

# **National Institute for Occupational Safety and Health (NIOSH)**

## **Town Hall Meeting for General Steel Industries, Inc. (GSI)**

**Meeting Date:** Tuesday, October 9, 2007, 7:00 p.m.

**Meeting with:** Former workers from General Steel Industries, Inc., and other interested parties, Collinsville, Illinois

### **NIOSH Team:**

Stuart Hinnefeld, National Institute for Occupational Safety and Health (NIOSH) Office of Compensation Analysis and Support (OCAS), Health Physicist

Laurie Breyer, NIOSH OCAS, Special Exposure Cohort (SEC) Petition Counselor

David Allen, NIOSH OCAS, Health Physicist

Mark Lewis, Advanced Technologies and Laboratories (ATL) International, Inc., Senior Outreach Specialist

Mary Elliott, ATL, Technical Writer/Editor

### **Proceedings:**

Mark Lewis opened the meeting at approximately 7:00 p.m. by greeting the attendees and introducing himself. More than 100 people were in attendance, including former employees of General Steel Industries, Inc. (GSI) and other parties having interest in the Energy Employees Occupational Illness Compensation Program Act (EEOICPA or the Act). He thanked them for meeting with the NIOSH Team about General Steel Industries.

Mr. Lewis asked if everyone had signed the attendance sheet and stated that the meeting was being recorded for the purpose of transcribing minutes that will appear on the NIOSH Web site. He introduced the other members of the NIOSH Team and turned the meeting over to Dave Allen of NIOSH.

Mr. Allen stated that the NIOSH Team was present to talk about Appendix BB – General Steel Industries, a document that is used by NIOSH for guidance when performing radiation dose reconstructions for EEOICPA claims for former GSI workers or their eligible survivors. He explained that EEOICPA is a federal program to compensate people who worked in the nuclear weapons program during the Cold War. NIOSH is the federal agency that performs dose reconstructions for EEOICPA claims.

GSI was under contract with the U.S. Atomic Energy Commission from 1953 to 1966 to x-ray uranium ingots and other forms of uranium metal using Betatron equipment. The uranium that was handled at GSI was used in the Hanford reactors to produce plutonium for nuclear weapons. Workers at GSI performed quality control testing for possible flaws in the uranium ingots. Mr. Allen stated that the Betatron facility that is covered under EEOICPA was located at 1417 State Street in Granite City, and was also known as General Castings and Granite City Steel. A former GSI worker commented that the GSI facility had never been known as Granite City Steel until that company bought it after GSI closed.

Another attendee asked if employees of Mallinckrodt Chemical Company and other companies are eligible to file EEOICPA claims with the U.S. Department of Labor (DOL). Mr. Allen

explained that EEOICPA covers 314 sites that performed work in the nuclear weapons complex, including approximately 30 large DOE plants such as Hanford and the Nevada Test Site. Many smaller sites like GSI are covered because they were involved in the nuclear weapons program to perform specific operations or one-day testing.

Mr. Allen explained the EEOICPA claims process. The program is administered by the DOL and all claims are filed through that agency. DOL verifies the worker's employment and medical diagnosis, and then assigns a medical code (ICD-9) for the cancer. DOL then forwards the case to NIOSH. NIOSH reconstructs the worker's radiation dose and returns the case to DOL. At that point, DOL enters the dose reconstruction into a computer program called the IREP (Interactive RadioEpidemiological Program), which calculates the probability of causation (POC) – the probability that the cancer may have been caused by the worker's exposure to radiation in the workplace. If the POC is greater than 50%, the claim may be compensated. The claim will not be compensated if the POC is less than 50%.

When asked to explain dose reconstruction, Mr. Allen stated that dose reconstruction is the process that is used to determine the radiation dose to the organ where the worker's cancer is located. Appendix BB was written as a supplement to Site Profile for Atomic Weapons Employers that Worked Uranium and Thorium Metals (Battelle-TBD-6000), a document that includes data for workers who handled uranium and other radioactive metals. NIOSH recognized that the Betatron operations at GSI differed from operations at other facilities for which the site profile was intended. Special models were developed to help dose reconstructors evaluate the radiation exposure that GSI workers may have received from x-raying not only the uranium ingots, but also steel castings.

Mr. Allen stated that NIOSH uses “bounding estimates” when data cannot be found for a site. Bounding estimates use the high-end data from similar operations to give the claimant the highest possible credible radiation dose.

An attendee asked if NIOSH gathers data from the covered facilities for the dose reconstructions. He expressed frustration that so many agencies are involved in what he felt is a complicated process that relies too much on the claimant to provide the information necessary to complete the dose reconstruction. His mother had filed for compensation on behalf of his deceased father more than five years ago. He related a personal experience in which the case was pended after his mother passed away recently, more than four years after she filed the claim. He stated that he is still waiting to hear the outcome of the case and cannot understand why the dose reconstruction is taking so long.

Mr. Allen responded that it has taken a great deal of time for NIOSH to gather the information that is needed to do the dose reconstructions for GSI. He stated that some of the dose reconstructions for GSI have been completed and others may be completed soon. Mr. Allen explained that NIOSH and its prime contractor (Oak Ridge Associated Universities, or ORAU) have completed over 20,000 cases since the dose reconstructions began five years ago.

Laurie Breyer asked the attendees to please hold their questions regarding individual claims until the end of the meeting when NIOSH personnel would be available to answer those questions.

**Question:**

Why is the study of the Hiroshima-Nagasaki survivors used as the model for the dose reconstructions?

**Mr. Allen:**

The Act mandated that study because it is based on data collected for thousands of Hiroshima-Nagasaki bombing victims. The dose reconstructions that were done for those victims have yielded a large amount of information regarding the incidence of various cancers. The study was also conducted on a very large living population over a long period of time, so the statistics are more accurate than those that are based solely on morbidity data. The Hiroshima-Nagasaki study has the most statistical power. There are other studies but they generally conclude that there is not a great statistical difference (whether or not radiation causes cancer) because the study populations are much smaller and the duration of the studies much shorter.

**Question:**

Doesn't that study seem more like a dinosaur – prehistoric in nature? It is such an old study. With the technology and the knowledge that we have today, couldn't they go forward to what is happening now through physics with what we know now, and not go backward into what was in our history and beyond in the shadow?

