National Institute for Occupational Safety and Health (NIOSH)
SEC Outreach Meeting for Nuclear Metals, Inc.

Meeting Date: Wednesday, March 14, 2012, 4:00 p.m.

Meeting with: Former Workers from Nuclear Metals, Inc., Concord, Massachusetts (First of three meetings)

NIOSH Team:

Samuel Glover, PhD, National Institute for Occupational Safety and Health (NIOSH) Division of Compensation Analysis and Support (DCAS), Health Physicist

Joshua Kinman, NIOSH DCAS, Special Exposure Cohort Petition Counselor

Edward Scalsky, Oak Ridge Associated Universities Team (ORAU), Health Physicist

Vernon McDougall, Advanced Technologies and Laboratories International, Inc. (ATL), Outreach Project Manager

Mark Lewis, ATL, Senior Outreach Specialist

Mary Elliott, ATL, Technical Writer/Editor

Also Attending:

Bob Barton, Sanford Cohen & Associates (SC&A), Health Physicist

Proceedings

[Name and identifying information redacted] of Nuclear Metals, Inc. (NMI) opened the meeting at 4:15 p.m. He stated that two former NMI workers had filed a special exposure cohort petition with the National Institute for Occupational Safety and Health (NIOSH) on behalf of their coworkers. [Name redacted] explained that he had become involved in the meetings at the request of the NIOSH team. He commented that he felt an obligation to help his former employees and friends.

[Name redacted] introduced Vernon McDougall of Advanced Technologies and Laboratories International, Inc. (ATL), a contractor that helps NIOSH with outreach related to the Energy Employees Occupational Illness Compensation Program Act (EEOICPA). Mr. McDougall introduced the NIOSH team.

Mr. McDougall asked permission to record the meeting. He explained that Mary Elliott would use the recording and her notes to draft minutes of the meeting that will eventually be posted on the NIOSH Web site. The attendees indicated their consent. Mr. McDougall explained that the published minutes would not include any personal information that could identify the speakers.

Dr. Glover stated that NIOSH asked for the meeting to gather information to help evaluate a SEC petition for Nuclear Metals. Dr. Glover added that classified information should not be discussed during the meeting, but that NIOSH can arrange for private, secure interviews with anyone who has that type of information.

Mr. McDougall stated that Congress passed the Energy Employees Occupational Illness Compensation Program Act (EEOICPA, or the Act) in 2000 to compensate people who had become ill from their work in the nuclear weapons complex. He explained that because of the work that Nuclear Metals did for the government, the facility is classified in the law as an Atomic Weapons Employer (AWE). Under EEOICPA, the attendees are eligible for compensation for cancers related to occupational radiation exposure and for beryllium disease. The Act does not provide compensation for AWE employees for illnesses caused by occupational exposures to other toxic materials, such as solvents or asbestos. NIOSH only deals with the part of the law that compensates for radiation exposure.

Mr. McDougall explained the roles of several government agencies in EEOICPA:

- The Department of Labor (DOL) receives and verifies claims, and then forwards cancer claims to NIOSH for dose reconstruction;
- NIOSH performs dose reconstructions, produces site profiles, and evaluates petitions for the SEC; and
- The Advisory Board on Radiation and Worker Health (ABRWH or the Board) oversees the work of NIOSH and advises the Secretary of Health and Human Services on petitions for adding new classes to the SEC. The Board members are appointed by the President.

Mr. McDougall stated that the benefit is $150,000 and medical expenses if NIOSH does a dose reconstruction that finds that the employee's cancer is likely to have been caused by their workplace radiation exposure. When NIOSH calculates a worker's dose, they use the worker's personal occupational exposure data and other data about their work. Since there is not sufficient data for some sites to accurately reconstruct the workers' radiation doses, NIOSH has a Special Exposure Cohort (SEC) petitioning process to allow workers those sites to be compensated without having dose reconstructions.

Mr. McDougall stated that NIOSH is currently evaluating the SEC petition for Nuclear Metals from 1958 to 1983. If NIOSH finds that they do not enough information to accurately reconstruct radiation doses for all members of the petitioned class, they will recommend to the Board that Nuclear Metals should be added to the SEC. The Board will decide whether or not they agree with NIOSH and, in turn, make their recommendation to the Secretary of Health and Human Services. Based on the Board's recommendation, the Secretary will decide whether to designate the class to the SEC and send it to Congress for their consideration. If the petition is successfully added to the SEC, then dose reconstruction is not required for these NMI workers in the class if they have one or more of 22 specific radiation-related cancers.

Worker 1: How is that going to happen?

Mr. McDougall: NIOSH will make a recommendation based on whether or not they have enough information

Worker 1: Those film badges, those dosimeters… You're not going to be able to use those. I was working in the foundry 14 hours a day and we were making good money. Workers would take their dosimeters and tap them down so they could keep working overtime just so their readings would not get too high. My hands were contaminated to three times the Nuclear Regulatory Commission (NRC) limit when I worked in the foundry because they would not give us more gloves.

Mr. McDougall: That is why we are here. A petition has been filed to add workers from Nuclear Metals to the Special Exposure Cohort for certain years. NIOSH will make a report and submit it to the Board. The Board will vote on whether or not to add Nuclear Metals to the SEC. If the vote is favorable, eligible workers will not have to have a dose reconstruction if they have one of 22 cancers.

Mr. McDougall introduced Mr. Scalsky and explained that he had a series of questions to ask the participants about their work at Nuclear Metals.

Mr. Kinman explained that his job as the SEC Petition Counselor at NIOSH is to serve as a point of contact to assist people who have questions about filing a petition, or need help during the petitioning process. He stated that he had brought a handout with information on the status of the SEC petition.

[Name redacted] commented that he and [name redacted] had submitted the SEC petition for Nuclear Metals to NIOSH. He stated that he wanted to help NIOSH gather information that may help a class of NMI workers become eligible members of the SEC.

Mr. Scalsky called the attendees' attention to a handout containing discussion topics for the meeting. He stated that the purpose of the meeting was to help NIOSH gain a better understanding of the workers' perspectives on the operations at Nuclear Metals, not only to help in the evaluation of the petition for NMI workers from 1958 through 1983, but also to improve the data used in the dose reconstruction process. Mr. Scalsky added that the discussion may also help the attendees to have a better understanding of the dose reconstruction process.

Mr. Scalsky described the background information that NIOSH has about Nuclear Metals, beginning with the Manhattan Engineer District (MED) research work that was done from 1942 through 1946 at the Massachusetts Institute of Technology (MIT), mainly melting and casting uranium. The work for the MED, and later the Atomic Energy Commission (AEC), continued at the Hood Building at MIT from 1946 through 1958. Nuclear Metals, Inc. was established as a private company to assume the contract work in 1954 and remained at the Hood Building until 1958. NMI built a new facility in West Concord for special metals production and research and development (R&D). The new facility was occupied in March 1958, with processes beginning in October 1958. NMI transferred both the work and the equipment from the Hood Building to the new facility.

