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AN INVESTIGATION INTO THE SILICA EXPOSURE OF YUCCA MOUNTAIN PROJECT WORKERS

HEARING

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

UNITED STATES SENATE

ONE HUNDRED EIGHTH CONGRESS

SECOND SESSION

SPECIAL HEARING

MARCH 15, 2004—LAS VEGAS, NV

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AN INVESTIGATION INTO THE SILICA EXPOSURE OF YUCCA MOUNTAIN PROJECT WORKERS

MONDAY, MARCH 15, 2004

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Las Vegas, NV.

The subcommittee met at 10 a.m., in Clark County Government Center, 500 S. Grand Central Parkway, Las Vegas, Nevada, Hon. Harry Reid presiding.

Present: Senator Reid.

OPENING STATEMENT OF SENATOR HARRY REID

Senator REID. When I first was approached by a large number of people from some of the largest corporations in America I had great sympathy for what they were trying to do. That was before I learned of the pain and suffering and death caused by asbestos to people, people who work in operations, for example, in Libby, Montana, who, one company, W.R. Grace, who was making billions of dollars at the time, billions of dollars net, were unwilling to spend $100,000 to create a safe house for people to work in, even though they knew that asbestos caused problems.

And not only have we learned that the people who worked in the operation itself have been made sick or are dead, but we've learned that their children and wives and neighbors are dead and dying as a result of bringing this stuff home in their clothes. And when I was preparing for this hearing, I was struck by the same thing. There are two books I would recommend to everyone. One of them's called "Libby, Montana", a brand new book. And the other is a book called "Fatal Deception", which tells the story of asbestos and what it's done to hundreds of thousands of people in America, some of whom are just learning that they're getting sick. They're getting sick because they washed their husbands' clothes, because they came and hugged their dad when he came home from work.

When I read the stuff here today about what happened at Yucca Mountain, it's the same thing, same thing, same thing as asbestos. The Department of Energy and the companies knew that the hole they were digging in the ground created dust, silicosis. Now I'm not sure they knew about the substance that's worse than asbestos, zeolite or whatever it's called. We'll learn about that today. But if they didn't now, they should have known.

And they went grinding right through that mountain 5 miles. They didn't even think of doing anything for the safety of those

people until they were 3 miles into that mountain. I can remember as a boy going into the mines with my dad and sometimes he would have to do what is called dry drilling, where he would pick up that jackhammer and stick it into the side of that hole, and dust flying all over because if something was on they couldn't get water down the hole at the time. And he knew, because people around there in Searchlight got sick from silicosis, and he knew that if you drilled with water coming into and the dust wasn't spewing it, chances are he wouldn't get sick. Well, my dad got silicosis.

Up in the mountain at Yucca Mountain they could have used water, they could have cut down the dust. We're going to have testimony here today of one witness who, when he finished working would take his clothes and get all the dirt out of the cuffs and did everything he could to get the dust out of his clothes. He would take them home and his wife complained so much about how much dirt was in his washer that he started taking them to the laundromat. That didn't last long. The manager of the laundromat said you're plugging up my washers, we don't want you washing here anymore. It got so bad that they started supplying the workers with their own coveralls, their own clothes.

So I just can't—I can't imagine what we have here. We don't know how many people—we know how many people have been exposed, thousands have been exposed who work in the tunnels, in the tunnel, thousands. But we don't know how many are going to get sick. It's just like some people who smoke they don't get sick, some do.

Margaret Chu, who is one of the big shots at the Department of Energy, she's in charge of this project, Yucca Mountain. Among other things, she said in a letter that I wrote to her in January, she said, the Department of Energy was aware of the presence of silica in the mountain strata. The Department also was aware of the potential for the silica to become airborne during mining operations. Dust masks were provided to workers to protect them from potential exposures to respirable silica during these early operations, but their use was not mandatory. That's an understatement. This is the woman that runs the program.

You know, the sad part about it, there's no price that anyone can put on the health of just one of these sick miners, scientists, or other workers. It wasn't just the miners.

The contractor was given bonuses for how fast they could go. The more dust, the more money they made. So this is the proverbial horse is already out of the barn, what can we do about it. But I hope everyone recognizes the legacy of the Department of Energy in this project. If they have no regard for the people that work in that tunnel, what regard are they going to have for the millions of people who are going to be exposed to this product around the highways and railways of this country? None, as they had no concern for the people out there. Their job was to get this hole dug so these big utilities, these multibillion dollar utilities would have a place to dump their garbage.

The Department of Energy is in a conspiracy with the big utilities to get this project done and it doesn't matter how much it costs and it doesn't matter how many people are made sick or caused to die as a result of it. That's a fact. And people think that the Ne-

vada delegation is shrill. Why do we complain about this? Why don't we try to make a deal with people out there? Why don't we try and make a deal, see what we can get for it? Well, you don't do deals with the devil.

I would also say that we've had some very courageous people to, in effect, blow the whistle on what's going on out there. We would not have known but for some of the people that are here today, put their jobs in jeopardy to speak up. Had they not done that, how would we have known?

So we're going to proceed with the hearing here today. This testimony that's taken will be returned to Washington and we'll see what we can do to come up something to try to help these injured people. I'm not sure that government is the right place for them to go now. I think they may have to go some place that we hear so many bad things about. They may have to go see a lawyer, go after these people who in my opinion if they didn't do criminal acts, it was close to it. But I'm standing by if we need to do something governmental, we will do that also.

We're going to hear today from Gene Griego, who is an underground worker contracted to Yucca Mountain from Los Alamos National Laboratories. We're going to hear from Jeffrey Dean, former underground worker on tunnel-boring machine at Yucca Mountain. He's now with Bechtel Nevada, the test site. Michael Taylor, current underground worker and environmental safety and health specialist, Yucca Mountain projects test coordination office, and we really do appreciate his stepping forward. It's interesting to note that his dad and I—I used to work for his dad in a service station, Charlie Taylor, Fifth and Fremont, among other places.

Dr. Jim Weeks, certified industrial hygienist at Advanced Technologies and Laboratories International; Dr. Nicholas Vogelzang, who is director of Nevada Cancer Institute, who isn't here but he will be here. We're so fortunate—oh, he is here, I'll be darned. Glad to have you here. We are very fortunate to have Dr. Vogelzang in Nevada. He comes with—his resume is—I was going over my work last night and I read to my wife the number of papers you've published, the books you've written, the chapters in books you've written, it's very impressive. And he came—he's here from the University of Chicago to work in our world-class cancer institute here in Las Vegas.

PREPARED STATEMENT OF SENATOR JOHN ENSIGN

And then we're going to hear from Gene Runkle, Senior Safety Advisor to the Director of the Office of Civilian Radioactive Waste Management. We appreciate everyone being here and look forward to hearing your testimony. We're going to have all the witnesses testify and then I'm going to ask on behalf of the panel questions.

Senator Ensign has also prepared a statement to be inserted for the record.

[The statement follows:]

PREPARED STATEMENT OF SENATOR JOHN ENSIGN

Senator Reid, thank you very much for holding a hearing on the silicosis problem at Yucca Mountain, Nevada. I would also like to thank the witnesses for being here to testify on this important matter. I apologize for not being able to attend in person.

During my time in both the U.S. House of Representative and the Senate, I have worked hard with Senator Reid to fight nuclear waste coming to Yucca Mountain. On many occasions, Senator Reid and I tried to convince Congress that Yucca Mountain wasn't, and still isn't, suitable for a number of reasons. Unfortunately, this lesson to the rest of the world is coming at the expense of innocent lives.

Silicosis, a respiratory disease caused by breathing in silica dust over a period of time, is deadly. A person can develop silicosis with less than a year's worth of exposure to this agent. However, one of the problems with this disease is that it acts like a time bomb, sometimes not exhibiting any major symptoms for 5, 10, or even 15 years. This means that men and women who worked at Yucca Mountain as early as the 1980's may only now be exhibiting the symptoms of a disease that could eventually lead to their deaths.

My grandfather suffered for years with lung disease caused by inhaling small particles in sanding shop. In those days, people were ignorant of the risks and how to prevent the problems. He spent the last several years of his life attached to an oxygen machine. We know better today, that if laws followed, suffering like what my grandfather went through should be preventable.

Nationwide, the number of cases of silicosis has declined with the strengthening of Occupational Safety and Health Administration's (OSHA) guidelines when it comes to workers being exposed to silica. However, the levels of silica, erionite, and other toxic dusts these workers at Yucca Mountain were exposed to were more than just illegal—they were potentially deadly.

Perhaps what is the most disturbing aspect of this situation deals with the fact that the Department of Energy (DOE) had every chance to prevent the spread of silicosis before anyone was ever exposed to it. Instead, this lawsuit alleges that DOE contractors doctored air monitoring data in order to deceive workers and visitors about their level of safety. With these inaccurate results, the DOE's contractors were able to get around the OSHA requirements for protective clothing, respiratory protection, and other preventive measures.

So, for miles these workers continued to drill and dig their way through the tunnels of volcanic rock that could become America's dumping ground for high-level nuclear waste. With each breath these workers took, they were inhaling some of the carcinogens that would make them sick years later. If found to be true, this action by the DOE is not only inexcusable but also reprehensible, and the DOE's contractors should own up to their actions.

Last month, the DOE apologized to the former workers, letting them know that they would offer free silicosis screening and notified them that the Inspector General has started investigating these allegations. If these allegations are found to have merit, I support Senator Reid in pursuing a criminal investigation into this matter. We, as lawmakers and as citizens, need to make sure that the welfare and safety of Nevadans is protected, and that a situation like this does not ever happen again.

As I said before, I have never been in support of Yucca Mountain becoming a high-level nuclear waste repository. Time after time again, studies have shown that Yucca Mountain is geologically unstable. With Yucca being the most expensive government project ever undertaken, I also firmly believe that Yucca is fiscally irresponsible. Now, with former and current workers falling ill to silicosis, Yucca has already become a health risk to otherwise healthy Nevadans.

In the class action complaint filed in Clark County's District Court by Gene Greigo and others, it states that, with adequate warning, "The workers and visitors so impacted would have refused to enter, much less work in, the tunnels at Yucca Mountain without at least adequate respiratory protection and protective clothing had defendants disclosed the facts to them." Unfortunately, this does not appear to be the case. The contractors that the DOE hired never gave these workers and visitors the option to protect themselves against these harmful airborne agents.

The DOE contends that Yucca Mountain is one of the most thoroughly researched areas of the world, and the DOE's contractors have spent billions of dollars in studying every aspect of this site. What is sad is that the DOE seemed to have let at least one thing slip under the radar—the very health and protection of those who were helping to dig its tunnels, despite a strong understanding by the DOE that Yucca Mountain contained volcanic rock with the silica and other deadly inhalants. As a lawmaker, this fact makes me wonder what else may have gone unnoticed or unchecked at this site.

The fight against Yucca Mountain is not over on many fronts for Senator Reid and me. For those who are testifying today, I am sorry that so many of you have to suffer because of the apparent oversights of a few. I wish you the best of luck with your legal endeavors on this issue, and my thoughts and prayers are with you and your families.

Senator REID. We'll proceed first with Gene Griego.

STATEMENT OF GENE B. GRIEGO, TECHNICIAN, LOS ALAMOS NATIONAL LABORATORIES, NEVADA

Mr. GRIEGO. My name is Gene Griego and I'm employed as a technician with Los Alamos National Labs at the Nevada test site. I've been employed by Los Alamos since April of 1991. In June of 1993 I was assigned to the Yucca Mountain project. I was attached to the earth and environmental systems group, their team, working out of the test coordination office. The test coordination office is responsible for all of the scientific experimentation at Yucca Mountain.

My primary duties were to provide constructive support to all the scientists doing various experiments on the project. We also monitored and supported the geological mapping of the tunnel walls right behind the tunnel-boring machine. Our work schedule consisted of a 24-hour, 5-day-a-week schedule. Due to manpower shortages in the test coordination office, we were required to work 16-hour shifts once a week.

Initially, the tunnel-boring machine, which began tunneling operations roughly in November of 1994 right away generated large amounts of dust. At this time, the tunnel-boring machine advanced about 30 feet a day. That was due to the constructor having to use mud cars to haul out the debris.

In June of—let me back up a bit about the dust hazard. What increased the dust hazard at Yucca Mountain was that water for dust control was limited because project scientists were concerned that their experiments would be compromised if there was unlimited water use.

In July of 1995, the conveyor belt system became fully operational. At this time, tunneling increased to between 100 feet and 150 feet per day. That's five times the dust hazard you had before. At this time also, they distributed painter's masks as respiratory protection, because people were complaining about the dust.

Finally, in August of 1996, a respiratory program was implemented. By that time, like Senator Reid mentioned, we were over 3 miles underground. During my physical to determine whether I could wear a respirator, my pulmonary function test indicated a lung function decline. During subsequent yearly physicals, my lung capacity continued to decline. In 2002 it was measured at 63 percent.

The attending physician then advised me to see a pulmonologist, and several months later I did see one. The pulmonologist diagnosed me with chronic obstructive pulmonary disease.

In August 2002, I was reassigned to the DX4 engineering group at the underground U1A complex conducting subcritical experiments. In November of 2002, I was doing some research on silica as a hazard analysis, and I came across a Los Alamos report titled, "Distribution of Hazardous Phases in the Subsurface of Yucca Mountain." I would like to enter this report into the record if I may.

Senator REID. That will be the order.

[CLERK'S NOTE.—The document referred to has been retained in Committee files.]

Mr. GRIEGO. This report listed all the carcinogenic substances that had been found in Yucca Mountain since the mid-1980's. Along with silica, this reported also their carcinogenic ranking according to the International Agency for Cancer Research. Along with the silica, there was a mineral fiber also found at Yucca Mountain called erionite. Doing further research, I discovered that erionite is considered many times more carcinogenic than asbestos.

To give you an example of one of the studies, 40 rats were exposed to asbestos and 40 rats were exposed to erionite. Nineteen of the 40 rats exposed to asbestos developed tumors. The 40 rats exposed to erionite died within a year. Pardon me.

Senator REID. Take your time.

Mr. GRIEGO. The following 3 months I discovered—just give me a minute—in the following 3 months I discovered more DOE and LANL reports that conclusively proved that DOE and its contractors had intentionally exposed their workers and the public to extremely hazardous substances in violation of the Hazard Communications Act and the Toxic Substance Control Act.