**Mr. Allen:**

The Hiroshima-Nagasaki study is specified in the Act because it contains data that can be used to determine probability of causation for specific organs – the probability of getting cancer from a particular dose of radiation.

**Question:**

Isn't our technology above and beyond that now?

**Mr. Allen:**

No. A subject would have to be studied for many years for an epidemiological study to yield enough information to determine the probability of causation. To put it quite simply, if you smoke a pack of cigarettes today, you are not going to get lung cancer tomorrow. You may get it a number of years down the road.

**Response:**

I think if you smoke the pack of cigarettes today, you get the cancer today. Just like these men who worked in these factories that day got their cancers that day.

**Question:**

Haven't they made any technological advances in the last 50 years since Nagasaki? Did the people who were running the tests back in those days know everything there was to know – like lymphoma, for example? When I had lymphoma, the doctors were arguing about what type of lymphoma I had. One of the doctors said I would die if they didn't do something, so to just call it Hodgkin's lymphoma so they could start treatment. I sent them my medical reports that showed that the doctors disagreed on my diagnosis. Nobody else in my family has ever had cancer in my lifetime. I am the only one.

**Mr. Allen:**

It is a matter of following the subjects for 50 years or so. As far as your individual case – your individual cancer, that determination is up to DOL. NIOSH cannot challenge that unless we spot something really obvious. Then we can ask them to take another look at the case.

**Response:**

I called DOL. They asked me how I got the number. I told them that I got it out of the telephone book.

**Question from a former GSI worker [Name Redacted]:**

I am going to ask a familiar question because I think it is an important question. I was one of the guys that worked in the Betatron. I don't understand how an accurate dose reconstruction can be made. We fired thousands and thousands of roentgens. We have absolutely no way of knowing the gross amount of roentgens that were fired with two Betatrons operating 24 hours a day, seven days a week. This is not meant to criticize anybody. I'm sure that the level of education up there is outstanding, but I don't think that you are in the miracle business.

**Mr. Allen:**

I certainly understand that criticism. That is why we are here today: to go over the process that we went through to arrive at this estimate and to explain why we think we can do it.

**Response from the former worker:**

I think the key word is "accurate." An accurate dose reconstruction would have to consider skyshine, activation, groundshine – the activation of dust, air, dirt, grease, liquids; ingestion of activation of the castings by welders, chipper, grinders, burners, machinists. I think that there is so much to be taken into consideration and too few facts.

**Mr. Allen:**

I agree that there is a great deal to be taken into consideration. As I said earlier, NIOSH has considered the possibilities and looked at the high end of the data to get a bounding estimate for the highest possible dose.

**Response from the former worker:**

My remarks are not meant to criticize. They are meant to be constructive in nature.

**Mr. Allen:**

I realize that and I think that it will be much clearer after we explain how we did this. You may still feel like there are some holes, and that is well taken; but I think it would do a lot of good if you could hear how we approached the problem.

**Question:**

Are you basing the whole thing on the Betatron?

**Mr. Allen:**

That is the difficult part and took a great deal of work.

**Question:**

What about the radioactive material that they put into the castings to make the tank hulls harder so they would resist shells? They put that in them for years and nobody said a word about it.

**Mr. Allen:**

What kind of radioactive material?

**Response:**

They put some kind of radioactive material in it. They still do it today.

**Mr. Allen:**

That brings up another point that I was going to make. This is a "living document." NIOSH tries to gather as much information as possible. We put all of the information together to come up with the best dose estimate that we can make. If we find new information that should be included in the dose estimate, or find that the estimate is flawed in some other way, the document can be revised. There is also a process in place for re-evaluating dose reconstructions that are close to compensability to see whether including the new information in the dose reconstruction will make the claim compensable.

**Question:**

How many claims have been paid?

**Mr. Allen:**

For GSI claims, the rate of compensation is approximately 30%, which is slightly higher than the national average.

**Question:**

My dad was a chipper. He had cancer on his leg and I believe he had cancer of the throat, but he wouldn't let anybody mess with it. He didn't want to be cut on. How can you say that this person got more than 50% and another didn't when you don't know how much exposure they had because you only did one study on one part of their body? Have you tested all of these people?

**Mr. Allen:**

No. We are going to discuss how we estimated the radiation dose.

**Response:**

That is just an estimate, but they are going on your recommendation whether or not these people get paid. You don't know. They know that they contaminated these people, or they wouldn't have sent us letters telling us that they had been contaminated. They already know that. They have been sitting on this money for years and drawing interest on it. My dad had the exact cancer that they said that this radiation caused. I don't care if he had an ounce of cancer, he was contaminated. They need to pay up what they owe. I don't care if he had an ounce of cancer, he was contaminated. It is a drop in the bucket. They were going to cut off my dad's legs. He just decided to give up.

**Mr. Allen:**

NIOSH is implementing the law as it is written. That is all that we can do.

**Response:**

Isn't that the way that the government wants it to work?

**Comment:**

There was an article in the newspaper that said that Senators Richard Durbin and Barack Obama and Representative Jerry Costello said that the program should get with it and start paying people the money that they were due, including medical bills. I just got a letter and talked to NIOSH and they told me, "We don't read those things."

**Comment:**

There was a meeting a couple of years ago in Granite City. They told us that the government buried some uranium residue from plutonium-239 at GSI without anybody's knowledge. Do you know anything about that?

**Mr. Allen:**

No, I do not. Because this document is a "living document," we can check into any information that you give us the best that we can. If you have documentation, then that's fantastic.

**Response:**

Where would you get documentation? My dad died in 1962, so he's been gone for almost 50 years. We don't know anything about what happened to him. Some of these people have records and files. But when you can't get documentation because the government doesn't keep it or the hospitals don't keep it, then you have a problem. Tell us what you need so we can get it to you.

**Mr. Allen:**

It can be tough to find documentation. I agree that it can be a problem. Let me explain to you what information we have and what we have done with it. If you have information that contradicts or supports what we have, please bring it forward and we will look into it. Sometimes the information checks out and sometimes it doesn't. Sometimes it is a rumor that we cannot substantiate and sometimes we can.

**Question:**

Why can't GSI be deemed an SEC site? Why can't you have people go in there and test the soil and test what is on the walls?

**Mr. Allen:**

It was tested in 1989 and 1993. We have been using those results, but that is only so good so many years later.

**Response:**

The plant closed 20 years ago. It is still there.

**Question:**

You've paid 30% so far. What is the average payment?

