

US EPA ARCHIVE DOCUMENT

-
- D. Testimony of Glenn Miller (referenced in Chapter 3). Excerpt from Hearing Transcript, Vol. 11, *Petitions of the Keweenaw Bay Indian Community, et al. on Permits Issued to Kennecott Eagle Minerals Company* (Michigan Department of Environmental Quality, May 12, 2008). (electronic only)**

STATE OF MICHIGAN

STATE OFFICE OF ADMINISTRATIVE HEARINGS AND RULES

In the matter of: File Nos.: GW1810162 and
MP 01 2007

The Petitions of the Keweenaw
Bay Indian Community, Huron
Mountain Club, National
Wildlife Federation, and
Yellow Dog Watershed
Environmental Preserve, Inc.,
on permits issued to Kennecott
Eagle Minerals Company. /

Part: 31, Groundwater
Discharge
632, Nonferrous
Metallic
Mineral Mining

Agency: Department of
Environmental
Quality

Case Type: Water Bureau
and Office of
Geological
Survey

HEARING - VOLUME NO. XI

BEFORE RICHARD A. PATTERSON, ADMINISTRATIVE LAW JUDGE
Constitution Hall, 525 West Allegan, Lansing, Michigan
Monday, May 12, 2008, 8:30 a.m.

APPEARANCES:

For the Petitioner MR. ERIC J. EGGAN (P32368)
Keweenaw Bay Indian Honigman Miller Schwartz and Cohn LLP
Community: 222 North Washington Square, Suite 400
Lansing, Michigan 48933-1800
(517) 377-0726

1 For the Petitioner MR. BRUCE T. WALLACE (P24148)
 Huron Mountain Club: Hooper Hathaway Price Beuche & Wallace
 2 126 S. Main Street
 Ann Arbor, Michigan 48104-1945
 3 (734) 662-4426
 4

5 For the Petitioners JEFFREY K. HAYNES (P25140)
 Yellow Dog Watershed Beier Howlett, PC
 6 Preserve and National 200 E. Long Lake Road, Ste. 110
 Wildlife Federation: Bloomfield Hills, Michigan 48304
 7 (248) 645-9400
 and
 8 F. MICHELLE HALLEY (P62637)
 National Wildlife Federation
 9 PO Box 914
 Marquette, Michigan 49855
 10 (906) 361-0520
 11

12 For the Respondent ROBERT P. REICHEL (P31878)
 Michigan Department of Assistant Attorney General
 13 Environmental Quality: Environment, Natural Resources and
 Agriculture Division
 14 6th Floor, Williams Building
 525 West Ottawa Street, PO Box 30755
 15 Lansing, Michigan 48909
 (517) 373-7540
 16

For the Intervenor RODRICK W. LEWIS (P43968)
 17 Kennecott Eagle JEFFREY W. BRACKEN (P25648)
 Minerals Company: CHRISTOPHER J. PREDKO (P56040)
 18 Warner Norcross & Judd LLP
 2000 Town Center, Suite 2700
 19 Southfield, Michigan 48075
 (248) 784-5000
 20

21 RECORDED BY: Marcy A. Klingshirn, CER 6924
 22 Certified Electronic Recorder
 Network Reporting Corporation
 23 1-800-632-2720
 24
 25

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

TABLE OF CONTENTS

PAGE

WITNESSES: PETITIONERS

GLENN C. MILLER, PH.D.

Direct Examination by Mr. Eggan	2138
Direct Examination by Ms. Halley.	2221
Cross-Examination by Mr. Bracken.	2226
Cross-Examination by Mr. Reichel.	2255
Redirect Examination by Mr. Eggan	2264
Recross-Examination by Mr. Bracken.	2274

ALEC R. LINDSAY, PH.D.

Direct Examination by Mr. Wallace	2276
Voir Dire Examination by Mr. Reichel.	2312
Direct Examination by Mr. Wallace (continued)	2313
Cross-Examination by Mr. Predko	2322
Cross-Examination by Mr. Reichel.	2360
Redirect Examination by Mr. Wallace	2362
Recross-Examination by Mr. Predko	2372
Further Direct Examination by Mr. Wallace	2375
Further Cross-Examination by Mr. Predko	2376

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

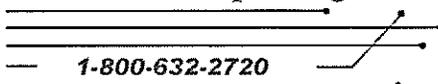
EXHIBIT INDEX

PAGE

IDENTIFIED RECEIVED

Intervenor's Exhibit 600.	2251.	2251
(3-8-07 Colleen Cripps letter)		
Petitioner's Exhibit 632-130.		2277
(Dr. Lindsay Curriculum Vitae)		
Petitioner's Exhibit 632-148.		2313
(Map and five photographs)		
Petitioner's Exhibit 632-149.		2313
(Video of Kirtland's warbler)		
Petitioner's Exhibit 632-150.		2313
(Video of Kirtland's warbler)		
Petitioner's Exhibit 632-109.		2365
(Summer breeding bird survey of the Yellow Dog Plains, 2004)		
Petitioner's Exhibit 632-110.		2365
(Fall migration bird survey of the Yellow Dog Plains, 2004)		
Petitioner's Exhibit 632-112.		2365
(Breeding bird survey of the Yellow Dog Plains)		

NetworkReporting



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 Petitioners 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 transport and fate
13 and 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

Page 2140

NetworkReporting

1-800-632-2720

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 water?

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
11 years -- 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

Page 2142

NetworkReporting

1-800-632-2720

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 -- quite
8 a bit drier there than it is in Michigan, it's always a
9 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 have to raise the pH somehow, using some alkaline agent
6 or some process which raises the pH. Then you've got metals
7 to deal with, which are -- metals in the other more --
8 perhaps more toxic constituents at the mine. And you've got
9 to make sure that they're removed appropriately. And then
10 finally there's oftentimes a source of very water-soluble
11 constituents that may not be as toxic but carry a heavy salt
12 load. And this is usually sulfate that you've got to deal
13 with also. And there's three separate issues that you deal
14 with. Generally you've got to consider them separately.

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

17 A Yes. We've had several publications on water treatment.
18 We've had some publication on pit lake water quality. We've
19 written on gold mine effluent out of peaks, several since
20 1992, 1993.

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

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

25 Q So this is work that you have supervised. Have you actually

1 done the writing on these articles?

2 A Yes.

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

4 A Yes, they have.

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

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

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

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

25 Q Were you -- I'm sorry. I didn't mean to interrupt. Were

Page 2146

NetworkReporting

1-800-632-2720

1 you finished?

2 A Yes.

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

5 A Yes; yes.

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

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

14 Q And how to treat those waters?

15 A Yes.

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

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

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

22 A Go ahead.

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

Page 2147

NetworkReporting

1-800-632-2720

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

2 Q Okay.

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

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

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

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

16 A It was related to sustainable development of mining or
17 mining in a sustainable community with the idea of Sir
18 Robert Wilson, CEO of Rio Tinto, who said it best. He said
19 to determine how you obtain a license to mine -- a social
20 license to mine, does the community want you in that
21 particular area, and how do you make sure that you have that
22 license to mine but you have the reputation and the ability
23 to develop a mine and distribute the wealth, at least a
24 portion of that wealth, to the community and then close the
25 mine in such a way that it doesn't cause anything but a

1 positive contribution to that community?

2 Q Other committees?

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

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

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

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

22 A I do. I serve on three primarily environmentally based
23 organizations. One is called EARTHWORKS. It's a national
24 organization based in Washington, D.C., that is concerned
25 about sustainable practices in mining. It's working with

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

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

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

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

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

1 a critic of the mine industry but not an opponent of the
2 mine industry, but certainly providing -- expressing
3 concerns about water quality issues and long-term legacy
4 issues in some of the mines that have been created in the
5 past.

6 Q That has been the essence of your research?

7 A Yes.

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

9 A We designed --

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

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

15 Q What was the name of that particular mine?

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

20 Q Where is the Nacimiento Mine?

21 A That's in New Mexico.

22 Q In New Mexico?

23 A New Mexico. We've developed pilot scale operations at the
24 Equity Silver Mine in British Columbia for a mining company.
25 We've been involved in a variety of discussions on mine

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

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

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

21 Q Have you worked with state government regulators?

22 A Yes.

23 Q On water treatment and acid mine drainage issues?

24 A Yes.

25 Q Where?

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

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

9 A Yes.

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

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

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

23 A We have. Our primary funder at the Leviathan Mine was
24 Atlantic Richfield Company. They have the -- when they
25 bought Anaconda they had a lot of water quality treatment

1 problems that they needed to deal with. We had a very --
2 we've had a very close association with them for eight
3 years. We've worked with Placer Dome now, a baric mining
4 company.

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

7 A Yes.

8 Q Where is the mine that they --

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

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

19 A Could you repeat that?

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

24 A Yes.

25 Q And what I'm wondering is -- and we're going to talk about

1 this in a minute. There are a number of components in that
2 system that are kinds of treatment. And I'm wondering, have
3 you worked with or are you familiar with those various kinds
4 of treatment that are involved in the wastewater treatment
5 plant system here?

6 A Yes.

7 Q Specifically precipitation systems?

8 A Yes.

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

10 A Yes.

11 Q Filtration systems?

12 A Yes.

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

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

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

22 A Yes, they are.

23 Q Ion exchange?

24 A Again, very uncommon in a lot of mine treatments but to work
25 in a -- at a university laboratory dealing with water

1 research, you very, very commonly use ion exchange for a
2 variety of applications. So I'm very acquainted with ion
3 exchange.

4 Q Evaporation systems?

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

10 Q Micro filtration?

11 A Yes.

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

14 A I've seen them in action and -- at least ion exchange. I've
15 not worked with those in mining because they're so uncommon.
16 But I have obviously been acquainted with them in looking at
17 scale-up issues and feel very comfortable commenting on
18 those.

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

23 A Yes.

24 Q Did you review the groundwater discharge permit that was
25 actually issued by the Department of Environmental Quality

1 here?