There was also industrial hygienists on the project that tried to sound the alarm before mining began and after. These reports were published many years before mining actually began and some shortly after mining began. Obviously DOE and its contractors ignored these reports, probably all in the name of meeting their milestones and, of course, collecting their hefty bonuses.

I hope out of our meeting today that DOE and its contractors are held accountable for their actions. In February of 2003, I called the University of California hotline and filed a complaint. A Mr. Patrick Reed took my allegations and said somebody would contact me shortly. Two months went by, nobody had called me, so I e-mailed Mr. Patrick Reed again and he replied that they were backlogged with claims and that I should make a claim through the audits and assessments of Los Alamos.

During this time, Los Alamos was going through the credit card scandal and I didn't have much faith that LANL management would conduct an honest investigation. But I set my reservations aside and I did file a claim through audits and assessments, gave them all my reports. I also gave them a list of about 30 witnesses they could interview. Mike Taylor was on that list.

Three months went by and audits and assessments called me and said that if OCRWM wasn't cooperating—OCRWM is the Office of Civilian Radioactive Waste Management—that I should file a claim through the OCRWM concerns program. And these 3 months that Los Alamos had my claim, they did not send anyone out to Nevada to investigate.

In early July of 2003, I filed a complaint with the OCRWM concerns program. Jack Gallagher with Inspection and Consultants, National Inspection and Consultants, an investigative firm out of Ft. Myers, Florida, conducted the initial interview with me, and at the time I gave him copies of all the reports I'd found and the witness list. A Nancy Cunningham was assigned to investigate the case.

On July 25, 2003, I attended a meeting with Greg Morgan, the OCRWM concerns program manager, and Nancy Cunningham. In this meeting, Mr. Morgan stated that he had found some good

things and not-so-good things about the industrial hygiene practices of his contractors. I then asked him if he was going to hold his managers accountable for the not-so-good things, since most of them were still on the project.

He then said that he wasn't about to slap his managers on the wrist for past discretions. I then said that I expected a little more than a slap on the wrist for the criminal behavior of his managers. I then asked him to see a copy of the report that Nancy Cunningham had submitted, and he told me that it wasn't for public consumption.

At that point, I told him he was wasting my time and I got up to leave. As I left his office he handed me a letter, and in this letter he stated that OCRWM had done nothing wrong, that they had given us respirators and that we chose not to use them and that I should seek medical attention from my personal provider.

About a week after this meeting with Mr. Morgan, I filed a complaint with the DOE Inspector General's office. For the following 6 months, OCRWM asked for extension after extension, and to this day, has not filed a report with the IG office about this matter.

In January of 2004, DOE publicly admitted that they had exposed their workers to high silica dust levels and that they were instituting a silica screening program. John Arthur, the deputy project manager—or actually I guess he's the project manager of OCRWM—called me to thank me for bringing this matter to DOE's attention.

During our conversation, I asked him if he was going to hold his managers accountable, and he said he would look into the matter and get back to me. Two weeks later, I get a letter from him in the mail and he states that OCRWM had done nothing wrong, we had been given respirators, et cetera, et cetera. At that point, I felt I had no other option but to contact the media.

PREPARED STATEMENT

Before I give up the podium, I'd like to thank Steve Tetralt, Keith Rogers of the Review Journal, and John Huck of TV5 News for giving me the opportunity to tell my story. Also I'd like to thank Mike Taylor for being here today and Jeff Dean for standing up with me. Thank you.

[The statement and information follow:]

PREPARED STATEMENT OF GENE B. GRIEGO

INTRODUCTION

I am Gene B. Griego and I have been employed by Los Alamos National Labs as a Technician since April of 1991. I was temporarily assigned to the Yucca Mountain Project as a Field Test Representative in June of 1993 attached to the Scientific Test Coordination Office in the Earth and Environmental Sciences-13 group. The LANL Test Coordination Office was responsible for all scientific activities conducted at YMP. The FTR's duties were to provide any constructor support that the scientists would require to complete their experiments. We also monitored and supported the Geological Mapping of the tunnel walls behind the Tunnel Boring Machine. It was a 24-hour 5-days-a-week operation. We worked rotating shifts and due to manpower shortages in the Test Coordination Office and were required to work a 16-hour shift once a week. From the start of tunneling operations in November of 1994 high levels of silica dust were generated by the Tunnel Boring Machine. The dust problem was worsened by the fact that water for dust control was limited because project scientists were concerned that their experiments would be com-

promised by unlimited water use. Initially tunneling progress was about 30 ft. per day due to having to use muck cars to haul out the debris. In July of 1995 the conveyor system became operational and tunneling progress increased to between 100 ft. and 150 ft. per day. At this point "painters masks" were made available to personnel for respiratory protection. Finally in August of 1996 after many complaints about the dust levels in the tunnel, primarily by scientific personnel, a proper respiratory protection program was installed. At this time the TBM was over 3 miles underground. In 1996 during my physical to determine my fitness to wear respiratory protection my "pulmonary function test" measured a decline in my lung capacity. My lung capacity continued to steadily decline during subsequent yearly physicals. In 2002 my lung capacity was measured at 63 percent and I was informed that I had the lung capacity of an 80-year-old man. I was 50 years old at the time. The attending physician recommended that I see a pulmonologist and a few months later I did. My pulmonologist diagnosed me with Chronic Obstructive Pulmonary Disease. Since I am a life-long non-smoker and no one in my immediate family smokes it was a mystery as to what had caused my condition.

DOE'S DEADLY SECRET

In August 2002 I was reassigned to my parent group DX–4 in support of Sub-Critical Experiments at the U1A complex. In the course of conducting a hazard analysis of "Silica" in November of 2002. I stumbled upon a report on the "DOE Information Bridge" website titled "Distribution of Potentially Hazardous Phases in the Subsurface at Yucca Mountain" This LANL report listed all the hazardous substances that had been found at YMP and their toxicity. I also discovered that I had six out of the eight symptoms of "Silicosis". During the next 3 months I found more DOE and LANL reports that conclusively proved that DOE and LANL managers had intentionally exposed workers and the public to extremely carcinogenic substances without informing them of the danger in violation of the "Hazard Communications Act" and the "Toxic Substance Control Act". DOE and LANL also ignored health and safety reports that were published years before mining operations began. These reports urged them to protect their personnel from these hazardous substances. Industrial Hygiene professionals who tried to sound the alarm before and after tunneling began were systematically terminated or silenced with threats of termination. Some apparently falsified monitoring data in order to keep their jobs. DOE has injured over a 1,000 people just to meet their milestones and of course to collect their hefty bonuses. They must be held accountable for their actions.

"BLOWING THE WHISTLE"

In February of 2003 I called the UC "Whistle-Blower" hot line and was told to contact Patrick Reed. I e-mailed Mr. Reed with my allegations and he said someone from UC would contact me shortly. Two months went by without anyone from UC contacting me. Again I e-mailed Mr. Reed and he responded that they were backlogged with claims and that I should contact the LANL "Audits and Assessments" group. This was about the time of the credit card scandal at Los Alamos. That was the reason I had called the UC hot line initially because I didn't have much faith in LANL's management to conduct an honest investigation. But I called them anyway and sent them the DOE and LANL reports I had uncovered and a list of 30 witnesses they could interview. After 3 months they suggested that I file a claim through the Office of Civilian Radioactive Waste Management Concerns Program. No one from LANL or UC ever came out to Nevada to conduct an investigation. I filed a claim with OCRWM in early July of 2003, Jack Gallagher from National Inspection & Consultants of Fort Myers Florida conducted the initial interview at which time he photocopied all the reports I had uncovered. Nancy Cunningham was assigned the case and conducted the investigation.

I attended a meeting on July 25 in Summerlin with Greg Morgan, OCRWM Concerns Program Manager, and Nancy Cunningham to discuss the results of the investigation. Mr. Morgan declared that the investigation had uncovered some good things and not-so-good things about the Industrial Hygiene practices of his contractors during tunneling operations. I asked him if he was going to hold his managers accountable for the not-so-good things since most of them were still on the project. He said that he was not going to slap his managers on the wrist for past discretions. I replied that I expected a little more than a slap on the wrist for the criminal negligence of his managers. I then asked him if I could see the report that Nancy Cunningham had submitted and he said that the report was not for public consumption. At that point I stated that he was wasting my time and I walked out of his office he handed me a letter as I walked out. The letter basically said that OCRWM had done nothing wrong and I should seek medical attention from my personal pro-

vider. A week later I called the DOE Inspector General hotline and filed another claim. I also called LANL Audits and asked the status of my complaint. They said it was closed and I then requested a report from them and all they sent me a copy of the OCRWM letter I had received from Greg Morgan on July 25. In the ensuing months OCRWM kept asking the IG for extension after extension and to this day has not submitted a report to the IG.

January of 2004 DOE admitted in a news release that they had exposed their personnel to high levels of silica dust and have implemented a silicosis screening program for former and current YMP workers. John Arthur, OCRWM Deputy Project Managers, called me to thank me for my perseverance in bringing this matter to DOE's attention. During our conversation I asked him if he was going to hold his managers accountable and he said he would look into the matter. Two weeks later I received a letter from him stating that after pouring over 400 reports he has concluded that OCRWM has not done anything wrong and that respirators had been provided. At this point I felt I had no other option other than contacting the media.

BIOGRAPHICAL SKETCH OF GENE B. GRIEGO

Gene moved with his family to Las Vegas in 1981 and was employed as a technician with EG&G Energy Measurements at the Nevada Test Site until 1991. He was primarily involved in assembling and fielding diagnostic cannisters used in nuclear tests. In 1991 he went to work for Los Alamos National Labs (LANL) performing the same functions. In 1992 the nuclear testing moratorium went into effect, and his group was transferred back to Los Alamos in New Mexico. In June of 1993 he was temporarily assigned to the LANL EES–13 Group in the Yucca Mountain Project's Test Coordination Office. Their job was to provide support for all scientific experiments on the project. He participated in all mining and tunneling activities up until August of 2002 when his group finally pulled him back to the weapons side of the Nevada Test Site.

Senator REID. Mr. Griego, thank you very much for your testimony, and we all recognize how difficult it is, but we appreciate it very much. We'll now hear from Jeffrey Dean. And what's going to happen, we're going to hear from all the witnesses, then I'll ask questions.

STATEMENT OF JEFFREY M. DEAN, FORMER UNDERGROUND WORKER, YUCCA MOUNTAIN

Mr. DEAN. Hello, Senator. This has had a tremendous effect on all of our lives. Gene was the first, to my knowledge, the first person to bring attention to this, and it's been kind of a long road for me. I have a lung disease and I never really had made a connection until recently it possibly could be related to my work at Yucca Mountain.

Senator REID. What is your lung disease?

Mr. DEAN. Excuse me?

Senator REID. What is your lung disease?

Mr. DEAN. I have pneumoconiosis and possibly—probable silicosis, possibly sarcoidosis. This is through the workers' comp. Additionally, I went to California for outside consultation and my doctor in California said that I have pneumoconiosis secondary to silicosis. And I had wrote this letter for my—actually it's my testimony from a worker's perspective, something that I threw together a few nights ago, and it will tell the story of my involvement with the tunnel.

Senator REID. Please read that.

Mr. DEAN. My name is Jeff Dean. I was involved with the tunneling and drilling operations at Yucca Mountain. I was hired as an underground conveyor operator June 26, 1995, by Parsons Brinckerhoff to support the tunnel-boring machine. I also worked

in various other capacities as needed, such as driller and equipment operator. My union affiliation is Operating Engineers.

Prior to Yucca Mountain, I worked at the Nevada test site for over 12 years as a surface driller supporting the nuclear testing program. I am currently working for Bechtel Nevada at the test site as a driller.

In March 2003, I had an abnormal chest X-ray during a medical screening program offered through my employer. Additionally, I had been suffering from shortness of breath. These findings prompted an extensive medical evaluation and work-up. My doctor stated in a letter to the Department of Labor that I have clear evidence of pneumoconiosis secondary to silicosis. I am also being evaluated for possible sarcoidosis, a rare lung disease of unknown origin.

I am currently being followed by frequent CAT scanning of the lungs along with pulmonary functions testing. After careful review of my work history, I believe that the bulk of my dust exposures came from my involvement on the Yucca Mountain project. I do not believe I was adequately protected from the respiratory hazards that were present during the early tunneling and drilling operations. There were many concerns raised about the dust levels, although I personally trusted that the DOE would shut us down if we exceeded the permissible exposure limits.

As construction craft workers, the majority of us have very little, if any, knowledge of the potential adverse health effects related to this type of work, specifically dust illnesses. Employers are normally responsible for a safe work environment and our job as workers was to construct the tunnel. We left the air monitoring and sampling to the health and safety professionals. I never had any reason to doubt or question this process until recently. This was my first tunnel job, as I had no previous underground experience and nothing to compare this job or these conditions with.

Looking back, I can still remember working in the Yucca Mountain tunnel, which was extremely dusty at times. The ventilation system had numerous leaks, muck would be falling off the conveyor belt along the tunnel. Each time a locomotive or other equipment would pass by, this would stir up more dust along with the high pressure air operations within the tunnel. It was impossible to eliminate the dusty environment that this work created, considering the existing conditions and limited use of water.

We normally worked through lunch without stopping, so it was common to see the miners eating their lunches on the tunnel-boring machine while working simultaneously. At the end of the shift, I would be so covered in dust that I would go outside and empty my pockets, which were usually full of dirt. I would sometimes blow the dust off my clothing using an air hose. After changing into my street clothes, I would again shake out my dirty clothes before putting them in the duffel bag, which I took home at the end of each work week for laundering.

My wife would complain about all the dirt, dust, and sometimes grease. She didn't like me bringing my work clothes into our house, so I started washing them myself at the laundromat until the manager noticed all the dirt and asked me not to come back.

It was soon thereafter when were issued the Yucca Mountain uniforms. The shirt had a name tag and the YMP logo patch. We thought this was provided to give us the professional look to show us off during the frequent YMP tours, although none of us union workers had ever been issued work clothes before. I certainly didn't make the connection at the time, we were just happy to have uniforms provided and not having to carry our work clothes home to wash.

There was also a dust cloud that hovered outside during heavy mining outside the portal where the tunnel exhaust was dispersed and around the muck pile at the end of the conveyor system. Sometimes there was so much muck coming off the belt that the outside mucker operators couldn't move the material fast enough, causing a back-up of the drill cuttings and plugging the conveyor system.

