  
21 source," you're talking about a constant source of water  
22 that has the same characteristics?

23 A Right; yeah.

24 Q And the same constituents and the same levels of  
25 constituents?



1 A Right; right.

2 Q Okay. And how would that issue be impacted by the TDRSA?

3 A Well, there's -- the -- part of this entire water treatment  
4 system is dealing with -- certainly there is going to be  
5 some variability in groundwater that they pump up, but  
6 that's probably not going to be a large variability. If it  
7 changes it'll change slowly over a period of weeks. When  
8 you get water on these -- say, a significant rain event  
9 that's put in the contact water basins, it may change that  
10 water source in a matter of a day or two in terms of  
11 quality. And that's where it makes it much more difficult  
12 and requires a whole lot more tweaking and problems in  
13 dealing with all the water. But the TDRSA, for example, if  
14 that had -- if you had to treat that water, you would --  
15 there would be some major configuration changes you would  
16 have to do to make sure that water was effectively treated.  
17 It would probably be a fairly severe water.

18 Q Is variability a factor that will impact this system under  
19 all circumstances?

20 A Certainly I think most people who treat waters like this  
21 would like to have a consistent source of water. There's  
22 some variation you can stand and some that's just going to  
23 be much more troubling.

24 Q Will the water coming from the treatment -- the temporary  
25 development rock storage area, the leachate, provide a

1 variability that will corrupt the treatment system?

2 A It would certainly impact it negatively.

3 Q Let me ask you a question about the contact water basins and  
4 a situation that might give rise to overflow. Why wouldn't  
5 just stopping things -- stopping mining operations resolve  
6 this problem, or would it?

7 A Well, certainly, if you don't pump water in the contact  
8 water basins, you don't have to worry about overflowing the  
9 contact water basins; that -- my experience with pumping of  
10 underground mines is that you can't stop pumping because, if  
11 you stop pumping, they fill up, and certainly the mine  
12 operation would be very, very severely impacted. In the  
13 same way with the contact water areas, if it rains heavily,  
14 you can't stop pumping those, because then that will run off  
15 from that contact water basin. There's a -- they're  
16 regulated; that that contact water needs to be pumped into  
17 contact water basins. So it'd be very difficult to stop  
18 filling those basins if you had a problem that you -- either  
19 the water treatment or they were filling up or something,  
20 it's very difficult to find an alternative other than  
21 pumping into the TDRSA.

22 Q Do you have any recommendation in terms of the number of  
23 contact water basins that are there?

24 A You know, it's -- I don't want to suppose to design this  
25 particular system, because I wasn't really asked to do that.

1 But I think design of increased capacity would certainly be  
2 something I'd suggest the designers take a look at.

3 MR. EGGAN: Your Honor, this might be a great  
4 place to take a break, if you choose. We can move on to  
5 another area, if you want.

6 JUDGE PATTERSON: That's fine, yeah.

7 MR. EGGAN: Okay. Before we do, your Honor, just  
8 a minor housekeeping issue.

9 JUDGE PATTERSON: Okay.

10 MR. EGGAN: I did not offer the Curriculum Vitae  
11 for Dr. Miller, but it is Exhibit 38 in the materials that  
12 we provided to you.

13 JUDGE PATTERSON: Okay.

14 MR. EGGAN: And we would like to offer Exhibit 38,  
15 which is Dr. Miller's Curriculum Vitae.

16 JUDGE PATTERSON: I believe those have all been  
17 stipulated to, haven't they?

18 MR. EGGAN: I think they have, but I just want to  
19 make sure that I've got a belt and suspenders on here.

20 MR. REICHEL: Yes, we've stipulated to admission  
21 of all CV's.

22 MR. EGGAN: Very good.

23 MR. BRACKEN: I have no objection.

24 JUDGE PATTERSON: So it will be entered by  
25 stipulation.

1 (Off the record)

2 MR. EGGAN: I'm ready when you are, Judge.

3 JUDGE PATTERSON: I'm ready.

4 MR. EGGAN: Okay.

5 Q Dr. Miller, I'd like to turn our attention now to the  
6 component of the wastewater treatment system called the  
7 wastewater treatment plant, and let's talk about that a  
8 little bit. In case it isn't painfully obvious to  
9 everybody, what is the -- basically the intent of the  
10 wastewater treatment plant? What does that do?

11 A Well, the intent is to remove the constituents in the water  
12 that would contaminate surface or groundwater.

13 Q I'd like to talk about the various components of the  
14 wastewater treatment plant. You've indicated that it's a  
15 complex system. And without belaboring it to the point of  
16 driving us all to distraction with -- you know, with detail,  
17 can you please give the hearing officer a sense of the  
18 wastewater treatment plant and the various components within  
19 it as the water flows through it?

20 MR. REICHEL: Excuse me.

21 A This is not completely clear, so if you --

22 MR. REICHEL: Excuse me. Counsel, could you  
23 please -- I think I know what that is. Could you please  
24 identify for the record what's being displayed so that it's  
25 clear?

1                   MR. EGGAN: Yes. What I have projected is MDEQ  
2 Exhibit 118, and it is --

3                   THE WITNESS: -- 6-1.

4                   MR. EGGAN: -- figure 6.1. It's the Kennecott  
5 application for groundwater discharge permit figure 6-1.

6       A       And if I can, I would use a sheet hat that has a little bit  
7 clearer writing on it to --

8       Q       It's the same sheet, though, isn't it?

9       A       It's the same sheet. It's the same sheet.

10      Q       Okay. Yeah, that's fine. Before you do that, Dr.  
11 Miller, --

12                  MR. EGGAN: -- I would offer this exhibit into  
13 evidence. It is part of the application, and it is a part  
14 of the materials that Dr. Miller looked at. It is Bates  
15 number MDEQ 010723.

16                  MR. REICHEL: Your Honor, this is -- as counsel  
17 noted earlier, this is one of the documents that is attached  
18 to and part of the actual wastewater treatment permit, DEQ  
19 or Respondent's Exhibit 118 that's already in evidence. I  
20 don't know that we need to add it again.

21                  MR. EGGAN: What I didn't -- what I wasn't sure of  
22 was whether the entire application had been admitted. If  
23 that's the case, then I won't --

24                  JUDGE PATTERSON: Are we talking about the permit  
25 or the application?

1                   MR. EGGAN: The application.

2                   MR. REICHEL: Okay. Well, it's -- I'm looking at  
3 the permit. It's in -- Counsel, it's my understanding it's  
4 in both.

5                   MR. EGGAN: It is; it is.

6                   MR. REICHEL: This is taken from the application  
7 but was also designated attachment VI-A flow diagram, which  
8 appears at page 31 of 32 of the permit.

9                   MR. EGGAN: It is; it is. The only difference is  
10 the writing is just a little bit clearer in the application  
11 in terms of being able to read the print, and so we used  
12 that one.

13                   MR. REICHEL: That's fine. Again, I have no  
14 objection to it in any event. I believe that -- clearly the  
15 permit is in evidence. I believe the application is already  
16 in evidence. I don't -- I'm not objecting, but I don't see  
17 the need to admit it one more time.

18                   MR. EGGAN: I don't think so either. If it's  
19 already been admitted, --

20                   MR. REICHEL: Yes.

21                   MR. EGGAN: -- I don't think so either. So I just  
22 want to make sure I got a belt and suspenders here.

23                   MR. REICHEL: That's fine. And again, I just  
24 wanted the record to reflect what was being displayed.

25                   MR. EGGAN: Understood. Anything from our friends

1 at the company?

2 MR. BRACKEN: I also understand that it's already  
3 admitted as part of the application.

4 MR. EGGAN: All right. Very good.

5 Q Doctor, if you wouldn't mind, then, can you please discuss  
6 the components of this system?

7 A The influent of the system -- these are influent components  
8 from the -- basically contact water underground and then at  
9 various ancillary systems going to the contact water basins.  
10 That infers a significant step here, is to raise the pH.  
11 And there's some issues that exist about this. They call it  
12 a lime softening in one place, but it is designed to  
13 precipitate metals using a pH adjustment. The metals will  
14 precipitate. There's some question in my mind whether it  
15 will do what it -- they suggest it will do to calcium, which  
16 is a significant -- these are various filtration steps to  
17 get rid of the precipitate that forms, because you want to  
18 have a real clean water when it goes in the reverse osmosis  
19 system. This is the reverse -- first reverse osmosis system  
20 that is in the process. Again, that is pushing water  
21 through the membranes under high pressure. There's a pH  
22 adjustment where the pH is raised from -- up to 9 to 11,  
23 which is alkaline, and that tends to ionize the boron. And  
24 then it's sent through a second reverse osmosis process,  
25 which will get -- which will further clean this water, but

1           it will also get rid of the boron, and finally this comes  
2           down here and goes into this tank where all the water -- the  
3           treated water comes into pH adjustment and then discharged.  
4           So this is the -- this is -- this handles about two-thirds  
5           of the water in the entire system as designed presently.  
6           There's an issue with sludge that is handled when you get  
7           the precipitate that's formed. You want to handle that  
8           sludge and manage that appropriately.

9           Q     We're going to talk about the sludge issue in a minute.

10          A     Okay.

11          Q     But we're just talking about the basic --

12          A     Water --

13          Q     -- components of the system. You mentioned a precipitation  
14                 step?

15          A     It's right here (indicating).

16          Q     Okay. And then a series of filtrations?

17          A     Yeah. The filtrations are right in here. That's correct.

18          Q     Okay. Very good. And then the reverse osmosis system?

19          A     Two of them (indicating).

20          Q     Reject water diversion?

21          A     Yes. That's a good point. The -- there's -- about a third  
22                 of the water in these two systems combined is then called  
23                 reject water. When you send something through a reverse  
24                 osmosis system, you have very -- pretty good water going  
25                 through the system, but then all the other contaminants are



1 located in what is in summation about a third of the water.  
2 And so that's now fairly contaminated water that is taken  
3 off and called reject water.

4 Q Okay. Is this a phase of the treatment system at the  
5 wastewater treatment plant also?

6 A Yes.

7 Q Explain to the hearing officer what this is.

8 A It's called a concentrate reduction process. Unlike a lot  
9 of mines that I've seen, there is no direct discharge of  
10 partially treated water. All the water needs to be treated.  
11 And what they do with this primary process is take  
12 two-thirds of the water, treat it and then make it available  
13 for discharge. But that third of the water now contains the  
14 entire -- most of the contaminant load. There's some in the  
15 precipitate early -- but most of the contaminant load, and  
16 that has to be treated again. That's treated with a  
17 subsequent reverse osmosis system. They go through some  
18 pretreatment steps again. They raise the pH and drop out  
19 metals. They do it a left bit differently here that's  
20 probably going to be perhaps more successful. And then they  
21 take it through this next reverse osmosis system and -- to  
22 get rid of as much of the contaminants as they possibly can.  
23 I might make the point, though, in -- you have -- what is  
24 used, at least in the documentation in the application, is  
25 they have a reject rate. Like, it can be 90, 95, 99 percent

1 of, say, something like sodium -- sodium would be rejected,  
2 and so the water is now 99 percent free of sodium. There's  
3 some that goes through, but it is -- and this first process  
4 is actually -- it's actually fairly good. On this process  
5 now, because you've now concentrated the water in that  
6 third, if you use the same value, you get more going  
7 through. If you have a 95 or 90 percent reject rate at a  
8 higher concentration, you have more going through to the  
9 point that this water that comes out of this -- this RO  
10 treatment now is -- contains a significantly higher  
11 contaminant load than the first two RO systems combined  
12 would do to the point that most of the contamination that is  
13 discharged comes from this specific system. And if I can  
14 make that -- I don't know if I can make that clearer. But  
15 this process is critically important because it's only one  
16 RO process with much more contaminated water, so this water  
17 contributes the bulk of the contaminants into the water that  
18 is ultimately discharged into the TWIS. There's another  
19 step in here, because all the boron that comes in that's  
20 retained in that second RO system now is here, and they  
21 treat this water by doing an ion exchange, which is another  
22 process. An ion exchange is a -- certainly a well-accepted  
23 method for removing boron from water, but it is also another  
24 process that tends to complicate the system. There's  
25 about -- of the RO water on this other process, there is

1           about 7 percent of the water left that's really got all the  
2           contaminants in. What they do with that water is basically  
3           evaporate that water, and then you get crystalline material  
4           at the end.

5       Q     Where is the evaporator?

6       A     The evaporator is -- I believe it's right at the end here.  
7           I have to admit that I --

8       Q     Is the --

9       A     "To evaporator." It just says "to evaporator," and it  
10          doesn't give a -- it's just to an evaporation system, which  
11          is just a -- you just distill off the water, boil it off.

12      Q     For the record, you have been referring in this discussion  
13          to a figure from the groundwater discharge permit  
14          application submitted by Kennecott. It's figure 6-2?

15      A     Correct.

16      Q     And this is the concentrate reduction process?

17      A     Right.

18      Q     Is that an explanation of each of the components of the  
19          system?

20      A     For the most part, yes.

21      Q     All right. Let's go back and just give a basic overview.  
22          You said about two-thirds of the water goes in phase one of  
23          this treatment plan, and a third of it goes in the  
24          concentrate reduction process?

25      A     Well, what happens is two-thirds of the water is treated in

1 the first process, and it results in a waste product for  
2 about a third of the water. That waste product is then  
3 treated in this concentrate reduction process.

4 Q I see. Okay. Does -- this plan -- and I'm talking about  
5 both figures 6-1 and 6-2, does it contemplate a treatment  
6 lab or a testing lab?

7 A I have not -- at least there was -- none of the  
8 documentation I reviewed had any indication that this had  
9 been tested as one large configured unit at all. And so  
10 this is a culmination of several unit processes, each of  
11 which I think has been shown to work, but I'm not aware that  
12 the system has ever been put together as proposed.

13 Q And I want to get to that point in a minute. I'm talking  
14 about a laboratory that is part of the wastewater treatment  
15 plant where they can test for --

16 A Oh, yeah.

17 Q -- various constituents; boron, gypsum, et cetera.

18 A Right. I would have to say that's assumed, but I don't  
19 know. I did not see where they would have a laboratory  
20 facility in this facility. They would almost be required to  
21 have it, because each of these units requires -- each of  
22 these designed -- for example, the ion exchange system  
23 requires for -- that's designed to remove boron in the  
24 concentrate reduction process. What an ion exchange system  
25 does is it exchanges some ion on -- like hydroxide for boron

1 as it comes on. And so at some point all that boron will  
2 take up all -- the majority of those sites, and then boron  
3 will still begin to leak out. And so in order to make sure  
4 a system works like this, you have to have a normal  
5 operating requirement to do extensive analytical work to  
6 make sure the boron isn't been discharged inappropriately.  
7 So it requires extensive laboratory testing.

8 Q Is boron an important issue in terms of this particular  
9 wastewater treatment plant?

10 A Boron is -- this water is unusual in the amount of boron.  
11 Boron is a plant -- it keeps plants from growing. It's used  
12 as a soil sterilant in some places. And boron is very  
13 important in this system because the concentration in the  
14 influent water, based on the data submitted, those  
15 relatively high, about -- an order of magnitude, a factor of  
16 ten higher than what can be discharged. So they have to  
17 remove about 90 percent of the boron. The -- even with this  
18 system, as they indicated, the discharge is about 177  
19 micrograms per liter where the discharge limit is about 285  
20 milligrams per liter. That may seem like a fair amount, but  
21 it really isn't. So if the system tends to drop off in its  
22 performance, then it's going to come very quickly to  
23 violating those discharge requirements.

24 Q I see. I think you're finished talking about the system?

25 A Yes; yes.

1 Q Okay. Then if you want, to have a seat. Among the systems  
2 that you have seen in your career, where does this fit in  
3 terms of complexity?

4 A Well, it's by far the most complex water treatment system  
5 I've ever seen for mining.

6 Q Do you know of another treatment system that contains this  
7 many components anywhere in the world?

8 A The answer is "no."

9 Q Well, some might say that's a good thing; that this is an  
10 innovative plan. What is your comment on that?

11 A It's certainly innovative and novel, but it's also untested.  
12 And I think that's the issue, I think, that's particularly  
13 important here, is that putting these -- I mean, you have  
14 seen reverse osmosis used in mining. It's not common, but  
15 it's -- there are several systems in the western United  
16 States that use this. But putting all of these together is  
17 something I have frankly never seen before.

18 Q The components of this system individually have been used  
19 elsewhere?

20 A Yes.

21 Q Have you ever seen all of these components fit together like  
22 this anywhere else?

23 A No.

24 Q Is there a concern that they'll work together?

25 A Well, I think that's a substantial concern. And the first

1 time I looked at this system I thought, "My, my, my, this  
2 is" -- and anyone who's done any water treatment knows that  
3 the -- when you line these things up together, every one of  
4 them has some potential to fail, you know. There's -- just  
5 an engineering design, you know you have some potential to  
6 fail. And when you multiply all those things together, you  
7 get something that becomes at least unwieldy and requires a  
8 lot of manipulation, and the operational reliability begins  
9 to go down. Because each of these -- the majority of these  
10 components, if one doesn't work, the whole system will go  
11 down.

12 Q Well, that would have been -- that would have been my next  
13 question. It looks like we are treating water in a  
14 sequence?

15 A Yes.

16 Q And what happens if one of those sequences fails?

17 A Well, for example, if the last one fails -- let's say -- I'm  
18 sure there'll be multiple evaporators, but if one of them  
19 fails that's handling a third of the water that you will be  
20 required either to have a very large storage capacity or a  
21 third of the treatment system will go down. If you're  
22 treating at maximum rate and one of the reverse osmosis  
23 systems goes down, then half of that capability goes down;  
24 if you're treating it 350 you immediately have to drop to  
25 175 gallons per minute. If the, you know, on of the other

1 components goes down then you lose that capacity of that  
2 aspect. In some cases you can lose the entire system  
3 operational capacity, and that needs to be a consideration  
4 in design and operation of it.

5 Q And we talked a few minutes ago about variability; the  
6 variability of the water quality that is coming into the  
7 system. Is variability a factor in a system as complex as  
8 this?

9 A It certainly is. The issues with scaling on membranes, for  
10 example. If you suddenly have a big surge of calcium  
11 sulfate you may have -- you may begin clogging membranes  
12 fairly quickly on the order of days, and so if you haven't  
13 prepared for that you may shut down both parts of the  
14 reverse osmosis system. And so all of those have to be  
15 considered in operation. It's a very, very complicated  
16 water treatment system, the likes I have not seen  
17 previously.

18 Q Now, we talked a minute ago about reverse osmosis and you've  
19 talked about it at various stages in this particular  
20 treatment system. Are you aware of a reverse osmosis system  
21 anywhere that would have the kind of demands placed on it  
22 that will be placed on it at this particular mine?

23 A No, but I have to say that I can't say that there is not  
24 such a thing as great confidence or a certainty of reverse  
25 osmosis systems that operate on a -- particularly from ocean



1 water that operate on -- continuously. But for a system  
2 like this where you've got a requirement for treating 24/7  
3 and with some variability in water, I'm just not aware of a  
4 system like this that's been proposed anywhere. And  
5 certainly I've not -- yeah, I've not seen performance data  
6 of anything close to this complexity.

7 Q In terms of -- in terms of just looking at the reverse  
8 osmosis component, have you seen a reverse osmosis system in  
9 a mine treating water like this operating 24/7?

10 A No. There's systems that operate, you know, on a regular  
11 basis, but they're designed so that they can go down for a  
12 particular amount of time.

13 Q Why is that? Why are they designed so they can go down?

14 A They have to be -- the membranes have to be cleaned; there has  
15 to be replacements of reverse osmosis membranes. There's a  
16 variety -- there's just a lot of operating parameters:  
17 pumps, pipes, valves, those sorts of things. And so they  
18 expect these can go down on a -- on some basis and so they  
19 operate them maybe five days a week or four days a week.  
20 For example, one in San Luis Mine in Colorado operates four  
21 days a week because that's -- they designed it to do that.  
22 They take weekends off and then a day for cleaning up. But  
23 this type of system will require a much higher level of just  
24 management.

25 Q Are reverse osmosis systems subject to clogging and fouling?

1 A Absolutely, they are.

2 Q Tell us about that.

3 A Well, pretreatment is one of the critical components for  
4 operating a reverse osmosis successfully. And certainly  
5 they've considered this in there by the filtration of --  
6 filtration that comes in, but if the water quality, for  
7 example, is not the same you get precipitation of gypsum  
8 that happens, that occurs throughout the process. And so  
9 it's a slow -- it's slow to come to equilibrium, and so you  
10 can't just precipitate, bang, filter and go forward, because  
11 the -- you can precipitate filter and then move forward, but  
12 you've still got gypsum precipitating in the process. It's  
13 a slower process. You begin to clog membranes in that  
14 process. And it's one that is certainly recognized in this  
15 business, but it's a very troubling and difficult thing to  
16 manage effectively.

17 Q What are these membranes that you've referred to -- what are  
18 they made out of?

19 A Mostly plastic, cellulose-acetate based a lot of them. Some  
20 of them are Teflon or fluorinated polymers. There's a  
21 variety of different membranes.

22 Q And what size would a membrane in a system like this be?

23 A I have to admit I didn't look at that exact calculation, but  
24 what they are is a series of --

25 Q Give us a range. Is it as big as a car or is it big as a --

1 as big as a 50-inch TV set? Just give us some sort of idea.

2 A Well, they all -- it's hard to make that kind of adjustment.

3 What they are is tubes with multiple membranes put in the

4 tubes and you build those up based on what kind of flow

5 rates, what kind of pressure you're going to use. So it's a

6 little hard to give them the -- is that -- a particular

7 size, but they can -- I mean, you can expand the size but as

8 far as design of the this particular treatment, they've got

9 a 5,000-square-foot building designed to put these things in

10 at present.

11 Q I think one of the reasons I asked you the question was, do

12 they indicate in the materials that they have submitted what

13 the size of the membrane is going to be?

14 A No; they don't have any specifications on membrane type

15 or -- and so that's why it's very difficult to estimate

16 size, because there is no indication of what -- even what

17 sort of system they're going to use. There's a variety of

18 different reverse osmosis manufacturers and different types

19 of systems.

20 Q Okay. I want to -- I want to have you take a look at the

21 notes on this particular page and I think there's a note

22 there that talks about the ionization system?

23 A It's ion exchange system. I just might quote this note

24 which suggests that they haven't got everything perfectly

25 worked out is -- the note's number 1: "Ion exchange system

1 for boron removal may be added in lieu of caustic prior to  
2 the second pass RO unit."

3 Q So what are they talking about here?

4 A Well, in the second RO unit the pH is raised. They had  
5 caustic, which is sodium hydroxide, at this step to raise  
6 the pH before they send it to the final unit. But running a  
7 high pH system is always a bit of a problem; it can impact  
8 membranes. And so what they're suggesting by this is they  
9 may not raise the pH before they run it through the second  
10 RO treatment but simply put an ion exchange system at the  
11 end, which is a fairly significant design. It's not a  
12 design detail; it's a design process that they're unsure of  
13 at this point.

14 Q Okay. So based on that particular note, what conclusion do  
15 you reach?

16 A Well, I don't think they've tested it, for one thing, and --

17 Q "It"; what's the "it"?

18 A The entire system. The entire system.

19 Q Okay. So what does that mean?

20 A Well, this is certainly an untested system and one that  
21 frankly is designed in a fairly speculative manner without a  
22 whole lot of data looking at this specific water and this  
23 condition with this group of unit processes pretty much put  
24 together.

25 Q Is there something about the predicted water quality that

1 has created this complex system?

2 A Oh, yes. Because of the soluble materials they have in  
3 there: sulfate, sodium chloride they've almost require to  
4 use a reverse osmosis system of some sort, but then they've  
5 got the acidity coming in the front. They've got to do some  
6 precipitations. And then they've got boron that they've got  
7 to deal with. So the predicted water quality is a critical  
8 component to design of a system like this.

9 Q And based on what you said before, this system is really  
10 based on their predicted water quality?

11 A Yes.

12 Q Okay. And based on what you said before, if the water  
13 quality is poorer than they have predicted, there's going to  
14 be a problem with the system?

15 A Certainly it would have to be redesigned.

16 Q My question for you is, if the water quality -- even if the  
17 water quality is as they predict, what is your prediction  
18 for this system? Is it going to -- is it going to work or  
19 should they go back to the drawing board?

20 A I think --

21 MR. BRACKEN: I'm going to object; lack of  
22 foundation. I don't think he has all the -- first of all,  
23 he hasn't done any testing. I assume all he's done is  
24 hypotheses.

25 MR. EGGAN: I think this -- I think this is a

1 person with imminent qualifications in terms of water  
2 treatment for mines and I think he's -- I think he is  
3 imminently qualified to testify as to whether this system is  
4 going to work even under the conditions they predict.

5 MR. BRACKEN: It's not a matter of qualifications;  
6 it's a matter of foundation, whether he's done anything on  
7 his own to justify him drawing a conclusion like that,  
8 except piling hypothesis onto hypothesis --

9 MR. EGGAN: Well, I don't think that the  
10 hypothesis is all that -- should be something you should  
11 concern yourself with, because I'm using the hypothesis that  
12 the system is going to receive the influent that you think  
13 it is. That's my question. Even if it receives the  
14 influent that you predict, is this system going to work?

15 MR. BRACKEN: I still have an objection as to this  
16 witness's ability to make the decision.

17 MR. EGGAN: Well, I think the witness has  
18 evidenced his ability to answer this particular question.

19 JUDGE PATTERSON: Well, I'll allow the answer.

20 A The issue is a process of how you develop a system like this  
21 and certainly, you know, it's based on the uncertainty of  
22 how they're going to treat boron. Plus, you know, just  
23 perhaps speculative. This system was designed with water  
24 quality and I would suggest that it needs certainly a much  
25 more extensive set of tests to determine in fact that these

1 individual components could put -- could come together to  
2 treat water quality that's both, you know, predicted and  
3 then plus some uncertainty in that water quality. And right  
4 now I don't think that data -- those data are available.  
5 Those data have not been generated, because the question  
6 process in determining what the water treatment system would  
7 be -- would need to be designed to do and there has been, to  
8 my knowledge, no data developed on how this system would  
9 actually work with this particular water.

10 Q Does the fact that they have put in the note, as we have  
11 indicated, indicate to you that they -- that they're  
12 concerned?

13 A I think there's a lot of, "If this doesn't work we'll do  
14 this" sort of thing and that suggests that they haven't  
15 demonstrated that this treatment system will do the job as  
16 designed.

17 Q Given the water quality that is going to be resulting from  
18 mining operations and the ecosystem that you talked about,  
19 is this approach, in your opinion, a prudent way to handle  
20 it, a wastewater treatment system?