**Mr. Allen:**

The compensation for this program is \$150,000 plus medical benefits after you file the claim.

**Response:**

Were all of the payments \$150,000? Was that 30% for paid or recommended?

**Mr. Allen:**

Yes. There is only one compensation amount. The 30% represents recommendations for compensability. NIOSH does the dose reconstructions and recommends compensation if the POC is greater than 50%. That is as far as we take it.

**Question [Name Redacted]:**

Isn't it slightly inaccurate to say that anybody has been paid so far? Your dose reconstructions have not been completed for the whole group, maybe indicating that 30% of GSI claims have a POC of greater than 50%. To be perfectly accurate tonight, has any GSI worker been paid by DOL and gotten a check?

**Mr. Allen:**

I just corrected that statement. Once the dose reconstruction is completed and the POC is greater than 50%, NIOSH does not track the claim any further. We do not track the payments; DOL does that. Approximately 30% of the dose reconstructions that NIOSH has completed have been recommended for payment.

**Response:**

What is the percentage of the GSI dose reconstructions that have been completed?

**Mr. Allen:**

We have completed about 150 of the 200 claims.

**Question:**

Is there money in the fund to pay these claims? I read on the Web site that there was not, as of 2004.

**Mr. Allen:**

There is money to pay the claims.

***Question:***

In the 2005 meeting in Granite City, why did the lady from Missouri tell us that her parents were among the first ones compensated and all they had to do was prove that they had cancer? It is my understanding that now that particular lady works for NIOSH. Why could they get paid just by proving that they had cancer?

***Mr. Allen:***

That is not the way the law is written. She could have been talking about the Special Exposure Cohort (SEC) for Mallinckrodt Chemical workers in St. Louis.

***Mr. Hinnefeld:***

We can talk with you later about that if you are interested.

***Ms. Breyer:***

Not everyone is eligible for payment under the SEC. The SEC class only includes specific workers during specific time periods with specific cancers and a qualifying employment period.

**Question from a former GSI worker (unidentified):**

Did the workers at Mallinckrodt have the badges and is that how you got your dose reconstruction? They didn't even give us dust masks at GSI.

***Mr. Allen:***

Some of the Mallinckrodt workers had badges. The whole idea behind the SEC is that NIOSH concluded that dose reconstructions cannot be done for a specific group of workers.

***Response:***

At General Steel, they didn't even tell me that there was radiation when I was working around the Betatrons. I was only 19 years old. They just said, "Get in there and get it, kid." If they dropped something on the tracks that tore up one of those railroad ties, we had to dig up the tie and replace it. There was a lot of dust. Then they found out 20 years later that there was still radioactive material in that dust. That is some pretty powerful stuff. You would spit it up for a week after you got into it.

***Mr. Lewis:***

I know that you all have concerns and some of you want to talk about your cases. We will stay around after the meeting to make sure that you have your chance. But at this rate, we will be here all night. Let's allow Mr. Allen to tell you how NIOSH does the dose reconstructions.

***Mr. Allen:***

Thank you. We will get back to the purpose of the meeting, which is to explain Appendix BB. We will entertain your questions after I am finished.

Appendix BB was written to explain how to do dose reconstructions for GSI claims. The sources of radiation that are considered at GSI are:

- (1) "Shine" from the two Betatron machines;
- (2) Direct radiation from uranium metal and from the x-rayed castings;
- (3) Inhalation and ingestion of uranium metal and the metal casting from grinding;
- (4) Other radiography sources such as iridium-129, cobalt-60, and a portable x-ray machine; and
- (5) The period of residual contamination from the uranium itself after 1966.

“Shine” refers primarily to skyshine, which is the effect that is caused by radiation scattering through the air and bouncing off walls and other surfaces. The Betatron emitted a lot of high energy radiation inside a shielded area, but the shielding only went so high. The radiation went up through the unshielded roof, bounced off the air, and came back down to where people were working on the ground, causing additional exposure besides what they received from the direct radiation in the shielded area. Radiation can also bounce off walls, around corners, etc. “Shine” is not nearly as intense as direct radiation, but it must be considered in dose reconstruction.

NIOSH modeled the exposure based on drawings of the Betatron buildings that showed ten-foot shield walls for the exposure area of that building. The drawings also showed more standard walls in the control room and ribbon doors. To come up with the “bounding estimate,” NIOSH made a crude model with only the ten-foot shielded walls and assumed that all other areas were open where walls and ceilings would have been in the GSI area. NIOSH then placed the Betatron in the center of the area and shot in all directions – straight up, straight down, straight at the control room – not just to get the exposure from the direct radiation through the shield walls, but also from the shine occurring from all possible surfaces in all possible directions. During dose reconstruction, NIOSH assigns the highest radiation exposure outside the shielded area to all workers for shine exposure.

In the shine model NIOSH used the exposure rate from a 100 roentgens-per-minute (100 R/min) shot. In order to be more favorable to the claimant, no casting was placed in front of the Betatron in the shine model. In the workplace, the casting would have absorbed some of the radiation, so the exposure in the model is maximized.

A short discussion ensued between an attendee and Mr. Allen regarding why NIOSH had used the exposure rate of 100 R/min from the 24 MeV (megaelectron volts) Betatron for the model in the document, rather than the higher rate of 250 R/min from the 25 MeV Betatron. The attendee said that he felt that the higher number should be used since the bounding estimate was supposed to represent the highest exposure. Mr. Allen replied that the Betatron emitted a pulsing, rather than continuous, beam that was set to a certain exposure by the operators. Mr. Allen said that the 25 MeV machine also had a capacitor bank that could be changed out by the operators when the capacitors started to degrade from use. When the attendee argued that the machine was never off because the operators worked around the clock, Mr. Allen stated that the operators calculated the exposure needed for the shot, set the machine to the correct exposure, and then turned the machine on for the shot. Once the machine reached the setting, it shut itself off and the operators set up the next shot. When the attendee continued to question the reason that NIOSH assumed the 100 R/min setting, Mr. Allen stated that the number was based on statements from GSI Betatron operators.

A former GSI worker [Name Redacted] from the Betatron facility stated that the 25 MeV Betatron was operated at 160 R/min under nominal conditions, but might be operated at a rate closer to 250 R/min occasionally under exceptional operating conditions; the 24 MeV Betatron was operated at a rate of approximately 100 R/min. The former worker added that a 10,000 R shot at the rate of 160 R/min would take approximately an hour and fifteen minutes when using the 25 MeV Betatron.