Mr. Scalsky stated that NIOSH has hundreds of documents to review for information on Nuclear Metals. Some of the documents indicate that NMI used low-level radioactive materials. He has not seen documents indicating the presence of other materials besides depleted uranium,

enriched uranium, and thorium. NIOSH would like to have a better understanding of the materials that were present at the facility. NIOSH is still searching for information about when NMI started working on reactor fuel elements and on the depleted uranium penetrators for the DOE and the Department of Defense (DOD). Mr. Scalsky added that there is already a class in the SEC of workers who worked at the Hood Building from 1942 through 1963.

Worker 2: Are you saying that you have no documentation on enriched uranium at NMI?

Mr. Scalsky: We have some information, but we have not yet gone through all of the documents that we have.

Worker 2: We worked with enriched uranium extensively. The company had to keep it separated so that it would not go critical.

Mr. Scalsky: That could be classified work.

Worker 2: No. We did not stop enriched uranium work until 1972 or 1973, when we completed a job for Argonne National Laboratory. We worked with enriched materials for Savannah River, Hanford, Argonne National Laboratory, and France.

Dr. Glover: When did that start?

Worker 2: It was going on when I joined the company in 1955. They started doing that work in the 1940s. The first fuel elements for the Stagg Field reactor were made at Nuclear Metals. The first fuel elements installed at Hanford and at Savannah River were made at Nuclear Metals. The production processes for making the fuel elements that were developed at NMI were installed at Hanford and Savannah River. Those all involved enriched uranium. With all of the documentation that you say you have, I am surprised that you do not have that information. Most of our work was not classified.

Mr. Scalsky: The information is probably there somewhere. We just have not gotten to it yet.

Worker 3: I submitted a list of the contracts that was compiled by [name redacted], who started working in the late 1970s. I was able to go back to about 1970 with the list, mostly for the CP-5 fuel element work for the Savannah River Site.

Worker 2: Is it appropriate for me to interject when I have information?

Mr. Scalsky: That is the kind of information that we are here to get from you. It will help us in pursuing the other documentation that we need.

Worker 2: We also did enriched uranium fuel for the IBC up by Detroit.

Mr. Scalsky: The specifics of any of these jobs would be very helpful. It would be helpful to know the timeframe in which they took place.

Dr. Glover to Worker 2: Would you be willing to write a brief summary of what you recall? It is really important for us to understand the thorium work. Enriched uranium is different because the methods for thorium are mass based. Usually they are based on uranium and urinalysis. That is not a really good way to do enriched uranium. Whole body counting needs to be checked to make sure that enriched uranium is fully accounted for, as well as thorium. I know that there was a broad group of radionuclides at the Hood Building, and some of that work transferred to the Concord facility.

Worker 2: Do you want that information during this visit?

Dr. Glover: You can mail that to us.

Worker 2: I need a chance to talk with some of the other workers so I can get that information.

Worker 4: I started working in 1973. I worked on the very tail end of the CP-5 job for about three months. I was in the department with [Name redacted] in joining and priming (inaudible). Four of us worked on that program full time. I put the elements together before extrusion and did the radiographs. I also did the visual and dimensional inspections. [Name redacted] kept track of all of the components in buckets that were chained to the fence out back. The tubes were segregated. There were a maximum of about a dozen in several areas throughout the plant and we kept track of where they were on a map. I was in the fabrication department for about three months before I went to quality control (QC). The last CP-5 job ended in August 1973. I worked on the last tubes that came out of there. I figured that it was a business decision by management at the time.

Worker 2: The CP-5 reactor was at Argonne National Laboratory. We got out of that work due to a change of ownership of NMI. We did not think that it was the place for highly enriched uranium work to be going on. By that, I mean in the plant and in Concord. We wanted to concentrate on other things. We petitioned the Nuclear Regulatory Commission (NRC) to cancel the enriched uranium license, but the NRC would not grant the request even though we had no more enriched uranium in the plant. We concluded that they wanted us ready in case there might be some special classified work that required our unique capabilities in the future. We did not fight them on that. If I write something up, I will write about enriched uranium chips and a hacksaw.

Worker 4: I degreased the chips, weighed them, and then put them into buckets. I had to be very careful that the chips did not get on the floor.

Dr. Glover: Did you burn the chips?

Worker 4: No, but I compacted them into pucks.

Worker 3: The reason why it important to have documentation of the work with enriched uranium and thorium in the 1950s, 1960s, and 1970s is that there was the potential exposure from the residual contamination of the process equipment to workers after that timeframe who had no knowledge of the work with those materials. Is there any data that documents the residual contamination? I do not think that there is.

Worker 4: We hung the dies that were used to extrude the materials from a big crane so we could clean them with a wire brush. We did not use a breathing apparatus when we did that.

Mr. Scalsky: So, the fuel element work started very early in the process.

Worker 2: Yes. The first fuel elements were for the Stagg Field reactor. From that time on, fuel element work continued in Concord for several years, even though we stopped the enriched uranium work.

Mr. Scalsky: When did the work start for the depleted uranium penetrators?

Worker 2: The first thing may be classified. I'm not sure that people know about it. The research work probably started in the late 1960s or early 1970s. NMI did not get into the production work until the mid-1970s, but there was penetrator work going on in the 1960s.

Mr. Scalsky: We know that you did a lot of work with depleted uranium. We know that NMI produced 500,000 rounds per month on the GAU-8 line; 350,000 20-millimeter (mm) rounds per month on the phalanx line; 8,000 120-mm rounds per month; and also 110 tons of steel powder per month. Was there any other work done with depleted uranium within the penetrators?

Worker 2: [Name redacted] will be here tomorrow. He once compiled a list of all the depleted uranium work. I do not know if he still has that, but it was a list of several hundred applications for depleted uranium – Boeing aircraft, military aircraft, medical collimators...

Worker 5: Counterweights for the airplanes, seeker bars, photocopiers…

Worker 1: We also made the armor covering for the M1A1 tank – the extrusion of depleted uranium sheet metal to protect our tanks from armor-piercing bullets.

Mr. Scalsky: A list of those jobs and when they were done would be very helpful.

Worker 2: There were literally thousands of jobs.

Worker 3: Conway's with the oil industry…

Worker 2: We worked with the oil industry for a long time, developing shaped charges that allowed them to dig deeper. Some of those are probably still down in some holes around the country. That was unclassified. We were into all kinds of applications for depleted uranium.

Worker 3: We submitted a marketing video with the petition that includes photographs of some of those commercial applications.

Worker 2: We made a lot of the metal for the tank armor applications, but not all of it. Eventually, for reasons that were best known to them, they came to us for the quality that they needed. We made thousands of pounds of metal for the tank applications. Other jobs were classified.

Worker 1: I made a list of things. Back in the late 1990s or early 2000s, I read an article in the Harvard Journal in which [name redacted] denied having trichloroethylene (TCE) on the property. That was not the case. There were 55-gallon drums of TCE on the property. We used it in the rep department to clean parts. When they put the new building on the west side, there was a quench tank with TCE. There were heated vapors from the process. There were no ventilation ducts going from that quench tank to the ceiling. Those vapors went up to the roof and then through the roof vent.

When I worked in the foundry, we rinsed the mops in the sinks after we mopped the floors. That rinse water drained from the sinks into a holding pond behind the building. Then they took out the sinks, so we used water that came out of the cooling tubes from the furnaces and into the cooling trays to fill the buckets. After we finished mopping, we rinsed the mops there so that the rinse water went back out to the pond.