21 MR. BRACKEN: Can I have a clarification of you  
22 meant by "ecosystem"?

23 Q When I say -- when I say "ecosystem" what do you think I  
24 mean? What do you mean; what does the word mean to you?

25 A Well, certainly the -- I would relate it to the impacts of

1 the discharge water on the physical and biological  
2 environment that would receive that water.

3 MR. BRACKEN: I'm going to object on foundation,  
4 because he's not an eco -- he's not a toxicologist in that  
5 regard.

6 MR. EGGAN: Well, I think what he has said is that  
7 he's an environmental chemist, and so I think that by its  
8 very nature establishes his qualifications.

9 Q Have you worked with ecosystems in the past?

10 A My top course is ecological toxicology, so -

11 MR. EGGAN: Your Honor, I think he's --

12 JUDGE PATTERSON: Yeah, I'll overrule.

13 Q Okay. Go ahead.

14 A Certainly that it almost ends up being a regulatory -- more  
15 of a regulatory issue, I have frankly not evaluated what  
16 discharge water quality would do to the ecological system,  
17 but as far as the discharge of contaminated water certainly  
18 I think just from a regulatory perspective this system would  
19 have to be demonstrated to be successful; and right now I  
20 guess what I have looked at is this system has not been  
21 demonstrated to be able to treat the water as they suggest.

22 Q Is it a prudent approach from your perspective to wait until  
23 the system in operation to see if it works?

24 A I cannot say what their plans are from this point forward as  
25 far as they would go forward, but certainly they would need



1 to do a lot more engineering design and a whole lot more  
2 testing of this to make sure this would work, because I do  
3 not believe this system would function as presently  
4 indicated on this fairly generic flow sheet.

5 Q Why do you think it would not function? And again, we're  
6 applying their current estimates, their current predictions.  
7 We're not even talking about what Dr. Maest or Dr. Prucha  
8 said.

9 A There's just too many single processes put together without  
10 demonstrating they will work. It's just -- when you design  
11 a system you want to make sure that there's a -- you know,  
12 this is the first step. This is the first step. But then  
13 there's many steps after that to make sure the system will  
14 operate.

15 Q You talked a few minutes ago about the briny solution at the  
16 end of the -- at the end of the treatment system and the  
17 sludge that will accumulate based on that. Is there  
18 anything in the plans that you have seen to cover how  
19 they're going to handle that sludge?

20 A No, other than just statements that they would be managed  
21 according to current regulations, which is not a management  
22 plan. Presumably -- and I'm speculating there -- they would  
23 be hauled offsite where they would be deposited, or even if  
24 left onsite it's completely up in the air how those  
25 sludges -- and there's two major sludges. One is the brine-

1 salt solution from the evaporation process, and then there's  
2 the sludge that occurs during the initial precipitation  
3 process.

4 Q How much are we talking about here?

5 A Well, again --

6 Q How much sludge?

7 A Again, that depends on the water content of the sludge,  
8 because usually these things have a -- are frankly  
9 predominantly water, but anywhere from calculated 10 to 15  
10 to 20 tons per day is kind of a back of the envelope  
11 calculation, assuming given water content.

12 Q Are there missing parameters among the permit application  
13 materials that would be important to you in determining the  
14 efficacy of the system?

15 A You mean in the influent water?

16 Q Yes. Yes.

17 A Yeah. I think that the TDS, the total dissolved solids,  
18 would have been very helpful to have. In some respects you  
19 can add that up, but you really don't know what is going to  
20 be -- plus there's addition of several steps of lime,  
21 sulfuric acid, sodium hydroxide, anti-scaling agents which  
22 are probably minor, so it's hard to know exactly what that  
23 sludge weight is going to be, so -- but you don't know what  
24 the dissolved solids, the salt content of the initial water  
25 coming in is. And then the other parameter that I would

1           have very much liked to have seen is the pH and acidity of  
2           the influent water, because that tells you how much calcium  
3           hydroxide you need to add to raise the pH, and that's part  
4           of this entire treatment design process.

5       Q     And this is information that was not included that in your  
6           view should have been?

7       A     I did not see it, and certainly I would have -- it would  
8           have helped to be able to evaluate the system.

9       Q     Do you think that the company has been optimistic or  
10          pessimistic about their ability to remove boron?

11      A     These two processes of ion exchange and reverse osmosis are  
12          the processes that you would use to remove boron; one or  
13          both of them. I'm not sure if they're optimistic or  
14          pessimistic; I just don't think there's enough data here to  
15          really evaluate whether they would be successful.

16      Q     Do you think that the Department of Environmental Quality --  
17          based on your review of the permit application, do you think  
18          the Department of Environmental Quality had sufficient  
19          information by which to evaluate this system and to allow  
20          this to be a treatment system?

21      A     I'm not sure I want to speculate what the Environmental  
22          Quality Department would do, but it certainly would not be  
23          sufficient information for me to evaluate whether this  
24          system would be successful. There's too many parameters  
25          left undecided; there's not enough data -- demonstration

1 data to determine whether this system actually could work as  
2 proposed.

3 Q I want to talk for a minute about the treated water  
4 infiltration system and note that we have an inflow rate at  
5 the treated water infiltration system that has been  
6 approved -- that has been offered by the company of 400  
7 gallons per minute. That's on Exhibit 44, which is there to  
8 your left, Mr. Miller. If the inflow rates are greater than  
9 those predicted by the company -- in other words, if the  
10 rate used to size the TWIS is understated, what impact will  
11 that have on the treated water infiltration system?

12 A It'll require redesign. One would think of an infiltration  
13 system as just basically putting water down in the ground  
14 and having it infiltrate. And I think this design is, as  
15 any design of a sophisticated infiltration system, is much  
16 more complicated than that. So if it does exist, if the  
17 water quantity to infiltrate is increased substantially, it  
18 will require a redesign of that system, you know, perhaps to  
19 a larger capacity.

20 MR. EGGAN: Can I have someone turn the Elmo on  
21 for me?

22 Q Dr. Miller, we're at the end of your testimony. I want to  
23 make sure that we all understand what your primary  
24 conclusions were. Are you able to read that listing of  
25 primary conclusions?

1 A Yes.

2 Q All right. And is that something that you and I put  
3 together?

4 A Yes.

5 Q Okay. What are your primary conclusions in terms of water  
6 inflow into the wastewater treatment system?

7 A Well, it says -- indicated here if it's greater than  
8 predicted the system will need to be redesigned to  
9 accommodate the additional water.

10 Q All right. Let me ask -- let me ask this. I'm referring to  
11 this as wastewater treatment system as a whole, but is that  
12 true for the individual components of this system? We've  
13 talked about the contact water basins. If the inflow is  
14 greater is that going to cause the contact water basin  
15 scenario to fail?

16 A Yes.

17 Q They'll overflow?

18 A Yes.

19 Q Is that true about the wastewater treatment plant itself?  
20 If the inflows are greater will the wastewater treatment  
21 plant by itself work?

22 A No, it will need to be redesigned.

23 Q And we talked about the treated water infiltration system  
24 just a moment ago. Will that system -- if the inflow is  
25 greater than as predicted by the company -- if it's greater,

1 will that system be able to handle the amount of water?

2 A No. It will need to be redesigned also.

3 Q All right. What is your main conclusion number 2?

4 A Well, if the water -- if the influent into the wastewater  
5 treatment is poorer -- particularly I think copper is the  
6 most sensitive item -- then the system will have to need to  
7 be redesigned to handle copper.

8 Q Can you talk about that copper issue just to make sure that  
9 we understand what that copper issue was?

10 A Well, copper concentrations -- most of the copper is going  
11 to be removed in -- well, the copper addition to the  
12 discharge water is going to primarily come from the second  
13 RO system of the concentrate reduction process and that's  
14 where the majority of copper comes from, and they predict --  
15 based on their predictions of water of -- that it will meet  
16 it at point -- excuse me -- seven micrograms per liter with  
17 a discharge limit -- which is one of the few discharge  
18 limits they have in the permit is ten, so it's only -- if it  
19 increases by 50 percent -- meaning, if the influent water  
20 goes from .14 to .2 or slightly above that, then they will  
21 go above the ten, meaning they will violate discharge  
22 standards.

23 Q Even under their current assumption?

24 A That's their current assumption. If their current  
25 assumption is off by only a small amount, then it will be --

1           violate that discharge limit.  If you use Dr. Maest's, then  
2           it violates it by a factor of 70.

3       Q     Seventy, 7-0?

4       A     Seven zero.

5       Q     Okay.  What is your conclusion number 3?

6       A     It is a complex, novel collection system; never -- it has  
7           not been shown to work, to my knowledge.  And the system  
8           is -- I think will need to be demonstrated before it will be  
9           successful and I believe that it is likely to fail due to a  
10          variety of issues; just the complexity of the system that it  
11          will not be able to handle that volume of water as predicted  
12          by the company.

13      Q     And your conclusion number 4?

14      A     And there are some parts of the system that -- where the  
15          information is just not provided that is critical to  
16          evaluating this water treatment system.

17                   MR. EGGAN:  Thank you, Doctor.  I don't have any  
18          further questions.

19                   MS. HALLEY:  I have just a couple.

20                                   DIRECT EXAMINATION

21      BY MS. HALLEY:

22      Q     Dr. Miller, most of your testimony has been related to the  
23          Part 31 permit so far and you understand that this mine is  
24          also regulated under Part 632?

25      A     Yes.

1 Q Okay. Have you read the so-called "demonstration clause" of  
2 Part 632?

3 A I've browsed through that; I haven't read it in great  
4 detail.

5 Q Okay. Could I refresh your memory and then ask you a couple  
6 of questions about it?

7 A Please do.

8 Q Okay. Part 632 requires that "techniques be demonstrated to  
9 be capable of accomplishing their stated objectives in  
10 protecting the environment and public health." Do you  
11 believe that this wastewater treatment facility has been  
12 demonstrated to be effective?

13 A No.

14 MR. BRACKEN: Objection, your Honor; foundation.  
15 They're now asking this chemist to tell us what -- to  
16 interpret regulations and rules; I don't think he's shown a  
17 foundation, nor do I think he has the background or  
18 qualifications to do that.

19 MS. HALLEY: I'm not asking him for any legal  
20 interpretation; I'm asking him for a factual understanding  
21 of whether this wastewater treatment plant system is  
22 capable -- has been demonstrated to be capable of what it's  
23 proposed to do. That's a factual question, not a legal  
24 question.

25 JUDGE PATTERSON: Just the language he's cited to.



1 MS. HALLEY: Pardon me?

2 JUDGE PATTERSON: I'll overrule the objection.

3 Q Dr. Miller, go ahead.

4 A This system since it's -- to my knowledge -- and there has  
5 not been any water that has actually gone through a system  
6 like this. There is not -- certainly not a demonstration  
7 that this series of components could be put together and  
8 actually treat the water as described. This is a novel,  
9 untested system.

10 Q So would you describe this system as being a generally  
11 accepted method of being effective at treating mine water in  
12 this way?

13 A Individual components of this system have been generally  
14 accepted to treat water, but together I don't think they've  
15 ever been shown to work together and -- with this  
16 complicated water. Not to my knowledge anyway. And so I  
17 would say that it is untested and certainly if you asked me  
18 whether this system component together would work, I'd say  
19 it might work. There might a lot of tinkering. But has it  
20 been shown to work, and the answer would be clearly no.

21 Q Thank you. So in your opinion has there been any actual  
22 testing that demonstrates this method would work?

23 A Not to my knowledge.

24 Q Has there been any modeling that would demonstrate that this  
25 technique would work?

1 A There has been some modeling. When you design a system like  
2 this your first step to do is to try to look at the water  
3 and then you use the unit components and how well they work  
4 and put those together. So yes, there has been modeling,  
5 but not demonstration of actual water treatment.

6 Q Okay. Has the modeling been of the whole system from  
7 beginning to end?

8 A Well, in each component, each unit process you take -- you  
9 model each unit process and determine what the water quality  
10 comes out of that unit process is and you put that in the  
11 next one and the next one and the next one. So it's a  
12 series basically of accommodation of processes where you  
13 look at each individual process to come up to the end.

14 Q So each process has been looked at, but the overall process  
15 has that been sort of --

16 A No.

17 Q "No"?

18 A That has not been demonstrated to work in this. And it is a  
19 complicated water.

20 Q And has there been any independent testing of this proposed  
21 technique?

22 A Not to my knowledge.

23 Q Okay. Documented applications in similar settings in  
24 mining?

25 A I looked for those and was unable to find any. There's

1 certainly reverse osmosis systems in mines, but not this --  
2 of this complexity and not operating under this set of  
3 requirements.

4 Q I see. How about contingency plans? Part 632 also requires  
5 contingency plans. Have you seen any contingency plans  
6 related to what happens if this wastewater treatment plant  
7 doesn't work as planned?

8 A Other than the one statement that they might try ion  
9 exchange rather than reverse osmosis, not really. I think  
10 they're at least -- well, I'll leave it at that.

11 Q So just to be clear, you said there's one statement that  
12 talks about substituting some other technology --

13 A Right.

14 Q -- if this doesn't work?

15 A Right; right. But that's a design criteria; it's not --  
16 depending on how you define "contingency." If the system  
17 fails -- there's some assumptions in there that the system  
18 can be down for ten days under normal operating conditions  
19 and the tanks would fill with water and then you would be  
20 able to -- they would be able to fix whatever problem might  
21 be. I suppose that would be a contingency plan, but if the  
22 system fails initially -- well, the issue is if it fails and  
23 this doesn't work, then they've got to go back to the  
24 drawing board and this is the issue that we've discussed  
25 previously about the need for a variety of steps in the

1 process to make sure everything works.

2 Q Related to Part 632 the contingency plan is required to  
3 include an assessment of the risk to the environment or  
4 public health and safety in the event of a failure. Does  
5 this contingency plan meet that requirement?

6 A I would have to defer an interpretation on that, because I  
7 really didn't look at that very -- that issue at all. But  
8 it was -- I saw no alternatives to this particular treatment  
9 operation, so there was really no contingencies if this  
10 whole system didn't work. But it is needed to be dealt with  
11 in a design -- in a design phase, so I really can't respond  
12 to that in a very strong manner.

13 Q But the statement that you saw, does it really address any  
14 of the risks to the environment?

15 A No. No. I did not see any risk assessment if this failed.

16 MS. HALLEY: No further questions.

17 MR. BRACKEN: Is this a good time for a break,  
18 your Honor?

19 JUDGE PATTERSON: Okay. Let's take ten minutes.

20 (Off the record)

21 MR. BRACKEN: Good morning, Dr. Miller. How are  
22 you?

23 THE WITNESS: Fine.

24 MR. BRACKEN: My name is Jeff Bracken; I represent  
25 Kennecott.

CROSS-EXAMINATION

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BY MR. BRACKEN:

Q First of all, who engaged your services in this matter?

A The Keweenaw Tribe.

Q And did they seek you out or did you seek them out?

A They sought me.

Q And when did you commence providing them services in this matter?

A Six weeks, two months?

Q From now?

A No. Six weeks to two months ago.

Q Ago?

A Yeah.

Q Okay. So we're talking about February, first of March, something like that?

A As I recall.

Q Okay. She don't test on that.

A Okay. That's good.

Q Is it fair to say you're an active member of the Sierra Club?

A Not as much as I used to be.

Q Did you used to hold any offices or positions?

A I used to be -- yes, I did have offices.

Q And what --

A I was a chapter chair of the Sierra Club I believe.

1 Q What chapter was that?

2 A Toiyabe Chapter.

3 Q What is the -- that sounds like a name -- that doesn't help  
4 me geographically where that was located.

5 A Mostly Nevada, some California.

6 Q And how did you -- were you actively involved in the Sierra  
7 Club?

8 A I've been a member for quite some time, but I was active  
9 maybe five, six, ten years; in the '80's.

10 Q And you're not only involved in the Great Basin Mine Watch,  
11 you've been described to me as an organizer of it. Is that  
12 fair to say?

13 A I believe that's correct.

14 Q And that's another environmental group?

15 A Yes.

16 Q That looks in a certain area -- geographically looks at  
17 mines and mine issues involving the environment?

18 A A variety of resource issues, yes.

19 Q Would it be fair to say that both your membership in the  
20 Sierra Club and the Great Basin Mine Watch is really from a  
21 activist point of view from an environmentalist?

22 A I'm not sure how you define that.

23 Q You have been described in something I read as dedicated  
24 environmental activist. Would that be a fair statement?

25 MR. EGGAN: Can we see where that came from?

1 MR. BRACKEN: Sure. Let me pull back that  
2 question and I'll -- because I have a document that I'll --  
3 I'm not ready to get to yet. I'll withdraw the question for  
4 the time being.

5 Q You talked in your testimony about acid mines and history of  
6 acid mining. And I got the impression from listening to you  
7 that your impression of the mining industry changes over --  
8 or has changed somewhat over time?

9 A Oh, certainly.

10 Q And would it be fair to say that historically the mining  
11 industry was not very attentive to the needs of the  
12 environment and has become more so?

13 A More so and much larger.

14 Q Much larger?

15 A On a per-ton basis the old mining industry had a lot of more  
16 impact on a per-ton basis; the scale of mining now is so  
17 much larger than it was in years past. And so -- and I  
18 don't know if, you know, I'd say whether the impact has  
19 changed a whole lot, but certainly there is a lot more focus  
20 on dealing with a variety of environmental issues than there  
21 was in the past. I would agree with you on that.

22 Q Would it be -- would you agree with this statement: that  
23 all mines, all new mines are good mines? That's where you  
24 have smart people working, you have a lot of investments,  
25 you have a lot of technology and ability to do good things.

1           Would you agree with that?

2       A     That's not the entire quote, I don't believe.

3       Q     Would you like me to show it to you?

4       A     I know I've said that before, is that the point -- the point

5           I would make is there that the -- that mines on closure were

6           usually where the problems end up being and in dealing with

7           legacy issues. And I think that's --

8       Q     What they leave behind when the mine plays out or the ore

9           plays out?

10      A     Right; right.

11      Q     And do you know what steps that have been taken by the MDEQ

12           to assure that once the ore -- actual ore mining is done

13           here how they're going to protect the environment; what

14           steps they've taken to do that?

15      A     You know, I have not really looked at that. I was actually

16           looking only at the specific issue of water quality

17           treatment, which is my area of expertise.

18      Q     That's fair enough. And actually, would you agree with

19           this? "The general impression of regulatory systems in the

20           United States, that all of them are quite good."

21      A     I think that's a value judgment I don't care to make a

22           comment on right now. There are -- they vary.

23      Q     Well, you made that statement before, haven't you?

24      A     I don't think I've -- if you've got a quote on -- that all

25           regulatory systems are good?



1 Q "All are quite good." I'd be glad to show it to you, if you  
2 want me to.

3 A If you can show that to me and -- although that's not part  
4 of what I was asked to do in this testimony.

5 Q Okay. But you have commented upon whether the MDEQ has  
6 collected enough data, looked at enough data to make a  
7 decision to grant the application, haven't you?

8 A Yes.

9 Q That's part -- and you've also made comments about how this  
10 process is going down the road?

11 A Yes.

12 Q So the quality of the regulatory system impacts on both of  
13 those subject matters that you've testified about?

14 A Well, it certainly will, although kind of a general  
15 statement like that, the contextual aspect of that I  
16 certainly would be interested in seeing what that context  
17 was. Because I certainly don't agree that all regulatory  
18 systems in the United States are good. They vary  
19 depending on a variety of factors.

20 Q Let me ask you this. Do you know anything about the  
21 regulatory system here in the state of Michigan administered  
22 by the MDEQ that would be contrary to that statement; that  
23 they're not good?

24 A I've really have not evaluated the MDEQ ever, period.

25 Q Okay. How many groundwater discharge permit applications

1           have you worked on?

2       A     Depending on how you define "worked on." I've looked at a  
3           dozen in different contexts, but a dozen mining applications  
4           where discharging water to the ground, yes.

5       Q     Okay. What different contexts were there than this?

6       A     Well, in Nevada there's a lot of concern about a certain  
7           type of drainage of precious metal heaps and there's ideas  
8           to do a ground application with heap drainage water, which  
9           is frankly fairly severe water. And there's a couple mines  
10          that basically put some fairly serious water into discharge  
11          systems -- or into french drains system. Similar to this,  
12          but a different quality of water, different issue.

13      Q     That's gold mining for the most part?

14      A     Gold mining for the most part.

15      Q     They have high concentrations of cyanide mercury?

16      A     No, not those -- cyanide is regulated down to two tenths of  
17          a milligram per liter. Mercury is an issue in one of them,  
18          but mostly it's sulfate arsenic, sodium; a variety of  
19          constituents that -- similarity.

20      Q     Is it fair to say -- I hope I'm not beating a dead horse on  
21          this. You're familiar with the several processes that are  
22          anticipated being used in the wastewater treatment plant at  
23          the Kennecott Mine?

24      A     True; yes.

25      Q     And for instance, metal precipitation is one that you're

1 familiar with from your work?

2 A Yes.

3 Q And you would agree that in and of itself, if that was the  
4 only process, that's a well-tested process?

5 A Yes.

6 Q Been used for how many years in the industry?

7 A It's a standard for treating acidic water, lime treatment.

8 Q Okay. And this is acidic water, so it's -- it would be the  
9 standard treatment you would have expected Kennecott to  
10 propose, or at least one of them?

11 A Sure.

12 Q And it's robust depending on how it's run?

13 A Yes, although there was some unusual aspects of this  
14 particular treatment here that I found unusual that we could  
15 go into if you'd like.

16 Q And in fact you from time to time have said it's a well-  
17 established, well-tested technology to be used in this --

18 A Yes.

19 Q You've also written or spoken about the reverse osmosis  
20 technology, which is one of the ones that's going to be used  
21 at this mine as well; correct?

22 A Correct.

23 Q And would you agree -- do you agree that it is again well  
24 tested in this industry?

25 A It's much less common than lime treatment, for example. In

1 Nevada which is a large mining industry, there's, I think,  
2 three examples where it's been used commonly out of, you  
3 know, some -- depending on how you count them -- 130 mines.  
4 So it's -- I would call that unusual, in Nevada certainly.  
5 And unusual in the other big mining state, which is Arizona.  
6 Although, it has been used there also.

7 Q Do you agree it's a well-tested technology?

8 A It's well tested under certain conditions and certain  
9 scenarios that it has been used extensively. It has not  
10 been used, to my knowledge, in a water that is like this  
11 water for discharge during mining.

12 Q How about for sulfate removal? Is that something it's been  
13 used for?

14 A It has been used for sulfate removal.

15 Q And in that context is it well tested?

16 A In that narrow context, it's tested, but again, it's tested  
17 examples I've seen tested for drinking water, making  
18 drinking water in a mine in Arizona. It's been used in San  
19 Luis on an intermittent basis for reducing the dissolved  
20 solids in it. And certainly in Nevada it was used in a pit  
21 lake to remove dissolved solids, including sulfate on an  
22 intermittent basis. And they -- it was -- they used it for  
23 one summer and did not use it after that.

24 Q Do you recall writing a paper called the -- I think it's a  
25 presentation "Reduction of Sulfate Concentration in Neutral

1 Mine Effluent"? Would you like to see a copy?

2 A I've written -- I've written numerous things about that,  
3 yeah.

4 Q This is September 27th, 2005. Would you like to see a copy?

5 A Sure. Is that a -- I think that might be a --

6 MR. BRACKEN: I have copies too, Counsel.

7 (Witness reviews document)

8 A Yes, I remember writing this. Yeah. I know what the  
9 context I wrote this in, though. I remember this. All  
10 right.

11 Q Okay. I note that in page two you talk about reverse  
12 osmosis and membrane methods, do you not?

13 A Yes.

14 Q And you had previously talked about chemical precipitation,  
15 which is one of the things we talked about earlier. And  
16 here you say, "Unlike the methods above, reverse osmosis in  
17 essence are well tested and robust."

18 A This -- yeah, that's exactly what I said. Let me expand on  
19 that. This context was for a pit lake called the -- one of  
20 the ones I mentioned before that had a very high arsenic  
21 level and it had a very high sulfate level, the Jamestown  
22 Mine in California, and they had to get rid of sulfate out  
23 of the pit lake. And this is the context where I have seen  
24 sulfate removal using reverse osmosis is to be quite  
25 successful. And I would affirm this that using RO to get

1 rid of sulfate out of the Jamestown pit lake would work,  
2 because it's a pit lake and they don't have to treat it all  
3 the time. They have the ability to go in and treat for one  
4 day or five days or ten days or 20 days. But when they shut  
5 it down, nothing happens. They just have a pit lake there.  
6 That's the difference, and that's the point I was making  
7 with Mr. Eggen is that a treatment system as complicated as  
8 the one that was proposed here requires many, many steps,  
9 requires to be operated effectively 24/7 over the vast  
10 majority of the year. That's where this system I think has  
11 not been tested extensively.

12 Q Okay. So the process has been tested. It's in this  
13 application in the operation of this system would have some  
14 issues?

15 A Yes.

16 Q Questions, you haven't done any yourself haven't gone out of  
17 your way and done any testing, any modeling about how this  
18 will work in this application?

19 A No, I haven't. But that's the point is I don't think  
20 anybody has.

21 Q Okay. But you haven't?

22 A I have not.

23 Q And the issue that you've just raised is an issue of  
24 operations, monitoring what's going on, watching your  
25 membranes, making sure they don't get scaled, those kind of

1 things? You make sure it continues to operate efficiently  
2 over time; is that right?

3 A Right. Certainly one part. The other part was the quality  
4 of water, the influent. So there's three components: One,  
5 the existing water that would be as predicted by Kennecott,  
6 and then the other two issues are the quality predicted by  
7 Dr. Maest and the quantity of water predicted by Dr. Prucha.

8 Q We'll get to that. First of all, have you seen any of Dr.  
9 Maest's work except -- have you seen how she did her work,  
10 look at how Stratus did the testing or did you just read the  
11 report?

12 A We read -- I read the report, but I looked at -- I did go  
13 into some background. I was not asked to do that  
14 specifically, but I did go into some of the background  
15 documentation.

16 Q So is it fair to say you're relying on her report?

17 A That's fair to say.

18 Q Would it be fair to say that you're also relying on Dr.  
19 Prucha's report?

20 A I believe that's fair to say.

21 Q If he has a report -- I'm not sure he has a report -- or his  
22 testimony in this case, whichever it is you're relying on?

23 A I'm relying on Dr. Prucha and Dr. Maest.

24 Q So when did you first meet Dr. Prucha?

25 A I met him during this proceeding and spent several days

1 going over these issues with him.