Mr. Allen said that NIOSH had heard new information in a meeting with former GSI workers earlier that afternoon. Since Appendix BB is a “living document,” NIOSH will revise it as necessary to provide a more accurate document for GSI dose reconstructions.

Ms. Breyer stated that NIOSH attended meetings with GSI Betatron operators in 2006. During those meetings, the operators shared information about the day-to-day operations in the Betatron area. Advocates for former GSI workers provided NIOSH with transcripts from the meetings that are now posted on the NIOSH Web site as well as several boxes of printed material, which were reviewed and incorporated into Appendix BB. Later, NIOSH received even more material from GSI workers and their advocates. She stated that the NIOSH Team had learned even more about the day-to-day operations at GSI during the meeting earlier that afternoon with more than a dozen former GSI employees who were directly involved in the Betatron operations. Ms. Breyer added that Mr. Allen was discussing the material from the document, not the information learned in the meeting that afternoon.

**Question:**

Should claims that were filed before Appendix BB was written be filed again?

**Mr. Allen:**

When a document is revised due to new information that may positively affect dose reconstructions, NIOSH initiates a process requesting that DOL reopen and return affected claims to NIOSH for re-evaluation. Appendix BB is currently under review by the Advisory Board on Radiation and Worker Health (ABRWH), so it is not likely that NIOSH will revise the document until that review is completed.

**Question from a former GSI worker:**

I worked on the (sounds like) reclaim system. Would I have been exposed to radiation from castings that came back from the Betatron area?

**Mr. Allen:**

Appendix BB accounts for that type of exposure.

**Question:**

Was only one cancer considered if a worker had more than one cancer? He was diagnosed with cancer of the jaw, but later found out that he had liver cancer as well.

**Mr. Allen:**

All primary cancers are considered. Multiple primary cancers increase the POC and the chance that the claim may be compensated, but only one claim can be made for each worker. When a primary cancer metastasizes (spreads) to another organ, the secondary cancer is not considered. Additional primary cancers should be reported to DOL.

The second radiation source discussed in the document is direct exposure to the radiation from the uranium metal. Since radiation exposure from uranium metal is a known constant, the numbers from other facilities were used to estimate the dose rate for GSI workers who were setting up or handling the uranium. The high energy of the Betatron caused some fission to occur in the uranium ingots, so fission products were also present in small amounts. The fission products are more radioactive than the uranium and must also be taken into consideration. To account for the additional radiation produced by the fission products in the various shapes that were examined with the Betatron, NIOSH modeled the calculation using a piece of uranium metal larger than the beam and thick enough to completely absorb the beam. To maximize the radiation dose that a worker may have received from the fission products, NIOSH adds all of the fissions that the beam caused in the larger model slab of uranium.

**Question:**

How does NIOSH account for radiation that a worker received from repairing uranium metal?

**Mr. Allen:**

GSI did not perform repairs on uranium ingots. After GSI x-rayed the ingots, the film was checked for the quality of the shot and the ingots were sent back to Mallinckrodt.

Most of the work done at GSI was the manufacture of steel castings or other alloys. Since the high energy of the Betatron activates the steel, other factors must also be taken into account in the dose reconstructions. Because there were many different sizes and shapes of castings, NIOSH tested a number of materials (HY80, nickel alloys, cast iron) to find the one that would produce the highest dose rate. Iron produced the highest dose rate when irradiated – iron-54 activates to radioactive iron-53 with a half-life of 8.5 minutes. One hour of exposure to iron-53 can give a worker a saturated level of seven half-lives. Alloy metals such as nickel and manganese can also give considerable dose rates when irradiated. However the half-lives of the radioactive forms of these elements are longer so it takes more time to reach saturated doses. The addition of these alloy metals to iron causes it to assume some of the properties of the alloy metal, so the half-life of a steel alloy is lengthened. Therefore, NIOSH uses pure iron to give the highest dose rate for the bounding estimate of the radiation from x-raying steel castings. As with the uranium sample, NIOSH used a sample of steel that was large enough to absorb all of the energy from a Betatron shot to arrive at the bounding estimate for the radiation dose a worker would have received from x-raying steel castings.

An attendee asked Mr. Allen if he had mentioned beryllium and what it does to the steel. A former GSI worker responded that there was no beryllium at GSI.

Mr. Allen continued: The third source of radiation at GSI was the inhalation and ingestion of radioactive particles from airborne uranium oxidation products. Since the exposure data for uranium from other facilities is widely available, NIOSH used data from uranium slug production (machining and cutting uranium metal) to account for the inhalation exposure at GSI. NIOSH used the maximizing data for machining operations as the upper bound rather than the lower figures for uranium handling for the whole time the workers were assumed to be in the Betatron area.

Repair of the steel castings that were x-rayed in the Betatron building also produced airborne radioactive contamination from inhalation or ingestion. NIOSH assumed that the grinding from the repair of the steel casting after a Betatron shot would cause an airborne contamination of 4,000 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), a figure that represents a very dusty environment. NIOSH also assumed that the grinding operation would take place after every shot and that the grinding was continuous until the next shot was done. These assumptions represent the bounding estimate.

The fourth source of radiation was from other industrial radiography sources at General Steel. There were three cobalt-60 sources (0.25, 10, and 80 curies); an iridium-192 source; and a portable 250 kiloelectronvolt (keV) x-ray machine. The energies from these sources were considerably lower than the 10 MeV that would be necessary to cause activation in steel or other metals. NIOSH compared the estimated radiation dose that a worker would get from operating the Betatron to the known radiation doses from the industrial radiography sources and found the Betatron dose to be higher. For the upper bound estimate, NIOSH assumed that all GSI workers operated the Betatron machine.

An attendee asked if there is a table in [Appendix BB](#) that displays that information. Mr. Allen stated that the information is summarized in the appendix, but can be found in table form in another document that dose reconstructors use for guidance called [Estimating the Maximum](#)

Plausible Dose to Workers at Atomic Weapons Employer Facilities (ORAUT-OTIB-0004). The attendee replied that he felt it would be helpful to include the table in Appendix BB because omitting it may give the impression that the doses were not calculated. Mr. Allen agreed that the inclusion of the table would improve the document.