2 A Yes.

3 Q And did you also review the permit modifications issued on

4 December 5 of 2007?

5 A Yes.

6 Q What about the comments of the parties? Have you reviewed

7 those?

8 A Yes, I have extensively.

9 Q And did you review the response that the Michigan Department

10 of Environmental Quality provided in response to the

11 comments?

12 A Yes.

13 Q Did you review the Michigan Department of Environmental

14 Quality Statutes and Rules related to groundwater and

15 groundwater treatment issues?

16 A Yes.

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

18 A All 50 pages.

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

20 A Yes.

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

22 A Yes.

23 Q And Dr. Robert Prucha?

24 A Yes.

25 Q Have you conferred with other experts involved in this case:

1 Dr. Maest, Dr. Prucha?

2 A Oh, extensively, yes.

3 Q Extensively?

4 A Yes.

5 Q Why?

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

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

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

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

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

25 Q Now, just to make sure that we're on the same page, you said

1 "the amount of information in the permit." Did you mean the
2 permit application?

3 A Excuse me. The permit application.

4 Q Okay.

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

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

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

25 Q Is this a site where there is a likelihood of acid

1 generation?

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

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

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

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

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

24 Q So that creates a pragmatic problem in addition to just the
25 general water treatment issues?

Page 2160

NetworkReporting

1-800-632-2720

1 A Very much so.

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

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

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

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

25 Q You indicated that you have reviewed the groundwater

1 discharge permit for this site. Is the permit that you
2 looked at consistent with permits you've seen in other
3 places in the United States?

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

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

12 A No.

13 Q Does that surprise you?

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

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

24 A I would have liked to have seen some more extensive
25 development of exactly the type of membrane systems that

1 were going to be used. I think that certainly the biocides
2 that would be used were not defined. The cleaning agents
3 where the --

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

5 A Okay.

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

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

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

13 A Right.

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

16 A No.

17 Q Tell Judge Patterson why that's important.

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

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

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

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

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

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

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

24 A It depends on if it was a biologically active agent. There
25 are a variety of things that can be used. But if those are

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

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

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

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

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

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

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

Page 2165

NetworkReporting

1-800-632-2720

1 to -- number at that point. It's simply -- they're required
2 to report it, which is different than regulating it.

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

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

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

17 A Yes.

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

19 A Well, they would have actually numbers for the discharge.
20 Like, there would be a total dissolved solid discharge, for
21 example, in a permit that would require them to -- so that
22 they -- there may be some mixing values or something. But
23 they may have a discharge that may be 800 milligrams per
24 liter, for example, that would be -- that would require that
25 you can't discharge this, and if you do, it's a violation.

Page 2166

NetworkReporting

1-800-632-2720

1 And then there's rather severe consequences if you have a
2 reportable violation.

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

9 A No. And that was, I guess, one of the concerns as I started
10 looking through; that there's quite a few numbers and
11 sometimes as many as five significant figures, meaning --
12 suggesting they have a very extensive knowledge of how well
13 the water is being treated. But these were all based on
14 expected -- like, a 95-percent treatment in, say, 1 R --
15 reverse osmosis process. So there was, to my knowledge --
16 and I don't believe there was any testing of the treatment
17 facility at all. It was just based on manufacturers'
18 expected water quality.

19 There was no -- that I saw, any taking the waters
20 and making a synthetic water and even sending it through any
21 kind of experimental system. It was pretty much just using
22 values that a water treatment company had given -- had
23 provided, and then another -- the modelers had predicted
24 what the water quality would be. Then the water treatment
25 people predicted how that water would be treated. And so

1 there was really no even laboratory-scale testing of this --
2 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 you 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

Page 2169

NetworkReporting

1-800-632-2720

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 basins where the
22 water -- the contaminated water is going to be stored. So
23 it's going to come from underground and some of the seepage
24 and some of the water that comes up from there. You've got
25 this temporary rock storage area which is going to receive

Page 2170

NetworkReporting

1-800-632-2720

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

Page 2171

NetworkReporting

1-800-632-2720

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

Page 2172

NetworkReporting

1-800-632-2720

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 operation 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

Page 2175

NetworkReporting

1-800-632-2720

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
14 those 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 3,135 gallons per minute.

5 And then this last column, the rate used to design
6 the treated water infiltration system was 400 gallons per
7 minute, and Dr. Prucha predicted 3,185. Given the figures
8 on Exhibit 44, if the water is coming to the system at rates
9 predicted by Dr. Prucha, what is your conclusion on the
10 impact of the system -- excuse me -- on the impact to the
11 wastewater 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

Page 2177

NetworkReporting

1-800-632-2720

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.
 Page 2178

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 2 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.

Page 2181

NetworkReporting

1-800-632-2720

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 correct,
23 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 its capacity from
11 what was predicted -- not capacity -- increase the amount of
12 water being predicted so it could drain those down so you
13 don't have to design the exact water treatment operation for
14 maximum flow. This allows a capacity storage to allow the
15 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
22 is helpful to this court to assist this trier of fact. I
23 mean, this is an expert witness, and all he's going to do is
24 be hypothesizing. It seems to me that the scientific method
25 requires him to test and make findings and conclusions, not

Page 2184

NetworkReporting

1-800-632-2720

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 laid 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
Page 2185

NetworkReporting

1-800-632-2720

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.

19 There's two issues I think that need to be
20 considered there is, how these water basins are managed. If
21 they're managed in such a way that the water is essentially
22 completely gone under normal scenarios, under normal
23 situations, if you have a full capacity to deal with, that's
24 an advantage. So if they're managed -- but if they're
25 managed that you have one of them, say, half full, for

Page 2186

NetworkReporting

1-800-632-2720

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

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

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

12 Q Okay. They're designed --

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

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

16 THE WITNESS: Ten-day.

17 JUDGE PATTERSON: Ten-day.

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

19 A Right.

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

22 A Yes.

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

25 A Yes. There is some -- a fair -- actually, a fair amount of

1 capacity in this temporary rock storage basin that they
2 would allow the water to flow in if these contact basins
3 were full.

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

6 A I think that would be a fairly substantial problem with the
7 water treatment system, because this rock, from what Dr.
8 Maest has indicated, is still fairly acid generating. It's
9 not as acid generating as the ore, but it's very -- still
10 very acid generating. So that water quality would be
11 severely degraded. And if that water had to be treated in
12 the water system too, there would be a whole lot of
13 complications they would need to deal with with treating
14 that water.

15 It would also serve, if they got everything wet in
16 that temporary rock storage basin -- effectively a humidity
17 cell, which is what you do if you're trying to make rock
18 generate acid. You put in what's called a humidity cell,
19 and that's where the microorganisms can basically consume
20 the -- the sulfide materials grow and generate. That's when
21 the real problems start, is when you get a nice microbial
22 community growing on the rock. You generate copious amounts
23 of acid.

24 Q What is it about the temporary development rock storage area
25 that leads you to believe that it would become like a

1 humidity cell? What would the conditions be?

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

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

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

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

25 A Right; yeah.

1 Q And the same constituents and the same levels of
2 constituents?

3 A Right; right.

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

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

20 Q Is variability a factor that will impact this system under
21 all circumstances?

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

Page 2190

NetworkReporting

1-800-632-2720

1 Q Will the water coming from the treatment -- the temporary
2 development rock storage area, the leachate, provide a
3 variability that will corrupt the treatment system?

4 A It would certainly impact it negatively.

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

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

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

1 A You know, it's -- I don't want to suppose to design this
2 particular system, because I wasn't really asked to do that.
3 But I think design of increased capacity would certainly be
4 something I'd suggest the designers take a look at.

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

8 JUDGE PATTERSON: That's fine, yeah.

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

11 JUDGE PATTERSON: Okay.

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

15 JUDGE PATTERSON: Okay.

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

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

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

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

24 MR. EGGAN: Very good.

25 MR. BRACKEN: I have no objection.

1 JUDGE PATTERSON: So it will be entered by
2 stipulation.

3 (Off the record)

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

5 JUDGE PATTERSON: I'm ready.

6 MR. EGGAN: Okay.

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

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

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

22 MR. REICHEL: Excuse me.

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

24 MR. REICHEL: Excuse me. Counsel, could you
25 please -- I think I know what that is. Could you please

Page 2193

NetworkReporting

1-800-632-2720

1 identify for the record what's being displayed so that it's
2 clear?

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

5 THE WITNESS: -- 6-1.

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

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

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

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

12 Q Okay. Yeah, that's fine. Before you do that, Dr.
13 Miller, --

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

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

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

Page 2194

NetworkReporting

1-800-632-2720

1 JUDGE PATTERSON: Are we talking about the permit
2 or the application?

3 MR. EGGAN: The application.

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

7 MR. EGGAN: It is; it is.

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

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

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

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

22 MR. REICHEL: Yes.

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

25 MR. REICHEL: That's fine. And again, I just
Page 2195

NetworkReporting

1-800-632-2720

1 wanted the record to reflect what was being displayed.

2 MR. EGGAN: Understood. Anything from our friends
3 at the company?

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

6 MR. EGGAN: All right. Very good.

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

9 A The influent of the system -- these are influent components
10 from the -- basically contact water underground and then at
11 various ancillary systems going to the contact water basins.
12 That infers a significant step here, is to raise the pH, and
13 there's some issues that exist about this. They call it a
14 lime softening in one place, but it is designed to
15 precipitate metals using a pH adjustment. The metals will
16 precipitate.

17 There's some question in my mind whether it will
18 do what it -- they suggest it will do to calcium, which is a
19 significant -- these are various filtration steps to get rid
20 of the precipitate that forms, because you want to have a
21 real clean water when it goes in the reverse osmosis system.
22 This is the reverse -- first reverse osmosis system that is
23 in the process. Again, that is pushing water through the
24 membranes under high pressure. There's a pH adjustment
25 where the pH is raised from -- up to 9 to 11, which is

Page 2196

NetworkReporting

1-800-632-2720

1 alkaline, and that tends to ionize the boron.