When I started working in the foundry, they told us that we could eat ice cream on the towers. [Name redacted] worked there forever. He always ate his lunch on the towers.

When we pulled the crucibles out of the furnace, they were so red hot that you could see through them. We worked double shifts so we could do two melts per shift. When we pulled the hot crucibles up, we put them into a tray like this. One day, [name redacted] slipped and wrapped his arms around one of the red hot crucibles, and that's how we found out that there was thorium in the building. None of us were ever told that there was thorium in the building until after [name redacted] was badly burned. That was in the 1980s.

We were on I-beam towers. The steel tanks were on the bottom and the blast furnaces were on the top. We lowered the crucibles down off the towers and onto the cement floor. They were never covered. The smoke billowed out of the hot crucibles – all the way to the ceiling, all through to the rep department, and all through the foundry. Then they found out that the crucibles should have been covered. After they started covering them, we had to take a double-handed clamp and reach in there to pull the cover off – and the smoke would billow out of there.

Worker 3 to Worker 1: We submitted a video with the petition that [name redacted] gave us of the operation that you just described. The video clearly showed the violent reaction when the stream from the water spritz bottle hit the underside of the furnace lid.

Worker 1: It was like a chip on fire. That was one of those "need to know" things.

Worker 2: I want to make an observation about what has been said – and I do not mean to dispute anything that has been said. I first joined the company in 1955 as a corrosion technician. I worked on the corrosion of beryllium, zirconium, thorium, and uranium, which we tested in 650° Fahrenheit (F) water and in 750°F steam. Those were accelerated tests to determine what would happen to materials that were burning in a reactor. Thorium is much more corrosive than uranium. But, my point is that our work with thorium was not classified, so I'm surprised to learn that someone did not know that we were working with thorium. There were no management restrictions or classified programs. I know of other work with thorium as well that may be of interest. I know that it sat around at the company for long periods of time. It oxidizes more

quickly than uranium, so there would be a yellow-tannish color and a flakiness on it, where uranium is a darker color when it oxidizes. [Name redacted] can speak about that more tomorrow. He was responsible for moving everything from Cambridge up to Concord. He tried to get the AEC to take the thorium back since it was government material, but they ignored his request for years.

Dr. Glover: Since we are talking about thorium, did you do radon measurements? Thoron is radon from thorium. It a very short-lived radon, but it is one of the daughter progeny.

Worker 2: You could talk to [name redacted] about that. [Name redacted] also gave me his telephone number.

Worker 1: They told us that thorium was a daughter product of all the uranium that we were working with.

Worker 2: We had thousands of pounds of thorium.

Worker 1: We were melting down the greensalt from uranium-234.

Dr. Glover: When uranium and its impurities are heated, its short-lived daughter progeny go to the surfaces. There is thorium in natural uranium (U-234).

Worker 1: That is how they found the thorium when [name redacted] got burned.

Worker 3: We processed thorium metal in the late 1960s and 1970s.

Worker 1: [Name redacted] brother lost his lung from shoveling beryllium oxide before we worked there.

Worker 2: I think that was true in the early 1940s. Beryllium oxide was dumped off at MIT. It was about a decade or so later before they found out about that. That was back in the Cambridge days.

Worker 1: It was inside the thermocouples in our furnaces, too. We had to re-brick the furnaces because it was a pain in the neck to get to the wires. We had to pull them out to re-thread them. We had to climb inside 20-inch cylinders to re-brick the furnaces and drill holes so we could wire the new thermocouples. We wore Tyvek suits when we did that.

Dr. Glover: NIOSH's role in EEOICPA is to reconstruct the radiation dose. We can only consider a worker's radiation exposure. DOL administers a separate part of the program – Part E for beryllium and chemical-related exposures. Those are not included as part of NIOSH's decision making. I appreciate your concerns with chemical exposures, but it would be most helpful to this evaluation if we could focus on the radiation aspects of the work.

Worker 5: Would there be possibility of cross-contamination of the areas from using the same tools that were used on contaminated machines, or from traffic going from one area into another? He mentioned mopping the floors.

Worker 1: In the shoe changing area, we took off our "hot" shoes and put our other shoes back on before going to a clean area.

Worker 6: But we were stepping on chips…

Worker 1: There was cross-contamination. Workers wore their contaminated clothing into the locker rooms when they went to the restrooms and to the showers.

Mr. Scalsky: Later on, we will talk about whether any surveys were done.

Worker 6: They had air monitors and film badges all over the buildings. I have a couple of things that I want to say. We had a burnout in the reduction area one time. There was a fusion process going on in the steel vessels with the greensalt and the dolomite. We did so many of them that one day, it burned a hole through the steel crucible. They shut us down because the radiation readings were way off the wall. A few days later, they had us go in to wash the walls, but only as high as we could reach. I don't know if that building was ever cleaned beyond that. There were people still working in there after that.

Mr. Scalsky: Is there documentation of those radiation levels?

Worker 6: I have no idea.

Dr. Glover: We categorized what we have into certain areas where we need more information. We want to understand what actually happened from the worker perspective versus the written documentation. It will help us as we go through our notes as we talk about the UF_4 and some of the other things. Would it be all right if we do that?

Worker 6: May I just say one thing first? I don't know exactly when the burnout happened, but I was there through the whole thing from start to finish. It almost went through the roof. In the crucible, first there was the greensalt, then the dolomite on top of that, and then the graphite on top of that and (inaudible) with steel. That went out of the furnace and then kept on going, almost to the roof. (Inaudible) but from me to you, I wouldn't be able to see you. That whole building had to be glowing by the time the smoke cleared.

Worker 3: That was in the reduction area in about the 1979 or 1980 time frame.

Worker 2: The reduction area was where they converted the greensalt (UF_4) to uranium metal.

Dr. Glover: So it was a thermite reduction…

Worker 5: They are talking about the operation described in my affidavit. The work would go on for hours into the evening before Safety would come in to give people their respirators, or to do swipes. There were hours and hours of overtime work in that department in particular, when there would be no measurements. You would pick up your badge, but be breathing the air (inaudible).

Worker 1: And no respirators. We had a crane to pick up the 375-pound lid that was like a flat circular plate. Sometimes we would have to roll it along the floor from one place to the other if we were really busy. Everybody loved working there because the money was good back then. There was unlimited overtime. Sometimes I worked 14- hour days: eight hours in QC and then six hours in the foundry. We would work from 4:00 p.m. until midnight on Friday, and then come back in at 6:00 a.m. on Saturday and work until noon. Then I would work hours on Sunday from 6:00 a.m. until noon.

Mr. Scalsky: We will talk about the work schedules and the overtime later on.

Dr. Glover: We're talking about UF_4 right now. We want to make sure that we have the timeframes right. Mr. Scalsky has listed that the UF_4 work was in the 1970s. It sounds like it went back further than that.

Worker 6: I started working in 1980.

Worker 7: In the mid-1970s, we were producing the material in-house in large quantities. There may have been some experiments that preceded that. Up until then, we were buying our metals from Tennessee Nuclear Specialties. That was when we were using 300-pound ingots. Our competition was smart enough to buy them out, which limited our access to Tennessee Nuclear. So we had to develop those specialty metals in-house.

Mr. Scalsky: But you got the UF_4 from the government, right?

Worker 7: Yes.