The fifth source of radiation at GSI was from the residual contamination from inhalation and ingestion and external radiation from the uranium. NIOSH assumes that all of the airborne contamination from cutting and machining uranium metal for all of the hours that uranium was worked was deposited directly on the floor. To maximize the dose, no adjustment was made for the dilution that would have occurred when the dust was tracked out of the area into other parts of the plant or from transport out of the area in railroad cars. NIOSH assumes the highest concentration in all areas.

An attendee asked how NIOSH accounted for the practice of recycling the sand that was used in the grinding operations throughout the plant. Mr. Allen stated that NIOSH does not limit use of the maximizing assumptions to the Betatron operators, but assumes that all GSI workers would have been grinders or cutters working on the castings.

Another attendee stated that he had attended the Advisory Board on Radiation and Worker Health (ABRWH or the Board) meeting in Naperville in December 2006, where he had heard a speaker say that a worker that wasn't directly in the Betatron building was not affected by it. The attendee estimated that 95% of the workers at GSI were affected by the Betatron. He worked as a "changer" who handled the ingots after they came out of the Betatron area. He described crawling around to remove the ingots and then setting them aside for transport back to Mallinckrodt. The attendee challenged the number of working hours that NIOSH allows in the dose reconstructions, saying that he sometimes worked six days a week. Mr. Allen explained that NIOSH estimates the radiation dose for a Betatron operator (radiographer) and adds the dose for worker grinding on a casting. NIOSH give this dose not only to the radiographers and grinders, but also to most of the other workers at the site. A slightly lower estimate is used for workers who did not work with radiological materials, such as accountants. The former worker stated that after they finished their work in the Betatron area, they returned to their jobs in the foundry. He expressed his concern that workers in the entire plant were affected by that. Mr. Allen stated that NIOSH overestimates the radiation dose by assuming that most workers were in the Betatron building for all of the hours that the Betatron was in operation. The overestimate is much higher than the workers would have received in the Betatron area.

Mr. Allen was asked if it was accurate to say that NIOSH treats everybody at GSI as a Betatron operator during dose reconstruction unless the worker is clearly an administrative type. The attendee stated that he had read in the appendix that any worker who touched the casting in the two hours following the shot was treated as an operator and asked how NIOSH decides which workers fall into that group. Mr. Allen stated that the statement in the appendix qualifies the science behind who falls into those groups, but that the maximizing assumption is that most employees would fall into the higher group – for example: riggers, grinders, cutters, chippers. The attendee asked Mr. Allen if NIOSH defines those job classifications through the claimant's CATI (computer assisted telephone interview). Mr. Allen responded that NIOSH looks at the interviews, but in order to expedite the dose reconstructions, the first assumption is that most GSI workers got the higher dose. Another attendee commented that inspectors would have been the first workers on the scene when the Betatron shot was done. Mr. Allen replied that the inspector would be involved in the quality assurance of the shots and would be assigned the

radiographer dose.

Mr. Allen explained that NIOSH uses the higher dose estimate to determine whether the case is compensable. Since a case cannot be compensated on an overestimate, if the POC is greater than 50%, the dose reconstructor must then determine whether it is compensable using the lower dose estimate. In most instances, the case will either be compensable using both estimates, or not compensable using either estimate. This efficiency method leaves fewer cases that actually require full dose reconstructions.

The attendee continued with his questions regarding whether NIOSH looks at all GSI workers as if they were Betatron operators. Mr. Allen reiterated that for the purpose of expediting the dose reconstructions, NIOSH assumes that most, but not all, GSI workers had the same exposure as the Betatron operators in an effort to be claimant-favorable. The attendee described the job classifications of an inspector and a timekeeper, and expressed concern that such jobs may seem like non-radiological jobs when, in fact, they are. Mr. Allen responded that NIOSH would give those jobs the same consideration as the radiographer. The attendee asked if it would be helpful to provide NIOSH with a list of job descriptions, to which Mr. Allen replied that the information would be helpful. Mr. Allen repeated that the vast majority of claims can be decided clearly using the efficiency methods, but if it is not clear NIOSH will assume that the worker received the same dose as the Betatron radiographer.

A discussion ensued among several attendees and Mr. Allen regarding the doses that might be given to workers in contiguous areas to the Betatron. Mr. Allen said that workers in the vicinity of the Betatron most likely would be given the radiography dose because they were likely to have been involved in the Betatron operations at some point. However, even using the bounding estimate to get the highest credible dose will not be enough to make every claim compensable. When asked if any of the new information from the earlier meeting with the Betatron operators would be beneficial in determining compensation for some workers, Mr. Allen responded that some of the information would be investigated, particularly the Betatron exposure rates (settings) and the longer working hours.

Another former GSI employee asked Mr. Allen if he realized that many workers had assignments all over the plant. Mr. Allen stated that NIOSH recognizes not only the mobility of the workers, but also that the steel went to different locations around the plant. A laborer may have been sent anywhere, which is why NIOSH uses the higher radiographer dose as the bounding estimate. The former employee stated that the company did not issue any protective clothing or face masks. The environment in the foundry was very dirty and workers inhaled a lot of dust and dirt. Mr. Allen said that NIOSH does not assume the use of protective equipment in the dose reconstructions.

An attendee expressed frustration that his dose reconstruction report was difficult to understand. Mr. Allen stated that a NIOSH representative would be available after the meeting to discuss the report with him. Another attendee said that he was put off by the "one size fits all" concept. Mr. Allen replied that even though most GSI cases are handled by applying the overestimate, there were actually two situations for GSI; and that is why NIOSH applies the bounding estimates to account for every possible exposure.

**Question from a former worker (unidentified):**

Why is grinding the only repair taken into account?

**Mr. Allen:**

Grinding was used to determine the bounding estimate because it was the dirtiest operation and would yield a high concentration for internal exposure from inhalation. NIOSH assumes that the worker is getting the casting straight from the Betatron shot, grinding on it continuously until the next casting comes over, and breathing in a concentration of 4,000  $\mu\text{g}/\text{m}^3$  constantly, instead of diminishing over time as it would naturally.

**Question:**

If everyone is given the overestimate in their dose reconstruction, what factors send the POC over 50%? Is it the information from the interview, the number of hours or years worked? Exactly what is it that puts the probability over the top?

**Mr. Allen:**

The NIOSH task ends with the dose estimate. After the dose reconstruction is sent to DOL, the claimant's information is entered into the IREP for the POC. Many factors are entered into the program including the worker's age at diagnosis, age at first exposure, gender, and type of cancer, among others.