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

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

13 A Okay.

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

15 A Water --

16 Q -- components of the system. You mentioned a precipitation
17 step?

18 A It's right here (indicating).

19 Q Okay. And then a series of filtrations?

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

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

22 A Two of them (indicating).

23 Q Reject water diversion?

24 A Yes. That's a good point. The -- there's -- about a third
25 of the water in these two systems combined is then called

1 reject water. When you send something through a reverse
2 osmosis system, you have very -- pretty good water going
3 through the system, but then all the other contaminants are
4 located in what is in summation about a third of the water.
5 And so that's now fairly contaminated water that is taken
6 off and called reject water.

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

9 A Yes.

10 Q Explain to the hearing officer what this is.

11 A It's called a concentrate reduction process. Unlike a lot
12 of mines that I've seen, there is no direct discharge of
13 partially treated water. All the water needs to be treated.
14 And what they do with this primary process is take
15 two-thirds of the water, treat it and then make it available
16 for discharge. But that third of the water now contains the
17 entire -- most of the contaminant load. There's some in the
18 precipitate early -- but most of the contaminant load, and
19 that has to be treated again. That's treated with a
20 subsequent reverse osmosis system.

21 They go through some pretreatment steps again.
22 They raise the pH and drop out metals. They do it a little
23 bit differently here that's probably going to be perhaps
24 more successful. And then they take it through this next
25 reverse osmosis system and -- to get rid of as much of the

1 contaminants as they possibly can. I might make the point,
2 though, in -- you have -- what is used, at least in the
3 documentation in the application, is they have a reject
4 rate. Like, it can be 90, 95, 99 percent of, say, something
5 like sodium -- sodium would be rejected, and so the water is
6 now 99 percent free of sodium. There's some that goes
7 through, but it is -- and this first process is actually --
8 it's actually fairly good.

9 On this process now, because you've now
10 concentrated the water in that third, if you use the same
11 value, you get more going through. If you have a 95 or 90
12 percent reject rate at a higher concentration, you have more
13 going through to the point that this water that comes out of
14 this -- this RO treatment now is -- contains a significantly
15 higher contaminant load than the first two RO systems
16 combined would do to the point that most of the
17 contamination that is discharged comes from this specific
18 system. And if I can make that -- I don't know if I can
19 make that clearer. But this process is critically
20 important, because it's only one RO process with much more
21 contaminated water. So this water contributes the bulk of
22 the contaminants into the water that is ultimately
23 discharged into the TWIS.

24 There's another step in here, because all the
25 boron that comes in that's retained in that second RO system

1 now is here, and they treat this water by doing an ion
2 exchange, which is another process. An ion exchange is a --
3 certainly a well-accepted method for removing boron from
4 water, but it is also another process that tends to
5 complicate the system. There's about -- of the RO water on
6 this other process, there is about 7 percent of the water
7 left that's really got all the contaminants in. What they
8 do with that water is basically evaporate that water, and
9 then you get crystalline material at the end.

10 Q Where is the evaporator?

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

13 Q Is the --

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

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

20 A Correct.

21 Q And this is the concentrate reduction process?

22 A Right.

23 Q Is that an explanation of each of the components of the
24 system?

25 A For the most part, yes.

Page 2200

NetworkReporting

1-800-632-2720

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

5 A Well, what happens is two-thirds of the water is treated in
6 the first process, and it results in a waste product for
7 about a third of the water. That waste product is then
8 treated in this concentrate reduction process.

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

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

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

21 A Oh, yeah.

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

23 A Right. I would have to say that's assumed, but I don't
24 know. I did not see where they would have a laboratory
25 facility in this facility. They would almost be required to

1 have it, because each of these units requires -- each of
2 these designed -- for example, the ion exchange system
3 requires for -- that's designed to remove boron in the
4 concentrate reduction process. What an ion exchange system
5 does is it exchanges some ion, like hydroxide, for boron as
6 it comes on. And so at some point all that boron will take
7 up of the majority of those sites, and then boron will still
8 begin to leak out. And so in order to make sure a system
9 works like this, you have to have a normal operating
10 requirement to do extensive analytical work to make sure the
11 boron isn't been discharged inappropriately. So it requires
12 extensive laboratory testing.

13 Q Is boron an important issue in terms of this particular
14 wastewater treatment plant?

15 A Boron is -- this water is unusual in the amount of boron.
16 Boron is a plant -- it keeps plants from growing. It's used
17 as a soil sterilant in some places. And boron is very
18 important in this system because the concentration in the
19 influent water, based on the data submitted, is relatively
20 high, about -- on an order of magnitude, a factor of ten
21 higher than what can be discharged. So they have to remove
22 about 90 percent of the boron. The -- even with this
23 system, as they indicated, their discharge is about 177
24 micrograms per liter where the discharge limit is about 285
25 milligrams per liter. That may seem like a fair amount, but

1 it really isn't. So if the system tends to drop off in its
2 performance, then it's going to come very quickly to
3 violating those discharge requirements.

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

5 A Yes; yes.

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

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

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

13 A The answer is "no."

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

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

24 Q The components of this system individually have been used
25 elsewhere?

1 A Yes.

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

4 A No.

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

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

18 Q Well, that would have been -- that would have been my next
19 question. It looks like we are treating water in a
20 sequence?

21 A Yes.

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

23 A Well, for example, if the last one fails -- let's say -- I'm
24 sure there'll be multiple evaporators, but if one of them
25 fails that's handling a third of the water that you will be

Page 2204

NetworkReporting

1-800-632-2720

1 required either to have a very large storage capacity or a
2 third of the treatment system will go down. If you're
3 treating at maximum rate and one of the reverse osmosis
4 systems goes down, then half of that capability goes down;
5 if you're treating it 350 you immediately have to drop to
6 175 gallons per minute. If the, you know, on of the other
7 components goes down then you lose that capacity of that
8 aspect. In some cases you can lose the entire system
9 operational capacity, and that needs to be a consideration
10 in design and operation of it.

11 Q And we talked a few minutes ago about variability; the
12 variability of the water quality that is coming into the
13 system. Is variability a factor in a system as complex as
14 this?

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

24 Q Now, we talked a minute ago about reverse osmosis and you've
25 talked about it at various stages in this particular

Page 2205

NetworkReporting

1-800-632-2720

1 treatment system. Are you aware of a reverse osmosis system
2 anywhere that would have the kind of demands placed on it
3 that will be placed on it at this particular mine?

4 A No, but I have to say that I can't say that there is not
5 such a thing as great confidence or a certainty of reverse
6 osmosis systems that operate on a -- particularly from ocean
7 water that operate on -- continuously. But for a system
8 like this where you've got a requirement for treating 24/7
9 and with some variability in water, I'm just not aware of a
10 system like this that's been proposed anywhere. And
11 certainly I've not -- yeah, I've not seen performance data
12 of anything close to this complexity.

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

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

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

20 A They have to be -- the membranes have to be cleaned; there has
21 to be replacements of reverse osmosis membranes. There's a
22 variety -- there's just a lot of operating parameters:
23 pumps, pipes, valves, those sorts of things. And so they
24 expect these can go down on a -- on some basis and so they
25 operate them maybe five days a week or four days a week.

Page 2206

NetworkReporting

— 1-800-632-2720 —

1 For example, one in San Luis Mine in Colorado operates four
2 days a week because that's -- they designed it to do that.
3 They take weekends off and then a day for cleaning up. But
4 this type of system will require a much higher level of just
5 management.

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

7 A Absolutely, they are.

8 Q Tell us about that.

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

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

25 A Mostly plastic, cellulose-acetate based a lot of them. Some

Page 2207

NetworkReporting

1-800-632-2720

1 of them are Teflon or fluorinated polymers. There's a
2 variety of different membranes.

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

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

6 Q Give us a range. Is it as big as a car or is it big as a --
7 as big as a 50-inch TV set? Just give us some sort of idea.

8 A Well, they all -- it's hard to make that kind of adjustment.
9 What they are is tubes with multiple membranes put in the
10 tubes and you build those up based on what kind of flow
11 rates, what kind of pressure you're going to use. So it's a
12 little hard to give them the -- is that -- a particular
13 size, but they can -- I mean, you can expand the size but as
14 far as design of this particular treatment, they've got a
15 5,000-square-foot building designed to put these things in
16 at present.

17 Q I think one of the reasons I asked you the question was, do
18 they indicate in the materials that they have submitted what
19 the size of the membrane is going to be?

20 A No; they don't have any specifications on membrane type
21 or -- and so that's why it's very difficult to estimate
22 size, because there is no indication of what -- even what
23 sort of system they're going to use. There's a variety of
24 different reverse osmosis manufacturers and different types
25 of systems.

Page 2208

NetworkReporting

1-800-632-2720

1 Q Okay. I want to -- I want to have you take a look at the
2 notes on this particular page and I think there's a note
3 there that talks about the ionization system?

4 A It's ion exchange system. I just might quote this note
5 which suggests that they haven't got everything perfectly
6 worked out is -- the note's number 1: "Ion exchange system
7 for boron removal may be added in lieu of caustic prior to
8 the second pass RO unit."

9 Q So what are they talking about here?

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

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

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

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

24 A The entire system. The entire system.

25 Q Okay. So what does that mean?

Page 2209

NetworkReporting

1-800-632-2720

1 A Well, this is certainly an untested system and one that
2 frankly is designed in a fairly speculative manner without a
3 whole lot of data looking at this specific water and this
4 condition with this group of unit processes pretty much put
5 together.

6 Q Is there something about the predicted water quality that
7 has created this complex system?

8 A Oh, yes. Because of the soluble materials they have in
9 there: sulfate, sodium chloride they're almost required to
10 use a reverse osmosis system of some sort, but then they've
11 got the acidity coming in the front. They've got to do some
12 precipitations. And then they've got boron that they've got
13 to deal with. So the predicted water quality is a critical
14 component to design of a system like this.