Worker 3: During the 1981 to 1982 timeframe, Carolina Metals, Inc. (CMI) came back online in Barnwell County, South Carolina. The reduction operation was transferred from Concord to CMI.

Worker 7: I was part of the team that developed the reduction technique, which required many visits to other places to learn the technology. The first reduction that we did in-house was a disaster. The process has been described by these fellows, but this was before they worked at NMI. The whole building was full of smoke. The flames shot up to the roof. There was a thermite reaction. It was very hot – nobody really knows the temperature. There was gas and smoke all over. I'm sure that I ate it and breathed it. There was no way to measure that at the time.

Worker 3: When did CMI start up?

Workers 2 and 5: That was in 1984.

Dr. Glover: Was the UF_4 associated with depleted uranium or natural uranium? Or did that also include enriched uranium?

Worker 7: It was mostly depleted uranium, but we discovered later that some fission products from spent nuclear fuel rods may have been added to the depleted uranium used for bullets.

Worker 3: DOE disclosed in 1999 that they were recycling spent fuel rod material into uranium. This turned up when they recovered some GAU-8 bullets from the (inaudible) conflict. They found fission products in the GAU-8 bullets. The only way that the fission products could have gotten into the depleted uranium stream was from this recycling effort that DOE was doing from the 1960s through about 1976. So, there were isotopes in the depleted uranium that we didn't even know were there when we were processing this. I don't have any idea what kind of hazard that presented. DOE did not disclose that to NMI until 1999. We had no clue.

Mr. Scalsky: You have no idea when that started?

Worker 3: No.

Dr. Glover: DOE started recycling uranium in 1952.

Mr. Scalsky: When did you start getting the UF_4?

Worker 3: Apparently from the beginning until 1976. It was in the government inventory. NMI was the largest consumer of that inventory. Obviously, it turned up in the GAU-8 bullets and we were the largest producer of the GAU-8 bullets as well. There is a high probability that it went through our plant.

Worker 2: We were told by the government that it would potentially be 26 million pounds a year. We were licensed for 5 million pounds for NMI. I'm not sure what the quantity was for CMI. We were responsive to that potential need.

Dr. Glover: Several of the people here worked at the gaseous diffusion plants, so they are very familiar with the potential for the transuranic elements – technetium, etc. – coming from the recycling program. Most of the uranium in the stockpile after 1952 was recycled, so essentially, it went through the reactors many times. There certainly would have been plutonium and other things in the recycled uranium. They have a known level, but you have to be careful when the chemical processes can concentrate like they did at Paducah. That is something that we need to pay attention to.

Workers 3 and 5: It looks like it was around until the 1983 to 1984 timeframe. Then the area was turned into the heat treating area for the penetrators.

Worker 1: The NRC made its appointment to come in two weeks ahead. Then we would start cleaning and covering everything that was supposed to be cleaned and covered the whole time we were there. It was a total joke. When the NRC left, it went back to normal.

Worker 2: The NRC also made many unscheduled visits. The State people made unscheduled visits. The Army made unscheduled visits. The Navy made unscheduled visits. The Marine Corps made unscheduled visits. We had about 4,000 different inspections. Every government contractors was required to inspect us on their own, independently from the others. We worked with many companies. I'm not disputing what [name redacted] is saying because he worked in

foundry. There may have been occasions when the NRC notified us two weeks in advance, but they usually just dropped in.

Mr. Scalsky: I have seen a lot of the NRC inspection reports.

Worker 3: Can we backtrack for just a second? My first go-around with Nuclear Metals, the material that we got from East Tennessee Specialties was extruded into rod stock, machined, extruded, etc. But my point is that we don't know if it was depleted or what. We don't know how radioactive.

Worker 5: If the engineers didn't know, what chance did the workers have?

Mr. Scalsky: The UF_4 came in drums, was emptied into the blender, mixed with magnesium granules, transferred to a bomb, capped with graphite, and slowly heated in a pit furnace. After cooling, the bomb contents consisted of a layer of magnesium fluoride and a depleted uranium derby that weighed approximately 1,800 pounds. When the drums of UF_4 were emptied into the blender, the material could get on the floor, so it had to be shoveled back into the blender. Did that create an airborne situation for you?

Worker 7: It certainly did. I don't know how long-lasting or how temporary it was. Putting the greensalt into the blender was like pouring a cup of coffee. It goes wherever it wants to go.

Worker 1 to Worker 7: Was [name redacted] working with you when he was covered with greensalt that day?

Mr. Scalsky: Let's go back to the depleted uranium penetrator process. There is a listing of the process that took place: the melt, forming the billet, extruding the rods with copper and pickling to get the copper off, the outgassing, the machining, the straightening, the aging, and the finishing. In those particular processes, which would create airborne conditions?

Worker 7: Machining and transferring the machine chips. Collecting the chips, moving them through the (inaudible) without them reacting.

Worker 3: In the pyrophoric processes.

Worker 2: There were occasional small fires with buckets of chips.

Worker 3: Pickling was pretty straightforward. There were NOx emissions. We went to NLO to look at how they were handling it. We ended up getting urea with nitric acid pickling solution. The urea was introduced into the scrubber and that absorbed the brown NOx fumes. There were occasions when the temperature of the pickling tank got a little out of hand. The rough rule of thumb is that for every 10°C of temperature, you double the reaction rate. It could really get aggressive. When it did, there were a lot of brown NOx gases given off. We eventually implemented the urea addition to the scrubbers to deal with that issue.

Mr. Scalsky: How about in the machining?

Worker 1: I worked in the acid area for a while. We got to the point where we were making bigger and bigger derbies that didn't fit in the acid tanks. We took a beaker of nitric acid solution and dumped it on the top of the whole derby. It is a little scary when you see sparks come off the derbies when you have a glass beaker of nitric acid in your hand.

Worker 7: Let's get back to the machining. There was a big learning curve during the really high production times. The early days at the Hood Building and at Nuclear Metals were mostly R&D. We got into the penetrator business – you read the numbers – hundreds of thousands so we had to go on to high-speed machine equipment. We had CNC lathes, which produced many, many tons of chips. When we got up into the high-caliber jobs, I would estimate six pounds of chips per penetrator. All of this was pyrophoric. We machined in enclosures that were vented and we used refrigerated coolant to keep the temperature down. We had conveyors to move this stuff to an endpoint, which was also flooded with coolant. Then quickly, and on a regular basis, move this out to a Butler building and put the (inaudible), which is a whole other story. We had fires, and sometimes all we could do was watch them burn. If you submerged it in water, it decomposed the water.

Worker 3: Grinding sludge in particular. If you would see it glowing under water, you knew you had to run for the hills. It was about to detonate.

Worker 7: It was a learning curve – a very steep learning curve.

Worker 1: One time, a spark from a forklift ignited a 55-gallon drum.

Worker 8: I recall an occasion when I was grinding penetrators and they were cooled by coolant. There were times during that process when the machine would dry up. There would be chips just sitting there until the next person started the operation.

Worker 5: There was a shearing operation where the extrusion rods were cut. I don't recall that being vented. Then a favorite overtime slot was breaking the ticks off the ends of casting parts from the CAF line. There was a lot of surface oxidation on the pieces. There was another with the phalanx penetrators and it was a spinning thing in the cleaning area. It was good overtime.

