revising some sections, as well, from that meeting.

The ones down the pike are Portsmouth, Mound and Oak Ridge, and they're being scheduled -- currently in the process of being scheduled.

**MR. GRIFFON:** Jim, are these minutes available on the web site at all or --

**DR. NETON:** Yeah, they will be. We did not do that at the Savannah River meeting, and then after we -- you know, in hindsight we decided that was -- probably would have been better to do and as they come available we'll certainly have them on our web site.

Okay, I want to spend a little bit of the remainder of my time talking about these two complex-wide efficiency documents and giving you an example of dose reconstruction for each flavor. The first one I'll talk about is a DOE complex-wide, and really it's a -- it's based on a number of different -- and I'm going to throw another term out at you, a technical information bulletin. I wouldn't get too hung up on the nomenclature, but these technical information bulletins are sort of small versions of technical basis documents. I don't know how else to describe it, but they're more even focused than a site pro-- a profile -- a technical basis document talks about a major chunk of the site. These things talk about specific processes.

For example, technical information bulletin 002 talks about maximum internal dose for certain DOE claims; 008 talks about how to interpret external dose measurements, and so forth. So there's one, two, three -- four different technical basis documents or technical information bulletins that are used for the DOE complex-wide approach.

The summary of the approach is to take advantage of some of the claims where we have better monitoring programs. If we limit the applicability to more recent employment, and specifically after 1970 time frame at DOE facilities, the radiation protection programs were at least somewhat more mature than they were in the very early days of operations in the late forties and fifties. There were some evidence of active air monitoring programs, bioassay programs, that sort of thing. And so we could take advantage of that.

We can also apply these maximizing factors where instead of having a number of different site profiles for all these sites, we could take, for example, the highest detection limit for any site in 1975 and use that as the missed dose for the worker. So we go through the whole complex and use the maximum assumptions by default, and then apply that to the worker, knowing that they're more than likely above what the worker had been exposed to.

In a similar fashion we'd use the maximum credible undetected intake. What is the largest intake, given that there were some RAD protection controls and processes in place that could have occurred and not been detected.

And as usual, to be claimant-favorable, these things would choose parameters that maximize probability of causation. Examples of that are things such as claimant-favorable solubility classes. If you're calculating a dose to the gallbladder, you would assume that it was soluble uranium, so it was absorbed from the lung and deposited maximally in that organ.

Okay. Just to go over a little -- a single example, and I tried to pick something which is typical, kind of mid-range of this approach.

Here's an example of a claimant or an Energy employee who worked somewhere in the Oak Ridge reservation as a security guard for 16 years and he worked from the late 1970s through the early nineties. Subsequently developed prostate cancer, which was diagnosed two years after end of his employment, and he was 63 years old at that time.

So we requested the information from the Department of Energy from the Oak Ridge reservation and we received a reported DOE dose for his entire 16-year period for external exposure of 84 millirem.

The individual was monitored, though, every quarter, and obviously most of those quarters came back with a zero dose, no detectable dose. So what we did was we reconstructed the person's dose assuming that all 70 dosimeter readings that were taken for the person were equal to the detection limit that's in the profile -- or in the document -- not necessarily the detection limit for the Oak Ridge reservation, but for the highest one of the DOE sites that we've evaluated. So doing so, 70 dosimeter exchanges times detection limit ended up assigning 2,840 millirem external dose to the prostate, just based on a missed dose calculation using an upper limit for the detection limit.

Okay, in the internal dose area, the worker had no evidence of urinalysis bioassay at all, but there was one non-detectable in vivo exam, which was below the detection limit of the measurement system. So the complex-wide approach would assume that the worker inhaled -- had a hypothetical intake of a mixture of 28 separate radionuclides that were likely to be present on DOE facilities during these time period. So there was an acute inhalation intake of 28 radionuclides that were equal to ten percent of the maximum permissible body burden at that time. In doing that, it was -- the estimate -- the overestimate or the dose was 11,923 millirem to the prostate gland.

I will say that when we do these, we take into account any existing bioassay data that we've received, such that the predicted intake must be above the value of the bioassay levels, so you'll never assign a dose lower than what the bioassay would predict. You're always going to be on the high side, the curve would be on the top of it.

So the results of this dose reconstruction -- did I miss a slide? Yeah.