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

17 A Yes.

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

21 A Certainly it would have to be redesigned.

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

1 A I think --

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

6 MR. EGGAN: I think this -- I think this is a
7 person with imminent qualifications in terms of water
8 treatment for mines and I think he's -- I think he is
9 imminently qualified to testify as to whether this system is
10 going to work even under the conditions they predict.

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

15 MR. EGGAN: Well, I don't think that the
16 hypothesis is all that -- should be something you should
17 concern yourself with, because I'm using the hypothesis that
18 the system is going to receive the influent that you think
19 it is. That's my question. Even if it receives the
20 influent that you predict, is this system going to work?

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

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

25 JUDGE PATTERSON: Well, I'll allow the answer.
Page 2211

NetworkReporting

1-800-632-2720

1 A The issue is a process of how you develop a system like this
2 and certainly, you know, it's based on the uncertainty of
3 how they're going to treat boron. Plus, you know, just
4 perhaps speculative. This system was designed with water
5 quality and I would suggest that it needs certainly a much
6 more extensive set of tests to determine in fact that these
7 individual components could put -- could come together to
8 treat water quality that's both, you know, predicted and
9 then plus some uncertainty in that water quality. And right
10 now I don't think that data -- those data are available.
11 Those data have not been generated, because the question
12 process in determining what the water treatment system would
13 be -- would need to be designed to do and there has been, to
14 my knowledge, no data developed on how this system would
15 actually work with this particular water.

16 Q Does the fact that they have put in the note, as we have
17 indicated, indicate to you that they -- that they're
18 concerned?

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

23 Q Given the water quality that is going to be resulting from
24 mining operations and the ecosystem that you talked about,
25 is this approach, in your opinion, a prudent way to handle

1 it, a wastewater treatment system?

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

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

6 A Well, certainly the -- I would relate it to the impacts of
7 the discharge water on the physical and biological
8 environment that would receive that water.

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

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

15 Q Have you worked with ecosystems in the past?

16 A My top course is ecological toxicology, so -

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

18 JUDGE PATTERSON: Yeah, I'll overrule.

19 Q Okay. Go ahead.

20 A Certainly that it almost ends up being a regulatory -- more
21 of a regulatory issue, I have frankly not evaluated what
22 discharge water quality would do to the ecological system,
23 but as far as the discharge of contaminated water certainly
24 I think just from a regulatory perspective this system would
25 have to be demonstrated to be successful; and right now I

Page 2213

NetworkReporting

1-800-632-2720

1 guess what I have looked at is this system has not been
2 demonstrated to be able to treat the water as they suggest.

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

5 A I cannot say what their plans are from this point forward as
6 far as they would go forward, but certainly they would need
7 to do a lot more engineering design and a whole lot more
8 testing of this to make sure this would work, because I do
9 not believe this system would function as presently
10 indicated on this fairly generic flow sheet.

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

15 A There's just too many single processes put together without
16 demonstrating they will work. It's just -- when you design
17 a system you want to make sure that there's a -- you know,
18 this is the first step. This is the first step. But then
19 there's many steps after that to make sure the system will
20 operate.

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

1 A No, other than just statements that they would be managed
2 according to current regulations, which is not a management
3 plan. Presumably -- and I'm speculating there -- they would
4 be hauled offsite where they would be deposited, or even if
5 left onsite it's completely up in the air how those
6 sludges -- and there's two major sludges. One is the brine-
7 salt solution from the evaporation process, and then there's
8 the sludge that occurs during the initial precipitation
9 process.

10 Q How much are we talking about here?

11 A Well, again --

12 Q How much sludge?

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

18 Q Are there missing parameters among the permit application
19 materials that would be important to you in determining the
20 efficacy of the system?

21 A You mean in the influent water?

22 Q Yes. Yes.

23 A Yeah. I think that the TDS, the total dissolved solids,
24 would have been very helpful to have. In some respects you
25 can add that up, but you really don't know what is going to

Page 2215

NetworkReporting

1-800-632-2720

1 be -- plus there's addition of several steps of lime,
2 sulfuric acid, sodium hydroxide, anti-scaling agents which
3 are probably minor, so it's hard to know exactly what that
4 sludge weight is going to be, so -- but you don't know what
5 the dissolved solids, the salt content of the initial water
6 coming in is. And then the other parameter that I would
7 have very much liked to have seen is the pH and acidity of
8 the influent water, because that tells you how much calcium
9 hydroxide you need to add to raise the pH, and that's part
10 of this entire treatment design process.

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

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

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

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

22 Q Do you think that the Department of Environmental Quality --
23 based on your review of the permit application, do you think
24 the Department of Environmental Quality had sufficient
25 information by which to evaluate this system and to allow

Page 2216

NetworkReporting

1-800-632-2720

1 this to be a treatment system?

2 A I'm not sure I want to speculate what the Environmental
3 Quality Department would do, but it certainly would not be
4 sufficient information for me to evaluate whether this
5 system would be successful. There's too many parameters
6 left undecided; there's not enough data -- demonstration
7 data to determine whether this system actually could work as
8 proposed.

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

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

Page 2217

NetworkReporting

1-800-632-2720

1 MR. EGGAN: Can I have someone turn the Elmo on
2 for me?

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

7 A Yes.

8 Q All right. And is that something that you and I put
9 together?

10 A Yes.

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

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

16 Q All right. Let me ask -- let me ask this. I'm referring to
17 this as wastewater treatment system as a whole, but is that
18 true for the individual components of this system? We've
19 talked about the contact water basins. If the inflow is
20 greater is that going to cause the contact water basin
21 scenario to fail?

22 A Yes.

23 Q They'll overflow?

24 A Yes.

25 Q Is that true about the wastewater treatment plant itself?

Page 2218

NetworkReporting

1-800-632-2720

1 If the inflows are greater will the wastewater treatment
2 plant by itself work?

3 A No, it will need to be redesigned.

4 Q And we talked about the treated water infiltration system
5 just a moment ago. Will that system -- if the inflow is
6 greater than as predicted by the company -- if it's greater,
7 will that system be able to handle the amount of water?

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

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

10 A Well, if the water -- if the influent into the wastewater
11 treatment is poorer -- particularly I think copper is the
12 most sensitive item -- then the system will have to need to
13 be redesigned to handle copper.

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

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

Page 2219

NetworkReporting

1-800-632-2720

1 goes from .14 to .2 or slightly above that, then they will
2 go above the ten, meaning they will violate discharge
3 standards.

4 Q Even under their current assumption?

5 A That's their current assumption. If their current
6 assumption is off by only a small amount, then it will be --
7 violate that discharge limit. If you use Dr. Maest's, then
8 it violates it by a factor of 70.

9 Q Seventy, 7-0?

10 A Seven zero.

11 Q Okay. What is your conclusion number 3?

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

19 Q And your conclusion number 4?

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

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

25 MS. HALLEY: I have just a couple.

Page 2220

NetworkReporting

1-800-632-2720

1 DIRECT EXAMINATION

2 BY MS. HALLEY:

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

6 A Yes.

7 Q Okay. Have you read the so-called "demonstration clause" of
8 Part 632?9 A I've browsed through that; I haven't read it in great
10 detail.11 Q Okay. Could I refresh your memory and then ask you a couple
12 of questions about it?

13 A Please do.

14 Q Okay. Part 632 requires that "techniques be demonstrated to
15 be capable of accomplishing their stated objectives in
16 protecting the environment and public health." Do you
17 believe that this wastewater treatment facility has been
18 demonstrated to be effective?

19 A No.

20 MR. BRACKEN: Objection, your Honor; foundation.
21 They're now asking this chemist to tell us what -- to
22 interpret regulations and rules; I don't think he's shown a
23 foundation, nor do I think he has the background or
24 qualifications to do that.25 MS. HALLEY: I'm not asking him for any legal
Page 2221**NetworkReporting**

1-800-632-2720

1 interpretation; I'm asking him for a factual understanding
2 of whether this wastewater treatment plant system is
3 capable -- has been demonstrated to be capable of what it's
4 proposed to do. That's a factual question, not a legal
5 question.

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

7 MS. HALLEY: Pardon me?

8 JUDGE PATTERSON: I'll overrule the objection.

9 Q Dr. Miller, go ahead.

10 A This system since it's -- to my knowledge -- and there has
11 not been any water that has actually gone through a system
12 like this. There is not -- certainly not a demonstration
13 that this series of components could be put together and
14 actually treat the water as described. This is a novel,
15 untested system.

16 Q So would you describe this system as being a generally
17 accepted method of being effective at treating mine water in
18 this way?

19 A Individual components of this system have been generally
20 accepted to treat water, but together I don't think they've
21 ever been shown to work together and -- with this
22 complicated water. Not to my knowledge anyway. And so I
23 would say that it is untested and certainly if you asked me
24 whether this system component together would work, I'd say
25 it might work. There might a lot of tinkering. But has it

Page 2222

NetworkReporting

1-800-632-2720

1 been shown to work, and the answer would be clearly no.

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

4 A Not to my knowledge.

5 Q Has there been any modeling that would demonstrate that this
6 technique would work?

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

12 Q Okay. Has the modeling been of the whole system from
13 beginning to end?

14 A Well, in each component, each unit process you take -- you
15 model each unit process and determine what the water quality
16 comes out of that unit process is and you put that in the
17 next one and the next one and the next one. So it's a
18 series basically of accommodation of processes where you
19 look at each individual process to come up to the end.

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

22 A No.

23 Q "No"?

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

Page 2223

NetworkReporting

1-800-632-2720

1 Q And has there been any independent testing of this proposed
2 technique?

3 A Not to my knowledge.

4 Q Okay. Documented applications in similar settings in
5 mining?

6 A I looked for those and was unable to find any. There's
7 certainly reverse osmosis systems in mines, but not this --
8 of this complexity and not operating under this set of
9 requirements.