Mr. Scalsky: Did you wear respirators during any of those operations?

Worker 5: I don't remember.

Worker 1: Not to my knowledge.

Dr. Glover: What we want to put into perspective is if the dose could be measured. There could be a tremendous dose, but if we can measure it there isn't going to be an SEC. A high dose doesn't make an SEC. Dose that I can't figure out is what makes an SEC. We want to make sure that we have identified the high air concentration areas. We want to make sure that we have monitored the highest exposed personnel – and that we can make sure that those high exposures are dealt with. The perspective is: What are the high areas? Did people move around? Those are the questions that Mr. Scalsky is trying to answer here.

Worker 4: I was in charge of the inspection area. We cut chem samples with a saw. There was coolant and there was a vent. We used to pull (sounds like) tensiles. We had a laser marker to mark the samples. But the big thing was quality. I definitely respect the fact that some of the other departments were a lot more dangerous than quality, but we literally handled the uranium. Some of the guys would sit there and do hundreds of inspections in a 12-hour period. They would literally be holding uranium in their hands for six or seven hours a day. I was an inspector at first, and I used to inspect GAU-8s with a cigarette hanging out of my mouth and a cup of coffee. All we had was a film badge. What I'm driving at is that there were hours and hours every day when we handled depleted uranium without gloves or respirators. It was nothing like breathing the smoke in, but we were definitely being exposed.

Worker 1: There were baskets of bullets. I was inspecting 300 bullets per night. We held them in our hands and rotated them to look at profiles and angles and to take measurements. It was all hand work. We didn't wear gloves.

Mr. Scalsky: Let's go back to the thorium for a minute. We haven't found a lot of details about the thorium work. There are still hundreds of documents that we have to go through. [Name redacted] mentioned that he was familiar with three thorium jobs: the billets from Tennessee Nuclear Specialties for rod stock, the billets that contained thorium powder, and the thoriated tungsten welding rods. What were some other thorium jobs that you did?

Worker 7: There were thoriated tungsten electrodes that were re-machined into a (sounds like) careful configuration regularly. There were powder-making machines.

Worker 1: There were straw-sized thorium tubes. Remember those?

Worker 5: Those were transition rods.

Worker 2: There was more thorium work than that. Thousands of pounds of thorium were moved from Cambridge to Concord. [Name redacted] was in charge of that and he may be able to provide documentation. I have seen the documentation between AEC and Nuclear Metals in the past. I don't know exactly what the work was but there was material that stayed around for years after we moved to Concord – on the floor, by the stockroom. Eventually, it was buried on the property and they had to dig that material up. I assume that the people who dug that up can provide you with the details. They found barrel after barrel of that stuff.

Worker 3: Tomorrow [name redacted] will be here. He was a health physicist with the company in the 1980s. There are two ways to detect thorium – fecal monitoring and whole body counts. When [Name and identifying information redacted] of Health & Safety there was no fecal monitoring. We had limited experience with whole body scanning. [Name redacted] had a whole body scan. [Name redacted] can tell you that the whole body scan didn't look for thorium.

Worker 7: Whole body scanning took place much later.

Mr. Scalsky: I know that you received a lot of thorium at the plant.

Worker 7: It was a different source of thorium. The volumes that they dealt with that predated our work there were huge in comparison to the distillation products that you dealt with in the foundry. But the residual contamination from that thorium was potentially still there.

Worker 1: I worked all over that place – QC, the CAF line, the reduction area, the foundry.

Worker 3: Tomorrow, between [name redacted] and [name redacted], you should be able to answer that.

Mr. Scalsky: There is a diagram of Nuclear Metals in the handout. Buildings A, B, and C were built in 1958; Building D was built in 1978; and Building E was built in 1984. The Butler buildings are not on the diagram. There are four Butler buildings that were built at different times during that period. Building A housed the laboratory space: chemistry, metallurgy, applied physics, and other laboratories. Building B contained the boiler room, the electrical switch room, the clinic, the cafeteria, and the locker rooms. Apparently, they stored some depleted uranium in the hallways at that particular time. Building C was the foundry and that had all the processes in there: the melting, extrusion, metalworking, rolling mill, swaging, grading, blending, pickling, and etching. That was the heart of the process. Building D had some copper removal, the pickling, the rod straightening, the aging, and machining. And Building E was added later to provide additional space for finishing and QA. There was storage of materials. There was liquid waste treatment. There was processing of waste material for shipping. The foundry had a lot of potential for airborne contamination. Have we missed anything?

Worker 8: The steel rep area was adjacent to the foundry.

Worker 7: There was a second floor mezzanine in Building C.

Worker 5: The CAF line was on the mezzanine. The shearing operation that I talked about was on the mezzanine above the machining area.

Worker 1: If you walked out of the foundry and through the steel doors, that was the acid area.

Dr. Glover: Were people restricted from going into other areas of the plant or could they go wherever they needed to go?

Worker 3: That was different at different times. In the early days, it was free reign.

Worker 1: Sometimes it was 'need to know.' You had to have permission to go into the restricted areas.

Worker 7: There were clean areas for processing certain powders like titanium. The entry into these was regulated by protective equipment such as shoe covers.

Worker 3: There was a period of time when the mezzanine had unrestricted access. If I needed to see someone in the heat treat area, I could just walk right up. It was an evolutionary process. The controls were put in place over time. It's safe to say that when we completed Building D in 1983, we were able to put in traffic controls. We installed hand and foot monitors. At that point,

all employees came and went through a single access in Building D. That helped make the entire plant restricted access separate from the office areas up front. The few labs that remained in Building A were not restricted until they put a change area in the labs in the late 1980s. Up until that point, the employees who worked in restricted access areas would change their shoes and join [name redacted] in his chem lab to eat their lunch or have a snack or coffee at break time.

There were a lot of changes from 1983 to 1985 when we were in peak production. Up until that time, there was no tight control of the traffic pattern because there wasn't a smooth flow of material through each production process. Many times, the material would go up to QC on the second floor to be inspected and then come back down to go to packaging. There was a lot of extra material movement, but only because it evolved over time in unexpected ways.

Mr. Scalsky: Let's turn to the page about work schedules. Work schedules are taken into account during the dose reconstruction process. Were there three shifts all the time?

Dr. Glover: We are asking about the whole period from 1958 through 1983. Did that change over time?

Worker 7: The three shifts were during peak penetrator production which started around 1978.

Worker 5: I was hired for the third shift on the GAU-8 line. My start date was [identifying information redacted] in 1979. That was just for a short time.

Worker 1: They did away with third shift and the supervisors and some of the other guys stayed on to replace people on the first and second shifts.

Worker 5: Wasn't large caliber running three shifts by the time GAU-8 cut back?

Worker 1: I got laid off in 1992. It happened before I got laid off.

Worker 7: Salaried personnel worked as long as they wanted. Hourly personnel sometimes worked 16- or 18-hour days. That is not really accounted for.

Worker 1: Hourly personnel worked 60 to 70 hours a week.

Worker 3: You didn't work a 40-hour week at NMI at any time. We were in a growth mode, constantly growing. That placed tremendous demands on everybody. There were many times that [names redacted] and I saw the sun come up when we were working on some of the proposals for the work we were doing.