This problem was remedied by the installation of the radial stacker, allowing the conveyor system to run at full speed. I believe the dust levels were higher on the back shifts, swing and graveyard. These were the shifts that made the most footage and generated the most dust. Day shift was often shut down for TBM maintenance. This was also the shift that normally hosted the Yucca Mountain tours. It was standard procedure to suspend tunnel activities and allow the dust to clear prior to the tour or when dignitaries would visit.

It is my opinion that the general attitude amongst the tunnel supervisors was focused on production. If you brought up an issue such as dust, you weren't considered a team player. These were the people who transferred off the program back to the union hall or unemployment line for many of them. Respirators would slow down production and everybody knew of the tremendous pressure the DOE was faced with. I know this is only speculation, but many workers were beginning to get concerned. I was laid off in October 1998, along with most of the swing shift crew due to lack of work. I went on to work at the Lake Mead intake two project in Boulder City, Nevada.

PREPARED STATEMENT

In closing words, I would like to bring some attention to the surface drillers involved with the dry drilling at Yucca Mountain. DOE had an extensive drilling program in place long before the tunnel was even started. I participated in some of the surface work and am familiar with the drilling procedures and dry drilling techniques used. This work produced significant dust exposures to some of these workers and respiratory protection was not provided at that time. I would like to see these former workers offered the same silicosis screening program as currently being offered to the underground tunnel workers, as they may also be at risk from their job duties at Yucca Mountain.

Thank you for allowing me to participate in your investigation and sharing my experiences from a worker's perspective.

[The statement follows:]

PREPARED STATEMENT OF JEFFREY M. DEAN

My name is Jeffrey M. Dean. I was involved with the Tunneling & Drilling Operations at Yucca Mountain. I was hired as an Underground Conveyor Operator on

June 26, 1995 by Kiewit/PB to support the Tunnel Boring Machine (TBM). I also worked in various other capacities as needed (such as Driller and Equipment Operator). My union affiliation is Operating Engineers.

Prior to the Yucca Mountain Project (YMP), I worked at the Nevada Test Site (NTS) for over 12 years as a Surface Driller supporting the Nuclear Testing Program. I am currently working for Bechtel Nevada at the NTS as a Driller.

In March 2003 I had an abnormal Chest X-ray during a medical screening program offered through my employer. Additionally, I had been suffering from shortness of breath. These findings prompted an extensive medical evaluation and workup. My doctor stated in his letter to the Department of Labor that I have clear evidence of Pneumoconiosis secondary to Silicosis. I am also being evaluated for possible Sarcodiosis (a rare lung disease of unknown etiology). I am currently being followed by frequent CT Scanning of the lungs along with Pulmonary Functions Testing.

After careful review of my work history, I believe that the bulk of my dust exposures came from my involvement on the Yucca Mountain Project. I do not believe I was adequately protected from the respiratory hazards that were present during the early Tunneling & Drilling Operations. There were many concerns raised about the dust levels (although I personally trusted that the DOE would shut us down if we exceeded the permissible exposure limits).

As Construction (Craft) Workers, the majority of us had very little (if any) knowledge of the potential adverse health effects relating to this type of work, specifically dust illnesses. The employer is normally responsible for providing a safe work environment, and our job (as workers) was to produce a tunnel. We left the air-monitoring and sampling to the Health & Safety professionals. I never had any reason to doubt or question this process until recently. This was my first tunnel job, as I had no previous underground experience and nothing to compare this job or these conditions with.

Looking back I can still remember working in the Yucca Mountain tunnel (which was extremely dusty at times). The ventilation system had numerous leaks, muck would be falling off the conveyor belt along the tunnel, each time a locomotive or other equipment would pass by, this would stir up more dust along with the high pressure air operations within the tunnel. It was impossible to eliminate the dusty environment that this work created considering the existing conditions and limited use of water. We normally worked through lunch without stopping, so it was common to see the miners eating their lunches on the Tunnel Boring Machine (TBM) while working simultaneously.

At the end of the shift, I would be so covered in dust that I would go outside and empty my pockets (which were usually full of dirt). I would sometimes blow the dust off of my clothing using an air hose. After changing into my street clothes, I would again shake out my work clothes before putting them into my duffle bag (which I took home at the end of each work week for laundering). My wife would complain about all the dirt (dust and sometimes grease). She didn't like me bringing my work clothes into our house, so I started washing them myself at the laundromat, until the manager noticed all the dirt and asked me not to come back.

It was soon thereafter when we were issued the YMP Uniforms. The shirt had a name tag and the YMP logo patch. We thought this was provided to give us the "professional look" (to show us off during the frequent YMP tours), although none of us union workers had ever been issued work clothes before. I certainly didn't make the connection at the time (we were just happy to have the uniforms provided, and not having to carry our work clothes home to wash).

There was also a dust cloud that hovered outside over the Exploratory Studies Facility (ESF) Pad (during heavy mining): outside the portal where the tunnel exhaust was dispersed and around the muck pile (at the end of the conveyor belts drop point). Sometimes there was so much muck coming off the belt that the outside mucker operators couldn't move the material fast enough, causing a back-up of drill cuttings and plugging the hopper. This problem was remedied by the installation of the Radial Stacker (allowing the conveyor system to run at full speed).

I believe the dust levels were higher on the back shifts (Swing & Grave). These were the shifts that made the most footage and generated the most dust. Day Shift was often shut down for TBM maintenance. This was also the shift that normally hosted the YMP Tours. It was standard procedure to suspend tunnel activities and allow the dust to clear prior to the tour or when dignitaries would visit. It is my opinion that the general attitude amongst the tunnel supervisors (including Walkers and some Shifters) was focused on production. If you brought up an issue (such as dust), you weren't considered a team player. These were the people who transferred off the project (back to the Union Hall or Unemployment Line for many of them). Respirators would slow down Production, and everybody knew of the tremendous

pressure the DOE was faced with. I know this is only speculation but many workers were starting to get concerned.

I was laid off on Oct. 13, 1998 (along with most of the swing shift crew), due to Lack of Work. I went on to work for Kiewit at the Lake Mead Intake II Project in Boulder City, Nevada.

In closing words I would like to bring some attention to the Surface Drillers involved with the "Dry" Drilling at Yucca Mountain. DOE had an extensive drilling program in place long before the tunnel was even started. I participated in some of this surface work and am familiar with the drilling procedures (and Dry Drilling techniques used). This work produced significant dust exposures to some of these workers and respiratory protection was not provided at that time. I would like to see these former workers offered the same Silicosis Screening Program that is currently being offered to the underground tunnel workers, as they may also be at risk from their job duties at Yucca Mountain.

Thank you for allowing me to participate in your investigation and sharing my experiences from a worker's perspective. Please don't hesitate to contact me if I can be of any further assistance.

BIOGRAPHICAL SKETCH OF JEFFREY M. DEAN

Jeffrey M. Dean resides in Las Vegas. He grew up in Woodland Hills, California until June 1980, when he moved to Louisiana to work in the drilling industry as a roughneck during the Oil Boom. He worked approximately 2 years at this trade, ending up back in California where he joined the Union. He was still working through the Operating Engineers Local 12 when he was called out to the Nevada Test Site in September 1982, where he pursued his career as a Driller. Jeffrey was involved in the Nuclear Testing Program and also worked at other military and governmental installations, including work in Russia in 1988 to participate in the Joint Verification Experiment, while employed by Reynolds Electrical & Engineering Co. (REECo). The work slowed after the nuclear weapons testing moratorium went into effect, and in September 1994 he went back to work in an offshore oilfield for a short period until he was called out to work on the Yucca Mountain Project in June 1995. He was involved in all aspects of the Tunneling and Tunnel Boring Machine operations, working as a Conveyor Operator/Driller and various other capacities as needed. He left the Yucca Mountain Project in October 1998 after the tunnel was completed. He went to work at another Kiewit venture, the Lake Mead Intake II Project in Boulder City, Nevada, where he worked Drilling & Tunneling until Jan. 2000. Jeffrey has been working at the Nevada Test Site for Bechtel Nevada since Aug. 2000.

Senator REID. Mr. Dean, thank you very much, and let me just say this. There's no question the DOE knew from previous experience, because we have a lot of test site workers who have silicosis now who didn't work in the tunnels, and there's a government program to try to help them. We have a lot of people who are very, very sick because of silicosis exposure, having worked at the test site all these years.

We'll now hear from Michael Taylor.

STATEMENT OF MICHAEL TAYLOR, ENVIRONMENTAL SAFETY AND HEALTH SPECIALIST, UNIVERSITY OF CALIFORNIA LOS ALAMOS NATIONAL LABORATORY, YUCCA MOUNTAIN PROJECTS TEST COORDINATION OFFICE

Mr. TAYLOR. My name is Michael Taylor. I have 22 years of operational field, industrial hygiene, and occupational safety experience at the Nevada test site and underground construction, working for the Reynolds Electrical and Engineering Company, Lockheed, Raytheon Services Nevada, and General Physics Corporation. Presently, I work at Yucca Mountain for the University of California Los Alamos National Laboratory, where I am an environmental safety and health specialist for the test coordination office. I worked on the Nevada test site as a respiratory technician, specialist, industrial hygienist, and safety specialist. I have developed

and operated occupational respiratory protection programs for both general industry and underground construction.

Prior to my employment at the Nevada test site, I earned a bachelor's degree from the University of Nevada, Las Vegas. I'm a certified occupational health and safety technologist, OHST. I have been at Yucca Mountain for approximately 9 years. I am classified as an underground worker. In addition, I am the most senior member of the all-volunteer Yucca Mountain mine rescue team.

Next, I want to clearly state that I am not speaking as a representative of the University of California Los Alamos National Laboratory or Yucca Mountain. I speak only as a member of the safety and health profession regarding the safety and health of the workers with whom I work. My involvement with the silica issues first began with my experience in nuclear weapons effects testing at the Nevada test site. Most of the tunnels made for nuclear weapons effects testing were constructed in volcanic tough and silica is a component of volcanic tough. Fibrous minerals may also be found in some types of volcanic tough. Silica and fibrous minerals are hazardous to human health because they can cause lung disease when deposited deep in your lungs.

While working at the Nevada test site and then at Yucca Mountain, I read many professional journal articles regarding the dangers of silica dust and fibrous minerals, including one by a Los Alamos scientist in late 1996. I have no idea when the project became aware of the fibrous minerals hazards.

In December of 1995, a geologist with the United States Bureau of Reclamation working with an underground mapping crew on the tunnel-boring machine in the north ramp of the exploratory studies facility asked if some industrial hygiene air sampling and monitoring could be conducted in his work area. The necessary industrial hygiene air sampling equipment and sampling medium was collected using National Institute for Occupational Safety and Health prescribed methods.

Over the course of 1 week, 11 air samples were collected on the mapping entry of the tunnel-boring machine. The samples were sent to a laboratory to be analyzed. Several weeks later the results came back from the certified laboratory, and 9 out of the 11 samples were over the action level, and two were over the threshold limit value for respirable crystal and silica dust.

Senator REID. What is the date of this?

Mr. TAYLOR. This was in December of 1995.

Senator REID. Thank you.

Mr. TAYLOR. Senator Reid, may I enter that document into the record?

Senator REID. Yes.

Mr. TAYLOR. At this point, January or February 1996, the Department of Energy underground construction subcontractor had excavated approximately 2,700 meters without providing any type of respiratory protection for underground workers. In January of 1996, the Department of Energy management and operating contractor did not have a written silica protection program and the industrial hygiene sampling and monitoring program was less than adequate. Workers received little or no information about the silica fibrous mineral hazards or protective measures.

The management and operating contractor did not have a workable occupational respiratory protection program. There were no provisions for the required respirator physical examinations for respirator training, for respirator fit testing. The management and operating contractor had very little or no occupational respiratory equipment available for issue and use by scientists or management and operating personnel.

In January or February of 1996, the management and operating contractor made a dust mask available for underground workers. It's this mask right here. While this mask is approved for some dust, mists, and fumes, it is not a high efficiency filter. A high efficiency filter is defined as being 99.97 percent effective against micron-sized particles. Within a month or 2, as a result of further discussion, scientific management and operating personnel were issued high efficiency particulates and air or hepa filter, half-mask respirators, which are effective against silica dust. So first we got this one. A couple months went by and then we got this one.

Over the next year and a half, the management and operating contractor continued to struggle with the development, implementation, operation, and compliance of a silica protection program and an occupational respiratory protection program. The underground construction subcontractor struggled with the normal measures that would be taken to protect workers from silica dust. Normal measures would include effective ventilation systems, atomizing water sprays, or air curtains. Normal measures would include engineering, administrative, work practice, and personal protective equipment controls.

The technology to implement these protective control measures was available. However, the underground construction subcontractor could not always get the control measures to work effectively. Again, please remember that the industrial hygiene air sampling program was less than adequate while the 25-foot-diameter tunnel-boring machine was excavating in the areas where fibrous minerals were suspected to occur.

On at least four occasions during the late 1996 to 1997 time frame, Department of Energy safety and health personnel issued a stop-work order for tunnel-boring machine operations because of noncompliance issues regarding the underground construction subcontractor's respirator program. I don't know how many complaints project workers filed about dust levels in the tunnel, but I would bet that there weren't many, because if you worked for the underground construction subcontractor, you did not stick around very long if you complained.

Old-timers have told me that the dust they saw during construction at Yucca Mountain was nothing compared to some other projects they worked on in other parts of the country or the world. These miners would all say that eating dust was part of the job and that they actually liked the underground construction subcontractor because they got a lot of overtime and the paychecks did not bounce.

During my tenure at Yucca Mountain, I have seen approximately 47 health and safety professionals come and go. Many of them became frustrated with the lack of progress and ineffectiveness of the management and operating contractor's safety and health program.

I say this to demonstrate what a challenge it was to work as a safety and health professional at Yucca Mountain.

Today at Yucca Mountain the underground construction subcontractor who excavated the exploratory studies facility and the east-west drift is gone. The management and operating contract has changed hands. Management and supervision is responsible and accountable for safety and health. We now have the Department of Energy management and operating contractor implement a program of a safety conscious work environment and integrated safety management systems.

Today during dust-producing operations we have effective engineering and work practice controls, full-face air purifying power, and air purifying respirators with high efficiency filters; or airline respirators are also used during dust-producing operations. This is what we use today.