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

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

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

19 A Right.

20 Q -- if this doesn't work?

21 A Right; right. But that's a design criteria; it's not --
22 depending on how you define "contingency." If the system
23 fails -- there's some assumptions in there that the system
24 can be down for ten days under normal operating conditions
25 and the tanks would fill with water and then you would be

Page 2224

NetworkReporting

1-800-632-2720

1 able to -- they would be able to fix whatever problem might
2 be. I suppose that would be a contingency plan, but if the
3 system fails initially -- well, the issue is if it fails and
4 this doesn't work, then they've got to go back to the
5 drawing board and this is the issue that we've discussed
6 previously about the need for a variety of steps in the
7 process to make sure everything works.

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

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

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

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

22 MS. HALLEY: No further questions.

23 MR. BRACKEN: Is this a good time for a break,
24 your Honor?

25 JUDGE PATTERSON: Okay. Let's take ten minutes.
 Page 2225

NetworkReporting

1-800-632-2720

1 (Off the record)

2 MR. BRACKEN: Good morning, Dr. Miller. How are
3 you?

4 THE WITNESS: Fine.

5 MR. BRACKEN: My name is Jeff Bracken; I represent
6 Kennecott.

7 CROSS-EXAMINATION

8 BY MR. BRACKEN:

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

10 A The Keweenaw Tribe.

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

12 A They sought me.

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

15 A Six weeks, two months?

16 Q From now?

17 A No. Six weeks to two months ago.

18 Q Ago?

19 A Yeah.

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

22 A As I recall.

23 Q Okay. She won't test on that.

24 A Okay. That's good.

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

1 Club?

2 A Not as much as I used to be.

3 Q Did you used to hold any offices or positions?

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

5 Q And what --

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

7 Q What chapter was that?

8 A Toiyabe Chapter.

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

11 A Mostly Nevada, some California.

12 Q And how did you -- were you actively involved in the Sierra
13 Club?

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

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

19 A I believe that's correct.

20 Q And that's another environmental group?

21 A Yes.

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

24 A A variety of resource issues, yes.

25 Q Would it be fair to say that both your membership in the
Page 2227

NetworkReporting

1-800-632-2720

1 Sierra Club and the Great Basin Mine Watch is really from a
2 activist point of view from an environmentalist?

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

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

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

7 MR. BRACKEN: Sure. Let me pull back that
8 question and I'll -- because I have a document that I'll --
9 I'm not ready to get to yet. I'll withdraw the question for
10 the time being.

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

15 A Oh, certainly.

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

19 A More so and much larger.

20 Q Much larger?

21 A On a per-ton basis the old mining industry had a lot of more
22 impact on a per-ton basis; the scale of mining now is so
23 much larger than it was in years past. And so -- and I
24 don't know if, you know, I'd say whether the impact has
25 changed a whole lot, but certainly there is a lot more focus

Page 2228

NetworkReporting

1-800-632-2720

1 on dealing with a variety of environmental issues than there
2 was in the past. I would agree with you on that.

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

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

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

10 A I know I've said that before, is that the point -- the point
11 I would make is there that the -- that mines on closure were
12 usually where the problems end up being and in dealing with
13 legacy issues. And I think that's --

14 Q What they leave behind when the mine plays out or the ore
15 plays out?

16 A Right; right.

17 Q And do you know what steps that have been taken by the MDEQ
18 to assure that once the ore -- actual ore mining is done
19 here how they're going to protect the environment; what
20 steps they've taken to do that?

21 A You know, I have not really looked at that. I was actually
22 looking only at the specific issue of water quality
23 treatment, which is my area of expertise.

24 Q That's fair enough. And actually, would you agree with
25 this? "The general impression of regulatory systems in the

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

2 A I think that's a value judgment I don't care to make a
3 comment on right now. There are -- they vary.

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

5 A I don't think I've -- if you've got a quote on -- that all
6 regulatory systems are good?

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

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

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

14 A Yes.

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

17 A Yes.

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

20 A Well, it certainly will, although kind of a general
21 statement like that, the contextual aspect of that I
22 certainly would be interested in seeing what that context
23 was. Because I certainly don't agree that all regulatory
24 systems in the United States are good. They vary
25 depending on a variety of factors.

Page 2230

NetworkReporting

1-800-632-2720

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

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

6 Q Okay. How many groundwater discharge permit applications
7 have you worked on?

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

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

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

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

20 A Gold mining for the most part.

21 Q They have high concentrations of cyanide mercury?

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

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

5 A True; yes.

6 Q And for instance, metal precipitation is one that you're
7 familiar with from your work?

8 A Yes.

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

11 A Yes.

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

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

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

17 A Sure.

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

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

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

24 A Yes.

25 Q You've also written or spoken about the reverse osmosis

Page 2232

NetworkReporting

1-800-632-2720

1 technology, which is one of the ones that's going to be used
2 at this mine as well; correct?

3 A Correct.

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

6 A It's much less common than lime treatment, for example. In
7 Nevada which is a large mining industry, there's, I think,
8 three examples where it's been used commonly out of, you
9 know, some -- depending on how you count them -- 130 mines.
10 So it's -- I would call that unusual, in Nevada certainly.
11 And unusual in the other big mining state, which is Arizona.
12 Although, it has been used there also.

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

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

18 Q How about for sulfate removal? Is that something it's been
19 used for?

20 A It has been used for sulfate removal.

21 Q And in that context is it well tested?

22 A In that narrow context, it's tested, but again, it's tested
23 examples I've seen tested for drinking water, making
24 drinking water in a mine in Arizona. It's been used in San
25 Luis on an intermittent basis for reducing the dissolved

1 solids in it. And certainly in Nevada it was used in a pit
2 lake to remove dissolved solids, including sulfate on an
3 intermittent basis. And they -- it was -- they used it for
4 one summer and did not use it after that.

5 Q Do you recall writing a paper called the -- I think it's a
6 presentation "Reduction of Sulfate Concentration in Neutral
7 Mine Effluent"? Would you like to see a copy?

8 A I've written -- I've written numerous things about that,
9 yeah.

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

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

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

13 (Witness reviews document)

14 A Yes, I remember writing this. Yeah. I know what the
15 context I wrote this in, though. I remember this. All
16 right.

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

19 A Yes.

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

24 A This -- yeah, that's exactly what I said. Let me expand on
25 that. This context was for a pit lake called the -- one of

Page 2234

NetworkReporting

1-800-632-2720

1 the ones I mentioned before that had a very high arsenic
2 level and it had a very high sulfate level, the Jamestown
3 Mine in California, and they had to get rid of sulfate out
4 of the pit lake. And this is the context where I have seen
5 sulfate removal using reverse osmosis is to be quite
6 successful. And I would affirm this that using RO to get
7 rid of sulfate out of the Jamestown pit lake would work,
8 because it's a pit lake and they don't have to treat it all
9 the time. They have the ability to go in and treat for one
10 day or five days or ten days or 20 days. But when they shut
11 it down, nothing happens. They just have a pit lake there.
12 That's the difference, and that's the point I was making
13 with Mr. Eggan is that a treatment system as complicated as
14 the one that was proposed here requires many, many steps,
15 requires to be operated effectively 24/7 over the vast
16 majority of the year. That's where this system I think has
17 not been tested extensively.

18 Q Okay. So the process has been tested. It's in this
19 application in the operation of this system would have some
20 issues?

21 A Yes.

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

25 A No, I haven't. But that's the point is I don't think

Page 2235

NetworkReporting

1-800-632-2720

1 anybody has.

2 Q Okay. But you haven't?

3 A I have not.

4 Q And the issue that you've just raised is an issue of
5 operations, monitoring what's going on, watching your
6 membranes, making sure they don't get scaled, those kind of
7 things? You make sure it continues to operate efficiently
8 over time; is that right?

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

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

18 A We read -- I read the report, but I looked at -- I did go
19 into some background. I was not asked to do that
20 specifically, but I did go into some of the background
21 documentation.

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

23 A That's fair to say.

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

Page 2236

NetworkReporting

1-800-632-2720

1 A I believe that's fair to say.

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

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

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

6 A I met him during this proceeding and spent several days
7 going over these issues with him.

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

9 A Yes.

10 Q Did you see any of his work product?

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

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

17 A I have to rely on his work.

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

21 A The volumes are obviously, you know -- I'm taking the
22 volumes that are proposed in both cases and making
23 determination of the water treatment ability based on those
24 volumes.

25 Q And you have assumed his are -- for your testimony today,

1 you've assumed his are correct and that Kennecott's aren't
2 except as otherwise indicated in your testimony?

3 A I'm not assuming anything's correct. I'm saying if one is
4 correct, this is the result. If another is correct, that is
5 the result.

6 Q Okay. So you haven't come to a decision on whether or not
7 one is correct or one's not correct; is that true?

8 A I was not asked to do that.

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

11 A Yes.

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

13 A Yes.

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

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

17 Q Sure. And would you agree that you'd have a greatly
18 increased level of confidence in the reliability of
19 someone's conclusions if they were based upon the use of the
20 method?

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

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

25 A Sure. I suppose it is. But you certainly make hypotheses.

Page 2238

NetworkReporting

1-800-632-2720

1 You test them and then you determine whether your hypotheses
2 are correct.

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

5 A In situations where there's a peer review process in place
6 they would. But oftentimes there's not a peer review
7 process in place.

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

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

18 Q You haven't peer reviewed their work?

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

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

22 A I don't know if there's skepticism, but you analyze the
23 work. And I might also mention that in a classic peer
24 reviewing of manuscripts, which is the accepted way of
25 publishing in a peer review journal is you have an editor

1 who sits as a judge and then you have people who are peers
2 in that area that review the work. I've had some things
3 that come through that the peer review done was just
4 terrible. And I made strong arguments to the judge, who was
5 the editor at that point, saying, "This guy is absolutely
6 wrong for this, this and this." The editor made a decision
7 in this one case, fortunately made a decision in my favor.
8 So I peer reviewed the peer review of my work and said
9 that -- so you do have a -- peer review means there is
10 somebody sitting as a judge of the arguments that are being
11 made.