Okay, occupational medical dose. Of course we're including that in our dose reconstructions, so we assume that there was an annual medical X-ray for this worker for each year of employment, whether or not we actually had any evidence of that. We would just automatically assume that at the most he would have had an annual medical X-ray. We would have no evidence that there was any more frequent than that, let's put it that way. And we would assign the highest dose received by any organ from that X-ray other than skin. So what I mean by that is an X-ray is taken with a collimated beam -- a collimated beam. Other organs that are not in the field of view would be irradiated. In this case we would have taken the lung dose as the highest dose and assigned it, and that ended up assigning 1.4 rem -- 1,411 millirem to the prostate gland from the X-rays -- the hypothetical medical X-ray.

So the results of this are that the total assigned dose to prostate was 14,922 millirem versus the record that was provided by Department of Energy for his occupational monitoring of 84 millirem, which resulted in a probability of causation of 10.4 percent at the 99 percent credibility level. I always -- it's sort of interesting to me to just keep track. The probability of causation at the 50th percentile in this particular case is one percent, given even these very extreme -- we believe -- overestimates for this particular case.

So that's an example of what we do with these AWE -- or the DOE complex-wide. I'd like to now talk about what we do in the AWE area. It's a little different.

There's a technical basis for estimating maximum plausible doses to workers at AWE facilities that's out on our web site, as well, and it includes an internal dose evaluation protocol that covers all the major modes of exposure. That would be internal, both inhalation and ingestion; external exposure, and residual contamination being present at this facility.

The approach here -- most of the -- this approach for complex-wide only is applicable to Atomic Weapons Employer facilities that handled natural uranium. A lot of the facilities handled natural uranium -- hang on, I think I have a number here. About 100 of the AWE facilities handled only natural uranium, and a large number of those -- more than 70 percent -- operated less than five years. So you've got a situation with a natural uranium exposure, similar processes or maximized -- processes that you could maximize, and you're actually only covering five years of exposure, and then any residual contamination from that exposure up to the point of diagnosis.

So in looking at a number of the AWEs that were out there, and in particular the ones in the early years, the seven that were evaluated early on, it was decided that if we assumed a constant internal exposure to 100 times the maximum allowable air concentration during the entire period of operation, we would overestimate the internal exposures for these workers. What we mean by that is we would assign -- and many of these operations only happened for like a six-month period, two days a week, six months, something like that. We assumed for the entire year that the person received 100 times the maximum allowable air concentration, eight hours a day, five days a week, 52 weeks a year. That covers the internal exposure.

And the external exposure is modeled by -- it turns out that there were maximum-size cylinders that were handled at these facilities, and so it was actually a Monte Carlo model to model the external exposure coming off of a big block of uranium metal, essentially. And so that was modeled both as a cylindrical and a rectangular ingots, and I believe the rectangular one came off higher, so we ended up using that one. There's not much difference between these two. So the worker was also assumed then to have been exposed external at a distance of one foot from this uranium metal for the same time period, the entire year, eight hours a day, five days a week.

We also made provisions in this document for external exposure from contaminated surfaces. If you generate this huge amount of air concentration, there's a certain settling that happens that one can calculate with a certain terminal settling velocity of the particles that will accumulate on the surfaces. We assumed no removal of that material, and then calculated, using standard models, the external exposure from a person walking around all these hypothetically-contaminated surfaces.

And then we also -- there's a model in here for ingestion of contamination on those surfaces. There's certain assumptions for transfer factors, settling into coffee cups, that sort of thing. So we tried to do a -- covering all the bases here with some fairly maximized assumptions to see how we could use this for these claimants.

As I mentioned, it was restricted to uranium only, and it does exclude dose reconstructions for the lungs, skin, breast, eyes and tissues. It just won't work for those. Obviously for lung cancer, if you're breathing this type of a air concentrations, it's just not going to work.

Okay, let me just briefly go over one case. This is a person who worked at an AWE that was located in Pennsylvania. He was employed as a millwright from the mid-fifties through the late seventies. The DOE operation only occurred in one year during that employment. And in fact, this is one of those facilities where it was for six months, and they actually only worked two days per month -- or they were contracted to work two days per month.

We assumed for this particular dose reconstruction, though, that the person worked the entire year, eight hours a day, five days a week, 52 weeks, breathing that 100 times the maximum air concentration. That's pretty -- that's fairly typical of how we would process these claims. The person did have -- was diagnosed with colon cancer one year after the end of his employment at the age of 54.