Workers and scientists have been empowered to be part of the work planning and work implementation process. Workers and scientists now know they have the right to stop work anytime they feel conditions aren't safe without fear of reprisal. Today Yucca Mountain is an Occupational Safety and Health Administration accredited voluntary protection star site, a distinction only one out of every 1,000 Occupational Safety and Health Administration work sites is able to obtain. Today Yucca Mountain has one of the best trained and equipped mine rescue teams in the country. Today the project has a written and workable silica protection program, industrial hygiene air sampling and monitoring program, and occupational respiratory protection program. Respirator physical examinations, respirator training, and respirator fit testing are all required and strictly enforced.

Dry drilling of holes for scientific investigations is only conducted using dust averters and vacuum systems. Effective engineering, administrative work practice, and personal protective equipment control measures have been developed and are being implemented.

Personally, I support Yucca Mountain. I feel that it fulfills an essential national energy need and it is critical to the safety of our citizens who live near the nuclear power plants across the country. It would also provide jobs for generations of miners to come. I feel that it is important to have long-term scientific studies and monitoring of the site. However, I do not ever again want to see a management and operating contractor or underground construction subcontractor at Yucca Mountain make the mistake of placing schedule over the safety and health of its workers.

PREPARED STATEMENT

In closing, I want to encourage current and former workers to sign up for the silica screening program that the Office of Civilian Radioactive Waste Management and the University of Cincinnati have established. Any former or current Yucca Mountain worker who is injured or sick should receive compensation for the medical care he or she needs. Finally, I sincerely hope that you will focus on the last part of my statement and recognize that today nothing is more important to Yucca Mountain than worker safety and health.

Thank you, Senator Reid.

[CLERK'S NOTE.—The statement and information were not available at the time of publication.]

Senator REID. Mr. Taylor, thank you very much for your testimony, and of course I do recognize the final part of your statement, but as I have indicated earlier, we have hundreds and hundreds of people who have been exposed unnecessarily to these substances as a result of the inattention, negligence, or I think criminal activity of the people at the test site. So I'm glad that's something's been done after the tunnel has been completed, I'm glad they have this fancy mask now, but this doesn't help Mr. Griego or certainly doesn't help Mr. Dean and the hundreds of other people there.

And we're not going to get into whether Yucca Mountain's good or bad at this stage. I think it's awful, because when they talk about having one site, remember we have 111 nuclear reactors around the country and there are also going to be nuclear waste there, you're never going to get rid of it, it's going to be there. So instead of having one site, we're going to continue to have all this other, but that's for another day.

Mr. Weeks, I think it would be helpful if you would give us your background because your testimony is a little bit different than what we've heard to this point.

STATEMENT OF DR. JAMES L. WEEKS, CERTIFIED INDUSTRIAL HYGIENIST, ADVANCED TECHNOLOGIES AND LABORATORIES INTERNATIONAL

Dr. WEEKS. My name is Jim Weeks. I'm a certified industrial hygienist.

Senator REID. What does that mean?

Dr. WEEKS. I thought we were going to ask questions later. It means that I'm a professional in the field of preventing occupational disease, and I'm certified by the American Board of Industrial Hygiene since 1984. I've been in the field for 20 years, and most of that time I've been concerned with problems of monitoring and control of dust mining, primarily in coal mines and primarily for the United Mine Workers of America.

By way of credentials, I currently have faculty positions at the public health schools at George Washington University and at Johns Hopkins University, and I've published a number of papers in this field. I'm the editor of a book on preventing occupational disease, and in this book we describe some generic approaches to how to prevent diseases.

I'm here basically to describe some basic information concerning silicosis and its causes and prevention, and I've looked at some of the data that's been made available to me by some government agencies. Silicosis is an ancient disease. We human beings have known about it since approximately the first century when the Greeks and the Egyptians talked about workers that worked with rock and were exposed to rock dust came down with disabling disease. It was described in more detail in 16th century Europe by physicians in Italy and elsewhere. It's been well known in the United States since the mid-19th century, it's been well known amongst miners and anyone that works with rock and stone for any period of time.

It's an irreversible disease, it's disabling, it's sometimes progressive, that is, sometimes it will continue even in the absence of ex-

posure, and it's sometimes fatal. There is no effective treatment, and because of these features, it really must be prevented. It's not a disease that we can allow to occur and then treat it afterwards. Its cause is well known. It's caused by respirable crystalline silica, and when people inhale excessive amounts of this dust, that's where silicosis comes from.

Silica is one of the most abundant minerals in the earth's crust, so that anytime one digs into the earth, there's a very high probability of being exposed to silica. And anyone that's worked in the mining industry, and the mining industry is very active in Nevada, has had experience with silica.

Let me go into some details concerning silica that are important for this project. It comes in many different crystalline forms, the most common of which is quartz, but there are other forms, and for these circumstances, the other form that's important is cristobalite. What's important about cristobalite is that it seems to have a greater disease-causing potential than does quartz, first of all, and second of all, there's a lot of cristobalite at Yucca Mountain, and that was known very early on by samples that were taken by, I believe at Los Alamos and elsewhere. The exposure limit for cristobalite is approximately half that of silica, just as an indication of its greater toxic effects.

Silica causes not only silicosis—let me say two things about silicosis. It occurs in two forms. Usually it occurs as a chronic disease. It takes many years of exposure for it to develop, but there is short-term high exposure, it can develop over a period of 6 months or even in some cases shorter. There was a notorious epidemic in West Virginia in the 1930's where workers came down with acute silicosis in a matter of months. And based upon some of the exposure information that I've seen, there have been instances of fairly high exposure well documented at Yucca Mountain.

Silica also causes lung cancer. It was identified as a probable cause of lung cancer in 1987. It was identified as a definite cause of lung cancer in 1997 by the International Agency for Research on Cancer. It's affiliated with the World Health Organization. The National Toxicology Program identified it as a carcinogen as well. Needless to say, lung cancer is a progressive and fatal disease usually.

Another feature about silica is that since the mid-1980's, silica that was freshly fractured, that is, just broken off of its parent rock, appears to be more disease—has a greater disease potential than stale silica. This is the so-called freshly fractured hypothesis. And any machine that cuts directly into rock, such as a tunnel-boring machine, mining machines, and drills is going to generate freshly fractured silica, and if the miners are there when that occurs, that's what they're going to be exposed to. Now, there's disagreement about what's a safe level of silica, which I really won't go into at this point, it's in my testimony.

That's all the bad news. The good news is that silicosis is preventable and we know how to do it. The methods are not complicated. It basically involves the use of water and ventilation and traps to control the dust. The methods have been well developed by the U.S. Bureau of Mines over the years, and I believe a consultant from NIOSH, which was formerly with the Bureau of

Mines, came to this project in 1996 and developed a dust control system that worked well, in fact. It appeared to work well based upon his measurements of exposure. Some other measurements that I've seen indicate that it may not have worked quite as well.

Within the field of industrial hygiene, there is a hierarchy of controls. Engineering controls are far preferred over anything else because you've got one system that controls, and one of the problems with respirators is that for every person wearing a respirator you have a system that you need to maintain. Mr. Taylor described what a respiratory program looks like. It involves medically evaluating workers, selecting the right respirator, monitoring exposure, maintenance and control of respirators, and so on. He offered up a couple of respirators. I brought exactly the same ones, quite by accident, except for one, this one right here. This is a respirator that you can get in your local hardware store, has one strap, it's a fairly flimsy filter. I understand that these were made available but few people wore them. This is not effective, and more important, it's not approved by NIOSH for use against dust such as silica.

Some of the other problems with respirators are that they leak. The protection that one gets in actual practice from respirators is usually much less than what is advertised in terms of what's called a protection factor. Respirators are uncomfortable, particularly if you have to wear one over a full shift, and if something's uncomfortable, the most natural thing to do is to take it off. It makes it difficult to communicate through. These are some of the reasons that if one is going to use respirators, it is important to institute a respiratory protection program.

Another feature involved in preventing silicosis is monitoring outcome, that is, taking medical exams of workers before they start to work and monitoring them periodically afterwards. An effective monitoring program and effective prevention program was described by the Bureau of Mines in 1963 based upon a survey done of metal miners throughout the country. The program that they described is basically the same program that one would apply now.

Now, I've obtained results of exposure to silica from MSHA, the Mine Safety and Health Administration, from DOE, and from NIOSH, and all of these agencies have been quite forthcoming with their data, and I want to express my appreciation for making that data available. I haven't spent a lot of time with this data, but it does show clearly that there were many instances of high exposure, well above the exposure limit and exposure to quartz and to cristobalite. I have very limited data on exposure to erionite. The exposure appears to be quite limited.

Samples that were taken after 1996 when the stop work order was put in place and the ventilation was put in place, suggests that dust levels were lower after that time, which I think demonstrates the feasibility and effectiveness of controls, that they do work and they do lower dust levels. There are some unexplained instances of fairly high exposure since that time, which frankly, I'm not quite sure what they indicate.

PREPARED STATEMENT

I must say that in my work with coal miners, the conditions that the gentlemen here describe sound very much like the conditions that coal miners describe in coal mines in the 1960's before the Coal Mine Act went into effect in 1969, and we've made tremendous progress in a concerted effort in preventing black lung in coal mines. I don't understand why we have to revisit silica as a hazard every 20 years or so. It's somewhat ironic that in dealing with this modern threat to disease, nuclear waste, that we should have to deal with this ancient problem, which is silicosis.

Thank you very much.

[The statement follows:]

PREPARED STATEMENT OF JAMES L. WEEKS, SCD, CIH

SILICOSIS IS PREVENTABLE

My name is Jim Weeks. I am a Certified Industrial Hygienist and have worked on dust problems in mining for over 20 years, primarily in coal mines, and primarily for the United Mine Workers of America. I am a former member of the faculty at the George Washington University School of Public Health and have an adjunct faculty position there and at the Johns Hopkins University School of Public Health. I received my undergraduate degree in engineering from the University of California at Berkeley and a doctorate in public health from Harvard University. I have published several papers in scientific journals on dust monitoring and control. I am the senior editor of a widely used book, "Preventing Occupational Disease and Injury", published by the American Public Health Association with a second edition due this fall. This book is devoted to the prevention of occupational illnesses—such as silicosis.

I am here to describe some basic information concerning silicosis, its causes, and prevention and some preliminary assessment of exposure data from the Yucca Mountain Project. I have no previous connection with this Project and am testifying today as an independent expert in the field and in response to an invitation from Senator Reid.

SILICOSIS

Silicosis is a serious occupational lung disease caused by exposure to crystalline silica. It occurs most often among miners, tunnel workers, foundry workers, sandblasting workers, and others. It usually occurs as a chronic disease that appears after about 10 or more years exposure but it can also occur as an acute disease in less than a year following exposure to higher levels of silica.[1] It has been written about extensively since at least the 16th century and was recognized by the ancient Greeks and Egyptians in the 1st century.[2]

It is irreversible, disabling, and sometimes fatal. There is no effective treatment. In some cases, it is also progressive, i.e., the disease will continue even after exposure has stopped. Because of these features, it must be prevented. Based on our long history, and the lives of many miners, we have learned how to prevent it. Any case of silicosis in our time results from a failure somewhere.

SILICA

Silicosis is caused by inhaling excessive amounts of fine ("respirable") particles of free crystalline silica. Silica is one of the most abundant minerals in the earth's crust so that any time one digs into the earth, there is a high probability of exposure to silica.

Silica comes in different crystalline forms. The most important for the present situation are quartz and cristobalite. Ordinarily, quartz is far more abundant but if there is a history of intense heat, cristobalite and other polymorphs may also be present. Since Yucca Mountain has a history of volcanic activity, one would anticipate the presence of cristobalite and other forms. As we know now, there is a lot of cristobalite in the rock at Yucca Mountain. The difference is important because

[1] Wagner GR. Asbestosis and Silicosis. Lancet. 349: 1311–15, 1997.

[2] Ramazzini B. Diseases of Workers. Modena, Italy: 1700. Reprinted 1963: New York: New York Academy of Medicine.

cristobalite has a greater disease-causing potential than does quartz, a feature reflected in its more stringent exposure limit. The exposure limit for cristobalite enforced by both the Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) is half that for quartz.[3]

Though the relationship between silica and silicosis is well established, there are other known health effects also. First, workers exposed to silica are also more susceptible to tuberculosis. For many years, the prevalence of TB in the United States was declining to the point of insignificance but over the past two decades, it has been slowly increasing.[4 5] Among other reasons, the increase is associated with workers migrating into the United States from less developed countries (some of whom might have worked on this project) where the prevalence of TB is higher.

Second, over the past two decades, a link between exposure to silica and the occurrence of lung cancer has been well established. The International Agency for Research on Cancer (IARC) identified silica as a Class II carcinogen (a probable human carcinogen) in 1987[6] and upgraded it to a Class I carcinogen (definite human carcinogen) in 1997.[7] In addition, the National Toxicology Program's 9th Report on Carcinogens listed silica as a known human carcinogen.[8] Lung cancer is well known as a progressive and usually fatal disease.

Third, since about the mid-1980's, so-called "freshly fractured" silica has been identified as having greater disease-causing potential than "stale" silica.[9] Exposure to freshly fractured silica on this project likely occurs for tunnel-boring machine operators, alpine miner operators, roof-bolters, and other drill operators. Freshly fractured silica contains free radicals, which are molecules that are highly toxic to living tissue.

Finally, there is disagreement concerning a safe exposure limit which is an important consideration when evaluating exposure data. Both OSHA and MSHA enforce a shift-average limit for mineral dust that contains silica that is roughly equivalent[10] to 100 $\mu g/m^3$ (micrograms per cubic meter,=0.100 mg/m^3) for quartz and 50 $\mu g/m^3$ for cristobalite.[11] The National Institute for Occupational Safety and Health (NIOSH) recommended in 1972 that this limit be lowered to 50 $\mu g/m^3$ for both quartz and cristobalite.[12] Since then, a steadily accumulating both of scientific literature has supported this recommendation as necessary to prevent not only silicosis but also lung cancer. The American Conference of Governmental Hygienists (ACGIH) recently reduced its exposure limit for quartz to 50 $\mu g/m^3$. In 2001 NIOSH reaffirmed its earlier recommendation of a 50 $\mu g/m^3$ exposure limit.[13] Gold miners exposed to silica at the OSHA or MSHA exposure limit had a 35 percent to 40 percent increase in the lifetime risk of developing silicosis.[14]

PREVENTION

Prevention of silicosis and other diseases caused by exposure to silica requires attention to both exposure and outcome.