2 Q Okay. So you've had conversations with him?

3 A Yes.

4 Q Did you see any of his work product?

5 A I'm not sure what you mean by "work product." I've seen the  
6 results and what the predictions are and been involved in  
7 discussions about, you know, faulting where I sat back and  
8 pretty much listened. But I've -- but I'm not a  
9 hydrologist.

10 Q Okay. So you have to rely on him?

11 A I have to rely on his work.

12 Q So to the extent that they're not accurate, obviously that  
13 affects your testimony in some regards? In regards to that  
14 you, for instance, the volumes of --

15 A The volumes are obviously, you know -- I'm taking the  
16 volumes that are proposed in both cases and making  
17 determination of the water treatment ability based on those  
18 volumes.

19 Q And you have assumed his are -- for your testimony today,  
20 you've assumed his are correct and that Kennecott's aren't  
21 except as otherwise indicated in your testimony?

22 A I'm not assuming anything's correct. I'm saying if one is  
23 correct, this is the result. If another is correct, that is  
24 the result.

25 Q Okay. So you haven't come to a decision on whether or not



1           one is correct or one's not correct; is that true?

2       A       I was not asked to do that.

3       Q       Okay.  Would it be fair to say that you're a scientist, a  
4           chemist; correct?

5       A       Yes.

6       Q       And you're testifying in that regard today?

7       A       Yes.

8       Q       You're familiar with what we call the scientific method, at  
9           least in generalities?

10      A       Sure.  I'm a big fan of the scientific method.

11      Q       Sure.  And would you agree that you'd have a greatly  
12           increased level of confidence in the reliability of  
13           someone's conclusions if they were based upon the use of the  
14           method?

15      A       Well, that's kind of a leading question, but you certainly  
16           hope to have some data to support your arguments.

17      Q       Well, the scientific method's a little more than just data,  
18           isn't it?

19      A       Sure.  I suppose it is.  But you certainly make hypotheses.  
20           You test them and then you determine whether your hypotheses  
21           are correct.

22      Q       Right.  And if you're doing a study, that would be subject  
23           to peer review?

24      A       In situations where there's a peer review process in place  
25           they would.  But oftentimes there's not a peer review

1 process in place.

2 Q And so how do you determine without going into it and  
3 without peer review somebody else's work?

4 A Well, all peer review is is somebody else looking at --  
5 looking at a work. And peer review means somebody else has  
6 looked at it and made a decision whether they support it or  
7 not. I mean, in some respects Dr. Prucha's view of the --  
8 of this material is a peer review of the Kennecott proposal.  
9 So that would be one form of peer review. Certainly he's an  
10 expert. I think Dr. Maest would be peer reviewing some of  
11 the geochemical work. And so that's a form of peer review.

12 Q You haven't peer reviewed their work?

13 A I'm not capable of peer reviewing either one of their work.

14 Q Now, peer review requires, does it not, a bit of skepticism  
15 about someone's work, to test it?

16 A I don't know if there's skepticism, but you analyze the  
17 work. And I might also mention that in a classic peer  
18 reviewing of manuscripts, which is the accepted way of  
19 publishing in a peer review journal is you have an editor  
20 who sits as a judge and then you have people who are peers  
21 in that area that review the work. I've had some things  
22 that come through that the peer review done was just  
23 terrible. And I made strong arguments to the judge, who was  
24 the editor at that point, saying, "This guy is absolutely  
25 wrong for this, this and this." The editor made a decision

1 in this one case, fortunately made a decision in my favor.  
2 So I peer reviewed the peer review of my work and said  
3 that -- so you do have a -- peer review means there is  
4 somebody sitting as a judge of the arguments that are being  
5 made.

6 Q When you're expressing an expert opinion, is it important  
7 for you to base that opinion only on data which has been  
8 obtained through the use of the scientific method?

9 A Well, in this case, the -- what I --

10 Q Boy, I don't think that's a tough question. That was just a  
11 general question. Excuse me. I didn't mean to interrupt  
12 you.

13 A I think that's a, with all due respect, somewhat misdirected  
14 question, because, you know, the scientific method is a  
15 process you go through to determine whether your hypothesis  
16 is correct. That often requires experimental data to be  
17 produced. It does not necessarily mean that in peer review  
18 you've got to do independent work to justify whether in fact  
19 something is going to happen. The peer review process  
20 generally will not require the peer reviewer to develop  
21 information.

22 Q I'm sorry. I didn't ask you about peer review on that  
23 question. I asked you, when expressing an expert opinion,  
24 do you base that opinion only upon data which you believe  
25 has been obtained through a scientific method?

1 A When I review something, I review it based on the sum total  
2 of my experience and education and the data that I have  
3 become knowledgeable about. And you analyze the data to see  
4 if -- data and conclusions to see if it was developed in a  
5 scientifically valid method. I guess I would leave it at  
6 that, though. You hope for -- the hope that the information  
7 that you review is true and was developed appropriately to  
8 test the hypothesis. So in many respects, I would agree  
9 with it, but I think it's not -- it's kind of a bit off  
10 exactly how the process works. I have to admit I don't  
11 think scientific process when I look to see a set of data  
12 that comes to my table to review. I think, "Is this valid  
13 data? Is it consistent with what they're" -- "does it help  
14 to answer the question at hand?" And that's basically an  
15 indirect way of saying the scientific process. So I'm not  
16 sure if --

17 Q So it's an indirect way of -- you do the same thing, even  
18 though it's not in a valid formal way?

19 A Well, I hope what I do is a valid formal way. But I analyze  
20 data to see if it's consistent with information that has  
21 been developed that I can understand and evaluate.

22 Q And is that what you did in this case?

23 A I looked at the data that basically Kennecott had developed  
24 and what -- and then I applied those values as far as the  
25 treatment processes to information that Dr. Prucha and Dr.

1 Maest had developed. But most of the information I looked  
2 at was based on -- based on the water treatment proposals by  
3 Kennecott.

4 Q And in your -- but it was based on what Dr. Prucha said as  
5 well as to volumes and Dr. Maest said as concentrations;  
6 correct?

7 A That's correct.

8 Q And did you do this in a way that you always do it?

9 A What I did was actually very straightforward is looked at  
10 the Kennecott proposal. Have I seen this system before?  
11 Is -- what are the uncertainties that I have seen in  
12 influent water quality? What happens if there is  
13 variability in influent water quality? Will all these  
14 things work together? What are the downsides of these  
15 things running? And then I also took Dr. Prucha's and Dr.  
16 Maest's input parameters and said, "How would this system  
17 react if these input parameters were changed to their  
18 suggestion?" And that's what I did was very -- was actually  
19 quite simple.

20 Q Okay. Have you ever been publically accused of engaging in  
21 such behavior when you didn't follow the scientific method  
22 and you drew conclusions that weren't --

23 A I had an occasion with the Division of Environmental  
24 Protection a year and a half ago, which I think that they  
25 have realized was not a correct conclusion. It was a state

1           agency.

2       Q     The State of Nevada Department of Conservation and Natural  
3           Resources --

4       A     Right; right.

5       Q     -- the Division of Environmental Protection?

6       A     Yes.

7       Q     Kind of a public fight, wasn't it?

8       A     It was kind of a public fight. It had to do with mercury  
9           emissions. And I just might mention that we measured a very  
10          high mercury content, very simple measurement, outside one  
11          of the mines and reported that.

12      Q     Okay. I'll get --

13      A     And but you bring the point up, and this is a question of  
14          ethics and how that was. That turned out to be the second  
15          highest reported -- well, the highest reported mercury  
16          emission in the State of Nevada. They had never measured,  
17          and so their criticism of me was objectionable.

18      Q     The Department of Environmental -- or Division of  
19          Environmental Protection said that the study that you had  
20          done, if I recall, clearly lacks basic scientific integrity;  
21          isn't that true?

22      A     They said that it did not. It was a very simple study.

23      Q     Well, isn't it true that what you did, you told them you  
24          conducted a study, you issued a study. Did you issue it  
25          under the auspices of the university?

1 A It was -- it was certainly issued from the University of  
2 Nevada. It was funded by some organizations other than the  
3 university, partially funded. Partially was out of mine.

4 Q Who funded it?

5 A I believe Earthworks funded part of it.

6 Q An environmental concern?

7 A An organization interested in mercury emissions from mining.

8 Q On the non-industry side?

9 A One could argue that.

10 Q And they funded this study?

11 A They funded the instrument. We funded the rest of it. It  
12 was basically a shared instrument. We -- that's all they  
13 funded was the instrument.

14 Q Isn't it true that part of the State of Nevada's complaint  
15 was that you used the instrument incorrectly?

16 A That was absolutely not true. The instrument was used  
17 correctly.

18 Q Excuse me. Is that what they said?

19 A I don't think they said that.

20 Q Isn't it true that there is no ambient air quality standard  
21 for mercury?

22 A There is the Environmental Protection Agency has issued --  
23 issues where there's a diminimus level of mercury that's  
24 concerned. They've also issued -- the Labor Department has  
25 issued standards where there's a clear problem for worker

1 exposure.

2 Q And those are ambient or workplace standards?

3 A One is workplace, one is ambient.

4 Q And over what period of time? Isn't the workplace standard  
5 over hours of exposure?

6 A It's hours of exposure.

7 Q And you took ambient air, you took samples over  
8 instantaneous and 60-second plots, didn't you?

9 A Well, it's a little bit more complicated than that.

10 Q Did you or not? Did you do that or not?

11 A We did -- no, we did not.

12 Q Isn't that what your report said? Isn't that what the  
13 department said you did based on your report?

14 A No. That was the average over 60 seconds. We took much  
15 longer measurements than that. They didn't understand the  
16 report.

17 Q Is there a -- is there a standard for ambient air quality  
18 for mercury? And is there a standard which relates to human  
19 health?

20 MR. EGGAN: Your Honor, I think I have to  
21 interpose an objection here. None of these issues have  
22 anything to do with what is going on in this case, clearly.  
23 This is a water treatment case. The ambient -- whether or  
24 not there's an ambient standard for mercury in Nevada, I  
25 don't know what relevance that has.



1                   MR. BRACKEN: The issue is clearly bias. This  
2 gentleman has indicated that he has -- he's a critic of the  
3 mining industry. And this is an example of where the  
4 department State of Nevada made it very public that they  
5 think he was so biased that he lacks scientific integrity.  
6 And I intend to move for admission of the report and the  
7 technical evaluation that goes with it. I think I'm allowed  
8 to do that.

9     A     Are you allowed, then, to do my response to that technical  
10           evaluation?

11    Q     Well, I'm sorry. You're not --

12    A     Because they would not -- they would not print that, because  
13           they did not have any answer to that. So, I mean, this is  
14           well beyond this particular hearing. And I will stand by  
15           that report as the only time mercury is measured in the  
16           State of Nevada in ambient air, and it is valid data.

17           And --

18    Q     And is there a -- you made the -- you made the conclusion,  
19           did you not, that it was thousands of times higher than was  
20           acceptable for human health?

21    A     No, I didn't.

22                   MR. EGGAN: Your Honor, again, I object. Are we  
23           going to litigate this whole issue of whether or not there  
24           was or wasn't a problem in Nevada?

25                   MR. BRACKEN: Your Honor --

1 THE WITNESS: He's also making statements that are  
2 not correct.

3 JUDGE PATTERSON: I don't know if it's going to  
4 add --

5 MR. EGGAN: Doctor --

6 JUDGE PATTERSON: It's an issue of credibility or,  
7 as Counsel said, bias. I don't think you're trying to prove  
8 that --

9 MR. BRACKEN: I'm not trying to prove --

10 JUDGE PATTERSON: -- whether he was right or  
11 wrong.

12 MR. BRACKEN: -- that at all. I'm not trying to  
13 prove that at all.

14 JUDGE PATTERSON: All right.

15 Q Let's just ask this question. Is it true that the State of  
16 Nevada found eight different ways in which they believed  
17 that you hadn't properly conducted your study or reported  
18 your study?

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

20 Q Would you like me to address those for you? Do you  
21 remember?

22 A You mean if you want to do that, we can go through, as long  
23 as you give me an opportunity to respond to each one of  
24 those, which I did in a written document that was equally as  
25 long. And the -- I have had a fair amount of experience on

1 mercury and mercury measurements.

2 Q Well, wait a minute.

3 A They have not.

4 Q Maybe we can just end it here. Isn't it true that the  
5 department found that the study clearly lacked basic  
6 scientific integrity; that they determined that no  
7 conclusions could be drawn from the data presented and that  
8 the study was so significantly flawed it was difficult to  
9 fully discuss all the deficiencies identified?

10 A That was the most vitriolic letter I've ever seen.

11 Q Answer the question. Would you answer the question?

12 A I do not believe they were correct in that. They were  
13 wrong. We had a fundamental disagreement about mercury  
14 measurements in ambient air.

15 Q Isn't --

16 A Their response was very, very harsh. That was not a peer  
17 review. That was a vitriolic response.

18 Q Is it true that that's what they said?

19 A I can't remember what they said.

20 Q Would you like to see it?

21 A I believe you if you say that.

22 Q Okay.

23 MR. BRACKEN: Your Honor, I'm going to move for  
24 admission of this report that goes to the credibility of  
25 this witness. This is a report that was issued March 8th --

1                   MR. EGGAN: Don't show it to him until he decides  
2 whether it's admissible.

3                   MR. BRACKEN: Okay. That's fine. I won't.

4                   JUDGE PATTERSON: March 8th of what year, Counsel?

5                   MR. BRACKEN: 2007.

6                   MR. EGGAN: You're moving the admission now?

7                   MR. BRACKEN: I am.

8                   MR. EGGAN: Your Honor, this is clearly and  
9 obviously a hearsay document. If it was dated March 8th of  
10 2007, clearly Counsel had it all this time period. It was  
11 never offered, presented as an exhibit. We've never seen it  
12 before. It relates to an issue that is collateral to these  
13 proceedings. If we choose to litigate this issue, I think  
14 that it's -- there is no reason to litigate this issue that  
15 apparently occurred -- was some sort of in-fight between Dr.  
16 Miller and the Nevada Division of Environmental Protection.  
17 And it's a hearsay document. It is some seven pages long.  
18 And I think it's -- I think the document itself is hearsay.

19                   JUDGE PATTERSON: Mr. Reichel, do you have a  
20 position?

21                   MR. REICHEL: No. I haven't seen this before. I  
22 have no objection to it.

23                   MR. BRACKEN: Your Honor, it was 2007 when it was  
24 issued. However, they didn't hire Dr. Miller until six to  
25 eight weeks ago. We didn't know he was testifying. We just

1 did a search and found out this information not too long  
2 ago, within weeks. And I think it talks to his credibility.  
3 It's an official document of the State of Nevada sent by the  
4 division head.

5 MR. EGGAN: Official document? It's on their  
6 letterhead, but it isn't under State seal or anything like  
7 that. I wouldn't -- I don't think it's --

8 JUDGE PATTERSON: We know what it is.

9 MR. BRACKEN: It is. And there's no way except  
10 but to prove via sometimes but by these extrinsic evidence  
11 like this. I think it just shows a bias towards mining  
12 companies and I think I'm allowed to bring that into  
13 evidence. I think there's a sufficient foundation that's  
14 self-authenticating.

15 MR. EGGAN: Your Honor, this is clearly hearsay.  
16 It clearly violates the rules that you established on how  
17 these proceedings were going to develop.

18 JUDGE PATTERSON: Well, I don't think it's  
19 hearsay, because it's not being submitted for the truth of  
20 the matter asserted.

21 MR. EGGAN: Oh, I disagree. It absolutely  
22 positively is being presented for that.

23 JUDGE PATTERSON: I think Dr. Miller has attempted  
24 as best he can under the constraints of cross-examination to  
25 explain, which you can certainly pursue on redirect. I'm

1 going to admit it for the limited purposes of assessing his  
2 credibility or bias, but certainly not for the truth of the  
3 matter asserted.

4 MR. BRACKEN: Exhibit 600.

5 JUDGE PATTERSON: Pardon me?

6 MR. BRACKEN: Intervenor Exhibit 600.

7 JUDGE PATTERSON: Okay.

8 (Intervenor's Exhibit 600 marked and received)

9 JUDGE PATTERSON: This would probably be a good  
10 time to break for lunch. It's a minute to 12:00.

11 (Off the record)

12 Q Dr. Miller, we were talking earlier about -- or you've been  
13 talking in your testimony about the fact that you relied on  
14 Dr. Maest's concentrations of constituents in the inflow  
15 water. Do you recall that?

16 A Yes.

17 Q And you've also talked at different times in your testimony  
18 today about the ability or inability of the system as  
19 designed by Kennecott being unable to react very well.  
20 Those are my terms. Or you have a concern about that or  
21 something; is that correct?

22 A Yes.

23 Q Do you know the way the mining is planned here, that this  
24 mining is going to build up over a period of three years  
25 until it gets to the full mining work that's going to be

1 performed here?

2 A How do you mean, "built up"?

3 Q Well, I mean it's going to start off slowly and then they're  
4 going to build it up and build it up?

5 A Sure. No, I -- yeah, that's the common way a mine is  
6 developed.

7 Q I figured it was. And you're familiar with that, I'm sure.  
8 So during that period if they're monitoring, though, they'll  
9 have the opportunity, will they not, to see what problems  
10 may arise and adjust by adding units or whatever?

11 A I thought about that. It certainly -- when you have a mine  
12 evolving under that time frame, getting engineering designs  
13 -- say the first year they have -- dig down somewhere into  
14 the \* (1:06:16) and the entrance. And I thought about that.  
15 The issues of delay of mine when these are on a very tight  
16 schedule are very difficult. Increasing the size of the  
17 water treatment unit quickly is probably going to be very,  
18 very difficult. Now, I have not -- and I was not asked to  
19 evaluate that. But by going through a permitting process to  
20 increase the TWIS, for example -- now, whether that could be  
21 undertaken quickly is doubtful. But certainly I would not  
22 disagree with your supposition that there will be some time.  
23 But I guess the argument I was making is that at present it  
24 is probably unlikely -- or it is unlikely that the system  
25 will operate as -- successfully, and certainly not at the

1 flows and concentration or -- because they're going to have  
2 to redesign and re-engineer the system.

3 Q One thing I forgot to talk about this morning was the  
4 evaporator crystalizer technology. Is that also well-  
5 tested?

6 A Not in the mining industry, but in other industries it's  
7 reasonably well-tested. Certainly just -- if you can't get  
8 rid of water any other way, you just evaporate it and you  
9 leave the crystalline material behind.

10 Q And the quality of the evaporated water is distilled water,  
11 in effect?

12 A It's not quite distilled water, but it's very good water.  
13 You don't get 100-percent removal of all constituents, but  
14 you get very good removal.

15 Q And you get some sludge or crystalline to get rid of?

16 A Right.

17 Q So the three main components that you and I have talked  
18 about, which are the metal hydroxide precipitation, the  
19 reverse osmosis and the evaporator crystalizer, are all  
20 tested technologies if not in mining certainly in industry;  
21 is that right?

22 A They have been tested but not in this exact configuration.  
23 And that's the uncertainty that comes in.

24 Q Sure. You're not saying, are you, that Kennecott is not  
25 trying to address all the problems that they have with this



1 water?

2 A No, I'm not saying that.

3 Q In fact, some of these processes I think I've seen -- maybe  
4 you suggested it; that the reverse osmosis process is an  
5 expensive one?

6 A It's very expensive.

7 Q So it's not that Kennecott is trying to get off on the cheap  
8 here; they're trying to address these problems and they're  
9 spending the kind of money that may be able to address them?  
10 Do you have a question -- let me restate. Let me try this  
11 again. You've indicated that you have some problems with  
12 putting these together. It's an innovative system, one  
13 that's unusual. Those are words you've used?

14 A Yes.

15 Q You said each of the component parts has been used  
16 successfully. They've put the three of them together, and  
17 they haven't spared any expense in doing that, have they?

18 A No.

19 Q So is it fair to say you'd even characterize this as a  
20 serious attempt to address the problems, even though  
21 untested?

22 A Untested, it is a serious attempt to address this water  
23 quality issue.

24 MR. BRACKEN: I have no further questions.

25 MR. REICHEL: Good afternoon, Dr. Miller. My name

1 is bob Reichel, and I represent the Department of  
2 Environmental Quality in this proceeding. I just want to  
3 follow up briefly on some of the points that Mr. Egan  
4 touched on in direct examination.

5 CROSS-EXAMINATION

6 BY MR. REICHEL:

7 Q As you may recall, sir, you testified that as part of your  
8 work on this project you reviewed the groundwater discharge  
9 permit that was issued by the DEQ?

10 A Correct.

11 Q And I believe you also testified that you had some concern  
12 that certain parameters -- that there were not numeric  
13 effluent limitations for certain parameters in the permit.  
14 Do you recall testifying about that?

15 A Yes.

16 Q I believe you used nickel as an example?

17 A And sulfate.

18 Q And sulfate. Okay. Thank you. I'm sure that you've looked  
19 at a lot of paper in this case. Have you read the entire  
20 permit, sir?

21 A Oh, yes.

22 Q Are you aware, then, sir that -- well, let's back up. Are  
23 you aware from reviewing the permit that there are a variety  
24 of conditions in the permit at different sections?

25 A Yes.

1 Q And one aspect of that which Mr. Eggen asked you to look at  
2 were some requirements applicable at the effluent from the  
3 treatment system; correct?

4 A (No verbal response)

5 Q Are you aware, sir, that the permit also contains additional  
6 requirements with respect to monitoring the quality of water  
7 in groundwater monitoring wells?

8 A Yes. Although I might add that the groundwater monitoring  
9 is some distance -- or there's some expectation that the  
10 groundwater contamination would turn up something if there  
11 was a problem. And I guess my argument is that if you have  
12 a good, well-regulated discharge with full regulatory  
13 control of the constituents in that discharge, then you will  
14 be certain that there will not be a groundwater problem, at  
15 least from the mine. In this case it's actually regulating  
16 based on what you find in groundwater, which may be a little  
17 late.

18 Q Well, I understand that, sir. But my question was simply  
19 you acknowledge, do you not, that there are limits -- among  
20 other conditions in the permit, there are limits established  
21 for various parameters in groundwater monitor wells; isn't  
22 that true?

23 A Yes.

24 Q And you said "some distance away." What, if any,  
25 understanding do you have about how far away these

1 groundwater monitoring wells are from the so-called  
2 infiltration system?

3 A I really wasn't asked to look at that, and so --

4 Q Fair enough. So you don't know?

5 A -- I don't know.

6 Q Are you aware, sir, that the permit -- I think you did  
7 briefly touch on this when Mr. Eggan was asking you some  
8 questions; that the permit also has attached to it as one of  
9 the appendices a table of expected effluent characteristics  
10 that was submitted to -- or based upon information submitted  
11 by Kennecott to the DEQ. Do you recall that?

12 A Yes.

13 Q You're familiar with that?

14 A Yes.

15 Q And are you aware, sir, that under the terms of the permit -  
16 - I believe it's condition 10-D. I can put it up here if  
17 you'd like to see it. But the condition 10-D of the permit  
18 states -- it talks about notifications of changes in  
19 discharge. It states, "If any chemical listed in Attachment  
20 1 is detected in the effluent monitoring of concentrations  
21 greater than five times the expected effluent quality in  
22 Attachment 1," there's a requirement that they "notify the  
23 Department to evaluate the data" and with the Department  
24 being able to require additional monitoring treatment or  
25 other corrective actions. Do you recall words to that

1 effect?

2 A Yes. The issue -- I just might add, though --

3 Q Sir, --

4 A Go ahead.

5 Q -- I'll ask the questions here. I mean, did you not

6 understand? Okay. Are you also aware, sir, that the permit

7 requires -- or prohibits certain kinds of activities by the

8 permittee -- let me be more specific here.

9 MR. REICHEL: Just noting for the record that what

10 I've projected on this overhead screen, I'll represent to

11 you, sir, is one of the pages from the groundwater discharge

12 permit we've been talking about, specifically page 14 of 32

13 under "General Conditions."

14 Q Do you see that where my hand is?

15 A Right.

16 Q It states among other things that the "discharge shall not

17 be or be likely to become injurious to the protected uses of

18 the waters of the state." Do you see that?

19 A Yes.

20 Q Under "D" it says, "The discharge shall not create a

21 facility as defined in Part 201, Environmental Response of

22 the NREPA." Do you see that?

23 A Yes.

24 Q I assume, sir, that since most of your work -- well, let me

25 ask you this: You've not previously worked on a project in

1 Michigan, have you?

2 A No.

3 Q So I don't know whether or not you're familiar with or  
4 you've become familiar with what Part 201 of the NREPA is?  
5 Do you have any understanding of that?

6 A I'm not -- no.

7 Q Fair enough. If I were to tell you, sir, that it is a  
8 provision that states environmental laws that are intended  
9 to prevent and remediate sites of environmental  
10 contamination, you wouldn't have any reason to disagree with  
11 that?

12 A No.

13 Q That's fine. Fair enough. You're not familiar with it. I  
14 think one of the other things that you mentioned in response  
15 to questioning by Mr. Eggan was that you were uncertain as  
16 to what was going to happen with respect to -- or you  
17 expressed some uncertainty about the use of biocides?

18 A Right.

19 Q And you weren't certain as to how that was going to be  
20 controlled or regulated or words to that effect; is that --

21 A Right.

22 Q Okay. Are you aware, sir, that there's a condition in the  
23 permit that requires the permit applicant -- or the  
24 permittee; in this case Kennecott; to request approval to use  
25 water treatment additives? Does this ring a bell with you?

1 A I saw that. But the point that I was making was, that falls  
2 short of being able to analyze what the impact of those  
3 biocides or additives is. And it's consistent with the  
4 other regulation that says this will be determined later.  
5 And that was -- it made it difficult for me to evaluate the  
6 application because there was no specificity of the  
7 chemistry that was being used.

8 Q I understand that's what your testimony was. But you don't  
9 disagree, do you, sir, that before the permittee; in this  
10 case Kennecott; could use or discharge water treatment  
11 additives, they would have to specifically disclose the  
12 proposed additives and obtain the approval of DEQ; that is  
13 true?

14 A I have no reason to not believe that.

15 Q I think you also were asked -- you expressed some  
16 uncertainty about what was going to happen with regard to  
17 the management of sludges that would be generated from some  
18 aspects of the treatment process. Do you recall that?

19 A Correct.

20 Q Again, this is not a memory quiz; I'm just trying to probe  
21 your understanding here. As a part of your work were you  
22 also asked to, or did you have occasion to look at another  
23 permit issued contemporaneously by the DEQ dealing with the  
24 mining activity itself, the so-called Part 632 permit?

25 A I saw only limited parts of that. I was not asked to look

1 at that.