Mr. Scalsky: When did the peak period start? We need to account for it during the dose reconstructions.

Worker 1: In the foundry, it was probably from 1984 to 1986.

Worker 6: Where I was, the peak was from 1980 to 1984.

Worker 2: There was also a lot of overtime in the 1970s. It depended on where you were.

Dr. Glover: Did people switch jobs?

Worker 2: Not usually. There were usually three (sounds like) crews for different kinds of work.

Worker 5: The shearing jobs were the easier ones for people to pick up for overtime work.

Worker 3: Removing burrs from the phalanx penetrators was another overtime job. When we were getting 50,000 rounds a month, we had a broaching operation for rear (sounds like) squat that left a burr on the penetrator. I was assigned to solve the problem. When I finally solved it, there were a lot of unhappy people because it cut into their overtime.

Worker 8: Just to address the switching jobs, I was primarily a powders person, but I also worked for [name redacted] and others inspecting GAU-8 and phalanx rounds on Saturdays and Sundays, or in the evenings, or even before my powder shift. I can remember working 30 days in a row at times. That was from 1980 on until President Reagan stopped it.

Worker 5: When you talk about peak period, you're talking about peak period for an individual worker. We may have been 75 people trying to do the work of 125 people. And then, we were 600 people trying to do the work of 800 people. I suppose that it was less expensive in the long run to offer more work at an overtime rate than to add employees and have the additional liability for insurance and other benefits.

Worker 2: There were times when we couldn't get enough employees. We hired several people from the Concord Reformatory – the prison. I talked with Congressmen and Senators about how to get workers to come down from Lowell to Concord. He just said, "Concord is light years from Lowell," and that was the end of the conversation. The overtime was driven by not being able to hire enough employees, but there is also some truth in what [name redacted] says. I think it is easier for any corporation to offer overtime than to take on the overhead cost of additional employees.

Worker 5: On the other hand, when the business was shrinking, they tried to keep people employed instead of laying them off.

Dr. Glover: The convincing argument in the report is going to have to be: How do you take the bioassay data; how do you understand the worker titles; and how do you understand that they were doing a good job? Understanding the overtime work and how that affects the analysis is something that Mr. Scalsky is trying to put his hands around.

Worker 2: Some of the people who can speak to that are [names redacted]. They were all in Health and Safety.

Worker 7: [Name redacted] would be helpful, too. Let's go back to the issue of trying to hire people. The country was booming in the mid-1980s. I think in general it was hard to find workers.

Worker 4: I supervised QC starting in 1980. Until then, I was a technician. As [name redacted] was saying, even in 1977 we worked a lot of overtime. I was working in either braze rings or steel powders. When the depleted uranium work came in in 1977 or 1978, the overtime immediately started and just kept going into the mid- to late 1980s. For long periods of time, we had three shifts. I monitored all the overtime in my department, and the average that most of my guys worked was 50 to 55 hours a week. Some of them worked as many as 65 hours. Occasionally, somebody with a family might work 40 hours.

Attendees (consensus)**:** The money was good. There was lots of overtime.

Mr. Scalsky: Now we are going to discuss the radiation protection aspects of the process. These are the issues that we need to understand in order to do the dose reconstructions. We need to know about the results of the film badges, the bioassay urine samples, the air monitors, the breathing zone samplers, the respiratory protection, the protective clothing, the X-ray examinations, the whole body counting, and the lung counting. It's all listed there. When were the film badges worn? When did you have them?

Worker 2: We had them in Cambridge. The same practices that we had in Cambridge were brought to Concord in 1958. I was issued a badge on my first day of work in 1955. Everyone in the company wore badges.

Mr. Scalsky: I had some indication that the badges were exchanged monthly. Is that true for everyone?

Worker 2: I think that [names redacted] could best answer that question.

Mr. Scalsky: Did you wear ring badges or other hand dosimetry?

Worker 2: Some people did at times.

Worker 4: We wore them in QC for a period of time, but not all the time. I remember wearing them off and on for a year or two. There was a period of time when I was told that I had to wear one every day. Sometime in the mid-1980s, we moved all of the depleted uranium out of Building A and moved it all into Building D. As [name redacted] was saying, before that we moved it all over the place, upstairs in the elevator, over to packaging, out to storage. There were hundreds of penetrator rounds lining the hallways. After Building D was complete, we could keep it in one area, and we had a changing area and monitors at the exit.

Worker 3: In the late 1970s, Quality Control was in Building A on the second floor. There were materials in hallways. You didn't have to go through a change area to get to the QC department, so it was not a restricted access area. The materials were stored adjacent to the laundry, and in the hallway next to the cafeteria. It was a staging area.

Worker 7: All these changes took place after we completed the new buildings. Before that, it was just a mess. That improved over time.

Worker 4: I think that the big thing was getting the reduction out of Concord. That opened up Building D and they put machining out there. It relaxed the space so we could move out of Building A.

Worker 5: It also opened up room to store the raw material and to ship waste products.

Worker 4: I worked there for 30 years. By far, the scariest operation in the plant was out in Building E in the mid-1990s. They started taking the chips and using hydrofluoric acid to melt them on a large scale. It was the Hydromet process. They had used the process on a smaller scale earlier. You could smell the acid in the air. It was the only thing that ever really bothered me and the guys who worked for me. The operation really didn't go all that long.

Worker 1: There was an orange cloud hanging in the air.

Worker 2: That was an Army-sponsored research program.

At this point, Dr. Glover recessed the meeting for a short break.

Dr. Glover: We're going to cover the rest of Mr. Scalsky's questions. We need to get through them. Are we still talking about film badges?

Mr. Scalsky: You said that everyone wore badges, including the administrative people.

Worker 7: When you came through the entrance, you put on your film badge; and when you left you put it back.

Worker 3: At different times, or maybe even in different areas, the badge exchange was either monthly or quarterly.

Mr. Scalsky: [Name redacted] mentioned that there may have been some workers who exchanged their badges either weekly or bi-weekly.

Our next topic is bioassay. Our documents show that urine sampling at NMI started in 1958. From 1958 to 1983, approximately 14,500 urine samples were analyzed for uranium. In 1983, 484 samples were analyzed for depleted uranium. Between 1958 and 1962 and in 1970, 255 urine samples were analyzed for enriched uranium. Six samples were analyzed for thorium in 1964. No samples were identified for 1968, 1972, or 1975. Does anyone remember why there would not be any samples for that period of time? Who provided samples? How often? Did you see the results of the analyses?

Worker 2: I'm having a little trouble following you. You say that there are no existing samples for 1964. Do you have the records for 1963, 1962, 1961? 1960?

Mr. Scalsky: This is our initial investigation. We have identified many documents so far. These results were all that could be identified in our records search.

Worker 2: You have no data to show that there were samples at other times?

Dr. Glover: We are not saying that we have complete documentation. These data are just what we have in our records.

Worker 2: Did you get permission to go through records at the company?

Mr. Scalsky: We are working on that, too.

Worker 2: There should still be health safety records for other time periods. We handled natural uranium as well, sometimes in extensive quantities. We used natural uranium to make fuel elements for the ACL. There seems to be a lack of completeness of records. (Inaudible) I thought that Health and Safety kept pretty complete files.

Mr. Scalsky: We will follow through on that.