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[3] The Mine Safety and Health Administration adopted the 1973 TLV as its exposure limit for silica (30 CFR Part 57.5001).

[4] Preventing and controlling tuberculosis along the U.S.-Mexico border. MMWR Recomm Rep. Jan 19;50(RR–1):1–27. 2001.

[5] Recommendations for prevention and control of tuberculosis among foreign-born persons. Report of the Working Group on Tuberculosis among Foreign-Born Persons. Centers for Disease Control and Prevention. MMWR Recomm Rep. Sep 18;47(RR–16):1–29. 1998.

[6] International Agency for Research on Cancer. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Silica and Some Silicates, Vol. 42. Lyon, France: WHO/IARC, 1987.

[7] International Agency for Research on Cancer. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Silica and Some Silicates, Vol. XX. Lyon, France: WHO/IARC, 1997.

[8] URL: http://ehp.niehs.nih.gov/roc/tenth/profiles/s161sili.pdf, (March 10, 2004).

[9] Castranova V. Generation of Oxygen Radicals and Mechanisms of Injury Prevention. Enviro Health Perspect 102 Suppl. 10:65–68, 1994.

[10] This is "roughly equivalent" because it is derived from a formula that reduces the limit for respirable dust that contains quartz (or cristobalite) as the percent of silica increases.

[11] 30 CFR Part 57.5001; 29 CFR 1926.

[12] NIOSH Criteria for a Recommended Standard. Occupational Exposure to Crystalline Silica. NIOSH Pub. No. 75–120. 1974.

[13] NIOSH. Hazard Review. Health Effects of Occupational Exposure to Respirable Crystalline Silica. NIOSH Pub. No 2002–129. 2002.

[14] Steenland K & Brown D. Silicosis among gold miners—exposure-response analyses and risk assessment. Am J Public Health, 85:1372–77, 1995.

Controlling Exposure

The principal means of preventing harmful effects of silica is by reducing exposure to silica dust. Following conventional practice in industrial hygiene, there is a hierarchy of controls that one should consider in controlling exposure. Engineering controls that prevent the release of hazards into the environment are preferred over other methods, such as the use of respirators. It is well-established in the practice of industrial hygiene and in OSHA and MSHA regulations that respirators should not be substituted for engineering controls.

In the present case, engineering controls for dust in tunnelling operations consist of water sprays to suppress dust, ventilation to remove it, and dust traps to contain it. Methods are well known, effective, feasible, and readily available throughout the mining and tunnelling industries. NIOSH published a handbook on dust control in 2003, based on work published previously.[15] In the chapter on tunnelling, for instance, 15 of 18 references were published before 1990 and most were available at no cost from the Bureau of Mines (now part of NIOSH).

If engineering controls are ineffective or not feasible, respiratory protection can be an effective alternative. Although respirators can protect workers, several problems must be addressed for respirators to be effective. Respirators leak, they are uncomfortable, they interfere with communication, they make breathing more difficult, and some people have other difficulties wearing them. In practice, air purifying respirators usually deliver less protection than the manufacturers claim.[16] [17]

Because of these problems, an effective program of respiratory protection does not consist merely of distributing respirators. It should include a variety of features that are described in the pertinent OSHA regulation.[18] These features include evaluating the hazard, selecting the appropriate respirator, evaluating workers' health (to determine any impairment that would make them unable to use a respirator and to identify any health problems that exposure might make worse), testing a respirator fit (to prevent leaks), monitoring monitoring, educating workers, and organizing proper maintenance and storage. Selecting the appropriate respirator is greatly facilitated by the NIOSH publications on silica (the 1972 Criteria Document and the 2001 Hazard Review) and by the NIOSH "Guide to the Use of Respiratory Protection."[19]

There is a wide range of respirators to choose from. At one end, disposable dust masks are not satisfactory for this job. One step up would be to use so-called air-purifying respirators. These have much better filters but are uncomfortable to wear. Another step up is to use a powered air-purifying respirator (PAPR) in which a battery-operated fan pulls air through a filter and provides it to the worker with a mask or as a curtain of clean air behind a face shield. This makes breathing easier. Many are used in underground coal mines. (Photographs of each type, obtained from the Internet, are attached.)

Monitoring Outcome

Workers on hazardous jobs such as this should receive medical monitoring as well. An exam when first hired is useful to establish a base-line and to identify any latent cases of silicosis or other lung diseases. An exam to evaluate suitability for wearing respirators is part of a respiratory protection program. And periodic exams are useful to ensure that no disease gets established and to identify any trends or clusters in the occurrence of disease. Recommendations specifically for medical surveillance and screening for respirable dusts were written by the current Director of Respiratory Disease Studies at NIOSH and published by the World Health Organization in 1996.[20]

In 1963, the Bureau of Mines and the U.S. Public Health Service conducted a survey of miners to determine the prevalence of silicosis among metal miners and to measure exposure to silica.[21] This was a follow-up to surveys conducted in 1914 and

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[15] Kissell F. Handbook for Dust Control in Mining. IC 9465. NIOSH, Pub. No. 2003–147.

[16] Spear TM, DuMond J, Lloyd C, Vincent JH. An effective protection factor study of respirators used by primary lead smelter workers. Appl Occup Environ Hyg. Feb;15(2):235–44. 2000.

[17] Chen CC, Willeke K. Characteristics of face seal leakage in filtering facepieces. Am Ind Hyg Assoc J. Sep;53(9):533–9. 1992.

[18] 29 CFR 1910.134. This regulation applies to general industry and is referenced because it outlines a model program for respiratory protection. It is modeled after the ANSI standard, Z 88.

[19] This guide is available on a CD at no cost from NIOSH.

[20] Wagner GR. Screening and Surveillance of Workers Exposed to Mineral Dusts. Geneva: World Health Organization, 1996.

[21] U.S. Public Health Service; U.S. Bureau of Mines. Silicosis in the Metal Mining Industry, A reevaluation: 1958–1963. Washington, DC: U.S. Government Printing Office. 1963.

1933. At the conclusion of this survey, they described a program for preventing silicosis (p 21–24) that covers the procedures described above. It recommended

—dust monitoring,
—dust control,
—workers' education,
—consult with the Bureau of Mines for technical assistance,
—medical evaluation of workers before working and periodically thereafter.

I mention these recommendations because they are as applicable today as they were 40 years ago. The means for preventing silicosis have been known for a long time. These recommendations made in 1963 were similar to those offered at the earlier surveys in 1914 and 1933.

DOCUMENTED EXPOSURE

I obtained results of exposure to silica from MSHA, from the Department of Energy, and from NIOSH. These agencies were very responsive to my requests and I wish to thank them for their cooperation. I have had only limited to analyze these data so have only some preliminary comments. The data from MSHA covers the period from 1996 to 2001; the data from DOE, from 1993 to 2001. The data from NIOSH were connected to a project to improve dust controls and did not directly measure workers' exposure.

These records document that exposure to quartz and cristobalite was common, that there were instances of exposure above, and some very much above, exposure limits. Other documents state that earlier in the life of this project, much cutting was done dry (i.e., without water to suppress dust), a circumstance that would have produced a great deal of dust. Respiratory protection was apparently uneven during this time.

Samples taken after dust controls were instituted in 1996 suggest lower levels, thus demonstrating the feasibility and effectiveness of controls. However, there are some unexplained instances of high exposure since that time. Respiratory protection and worker education appear to be better since 1996 although there is room for improvement. The records indicate that workers were using respirators as part of a respiratory protection program as described in the ANSI Z88–1969 standard.

CONCLUSION

It is ironic that cases of silicosis occurred in connection with this project. This project is designed to address a modern hazard but in the course of doing so, this ancient hazard was apparently overlooked.

Silicosis and lung cancer are both serious and irreversible diseases. Prevention is a necessity. Silica—quartz and cristobalite—is well known as a cause. Prevention is also feasible with methods that are well known and effective. In these times, any case of silicosis results from a failure to use available knowledge.[22]

BIOGRAPHICAL SKETCH OF JAMES L. WEEKS, SCD, CIH

Dr. James (Jim) Weeks holds a position at Advanced Technologies and Laboratories International, Inc., a consulting firm in Germantown, Maryland. This firm employs about 150 people in three other locations: Gaithersburg MD, Oak Ridge TN, and Richland WA. It provides technical services and performs work on a variety of environmental and occupational health issues for many agencies, including the National Institute of Occupational Safety and Health, the Occupational Safety and Health Administration, the Department of Energy, the Environmental Protection Agency, and the Department of Defense. Jim is working on problems of heat stress among hazardous waste workers and falls from scaffolds.

Jim provides technical assistance to the American Postal Workers Union and the United Mine Workers. He continues to serve the George Washington University's School of Public Health and Health Sciences as Adjunct Associate Professor.

Senator REID. Thank you very, very much for your testimony. I'm grateful to you for it. I will have some questions for you, as you have indicated, but I think the one sentence of your testimony is so strong, any case of silicosis in our time results from a failure somewhere is your direct statement. I think you've certainly pro-

[22] Wagner GR. The inexcusable persistence of silicosis. Am J Public Health. Oct;85(10):1372–7. 1995.

vided that well, and of course all the data that's provided to you by these other organizations post-1996 when the closure took—the mines——

Dr. WEEKS. No, I received data from 1993, yes I did.

Senator REID. Thanks. I appreciate that. Thanks for clearing that up.

We'll now hear—how do you pronounce your last name?

Dr. VOGELZANG. Vogelzang.

Senator REID. Vogelzang, just like it looks. I just want to, so people didn't think I was trying to be puffy here, Dr. Vogelzang was director of the University of Chicago Cancer Research Center for 21 years—I'm sorry, for 4 years. He's been at the University of Chicago for 21 years, one of the finest centers for medical technology in the world, and he has authored approximately 50 papers on the subject of mesothelioma. He has authored nearly 350 scientific publications, 320 abstracts, given 300 lectures. He is a survivor of Hodgkin's disease himself. He has been listed in Best Doctors in America since 1994, and as I indicated, we're very fortunate to have you now a resident of the State of Nevada. Please proceed, Doctor.

STATEMENT OF DR. NICHOLAS J. VOGELZANG, DIRECTOR, NEVADA CANCER INSTITUTE

Dr. VOGELZANG. Thank you, Senator Reid. I appreciate this opportunity.

Senator REID. And I'd like you to spend just a little bit of time on the erionite.

Dr. VOGELZANG. Right. Dr. Weeks and I did not have a chance to communicate ahead of time, and I am actually quite intrigued by the issue of silicosis and cancer of the lung; but I did not go into that in my testimony, so I'm going to focus on mesothelioma and its relationship to erionite and perhaps some issues related to mordenite. And again, I don't have the occupational exposure data that was in the ambient dust or air. I would just like to confine my comments then to mesothelioma and erionite.

Mesothelioma is a routinely fatal cancer of the lining of the lung. It usually occurs after asbestos exposure, about 30 to 60 years after asbestos exposure. Once diagnosed, the patients live on the average about 15 months. The average person is over 50 when they develop the disease. The current age is 70 when patients develop the disease. It occurs in about 5,000 patients a year in the United States. However, in certain countries, for example, Australia, it is a particularly larger burden due to larger use of more carcinogenic asbestos. Treatment for this disease is limited, although we've really seen some good results with a new type of chemotherapy.

Senator REID. That's something you developed, is that right?

Dr. VOGELZANG. That's correct. My experience with erionite is not that of an occupational scientist or physician, rather as a mesothelioma doctor. And as I understand it, this is my reading in the literature, erionite is a carcinogen. It is listed as a group 1 carcinogen by the International Agency for Cancer Research, and as we heard previously from the other witnesses, it is quite capable, in fact more capable than asbestos, of causing mesothelioma.

Now, I received a report by Drs. Guthrie, Bish, Chapera, and Raymond from the Los Alamos laboratories dated May 1995 in which they analyzed the presence of erionite in the test drill sites. This map on page 17 describes a heavy concentration of erionite in what is known as core UZ14. Unfortunately, I could not locate core UZ14, it does not appear to be within the confines of the drill or the mining area. However, there was fractured erionite in core UE25AGU3 and G3. Now, interestingly—and those areas are very close to the tunneling—mordenite is a similar fibrous material that can at least look very much like asbestos. Very little is known about that compound as far as its risk of mesothelioma, whether it's as high a level; but it is listed as a class 3, which means possibly capable, and mordenite is found in almost all of the drill sites, the test sites in the area. And again, I don't want to take up your time listing them all, but at least 10 sites list mordenite as being present. And again, I do not have information as to the presence of mordenite in the respirable air.

Turning then back to erionite, erionite has——

Senator REID. Doctor, what does mesothelioma mean?

Dr. VOGELZANG. Mesothelioma means cancer of the mesothelium. The mesothelium is between our skin, the ectothelium, and the intestines, the endothelium; so it's the middle—meso means middle—of our body.

The link between erionite and mesothelioma is most noticed in Turkey; and in that area, there are volcanic-containing tufts that have very high levels. However, there seems to be a link between erionite and genetics; because in most places in Turkey, it's only found in certain villages even though an entire area is exposed. So there may be a strong link between genetics and mesothelioma. That has not yet been proven in any populations in the United States.

Erionite is present throughout the West. It's found in Nevada, California, and Oregon. However, at the current time, it has not been linked to mesothelioma in this population. The Turkish occupation was non-occupational; that is, it was within the living areas. We believe that occupational exposure to erionite, which has not been well-documented yet, would lead to even increased risk of mesothelioma. We do know that workers exposed to zeolite in Libby, Montana, were exposed to erionite; and, therefore, that is a substantial concern for those patients and those individuals.

So concluding, erionite is a known cause of mesothelioma in animals and man. However, there are no documented cases of erionite-induced mesothelioma as of yet in the United States.

Senator REID. Now, Doctor, just one brief question while it's on my mind. Cases relating to this substance using past history with asbestos would take some time to develop.

Dr. VOGELZANG. Many years, 60 years or more.

Senator REID. And so, sadly, the people exposed to this at the Nevada, near the Nevada test site at Yucca Mountain, there is no telling when it will come. The average age, you said—you didn't say the average but it usually appears after 50.

Dr. VOGELZANG. Right.

Senator REID. I had a, interestingly enough, 2 weeks ago my brother called me and my brother's 12 or so years older than I and

he had a friend, and he said, do you remember, and he mentioned him. I said sure, my brother Dale used to live with the family when we were in Searchlight. And he said, well, he's got mesothelioma and he's never been around anything that he knows of, but of course he knew that he had a death sentence at the time of 14, 15 months, and he never remembered——

Dr. VOGELZANG. Well, these may well be erionite-exposed individuals.