2 Q Fair enough. If I were to tell you that that permit  
3 contained conditions that specified that sludges generated  
4 from the wastewater treatment plant would be required to be  
5 disposed in a licensed landfill, would you have any reason  
6 to disagree with that?

7 A If you say so, I would not have any agreement (sic).

8 Q You've also, during your direct exam, expressed concerns  
9 about -- among other things, about operational problems that  
10 might be encountered during the operation of the system as  
11 proposed here. Do you recall that?

12 A Yes.

13 Q And I believe you noted at some point that the -- or  
14 commented that the schematics of the treatment system  
15 provided in the permit application were just that; were  
16 schematics? They were not final engineering drawings? Or  
17 words to that effect?

18 A Certainly, no, they're not.

19 Q Okay. Again, are you aware or do you know that under the  
20 permit issued -- the mining permit under Part 632 has a  
21 requirement that before Kennecott were to construct the  
22 wastewater treatment system, that they were required to  
23 submit to the DEQ for review and approval the detailed  
24 engineering plans for the system?

25 A (No verbal response)



1 Q I can show you that. Again, I'm not trying to trick you.  
2 I'm just asking you if you were aware of that, sir?

3 A I knew that they had to have a demonstration prior to be --  
4 to getting a permit to mine. I was aware of that. And that  
5 has not yet been demonstrated, but -- it's not been  
6 demonstrated to this point, certainly on the discharge  
7 permit.

8 Q Well, I understand that's your opinion, sir, and if you want  
9 to pursue that further with counsel for the Petitioners,  
10 that's fine. But that wasn't my question. It wasn't  
11 whether there was a demonstration. Again, you have no  
12 reason to disagree with the proposition that it is a  
13 requirement, before Kennecott can build this proposed  
14 wastewater treatment plant, they have to submit the actual  
15 engineering plans to the DEQ and have those reviewed and  
16 approved by the DEQ?

17 A I really have no opinion on that, --

18 Q You don't know. Okay.

19 A -- because I was not -- that was not part of what I was  
20 asked to review.

21 Q All right. Fair enough.

22 MR. REICHEL: May I have just a moment, Judge?

23 JUDGE PATTERSON: Sure.

24 Q Dr. Miller, turning back now to the groundwater discharge  
25 permit, the one that you have had on occasion to look at,

1 are you aware, sir, that the permit contains specific  
2 enforceable limits on the volume of water that is -- that  
3 Kennecott would be authorized to discharge?

4 A Yes.

5 Q And although it's not stated in gallon-per-minute terms, are  
6 you aware that the stated volumetric limitation is the  
7 equivalent of 350 gallons per minute?

8 A Yes.

9 Q And finally, the permit contains Section 12, a series of  
10 compliance requirements. Let Ms. just put this up here so  
11 you can see what I'm referring to.

12 MR. REICHEL: Again, I would note for the record  
13 what I'm projecting here is a portion of the Part 31 permit  
14 which appears at page 16 of 32 under the heading "12.  
15 Compliance Requirements." Let's see if I can make that a  
16 little more legible.

17 Q I'm not going to ask you to read through all of this, but I  
18 would direct your attention to 12-D, which states in part,  
19 "In accordance with the applicable rules, the department may  
20 require additional activities including but not limited to  
21 the following:" And that includes, among other things,  
22 revising -- it's "6. Revising the operational procedures at  
23 the facility. 7. Changing the design or construction of a  
24 wastewater operations facility." Extending on through --  
25 I'm not going to read them all. "10. Close the facility or

1 end the discharge that results in the applicable standard  
2 being -- " Do you see that all of those terms appear on the  
3 face of the permit? Is that correct?

4 A Yes.

5 MR. REICHEL: Just one moment, Judge.

6 (Counsel reviews documents)

7 MR. REICHEL: That's all I have. Thank you, Dr.  
8 Miller.

9 MR. EGGAN: A question or two on redirect, Judge.

10 JUDGE PATTERSON: Okay.

11 REDIRECT EXAMINATION

12 BY MR. EGGAN:

13 Q Mr. Bracken asked you some questions about the components of  
14 the system. This is something you testified about this  
15 morning. The components of the system individually have  
16 been tested and in the main have shown that they're capable  
17 of working. Is it true that a reverse osmosis system has  
18 been shown to operate 24/7 at a facility like this?

19 A Not at any mine that I'm aware of.

20 Q All of these components, the components in the treatment  
21 system -- and we're talking about at the wastewater  
22 treatment plant. To your knowledge have they ever been put  
23 together in a mechanism like this?

24 A Not to my knowledge.

25 Q Anywhere in the country?

1 A Not to my knowledge. And I -- yeah, not to my knowledge.

2 Q Can you as a scientist conclude that -- isn't it a  
3 reasonable argument, "Geez, you know, they work together  
4 individually. Why can't we just throw them together and  
5 assume that they're going to work?"

6 Q Well, you know, one would like to be able to say that, but I  
7 think to anybody who's really worked on these type of  
8 systems, that the integration of these is a separate -- it's  
9 a separate issue entirely. And unit operation and  
10 integration is always, say, a more complicated issue than  
11 one would think, about just putting unit operations  
12 together. Classes in engineering on unit operations,  
13 putting it altogether requires an integration that adds  
14 another dimension of complexity onto it. I'm not saying it  
15 won't work. I'm just saying that it certainly -- it's  
16 certainly put together without that integration applied in  
17 the system in a way that would show that there have been  
18 some demonstrated success.

19 Q Did you apply a scientific method in your analysis? I think  
20 Mr. Bracken asked you if you applied a scientific method in  
21 your analysis here. Did you?

22 A In a broad sense, absolutely. He asked the question, "Is  
23 this system going to work under a variety of different  
24 conditions?" If you look at the data that was presented by  
25 Kennecott and Dr. Prucha and Dr. Maest, and then you

1 evaluate, based on the data that is at hand the date it was  
2 provided by everybody. And then you evaluate that and make  
3 a decision as whether that will work. So in that sense  
4 that's as close to a scientific process as you can get,  
5 working on -- you know, with data somebody else has  
6 produced.

7 Q Now I need to ask you about the situation in Nevada. It  
8 sounds like you had a disagreement with the folks in the  
9 Nevada over a mercury issue?

10 A I think that's well-characterized, yeah.

11 Q Tell the hearing office what the essence of that issue was.

12 A The issue -- this was one that was a very scientific process  
13 in terms of argument. It was a very, very simple study that  
14 was done by an undergraduate student and I, under my  
15 direction, I might add, where we had an instrument that was  
16 brought in that was used commonly by the federal agencies  
17 for measuring mercury.

18 Q Why don't we just take a step back? What was the issue?  
19 What was the concern here?

20 A The issue was that we examine -- is there an instrument  
21 that's easily portable that you could take out to mine sites  
22 and measure mercury at low concentrations? And second, the  
23 other question was, could you measure mercury at sites very  
24 proximate to mines but on publicly accessible areas? We got  
25 the instrument in; we went through the initial understanding

1 of how it operated. We took the instrument out, measured  
2 background concentrations at several areas, about two  
3 nanograms per cubic meter, which is a term -- number that  
4 you use. Then we went to several mines and measured mercury  
5 concentrations around that mine -- those mines. And two out  
6 of about seven or eight that we measured had concentrations  
7 that were a thousand times higher than what the background  
8 concentration was just a few miles away. And so our  
9 conclusion based on that data was, yes, the instrument  
10 worked, and it was very easy; it worked very well. And two,  
11 you could -- there was enough mercury around mines to  
12 measure. That was the conclusion of the study. It was  
13 nothing beyond that. And the report would show that; that  
14 that was the conclusion of the study.

15 Q And you submitted that to the -- to whom?

16 A It was a report -- it was a report submitted to the people  
17 that provided the instrument. And it was the kind of report  
18 that we issue periodically on some of the work that we do.

19 Q What happened next?

20 A It was -- it was -- we've had, as you might suspect, some  
21 disagreement on mercury issues in Nevada between myself and  
22 the State Division of Environmental Protection. They were  
23 actually -- they had no idea the concentrations were as high  
24 as we measured them. And they were confirmed, by the way,  
25 just last week in a report that we were involved in, the

1 concentrations that another person in my department who is  
2 not a -- doesn't have the same relationship with the  
3 division I have -- measured concentrations that were even  
4 higher than what we measured. But the division at that  
5 time, which was a year -- February of 2007, became very  
6 irritated that we released this report without first of all  
7 discussing it with them. And I have never seen such a  
8 vitriolic letter sent to me ever. I responded to it in  
9 kind. But it is not fully resolved yes.

10 Q Well, a question or two. It sounds like you prepared a  
11 report as part -- you prepared a report of your findings?

12 A Correct.

13 Q And a letter or -- yeah, a letter that has become part of  
14 this record was then sent to you?

15 A Right.

16 Q Did you follow that letter, then, with a letter to them?

17 A Yes.

18 Q And so you prepared a response to that?

19 A Point-by-point.

20 Q Do you have either the report that you submitted or the  
21 letter in response with you today?

22 A I do. It's in my suitcase over in the hotel.

23 MR. EGGAN: Your Honor, I'm going to be offering a  
24 copy of that report about -- of the report as well as the  
25 response. But my concern is that Mr. Miller won't be here

1 when we do it. If that's a concern of yours and it would be  
2 critical to the foundation, then I can get him to run back  
3 to the hotel and run back with it and we'll do it that way.  
4 But he does have a flight to catch. And what we would  
5 prefer to do is simply get it and offer it in his absence,  
6 if that is acceptable to you.

7 JUDGE PATTERSON: I'll ask Counsel what that would  
8 do for --

9 MR. BRACKEN: Obviously, without seeing it I'd  
10 like to reserve any comments I have about the letter. I  
11 understand Dr. Miller has a flight out of here. And maybe  
12 if the letter comes and make an argument that I think  
13 there's a problem with it, --

14 MR. EGGAN: Would it be hearsay?

15 MR. BRACKEN: -- we'll try to deal with that.

16 MR. EGGAN: Would the objection be hearsay?

17 MR. BRACKEN: No. We'll try to deal with that in  
18 a way that's consistent with the way it was dealt with  
19 before. And maybe if there were questions I would have to  
20 ask before I drop an objection, we could do it by telephone  
21 or something like that, some way that he can leave.

22 JUDGE PATTERSON: What time is your flight?

23 THE WITNESS: Well, it's out of Detroit. I'm  
24 probably going to still make it at 5:00 o'clock.

25 MR. BRACKEN: I think we can handle this outside



1 of -- without having him stay here or running back to the  
2 room.

3 MR. EGGAN: That's your preference, but it just  
4 seems to me that there would be -- giving your ruling on the  
5 admissibility of the original letter, there should be no  
6 question about the admissibility of his response.

7 JUDGE PATTERSON: Well, that was my thought. It  
8 would even the playing field, so to speak.

9 MR. BRACKEN: That's very possible, your Honor.  
10 It would probably take something substantial for me to not -  
11 - to not have an objection -- or to have an objection.

12 MR. EGGAN: We may add a paragraph or two about  
13 you, Mr. Bracken.

14 MR. BRACKEN: That's all right. People have said  
15 it before.

16 MR. EGGAN: Well, I'll bring it in the morning and  
17 we can look at it.

18 JUDGE PATTERSON: Mr. Reichel, does that work for  
19 you?

20 MR. EGGAN: Mr. Reichel, do you have an objection?

21 MR. REICHEL: Given the situation, I have no  
22 objection to that procedure.

23 MR. EGGAN: All right. Good. Just a question or  
24 two on that issue.

25 Q In the aftermath of the report and this set-to that you had

1 with Nevada, has there been any change in how Nevada handles  
2 mercury?

3 A This is part of a continuing disagreement, I think, and it's  
4 a very sensitive issue within the mining industry and within  
5 regulatory agencies and the environmental community. There  
6 has been increased focus -- continuously increased focus on  
7 mining to the point that one of the -- a subsequent argument  
8 I've had with some of the same agency officials about a  
9 particular mine which recognized on hindsight now is the  
10 single largest source of atmospheric -- mercury into the  
11 atmosphere including all of the power plants, ultimately  
12 because of this very testy situation, I think that their  
13 sensitivity -- they actually shut down a mine because of the  
14 amount of mercury, which was well over -- is on the order of  
15 four to seven thousand pounds of mercury released, and a  
16 normal power plant does two to four hundred. That mine was  
17 actually shut down because of the sensitivity to this. So I  
18 -- you know, we have debated back and forth with the  
19 Division of Environmental Protection. Two of the people who  
20 wrote that letter I know very well. One of them was a  
21 former student in my department. And so we get over those  
22 things and we move on. We had a meeting last week. Those  
23 two same people that signed that letter were in the meeting.  
24 So we get along fine.

25 Q So the instrument that you used, that was the subject of

1           this critique?

2           A     They were arguing strongly, which surprised me.  At this  
3           meeting we had last week having to do with another source of  
4           mercury, they were strong advocates of getting this into the  
5           hands of this research scientist that was using it.  And  
6           they helped her obtain that instrument, because it had  
7           special attributes for that particular study.

8           Q     So the instrument that was really at issue in the letter of  
9           criticism is now being used?

10          A     They're ones that helped her find it.

11          Q     Have you had any contact with the Environmental Protection  
12          Agency since this incident has occurred?  Has there been any  
13          change in your relationship with them?

14          A     No.  We've had well over \$200,000 funding on mercury  
15          measurements and mercury policy development from Region 9 of  
16          the USEPA.  And starting last year about this time on a  
17          national participatory panel on mercury management in Nevada  
18          -- or mercury management in the U.S.  And I was suggested to  
19          participate in that because of my knowledge about mercury  
20          management in Nevada, which -- I probably knew as much as  
21          anybody in the country.  So, I mean, this is the back-and-  
22          forth that went between the division staff and I.  We've  
23          largely gotten over that; a few little wounds still, but I  
24          think we've both moved on and I think we both see the result  
25          of that as better mercury regulation and management in

1 Nevada.

2 Q Are you an anti-mining-industry guy, or what can you say?

3 A No, I'm not. If that had been my goal in Nevada, boy, would  
4 I have failed. And it is -- again, I'm proud of the mining  
5 industry in Nevada. It's come a long way. And I've worked  
6 with the industry and the state regulatory agencies to make  
7 sure that mining is done in a manner that's sustainable and  
8 protective of the environment to the extent possible.

9 Q Did anything that happened in Nevada or your relationship  
10 with, like, a Sierra Club and World Watch -- did any of  
11 relationships that you have influence any opinion that  
12 you've offered in this case?

13 A No, it really didn't. This was a straight technical  
14 evaluation.

15 Q And are the conclusions that you reached with respect to  
16 this project based on a scientific analysis?

17 A Yes.

18 Q Very good.

19 MR. EGGAN: I don't think I have any other  
20 questions. Thank you.

21 MR. BRACKEN: I have one or two brief questions.

22 RE-CROSS-EXAMINATION

23 BY MR. BRACKEN:

24 Q This may even be -- we may have gone over this before. But  
25 my understanding is, your testimony is based upon your

1 understanding, as least in part, that no testing or modeling  
2 has been done on the components?

3 A No. I said modeling has been done.

4 Q Okay. No testing has been done?

5 A To my knowledge no testing has been done on the system as  
6 described. Individual parts of it have but not the entire  
7 system.

8 Q And finally, did I hear you say that you don't -- do not  
9 know where the monitoring wells that have been required by  
10 the department are located, with respect to where the  
11 effluent is going to be infiltrated back into the --

12 A I read that, but I cannot -- I could not tell you -- I know  
13 there is a monitoring network, but I have to say that I  
14 could not place those on a map for memory.

15 Q That's fair enough. I'm not sure I could either. Would it  
16 be fair to say that you would want to see at least some of  
17 those wells very close to the TWIS so if there was a  
18 problem, you'd catch it early?

19 A Certainly you'd want to have -- and perhaps a bit of a trick  
20 question, 'cause that's one thing I do remember, is some of  
21 the those monitoring wells were placed reasonably close to  
22 the TWIS. And that would be something that would be  
23 important. But as far as the placement of monitoring wells  
24 and how long it would take for that water to come up into  
25 those wells, it's something I didn't look at. But I do --

1 as I recall, they were placed reasonably close to the TWIS,  
2 although I won't put them on a map for you this afternoon.

3 Q And I'm not asking you to. But that would be preferred, in  
4 your opinion, to have at least some of them very close to  
5 the TWIS?

6 A Sure.

7 MR. BRACKEN: Bob?

8 MR. REICHEL: I have nothing further.

9 MR. EGGAN: I have nothing further.

10 JUDGE PATTERSON: Thank you, Doctor.

11 MR. WALLACE: Your Honor, Petitioner's next  
12 witness is Professor Alec Lindsay. But before he testifies  
13 we need to swap out equipment.

14 JUDGE PATTERSON: You need a technical adjustment.  
15 Okay.

16 (Off the record)

17 MR. WALLACE: Petitioners call Dr. Alec Lindsay.

18 REPORTER: Would you raise your right hand? Do  
19 you solemnly swear or affirm the testimony you're about to  
20 give will be the whole truth?

21 DR. LINDSAY: I do.

22 ALEC R. LINDSAY, PH.D.

23 having been called by the Petitioners and sworn:

24 DIRECT EXAMINATION

25 BY MR. WALLACE:

1 Q Dr. Lindsay, please state your name for the record and spell  
2 your last name.

3 A My name is Alec Lindsay, L-i-n-d-s-a-y.

4 Q And where do you live, sir?

5 A I live in Marquette, Michigan.

6 Q How are you currently employed?

7 A I'm an associate professor at Northern Michigan University.

8 Q And of what are you a professor, sir?

9 A In the department of biology.

10 Q Do you specialize within the field of biology?

11 A Yes. Say, conservation biology, avian biology, conservation  
12 genetics, illusionary genetics. Those are sort of my main  
13 fields.

14 Q What is conservation biology, sir?

15 A Conservation biology is concerned with looking at wild  
16 populations of organisms, various forms of data and using  
17 those data to make assessments about the possible future  
18 fates of wild organisms.

19 Q And what is avian biology?

20 A General study of birds, but it their behavior or their  
21 genetics, their evolution, their ecology, their  
22 conservation; the study of birds.

23 Q Is there a difference between an avian biologist and an  
24 ornithologist?

25 A Nope.

1 Q Same thing?

2 A Same thing.

3 MR. WALLACE: May it please the court? We have  
4 previously marked and have a stipulation to the  
5 admissibility of Dr. Lindsay's CV as Petitioner's Exhibit  
6 130. And we would ask that it be admitted?

7 JUDGE PATTERSON: I'm sorry? 130?

8 MR. WALLACE: 130, yes, sir. That it be admitted  
9 by stipulation.

10 MR. PREDKO: No objection.

11 MR. REICHEL: No objection.

12 (Petitioner's Exhibit 632-130 received)

13 Q Tell us, to the extent you haven't already addressed it,  
14 sir, what fields you do research in as a professor.

15 A Well, I guess I do research in general conservation studies,  
16 in particular wild organisms in the UP, largely on birds. I  
17 work on loons. I have historically worked on harpy eagles,  
18 but I'm not doing that anymore. I'm doing some white-tailed  
19 deer research. And so those are the organisms that I work  
20 on. And in general we're interested in looking at the  
21 different factors that affect loon conservation, that affect  
22 the conservation of bird species in general and also now  
23 getting into mammals, although reluctantly so.

24 Q What has your post-secondary education consisted of?

25 A I did my undergraduate at the University of Wisconsin-



1 Madison. I had a double major in zoology and classical  
2 humanities. I then went to graduate school at the  
3 University of Michigan where I got my Ph.D. in ecology and  
4 illusionary biology.

5 Q When did you receive your Ph.D., sir?

6 A 2002.

7 Q Did you have to do a dissertation?

8 A I did.

9 Q And what was the subject of that?

10 A Vocal and molecular evolution in loons.

11 Q Tell us about any other graduate school projects you  
12 participated in that might bear on your testimony today.

13 Q Oh, I worked with the Peregrine Fund. They were working on  
14 endangered harpy eagles from Central and South America, and  
15 they were interested in looking at different factors that  
16 would affect this major -- this big raptor as they're trying  
17 to reintroduce them and reestablish their populations in the  
18 wild. I did some work with the Wisconsin DNR on their loon  
19 research, as well as some breeding bird population studies.

20 Q Have you been employed outside of academia in any activity  
21 that might be pertinent to your academic interests?

22 A After my undergraduate years I worked in a lumber yard, but  
23 that's probably not pertinent. But I did work in Alaska  
24 doing some bird studies; again, bird population studies;  
25 with the US Fish & Wildlife Service. And then I did another

1 bird study down in Texas, Big Ben National Park. I'm  
2 heading up a field crew down there censussing birds, and  
3 then with the Wisconsin DNR doing some behavioral studies  
4 where they were trying to assess, actually, the effects of  
5 mercury on loons.

6 Q Give us an idea of what positions you've held and  
7 particularly what courses and subjects you've taught as you  
8 progressed in academia.

9 A I've been an assistant professor, and I was promoted to  
10 associate professor and given tenure last year. I started  
11 as an assistant professor in 2002. And I teach a wide  
12 variety of courses, but the big ones, my favorite ones I  
13 guess I specialize in are Conservation Biology, Ornithology,  
14 Evolutionary Biology, Ecology of the Northern Forests -- I  
15 teach that for non-majors -- and then a few other courses as  
16 well.

17 Q Do you participate in professional activities outside of  
18 your teaching activities?

19 A Sure. I publish papers in journals. I give talks to  
20 professional society at professional meetings; give talks  
21 also to local groups, local Audubon group and other groups  
22 just on sort of bird conservation.

23 Q Have you received any grants in your fields of  
24 specialization?

25 A Yeah, both internal grants, external grants, working on

1 avian conservation, I guess, and as well as some mammal taxa  
2 now.

3 Q Sir, are you familiar with the proposed location for the  
4 Eagle Mine?

5 A Yes.

6 Q While we're bringing this up, could you describe to us or  
7 enumerate for us whether there are significant national  
8 areas in the region of the proposed Eagle Mine site and what  
9 those might be?

10 A Sure. The significant natural areas around the mine site  
11 are -- well, I mean, the plains themselves are certainly a  
12 significant natural area as far as birds are concerned. And  
13 then to the south there is the McCormick tract, to the north  
14 the Huron Mountain Club, and then I guess to the southeast  
15 is the Mulligan Plains and sort of just north of Silver Lake  
16 Basin, in that area. I'd say all those are significant for  
17 avian conservation or for avian -- for bird concerns.

18 Q And why are each of the areas you've mentioned significant  
19 for avian concerns?

20 A Well, different reasons. There are different reasons why  
21 we'd be concerned about different habitats. Some are used  
22 for breeding birds, others wintering birds, others birds on  
23 migration. So the Huron Mountain Club as well as the  
24 McCormick tract have some big stands of old growth forest,  
25 which is -- well, I guess we're all probably aware that

1           those are few and far between. The --

2       Q     And when you're saying "old growth," how old are we talking  
3           about?

4       A     Oh, hundreds of years some of the trees haven't been cut,  
5           I've been told. I haven't been to the Huron Mountain Club  
6           but -- there. But also within -- I have done quite a bit of  
7           hiking in the McCormick tract, for instance, and a number --  
8           some of those trees are in the hundreds of years old as  
9           well. So to answer your question, for migration, for  
10          breeding, for wintering, and the different habitats play  
11          different roles in that regard -- also depending on what  
12          species you're talking about.

13       Q     What's the significance of the Mulligan Plains? I don't  
14           think they've been mentioned yet in this trial. Perhaps  
15           they have but -- well, first of all, where are the Mulligan  
16           Plains?

17       A     Well, the Mulligan Plains -- what's this here? These  
18           (indicating) are the Mulligan Plains just down to the south.  
19           So here's, I think -- that's where Pinnacle Falls is on the  
20           Yellow Dog River, and we see there's the mine site. And so  
21           Mulligan Plains are actually a different watershed. They're  
22           not actually in the Yellow Dog Watershed. They feed into  
23           the Dead River. So, you know, in the immediate vicinity,  
24           there are a number of different watersheds from the Salmon  
25           Trout to the Yellow Dog to the Dead River Watershed.

1           The Mulligan Plains form a real nice corridor that  
2 could very easily be used as a migration corridor as a  
3 flyaway for birds as they're heading north or south on  
4 migration. So that's the Mulligan Plains. Also, I mean,  
5 just being the watershed like that, it's got a boggy -- a  
6 fertile boggy habitat, not unlike sort of some of the  
7 headwaters of the Salmon Trout.

8       Q     You used the term "flyaway." What's a flyaway?

9       A     Flyaways are -- when birds -- migratory birds, the species  
10 that migrate, when -- as they're migrating they'll  
11 oftentimes use -- or at least we associate them -- as we go  
12 out and observe them, we associate them using topographic  
13 features that sort of funnel them or direct them one way or  
14 another or at least back to their breeding habitat or to  
15 their wintering habitat. And so, you know, one of the more  
16 well-documented flyaways is the Mississippi River. Birds  
17 flying north and south use the Mississippi River, and to a  
18 lesser degree, other rivers get used as flyaways for  
19 migrating birds. So the Mulligan Plains, being that it's  
20 sort of this nice funnely valley might be one that would be  
21 used for birds migrating north to south.

22       Q     Are either the Yellow Dog Plains or the bed of the Salmon  
23 Trout River flyaways?

24       A     I can't definitively say whether they are. There haven't  
25 been many studies at all up there looking at them on

1 migration to say definitively that they are. The number of  
2 birds that we saw on the migration study that we did just in  
3 one fall was a significant number of birds that -- I mean, I  
4 would suspect that -- as birds are coming up from north to  
5 south or south to north, they'll oftentimes get funneled by  
6 the Great Lakes -- shorelines of Great Lakes, so they'll  
7 move up or down the Lake Michigan shoreline. And then, once  
8 they hit the U.P., they can start heading north again, and  
9 then they'll oftentimes use these river systems like, say,  
10 the Escanaba River moving your way north and then the  
11 Mulligan Plains up the Salmon Trout. The other great thing  
12 about these river systems for birds on migration, it's a  
13 time when they're energetically taxed. They've been flying  
14 sometimes thousands of miles, and so they need to have  
15 stop-off sites where they can bank on having lots of  
16 nutrients, and so river systems are oftentimes very  
17 productive places for them to stop.

18 Q Have you visited the Yellow Dog Plains, sir?

19 A Yes.

20 Q How often have you been there over the past years, would you  
21 say?

22 A In the past few years, at least a dozen, if not more. I  
23 guess I've been going to the Plains since 1997 for one  
24 reason or another.

25 Q And why do you go there, and what do you do when you're

1           there?