Worker 3: I know that for some of the claims there are gaps because of very limited data. For instance, there might be results from a urinalysis in 1987 late in a person's career where they were in a managerial role, but not from the 1970s when they may have been an individual contributor. Or there may be a data point from 1968 in a claimant's file when the work they did was very limited, and then there is nothing else. We often see that any data that is available is taken as typical for the entire employment period, where there may have been changes in job function over time from contributing work in the earlier years to a supervisory role later in their employment. In my own case, I don't recall ever having a request for urinalysis, yet there were a lot of situations where I wish I had. I was involved in experimentation with the hydrofluorination of machine turnings. After six months of the experiments, the technician looked around the lab and noticed that all the chrome had disappeared from the hardware in the lab and all the windows had frosted because of the hydrofluoric acid. We looked at each other and said, "Crap, what else got out?"

Worker 7: Those experiments destroyed the lab.

Worker 3: Hopefully, we will learn more about the urinalysis program tomorrow. I think the focus of that was on the foundry and production area workers.

Worker 4: The workers in QC gave many samples for urinalysis. I did, too.

Mr. Scalsky: Did you see the results of your samples?

Worker 4: I don't recall. If I got them, they were all within range so I didn't worry about them.

Worker 2: My answer is yes.

Worker 5: We certainly were told if we were "hot," because we would be taken out of the work area or cut back on overtime. The production workers were certainly exposed. They really managed their operations because there were so few people relative to the work that was required. If someone was getting close to their quarterly exposure limit, they would be told that

they could only work a certain amount of time in a certain area to try to keep their exposures down.

Dr. Glover: Was that mostly from an external dosimetry standpoint or a bioassay standpoint?

Worker 5: It could have been for both. I was pulled off the CAF line once because of a sample that was ridiculously high. We did get our results. My next sample was perfectly normal. Some of the guys would have someone else do their samples so they could protect their overtime.

Mr. Barton: How frequently did you submit samples? Would you say that it was related to the work that you were doing? Was it on a yearly basis or a monthly basis?

Attendees (consensus)**:** Production and foundry workers were sampled every week.

Mr. Scalsky: Our next subject is air monitoring. Our documents show that there were 12 air monitors located throughout the plant. We have not yet identified the locations of these samplers or their proximity to the processes. Can you shed any light on that?

Worker 3: The only one that I am aware of was in the reduction area. There was an air monitor in an enclosure room where they took the derbies out of the reduction vessel. The derbies were caked with fluoride and they were supposed to chisel it off in the enclosure. Unfortunately, it was an awkward spot to work in so the guys would pull the derby outside the enclosure away from the air monitor. I guess that that made everything okay because the work was done away from the air monitor. [Name redacted] will have more information on that because he also worked full-time in the reduction area.

Air monitoring, as such, was looked at from an averaging standpoint. During an 8-hour period, the results are averaged instead of looking at an unusual occurrence that would create a peak airborne contamination, such as a fire.

Worker 8: They changed the filters a lot.

Mr. Scalsky: I have information that says that the filters were changed every two weeks, or if there was a fire or other event. Is that correct?

Worker 2: There were periods where they were changed every week. I'm sure there were times when they were changed more frequently or less frequently. It evolved from 1958 to 1983. I can't be more specific.

Mr. Scalsky: So we can say that it varied with time and it varied with situations. There is a report from a 1959 AEC inspection that indicated that air samples should be obtained during every operation involving highly enriched uranium. Did that happen?

Worker 7: In some cases, such as a new machining operation, the answer is yes. But again, those were averaged over an eight-hour period.

Worker 2: In regards to the highly enriched uranium, [names redacted] can probably give you more detailed information on that.

Dr. Glover: Do we have documentation that the radiation safety program, that it changed over time?

Mr. Scalsky: Not yet.

Dr. Glover: If you have any of those reports, they would be helpful. Most facilities only keep the most current copy. It would help put things into perspective. It would also be useful to have monthly reports of the bioassay program. Do you know what company did the bioassay samples?

Worker 3: In the early 1970s, [name redacted] was the primary person in charge of health. He has already been interviewed.

Mr. Scalsky: Were breathing zone samplers used?

Worker 8: Whether we had personal air monitors (PAMs) depended on the operation that we were doing.

Worker 3: It also depended on the availability at the time. We had a lot more available in the mid-1980s than we did in the 1970s. I've already mentioned several situations where we had the potential for airborne contamination – the hydrofluorination experiments, the foam resin encapsulation machine turnings in the late 1970s. We had bioassay during the encapsulation process because there was isocyanate in the resin and people were having reactions to it. We also put up isocyanate monitors and alarms during that operation, but we didn't have PAMs or area monitors that were reporting the fires that we had.

Mr. Scalsky: You did a lot of different experiments. Is there other documentation on the experiments, other than the papers that you wrote?

Worker 7: There were official programs that were sponsored by the Army that were very well documented, such as the Hydromet process. There are probably some others. The big goal here was to reduce the volume of material that was going to the waste burial site because the cost while I was working went from $2 per cubic foot in the 1960s to more than $100 per cubic foot later because there were special provisions for the packaging and shipping.

Worker 2: The Hydromet process was an attempt to turn chips back into useful metal. We did a lot of research to establish the potential beyond the Army sponsorship of the program. It was a $3.5 million program that never went into production.

Worker 3: I have a WPI report about the purity of the UF_4 that found, because of the hydrofluorination, that there was a high concentration of uranyl fluoride. We did some mass spectrometry work that was reported in their report.

Worker 4: The breathing zone monitors were never used in Quality Control.

Worker 5: They weren't used on the CAF line during the year that I worked there, either. I remember seeing people with them later, but because I came and went between so many departments, it is hard to establish the time.

Worker 3: the 1970s, I don't know that we had a formal document in the company that spelled out our radiation safety program and how it was conducted. I don't recall, until the late 1980s, that we ever had a radiation work permit (RWP) program.

Worker 5: When I was a process auditor, I started writing technical documents for standard operating procedures (SOPs). It was a big deal that we wrote the minimum safety requirements into those procedures. I had to actually spend time with the health physics and safety technicians. That started around 1981 or 1982 when [identifying information redacted] wrote the first SOP for the 774 program. The SOPs were very basic.

Mr. Scalsky: Let's talk about radiation and smear surveys. You have already said that you had some radiation safety on site at different times. When did that start?

Worker 2: That started in Cambridge.

Worker 3 to Worker 2: [Name redacted] told me that in 1972 the health and safety person was a part-time rep operator. Wouldn't you say that was the start?

Worker 2: I was away from the company from 1969 until 1972.

Worker 3: [Name redacted] said that shortly after that you put him and [name redacted] in charge of Health and Safety. I believe he said that you assigned them that responsibility in 1974.

Worker 2: There were others associated with health and safety as well.

Worker 3: They weren't doing radiation surveys or swipes, though.

Mr. Scalsky: So it may have been in the 1980s that radiation surveys were done for specific jobs. Do you recall any times before that?

Worker 3: I'm not aware of any.

Mr. Scalsky: What about smear surveys? Do you recall smear surveys prior to the 1980s?

Worker 7: I think that they were done when there was an occurrence, but they were not routine.