In the external dose area -- we have no external dose measurements for this facility at all, but as I mentioned before, there was a Monte Carlo simulation given these large blocks of uranium -- natural uranium present in the facility. What would be the continuous exposure for one year at one foot from the uranium metal itself -- basically that's what I said. If we do this calculation, we would assign 4,100 millirem to the colon from exposures from working right next to this derby for the entire year. The residual radioactivity model, which is walking around these theoretically-contaminated surfaces for the entire year, adds another 1,032 millirem. And -- oh, this is from -- this is from the contaminated surfaces, 43 millirem. This is from residual -- ingestion of residual radioactivity.

I think these are somewhat different than your slides. I apologize. I'll make sure that we get copies of this out. These numbers are a little higher. What I neglected when I was pulling these off the dose reconstruction is there's two classes of gamma exposure, 30 to 250 keV and greater than 250. I inadvertently only pulled up one column, so that's why these numbers are higher. I apologize for that. I'm glad I caught this looking it over last night.

So at any rate, we have these three modes of exposure that we've covered for external.

In the internal dose area, no bioassay results were available for this worker. Again we assumed this breathing of 100 times the MAC for the entire year. We used the claimant-favorable solubility class, which means that, you know, all the activity would have been absorbed -- or the more rapid clearance from the lung through the GI tract and absorption. If you do the calculations -- it's always kind of interesting to me to put this sort of on a mass scale -- we would have assumed that the person inhaled 4.7 grams of natural uranium during that year, which is quite a bit of uranium, mass-wise, to inhale. And again we included the dose from residual contamination.

Doing that, we ended up with 5,870 -- that should be millirem -- boy -- to the colon. I need to fix these, I'm sorry.

Medical dose, we assume one annual medical X-ray during the year of the contract. The highest dose, again, received by any organ other than skin, and that ended up assigning 95 millirem to the colon.

So when you add all that up -- I'll get to my last slide -- the total dose to colon was 5,870 millirem for the internal exposure pathway, 5,270 from external, which resulted in a probability of causation of almost 18 percent at the 99 percent credibility level. Again, I like to look at the 50 just to see the spread between these two numbers, and it was three and a half percent at the 50th percentile.

I believe that's all I have to say. I'd be happy to answer any questions.

**DR. ZIEMER:** Okay, I've got Tony and then Gen.

**DR. ANDRADE:** (Off microphone) I'm curious about why --

**THE COURT REPORTER:** Dr. Andrade...

**DR. ANDRADE:** Sorry about that. I was curious as to why some of these all-ranging site profiles, especially if you're dealing with natural uranium, did not include your radon exposures or radon intakes. If you're going to be dealing with that, you know, and people work, even for a long period of time, it may not add significantly to the POC, but nevertheless, it perhaps would give more credibility to the AWE-wide profiles.

**DR. NETON:** That's a good question. I think -- I failed to communicate to you, this is for natural uranium only and does not apply to facilities that processed uranium ore that may have radium-226 in the stream. So if you receive natural uranium, you just can't grow in radon in that decay chain in any quantity that would make any difference in the dose calculation.

**DR. ANDRADE:** So this is for processed uranium.

**DR. NETON:** Exactly.

**DR. ANDRADE:** You're not dealing with ores at all.

**DR. NETON:** That's correct.

**DR. ANDRADE:** And when you say "natural", it is processed naturally.

**DR. NETON:** It is processed uranium, already refined, in either powder or metallic form of some type. We did allow for a 100-day decay so that the protoactinium 234-M beta would grow in and you'd optimize that exposure, but radium's been taken out of this natural uranium already. Sorry for the confusion on that.

**DR. ANDRADE:** Thank you.

**DR. ROESSLER:** Jim, I want to I guess just comment on the claimant-friendly aspect of some of this. I was particularly struck when you were talking about the DOE site occupational medical dose. Now aren't most of those for the lung or the chest -- they're chest X-rays, aren't they?

**DR. NETON:** Correct.

**DR. ROESSLER:** So you assumed -- or what you assume is that the primary beam includes the prostate --

**DR. NETON:** Correct.

**DR. ROESSLER:** -- in that example, which --

**DR. ZIEMER:** And no collimation.

**DR. ROESSLER:** -- yeah, and no collimation. To me, that's an example of being extremely claimant-friendly or an example of very poor medical procedures. I just wanted to make the comment.

**DR. NETON:** I agree with you. The bottom line is that we don't have any information about