2           A     Well, originally, when I started grad school at the  
3           University of Michigan, people -- and I have a trout fishing  
4           problem.  And so I'll go up to the Yellow Dog Plains, and  
5           they said, "You got to go up to the Yellow Dog and fish the  
6           Yellow Dog."  And so I went up there first as a grad student  
7           and just camped out and fished the Yellow Dog Plains, and  
8           that's -- I was also a birder, and that's when I started to  
9           recognize that there's some pretty remarkable birds up  
10          there.

11          Q     How would you describe the Yellow Dog Plains from the  
12          standpoint of ecological richness and biological diversity?

13          A     Well, there's a varied number of habitat types up on the  
14          Yellow Dog Plains and -- I mean, you can see it just sort  
15          of -- well, maybe you can't.  But if you look at that map,  
16          if I were going to -- if you took a topographic map of the  
17          U.P. and I was going to try to pinpoint areas that would  
18          have lots of habitat variation which would increase species  
19          diversity, I'd look at a place like this where you have lots  
20          of topographic relief, big flat areas, lots of water, some  
21          small lakes, ponds, et cetera.  So there's a great degree of  
22          diversity from some of the big -- as I said, some of the big  
23          old growth stuff in the McCormick Wilderness area, up into  
24          the Huron Mountain Club.  Then the area of the Yellow Dog  
25          Plains themselves, although to, say, a lay person's eye,

1           they might look scarred and denuded of life, even though  
2           there have been jack pine harvesting going on there, it  
3           still has quite a rich avifauna, bird --

4       Q     Could you say that to me again?

5       A     Avifauna; the bird species.  It's quite a rich area.

6                    JUDGE PATTERSON:  Is that a-v-a- -fauna?

7                    THE WITNESS:  Yeah; a-v- -- no -- a-v-i- -fauna.

8                    MR. WALLACE:  I think I identified this for the  
9           record but, moving from the map which was previously  
10          admitted as Petitioner's Exhibit 32, I'd like to look at  
11          what's been admitted as a demonstrative exhibit, Number 146,  
12          last week with Dr. Strand and looking at slide 1 of Exhibit  
13          146.

14       Q     Ask you if you can identify what's shown in that photo, and  
15           tell us what kind of habitat -- for what kinds of species  
16           this might provide habitat.

17       A     Well, I can't identify where this is.  I've never seen this  
18           spot before but --

19       Q     Can you recognize habitat type and then --

20       A     Oh, yeah.  I mean, this is --

21       Q     -- and make a judgment about what birds would live there?

22       A     Yeah.  It's very typical of, you know, these boreal, mixed  
23           boreal riparian habitats.  And so, you know, if I were  
24           canoeing up this stream up in the Yellow Dog Plains, I would  
25           undoubtedly be hearing things like Northern Parula,



1 black-backed woodpecker, Connecticut warblers, alder  
2 flycatcher, kingfishers, herons, maybe a least bittern, if I  
3 were lucky and really hunted it out but --

4 Q I didn't write all those down, but tell us a little bit  
5 about the Northern Parula. What is that?

6 A Oh, it's a -- that's a warbler. It's a wonderful little  
7 warbler, maybe three and a half inches long, and that's up  
8 in these wetland habitats. They've just appeared in the  
9 last week from their migration north from down in Central  
10 America. They kind of look tropical actually, I mean, but  
11 they're just a little breeding wood warbler.

12 Q How recently have you been out in the Yellow Dog Plains?

13 A I was actually there on Saturday.

14 Q Okay. You were in court here last week; right?

15 A I was. And then you guys sent me home. And so I thought,  
16 "Well, I'm going to go fishing." And so I went up on the  
17 Yellow Dog Plains and fished and birded.

18 Q Did you see any birds to speak of?

19 A I did, yeah; 25 species in about an hour and a half.

20 Q Now, slide 2 has been identified as the Salmon Trout River  
21 above the orebody. Does -- that photograph to the left on  
22 slide 2 of Exhibit 146, does that depict a flyway to you?

23 A It very well could be, yeah. The -- you know, for birds,  
24 you know, on migration, their concerns are energy, water,  
25 shelter. And when you stop off on a river, you're going to

1 find at least two out of three of those. The shelter is  
2 something you might -- you could hunt maybe just as easily  
3 anywhere else. But you've got water and, being a riparian  
4 system, it's usually quite productive, and it can be used  
5 for feeding as well.

6 Q The Salmon Trout River has been described as running  
7 generally -- and it's shown on the map as running generally  
8 southwest to northeast and giving out into Lake Superior.  
9 Might the Salmon Trout be used navigationally by migrating  
10 birds, then?

11 A Yeah, it sure might. And it might maybe seem  
12 counterintuitive that -- because what the birds are probably  
13 doing is, as they're flying south to north or north to south  
14 but, for the most part, say south to north, they hit a river  
15 system, and then they follow it. Once they follow it up to  
16 the northeast, then they got Lake Superior to go around, if  
17 they're going to go around it, which things like hawks,  
18 harriers, they will go around the lake. So they will make  
19 their way one direction or the other. Usually they'll make  
20 their way west. But that's -- I mean, for birds to fly a  
21 little bit off course heading a little bit east, not a big  
22 deal.

23 Q As an ornithologist in the Upper Peninsula, do you have an  
24 understanding of the mouth of the Salmon Trout River as a  
25 rich area for birds?

1 A Yeah. The couple people who I've talked to who spent time  
2 in the Huron Mountain Club and one very experienced birder  
3 in particular told me on two different occasions that the  
4 mouth of the Salmon Trout is -- and these were his words --  
5 but the birdiest place he's ever been. As far as just  
6 standing in one spot, it was one of the birdiest spots he's  
7 been.

8 Q That's an adjective in your profession, "birdiest"?

9 A Oh, yes; yes, only --

10 Q And looking at the lower right-hand corner of slide 2 of  
11 Exhibit 146, what about that topography would make it birdy?

12 A Well, the river running into the lake -- you're talking  
13 about the lower -- the mouth of the river?

14 Q Yes, sir.

15 A Okay. Yeah. And so the river running into the lake, both  
16 all the nutrients that are coming down from the river are  
17 supplying all the aquatic insects with -- well, the  
18 nutrients are supplying the phytoplankton, supplying the  
19 other little macroinverts, and then that makes its way up  
20 through the food chain. And then be it warblers, be it  
21 vireos, be it even wading birds like sand pipers, there's  
22 all kinds of food locked and being sort of dumped into the  
23 lake right there and then -- it's not flowing as fast  
24 anymore -- hits the lakes, stalls up. There's the wave zone  
25 there, where it's also highly productive, and then you've

1 got the trees on either side. So you've got cover. You've  
2 got productivity in the forest. You've got productivity in  
3 the river, and then you've got the lake. So they kind of  
4 probably all get dammed up there. The birds maybe -- I  
5 mean, as they're flying down the river, and feed there.

6 Q And you're talking about -- you said "nutrients." Are you  
7 talking about food that birds feed on that come downstream  
8 from further up on the Salmon Trout into the mouth area?

9 A Yes.

10 Q Slide 8 is a -- obviously a picture of the Yellow Dog River.  
11 Why is the Yellow Dog River a particularly rich area in the  
12 area of the Yellow Dog Plains?

13 A Well, it, you know, drains out of the -- part of it drains  
14 out of the McCormick. And then, as it makes its way down  
15 sort of on the south side of the plains there, it's a pretty  
16 rich riparian area that hasn't been logged in the immediate  
17 vicinity, like, say, 50 meters or so. So you don't have a  
18 lot of runoff, so the river itself is in good shape as far  
19 as delivering water and nutrients downstream. It's in an  
20 area with lots of topographic relief, which is oftentimes  
21 associated with high levels of bird diversity.

22 Q Are there any particular birds that you would expect to see  
23 or have seen in the Yellow Dog River Valley when you've been  
24 there?

25 A Oh, yeah. You know, we've seen black-backed woodpeckers,

1 spruce grouse, merlin; just saw a merlin on Saturday. That  
2 was a nice bird to see.

3 Q We'll get to this in a minute, but are those fairly unusual  
4 birds, the three you just mentioned?

5 A Yeah. The three I just mentioned are either threatened or  
6 species of special concern listed by the state.

7 Q You had the black-backed woodpecker, --  
8 Spruce grouse.

9 Q -- spruce grouse and the merlin?

10 A Yeah.

11 Q Okay. What's a merlin?

12 A Oh, it's a falconiform, so it's a -- it's related to  
13 peregrine falcon or American Kestrel; feeds on other birds;  
14 nests in conifers oftentimes taking over sort of old crow  
15 nests and modifying those but --

16 Q Does it have a nickname of some -- a hawk nickname?

17 A The merlin?

18 Q Sparrow hawk, chicken hawk?

19 A Oh, yes. Some -- they used to be called -- I think they  
20 used to be called the chicken hawk. I don't know.

21 Q Chicken hawk. Did you see a merlin last weekend?

22 A Yeah, just on Saturday; yeah.

23 Q Is Cedar Creek another natural feature in the area of the  
24 Yellow Dog Plains?

25 A Yeah, it is. I haven't seen it.

1 Q And does it provide bird habitat?

2 A Undoubtedly.

3 Q To me this looks a little bit like the Salmon Trout stretch  
4 that we looked at earlier. Are there some other species  
5 that you didn't mention that you might find in this kind of  
6 habitat area?

7 A Oh, the -- you know, I don't know why it looks it more like  
8 yellow warbler habitat. It looks -- the tall conifers in  
9 the back evoke winter wren songs in my head and, yeah,  
10 probably hermit thrush, Swainson's thrush probably -- I  
11 mean, probably pileated woodpecker in the back there as well  
12 in those big trees.

13 Q Are pileateds a species that have been seen in the Yellow  
14 Dog Plains?

15 A Yes; yeah.

16 MR. WALLACE: Judge, may I approach?

17 JUDGE PATTERSON: Sure.

18 MR. WALLACE: I've got hard copies of a few of the  
19 newer documents.

20 JUDGE PATTERSON: Thank you.

21 Q I'm showing you, sir, what's been marked slide 1 of Proposed  
22 Demonstrative Exhibit 148 and ask if you can tell us what  
23 that is, sir.

24 A This is -- Price, et al., in 1995 made a summer atlas of  
25 birds using Breeding Bird Atlas survey data, and they

1 compiled these data and generated species richness contour  
2 maps across the continental U.S., and that's what you see  
3 depicted here, is a contour map. And so each contour line  
4 shows a certain -- an increase in the number of species of  
5 birds that you find across the continental U.S. So the real  
6 light areas like we just heard about in Nevada, for  
7 instance, there's fewer than 30 species during the breeding  
8 season. And as you make your way up into those darker  
9 regions, as you can see are concentrated around the Great  
10 Lakes, over 60 species. This is from compiled data from, I  
11 thyroid over ten years that they compiled these data to make  
12 these records.

13 Q So how would you describe the area in which the Yellow Dog  
14 Plains is located in terms of biological and particularly  
15 avian richness.

16 A As far as avian species richness goes, it's one of the  
17 highest areas in the continental U.S. There's -- there are  
18 a lot of bird species that breed up in this area.

19 Q And this more than -- greater than 60, does that mean  
20 greater than 60 species to be found there?

21 A Yes; yeah.

22 Q You made reference to the Breeding Bird Atlas. What's that,  
23 sir?

24 A Oh, it's a canvassing effort that's done. And I'm not --  
25 Audubon is involved -- Audubon Society is involved. But

1 volunteers -- volunteer sort of amateur ornithologists go  
2 out and drive down roads and basically census all the birds  
3 that they see and hear, record those and then turn them into  
4 a central atlas area. They also oftentimes will then  
5 take an atlas block and then look for breeding records  
6 so -- but that's a slightly different atlas technique. But  
7 it's --

8 Q And do they break down the bird counts by a particular area?

9 A Yeah. Well, I mean, obviously not every square foot of  
10 Oklahoma was covered, but what Price did is extrapolate from  
11 all the different coverage areas and used that to make these  
12 contour maps.

13 Q I may be mixed up about this, but I have a book at home  
14 that's about several-hundred pages long, great big, which I  
15 think claims to be the Breeding Bird Atlas for Michigan.

16 A Oh.

17 Q Is that the volume of the text that has resulted from this  
18 study, these surveys?

19 A Yeah. It's a related -- yes, exactly.

20 Q Did you have occasion, sir, to oversee and assess a bird  
21 survey of the Yellow Dog Plains back in 2004?

22 A Yes.

23 JUDGE PATTERSON: Mr. Wallace, what year was that?

24 MR. WALLACE: Excuse me?

25 JUDGE PATTERSON: What year was the study done?



1 MR. WALLACE: 2004, sir.

2 JUDGE PATTERSON: -4. Okay. Thanks.

3 Q And is that the cover sheet for the summer portion of the  
4 study?

5 A That it is.

6 Q Rather than going through this in detail, why don't you  
7 describe the study that you supervised and tell us the  
8 methodologies and purposes behind it?

9 A Sure. The purpose was to try to document the birds that  
10 were breeding on the Yellow Dog Plains and using the various  
11 different types of habitats up there. And so what we did is  
12 devise a census plan really based on the Breeding Bird Atlas  
13 techniques, where you go out and try to identify as many  
14 species as you can to find out who is using the area and  
15 then establish, for as many of those that you establish are  
16 using the area, to what degree are they using it. Are they  
17 nesting? Are they feeding? Are they just using it for  
18 migration? So that -- yeah, that was in 2004. Mr. Skye  
19 Haas was the one who went out on the Plains and did the  
20 majority of the actual censussing.

21 Q And is Petitioner's Proposed Exhibit 110 the cover sheet of  
22 the fall portion of that study, sir?

23 A Yes, that's the fall migration portion.

24 Q Does Proposed Exhibit 112 set forth what actually was  
25 determined by this survey?

1 A Yes. Those are the species that were observed, their common  
2 names, the number of individuals and -- yeah, that's what  
3 that depicts.

4 Q How many species did the summer bird survey reveal to be  
5 located in the Yellow Dog Plains?

6 A 94, I think I recall, 95.

7 Q And I think you testified earlier that 60 is kind of the --  
8 a high number or the highest level of --

9 A Yes. For that Breeding Bird Atlas, more than 60 was sort of  
10 where they stopped because -- I mean, I gather because there  
11 aren't that many regions where you're going to find 75 or  
12 more. But they stopped their contour maps at 60 but --

13 Q And in the summertime you are able to determine what birds  
14 are breeding there pretty well?

15 A Well, determining breeding status is -- I mean, yes, you can  
16 fairly well. I mean, the Breeding Bird Atlas has specific  
17 criteria to look at probability of breeding; you know, if  
18 they're probable breeders or definitive breeders. Obviously  
19 finding a nest with eggs is the coudegras, but sometimes you  
20 can't find a nest with eggs.

21 Q What's a bird flying along with straw in its beak? Is  
22 that --

23 A That's a bird carrying nesting material, so, like, around  
24 here you probably see starlings doing that periodically  
25 going into your eaves, and that would be a high confidence

1 of breeding.

2 Q Would fledged baby birds be --

3 A Fledged baby birds would be another one, yeah.

4 Q And generally what did the fall migration survey reveal to  
5 you about the numbers of migratory birds that passed through  
6 the Yellow Dog Plains?

7 A A lot of birds, a lot of individuals and then also a log of  
8 species. I think 118 species were identified as using the  
9 Plains in one fashion or another.

10 Q Now, for migratory birds, is that a big number, small  
11 number, medium?

12 A That's a big number. I mean, the total number of species  
13 that occur in Michigan -- and this is including things like  
14 the violet green swallow, whose very first appearance in the  
15 State of Michigan was just last week in Marquette. There's  
16 345 species but -- you know, in the State of Michigan that  
17 have been identified.

18 Q I think some of the same birds appear in the fall migration  
19 as in the summer, but are some of these birds in bold face  
20 on this slide of the Exhibit 112?

21 A Yeah. The bold-faced ones are bolded because those are the  
22 ones that are recognized by the Michigan Natural Features  
23 Inventory as being some either threatened or endangered  
24 status, although I don't think there are any  
25 endangered-status birds on here but -- or species of special

1 concern. So that's the "SC." So for instance, spruce  
2 grouse says "SC," species of special concern. Common loon  
3 is threatened; harrier, special concern. The merlin is  
4 threatened.

5 Q Okay. You're moving pretty fast.

6 A Sorry.

7 Q The Northern harrier it's called?

8 A Northern harrier, yes.

9 Q And what kind of bird is that?

10 A That's a raptor, so it hunts over fields, catches small  
11 mammals, insects.

12 Q And the merlin you described to us earlier. What's  
13 significant about the black-backed woodpecker?

14 A The blacked-backed woodpecker is -- well, it's a species of  
15 special concern. It has fairly specialized habitat  
16 requirements. It really prefers burned areas, but it also  
17 likes old -- older dead and dying jack pines and other  
18 conifers. It's got -- it's actually -- oddly enough, like  
19 the spruce grouse, it's a fairly tame bird to get to see.  
20 They don't seem to care so much about human disturbance.

21 Q I noticed the black-backed woodpecker and also the pileated  
22 woodpecker. And I'm getting ahead of myself a little bit  
23 here. But do you know whether the black-backed woodpecker  
24 and pileated woodpecker are both birds that also are to be  
25 found in the Huron Mountain Club?

1 A Yes, they both are.

2 Q And would you expect individual black-backed woodpeckers and  
3 pileated woodpeckers to use both the Huron Mountain Club and  
4 the Yellow Dog Plains as part of their either nesting or  
5 foraging areas?

6 A Yeah, I certainly would.

7 MR. WALLACE: Well, before we get off this, I  
8 would move the admission of Exhibits 109, 110 and 112.

9 MR. PREDKO: Your Honor, rather than voir dire the  
10 witness now about these, can we defer admission of these  
11 'til the end of my cross? I have some fairly --

12 JUDGE PATTERSON: I don't -- I have no problem  
13 with that.

14 MR. PREDKO: Okay.

15 MR. WALLACE: That's fine, as long as Dr. Lindsay  
16 is still here when you go for it.

17 MR. PREDKO: I hope he is.

18 JUDGE PATTERSON: It'd be hard to cross without  
19 him.

20 MR. REICHEL: I'm interested in getting a little  
21 background on it, but I don't mind doing a direct cross.  
22 That's fine.

23 MR. WALLACE: Okay. You know, there's a lot more  
24 we could talk about now in foundation, but I'm trying to  
25 move this along, so we can come back to it, and you can ask

1           your questions.  Anyhow, I'd move the admission, and they're  
2           going to voir dire later, I guess.

3                       JUDGE PATTERSON:  Okay.

4       Q       What I'm going to put up next, Dr. Lindsay, is a copy of  
5           what's been previously admitted as Petitioner's Exhibit 24,  
6           which is an All Taxa inventory of birds -- organisms from  
7           the Huron Mountain Club, and we've moved to page 112.

8                       MR. WALLACE:  And if you could scroll down a  
9           little bit --

10      Q       Have you studied the All Taxa inventory for the Huron  
11           Mountain Club, sir?

12      A       Yes, I've seen it; yeah.

13      Q       From the standpoint of bird populations?

14      A       Yes.

15      Q       First of all, let me ask you just as a general matter, how  
16           many bird species have been identified over the entire time  
17           covered by the All Taxa inventory in grand total -- separate  
18           species, if you know?

19      A       I think it's 234.

20      Q       Now, I realize that number includes passenger pigeons and  
21           includes lots of things that may not nest there every year  
22           or whatever.  But even taking that into consideration, is  
23           234 a large number, small number for any -- for a given  
24           25-square-mile area?

25      A       Yeah.  For a 25-square-mile area, I'd be hard-pressed, you

1 know, to find that many species. You could maybe go to  
2 White Fishpoint where, on a point of migration -- a  
3 funneling point for migration to see that many species. But  
4 234 -- and I think I mis-spoke earlier. 342 in the U.P.  
5 checklist, not Michigan's checklist -- but I mean 342 in the  
6 entire U.P. you can see two-thirds of them.

7 Q Two-thirds of them at the Huron Mountain Club?

8 A Well, they've been recorded there, I should say. I --

9 Q Yeah.

10 MR. PREDKO: Your Honor, I would just like to  
11 place an objection to the extent there's some implication  
12 that this All Taxa inventory is some current inventory of  
13 the Huron Mountain Club. Past testimony has shown that it's  
14 a historical compilation dating back sometimes to the  
15 1920's.

16 MR. WALLACE: Yeah. I was trying to be extremely  
17 clear about that, but that's -- we would stipulate to that.

18 JUDGE PATTERSON: Yeah.

19 MR. PREDKO: Appreciate it.

20 A The -- and the 342 that I mentioned is also a historic  
21 number as well. So that includes birds that have been  
22 recorded in the U.P. 25 years ago.

23 Q Okay. Let's just look at three or four pages of the bird  
24 inventory, and pick out, if you would, a handful of species  
25 that are significant to you that are found at the Huron

1 Mountain Club?

2 A Well, forgetting bias, I have to say the common loon is  
3 right there top and center for a good reason. I like --

4 Q Is there more than one kind of loon?

5 A Yes, worldwide? Five species.

6 Q Five species. Okay. Is the common loon common in Michigan?

7 A It used to be. You used to see -- there -- we have nesting  
8 records at the University of Michigan of common loons  
9 nesting in the Detroit area, in the Ann Arbor area. Now  
10 their range has been restricted to the northern Lower  
11 Peninsula and in the U.P. and then further north into  
12 Canada, so they're not common anymore. They're probably  
13 named "common" because, when they were first named, they  
14 were the common loon species to see.

15 Q Any other species of note on page 113?

16 A Well, if you maybe scroll down, I --

17 MR. WALLACE: Scroll down a little.

18 A I mean, they're -- each one of these species has a story,  
19 but I don't know all those stories.

20 Q And we don't have time for all of them but, if you've --

21 A I would hope not, --

22 Q -- got a couple --

23 A -- for your sakes.

24 Q Okay.

25 A Let's keep going maybe --



1 Q You want to go to the next page?

2 A All the ducks. There's all the falcons, including the  
3 peregrine falcon, which at least there was some historic  
4 nesting record. That's what the "N" is for peregrine  
5 falcon. There's spruce grouse in the gal forms,  
6 Falcipennis. And spruce grouse is a remarkable bird.

7 Q I'm going to ask you a little bit more about it in a couple  
8 minutes when we take a look at a picture of it.

9 A Okay. These rails are difficult birds to see; yellow rail,  
10 Virginia rail. And they're summer breeders -- sandhill  
11 cranes. I heard a pair of sandhill cranes just on Saturday  
12 up on the Yellow Dog Plains calling to one another, probably  
13 doing their mating ritual, although I couldn't see them.  
14 Yeah, you can continue on if you like. There's the  
15 passenger pigeon, which is interesting historically.  
16 Obviously they're extinct, but they -- yeah; that there's  
17 records of them on the club is at least interesting to me as  
18 an ornithologist. Oh, and a great gray owl. That's also  
19 certainly of interest; records of those in the winter.  
20 They're in the club.

21 Q Now, has there been evidence -- well, tell us about the  
22 great gray owl. Is that a common animal or rare?

23 A No. It's a -- it breeds up in the north of Canada but, I  
24 mean, what you can see from that, it's -- and it also  
25 certainly makes sense. You find great gray owls -- that "W"

1 is in the winter -- on their winter records from there. And  
2 with the migration survey that was done, Skye Haas found  
3 remains of a great gray owl up on the Plains and, you know,  
4 probably wasn't using it on migration. It might have been  
5 there perhaps for a year. But at any rate, the remains of  
6 the great gray owl were up there on the Plains. And what  
7 they do is they use the Plains as their wintering range;  
8 whereas, things like the Northern Parula go south for the  
9 winter. So does the great gray owl. But oddly enough, the  
10 U.P. is south and balmy for a great gray owl in the winter.

11 Q Well, we'll probably get back to this, but is the use of  
12 habitat only in winter significant on the issue of how many  
13 months a year you ought to study a given area to know what's  
14 there and when?

15 A Oh, yeah. I mean, the conservation of birds -- you know,  
16 historically, people did a lot of studies on avian  
17 conservation in their summer breeding habitat, looking at  
18 different concerns of development, et cetera, and yet  
19 without being able to delineate necessarily exactly what the  
20 problems were for these taxa until they started looking at  
21 wintering grounds. Birds that fly south -- like, for  
22 instance, dickcissels fly south to South America. And down  
23 there they were still using DDT; same -- red shoulder hawks;  
24 still using those sorts of contaminants. And so in their  
25 wintering grounds, they affect the birds that come back up

1 and breed. So likewise, great gray owls that use the Yellow  
2 Dog Plains in the winter, that will affect their populations  
3 when they go back to breed further north.

4 Q Are there some other species that actually think of Michigan  
5 as a good place to spend the winter -- to fly south to to  
6 spend the winter that come to mind?

7 A You know, there are -- you know, there's been -- like,  
8 things like gyrfalcon is another one of these northern  
9 species that's -- there's been a gyrfalcon that's been  
10 sighted in the last couple years around Marquette. Other --  
11 it's mostly the big raptors like owls. And the owls  
12 periodically make these invasions down into the south.

13 Q And what drives them down here?

14 A It's when their -- it seems to be when their prey  
15 populations have sort of -- they're on a bust cycle. Like,  
16 when the lemmings -- when lemming numbers are down, then the  
17 owls start to flood into Minnesota of the U.P. They come  
18 across at the Soo. They make their way just looking for red  
19 squirrels and voles to eat.

20 Q What are we looking at in slide 6 of Lindsay demonstrative  
21 148?

22 A Oh, you're looking at some pictures of spruce grouse from  
23 Bill Robinson's -- Dr. Bill Robinson's wonderful book on the  
24 bird.

25 Q And what's noteworthy about this bird?

1       A     Well, this -- it's a member of the grouse family.  It's --  
2             unlike the ruffed grouse, you're not allowed to hunt spruce  
3             grouse, although it's in hunting magazines, and Bill  
4             Robinson does some hunting magazines.  Or when you look at  
5             the hunters' literature, they oftentimes refer to spruce  
6             grouse as stupid.  And if you -- whereas, ornithology texts  
7             refer to them as trusting.  They're really easy to get close  
8             to.  Somebody was just recounting to me a story of driving  
9             down the road up on the Yellow Dog Plains, and there was a  
10            spruce grouse in the middle of the road and thought for sure  
11            they had run right over it.  Likewise, you can -- you can  
12            just get remarkably close to these birds.  And that's  
13            actually Dr. Robinson there on the right.  He did a series  
14            of studies through the 60's and 70's up on the Yellow Dog  
15            Plains really figuring out a lot about spruce grouse  
16            biology.  He's got a tape recorder there of some  
17            vocalizations and a stuffed model of a female spruce grouse,  
18            and that's the male coming into display to the female there.  
19            And you can go up there now, call in these spruce grouse  
20            using a recording, or sometimes people can actually imitate  
21            them well enough just using their voice.  I can't, so don't  
22            ask me for that.  And you can call them right in to you,  
23            especially if you have, like, just a black -- I shouldn't  
24            give out these secrets on the record -- but black plastic  
25            bag.  And they get attracted to that and angry with it, and

1           they'll attack your black plastic bag. And they're sort of  
2           a remarkable bird; these red combs that come flashing up in  
3           their aggressive -- the males when their getting aggressive  
4           with other males.