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

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

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

19 A I think that's a, with all due respect, somewhat misdirected
20 question, because, you know, the scientific method is a
21 process you go through to determine whether your hypothesis
22 is correct. That often requires experimental data to be
23 produced. It does not necessarily mean that in peer review
24 you've got to do independent work to justify whether in fact
25 something is going to happen. The peer review process

Page 2240

NetworkReporting

1-800-632-2720

1 generally will not require the peer reviewer to develop
2 information.

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

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

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

25 A Well, I hope what I do is a valid formal way. But I analyze

1 data to see if it's consistent with information that has
2 been developed that I can understand and evaluate.

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

4 A I looked at the data that basically Kennecott had developed
5 and what -- and then I applied those values as far as the
6 treatment processes to information that Dr. Prucha and Dr.
7 Maest had developed. But most of the information I looked
8 at was based on -- based on the water treatment proposals by
9 Kennecott.

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

13 A That's correct.

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

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

Page 2242

NetworkReporting

1-800-632-2720

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

4 A I had an occasion with the Division of Environmental
5 Protection a year and a half ago, which I think that they
6 have realized was not a correct conclusion. It was a state
7 agency.

8 Q The State of Nevada Department of Conservation and Natural
9 Resources --

10 A Right; right.

11 Q -- the Division of Environmental Protection?

12 A Yes.

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

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

18 Q Okay. I'll get --

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

24 Q The Department of Environmental -- or Division of
25 Environmental Protection said that the study that you had

1 done, if I recall, clearly lacks basic scientific integrity;
2 isn't that true?

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

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

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

10 Q Who funded it?

11 A I believe Earthworks funded part of it.

12 Q An environmental concern?

13 A An organization interested in mercury emissions from mining.

14 Q On the non-industry side?

15 A One could argue that.

16 Q And they funded this study?

17 A They funded the instrument. We funded the rest of it. It
18 was basically a shared instrument. We -- that's all they
19 funded was the instrument.

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

22 A That was absolutely not true. The instrument was used
23 correctly.

24 Q Excuse me. Is that what they said?

25 A I don't think they said that.

Page 2244

NetworkReporting

1-800-632-2720

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

3 A There is the Environmental Protection Agency has issued --
4 issues where there's a diminimous level of mercury that's
5 concerned. They've also issued -- the Labor Department has
6 issued standards where there's a clear problem for worker
7 exposure.

8 Q And those are ambient or workplace standards?

9 A One is workplace, one is ambient.

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

12 A It's hours of exposure.

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

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

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

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

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

20 A No. That was the average over 60 seconds. We took much
21 longer measurements than that. They didn't understand the
22 report.

23 Q Is there a -- is there a standard for ambient air quality
24 for mercury? And is there a standard which relates to human
25 health?

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

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

15 A Are you allowed, then, to do my response to that technical
16 evaluation?

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

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

23 And --

24 Q And is there a -- you made the -- you made the conclusion,
25 did you not, that it was thousands of times higher than was

Page 2246

NetworkReporting

1-800-632-2720

1 acceptable for human health?

2 A No, I didn't.

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

6 MR. BRACKEN: Your Honor --

7 THE WITNESS: He's also making statements that are
8 not correct.

9 JUDGE PATTERSON: I don't know if it's going to
10 add --

11 MR. EGGAN: Doctor --

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

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

16 JUDGE PATTERSON: -- whether he was right or
17 wrong.

18 MR. BRACKEN: -- that at all. I'm not trying to
19 prove that at all.

20 JUDGE PATTERSON: All right.

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

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

1 Q Would you like me to address those for you? Do you
2 remember?

3 A You mean if you want to do that, we can go through, as long
4 as you give me an opportunity to respond to each one of
5 those, which I did in a written document that was equally as
6 long. And the -- I have had a fair amount of experience on
7 mercury and mercury measurements.

8 Q Well, wait a minute.

9 A They have not.

10 Q Maybe we can just end it here. Isn't it true that the
11 department found that the study clearly lacked basic
12 scientific integrity; that they determined that no
13 conclusions could be drawn from the data presented and that
14 the study was so significantly flawed it was difficult to
15 fully discuss all the deficiencies identified?

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

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

18 A I do not believe they were correct in that. They were
19 wrong. We had a fundamental disagreement about mercury
20 measurements in ambient air.

21 Q Isn't --

22 A Their response was very, very harsh. That was not a peer
23 review. That was a vitriolic response.

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

25 A I can't remember what they said.

Page 2248

NetworkReporting

1-800-632-2720

1 Q Would you like to see it?

2 A I believe you if you say that.

3 Q Okay.

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

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

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

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

11 MR. BRACKEN: 2007.

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

13 MR. BRACKEN: I am.

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

25 JUDGE PATTERSON: Mr. Reichel, do you have a
Page 2249

NetworkReporting

1-800-632-2720

1 position?

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

4 MR. BRACKEN: Your Honor, it was 2007 when it was
5 issued. However, they didn't hire Dr. Miller until six to
6 eight weeks ago. We didn't know he was testifying. We just
7 did a search and found out this information not too long
8 ago, within weeks. And I think it talks to his credibility.
9 It's an official document of the State of Nevada sent by the
10 division head.

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

14 JUDGE PATTERSON: We know what it is.

15 MR. BRACKEN: It is. And there's no way except
16 but to prove via sometimes but by these extrinsic evidence
17 like this. I think it just shows a bias towards mining
18 companies, and I think I'm allowed to bring that into
19 evidence. I think there's a sufficient foundation that's
20 self-authenticating.

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

24 JUDGE PATTERSON: Well, I don't think it's
25 hearsay, because it's not being submitted for the truth of

Page 2250

NetworkReporting

1-800-632-2720

1 the matter asserted.

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

4 JUDGE PATTERSON: I think Dr. Miller has attempted
5 as best he can under the constraints of cross-examination to
6 explain, which you can certainly pursue on redirect. I'm
7 going to admit it for the limited purposes of assessing his
8 credibility or bias, but certainly not for the truth of the
9 matter asserted.

10 MR. BRACKEN: Exhibit 600.

11 JUDGE PATTERSON: Pardon me?

12 MR. BRACKEN: Intervenor Exhibit 600.

13 JUDGE PATTERSON: Okay.

14 (Intervenor's Exhibit 600 identified and received)

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

17 (Off the record)

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

22 A Yes.

23 Q And you've also talked at different times in your testimony
24 today about the ability or inability of the system as
25 designed by Kennecott being unable to react very well.

Page 2251

NetworkReporting

1-800-632-2720

1 Those are my terms. Or you have a concern about that or
2 something; is that correct?

3 A Yes.

4 Q Do you know the way the mining is planned here; that this
5 mining is going to build up over a period of three years
6 until it gets to the full mining work that's going to be
7 performed here?

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

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

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

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

17 A I thought about that. It certainly -- when you have a mine
18 evolving under that time frame, getting engineering
19 designs -- say the first year they have -- get down
20 somewhere into the add-it (phonetic) and the entrance. And
21 I thought about that. The issues of delay of mine when
22 these are on a very tight schedule are very difficult.
23 Increasing the size of the water treatment unit quickly is
24 probably going to be very, very difficult. Now, I have
25 not -- and I was not asked to evaluate that. But by going

Page 2252

NetworkReporting

— 1-800-632-2720 —

1 through a permitting process to increase the TWIS, for
2 example -- now, whether that could be undertaken quickly is
3 doubtful.

4 But certainly I would not disagree with your
5 supposition that there will be some time. But I guess the
6 argument I was making is that at present it is probably
7 unlikely -- or it is unlikely that the system will operate
8 as -- successfully, and certainly not at the flows and
9 concentration or -- because they're going to have to
10 redesign and re-engineer the system.

11 Q One thing I forgot to talk about this morning was the
12 evaporator crystalizer technology. Is that also well-
13 tested?

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

18 Q And the quality of the evaporated water is distilled water,
19 in effect?

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

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

24 A Right.

25 Q So the three main components that you and I have talked

1 about, which are the metal hydroxide precipitation, the
2 reverse osmosis and the evaporator crystalizer, are all
3 tested technologies if not in mining certainly in industry;
4 is that right?

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

7 Q Sure. You're not saying, are you, that Kennecott is not
8 trying to address all the problems that they have with this
9 water?

10 A No, I'm not saying that.

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

14 A It's very expensive.

15 Q So it's not that Kennecott is trying to get off on the cheap
16 here; they're trying to address these problems and they're
17 spending the kind of money that may be able to address them?
18 They're -- you have a question. Let me restate. Let me try
19 this again. You've indicated that you have some problems
20 with putting these together. It's an innovative system, one
21 that's unusual. Those are words you've used?

22 A Yes.

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

Page 2254

NetworkReporting

1-800-632-2720

1 A No.

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

5 A Untested, it is a serious attempt to address this water
6 quality issue.

7 MR. BRACKEN: I have no further questions.

8 MR. REICHEL: Good afternoon, Dr. Miller. My name
9 is Bob Reichel, and I represent the Department of
10 Environmental Quality in this proceeding. I just want to
11 follow up briefly on some of the points that Mr. Eggan
12 touched on in direct examination.

13 CROSS-EXAMINATION

14 BY MR. REICHEL:

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

18 A Correct.

19 Q And I believe you also testified that you had some concern
20 that certain parameters -- that there were not numeric
21 effluent limitations for certain parameters in the permit.
22 Do you recall testifying about that?