**Question from a former GSI worker [Name Redacted]:**

How do we know which cancers are caused by radiation?

**Mr. Allen:**

EEOICPA assumes that all but one cancer can be caused by radiation. Compensation is a matter of the probability that the worker's cancer was caused by radiation. The IREP determines the POC based on various types of cancer and what the risks are for a particular dose. Chronic lymphocytic leukemia is excluded because the National Cancer Institute has determined that it is not a radiogenic cancer. Other forms of leukemia are included under EEOICPA.

**Question from a former worker (unidentified):**

How do you factor years into this formula?

**Mr. Allen:**

That is part of the IREP program.

**Comment:**

My cancer is papillary thyroid cancer. When I had my surgery, the doctor asked if I had ever worked in a nuclear power plant. When I told him, "No," he said that type of cancer is caused by radiation. Since that time, I have had three other doctors who have all said the same thing – that there is an 80% chance that the cancer was caused by radiation. The (dose reconstruction) report that I got back from you says that it can't be.

**Comment:**

My dad had the same type of cancer that you are looking for, but his report also said that the cancer could not have been caused by radiation. That just blows my mind.

**Mr. Allen:**

The part that blows my mind is that the doctor will tell you that it was caused by radiation. Did he ever ask you how much radiation you got? You have to know how much radiation. You get exposure from the sun and many other things just from living on this planet. For a doctor to tell you that your cancer is caused by radiation without asking about your exposure is very irresponsible.

**Comment:**

Everyone knows that you get radiation from the sun. It will give you brown spots.

**Mr. Allen:**

There is penetrating radiation from the sun, too.

**Comment:**

Some of these cancers can take 30 or 40 years to show up.

**Mr. Allen:**

Yes, some of these do. They used the Hiroshima-Nagasaki study because it followed these people for many, many years.

**Comment:**

I have a doctor's report in here that says that a person has a better chance of getting cancer from low dosages than from high dosages.

**Mr. Allen:**

I think that NCI probably disagrees with that report. We have to use the IREP to determine probability.

**Question:**

If you don't have cancer, you can't be compensated. Is that right?

**Mr. Allen:**

Subpart B is for radiation induced cancer only. That is the only part of the law that NIOSH deals with.

**Question [Name Redacted]:**

In December 2006 at the Naperville ABRWH meeting, Dr. Neton gave some figures for pay rates for the various cancers. I noticed that the one cancer that was glaringly omitted was 2005 data for prostate cancer. There are a lot of people here who have prostate cancer. Is there any NIOSH data that you can give us for payout rate for prostate cancer in this program?

**Mr. Allen:**

I don't have that information at my fingertips. The doses received at GSI were primarily external doses, so the statistics for which cancers are paid more predominantly are going to be skewed from what you are going to see at GSI because the doses at other facilities are primarily internal from inhaling uranium, thorium, and plutonium.

**Question [Name Redacted]:**

Many people ask that question of us advocates. Mr. Hinnefeld, do you know that number?

**Mr. Hinnefeld:**

I don't know that number right off the top of my head, but we can generate it when we get back to the office. The compensability rate for prostate cancer is low. We don't have a very high success rate for showing probability, but it is not "0." There are cases in which prostate cancer has been compensated.

**Question [Name Redacted]:**

From the discussions with (Bob Anigstein) of SC&A (Sanford Cohen & Associates, the ABRWH support contractor), they seem to prefer to use the program MCNP5 for their modeling. It seems that NIOSH likes the program Attila. It seems we have two groups of experts that are working to model data, but you have very little actual data on activation and things like that. Can you comment on why NIOSH seems to prefer Attila and how do the results compare?

**Mr. Allen:**

NIOSH actually did use both MCNP and Attila for GSI. We used MCNP for the activation of the uranium and the steel. We used Attila for skyshine. As far as the comparison of the

programs goes, MCNP is more versatile but it is a much slower application and a run can take a matter of hours or even days. Attila uses a different mathematical engine and is not as versatile, but it runs much faster. We used it for the skyshine so we could model many points around the building quickly, rather than taking longer with MCNP – possibly months.

**Question [Name Redacted]:**

Would SC&A have to use the same program to check the data that you generated for skyshine?

**Mr. Allen:**

No, I don't think so. It can be modeled using MCNP, but it will just take a great deal of time. That is up to SC&A.

**Question [Name Redacted]:**

When you modeled the skyshine with Attila for Appendix B, did you use the new Betatron or the old Betatron for the dose rate?

**Mr. Allen:**

We actually modeled both Betatrons, but we used the same figure of 100 R/min because it gave the highest dose rate for shine in the control room of the old Betatron building.

**Response [Name Redacted]:**

The highest dose rates from skyshine were in the control room?

**Mr. Allen:**

Yes, that was where the highest dose rate was for all of the spots that we modeled.

**Response [Name Redacted]:**

I suggest that you look at the new Betatron. The control room was shielded, so you need to do a skyshine tester analysis in comparison to the unshielded 10 Building that was 30 feet away.

**Mr. Allen:**

Some of the skyshine bounces some radiation up over that shield wall and then back down to the ground. Then it bounces on out further, but the dose rate will tend to go down the further out that you go. What we are talking about is the distance between the old Betatron machine and the old Betatron control room. Are you saying that Building 10 was closer than that to the new Betatron machine?

**Response [Name Redacted]:**

I am saying that 10 Building may be another ten feet further, but it was also populated by 200 to 300 men.

**Mr. Allen:**

NIOSH assigns the same dose for skyshine to everyone. The highest number that we got from that model happened to be in the old Betatron control room, but it could have been anywhere.

**Response [Name Redacted]:**

Are you saying that it bounced right over the wall and you are taking that as your number?

**Mr. Allen:**

Basically, yes. We modeled the shield walls and ignored the smaller cinderblock walls and the roof and pointed the machine in every direction. The control room was where we found the highest dose. We did the same thing at the new Betatron.

**Response [Name Redacted]:**

I think [Name Redacted] is asking you if that makes sense. Does that result have any validity? The control room is the one place where the men are ensconced and, hopefully, the most

protected. Yet you say that is where the highest dose was received. If that is true in the real world – and we must reiterate that your figures are not based on any real world data in actual control rooms – even though a control room exists for a similar Betatron in West Allis, Wisconsin. Nevertheless, that doesn't make sense to me.