Senator REID. And he's 70 years old.

PREPARED STATEMENT

Dr. VOGELZANG. That would be approximately the right time period. I believe though that most importantly we need to establish a registry of mesothelioma, particularly in miners. I believe there needs to be very careful genetic and occupational establishment of the risks of both erionite but also mordenite. There's little data anywhere in the scientific literature on mordenite. And also, any of this research must take into account the long latency period of mesothelioma. I'd like to thank you, Senator Reid, for this opportunity today.

[The statement follows:]

PREPARED STATEMENT OF NICHOLAS J. VOGELZANG, M.D.

MESOTHELIOMA

Malignant mesothelioma is a cancer of the lining of the chest and abdomen and is usually associated with a history of exposure to asbestos 30–60 years prior to the diagnosis. Mesothelioma is one of the most aggressive human cancers, is frequently diagnosed at an advanced stage, and is very difficult to treat. Patients in this situation usually survive about 15 months. Most people who get mesothelioma are over 50 years of age. Men are more likely than women to get this disease. Mesothelioma of the pleura accounts for about 2,000–3,000 cancer deaths per year in the United States, while a similar number die from mesothelioma of the lining of the abdomen (peritoneum).

Depending on the stage of diagnosis and the overall health of the patient, several treatment options exist for mesothelioma including surgery, chemotherapy and radiation. If caught early, a surgical cure is sometimes possible. However, if the cancer has spread or progressed, a cure is not possible. Chemotherapy and radiation may prolong life, but can rarely cure the cancer.

ERIONITE

Erionite is a naturally occurring fibrous zeolite. Its basic structure is aluminosilicate tetrahedra. An oxygen molecule is shared between two tetrahedra. The structure of erionite is chainlike, with six tetrahedra on each edge of the unit forming part of a chain of indefinite length. Erionite consists of white prismatic crystals in radiating groups. It is not known to occur in other than fibrous form, in single needles, or in clusters. Erionite fibers, with a maximum length of approximately 50 μm, are generally shorter than asbestos fibers. Erionite particles resemble amphibole asbestos fibers and absorb water up to 20 percent of their weight. Zeolites, in general, have good thermal stability, rehydration kinetics, and water vapor adsorption capacity (Clifton 1985).

The EPA regulates erionite under the Toxic Substances Control Act (TSCA) as a chemical substance for which there are significant new uses and thereby specifies procedures for manufacturers, importers, or processors to report on those significant new uses. OSHA regulates erionite under the Hazard Communication Standard and as a chemical hazard in laboratories.

Deposits of fibrous erionite are located in Nevada, Arizona, Oregon, and Utah. Erionite fibers have been detected in samples of road dust in Nevada. U.S. residents of the Intermountain West may be potentially exposed to fibrous erionite in ambient air (Rom et al. 1983, IARC 1987a).

ERIONITE AND MESOTHELIOMA

There is scientific evidence that exposure to erionite causes mesothelioma. An IARC Working Group reported that there is sufficient evidence of carcinogenicity of erionite in experimental animals to label it as (IARC 1987a,b). When administered by inhalation, erionite induced pleural mesotheliomas in rats of both sexes. When administered by intraperitoneal injection, erionite induced peritoneal mesotheliomas in male mice. When administered by intrapleural injection, erionite induced pleural mesotheliomas in male and female rats.

Erionite fibers have been identified in lung tissue samples in cases of mesothelioma. The link between erionite and mesothelioma is most firm in two villages in Turkey where 50 percent of deaths are caused by mesothelioma. Erionite-containing volcanic tuffs were found in samples collected from the walls of local dwellings and rock and dust samples (Pooley 1979, cited by Baris et al. 1996). Descriptive studies have demonstrated very high mortality from malignant mesothelioma, mainly of the pleura, in these Turkish villages where the population had been exposed to erionite from birth. Erionite fibers were identified in lung tissue samples in cases of pleural mesothelioma; ferruginous bodies (diagnostic of exposure) were found in a much higher proportion in the lungs of inhabitants in contaminated villages than of those in two control villages (Baris 1991).

Erionite is a very potent carcinogen and mutagen. The rate of mesothelioma cases in these Turkish villages is estimated to be four times greater than that in populations industrially exposed to asbestos (Esmen and Erdal 1990). Furthermore, animal experiments demonstrate that erionite is more potent than asbestos in causing mesothelioma. Mineralogical analysis of the mesothelioma patients' lung tissues showed more than 90 percent of the fibrous particles to be erionite (Baris 1991).

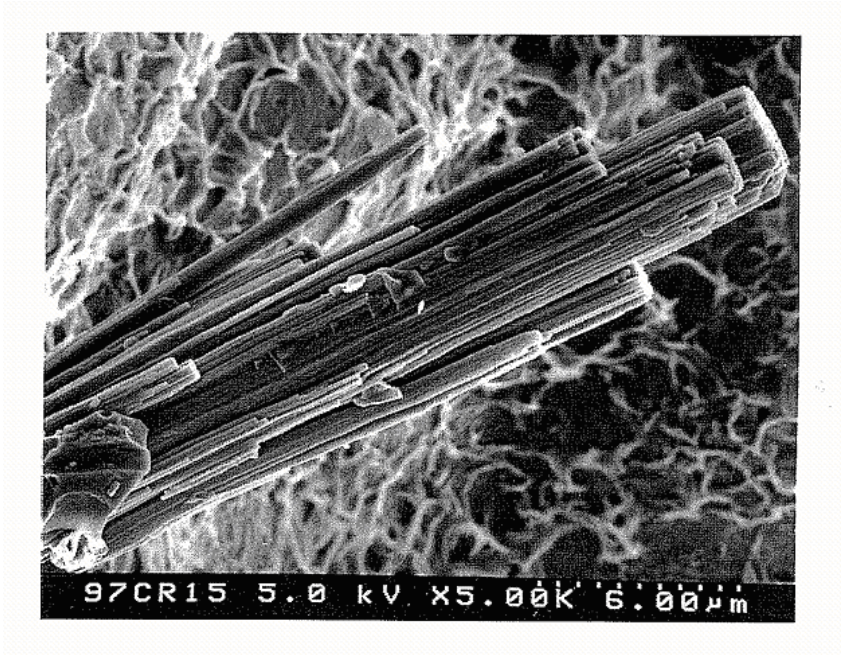
These studies suggest that a very small number of erionite fibers is sufficient to cause mesothelioma. While erionite is present in Nevada, California, Oregon and other States, it has not been linked to mesothelioma in the populations.

It is worthy of note that while some research suggests that certain individuals have a genetic predisposition to mesothelioma possibly making them more susceptible to erionite carcinogenity, it has yet to be proven. A gene has not been identified for mesothelioma nor have other environmental factors been eliminated to date. Further epidemiological and environmental investigations are needed.

The exposures in Turkey are non-occupational; however, there is much scientific evidence to indicate that occupational exposure to certain minerals, metals, and fibers can cause lung disease. Occupational exposures occur during mining, milling and processing of some zeolites as well as during agricultural work in areas in which soils are contaminated with erionite. Therefore, given the low-exposure necessary to cause mesothelioma, it can be extrapolated that the effects of occupational and non-occupational exposures would be approximately equal.

All workers involved in the production or use of zeolite-containing products are potentially exposed to erionite, which is mined with deposits of other zeolites. Total dust exposures in an open-pit zeolite (containing erionite) mine in Arizona for miners ranged from 0.1 to 13.7 mg/m^3; respirable dust in the mining area was 0.01 to 1.4 mg/m^3 (IARC 1987a).

In conclusion, erionite is a known cause of mesothelioma in animals and man. However, there are no documented cases of erionite-induced mesothelioma in the United States. Further research is needed to determine the genetic and occupational risks of erionite exposure. Such research must take into account the long latency period of asbestos-related mesothelioma.



BIOGRAPHICAL SKETCH OF NICHOLAS J. VOGELZANG, M.D.

Dr. Vogelzang received his M.D. degree from the University of Illinois at Chicago in 1974. He completed his internship, residency, and chief residency in internal medicine at Rush-Presbyterian-St. Luke's Medical Center in Chicago, followed by his fellowship in medical oncology at the University of Minnesota in Minneapolis. He served as a faculty member at the University of Chicago from 1982 through 2003. Prior to joining Nevada Cancer Institute on January 1, 2004, Dr. Vogelzang served as the director of the University of Chicago Cancer Research Center from 1999 to 2003.

Dr. Vogelzang has 25 years of experience as an oncology physician/scientist in the field of asbestos-related mesothelioma and has authored approximately 50 papers on the subject. In addition, he has conducted large-scale national trials in the field. He has served on numerous committees of the American Society of Clinical Oncology, as well as on its Board of Directors from 1993 to 1996. He is a former president of the Illinois Division of the American Cancer Society. Dr. Vogelzang was the principal investigator at the University of Chicago for Cancer and Leukemia Group B (CALGB) from 1988 to 1999, Chair of the mesothelioma subcommittee from 1985 to 1998. He is a founding board member of the Mesothelioma Applied Research Foundation and is a member of many professional societies, including the American Association for Cancer Research, the American Urological Association, the Society of Urologic Oncology and the European Society for Medical Oncology.

Dr. Vogelzang serves on the Editorial Board of Seminars in Oncology, has served on the boards of Cancer, Cancer Research, The Prostate Journal, and the Journal of Clinical Oncology, and is a reviewer for numerous other journals. He is the author of nearly 350 scientific publications (including peer-reviewed papers, internet publications, reviews, book chapters and books and journal issues), over 320 abstracts and letters, and has given over 265 scientific lectures. As a survivor of Hodgkin's disease, he is a sought after public speaker. He is the lead editor of the Comprehensive Textbook of Genitourinary Oncology.

Dr. Vogelzang has received numerous awards that distinguish him as a physician-researcher including: Distinguished Trinity Christian College Alumni, 2003, listed in Best Doctors in America, 1994 to present, Fred C. Buffett Professorship, University of Chicago, 1999 to 2003, Castle Connolly Medical, Ltd., America's Top Doctors,

2001; Chicago Metro Area, 2001, American Cancer Society St. George National Award, 1999, Listed in top 500 doctors in Chicago by Chicago Magazine, 1998, 2003.

Senator REID. Thank you very much for being here. I appreciate your patience. We may have a couple questions if you don't mind just waiting.

If we could now hear from the Department of Energy. Who's going to be the spokesperson?

STATEMENT OF GENE E. RUNKLE, SENIOR SAFETY ADVISOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

Mr. RUNKLE. Senator Reid, I am Gene Runkle, senior safety advisor to the director of the Office of Civilian Radioactive Waste Management. I am also the program manager for the Yucca Mountain Silicosis Screening Program. Thank you for the opportunity to testify at this hearing.

The Department of Energy is committed to providing a safe workplace for our workers. Specific concerns have been raised about potential worker exposures to elevated levels of silica during tunnel mining and underground operations in the 1990's. We have taken these concerns seriously and have confronted the issues in a straightforward manner. We commended the former workers who raised this concern and we have initiated a medical screening program based upon the broadest reasonable assumption of possible exposures. We are committed to addressing potential health effects on former and current workers on the Yucca Mountain project.

In the fall of 2003, the Department analyzed exposure monitoring data, which indicated that allowable levels of respirable silica were exceeded for some operations from 1993 through 1997. To determine working conditions during that period, we have reviewed some 400 documents on mining operations, monitoring, and respiratory protection. The tunnel was mined with minimal use of water to ensure scientific integrity of the tests. To compensate, special filters were designed and safety programs were put in place. Respiratory protection was made available to Yucca Mountain workers. However, between 1992 and 1996, requirements for its use were not consistently applied.

Since 1996, requirements for the use of respiratory protection have been in effect and have been rigorously enforced. In 1998, we established the Silica Protection Program to provide ongoing medical surveillance through X-rays, lung function evaluations, and exams. Through this program we have diagnosed two individuals with silicosis, both of whom worked at Yucca Mountain and were also previously involved in other mining activities.

The silica protection program also addresses erionite, a fibrous material found in certain types of rock formations. The respiratory protection provided to workers are equipped with high efficiency filters that remove particulates, including erionite, silica dust, and radon. Any health effects from erionite would be identified by the ongoing medical surveillance and screening programs.

We believe we have a sound program in place to protect our workers. To ensure this, we recently arranged for an independent review. This assessment was conducted by certified industrial hygienists from industry, the National Institute for Occupational Safety and Health, and the Department. All of these experts are

from outside of our program. They determined that the program was sound, but recommended some enhancements that we are now evaluating.

In response to concerns about historical silica exposures, we contracted with the University of Cincinnati to establish the silicosis screening program for current and former workers. This medical screening program is voluntary and is available at no cost to the workers, an estimated 1,200 to 1,500 individuals. To date, we have mailed some 2,400 letters and around 240 workers have signed up to participate. Work history interviews have started and medical examinations will begin shortly.

After the screening is complete, there will be an evaluation to determine what additional actions should be taken. Since the screening program was announced in January, two additional concerns have been raised. The State's environmental protection division conducted an inspection of the muck pile outside of the tunnel in response to congressional inquiries about the possibility of silica dust blowing off the pile, and found the site to be in compliance. The project has undergone five air quality inspections since 1994 and has been in compliance each time.

Another topic of concern is the alleged falsification of data in 1996. On February 18, 2004, we requested the Office of the Inspector General to investigate these allegations. We are awaiting the completion of the investigation and will take appropriate action to address the findings. If the Nuclear Regulatory Commission authorizes construction of a repository at Yucca Mountain, tunnels will be mined for waste placement. To perform these operations safely, we are utilizing the internationally recognized expertise of the Colorado School of Mines and the National Institute of Occupational Safety and Health.

PREPARED STATEMENT

In summary, the Department of Energy acknowledges that allowable levels for respirable silica were exceeded at times during tunnel operations in the early to mid-1990's. We have established a screening program to identify and offer medical screening free of charge to current and former workers. We will continue to emphasize a safety-conscious work environment and future operations will be built upon this commitment. Thank you, and at this time, John Arthur, Deputy Director of the Office of Repository Development, and I would be pleased to answer any questions.