23 A Yes.

24 Q I believe you used nickel as an example?

25 A And sulfate.

Page 2255

NetworkReporting

1-800-632-2720

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

4 A Oh, yes.

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

8 A Yes.

9 Q And one aspect of that which Mr. Eggan asked you to look at
10 were some requirements applicable at the effluent from the
11 treatment system; correct?

12 A Correct.

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

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

Page 2256

NetworkReporting

1-800-632-2720

1 Q Well, I understand that, sir. But my question was simply,
2 you acknowledge, do you not, that there are limits -- among
3 other conditions in the permit, there are limits established
4 for various parameters in groundwater monitor wells? Isn't
5 that true?

6 A Yes.

7 Q And you said "some distance away." What, if any,
8 understanding do you have about how far away these
9 groundwater monitoring wells are from the so-called
10 infiltration system?

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

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

13 A I don't know.

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

20 A Yes.

21 Q You're familiar with that?

22 A Yes.

23 Q And are you aware, sir, that under the terms of the
24 permit -- I believe it's condition 10-D. I can put it up
25 here if you'd like to see it. But the condition 10-D of the

1 permit states -- it talks about notifications of changes in
2 discharge. It states, "If any chemical listed in Attachment
3 1 is detected in the effluent monitoring of concentrations
4 greater than five times the expected effluent quality in
5 Attachment 1," there's a requirement that they "notify the
6 Department to evaluate the data" and -- with the Department
7 being able to require additional monitoring treatment or
8 other corrective actions. Do you recall words to that
9 effect?

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

11 Q Sir, --

12 A Go ahead.

13 Q -- I'll ask the questions here. I mean, did you not
14 understand? Okay. Are you also aware, sir, that the permit
15 requires -- or prohibits certain kinds of activities by the
16 permittee? Let me be more specific here.

17 MR. REICHEL: Just noting for the record that what
18 I've projected on this overhead screen, I'll represent to
19 you, sir, is one of the pages from the groundwater discharge
20 permit we've been talking about, specifically page 14 of 32
21 under "General Conditions."

22 Q Do you see that, where my hand is?

23 A Right.

24 Q It states among other things that the "discharge shall not
25 be or be likely to become injurious to the protected uses of

Page 2258

NetworkReporting

1-800-632-2720

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

2 A Yes.

3 Q Under "D" it says, "The discharge shall not create a
4 facility as defined in Part 201, Environmental Response of
5 the NREPA." Do you see that?

6 A Yes.

7 Q I assume, sir, that since most of your work -- well, let me
8 ask you this: You've not previously worked on a project in
9 Michigan, have you?

10 A No.

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

14 A I'm not -- no.

15 Q Fair enough. If I were to tell you, sir, that it is a
16 provision that states environmental laws that are intended
17 to prevent and remediate sites of environmental
18 contamination, you wouldn't have any reason to disagree with
19 that?

20 A No.

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

Page 2259

NetworkReporting

1-800-632-2720

1 A Right.

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

4 A Right.

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

9 A I saw that. But the point that I was making was, that falls
10 short of being able to analyze what the impact of those
11 biocides or additives is. And it's consistent with the
12 other regulation that says this will be determined later.
13 And that was -- it made it difficult for me to evaluate the
14 application because there was no specificity of the
15 chemistry that was being used.

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

22 A I have no reason to not believe that.

23 Q I think you also were asked -- you expressed some
24 uncertainty about what was going to happen with regard to
25 the management of sludges that would be generated from some

1 aspects of the treatment process. Do you recall that?

2 A Correct.

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

8 A I saw only limited parts of that. I was not asked to look
9 at that.

10 Q Fair enough. If I were to tell you that that permit
11 contained conditions that specified that sludges generated
12 from the wastewater treatment plant would be required to be
13 disposed in a licensed landfill, would you have any reason
14 to disagree with that?

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

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

20 A Yes.

21 Q And I believe you noted at some point that the -- or
22 commented that the schematics of the treatment system
23 provided in the permit application were just that; were
24 schematics? They were not final engineering drawings? Or
25 words to that effect?

Page 2261

NetworkReporting

1-800-632-2720

1 A Certainly, no, they're not.

2 Q Okay. Again, are you aware or do you know that under the
3 permit issued -- the mining permit under Part 632 has a
4 requirement that before Kennecott were to construct the
5 wastewater treatment system, that they were required to
6 submit to the DEQ for review and approval the detailed
7 engineering plans for the system?

8 A (No verbal response)

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

11 A I knew that they had to have a demonstration prior to be --
12 to getting a permit to mine. I was aware of that. And that
13 has not yet been demonstrated, but -- it's not been
14 demonstrated to this point, certainly on the discharge
15 permit.

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

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

Page 2262

NetworkReporting

1-800-632-2720

1 Q You don't know. Okay.

2 A -- because I was not -- that was not part of what I was
3 asked to review.

4 Q All right. Fair enough.

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

6 JUDGE PATTERSON: Sure.

7 (Counsel reviews documents)

8 Q Dr. Miller, turning back now to the groundwater discharge
9 permit, the one that you have had an occasion to look at,
10 are you aware, sir, that the permit contains specific
11 enforceable limits on the volume of water that is -- that
12 Kennecott would be authorized to discharge?

13 A Yes.

14 Q And although it's not stated in gallon-per-minute terms, are
15 you aware that the stated volumetric limitation is the
16 equivalent of 350 gallons per minute?

17 A Yes.

18 Q And finally, the permit contains Section 12, a series of
19 compliance requirements. Let me just put this up here so
20 you can see what I'm referring to.

21 MR. REICHEL: Again, I would note for the record
22 what I'm projecting here is a portion of the Part 31 permit
23 which appears at page 16 of 32 under the heading "12.
24 Compliance Requirements." Let's see if I can make that a
25 little more legible.

Page 2263

NetworkReporting

1-800-632-2720

1 Q I'm not going to ask you to read through all of this, but I
2 would direct your attention to 12-D, which states in part,
3 "In accordance with the applicable rules, the department may
4 require additional activities including but not limited to
5 the following:" And that includes, among other things,
6 revising -- it's "6. Revising the operational procedures at
7 the facility. 7. Changing the design or construction of a
8 wastewater operations facility." Extending on through --
9 I'm not going to read them all. "10. Close the facility or
10 end the discharge that results in the applicable standard
11 being -- " Do you see that all of those terms appear on the
12 face of the permit? Is that correct?

13 A Yes.

14 MR. REICHEL: Just one moment, Judge.

15 (Counsel reviews documents)

16 MR. REICHEL: That's all I have. Thank you, Dr.
17 Miller.

18 MR. EGGAN: A question or two on redirect, Judge.

19 JUDGE PATTERSON: Okay.

20 REDIRECT EXAMINATION

21 BY MR. EGGAN:

22 Q Mr. Bracken asked you some questions about the components of
23 the system. This is something you testified about this
24 morning. The components of the system individually have
25 been tested and in the main have shown that they're capable

Page 2264

NetworkReporting

1-800-632-2720

1 of working. Is it true that a reverse osmosis system has
2 been shown to operate 24/7 at a facility like this?

3 A Not at any mine that I'm aware of.

4 Q All of these components, the components in the treatment
5 system -- and we're talking about at the wastewater
6 treatment plant. To your knowledge have they ever been put
7 together in a mechanism like this?

8 A Not to my knowledge.

9 Q Anywhere in the country?

10 A Not to my knowledge. And I -- yeah, not to my knowledge.

11 Q Can you as a scientist conclude that -- isn't it a
12 reasonable argument, "Geez, you know, they work together
13 individually. Why can't we just throw them together and
14 assume that they're going to work?"

15 Q Well, you know, one would like to be able to say that, but I
16 think to anybody who's really worked on these type of
17 systems, that the integration of these is a separate -- it's
18 a separate issue entirely. And unit operation and
19 integration is always, say, a more complicated issue than
20 one would think, about just putting unit operations
21 together. Classes in engineering on unit operations,
22 putting it altogether requires an integration that adds
23 another dimension of complexity on to it. I'm not saying it
24 won't work. I'm just saying that it certainly -- it's
25 certainly put together without that integration applied in

Page 2265

NetworkReporting

1-800-632-2720

1 the system in a way that would show that there have been
2 some demonstrated success.

3 Q Did you apply a scientific method in your analysis? I think
4 Mr. Bracken asked you if you applied a scientific method in
5 your analysis here. Did you?

6 A In a broad sense, absolutely. He asked the question, "Is
7 this system going to work under a variety of different
8 conditions?" If you look at the data that was presented by
9 Kennecott and Dr. Prucha and Dr. Maest, and then you
10 evaluate, based on the data that is at hand the date it was
11 provided by everybody, and then you evaluate that and make a
12 decision as whether that will work -- so in that sense
13 that's as close to a scientific process as you can get,
14 working on -- you know, with data somebody else has
15 produced.

16 Q Now I need to ask you about the situation in Nevada. It
17 sounds like you had a disagreement with the folks in Nevada
18 over a mercury issue?

19 A I think that's well-characterized, yeah.

20 Q Tell the hearing officer what the essence of that issue was.

21 A The issue -- this was one that was a very scientific process
22 in terms of argument. It was a very, very simple study that
23 was done by an undergraduate student and I, under my
24 direction, I might add, where we had an instrument that was
25 brought in that was used commonly by the federal agencies

Page 2266

NetworkReporting

1-800-632-2720

1 for measuring mercury.

2 Q Why don't we just take a step back? What was the issue?
3 What was the concern here?

4 A The issue was that we examine -- is there an instrument
5 that's easily portable that you could take out to mine sites
6 and measure mercury at low concentrations? And second, the
7 other question was, could you measure mercury at sites very
8 proximate to mines but on publicly accessible areas? We got
9 the instrument in; we went through the initial understanding
10 of how it operated. We took the instrument out, measured
11 background concentrations at several areas, about two
12 nanograms per cubic meter, which is a term -- number that
13 you use. Then we went to several mines and measured mercury
14 concentrations around that mine -- those mines. And two out
15 of about seven or eight that we measured had concentrations
16 that were a thousand times higher than what the background
17 concentration was just a few miles away. And so our
18 conclusion based on that data was, yes, the instrument
19 worked, and it was very easy; it worked very well. And two,
20 you could -- there was enough mercury around mines to
21 measure. That was the conclusion of the study. It was
22 nothing beyond that. And the report would show that; that
23 that was the conclusion of the study.