5       Q     And whether it's by dint of -- it's trusting nature or other  
6           characteristics, how is this rated in terms of rarity in  
7           Michigan?

8       A     It's a species of special concern. They --

9       Q     Are the populations diminishing in the Upper Peninsula or  
10          holding stable now, or what would you say?

11      A     I'd have difficulty evaluating that. There aren't a lot of  
12          long-term studies on them, so I can't really say.

13      Q     Does the Yellow Dog Plains and the area of the proposed  
14          Eagle Mine provide good habitat for spruce grouse?

15      A     Yeah. They -- they're also very unusual. I hesitate to say  
16          "unique," because there are a couple of other birds. But  
17          they're very unusual in that they feed on needles in the  
18          winter; actually eat pine needles, and there are very few  
19          birds that actually feed on leaves of any sort, foliage of  
20          any sort. They'll feed on seeds or insects, but these  
21          actually feed on pine needles, jack pine needles and spruce  
22          needles in the winter so that they can overwinter there.

23      Q     What bird are we seeing in photograph number 5, sir? And  
24          this -- again, this is Exhibit Demonstrative 148.

25      A     Yeah. That's a common -- those are three common loons.

1 Q And does the loon have any particular status or position in  
2 terms of state recognition or public recognition in Michigan  
3 or other states?

4 A Oh, you know, it's -- obviously it's not our state bird.  
5 The state bird of Michigan is the robin, I believe. But  
6 it's the state bird of Minnesota. It's obviously on coins  
7 in Canada. It's also got -- in the public it's certainly an  
8 icon of wilderness. It's a wilderness icon. You go to --  
9 when I do loon research, I go to people's -- they --  
10 oftentimes they'll -- when they hear I'm doing loon  
11 research, they'll invite me into their house, and they'll  
12 have kinds of loon iconography all around their cabins and  
13 cottages. Like, the best was a toilet paper holder that had  
14 two loons with their bills coming together and holds the  
15 toilet paper. That's all at their cottage. Up in the  
16 north, loons mean north and wilderness to people.

17 Q Is there any scientific basis to connecting loons to  
18 wilderness?

19 A Well, in scientific circles, they've been argued and used as  
20 flagship species. They are affected by a number of  
21 different antivergenic \* disturbances.2:46:01, by  
22 development -- lakeshore development, by environmental  
23 contamination, as well as then on their wintering grounds  
24 they can also suffer \*antivergenic insults.

25 Q And again, in terms of their rarity, how are they rated?

1 A They're threatened in the State of Michigan.

2 Q And what sort of protection does that get them, if anything?

3 A The protection is that they -- you know, I'm not sure. I  
4 mean, you can't -- apart from other migratory birds, they're  
5 not a game species, but likewise, non- -- you can't shoot  
6 Northern Parulas to eat them either. But they -- I'm not a  
7 regulatory person, so I don't know what exactly legal  
8 protections you'd get for a threatened species.

9 Q And what's the highest level of rarity?

10 A Well, endangered.

11 Q Endangered. And are there any endangered birds that can be  
12 found in the Yellow Dog Plains?

13 A Yes; yeah. We -- the endangered bird that we have found  
14 there is the Kirtland's warbler.

15 Q Have you ever seen a Kirtland's warbler yourself, sir?

16 A Yup. That's a picture I took, Kirtland's warbler, in the  
17 yellow circle; difficult to identify from that photo. I  
18 mean, it looks like a yellow dot from there, but I think you  
19 have a --

20 Q Is it in the yellow dotted line rectangle? Is there a bird  
21 in there?

22 A Yes; yes.

23 MR. WALLACE: Now let's look at 3.

24 A That's a little closer. It's in jack pine barrens on the  
25 Yellow Dog Plains. This is in 2006, so it wasn't during the

1 time of the other surveys. And, you know, we didn't get  
2 much closer to the bird, but we did also take some video of  
3 the bird and recorded the bird singing, so that's a definite  
4 mark of being able to identify a bird species. I think this  
5 is also accepted by the Michigan Rare Bird Committee.

6 MR. WALLACE: Let's look at slide 3.

7 A There, that's through the spotting scope.

8 Q Okay. That is a photograph that was taken --

9 A -- of that bird, yeah, sort of --

10 Q -- of that bird, the one that we were kind of --

11 A Zooming in on, yes.

12 MR. WALLACE: Could we look at proposed  
13 demonstrative 149?

14 Q Dr. Lindsay, tell us what we're about to look at here.

15 A Well, what you're about to look at is the video that I shot  
16 of the bird singing up there in the Yellow Dog Plains, as  
17 well as the two other people who observed it, Nancy Moran  
18 and Skye Haas. Hopefully you'll be able to hear it singing.  
19 That's through the spotting scope. It's not --

20 (Presentation of video)

21 Q Is that call distinctive?

22 A Yes; yes. Blackflies.

23 Q Those are all blackflies there?

24 A Well, that's Skye, and then the blackflies are around him.

25 Q And is this Kirtland's habitat that we're looking at?



1 A Yeah, that's -- yeah; yes, it -- at least one Kirtland's  
2 male thinks so. And, yeah, I mean, it's a place that we --  
3 you know, we certainly would survey for them. The U.S. Fish  
4 & Wildlife Service surveys for Kirtland's because they think  
5 it's putatively good habitat for Kirtland's warblers.

6 Q When you see that habitat in the Yellow Dog Plains, you  
7 expect the possibility of a Kirtland's warbler or a  
8 peregrine to whatever to show up?

9 A Yeah.

10 MR. WALLACE: Now we're going to look at a video  
11 that's proposed demonstrative 150, your Honor.

12 Q Well, while we're doing this, let me just ask you, Dr.  
13 Lindsay, what is it about the Yellow Dog Plains that makes  
14 it attractive Kirtland's habitat?

15 A They prefer young jack pine stands preferentially that have  
16 a regular burning cycle. They tend to -- they're ground  
17 nesters. They nest in young jack pines that have their  
18 branches sort of intertwined among one another, providing  
19 some cover, that then also those jack pines -- that there  
20 are sort of gaps in the jack pines where they oftentimes go  
21 out and forage so --

22 (Presentation of video)

23 Q And given that call, sir, is there any question that that's  
24 a male Kirtland's warbler?

25 A No.

1 Q Do the females sing back?

2 A No. They might make little call notes, little chip notes,  
3 but only the males sing.

4 Q So does that mean, if you're going to see a Kirtland's  
5 warbler, it's more likely to see the males?

6 A Yes.

7 Q And why would the male be there, if you know as an avian  
8 biologist, sir?

9 A Well, he apparently thought there was a possibility of a few  
10 showing up and felt that it was good enough habitat to  
11 say -- to make his declaration that, "This is my habitat,  
12 and I'm ready for mating."

13 Q Is a male Kirtland's warbler singing in May from the top of  
14 a jack pine involved in the mating process, at least from  
15 his standpoint?

16 A Yes; yeah, he's on the market.

17 MR. WALLACE: At this time I would move the  
18 admission of demonstratives 148, 149 and 150 but only as  
19 demonstratives. I -- they are meant only to be in the  
20 record as aids to the testimony of Professor Lindsay.

21 MR. PREDKO: I would just first say that the  
22 videos and the materials here were not provided to opposing  
23 counsel to DEQ and Kennecott until today, and I'm not  
24 sure -- well, better that this is a bench trial than a jury  
25 trial, because I'm not sure how a jury trier of fact would

1 figure out how to parse out what's to be taken for the truth  
2 of the matter asserted and what's to be taken just as a  
3 demonstrative. That said, we have no objection to the  
4 documents and the videos being admitted purely for  
5 demonstrative purposes.

6 MR. REICHEL: Just a quick voir dire question?

7 JUDGE PATTERSON: Sure.

8 VOIR DIRE EXAMINATION

9 BY MR REICHEL:

10 Q Dr. Lindsay, were you present when those videos were taken?

11 A I was the one shooting them.

12 MR. REICHEL: Okay. No objection.

13 JUDGE PATTERSON: They will be admitted.

14 MR. WALLACE: Thank you.

15 (Petitioner's Exhibits 632-148, 632-149 and  
16 632-150 received)

17 DIRECT EXAMINATION

18 BY MR. WALLACE: (continued)

19 Q Professor Lindsay, have you had an opportunity to review the  
20 environmental impact assessment along with pertinent  
21 appendices filed on behalf of Kennecott in support of its  
22 application?

23 A I have.

24 Q And what did you determine about the thoroughness or  
25 completeness of the EIA from the standpoint of avian

1 biology?

2 A I would say that it was a -- if it were a student, I would  
3 say that was a decent pilot study. They went out for --  
4 what's interesting is they went out three -- on three  
5 different times. I didn't see any mention of how many hours  
6 were spent in the field, how much time. I saw that they did  
7 a transect study that extended outside of the 92 acres that  
8 they asserted would be the affected area and, in doing those  
9 transect studies, they saw 53 or 54 -- I don't recall the  
10 exact number -- species of birds. They also noted that  
11 that's a relatively high diversity in the number of bird  
12 species that were found. But a transect study is an  
13 interesting type of study to do in the beginning. If you're  
14 just trying to -- I mean, transects and point counts can  
15 tell you things about densities of birds. They would be  
16 something to do if I were going to be comparing, say, two  
17 different habitat types. But if I were just trying to  
18 establish what species are using particular habitats, I  
19 would want to do as much surveying work as I can and also  
20 over all seasons, because the habitats are used outside of  
21 May, June and September.

22 Q So would two years, twelve months a year produce an adequate  
23 study from the standpoint of a plan that might disturb  
24 habitats in the area?

25 A Two years, twelve months a year would be adequate.

1 Q And did you see anywhere in this EIA that two years and  
2 twelve months each year were studied from the standpoint of  
3 flora and fauna in the Yellow Dog Plains area?

4 A No.

5 Q How about beyond the Yellow Dog Plains area? Did you see  
6 any EIA assessment of potentially affected habitats outside  
7 the Plains but contiguous or nearby?

8 A No.

9 Q What are some of the -- from your standpoint and from your  
10 understanding of what is proposed to occur in developing the  
11 Eagle Mine, what are some aspects of potential hazards to  
12 birds that this mine suggests to you?

13 A Well, the two bigger ones that I guess I would note would be  
14 the effects of the actual site, which I think, as they note,  
15 is a 92-acre surface scrape, and then also the roads that go  
16 into that area, which I didn't really see any discussion of  
17 the transport. And roads are a significant concern for  
18 birds.

19 Q In the immediate area of the proposed mine, the 92 acres or  
20 even some acreage beyond that, what immediate impacts would  
21 you expect on bird populations and species count?

22 A Well, the 92 acres themselves won't be used as breeding  
23 habitat, at least likely not for any of the species that are  
24 breeding there now. Starlings might move in as they  
25 oftentimes do with development. But the other thing about

1 development in general is that it -- when you displace those  
2 birds off 92 acres of soil it can have sort of compounding  
3 ramifications outside of that area. It's kind of like an  
4 explosion that has waves of influence radiating out from it  
5 inasmuch that the birds that return after their winter in  
6 the south they move back north, they find that the habitat  
7 that they were intending to use in those 92 acres aren't  
8 there and they get displaced, maybe just to adjacent  
9 habitats. But when that happens -- and this has been shown  
10 in the literature. When that happens that birds get  
11 compressed, densities may increase -- it's not necessarily  
12 that those birds die, but densities increase. As densities  
13 increase and these birds are -- a lot of these birds are  
14 territorial, so as densities increase territories get  
15 smaller, and as territories get smaller each pair of birds  
16 or each female that's raising her offspring can raise fewer  
17 offspring because she's sharing that habitat with more  
18 individual birds. And so productivity goes down as density  
19 goes up when they get forced in due to development, due to  
20 this sort of disturbance. So that's one affect that will  
21 sort of radiate out from that surface scrape.

22 Q And would you expect that they'll radiate out, you know,  
23 perhaps miles in the case of some species?

24 A Yeah, perhaps in the case of some species. Certainly for --  
25 yeah, certainly for hundreds of meters and, yeah,

1           potentially kilometers.

2       Q     How about something like the Pileated Woodpecker?

3       A     Yeah, the Pileated Woodpecker would be a good example. I  
4       haven't done extensive surveys on the 92 acres so I can't  
5       say how high quality that habitat is, but certainly that  
6       could affect things like the Pileated Woodpecker.

7       Q     We've seen photographs of presumably the 92 acres right at  
8       the -- right at the center of the mine site that showed that  
9       the -- that it had been logged in some fairly recent time  
10      period and showed stumps and grasses and shrubs had replaced  
11      the more mature trees. As you've walked the Yellow Dog  
12      Plains would an area of stumps and grasses and shrubs  
13      provide habitat for species that would be living there now?

14      A     Oh, yeah. I mean, yeah. There are a number of sparrows,  
15      warblers. Kirtland's Warbler likes those sorts of small  
16      scrubby jack pines; as you saw in that video stumps. Yeah,  
17      they might look to the human eye as being sort of not very  
18      pretty, but depending on what bird species you are it might  
19      look like great habitat.

20      Q     Did you see any effort in the EIA to address this explosion  
21      effect of displaced habitat?

22      A     No. No, there's recognition, I think, of the 92 acres being  
23      gone, but not that that affect of those 92 acres -- that  
24      that effect would radiate around that at all.

25      Q     What about increased road use? What does road use do to

1 bird habitat?

2 A Well, road use there are quite a few studies that have  
3 looked at roads and their effects on bird populations.  
4 Roads affect breeding birds both from direct mortality in  
5 cars and trucks hitting birds. They affect it in dust.  
6 They affect also with noise and there have been a few  
7 studies that have shown noise effects, shown direct impact  
8 effects and those can radiate -- those can also extend  
9 depending on the study and depending on the species anywhere  
10 from tens of meters to over a kilometer in either direction  
11 from roads. Now, it also depends on the use of the road.  
12 The use of the AAA at this point probably not a big effect.  
13 If that road use increases you'd see an increased affect.

14 Q Did you see any effort in the EIA to study the effect of  
15 birds on either side of the roads that will be seeing  
16 greater traffic when the mine operation starts up?

17 A Not that I recall.

18 Q Was road use addressed at all in terms of ecological  
19 consequences?

20 A Not that I recall.

21 Q Okay. Were the sides of the roads and a kilometer or more  
22 on either side of them treated as an affected area in the  
23 EIA?

24 A No.

25 Q Was anything along the road paths studied from a ecological



1           standpoint or affected area standpoint that you saw?

2       A       Not that I saw.

3       Q       From the standpoint of avian biology do you believe that the  
4           potential for acid mine drainage into the headwaters of the  
5           Salmon Trout River or the Yellow Dog River could affect bird  
6           populations?

7                       MR. PREDKO:  Objection; no foundation.

8       Q       Do you have any expertise, sir, in the relationship of pH of  
9           water bodies to bird productivity or bird populations?

10      A       The loon studies I did in Northern Wisconsin were undertaken  
11           because the Wisconsin DNR was looking at an association  
12           between low pH lakes and low loon productivity, so I've that  
13           experience.

14      Q       Do you expect lowered pH to affect birds adversely?

15      A       I would -- some species, depending on the species.

16      Q       How about heavy metal deposition?

17      A       Mercury is the one I can speak to and I would certainly  
18           expect mercury to.

19      Q       How about other kinds of human activity and consequences of  
20           human activity such as noise or light or dust; do you expect  
21           them to affect bird life in the area of the Yellow Dog  
22           Plains?

23      A       Almost certainly.

24      Q       Have you in fact done a study of human development and  
25           activity and how it relates to bird populations along

1 surface water body?

2 A Yeah. Yeah, did a breeding bird study in Northern Wisconsin  
3 looking at the affects of development on lakeshores  
4 developed and undeveloped lakeshores and how it affected  
5 breeding bird communities.

6 Q Were the -- was what you learned in the course of that study  
7 in your mind translatable to other kinds of human  
8 development not on lakeshores?

9 A Yeah, in general, I mean, it sort of fits in with the larger  
10 body of the effects of development on breeding bird  
11 communities, and that is that there are effects of  
12 development. And in the case that we were looking at in  
13 Northern Wisconsin it's actually -- it's not very -- it  
14 might not appear to be significant development, it's because  
15 of people building cabins and houses on lakeshores, but that  
16 that actually has subtle but significant affects on the  
17 breeding bird communities that you find on those lakeshores.  
18 And so, yeah, I guess as far as the translatability of it,  
19 it fits into a larger body of work that looks at the effects  
20 of development on breeding bird communities.

21 Q What are guilds?

22 A Guilds are -- you can look at, oh, let's say for instance --  
23 let's take the common loon. It has -- we can look at the  
24 guild associations of different birds. If you want to look  
25 at, say, nesting guilds. Well, the common loon is a

1 platform nester, nests on a platform; whereas a hummingbird  
2 is a cup nester. And so those are sort of two different  
3 guilds that those two different species occupy. Likewise, a  
4 loon is a bird that feeds on fish, and a hummingbird is a  
5 bird that feeds on nectar. So hummingbirds are in the  
6 nectar guild; loons are in the fish-eating piscivorous  
7 guild. Likewise, there could be seed eaters as a guild or  
8 an insect eater as a guild. And it's a different way of  
9 looking at bird species more than sort of their ecological  
10 function as opposed to just what species are you looking at.  
11 "Oh, that's an insect eater," or "oh, that's a fish eater."  
12 I mean, cormorants I just -- as far -- the guild that a  
13 cormorant -- a double-crested cormorant occupies is  
14 something that is important to people now, so --

15 Q Can it be important to look at birds from the standpoint of  
16 what guilds they occupy to understand what effects human  
17 activity may have on them?

18 A Yes. And so, for instance, insectivorous birds; if you lose  
19 insectivorous birds studies have shown that insectivorous  
20 birds have dramatic affects on -- they can have dramatic  
21 affects on insect populations. And insects, especially  
22 phytophagous insects, insects that feed on plant material,  
23 those insects can have detrimental affects on forests and  
24 forest health, and when you start to lose insectivorous  
25 birds then those insects do better and your forests do

1 worse. So there's sort of these compounding layered affects  
2 of losing some birds that occupy certain guilds over others.

3 Q Did you see any effort in the EIA to assess the potential  
4 impact on bird populations from the Yellow Dog Plains up to  
5 Lake Superior from the standpoint of guild structure and  
6 health?

7 A No.

8 Q Okay. Do you feel based on your familiarity with the Yellow  
9 Dog Plains area from the standpoint of bird populations and  
10 the specific surveys you've conducted and your understanding  
11 of the prospect of substantial human activity there in the  
12 future with the development of the mine to rate the  
13 likelihood that these mining operations will affect bird  
14 populations in the Yellow Dog Plains?

15 A To rate it; is that what you asked?

16 Q Yes.

17 A Yes, I could make a rating.

18 Q And let me include in my question then both the Yellow Dog  
19 Plains and the Huron Mountain Club lands and ask you how you  
20 would rate the likelihood that these mining operations are  
21 going to adversely affect bird populations in those areas?

22 A Almost certainly.

23 MR. WALLACE: Pass the witness.

24 MR. PREDKO: Take a short break, your Honor?

25 JUDGE PATTERSON: All right.

1 (Off the record)

2 MR. PREDKO: Good afternoon, Dr. Lindsay.

3 THE WITNESS: Good afternoon.

4 MR. PREDKO: As you know, my name is Chris Predko;  
5 I represent Kennecott in this matter. I do have some  
6 questions for you today.

7 CROSS-EXAMINATION

8 BY MR. PREDKO:

9 Q First, I want to talk about the bird surveys that were  
10 apparently done under your direction. Were they done under  
11 your direction?

12 A Yeah, I would say under my supervision.

13 Q Well, tell me what that means.

14 A Well, I was originally approached by the Yellow Dog  
15 Watershed Preserve to do some surveys to figure out just  
16 what birds were using the Yellow Dog Plains, and so then  
17 knowing both the abilities and the experience of Christopher  
18 Skye Haas I with him developed the protocols that he would  
19 use, which basically were the standard Michigan Breeding  
20 Bird Atlas protocols that he's been using to atlas birds for  
21 the Michigan Breeding Bird Atlas for the last I think four  
22 or five years. So with that I helped design that and then  
23 he did the bulk -- I went out maybe on two occasions with  
24 him, but he's a top-rate, one of Michigan's best amateur  
25 birders.

1 Q Now, who did he commission to assist him do the surveys? I  
2 assume he didn't do all these all by himself.

3 A Well, no, he did them all by himself -- well, he did them --  
4 he was the -- he was the one who identified every bird  
5 species that was up there; some other -- I think there's one  
6 other student who had taken an ornithology class with me and  
7 she went up there with him, and then another student who  
8 just took an ornithology class with me this year, but he's  
9 another one of these savant birders who went up there with  
10 him. So I think those two people went with him, but really,  
11 Mr. Haas is the one responsible.

12 Q Does Mr. Haas have any formal training?

13 A Oh, he's taken two ornithology classes. There aren't really  
14 sort of birding certification bodies. He got, you know,  
15 first state records of birds on his list that, you know,  
16 sort of -- he just had the first -- in fact, just last week  
17 the first state record of the violet green swallow showed up  
18 in Marquette; he's the one who identified it out of a flock  
19 of 30 swallows over the lower harbor in Marquette. It's a  
20 bird that usually occurs out west, but he was able to pick  
21 out a field --

22 Q He's not a biologist though; correct?

23 A He's an undergraduate student, so he's a developing  
24 biologist.

25 Q He's not a degreed biologist; correct?

1 A No.

2 Q "No"; that's not correct?

3 A I'm sorry. Yes, it is correct. Pardon me. No, he's not.

4 Q Okay. And from what you said, the students that assisted  
5 him are also not degreed biologists; correct?

6 A Correct.

7 Q Now, the survey area; you really didn't say anything much  
8 about that other than that -- the Yellow Dog Plains. Was it  
9 a survey of the entire Yellow Dog Plains?

10 A Well, no. It was a survey of many of the habitats within  
11 the plains. I mean, trying to cover -- so to cover the  
12 whole Yellow Dog Plains every square inch would take a long  
13 time and be pretty ineffective. But covered as many  
14 habitats within the confines of the plains -- you know,  
15 didn't go across the Yellow Dog River, didn't go down the  
16 escarpment on the other side of the jack pine barrens, you  
17 know, over along the Salmon Trout River.

18 Q And so I take it what was done is that -- is somebody chose  
19 representative habitats that exist within the plains and you  
20 used those points for study points?

21 A Yeah, tried to identify as many habitats -- the very  
22 habitats that are available out there and survey them all  
23 adequately.

24 Q And that's what you would do if you have such a big area to  
25 survey; correct? That's proper?

1 A Well, and if you're trying to identify -- if what your goal  
2 is -- I mean, that's the other question: what's your goal?  
3 It's to identify all the bird species that are using the  
4 area. Yeah, you go to as many microhabitats as you can.

5 Q But obviously you just -- you told us here that you couldn't  
6 go to every habitat, so you chose or Mr. Haas chose  
7 representative habitats; correct?

8 A Yes, we probably missed some habitats and we missed some  
9 species. There are probably more species than the ones that  
10 we identified.

11 Q Now, the survey does say that as far as the survey area --  
12 the survey area was nine square miles. Is that essentially  
13 a description of the Yellow Dog Plains? And I'm looking --  
14 for reference it's Petitioner's Exhibit 109.

15 A I don't know if that's the approximate area of the Yellow  
16 Dog Plains, the whole plains. I'm not sure what the plains  
17 constitute.

18 Q Fair to say that rather than you directing Mr. Haas to  
19 survey certain areas that he took that upon himself?

20 A Yes.

21 Q So you, sir, sitting here today couldn't tell us what points  
22 Mr. Haas used to survey the Yellow Dog Plains; correct?

23 A Correct.

24 Q I'm sorry. Technology seems to take even longer than  
25 handing hard copies.



1 (Pause in dialogue)

2 Q I'm showing you on the screen what is marked and is admitted  
3 as Intervenor 386 and it's an aerial view of the Yellow Dog  
4 Plains. Do you recognize it as an aerial view of the Yellow  
5 Dog Plains?

6 A I do.

7 Q Okay. And so for all of -- well, let me ask you this. Did  
8 you know where within the Yellow Dog Plains the mine site is  
9 to be located?

10 A I have a fairly good idea. Having not flown over it, it  
11 makes it a little more difficult. But yes, I have a pretty  
12 good idea that it --

13 Q Are you able to use your laser pointer there and point it  
14 out for us where you think the surface facility is going to  
15 be?

16 A I think this facility is going to be right up in here  
17 (indicating).

18 Q Okay. Well, you're close and it wasn't any sort of  
19 trickery; it's hard to see on here. But the -- you see the  
20 yellow dot there in the center?

21 A Yes.

22 Q That is actually the orebody which is close to the Salmon  
23 Trout River, and then the surface facility is actually going  
24 to be located in this area here (indicating) to the east of  
25 the orebody.

1 A Thanks for blowing it up.

2 Q Have you seen an aerial photo as either part of the  
3 Environmental Impact Assessment or any other materials  
4 you've reviewed for this case that would show you the area  
5 where this site is to be located?

6 A Not that I recall.

7 Q Based on your statement that you don't know which  
8 observation points that Mr. Haas used for the survey, then I  
9 take you don't know where any of the birds that were  
10 identified in the survey were seen across the whole Yellow  
11 Dog Plains; correct?

12 A Correct.

13 Q Did Mr. Haas then draft the wording of this report, Exhibit  
14 109?

15 A He did.

16 Q And I do note that Mr. Haas says something about the number  
17 of bird species or the high counts may be more than usual  
18 because he surveyed for a longer period of time than what is  
19 required or recommended by the breeding bird atlas. "Yes";  
20 do you agree with that?