[The statement follows:]

PREPARED STATEMENT OF GENE E. RUNKLE

Mr. Chairman and members of the committee, I am Gene Runkle, Senior Safety Advisor to the Director of the Office of Civilian Radioactive Waste Management (OCRWM). I am also the Program Manager for the Yucca Mountain Silicosis Screening Program. Thank you for the opportunity to testify at this hearing and to provide information about the Silicosis Screening Program.

Management at all levels of the Department of Energy (DOE) and the Office of Civilian Radioactive Waste Management is committed to providing a safe work place for our workers. Establishing a safety conscious work environment is our commitment to an employee's right to raise concerns without fear of retaliation, to self-identification of issues, to prompt action to address any issues and concerns, and to continuous improvement of all processes. We are continuously improving our safety program, as evidenced by accomplishments such as the certification in 2000 of

our Integrated Safety Management System, and the award in 2003 of Star Status in the Department's Voluntary Protection Program. A safety conscious work environment is the cornerstone of our commitment to protect worker health and safety and the public.

As you are aware, concerns about worker exposures to airborne crystalline silica generally relate to work performed at the Yucca Mountain Exploratory Studies Facility in the early to mid-1990s. During this period, there was active mining of a 5-mile tunnel to provide access, for testing purposes, to the geologic strata where spent nuclear fuel and high-level radioactive waste would be emplaced in a repository. This work was performed by a firm that has completed its work and is no longer associated with the Yucca Mountain Project. To determine working conditions and practices during that period, we have reviewed some 400 documents associated with tunnel mining operations, personal monitoring data, and respiratory protection. In addition, we are aggressively evaluating the risks of worker exposure to silica from Yucca Mountain Project activities from the mid-1990s up to the present time and intend to continue into the future.

Specific concerns have been raised about potential worker exposures to elevated levels of silica during tunnel mining and other underground operations in the 1990s. The Department has taken these concerns seriously and has confronted the issues in a straightforward manner, and we will continue to do so. We have commended the former employees who raised this concern, and we have initiated a medical screening program based upon the broadest reasonable assumption of potential exposures. We have also made extensive efforts to notify all current and former Yucca Mountain workers about the screening program. We have been candid in our responses to questions on this issue and in our other communications, acknowledging what we do not know and committing to address potential health effects on former and current workers from their work on the Yucca Mountain Project.

BACKGROUND

In September 2003, a former Yucca Mountain Project employee expressed a concern to the DOE Office of Inspector General that there had been overexposure to respirable silica and carcinogenic substances during tunnel mining operations from 1993 through 1998. In the fall of 2003, OCRWM and the Office of Environment, Safety and Health analyzed exposure-monitoring data, which indicated that allowable levels of respirable silica were exceeded for some operations from 1993 through 1997. Monitoring data for erionite (a known carcinogen), other fibrous zeolites, and diesel exhaust also were analyzed; however, respirable silica was determined to be the likely primary hazard for workers.

Silica is one of the minerals that naturally exist in desert soils and in the rocks at Yucca Mountain. It can become airborne during dust-producing activities like tunnel boring operations. If inhaled, silica can collect in the respiratory system and, with long-term exposure, can cause a chronic, progressive lung disease called silicosis.

Exposure to silica and dust is controlled through engineering controls including ventilation, good work practices, and personal protective equipment such as respirators. The level of control achieved is determined by monitoring the air for silica concentration. Unlike other hard-rock mining operations that use water for dust suppression, the Exploratory Studies Facility tunnel was bored with minimal use of water to ensure scientific integrity of the tests that would be performed there. To compensate, special air pickups and filtration systems were designed for the tunnel and mining equipment. Operators were not satisfied with the performance of these systems in dealing with difficulties encountered during actual boring operations and enhanced the systems multiple times to improve dust control.

Prior to the beginning of tunnel boring operations in 1994, safety programs were in place. Respiratory protection was made available to Yucca Mountain workers; however, between 1992 and 1996, requirements for its use were not consistently applied. In 1996, the Office of Civilian Radioactive Waste Management issued a stop work order, established a rigorous respiratory protection program, and enhanced monitoring of the work environment. Also in 1996, ventilation in the tunnel was improved to better control dust levels. Our records indicate that requirements for the proper use of respiratory protection have been in effect since 1996 and have been rigorously enforced.

In 1998, we established the Silica Protection Program to provide ongoing, annual medical surveillance of current tunnel workers. This program continues today, and we are actively monitoring our workers' health. We meet the standards for worker safety as outlined in the Occupational Safety and Health Administration's Special Emphasis Program and in National Institute for Occupational Safety and Health

recommendations, and our medical surveillance program meets or exceeds Federal standards. Employees enrolled in the Silica Protection Program receive X-rays that are evaluated by radiology specialists, lung function evaluations, and physical exams. The Silica Protection Program has identified two cases of silicosis to date. Both of these individuals worked at Yucca Mountain and were also involved in other mining activities.

The Silica Protection Program also addresses erionite, a fibrous material found in volcanic and sedimentary rocks. The respiratory protection provided to workers is equipped with high efficiency particulate air (HEPA) filters, which filter 99.97 percent of all particles 0.3 microns in size or larger. This level is sufficient to filter out the bulk of airborne particulates found in the Exploratory Studies Facility, including erionite, silica dust, and radon progeny particulate radionuclides. An extremely small quantity of erionite was found during mining operations—a fracture coating 1 millimeter thick. Mining operations were carefully planned to avoid erionite deposits that are known to exist in the Yucca Mountain strata below the current tunnel. Regulatory standards for erionite do not exist, so erionite levels are compared to regulatory standards for asbestos, which is a similar carcinogen. Erionite exposure levels during and since the mining operations have not exceeded the asbestos regulatory standards.

In drilling locations where scientists identified that erionite may be present, the Department of Energy utilized a self-imposed erionite control protocol to protect workers. This protocol included protective clothing, respirators, and erionite monitoring and is similar to that utilized by industry to protect workers from asbestos. Any potential health impacts from erionite would be picked up by the ongoing medical surveillance and screening programs.

We firmly believe we have a sound program in place to protect our workers and provide a safe working environment. However, to provide assurance in this matter, we recently arranged for a team of industrial hygienists to perform an independent review of the current Silica Protection Program and other aspects of our industrial hygiene program at the Yucca Mountain Project. Certified industrial hygienists from Bechtel National, Inc.; the Department of Energy Office of Worker Protection Policy and Programs; Shaw Environmental and Infrastructure, Inc.; and the National Institute for Occupational Safety and Health conducted the assessment. They determined that the program is sound but recommended various managerial and technical enhancements that we are now considering.

SILICOSIS SCREENING PROGRAM

Now I will provide details on the actions OCRWM has taken in response to concerns about historical silica exposures.

OCRWM contracted with the University of Cincinnati, which has considerable experience in performing similar screening programs, to establish a one-time, independent medical screening for current and former workers. On January 15, 2004, the Silicosis Screening Program was announced, and a toll-free information line operated by the University of Cincinnati became operational. The Program is voluntary, available at no cost to workers, and open to all current and former workers who spent 20 or more days underground in a year. The University of Cincinnati leads a consortium that includes Zenith Administrators; Duke University Medical Center; and the Center to Protect Workers' Rights, which has been instrumental in working with labor organizations to facilitate worker notification.

The screening program is open to workers who may have been exposed to airborne silica in the tunnel at various times during tunnel mining operations—an estimated 1,200 to 1,500 individuals (1992-present). We will not know who has been affected until the medical screening is complete. After the initial screening, there will be an evaluation to determine what additional actions should be taken.

To date, approximately 2,400 letters notifying current and former workers about the program have been mailed, and approximately 240 individuals have signed up to participate. Work history interviews have started, and the medical exams will begin shortly. A few non-employees have also called the information line. We welcome anyone who visited the underground facilities multiple times within a year to call and obtain information, but I want to stress that we do not anticipate that any non-workers would have been impacted, due to their restricted access to work areas and the short duration of their visits.

Since the Silicosis Screening Program was announced in January, two additional concerns have been raised.

The State of Nevada Environmental Protection Division conducted an inspection of the "muck pile" outside the Exploratory Studies Facility tunnel in response to Congressional inquiries about the possibility of silica dust blowing off the pile. The

Environmental Protection Division conducted an air quality permit inspection on February 12, 2004. The site was found to be in compliance. The Yucca Mountain Project has undergone five air quality inspections since 1994 and has been found to be in compliance each time. In addition, the Yucca Mountain Project conducts its own samplings, using an air monitoring network throughout the site.

A second topic of concern is the alleged falsification of data in the 1996 timeframe. On February 18, 2004, Dr. Chu, OCRWM Director, requested that the DOE Office of the Inspector General investigate these allegations, and OCRWM management requested all employees to respond to any requests for information from the Inspector General. Dr. Chu also requested that the Inspector General determine why DOE was not notified of this former employee's statements when they were originally made. We are awaiting completion of the Inspector General investigation and are committed to taking appropriate action in response to their findings.

FUTURE OPERATIONS

If the Nuclear Regulatory Commission authorizes construction of a repository at Yucca Mountain, an extensive network of tunnels would be mined to create areas for waste emplacement. We are looking ahead to this mining operation and taking steps to ensure we can perform it safely. The Department of Energy and Bechtel SAIC Company, LLC, are planning safety and health and industrial hygiene programs for the construction period to address the significantly increased level of work that would accompany future activities. The Department is currently utilizing the internationally recognized expertise of the Colorado School of Mines to advise on emerging and innovative excavation and dust control technologies that could be used at Yucca Mountain. Additionally, we will continue to use the expertise of the National Institute for Occupational Safety and Health for advice and recommendations on enhancing our health protection programs.

CONCLUSION

In summary, the Department of Energy identified that allowable levels for respirable silica were exceeded during some tunnel operations in the early to mid-1990s and implemented more comprehensive silica protection processes. In response to employee concerns on potential exposure to silica, we have established a Silicosis Screening Program with the University of Cincinnati for current and former workers. We will continue to protect our workers through a safety conscious work environment, which emphasizes self-identification of issues and concerns; prompt response to issues; and continuous improvement. Future operations will build upon this commitment, and we will continue to implement a safety conscious work environment to the benefit of our workers and the public.

Thank you. I would be pleased to answer any questions.

BIOGRAPHICAL SKETCH OF GENE E. RUNKLE

Mr. Runkle is the Senior Safety Advisor to the Director of the Office of Civilian Radioactive Waste Management and also the Program Manager for the Yucca Mountain Silicosis Screening Program. He holds a Master of Science degree in health physics with a specialty in internal dosimetry of inhaled radionuclides and has published and presented over 50 technical papers on radiation protection, chemical safety, computer simulation modeling, quality assurance, and inhalation toxicology.

Mr. Runkle has served as the Director for the Occupational Safety and Health Division for the DOE Albuquerque Operations Office with oversight of industrial hygiene, radiation protection, and occupational safety for the Nuclear Weapons Complex and the Waste Isolation Pilot Plant for geologic disposal of transuranic waste. Prior to his work with the Department, he worked with Sandia National Laboratories supporting probabilistic risk assessment analyses for the disposal of high level waste and spent fuel in geologic formations.

Senator REID. Thank you very much. Mr. Runkle, first with you, you have a very nice delivery and you appear to be a very nice man, but you just breezed through what has happened to these people. We acknowledge, as Mr. Taylor has indicated, you've set up a program now to take care of people, but what about the years of neglect of these people? You breezed through that like it doesn't exist. You say you set up a screening panel for these people so they

can find out how sick they are, and Mr. Taylor said I think they should—their medical expenses should be paid.

My personal feeling, and I have already said that in my opening statement, I think they deserve more than their medical treatment. I think the pain and suffering that they've gone through they deserve some compensation for this. And you also just glibly go over the fact that I didn't come up with this, Dr. Margaret Chu is concerned about falsification of records, and as we know, Inspector General hasn't reported back on the original problem that was pointed out by Mr. Griego.

But I just have to say that I'm terribly disappointed in the Department of Energy. This isn't the first time. I voted against Abraham and I'm glad I voted against him. But you just breezed through this. You got people that are sick, two of them are right here. These people aren't feigning what they have. They didn't go out looking for someone, help me so I don't have to go to work anymore. And I think the Department of Energy has to get real about this and rather than brag about what they are doing now, talk about what they didn't do before.

We have people, for example, the contractors aren't—it's my understanding this starts with the—I think that's a New Zealand or Australian company, something like that.

Mr. RUNKLE. Nebraska.

Senator REID. No, I don't think so. Is it a Nebraska corporation? Well, Nebraska's not New Zealand, I'll tell you that. But anyway, I think that we just have to understand what has gone on in the past is something we have to recognize and not brag about you scored a touchdown. I think there's been some penalties that have been incurred in the past that we have to identify, and I just think that, I'm terribly disappointed in your testimony. I don't know what more I can say than to just say that.

And I say this about Mr. Taylor. I know that you're a company man and you should be, and I appreciate your courage in coming forward, and I know, having heard from not you but other people, people make fun of you, as you know, for coming forward, you're not a company man, why are you doing this. This is the pressure on people out there. I don't know if his career is going to be affected or not. I'm sure it's not going to be helped by his being here, but I want you to know how much I appreciate your courage in coming here. And I didn't agree with all your testimony, but I think your being here speaks volumes.

Mr. RUNKLE. Senator, if I could——

Senator REID. If I want you to answer a question, I'll ask you, okay?

Doctor, if I could ask you some questions here. How are we going to determine what exposure, if any, these people have had to this thing that's even more serious than silica?

Dr. VOGELZANG. Erionite is—frankly, I don't have the data, so——

Senator REID. Is there a way of getting it though?

Dr. VOGELZANG. Well, I would defer to Dr. Weeks. I think if the ambient air sampling can be retrieved, there are experts who can identify these crystalline fibers. Theoretically, I guess, those samples should have been retained. Is that correct? So if they're re-

tained, if they weren't adequately analyzed for erionite and mordenite, then they should be reexamined.

Senator REID. See, because I think we have an obligation to the hundreds and hundreds of people that work there, because if in fact we can go back and do some testing and find out maybe they weren't exposed to this, then that's a tremendous relief to people that they know that 20, 30, 40, 50 years from now when they're old men, mostly old men, some women, that they aren't going to get mesothelioma. Dr. Weeks.

Dr. WEEKS. I received some data from Mr. Runkle on erionite samples, and out of approximately I think 20 or so samples, most were negative and there were a couple that showed very low levels. But here's the problem. Erionite occurs in seams in the rock. So if you take a sample at any time, you may or may not. It's a hit or miss proposition whether or not you're actually operating in the seam where it is at the time, and most often you don't know whether you've been in the seam until you've gone through it, so it's ancient history at that point. So it's very difficult to get an estimate of what people were exposed to.