Mr. Scalsky: The next topic is respiratory protection and protective clothing. Did you wear respirators or dust masks?

Worker 6: When I first worked in the reduction area, all I had was a mask until I demanded a cartridge respirator. Those were issued every week and cleaned in a "dishwasher."

Dr. Glover: Was there a respirator fitting program?

Worker 6: They didn't always fit right, but it was better than not having one.

Worker 3: There were some issues with facial hair. Some of the employees refused to shave, so the masks didn't fit right.

Mr. Scalsky: Were those issues resolved?

Worker 6: I don't think they made anybody shave.

Worker 4: I don't think there was really anything until the mid-1980s. I was the QC supervisor. Before that, there were no respirators, no coveralls or shoe covers. Really there was nothing. The changes that they were talking about earlier were all in Building D. Then there was a change area. You had to wear a uniform out there or a lab coat if you were staff. If you were staff, you could put booties on, or you changed your shoes if you were a production worker.

Worker 3: That was in the mid-1980s. When I started in 1977, I had a blue lab coat that I kept in my office. At some point in the early 1980s, you had to hang them up in the entrances to the changing areas. In the 1970s, many of the areas were still unrestricted so you didn't have to change your clothes or your shoes.

Worker 4: They had a very robust respirator fit program in the 1990s because of the beryllium.

Worker 3: Steel-toed safety shoes were required due to the OSHA requirements.

Worker 2: The employees wore uniforms that they changed daily. They put them on at the beginning of their shifts and left them in a hamper at the end of the shift.

Worker 3: The uniforms were dedicated to areas, such as machining and foundry. We went through quite a few vendors for the laundry services trying to make sure that we got stuff back clean and not "hot."

Mr. Scalsky: Did they wear gloves and head coverings?

Worker 3: The extrusion press operators wore asbestos gloves for the hot billets. At one time there was a problem because they were over-using the leather-palmed work gloves. We will have better information on that tomorrow. The policy at the time was to change the gloves monthly because they were getting "hot."

Dr. Glover: Did they wear ring dosimeters?

Worker 3: More often than not, but not all the time.

Mr. Scalsky: What about ventilation? Was there local ventilation for specific jobs or was it general ventilation?

Worker 3: Each operation had its own ventilation line, particularly at the machinery.

Mr. Scalsky: Did it cover the entire area?

Worker 5: It didn't cover the entire bay. It covered the cutting area, but you had to open that up to change the tools or the parts.

Worker 3: In different machines – an old engine lathe would have a 6-inch or 4-inch exhaust line that the machinist would position near his cutting tool. When we got the CNC high-speed machines, we made sure that we got them with cabinets so they would be enclosed because we wanted the entire lathe vent area closed when we were throwing 100 gallons of water-soluble coolant on them to suppress the flames. The enclosures were very easily ventilated. The (inaudible) machines on the CAF-line had a door of sorts (inaudible).

Worker 2 to Worker 3: Can you describe the ventilation lines in the foundry?

Worker 3: They had different systems. There were some areas where the exhaust went into that I believe were ventilated. Then you would have the 4-inch or 6-inch line that went from the ceiling near the top of the crucible where, when they would pop the lid and then do the water spritz, they would put the vent line somewhere in the area. That evolved over time, too. It got better and better. I recall that they had enclosures that they put around these things. The whole enclosures may have been vented in the 1980s, but in the earlier times we used the portable ventilation lines.

Mr. Scalsky: Were those effective?

Worker 2: No. You saw the video of the typical furnace reaction when we were distilling off the daughter products. I spent a lot of time in the foundry doing the experimental uranium-niobium melts where we were trying to do some reduction. I was also applying some cold washes to the crucibles, looking at some cold washes because they were working at a higher temperature than the standard uranium melts at the gradient temperatures that we were using. [Name redacted] and I would be working there. He would pop the lid and show me essentially what happened in the video with the lid pacification. Due to the vacuum of the foundry furnace, it would distill off the daughter products and you would divide the uranium on the lid. Before you could grab this thing and have it react unexpectedly, we wanted to make sure that it reacted in a controlled way. So we would pop off the lid and expose it, then we would take the little squirt bottle and shoot it. Most of time, you would get a little puff of flame and some sparks would drop down from the lid and here's your little 6-inch vent line. In an extreme case when there was a detonation, you had the full crew in full regalia with a filter mask, face shield, and a (sounds like) silver skirt, but the guys who were filming the movie didn't have any protection. They all got knocked off their feet when they squirted the bottle and the thing went bang. It blew the camera over and knocked everyone down. [Name redacted] was one of the guys behind the camera. A couple of the guys got burned in that explosion. It was an unpredictable reaction. You could see with the volume of flame that the 6-inch line was not very effective. [Name redacted] can speak to other instances that he witnessed first-hand.

Mr. Scalsky: Now let's talk about X-Ray examinations. Did you have a pre-employment X-ray?

Worker 2: We had a pre-employment X-ray and an annual physical.

Worker 5: I remember having a pre-employment physical, but I don't remember having an X-ray. I remember going to an office to see [name redacted] for the physical.

Dr. Glover: Did they have the X-rays on site?

Workers 3 and 7: They were done through Emerson Hospital, front, back and side views.

Dr. Glover: The X-rays cannot be counted in the dose reconstructions if they were not done onsite.

Mr. Scalsky: What about whole body counting?

Worker 3: In the mid-1980s, there were some experiments with whole body scanning. There was a mobile facility that was set up behind Building D. I didn't have a whole body scan. I think it was focused on the foundry and reduction workers. [Name redacted] had a whole body scan. He came back after the plant layoff and had to go take a shower and go have a scan. He was sent back to take another shower because he had contamination. He still showed contamination after the second shower. He never got an adequate answer to why he could return from two weeks of vacation and still be contaminated. He can address that tomorrow.

Mr. Scalsky: What about lung counts?

Worker 3: I will defer to [name redacted] to address that tomorrow.

Mr. Scalsky: Nuclear Metals shipped and received materials from many facilities, including Fernald, Rocky Flats, Savannah River, Oak Ridge, Brookhaven National Laboratory, Lawrence Livermore National Laboratory, Fermi Test Reactor, Argonne National Laboratory, United States Enrichment Corporation, Lockheed Martin Idaho Technology Company, and Mound. This is just a partial listing. We know that there were other facilities.

Worker 2: Do you want names of all the places?

Mr. Scalsky: It would be helpful if we could identify whether they were for thorium or uranium or other materials.

Worker 3: There is also a list of places where we shipped the depleted warheads. We sent explosive (sounds like) loaders to the Iowa Army Ammunition Plant. After they loaded those we would ship them to various test sites, which included Los Alamos National Laboratory. We sent non-DU warheads to a research and development laboratory in the United Kingdom for testing.

Worker 4: I stepped out for a second when you were talking about ventilation. In QC, we didn't have any ventilation during our work with solid uranium other than when we cut the chem samples.

Dr. Glover: NIOSH prefers to use bioassay or internal dosimetry. We only go to air monitoring data if we were trying to supplement the bioassay data, or if we don't have any bioassay data.

Mr. Scalsky: Do you have any other questions?

Worker 7: NMI was a fun, challenging place where you could actually see the results of your work.

Mr. Scalsky thanked the attendees and adjourned the meeting at 6:50 p.m.