**Mr. Allen:**

You are right. In the real world, there would be a second floor with capacitors causing shielding, in addition to the shielding caused by the flooring for the second floor. That is not in our calculations. We were bounding it by only using the thicker shield walls. By our calculation, the radiation would be bouncing over the walls and coming straight down into the control room with nothing above that control room.

Mr. Allen continued the presentation. He stated that the residual contamination model for internal dose started with the airborne concentrations from the machining and cutting during the uranium work. NIOSH assumed that the contamination that fell to the floor was not diluted by foot traffic or any other means. NIOSH then assumed that the contamination was resuspended at the same airborne level until 1993 when the building was declared clear. The bounding estimate did not account for any dilution or removal of contaminated material. As a reality check, NIOSH looked at the 1989 survey done by FUSRAP (Formerly Utilized Sites Remedial Action Program) to determine what that level might have been. NIOSH assumed a concentration of 117,000 dpm/m<sup>2</sup> of loose, resuspendable material. In reality, over the 20 years between the plant closure and the end of the clean up operations, much of the contaminated material would have been ground into surfaces and could not have been resuspended. The highest level of airborne contamination that was found during the FUSRAP survey was approximately half of the NIOSH bounding estimate. In reality, the average rate for the fixed contamination would be less than one hundredth of the NIOSH bounding estimate.

NIOSH started by using the same model with the same contamination level for the external residual dose rate from the uranium dust and found that the dose rate was not very high. The resulting dose rate could not be used as a bounding estimate because it is very credible that the dust would have been cleaned up, swept up, or concentrated in one spot or another, and that would cause a higher external dose rate in an area. The FUSRAP survey cited a vacuum cleaner containing a “decent” amount of uranium that had a reading of 90 µR/hr (microrentgen per hour) on contact. To arrive at the bounding estimate for the residual external dose, NIOSH assumed that all GSI workers during the residual period were in contact with the vacuum cleaner for 2,500 hours per year until 1993. It is possible that the vacuum cleaner may have had a higher reading closer to the end of the uranium work, but the bounding in the estimate comes from the 2,500 hours of contact per year. Moving away from the vacuum cleaner, the dose rate would actually drop. The FUSRAP survey indicated that the reading under the vacuum cleaner was less than half of 90 µR/hr.

NIOSH makes other assumptions to create a more claimant-favorable scenario, giving the radiographer a 12 mrem dose:

- Allows 30 minutes to set up each shot and 30 minutes to take it down. In reality, it takes more time to set up the shot than to take it down, but the material is more radioactive after the shot. By allowing a longer time at the higher exposure, the worker's dose is maximized.
- Assumes a one hour shot at 100 R/min. During the shot, the radiation is from skyshine. In reality, the shots took longer, but the longer time would lower the dose. By decreasing

the length of time that the worker is out of the shielded area, the worker's dose is maximized.

Mr. Allen stated that if the above scenario was changed to assume a four hour shot for uranium at 100 R/min, with 15 minutes to set up the shot and 15 minutes to take it down, the worker's dose would decrease by 50%, from 12 mrem down to 6 mrem, because the worker is spending four hours outside the shielded area. If the same calculation is done allowing 30 minutes each for setting up and tearing down the four-hour shot, the dose is 9.9 mrem.

**Comment [Name Redacted]:**

The uranium comes in several forms: slabs, slices, and ingots. All of them are too big to shoot with just one piece of film. For example, an 18-inch slice takes two pieces of film. Doesn't that double a worker's exposure since he has to physically go in there to set up the second piece of film? It takes four pieces of film to shoot an ingot. Doesn't that give the worker even more exposure? [Name Redacted] can explain it better.

**Response [Name Redacted]:**

The film comes in a 14" x 17" metal cassette. The purchase order specified 14" x 17" AA film. For an 18 inch slice, you have to use two films and two shots. When the first shot is set up, you have to mark the slice into sections so you can prove overlap when the films are done. You set up the shot for the first section and when that shot is done, you go exchange the films and set up the second section so it overlaps the first. The reason it has to be overlapped is to get complete coverage of the piece.

**Mr. Allen:**

The reason that you don't use bigger film is because the Betatron beam is not big enough to shoot the whole shot at six feet, assuming that the uranium is shot at that distance.

**Comment from a former worker (unidentified):**

Actually, you would have to shoot an 18-inch piece three times because when you overlap two 14" x 17" films, they still won't cover a circle with an 18-inch diameter.

**Response [Name Redacted]:**

Each piece has to be put in separately, so there is three times the exposure.

**Mr. Allen:**

Why don't the three of us look at this after the meeting to make sure we are all on the same page?

Mr. Allen concluded the presentation on Appendix BB – General Steel Industries. He opened the floor to any questions not specific to claims.

**Question:**

Did you say that skin cancer is not included in the cancers for dose reconstruction?

**Mr. Allen:**

Skin cancer is very reconstructable. Certain types of skin cancer are probably among some of the highest paid cancers.

**Response:**

Channel 4 had a story on a worker from Granite City Steel about a month ago. He had a cancer that covered his face and his arms. He said that he has been fighting with DOL for a long time and may have to hire a lawyer.

**Question:**

What about asbestos?

*Mr. Allen:*

NIOSH only deals with radiation doses for Part B EEOICPA claims.

**Question [Name Redacted]:**

I don't understand why NIOSH didn't retrieve the film badge data for GSI that is still at Landauer. One worker in that data set had a lifetime dose of 38,000 millirem. Will your dose reconstruction using the bounding estimates cover that dose?

*Mr. Allen:*

The appendix gives approximately 6 rem/year for the first eight or nine years, which would be more than the 38 rem that you mentioned.

**Comment [Name Redacted]:**

I believe that dose was accumulated in less than one year by this gentleman. I don't know if the dose was due to an accident. He was an isotope operator. It would probably behoove you to look at that real data since the entire modeling scenario is based on computer models.

*Mr. Allen:*

We are in contact with Landauer trying to retrieve that data. They have some data through 1973, but we don't know the start date.

**Comment [Name Redacted]:**

The start date is 1963. They have weekly film badge data for 30 workers who were mostly Betatron and isotope operators. They also have yearly summaries.

*Mr. Allen:*

NIOSH plans to retrieve that data and use it to refine the estimate.