24 Q And you submitted that to the -- to whom?

25 A It was a report -- it was a report submitted to the people

Page 2267

NetworkReporting

1-800-632-2720

1 that provided the instrument. And it was the kind of report
2 that we issue periodically on some of the work that we do.

3 Q What happened next?

4 A It was -- it was -- we've had, as you might suspect, some
5 disagreement on mercury issues in Nevada between myself and
6 the State Division of Environmental Protection. They were
7 actually -- they had no idea the concentrations were as high
8 as we measured them. And they were confirmed, by the way,
9 just last week in a report that we were involved in, the
10 concentrations that another person in my department who is
11 not a -- doesn't have the same relationship with the
12 division I have -- measured concentrations that were even
13 higher than what we measured. But the division at that
14 time, which was a year -- February of 2007, became very
15 irritated that we released this report without first of all
16 discussing it with them. And I have never seen such a
17 vitriolic letter sent to me, ever. I responded to it in
18 kind. But it is not fully resolved yet.

19 Q Well, a question or two. It sounds like you prepared a
20 report as part -- you prepared a report of your findings?

21 A Correct.

22 Q And a letter or -- yeah, a letter that has become part of
23 this record was then sent to you?

24 A Right.

25 Q Did you follow that letter, then, with a letter to them?

1 A Yes.

2 Q And so you prepared a response to that?

3 A Point-by-point.

4 Q Do you have either the report that you submitted or the
5 letter in response with you today?

6 A I do. It's in my suitcase over in the hotel.

7 MR. EGGAN: Your Honor, I'm going to be offering a
8 copy of that report about -- of the report as well as the
9 response. But my concern is that Mr. Miller won't be here
10 when we do it. If that's a concern of yours and it would be
11 critical to the foundation, then I can get him to run back
12 to the hotel and run back with it and we'll do it that way.
13 But he does have a flight to catch. And what we would
14 prefer to do is simply get it and offer it in his absence,
15 if that is acceptable to you.

16 JUDGE PATTERSON: I'll ask counsel what that would
17 do for --

18 MR. BRACKEN: Obviously, without seeing it I'd
19 like to reserve any comments I have about the letter. I
20 understand Dr. Miller has a flight out of here. And maybe
21 if the letter comes and make an argument that I think
22 there's a problem with it, --

23 MR. EGGAN: Would it be hearsay?

24 MR. BRACKEN: -- we'll try to deal with that.

25 MR. EGGAN: Would the objection be hearsay?

Page 2269

NetworkReporting

1-800-632-2720

1 MR. BRACKEN: No. We'll try to deal with that in
2 a way that's consistent with the way it was dealt with
3 before. And maybe if there were questions I would have to
4 ask before I drop an objection, we could do it by telephone
5 or something like that, some way that he can leave.

6 JUDGE PATTERSON: What time is your flight?

7 THE WITNESS: Well, it's out of Detroit. I'm
8 probably going to still make it at 5:00 o'clock.

9 MR. BRACKEN: I think we can handle this outside
10 of -- without having him stay here or running back to the
11 room.

12 MR. EGGAN: That's my preference, but it just
13 seems to me that there would be -- given your ruling on the
14 admissibility of the original letter, there should be no
15 question about the admissibility of his response.

16 JUDGE PATTERSON: Well, that was my thought. It
17 would even the playing field, so to speak.

18 MR. BRACKEN: That's very possible, your Honor.
19 It would probably take something substantial for me to
20 not -- to not have an objection -- or to have an objection.

21 MR. EGGAN: We may add a paragraph or two about
22 you, Mr. Bracken.

23 MR. BRACKEN: That's all right. People have said
24 it before.

25 MR. EGGAN: Well, I'll bring it in the morning and
Page 2270

NetworkReporting

1-800-632-2720

1 we can look at it.

2 JUDGE PATTERSON: Mr. Reichel, does that work for
3 you?

4 MR. EGGAN: Mr. Reichel, do you have an objection?

5 MR. REICHEL: Given the situation, I have no
6 objection to that procedure.

7 MR. EGGAN: All right. Good. Just a question or
8 two on that issue.

9 Q In the aftermath of the report and this set-to that you had
10 with Nevada, has there been any change in how Nevada handles
11 mercury?

12 A This is part of a continuing disagreement, I think, and it's
13 a very sensitive issue within the mining industry and within
14 regulatory agencies and the environmental community. There
15 has been increased focus -- continuously increased focus on
16 mining to the point that one of the -- a subsequent argument
17 I've had with some of the same agency officials about a
18 particular mine which, recognized on hindsight now, is the
19 single largest source of atmospheric -- mercury into the
20 atmosphere including all of the power plants, ultimately
21 because of this very testy situation, I think that their
22 sensitivity -- they actually shut down a mine because of the
23 amount of mercury, which was well over -- is on the order of
24 four to seven thousand pounds of mercury released, and a
25 normal power plant does two to four hundred. That mine was

Page 2271

NetworkReporting

1-800-632-2720

1 actually shut down because of the sensitivity to this.

2 So I -- you know, we have debated back and forth
3 with the Division of Environmental Protection. Two of the
4 people who wrote that letter I know very well. One of them
5 was a former student in my department. And so we get over
6 those things and we move on. We had a meeting last week.
7 Those two same people that signed that letter were in the
8 meeting. So we get along fine.

9 Q So the instrument that you used, that was the subject of
10 this critique?

11 A They were arguing strongly, which surprised me. At this
12 meeting we had last week having to do with another source of
13 mercury, they were strong advocates of getting this into the
14 hands of this research scientist that was using it. And
15 they helped her obtain that instrument, because it had
16 special attributes for that particular study.

17 Q So the instrument that was really at issue in the letter of
18 criticism is now being used?

19 A They're ones that helped her find it.

20 Q Have you had any contact with the Environmental Protection
21 Agency since this incident has occurred? Has there been any
22 change in your relationship with them?

23 A No. We've had well over \$200,000 funding on mercury
24 measurements and mercury policy development from Region 9 of
25 the USEPA. And starting last year about this time on a

Page 2272

NetworkReporting

1-800-632-2720

1 national participatory panel on mercury management in Nevada
2 -- or mercury management in the U.S. And I was suggested to
3 participate in that because of my knowledge about mercury
4 management in Nevada, which -- I probably knew as much as
5 anybody in the country. So, I mean, this is the back-and-
6 forth that went between the division staff and I. We've
7 largely gotten over that; a few little wounds still, but I
8 think we've both moved on and I think we both see the result
9 of that as better mercury regulation and management in
10 Nevada.

11 Q Are you an anti-mining-industry guy, or what can you say?

12 A No, I'm not. If that had been my goal in Nevada, boy, would
13 I have failed. And it is -- again, I'm proud of the mining
14 industry in Nevada. It's come a long way. And I've worked
15 with the industry and the state regulatory agencies to make
16 sure that mining is done in a manner that's sustainable and
17 protective of the environment to the extent possible.

18 Q Did anything that happened in Nevada or your relationship
19 with, like, a Sierra Club and World Watch -- did any of the
20 relationships that you have influence any opinion that
21 you've offered in this case?

22 A No, it really didn't. This was a straight technical
23 evaluation.

24 Q And are the conclusions that you reached with respect to
25 this project based on a scientific analysis?

Page 2273

NetworkReporting

1-800-632-2720

1 A Yes.

2 Q Very good.

3 MR. EGGAN: I don't think I have any other
4 questions. Thank you.

5 MR. BRACKEN: I have one or two brief questions.

6 RE-CROSS-EXAMINATION

7 BY MR. BRACKEN:

8 Q This may even be -- we may have gone over this before. But
9 my understanding is, your testimony is based upon your
10 understanding, as least in part, that no testing or modeling
11 has been done on the components?

12 A No. I said modeling has been done.

13 Q Okay. No testing has been done?

14 A To my knowledge no testing has been done on the system as
15 described. Individual parts of it have but not the entire
16 system.

17 Q And finally, did I hear you say that you don't -- do not
18 know where the monitoring wells that have been required by
19 the department are located, with respect to where the
20 effluent is going to be infiltrated back into the --

21 A I read that, but I cannot -- I could not tell you -- I know
22 there is a monitoring network, but I have to say that I
23 could not place those on a map for memory.

24 Q That's fair enough. I'm not sure I could either. Would it
25 be fair to say that you would want to see at least some of

1 those wells very close to the TWIS, so if there was a
2 problem, you'd catch it early?

3 A Certainly you'd want to have -- and perhaps a bit of a trick
4 question, 'cause that's one thing I do remember is, some of
5 those monitoring wells were placed reasonably close to the
6 TWIS. And that would be something that would be important.
7 But as far as the placement of monitoring wells and how long
8 it would take for that water to come up into those wells,
9 it's something I didn't look at. But I do -- as I recall,
10 they were placed reasonably close to the TWIS, although I
11 won't put them on a map for you this afternoon.

12 Q And I'm not asking you to. But that would be preferred, in
13 your opinion, to have at least some of them very close to
14 the TWIS?

15 A Sure.

16 MR. BRACKEN: Bob?

17 MR. REICHEL: I have nothing further.

18 MR. EGGAN: I have nothing further.

19 JUDGE PATTERSON: Thank you, Doctor.

20 MR. WALLACE: Your Honor, Petitioner's next
21 witness is Professor Alec Lindsay. But before he testifies
22 we need to swap out equipment.

23 JUDGE PATTERSON: You need a technical adjustment.

24 Okay.

25 (Off the record)
Page 2275

NetworkReporting

1-800-632-2720