21 A I agree he notes that, yes.

22 Q And looking at the -- Mr. Haas's reports here that we  
23 have -- your counsel -- or petitioner's counsel has marked  
24 as Exhibit 109, 110 and then some data pages in 112, are you  
25 able to tell me where any of the species identified were

1           seen on the Yellow dog Plains? And I could --

2       A     Do you mean within a one-meter square area, a 30-square  
3           meter area?

4       Q     Geographically where they were on the very large area of the  
5           Yellow Dog Plains.

6       A     No; I can't tell you where each species was. These species  
7           have different habitat associations, so with a different  
8           degree of probability I could tell you where they were  
9           identified, but we did not take any sort of GPS coordinates  
10          on each species where it was seen. We were just trying to  
11          document overall use of the plains.

12      Q     So with respect to the species of special concern or the  
13          threatened species that you described were in this report,  
14          you can't tell me whether those species were in the area  
15          where the surface facility is going to be located or  
16          potentially a mile away on the edge of the Yellow Dog  
17          Plains?

18      A     Some of them I can. I can tell you that those species are  
19          located there, because I've seen them there when they were  
20          documented in 2004 by Mr. Haas.

21      Q     And I'm restricting the question to the -- Mr. Haas's  
22          report.

23      A     Okay. So no, I can't tell you where those individuals --  
24          those individual birds were found; I can't pinpoint it on a  
25          map.

1 Q Now, Mr. Wallace showed you a picture that was used as a  
2 demonstrative exhibit. And I'm not sure what number it was,  
3 but it was a picture of a stream, some wetlands and some  
4 conifers in the background and you said that you didn't  
5 recognize that spot; that that's not one of the spots that  
6 you had been to; right?

7 A I didn't contribute that picture and memorable though many  
8 spots are, it's hard to remember each stretch of river. So  
9 I can't say definitely I'd been at that point where that --

10 Q Okay. Well, that spot I believe -- although I didn't take  
11 that picture either, I believe it's in the area of the  
12 river, Salmon Trout, right over the orebody. Have you been  
13 to that spot?

14 A Yeah, I have been there.

15 Q When's the most recent time?

16 A Right at that part of the river where that picture was  
17 taken? If that's where the picture was taken, I mean, I was  
18 on Saturday over the -- on the Salmon Trout, but leaves  
19 aren't out, the reeds and grasses aren't up like they were  
20 in that picture; it's hard to say whether I was at that spot  
21 on Saturday, but I was on the Salmon Trout on Saturday.

22 Q You were on the -- the Salmon Trout, I understand it, is a  
23 fairly long river?

24 A Yeah.

25 Q So you don't know where you were with respect to the orebody

1           then?

2       A     Just down the street in the AAA.  My understanding of where  
3           the orebody is -- I know where Eagle Rock is and I  
4           understand that that's actually very close to where the  
5           entrance and the orebody is.  And then, you know, just down  
6           the AAA from that is where the Salmon Trout crosses the AAA.  
7           And then there are two-tracks that go back into the woods  
8           and you can drive back there.

9       Q     And where were you with respect to that?

10      A     I was -- crossing of the AAA and the Salmon Trout.

11      Q     Okay.  So you were actually then pretty close?

12      A     Yeah.

13      Q     I mean, that's -- I believe this two-track here -- or this  
14           road; that's the AAA?

15      A     Yeah, that's it.

16      Q     And then Eagle Rock is there just north of the AAA?

17      A     Yup.

18      Q     Okay.  When you were there did you see this area here  
19           (indicating) that is north of Eagle Rock?

20      A     On Saturday?  No, I didn't.

21      Q     Have you at any time surveyed that area there that is north  
22           of Eagle Rock?

23      A     I've seen it; I haven't done a -- I haven't used it in part  
24           of my survey.

25      Q     You've seen it in person though?

1 A Yeah. I've hiked up Eagle Rock and, I mean, I hiked around  
2 Eagle Rock and birded those jack pines back in that area.

3 Q That's not the picture I want you to see; these are.

4 (Pause in dialogue)

5 Q This is part of what is -- I can read on the bottom is, for  
6 the record, Intervenor 12, Bates stamp 109105, I believe.  
7 And I'm asking you to take a look at the top picture on that  
8 page and ask you if you recognize this area.

9 A I mean, again, --

10 Q I'll represent to you, sir, that this is the area north of  
11 Eagle Rock.

12 A Without any significant distinguishing marks, it's hard for  
13 me to say I recognize this specific area, but I've seen  
14 areas like this up in that --

15 Q Did the area north of Eagle Rock when you were there look  
16 similar to this?

17 A You know, I was there once in the winter and then the other  
18 time that I was there in the summer was probably three years  
19 ago. But I know areas, yeah, like this are north of Eagle  
20 Rock that look like this.

21 Q And this area to you -- I mean, it looks recently logged,  
22 clear cut; correct?

23 A It does.

24 Q Okay. And in this area here there are no young jack pines  
25 stands similar to those that we saw in your demonstrative

1 video, are there?

2 A Not that I can see.

3 Q And then the bottom picture on that same page is in the same  
4 area and then you see the taller conifers in the back;  
5 right?

6 A Indeed.

7 Q Now, would you agree with me that neither the forefront  
8 clear-cut area, nor the taller older conifers in the back  
9 are suitable Kirtland's Warbler habitat?

10 A No, as such the way they look there I wouldn't think I'd  
11 find a Kirtland's Warbler there.

12 Q And that's because obviously in the forefront there are no  
13 young jack pines and the conifers in the back are -- look to  
14 be over 18 feet; right?

15 A Yeah, it looks -- yes.

16 Q Okay. I'm showing you again, Doctor, what has been admitted  
17 as Intervenor 386, which is the aerial of the Yellow Dog  
18 Plains. And I know you were there for this one because I  
19 saw you in the video with Mr. Haas or heard you in the  
20 video. Are you able to show me where you saw the Kirtland's  
21 Warbler that was in the video?

22 A Well, it's a little -- if we were driving down the AAA I  
23 could drive you there fairly quickly, but it was -- it was  
24 down in this (indicating) area.

25 Q Does that help?

1 A Yeah, that helps.

2 Q Zoomed in a little bit.

3 A It was -- actually, it was probably right in this area.

4 Q So on the eastern side of the Yellow Dog Plains; correct?

5 A In the eastern side, yeah.

6 Q Okay. You talked a little bit about migration corridors.

7 And I noticed when you were asked questions that you used

8 words like "might" or "may be" migration corridors; that is,

9 that the Yellow Dog Plains might be a migration corridor or

10 that the Salmon Trout River might be a migration corridor.

11 Do you remember that?

12 A I do remember that.

13 Q Okay. I assume that you have not studied that area to make

14 that determination; is that correct?

15 A Not with a specific corridor goal in mind to establish

16 whether it's a corridor or not.

17 Q And maybe I'm wrong, but to establish whether a particular

18 area is a corridor I assume that you would have to do more

19 than one year of migration study; is that right?

20 A I would agree.

21 Q Okay. And were there any more years of migration studies

22 done for the Yellow Dog?

23 A Not by our group; I mean, not by me.

24 Q Okay. Any that you're aware of that Skye Haas did for the

25 Yellow Dog Preserve?



1 A None that I'm -- none that I'm aware of.

2 Q And just to be clear, that the survey that was done was  
3 commissioned by one of the petitioners in this case; right?

4 A By the Yellow Dog Watershed Preserve?

5 Q Yes.

6 A They're a petitioner? I'm not privy to --

7 Q It is.

8 A Okay. There you go.

9 Q And I do note that in Exhibit 109 on the second page that  
10 under "acknowledgment" that Mr. Haas says, "I would like to  
11 thank Cynthia Pryor for the opportunity to conduct these  
12 surveys and all her help and guidance in determining what  
13 locations to survey and how to access these areas." Does  
14 Cynthia Pryor have any training or experience in bird  
15 surveying?

16 A To my knowledge no.

17 Q Can you think of any reason why she would be directing Mr.  
18 Haas to the specific locations to survey birds?

19 A Well, I guess maybe like if there's something wrong with my  
20 car and I know it's coming from the front wheel I'd direct a  
21 mechanic to go look at the front wheel, and so I think  
22 Cynthia Pryor probably had -- I mean, she had more knowledge  
23 had I did. I haven't been involved in these issues, but she  
24 had more knowledge of where different disturbances were  
25 going to be occurring across quite a large landscape, and so

1 getting some direction from somebody who had knowledge about  
2 what's going on in the landscape was probably not an unwise  
3 thing to do. So that's why I think she was involved in  
4 guiding.

5 Q And when you say "different disturbances," I assume what  
6 you're referring to is the proposed mine; correct?

7 A Yes, and their related activities.

8 Q And you know that this survey was done or commissioned by  
9 the Yellow Dog Preserve in preparation to oppose this mine;  
10 correct?

11 A No, I didn't know that and I was actually pretty explicit  
12 with Cynthia Pryor that if she wanted the birds surveyed up  
13 there I could help organize that and oversee that. But I --  
14 to what end was not my concern.

15 Q Well, you just said though, sir, that it would be a good  
16 idea for her to get involved because she would know where  
17 the disturbances were and you said that the disturbance that  
18 was anticipated was a proposed mine; right?

19 A I did.

20 Q And so she told you or you already knew that there was a  
21 proposed mine going in in the Yellow Dog Plains; right?

22 A I did, yeah.

23 Q Okay. And --

24 A But I don't know anything about opposition to it. Your  
25 question had to do with that this was going to be used for

1           opposition to the mine and I had no idea in that regard.

2       Q     Ms. Pryor didn't tell you that she was opposed to this mine?

3       A     She probably did.  But I mean, I had -- I mean, people ask

4           for studies all the time.  You know, and what it is, what

5           their goals are is not necessarily -- I'm sure the

6           consultants that Kennecott hired, they weren't trying to

7           show that the mine should go in here, or they weren't trying

8           to not find Kirtland's Warblers, for instance.

9       Q     And that's not the question I'm asking you, sir.

10      A     Okay.

11      Q     Let me ask you this.  Do you know that Ms. Pryor and the

12           organization that she works with, the Yellow Dog Preserve,

13           have been active and publicly opposing this mine?

14      A     Yes.

15      Q     And you knew that at the time that she contacted you with

16           respect to this survey?

17      A     Probably, yeah.  It was 2004.

18      Q     Any idea what Ms. Pryor means here when she talks -- well,

19           what Mr. Haas means here when he's thanking Ms. Pryor for

20           determining how to access certain areas?

21      A     Not sure.

22      Q     Now, Mr. Wallace asked you some questions about whether some

23           birds that were using or living on the Yellow Dog Plains

24           could also be residents of or using Huron Mountain Club or

25           the McCormick Tract, something along those lines.  Do you

1 remember that?

2 A Yes.

3 Q Okay. And again, your answer was they could be; right?

4 A Yes.

5 Q And I assume that's again because you have not conducted any  
6 study to show whether there are birds -- particular birds  
7 using the Yellow Dog Plains who also use Huron Mountain Club  
8 and McCormick Tract; correct?

9 A Correct.

10 Q And more specifically you don't know, sir, sitting here  
11 today whether there are any particular birds who are  
12 currently using that heavily logged site that will -- that  
13 is proposed as the mine site are using either the Huron  
14 Mountain Club property or the McCormick Tract?

15 A No, I don't.

16 Q You said you reviewed the Environmental Impact Assessment in  
17 this case; right?

18 A I did.

19 Q Have you had the opportunity to ever review other  
20 Environmental Impact Assessments? Well, we'll start with  
21 mining.

22 A No, not mining.

23 Q So you've never reviewed another Environmental Impact  
24 Assessment for a mine?

25 A Correct.

1 Q Have you ever reviewed an Environmental Impact Assessment  
2 for any other regulated type of establishment, industrial or  
3 otherwise?

4 A Not to my recollection.

5 Q Now, you said something along the lines of if you were  
6 directing the study for the proposed mine or -- well, I  
7 don't think you said that. Let me strike that. Let me  
8 start over. That that -- to identify species that use the  
9 area, the Yellow Dog Plains, that you'd have recommended a  
10 24 consecutive month, two-year period survey?

11 A I said something like that, yeah.

12 Q Okay. Now, and you talked about your grad students and have  
13 they submitted something like what was in the EIA that you  
14 said that would have been a good pilot study; right?

15 A A good pilot study.

16 Q Okay. Now, have any of your grad students ever conducted a  
17 24 consecutive month survey of birds?

18 A No.

19 Q And the method used in the Environmental Impact Assessment  
20 is a standard method for surveying birds; correct?

21 A Yes, it's a -- yeah, for some type of -- for some goals.

22 Q And the times that the birds were surveyed I think there was  
23 a May and that's the breeding survey; right?

24 A Well, May might be spring migration. June would probably be  
25 more breeding and there was June.

1 Q Okay. We have a May spring migration survey; right?

2 A (No verbal response)

3 Q A June breeding survey; correct?

4 A Correct.

5 Q And then is it a November or September --

6 A I think September.

7 Q September and that's another migration study; right?

8 A Appear to be, yeah.

9 Q And those times surveying birds -- I mean, that's standard

10 also; correct?

11 A For some goals, yes.

12 Q Okay. Well, in fact when Mr. Haas did his surveys he only

13 did one breeding survey and one migration survey; right?

14 A True.

15 Q He didn't do the second migration survey, did he?

16 A That's also correct, and -- I mean, I agree we could have

17 maybe found more bird species if that's what you're driving

18 at.

19 Q Well, no, what I'm driving at is that the times that

20 Kennecott consultants surveyed birds, those are the standard

21 times to survey birds, because those are when the birds are

22 most active; right?

23 A Yes. I mean, although I don't know when they surveyed birds

24 specifically other than the months. I don't recall them

25 saying -- did they survey in the morning? Did they go from

1 5:00 a.m. to 10:00 a.m.? Which is great time to survey  
2 active birds. If they go from 5:00 p.m. to 10:00 p.m. I  
3 don't recall that being in there. Maybe it --

4 Q Do you think it might be in here? I think it might be in  
5 here.

6 A Do you?

7 Q Yeah.

8 A Okay.

9 Q Are you saying then it's not in there, sir?

10 A No, I'm not saying that. I'm saying I don't recall seeing  
11 it.

12 Q So if I were to tell you without finding it that it is in  
13 the survey, the time that they surveyed the birds, would you  
14 have any reason to disagree with that?

15 MR. WALLACE: Well, he says he doesn't know, so he  
16 would have no reason one way or the other to question the --

17 MR. PREDKO: Well, why don't we let the witness  
18 testify?

19 MR. WALLACE: Well, I'm objecting to your  
20 question.

21 MR. PREDKO: I didn't hear an objection.

22 MR. WALLACE; I object. I object, because you're  
23 asking him to, you know, respond on something he's already  
24 said he doesn't know anything about.

25 MR. PREDKO: So is your objection asked and

1 answered?

2 MR. WALLACE: Well, okay. Asked and answered.

3 Give me other ideas. It's objectionable for that reason.

4 Q Sir, you don't have any reason to disagree that they put the  
5 timing in their surveys in the EIA, do you?

6 A The only reason I have to disagree is that I did look for  
7 the number of hours that they spent in the field and I  
8 didn't find it. I'm not saying it's not in there; it's a  
9 very hefty document. But I'm saying I didn't find it.

10 Q Fair enough. I do also notice that the number of hours  
11 spent surveying is not in your report, is it?

12 A True enough.

13 Q You talked just a little bit about pH and heavy metals and  
14 their potential effects on birds. Do you remember that?

15 A Yes.

16 Q Okay. Now, I take it that you didn't do any studies with  
17 respect to this site on any potential affects of pH or heavy  
18 metals on birds in the area, did you?

19 A No.

20 Q And I assume then that you don't know what the -- well, what  
21 the baseline pH is for the rivers or what any potential  
22 heavy metals concentrations that may be deposited in or  
23 around the site?

24 A No.

25 Q And you would rely on somebody else to do that type of thing



1 in this case; right?

2 A Yes.

3 Q You talked about the effects of road travel on birds or the  
4 potential effects; right?

5 A Yes.

6 Q And I assume that you base your testimony on studies that  
7 have been done on road effects; right?

8 A Correct.

9 Q Isn't it true, sir, that the majority if not all of those  
10 studies that have been done on road effects as they relate  
11 to birds have been done on paved highways?

12 A Yes, I think you're -- that's correct.

13 Q And most of the studies that have been done have been done  
14 on fairly heavily traveled paved highways?

15 A Yes.

16 Q Not on two-tracks or dirt roads; right?

17 A Right. But it's not the pavement that's doing the damage.

18 Q Well, certainly -- well, you're familiar with the noise that  
19 comes from the tires on the road; right?

20 A Oh, yeah.

21 Q Okay. And part of what makes the noise on the paved roads  
22 is the friction of the tires on the paved surface; correct?

23 A Yeah.

24 Q And so you're going to have less noise on the dirt surface  
25 in terms of that friction; right?

1 A No. If you ever traveled the Triple A, the washboardy dirt  
2 road up there, I mean, you can't talk to the person sitting  
3 in the passenger's seat next to you sometimes with how  
4 washboardy that road is. So paved roads have a certain type  
5 of noise, but, I mean, especially well-traveled washboardy  
6 dirt roads can be pretty noisy.

7 Q Well, you're talking about the noise from inside of the car;  
8 correct?

9 A Yes.

10 Q You also talked about the potential effect of changing the  
11 types of species of birds that will use the area; right?

12 A Right.

13 Q And you relied on a study that you did that had to do with  
14 manmade developments or essentially neighborhoods around  
15 lakes; right?

16 A Development, yes.

17 Q And the results that you got in that study were that you had  
18 with an increased density of manmade developments, you had a  
19 decrease in the number of insectivore birds at those  
20 locations; right?

21 A Correct.

22 Q And you say that that may happen here; correct?

23 A Yes.

24 Q That if Kennecott builds its mine in this area -- and again,  
25 I'm pointing at Intervenor 386 -- builds the mine in the

1 area just east of the orebody that has been recently logged,  
2 you're saying that we may have a decrease in the number of  
3 insectivores in that area?

4 A That's a possibility.

5 Q Okay. Now, would you agree with me, sir, that that area has  
6 already been affected by logging?

7 A Yes, I would agree with that.

8 Q And logging involves human presence; right?

9 A Yes.

10 Q So some of those same types of effects may have already  
11 occurred; right?

12 A Some of them.

13 Q Okay. Now, in Mr. Haas' report, Exhibit 109, the breeding  
14 bird survey, he says the five most common breeders on the  
15 plains are the Chipping Sparrow, Savannah Sparrow, yellow  
16 rumped warbler, American robin, and Northern Flicker; right?

17 A Correct.

18 Q Now, you would agree with me, sir, that really only one out  
19 of the five of those is a pure insectivore; correct?

20 A Yes, I -- yes.

21 Q And that's the warbler; right?

22 A Yeah.

23 Q In this report it says that the remains of a Great Gray Owl  
24 were found; right?

25 A Correct.

1 Q Now, again, you don't have any idea where within the Yellow  
2 Dog Plains those remains were found, do you?

3 A I do not.

4 Q And the report doesn't mention it, but I'll ask, do you know  
5 whether a Great Gray Owl nest found?

6 A It was not.

7 Q Would you agree, sir, that looking at Intervenor 386 and  
8 having been to those areas that the Yellow Dog Plains is a  
9 highly fragmented area?

10 A Yes, it's fragmented.

11 Q Would you say it's highly fragmented?

12 A In comparison to the surrounding landscape, it's more  
13 fragmented. There are more fragmented landscapes than the  
14 Yellow Dog Plains. But it's a -- yeah, it's a -- especially  
15 within that big --

16 Q Well, in fact, in conservation biology when you talk about  
17 fragmentation, that would be almost a textbook picture of  
18 fragmentation, wouldn't it?

19 A I would agree.

20 Q Now, with respect to the insectivore loss issue, again, I  
21 think that you said in your study that you did that all  
22 lakes in all regions may have different results; right?

23 A All lakes in all regions? Like, extrapolating this to other  
24 lakes and other --

25 Q Yes.

1 A -- in Minnesota, for instance, might have slightly different  
2 results?

3 Q Correct.

4 A Yes, I would agree with that.

5 Q Okay. And so you would agree with me that you cannot  
6 necessarily extrapolate your results that you had in your  
7 study which was, I believe, in Wisconsin, --

8 A Northern Wisconsin, yes.

9 Q -- which involved lakes to the Yellow Dog Plains, can you?

10 A As I had said in my earlier testimony, it fits within a  
11 larger body of evidence. It looks at general development  
12 effects. And general development has effects on breeding  
13 bird communities. And so indeed it may not be the same  
14 specific effects we documented with lakeshore development,  
15 but development effects breeding birds. And further  
16 development on the Yellow Dog Plains would effect breeding  
17 birds.

18 Q One of the things -- well, do you know Dr. Flaspohler?

19 A I do.

20 Q Okay. And so you know -- well, he testified earlier in this  
21 case. Did you know that?

22 A I did, yes.

23 Q And he is also a birder; right?

24 A He is.

25 Q And he teaches ornithology; right?

1 A Correct.

2 Q In fact, I think he's probably been doing it a little bit  
3 longer than you have?

4 A Yes.

5 Q And Dr. Flaspohler talked about the fact that you may have  
6 cowbirds attracted to new edges; right?

7 A That's -- yes.

8 Q Okay. And cowbirds eat insects, don't they?

9 A They do.

10 Q And so as well as having a potential loss of insectivores,  
11 you may have some birds that are attracted to the site who  
12 are also insectivores; right?

13 A Sure. But you recognize the other problems with cowbirds?  
14 Again, a cowbird isn't necessarily something I'd wish on  
15 any sensitive habitat.

16 Q Well, and the other thing -- yes, sir. Yes, sir. I  
17 understand what --

18 A Okay.

19 Q -- cowbirds do.

20 A Okay.

21 Q And the other thing that Dr. Flaspohler told us is that in  
22 that area that's already been logged there where the surface  
23 facilities are going to go is that the cowbirds are likely  
24 already there.

25 A They might be.

1 Q Because it goes back to the pictures I showed you earlier  
2 that had the edge of standing conifers next to the clearcut  
3 site. And that sort of area would attract the cowbirds;  
4 right?

5 A Correct. Well, it makes nests more available to them, so  
6 they find nests to parasitize more easily in edges.

7 Q Now, in your study you only studied the birds aspect,  
8 meaning you did find that there was, I guess, fewer  
9 insectivores in developed areas; right?

10 A Right.

11 Q And you surmise, then, without studying that there may be  
12 the potential effect of, I guess, the lowering the health of  
13 the forest; right?

14 A Based on other studies that have shown where you exclude  
15 insectivores, you can increase the number of insects and  
16 decrease forest health. So there's other studies that did  
17 that. But you're right. We didn't -- we didn't exclude  
18 insectivorous birds from a study site.

19 Q Sure. And so you don't know in those areas that you studied  
20 that the health of the forest in those areas is even  
21 affected by the loss of insectivores, do you, because you  
22 didn't study it?

23 A No, we didn't study it. Other people did.

24 Q And you don't know whether any loss of insectivores in this  
25 area, if it happens, would effect the health of the forest?

1 A I can't say definitively, no.

2 Q Dr. Lindsay, do you have a personal philosophical view  
3 regarding use of Michigan's environment for sulfide-nickel  
4 mining?

5 A No. I mean, not as that question is stated.

6 Q Well, isn't it true that your opinions regarding this mine  
7 are not based on purely objective science?

8 A Not all of my opinions, no.

9 Q Some of your opinions are not based on purely objective  
10 science, though?

11 A Sure. Like, maybe I wish they would use different colors on  
12 their trucks, but that doesn't have anything to do with  
13 science.

14 Q I'm talking about not wanting the mine there, period.

15 A Yes, there are, I think, economic reasons, for instance,  
16 which I'm not an economist, but I -- as a layperson, I think  
17 there are economic reasons to consider to consider rejecting  
18 the mine proposal.

19 Q Okay. And I think you know where I'm going here.

20 A I think so.

21 Q And we had discussion with some of your colleagues, Dr.  
22 Flaspohler and Dr. Strand. And you signed, did you not, or  
23 authorized to be signed on your behalf a letter to the  
24 governor of this state?

25 A I did.



1 Q And in that letter you urged the governor to not approve  
2 this mine, don't you?

3 A Yes, that is in the letter. I objected to some of the  
4 language when they were drafting the letter, but that's in  
5 the letter. My name is on it.

6 Q Well, I assume that you -- well, you did just say you  
7 authorized your name to be on it; right?

8 A Yes. There are multiple drafts that get passed back and  
9 forth of these things. And actually specifically because  
10 this was not a letter based on science, there's nothing in  
11 there about birds, there's nothing in there; right? And so  
12 I actually didn't feel as I was signing an argument about  
13 economic issues, not about scientific issues. So I didn't  
14 necessarily think -- yeah. I'm not an economist.

15 Q Well, as an academic and a professor, what you put out there  
16 in writing is important to you; correct?

17 A It is.

18 Q And what has your name on it is important to you; correct?

19 A It is.

20 Q And this is not a letter just to one of your internal  
21 colleagues; right?

22 A It is not.

23 Q This is a formal letter to the governor of this state, is it  
24 not?

25 A It is.

1 Q And in that letter the first paragraph, which is up on the  
2 screen, you say,

3 "Dear Governor Granholm, we the undersigned urge  
4 you to reject the proposal to allow Kennecott Mining  
5 Company to create a nickel-sulfide mine in the Upper  
6 Peninsula of Michigan. Many of our colleagues have  
7 offered appropriate environmental reasons to reject the  
8 mining proposal. We appreciate those reasons. Here we  
9 present additional reasoning for rejecting the mining  
10 proposal. Reasoning that, we believe, has been  
11 underappreciated."

12 And did you agree with that?

13 A Everything except what's in the first sentence. And the  
14 first said, "I encourage the authors of this to say is to  
15 consider rejecting." I did not feel confident in saying  
16 based on this argument that it should be rejected. And  
17 you're right. I dance a fine line and decided because I  
18 felt that that's what I wanted to do was encourage people to  
19 consider this argument rather than -- because I don't think  
20 this is an argument that's being made a lot. And frankly, I  
21 don't know that it's relevant to the DEQ, so we didn't send  
22 it to the Department of Environmental Quality. It's an  
23 economic argument. And so that's why I thought that it was  
24 one worth considering.

25 Q And then in the letter you and your colleagues go on to talk

1 about those reasons that are underappreciated. And it's up  
2 on the screen again. And you say,

3 "First, many appreciate the various environmental  
4 costs that scientists tell us will or may occur if this  
5 mine were built. Despite well appreciated complexities  
6 that uncertainty brings to a decision making process,  
7 uncertainty about the cost inevitably results in those  
8 costs being discounted, at least to some extent.  
9 Sadly, this accounting overlooks an important dimension  
10 of the cost, a dimension that transcends science and  
11 economics. Namely, many Michiganders very simply and  
12 quite reasonably think that the proposed nickel-sulfide  
13 mine represents an inappropriate relationship with  
14 Michigan's natural environment. In the same way that  
15 human prostitution is not made right because it would  
16 create jobs or because psychologist debate what exactly  
17 are its effects on human health, the value of  
18 nickel-sulfide mining cannot be made right by  
19 scientific or economic arguments. In contrast to the  
20 science and economics of nickel-sulfide mining, there  
21 is no uncertainty that many, perhaps most, Michiganders  
22 respect nature in a way that precludes nickel-sulfide  
23 mining. Manifesting their respect is to manifest our  
24 democratic principles."