**Question from a former worker [Name Redacted]:**

Would you make certain that the Board gets the data that I gave you earlier on wages and hours?

*Mr. Allen:*

We will be sure to see that they get that information.

**Question:**

Have there been any studies on the residual radiation of the cassettes themselves and the marginal handling of the films?

*Mr. Allen:*

We have looked at that as another material that can be irradiated from the Betatron beam. But film tends to be behind the steel being x-rayed, so it is shielded more than the front of the steel. We did not account for it in the appendix because the bounding estimates on the front of the steel tended to overestimate that. It would not be a big dose and it would tend to go away quickly.

**Question from a former GSI worker (unidentified):**

Did I hear you say earlier that you use the same figures for everybody working around the Betatron? Did everyone get the same dose?

*Mr. Allen:*

We are starting with that dose estimate for most of the people, but there are other things that we have to account for. There is a dose conversion factor for the specific organ of the cancer. We also have to consider the years that you worked and how long you worked.

**Response:**

Does that mean that my dose report will be basically the same as everyone else's?

**Mr. Allen:**

There are small differences in the external dose. For the internal, there is a great deal of difference. When you inhale or ingest uranium, it is metabolized differently by different organs. It tends to concentrate in certain organs. If your cancer is in one of the organs where it tends to concentrate, your dose is going to be considerably higher than if it is in one of the organs where it does not concentrate.

**Question:**

Can you tell us what organs it tends to concentrate in?

**Mr. Allen:**

If you inhale uranium, it will concentrate in the lungs. Your body tends to clear it mechanically through the gastrointestinal tract. It doesn't tend to stay there. Once it gets into the bloodstream, it can get to the bones, the bone marrow, the liver to an extent, and the kidneys.

**Response:**

If you inhale it while you were working with it, could it cause lung cancer? Father worked there and had lung cancer. That is why I asked.

**Mr. Allen:**

If you inhale it into the lungs, you will get a dose. If you inhale enough of it, it can cause lung cancer.

**Response:**

His dose reconstruction report had a POC that I would consider minimal. You said you gave the same dose to everyone as the people who worked in the Betatron building, so I don't understand how it could be so low.

**Mr. Allen:**

Most people were given that exposure. There were some cases that were given the lower dose because it wasn't clear, but it was enough to make the claim decision clear. There were other cases in which it was clear that the worker would not have been anywhere near the steel within two hours of the shot or near the Betatron building at all, so they were given less dose.

**Comment:**

This gentleman said that the steel itself contained uranium.

**Mr. Allen:**

He said that it contained some radioactive isotope that was used to harden it. That is news to me. I need to get that information from him.

**Question from a former GSI worker (unidentified):**

During the time I worked at General Steel, I worked on almost every casting throughout the plant. I was a boilermaker-burner. I was opening up cracks in every casting in there that was being re-welded. I have been hospitalized over the past 20 years with cancers of the prostate, colon, skin, and blood. The doctors say that I am lucky to be alive. Is anybody in this room ever going to see a dollar of this money that they are talking about?

**Mr. Allen:**

I believe so. Roughly 30% of the GSI dose reconstructions that I have looked at have a probability greater than 50%. DOL usually does not delay that long. If there haven't been checks for those claims yet, they should be coming soon.

**Question:**

What is the probability that claims that have been denied will be reconsidered?

**Mr. Allen:**

There is not a good chance of that happening until the document is revised.

**Question:**

Do you think that you got enough information tonight to re-evaluate claims?

**Mr. Allen:**

We have enough information to re-evaluate Appendix BB. If that changes, we will have to re-evaluate the previously completed claims. But the ABRWH is reviewing the document now, so NIOSH will wait until their review is complete and make all of the revisions at one time.

**Comment from a former GSI worker (unidentified):**

The problem is that the majority of us worked at General Steel in the early 1950s, so I don't have any hope of seeing it through. We are older and the longer you take, the more of us will be dead. The other part of it is that I am 78 and if I get paid, what am I going to do with it? This is taking too long.

**Mr. Allen:**

To answer your question: When you get paid, you can do anything you want to with it. Part of the reason why these documents are put together when we have enough information is to get to the point where we can get the right compensation decision. The reason why we have a process in place to get more information is that there may be something out there that can help us do better dose reconstructions and get more claims compensated. That is the only way we can deal with more than 300 sites and get compensation decisions out there and still get them right.

**Comment from a former GSI worker (unidentified):**

I am a cancer survivor. I have had a couple of blood transfusions. I get treated here at Barnes Hospital and St. Louis University, and I get information from relatives in the medical field at Mayo Clinic. I listened to you talk about the iridium-192 and cobalt-60. You may think that it is not as dangerous to work with as a Betatron. I have gotten zapped and I have looked into it. The way they are made, they are dangerous. There are new lung cancers that you should be looking into. Thirdly, you do receive a dose when you set up the film and remove it. And you are forgetting one important thing – the collimator on front end of the Betatron. Thank you.

**Question:**

When was this program set up? When was the law initiated and the funds set aside for compensating these people who were exposed?

**Mr. Allen:**

The law was signed in December 2000. NIOSH does not issue the checks, our part ends with the dose reconstruction. We have sent more than half of the GSI dose reconstructions back to DOL and we should be finishing with the rest of them in the near future.

**Question:**

You said that the law was signed in December 2000, is that when you started your investigation for the dose reconstruction?

**Mr. Allen:**

No. That is when President Clinton signed the law. There was a lot of bureaucracy involved before they even decided what agency would deal with it. NIOSH started gathering information for dose reconstructions late in 2002. There are more than 300 sites, so it has taken some time to

develop all the documents we need for dose reconstruction. The appendix for GSI was signed in June 2007. Since then, we have completed dose reconstructions for almost 150 GSI claims. Today, we got more information from the men who worked with the Betatrons that we will use to revise the appendix. If that information results in an increase in dose, previously denied claims that may be affected will be reevaluated. There is always the possibility that some of the information could cause the bounding estimates to decrease.

**Question:**

If the dose reconstruction has a POC over 50% and employee was smoker, how does that affect the POC?

***Mr. Allen:***

Smoking is a factor that is put into the POC for lung cancers only. It will lower the probability that the radiation caused the cancer, but not as much as you would think.

Mark Lewis thanked the attendees for meeting with the representatives from NIOSH. He adjourned the meeting at approximately 9:15 p.m.