Senator REID. Doctor, if I could also ask you this, when we talk about these men here, experiences of sucking in large amounts of dust, some people sitting on the machines eating their lunch while they were working, it doesn't take, as I understand it, large gobs of this stuff to make you sick, it takes a tiny speck, is that right?

Dr. VOGELZANG. That's correct.

Senator REID. When I say a tiny speck, that's my language. Put it in medical terms.

Dr. VOGELZANG. Well, this is an ongoing debate in the legal community as to what is sufficient to cause mesothelioma. What I have basically said is it can take several months of exposure. I have patients whose exposure duration has been for 2 or 3 months; for example, a summer student working in tearing down a boiler. That was his only exposure and 40 years later developed mesothelioma. So I believe that it can be from short, intense exposure, and I think Dr. Weeks is correct. These seams may not have been identified as the cutting devices were going through. It's just difficult.

Senator REID. And also, as I indicated earlier, there's two books that I read and I'm certainly far from an expert, but they're "Fatal Deception" and "Libby, Montana". We now have even a third generation of people getting sick, children, grandchildren, as a result of they believe hugging their dad when he came home or digging in his lunch bucket or washing clothes. That's certainly possible also, isn't it?

Dr. WEEKS. We call that para-occupational exposure. Most of the para-occupational exposure has been to wives, although certainly the court system has identified children of asbestos workers to be at substantial risk.

Senator REID. It's my understanding, Dr. Weeks, that the DOE, through its memorandum of understanding with the Occupational Safety and Health Administration was responsible for endorsing whatever the requirements were for people breathing decent air, is that right?

Dr. WEEKS. As I understand it, the memo was with the Mine Safety and Health Administration.

Senator REID. Okay, I'm sorry.

Dr. WEEKS. A similar agency.

Senator REID. And there was no program in place, good, bad or indifferent prior to 1996 that you've been able to determine?

Dr. WEEKS. The first memo I saw was dated 1986. I don't know what exactly resulted from that. According to the memo, there should have been monitoring of exposure and so on; but as a matter of fact, the only data that I have from MSHA is post-1996.

Senator REID. In your review of these materials, did you see anything that some workers said that when they tried to wear some of these things that Mr. Taylor showed that they were criticized because it took much time and slowed down their work? Did you see any of that in your work, in your papers?

Dr. WEEKS. I've not encountered that.

Senator REID. Pardon me?

Dr. WEEKS. I've not encountered that.

Senator REID. I would ask Mr. Griego or Mr. Dean, did you hear of anyone or were you aware of criticism being made when people tried to wear these masks of people criticizing you because it slowed things down?

Mr. DEAN. No, sir.

Senator REID. Mr. Griego?

Mr. GRIEGO. Yes, but mainly it was management saying that things are slowing down.

Senator REID. Yes, and I am certainly aware of that. I perhaps didn't state that properly. In Dr. Chu's letter to my office, she said the Department believes approximately 1,200 to 1,500 workers were exposed. Now, Mr. Runkle, you say that 2,400 current and former workers have been contacted. This is twice as many as Dr. Chu has indicated in her letter. How come we now have you sending twice as many letters as she's noted?

Mr. RUNKLE. When we originally estimated the 1,200 to 1,500, that was the best estimate that we had at the time. That still stands as the number of people who were working underground from 1992 to present. However, in going back to some of the subcontractor units that had done work with the Yucca Mountain project, they provided the names of all of their employees, administration folks and others that were not working underground. To be conservative and to cover the entire picture, we sent letters to those people. We still have a few more that we're sending.

Senator REID. And also, I don't think anyone on the panel would disagree with this, it's not only the laborers, the operating engineers, the miners that were made sick. There were also people who were, for example, Mr. Griego, you were also behind, you weren't right up with the drilling machine, you were back because you had other work to do as I understand it.

Mr. GRIEGO. Well, part of our duties was to monitor the mining up front at the tunnel-boring machine head, so we were up there occasionally.

Senator REID. Okay. And how about you, Mr. Dean? Where were you? Were you close to the drilling equipment?

Mr. DEAN. Quite a bit of the time I was walking along the tunnel from the portal to the tunnel-boring machine. My job was to take care of the conveyor system, which also extended outside where the

muck pile dropped off. My basic job was to cover that whole area, but I would be reassigned to different areas as they needed me. As operating engineer, I worked extensive in alcove 5 in the heater drift and I did quite a bit of dry drilling along the tunnel in various points along the tunnel.

Senator REID. There were also people who were non-union members who were working for the contractor who were so-called supervisors or bosses that were wandering in and out of that project all the time, is that right?

Mr. DEAN. Yes.

Senator REID. Thank you. Mr. Weeks, without the use of water, what other methods of controlling dust could have been used?

Dr. WEEKS. Well, water is really critical for dust control, and in my opinion it's really essential to keep the dust down. And I understand that there are reasons not to use water, but there are very compelling reasons that water should be used. Now, the alternative methods are to use ventilation, a lot of it, and to have some dust traps or things of that sort which can be used on drills, but it's difficult to use them on mining machines or the tunnel-boring machines.

Senator REID. Especially when it's 25 feet in diameter.

Dr. WEEKS. Exactly.

Senator REID. Finally, Dr. Weeks, do you know of people being exposed to silica in other ways than mining activities? I really don't know the answer to the question.

Dr. WEEKS. Yes. People are exposed in construction. Sand blasters have a very high exposure level. People in iron foundries are exposed to silica.

Senator REID. Yes, and you mentioned that, okay.

Dr. WEEKS. People in foundries are exposed to silica as well.

Senator REID. Mr. Taylor, would you describe maybe in a little more detail your background. What makes you so knowledgeable about the problems? And I guess, why are you willing to come forward today, because no one forced you. You weren't brought here by subpoena.

Mr. TAYLOR. The main reason I'm willing to come forward today is because I don't ever want to see a contractor like we had before at Yucca Mountain. I feel that I owe that to the workers that are there now and future workers that may come forward. I just don't feel that we need that kind of outfit. We didn't need it then and that's the main reason I'm coming forward, because I don't want to ever see it happen again.

I'm no one special. I'm just a field industrial hygienist. What makes me special is, I guess, I hung out, I've been there for 9 years. I've seen 47 other people come and go, and it was my job to not only point out the hazard but to get the hazard fixed, to get the right engineering controls, work practice controls; but I'm not going to sit here and tell you that I'm somebody special. I'm just an ordinary field industrial hygienist who does their job.

Senator REID. Well, we can draw our own conclusions on that. Let me just say this, that I have fond memories of your dad. That was a tough business there. He was in it for many years, as was my brother. I have fond memories working. I never got a good shift, I always worked night shift. No one else would work those there.

Mr. TAYLOR. I think that's where I got my work ethic from.

Senator REID. Mr. Dean, you have indicated that your—in your testimony, your written testimony that you felt management was concerned about production and maybe too concerned to take time on sufficient ventilation. What—why do you say that? I guess my question is, why do you feel management put schedule and cost savings ahead of worker safety?

Mr. DEAN. Well, from the people that I have talked to in management, the walkers, the shifters who had traveled around, a lot of these people, they call them tramp miners because they go from one job to another, they didn't like working this type of government work. The money was good for them, but they were being watched too closely, but their attitude certainly was, I remember the bosses, the shifters, walkers, they would say, let's drive this tunnel. They wanted to make some hole.

They would get in trouble if a whole shift went by and there wasn't any production. If the machine would break down, everybody would group up and hurry to get it fixed. If you could hold it together with a piece of string on the night shift just to keep going, that's what we would do. We'd keep that machine going and they'd shut down on day shift to fix it. That was the big focus was on production and not safety.

Senator REID. You said that you as a worker there like the rest of the workers trusted the DOE to keep the workplace safe. Is that true?

Mr. DEAN. Yes, I did, absolutely.

Senator REID. You thought that the dust, if it were bad they would have told you about it.

Mr. DEAN. Yes.

Senator REID. Dr. Vogelzang, I'm sorry, I'm not the first one who's had a little trouble hearing but I'll get used to it, you heard, and I'm certain this is no medical diagnosis here, but you've heard what are the possible diagnosis that Mr. Dean has. He mentioned what they were. Are any of those compatible with silicosis and/or the other problem?

Dr. VOGELZANG. Yeah, I'm not a pulmonologist, but certainly the occupational lung diseases that exist. I was just looking at one of the chapters from one of the general medical textbooks, and this occurs in pottery workers and sandblasters, glass makers, foundry workers, silica miners, and stone workers. I mean, it's a very common thing to hear a story that people were exposed and then later on developed decreases in their pulmonary function tests and have X-ray abnormalities. So it's——

Senator REID. As Dr. Weeks mentioned, it's hard to comprehend that with a project that is so modern, with a borer, a big drill that will drill a hole as much as 150 feet in one day through this rock, modern technology at its zenith, that we're now trying to figure out why they let a disease that goes back centuries occur, so preventable. As you indicated, Dr. Weeks, silicosis is preventable, is that not right?

Dr. WEEKS. Yes, it is, that's right.

Senator REID. And I think in my mind you painted a very vivid picture there in some of your comments that here we have a brand new project but we're still talking about something that should

have been known 100 years ago, and we know because of some of the—from what a layman, Mr. Griego came up with, we know, he knows, but they knew about this before the project ever started, 10 years before the drilling actually started, and nothing was done about it. That's a real difficult situation.

Mr. GRIEGO. Senator, may I address the question about whether this project was—Gene Griego.

Senator REID. Oh, I'm sorry. I couldn't see you, Gene. Please go forward.

Mr. GRIEGO. I'd like to address the question about whether this project was a schedule-driven project.

Senator REID. Please answer.

Mr. GRIEGO. I got an independent management financial review of Yucca Mountain done by the Peterson Consulting Company. This report came out July 15, 1995, and I'll just read a short sentence of one of their findings: "The review team is concerned with the program approach, and an attempt to meet the 1988 technical and site solubility evaluation milestone will result in a de facto schedule-driven project. Furthermore, an aggressive schedule coupled with reduced funding levels may encourage risk taking to eliminate or inappropriately postpone the necessary level of scientific investigation."

Senator REID. Wow.

Mr. GRIEGO. I'd like to enter this document into the record.

Senator REID. Yes. We'll make sure that takes place.

[CLERK'S NOTE.—The information was not available at the time of publication.]

Senator REID. Well—and Mr. Griego is the one that, rather than you, Mr. Dean, that worked behind the tunnel-drilling machine during measurements of the location of drilling. He said that miners who drove the drilling machine were exposed to much more dust than he was.

Mr. GRIEGO. That's in the 1996 monitoring report, Senator.

Senator REID. I'm grateful to every one of you here for coming and I'm sorry if, Mr. Runkle, I was rude to you. I don't mean to be, but I have such a terrible distaste in my mouth for what the DOE has done here. This is a—and you're not personally responsible and I understand that, you have a job to do and you came here to put the best light on it you can and I understand that.

Let me close by saying that we have established here without any question that silicosis is preventable. We've established without any question that the asbestos-like fibers in this mountain that cause even a worse disease than silicosis should have been monitored, should have better records. It hasn't been done.

Silicosis as a hazard has been known for five centuries at least. DOE knew that it was in the area. As I've said before, when I first learned about this—because of my dad I've always been very aware of silicosis—I thought all kids' dads coughed like my dad at night. I can remember, and I've also said this on occasion or two before, there was a guy in Searchlight, his name was Monk, I don't what his name was, Monk. In the summertime when we would be outside a lot, you could hear him coughing all over town. You could hear him coughing. It was something I can't imitate because it's

not a real cough. It was just a terrible sound that this man did before he died.

So I've watched this closely, and there was a man, his name was McFarlane, wrote a number of books on Nye County, the Nye County commissioners hired him to do some historical work, and one of the things he talked about in his book is after Tonopah had been online, and Tonopah is just a short ways from where Yucca Mountain is, had been online for a while, they would not hire Americans, they only hired foreigners, because they knew they'd kill them in the mines. The silicosis was so bad in Tonopah that this history book recently written, that they—and the work that he did found that they wouldn't hire Americans, only foreigners, because I guess they didn't care if they died.

DOE ignored the threat for years and knowingly exposed thousands of workers to this. We can blame it on the contractors, and it certainly is their fault, but they were under the auspices of the Department of Energy. Many of these workers are now sick and dying. Many more will get sick, and think of the pain, emotional trauma that these people are going through, who aren't sick yet. Are they going to get sick? Are they really sick? The 2,400 notices you've sent out, some of them are like most of us, they don't want to know. They're not going to return that stuff. They're feeling okay now and maybe they smoke too much or maybe that's why they're breathing too hard and they're not going to go forward and find out. That's what's going to happen to a lot of them.

As a legislator in Congress, I'm going to do everything I can to see what we can do to move forward on this. What has taken place here is just absolutely wrong. This record will be open for 7 days, and if there are other questions that I come up with, I'll submit these to you and if you would be kind enough to get the answers back as quickly as possible.

I'd like to also acknowledge my staff, who has done a wonderful job helping me prepare for this. Drew Willison has been with me for a long time now and he's my person on the Subcommittee of Energy and Water and does a wonderful job. On my Senate staff, Sarah Mills, she's done a wonderful job doing the writing up, getting this ready for us.

I hope that those people who have been watching and in the sound of my voice understand that our concerns about what has taken place at Yucca Mountain is not some knee-jerk reaction, that we're just making all this up. This is an indication of how the Department of Energy has treated the State of Nevada and has treated the people that work at Yucca Mountain. They're just pawns. They're there for the big utilities so the big utilities will leave them alone and get this hole dug in the mountain so that they can get this poisonous substance out of their back yard into our back yard and haul it sometimes as much as 3,000 miles along the highways and railways of this country to bring it here.

CONCLUSION OF HEARING

I predict it will be never be done. After September 11, how are we going to allow the most poisonous substance known to man to be hauled by our schools, our businesses, our homes, and our churches. I just don't think it's going to happen. I don't think the

public will stand for this. But in the meantime, we're spending billions of dollars to satisfy the utilities, and as a conspiratorial party to this has been the Department of Energy now for many years.

This hearing is now in recess.

[Whereupon, at 11:30 a.m., Monday, March 15, the hearing was concluded, and the subcommittee was recessed, to reconvene subject to the call of the Chair.]

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