25 Did you agree with that?

1 A Parts of it. I agree with the sections that -- you'll  
2 notice that what this is saying is that,

3 "Namely, many Michiganders very simply and quite  
4 reasonably think the proposed nickel-sulfide mine  
5 represents an inappropriate relationship to Michigan's  
6 natural environment."

7 And I think the argument then goes on on behalf of those  
8 many Michiganders who think that this would, for instance,  
9 be an immoral issue and not even just economics, not even  
10 just the potential environment impacts, but they believe  
11 that. And we -- and that that would be something that  
12 should be considered, like -- and that's why, although I  
13 begged them to find a different metaphor than prostitution,  
14 because I figured it might arise in some sort of a hearing  
15 like this, it's still in there. And distasteful though the  
16 metaphor might be, it's not actually I think all that  
17 unreasonable the metaphor.

18 Q Okay. So you actually do believe that part?

19 A I think it's a reasonable metaphor for saying you wouldn't  
20 necessarily -- and I'm not saying that the metaphor holds  
21 that nickel-sulfide mining is something akin to  
22 prostitution, but I think it's a metaphor that's worth  
23 considering when you're making these value judgments.

24 Q Well, as a signatory of this letter, you and your colleagues  
25 are not describing the thoughts and concerns of other

1 people. You're describing the thoughts and concerns of  
2 yourselves as well as other Michiganders, aren't you?

3 A Well, I think we're encouraging the governor to consider  
4 these other arguments. And I don't think -- I did not sign  
5 a letter that says, "I think that nickel-sulfide mining  
6 is" -- and I wouldn't sign such a letter that says it's akin  
7 to prostitution. It's saying "consider this." It's a  
8 metaphor.

9 Q Nevertheless, sir, knowing that this letter may come up in a  
10 context like this, you authorized your name to be put on it,  
11 didn't you?

12 A Yes. I mis-assessed that probability.

13 Q And I assume that you didn't ask for any sort of retraction  
14 of the letter, did you?

15 A No.

16 Q Now, there have been some commentary by lawyers with  
17 previous witnesses who coincidentally also had some  
18 disagreement with the terms of this letter who  
19 coincidentally also testified for the Petitioners in this  
20 case. There have been some commentary that every biology or  
21 every science professor in the U.P. signed this letter.  
22 Now, that's not true, is it?

23 A If someone said "every," no, that's not true.

24 Q Okay. Well, in fact, the professor who you referred to  
25 today, Phil Robinson, he didn't sign this letter, did he?

1 A He's an emeritus professor with Alzheimer's disease, and so  
2 I don't think we approached him, or I don't think they  
3 approached him.

4 Q Now, you talked about the Spruce Grouse?

5 A Yes.

6 Q And the Spruce Grouse is a species of special concern;  
7 right?

8 A Yes.

9 Q And special concern species are not legally protected;  
10 right?

11 A True.

12 Q And in fact, the way that the DNR looks at special concern  
13 species is that many of these species are a concern because  
14 of declining populations; right?

15 A Indeed.

16 Q Now, with respect to the Spruce Grouse and its population in  
17 the U.P., you had said earlier that you don't know the  
18 status of the population; correct?

19 A I don't.

20 Q And you're familiar with the MNFI database; right?

21 A I am.

22 Q Okay. And would you be surprised if the MNFI folks also  
23 don't know the current status of the Spruce Grouse?

24 A No.

25 Q You wouldn't be surprised?

1 A I wouldn't be surprised.

2 Q And in fact, would you be surprised if they currently  
3 believe that surveys are also needed to update the species  
4 status in the Upper Peninsula?

5 A No, I wouldn't be surprised at that.

6 Q Now, the Spruce Grouse, as we can see from the pictures, is  
7 apparently tolerant of human presence; right?

8 A Yes, sometimes to its demise.

9 Q Now, with respect to the different species of birds that may  
10 be in and around the area of the proposed surface facilities  
11 for the mine, now, what birds there are there that may be in  
12 those clearcut areas or nearby, isn't it most likely that  
13 with the building of the mine site that they will just fly  
14 away to another nearby habitat area?

15 A That is what will likely happen for those birds, yes.

16 Q And again, as you said earlier, different species of birds  
17 react differently to human presence; right?

18 A Indeed.

19 Q There's no general rule that covers the reaction of all  
20 birds?

21 A No.

22 Q I do want to just ask you a few questions about the  
23 Kirtland's warbler. Now, when you saw the warbler and you  
24 took the video, you saw a singing male; right?

25 A Yes.

1 Q Okay. You didn't see a female?

2 A Did not see a female, no.

3 Q You didn't see a nest?

4 A No. We did very limited -- very limited searching.

5 Q Okay. And you know that the Upper Peninsula in general is

6 on the fringes of the Kirtland's habitat; right?

7 A Yeah. They're expanding into the Upper Peninsula.

8 Q And when they do expand, that the way that they do generally

9 is that a singing male will fly out a little bit further

10 than others had before and sit and sing for his female, I

11 guess; right?

12 A Yeah. Typically it's the males that first get sighted, and

13 that's probably the way it works.

14 Q The stray males; right?

15 A Well --

16 Q Have there been any studies as to what the likely reaction

17 of a Kirtland's warbler would be to human presence if in

18 fact one was located to be nesting in or around the area of

19 the proposed mine?

20 A I'm unsure. I'm not up on the Kirtland's warbler

21 literature.

22 Q Are you aware of the location of the largest Kirtland's

23 warbler population in Michigan?

24 A Yes.

25 Q And that location is Camp Grayling; right?



1 A Yeah, down in the Mio area.

2 Q And Camp Grayling is an active military base, isn't it?

3 A I don't know. If you say it is.

4 Q Well, are you aware that the kinds of things go on at the  
5 active military base Camp Grayling include things like small  
6 arms ranges, demolition ranges, mortar ranges, aircraft  
7 airspace ranges, land navigation convoys, tank maneuvers,  
8 and artillery ranges? Are you aware of that?

9 A No.

10 Q You said that you reviewed the environmental impact  
11 assessment and the bird surveys that were done in that;  
12 right?

13 A I did.

14 Q Were you aware that Kennecott consultants after those  
15 surveys were done also conducted surveys in the years of  
16 2006 and 2007?

17 A I don't recall seeing any documentation of that at all.

18 Q So you haven't reviewed those?

19 A No. I'm not aware of them at all.

20 Q And are you aware that after -- well, let me ask you this:  
21 I heard that the Mining Journal in May or June of 2006  
22 published a picture of the Kennecott's warbler that was seen  
23 near or on the Yellow Dog Plains. Are you familiar with  
24 that?

25 A I think it did, yeah.

1 Q The picture that they published, was that your picture?  
2 A I don't think so. I don't think so. I took a lot of  
3 pictures. It might have been -- it might have been Scot  
4 Stewart's. I'm not sure. They're sort of -- they have  
5 stock sort of birders who usually contribute their photos.  
6 Maybe it was mine, but --  
7 Q Okay. Are you aware that after that picture came out in the  
8 Mining Journal that Kennecott commissioned its consultants  
9 to do a specific search and survey for the Kirtland's  
10 warbler?  
11 A I was not aware of that, no.  
12 Q And so, then, you're not aware that their survey -- their  
13 specific survey for the warbler and their 2006-2007 surveys  
14 did not turn up any warblers?  
15 A When did they go out there after the picture was published?  
16 Q I'm not sure of the exact date, sir. I know it was  
17 subsequent to the picture being published, and I know that  
18 there was a specific survey for the warbler. And then also  
19 a 2006 and 2007 survey, all of which you've not seen; right?  
20 MR. WALLACE: I'm going to object to the lack of  
21 foundation in this series of questions in which Counsel has  
22 testified as to whether Kirtlands were found and studies  
23 that we made. This gentleman said he doesn't know anything  
24 about that, so there's no foundation for any of the content  
25 of these questions.

1 MR. PREDKO: Well, the foundation will be  
2 established in our case in chief. But fair enough. I'm  
3 done asking this witness questions about that.

4 JUDGE PATTERSON: All right.

5 MR. PREDKO: I'm actually done asking the doctor  
6 any more questions. Thank you.

7 MR. REICHEL: Good afternoon, Dr. Lindsay. My  
8 name is Bob Reichel. I represent the Department of  
9 Environmental Quality. I just wanted to follow-up on a few  
10 things that were touched on in your direct exam.

11 CROSS-EXAMINATION

12 BY MR. REICHEL:

13 Q You were asked -- you were shown a couple of documents which  
14 I believe have been referred to as Petitioner's Proposed  
15 Exhibits 109 and 110, which are titled respectively the 2004  
16 Summer Breeding Bird Survey of the Yellow Dog Plains and  
17 then the other one is the Fall Survey. I just want to be  
18 clear about this. As I understand your testimony, you did  
19 not write those reports; is that correct?

20 A I did not write them, no.

21 Q Mr. Haas wrote them; correct?

22 A Correct.

23 Q You didn't personally collect the data that was compiled or  
24 reported in those reports; correct?

25 A Correct.

1 Q And I believe you testified in response to an earlier  
2 cross-examination that you don't know the specific locations  
3 where various species that were referred to in the report  
4 were actually observed in relation to the site of the  
5 proposed mine; correct? Do you want me to restate that  
6 or --

7 A No. The difficulty with the question is some of these  
8 species I could tell you where they are. I can't tell you  
9 where every occurrence of each individual of those species,  
10 and so -- and I could tell you where you could find Chipping  
11 Sparrows. You can find them all over. And, I mean, I just  
12 found one there on Saturday. But, you know, when there's  
13 just one or two individuals, it's difficult to say where  
14 they were. So, no, I don't know each individual bird. The  
15 species is a little bit more difficult to say. Each  
16 individual bird I don't know where they were.

17 Q Well, let me just be clear about my question. Perhaps you  
18 misunderstood it. I was simply asking, these two documents  
19 state -- the author states that certain birds or species  
20 were observed during the course of the activity described  
21 here; correct?

22 A Indeed.

23 Q And I'm just trying to establish that with respect to the  
24 observations that are reported by Mr. Haas, you don't know  
25 where they were seen?

1 A Those individuals? No, I do not know where those individual  
2 birds were seen.

3 MR. REICHEL: Just a minute, please. I think that  
4 covers what I have. Thank you, sir.

5 MR. WALLACE: I have a few more questions to  
6 follow-up.

7 REDIRECT EXAMINATION

8 BY MR. WALLACE:

9 Q Are you familiar with the methodology in preparation of the  
10 Michigan Breeding Bird Survey?

11 A Some of it, yes.

12 Q Do you know whether that survey is conducted by individuals  
13 with Ph.D.'s in ornithology going out and looking for birds,  
14 sir?

15 A Only a few. Only a few individuals.

16 Q Who goes out and finds the birds and records them for the  
17 Michigan Breeding Bird Survey?

18 A They're amateur birders that vary in their abilities from  
19 being good enthusiasts to being some of the best birders in  
20 the state.

21 Q Okay.

22 A Skye Haas is a better field ornithologist, a better birder  
23 than I am or most 99 percent of the people in Marquette  
24 County are.

25 Q Skye Haas who actually identified the majority --

1 A Mr. Haas, yes.

2 Q -- of the birds in this report?

3 A Yeah. He's one of the -- one of the best.

4 Q And you coordinated this study and you assessed it and you  
5 edited it; is that correct?

6 A Yes.

7 MR. WALLACE: Okay. I'm going to move the  
8 admission of Exhibits 109, 110 and 112, Your Honor.

9 MR. PREDKO: Kennecott does have an objection to  
10 admitting these. It's hearsay and foundational objection,  
11 because he's already testified that these are somebody  
12 else's reports. He doesn't know much about the contents of  
13 those reports. I don't think that he's the proper witness  
14 to admit these reports. I think they're unreliable and  
15 should not be admitted.

16 MR. REICHEL: I would join in those objections.

17 MR. WALLACE: Well, I think they're making an  
18 argument that would make all the birding surveys  
19 inadmissible under the testimony we've received already from  
20 Professor Lindsay. This is the way these studies are done.  
21 That's what he's told us. He did it -- he coordinated it,  
22 he assessed it, he edited it. I can continue laying a  
23 foundation for a long time, but this is so clearly  
24 admissible that I don't think there's the need to do so.  
25 And I move again its admission. This is his study. The

1 part of it of identifying birds he had an expert birder go  
2 out and identify them, a man that had taken courses at  
3 Northern Michigan University, taken courses from him. And  
4 he oversaw it and he's willing to put his name on it and  
5 offer it here in court. So I don't think there can be any  
6 question about its admissibility.

7 MR. PREDKO: One of the most -- one of the most  
8 important things about the survey, Your Honor, is we can all  
9 guess as to the location at which these birds were spotted.  
10 Dr. Lindsay unfortunately can't tell us that location  
11 because he's not familiar enough with the study or either  
12 that or the study didn't provide that. We think that the  
13 study itself being admitted through this witness is  
14 unreliable.

15 JUDGE PATTERSON: Well, I think that goes to the  
16 weight of the study this proponent of it. But I think based  
17 on the testimony that he coordinated it, studied it and  
18 edited it and signed onto it, I think there's been a proper  
19 foundation for it. I'll overrule the objection.

20 (Petitioner's Exhibits 632-109, 632-110 and  
21 632-112 received)

22 Q In cross-examination, you were asked about the area  
23 encompassed by this, and I think it was represented and you  
24 didn't disagree that maybe the study covered some nine  
25 square miles; correct?

1 A Yeah. That's what was -- yeah.

2 Q From your standpoint as an avian biologist, why would it be  
3 important from the standpoint of understanding bird  
4 populations proximate to a proposed mining operation to look  
5 at an entire nine square mile area?

6 A Oh, because they fly. They're a mobile species that use --  
7 they have wide ranges. These aren't -- these aren't jack  
8 pines or hemlocks. They do have defined territories and,  
9 depending on the species, they can be smaller or bigger. A  
10 merlin has quite a large home range, whereas a Norther  
11 Parula might have a smaller territory. But birds are  
12 mobile. They fly around. They look for mates in various  
13 places, they look for food in various places, they look for  
14 nests in various places. Yeah. That's why I think it would  
15 be prudent to include a larger area than just a surface  
16 scrape.

17 Q And is that why the entire Yellow Dog Plains including this  
18 nine square mile area and areas north of the mine right up  
19 to Lake Superior are all potentially affected by this  
20 proposed mine site?

21 MR. REICHEL: Objection.

22 MR. PREDKO: Objection.

23 MR. REICHEL: Leading.

24 MR. PREDKO: Same objection, Your Honor.

25 JUDGE PATTERSON: Can you rephrase?



1 Q I'm saying -- yeah -- what is the reason that as an avian  
2 biologist you are concerned that the area of the entire  
3 Yellow Dog Plains and the area north up to the shores of  
4 Lake Superior are potentially affected by this mining  
5 operation, sir?

6 A Well, as I earlier stated, by displacing birds from 92  
7 acres, even if that's only the birds that are affected, they  
8 move out. They move into adjacent territories or maybe not  
9 even adjacent. They might leapfrog into other less suitable  
10 habitat. It's going to effect a greater area as these birds  
11 move out and around. And so that the productivity of within  
12 individual species is going to be affected by having a large  
13 swath of land that's being used for any sort of industrial  
14 or mining activity.

15 Q When you looked at the results of this survey, were you  
16 satisfied that the areas studied from the standpoint of the  
17 birds that were found there adequately covered the area that  
18 you talked to Mr. Haas about surveying?

19 A Could you restate that?

20 Q Let me ask a question a different way. When you looked at  
21 this study, did anything strike you given your background as  
22 an ornithologist as being wrong or unlikely about its  
23 results?

24 A No. I mean, it's unusual, but it's not -- it's unusual in  
25 that it's a -- that there are -- as was noted in the EIA,

1           this is a -- with the techniques that they used, they  
2           identified 54 species and they noted that there's relatively  
3           high species diversity in a pretty small area. And that's  
4           what I would guess I'm -- I can't compare hours. I know the  
5           hours that Mr. Haas was out, but I don't know the number of  
6           hours and how much observation time were done by the  
7           consultants. But I would guess there's probably more  
8           observation time done by Mr. Haas. And so that's probably  
9           why he identified more species. And so it's unusual but not  
10          necessarily a big surprise to find that many species.

11        Q     Okay. So let's be clear about that. What would be the  
12          reasons that your survey found nearly twice as many species  
13          as the Kennecott survey?

14        A     They were specifically targeting varied habitats that as  
15          opposed to doing a transect, which transects can, depending  
16          on their length and their arrangement, can certainly be a  
17          good gauge for looking at diversity. If you wanted to  
18          compare diversity between habitats, you'd use sort of the  
19          same transect setup in one habitat as you did in another  
20          habitat and then compare the two. It's a nice control. But  
21          if you're just trying to document all the species that are  
22          out there, which is what our goal was to see what species  
23          were out there and using that landscape, then you want to  
24          sample all the habitats as completely as you possibly can.

25        Q     Okay. Did you see any focus from what you could tell of the

1 Kennecott survey on trying to find threatened or species of  
2 special concern or endangered species?

3 A There was -- I mean, they had -- I remember the  
4 environmental impact statement them noting they didn't find  
5 any, don't -- and they also did a literature search. But I  
6 don't know that they necessarily did any nest searching, for  
7 instance, for Spruce Grouse, which there are great stories  
8 of loggers cutting down jack pines with a Spruce Grouse  
9 right between their feet and the chainsaw going ten inches  
10 above the Spruce Grouse but the logger never even saw it and  
11 the Spruce Grouse sat on its nest. And so you really have  
12 to search for these species, some of them, specifically  
13 going to their specific habitats to find them. And so I  
14 didn't see that in the EIA. They did note that they didn't  
15 find any, but I didn't see any specific searching for those  
16 species.

17 Q They didn't find any Spruce Grouse, you said?

18 A I don't believe so.

19 Q Approximately how far away from the center of the proposed  
20 mine site was the area where you indicated you saw the  
21 Kirtlands?

22 A I think it's probably maybe two kilometers.

23 Q Two kilometers?

24 A I mean, that's as the warbler flies.

25 Q Have you been to the area in the Lower Peninsula where

1 Kirtlands breed?

2 A No.

3 Q So the only Kirtlands you've seen are those in the Upper  
4 Peninsula?

5 A Yes.

6 Q You haven't made any effort to retract the letter was that  
7 to Governor Granholm, have you, sir?

8 A No.

9 Q Have you been aware of any of your colleagues trying to  
10 retract it?

11 A Not that I'm aware of, no.

12 Q Did quite a large number of faculty members at Northern  
13 Michigan University sign this?

14 A There were, yeah, a number of them. I don't know what  
15 "large" is. But, yeah, there are a number who did.

16 Q Okay. Were the other signators academics, if you know, sir?

17 A Yes, I think so.

18 Q Were they for the most part or completely scientists who  
19 signed this letter asking the governor to oppose the mine,  
20 to reject the mine?

21 A The ones that I know of.

22 Q They're all scientists?

23 A The ones that I know of from NMU and from Michigan Tech are  
24 scientists. I think there are a -- I think there's an  
25 ethicist from Michigan State. I didn't see the final draft

1 or the final version with all the names, but --

2 Q But you're not backing away from the request made in that  
3 letter, are you, sir?

4 A No.

5 Q Now, if you would have had greater resources to conduct the  
6 2004 survey, would you have conducted a survey the following  
7 year?

8 A Yes. The following year, greater resources and we would  
9 have done a lot more surveying.

10 Q Do you have any idea how much this survey cost?

11 A These ones?

12 Q The one that was conducted.

13 A Oh, it might have been in the neighborhood of \$3,000. I  
14 don't -- I wasn't -- I didn't receive any payment for it.  
15 We paid Mr. Haas for his hours and his mileage, but I wasn't  
16 involved in that.

17 Q And so for at least from what you know for somewhere on the  
18 order of 6,000 it could have covered two years?

19 A Yeah, I think so.

20 Q And tell us just to be clear, sir, why it's important to  
21 survey not only more than one year but 12 months of each of  
22 the years surveyed.

23 A Different birds migrate at different times. So, you know,  
24 just going out in May if you were trying to get migratory  
25 species, you'd miss some of the earlier migrants. If you

1 just go out in September, you'll miss some of the later  
2 migrants. If you don't go out in December or January, you  
3 might miss the snowy owls and the Great Gray Owls and the  
4 hawk owls or the gyrfalcons that come down as well as, you  
5 know, snow buntings and other sort of winter species that  
6 come down and use the habitat in the winter. So, I mean,  
7 bird activity there are a couple months where things stay  
8 stable, but of the year up there in the U.P., but there's  
9 sort of constantly changing cycles of species moving through  
10 at different times.

11 Q Okay. Now, you may know this, you may have read this, but  
12 the regulations require 12-month surveys for two years for  
13 the EIA for the mining permit application.

14 A Okay.

15 Q Okay.

16 MR. PREDKO: I'm going to object. I think that  
17 mischaracterizes what the law requires.

18 MR. WALLACE: Well, it requires whatever it  
19 requires.

20 Q Did you see anything in the EIA that explained why Kennecott  
21 had failed to do two years of 12-month studies, sir?

22 MR. PREDKO: Same objection.

23 MR. WALLACE: Either he did or he didn't.

24 JUDGE PATTERSON: Well, I think we can all read  
25 the statute.

1 A I didn't see anything in there.

2 Q Okay. Yeah. My question is no longer about the statute,  
3 but in the EIA itself, was there any explanation, scientific  
4 or otherwise, of why Kennecott had failed to do 12-month  
5 studies for two years in a row?

6 MR. PREDKO: Same objection.

7 A No, I didn't see that in the EI.

8 MR. WALLACE: Okay. I have nothing further.

9 MR. PREDKO: Just a couple, Your Honor.

10 JUDGE PATTERSON: Okay.

11 RE-CROSS-EXAMINATION

12 BY MR. PREDKO:

13 Q Now, you said that birds are mobile because they fly; right?

14 A Most.

15 Q And for that reason, if the bird's habitat is disturbed in  
16 the area of the proposed mine site, they're able to fly away  
17 because, again, they're mobile; right?

18 A Correct.

19 Q And they're able to fly away to other suitable habitat;  
20 right?

21 A Indeed.

22 Q And there is no shortage of clearcut jack pine areas in the  
23 area; right?

24 A I can't necessarily say that. There's such an idea of  
25 habitat saturation that habitat, you know -- it's sort of

1           like filling a cup with water and the habitats that are  
2           there, the species fill in until all the habitats are  
3           saturated. And if you go in and, say, plunk a rock into  
4           that cup, it's going to overflow and those species are going  
5           to move and they're going to potentially try to go somewhere  
6           else. They might pack into other habitats, but so I don't  
7           necessarily know that there are available habitats out  
8           there, but they will move, more than likely.

9           Q     You don't know whether the habitats surrounding the areas of  
10           the Yellow Dog Plains are saturated, do you?

11          A     No. I haven't studied that.

12          Q     Okay. And you would agree with me that there are other  
13           areas of clearcut jack pine other than the proposed mine  
14           site; correct?

15          A     There are, yes. I've seen other --

16          Q     And there are also other areas of older conifers; correct?

17          A     Yes.

18          Q     And with respect to the Kirtland's warbler, are you aware,  
19           Doctor, that there are several areas in the Upper Peninsula  
20           that are specifically being managed to provide a habitat for  
21           the Kirtland's warbler?

22          A     Yeah. I find that interesting, yeah.

23          Q     Okay. And are you aware, for instance, that the Hathaway  
24           National Forest will provide a minimum of 6,700 acres of  
25           jack pine in the appropriate age class to achieve the



1           desired Kirtland's warbler habitat?

2       A       I know that they're starting to do that, yeah.

3       Q       And are you aware also that the Ottawa National Forest will

4           also manage approximately 4,000 to 5,000 acres of jack pine

5           for Kirtland's warbler?

6       A       I didn't know that, but -- yeah.

7       Q       Dr. Lindsay, are you aware of any other study that has done

8           a 12-month to a year study of birds, meaning 12 months out

9           of the year?

10      A       Yes.

11      Q       And what was that?

12      A       Oh, there's some in the Galapagos Islands, ones that are

13           well-funded. Those of us who have to do things on

14           shoestring budgets, can't afford to do it for 12 months. So

15           there are -- there are certainly year-round bird studies.

16      Q       You mentioned earlier that you have not been to the Huron

17           Mountain Club; right?

18      A       This is true.

19      Q       And that's because you're not a member; right?

20      A       No, I'm not a member. Yes; yes. I'm not a member.

21      Q       Any idea whether the Huron Mountain Club could afford such

22           studies?

23      A       I'm trying to think of evidence. I don't really -- I can't

24           say one way or the other.

25      Q       Do you know whether the Huron Mountain Club has done any

1 studies subsequent to what the Yellow Dog Preserve did in  
2 2004?

3 A Subsequent to it?

4 Q Yes.

5 A I don't know. I'm not aware of -- I know they have a  
6 science center and I know they do some work within their  
7 preserve, but I don't know what that work has been.

8 MR. PREDKO: Thank you.

9 MR. WALLACE: I think just one more, Dr. Lindsay.

10 MR. REICHEL: I was just going to say --

11 MR. WALLACE: I'm sorry, sir.

12 MR. REICHEL: -- I have nothing else.

13 MR. PREDKO: Let him say it.

14 FURTHER DIRECT EXAMINATION

15 BY MR. WALLACE:

16 Q Do you know whether in fact the Huron Mountain Club's All  
17 Taxa inventory includes gathering of winter data?

18 A Yes, there are winter data in there.

19 MR. WALLACE: Thank you.

20 FURTHER CROSS-EXAMINATION

21 BY MR. PREDKO:

22 Q That All Taxa inventory doesn't include data for the Yellow  
23 Dog Plains, does it?

24 A Not that I'm aware of.

25 MR. PREDKO: Thank you.

1 JUDGE PATTERSON: Anybody else?  
2 MR. REICHEL: Nothing further.  
3 JUDGE PATTERSON: Thank you, Doctor.  
4 THE WITNESS: Thank you.  
5 JUDGE PATTERSON: It's almost 5:00 o'clock. We're  
6 off the record.  
7 (Proceedings adjourned at 4:55 p.m.)

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