1 revising some sections, as well, from that
2 meeting.
3 The ones down the pike are Portsmouth, Mound
4 and Oak Ridge, and they're being scheduled --
5 currently in the process of being scheduled.
6 **MR. GRIFFON:** Jim, are these minutes
7 available on the web site at all or --
8 **DR. NETON:** Yeah, they will be. We did not
9 do that at the Savannah River meeting, and then
10 after we -- you know, in hindsight we decided that
11 was -- probably would have been better to do and
12 as they come available we'll certainly have them
13 on our web site.
14 Okay, I want to spend a little bit of the
15 remainder of my time talking about these two
16 complex-wide efficiency documents and giving you
17 an example of dose reconstruction for each flavor.
18 The first one I'll talk about is a DOE complex-
19 wide, and really it's a -- it's based on a number
20 of different -- and I'm going to throw another
21 term out at you, a technical information bulletin.
22 I wouldn't get too hung up on the nomenclature,
23 but these technical information bulletins are sort
24 of small versions of technical basis documents. I
25 don't know how else to describe it, but they're

1 more even focused than a site pro-- a profile -- a
2 technical basis document talks about a major chunk
3 of the site. These things talk about specific
4 processes.
5 For example, technical information bulletin
6 002 talks about maximum internal dose for certain
7 DOE claims; 008 talks about how to interpret
8 external dose measurements, and so forth. So
9 there's one, two, three -- four different
10 technical basis documents or technical information
11 bulletins that are used for the DOE complex-wide
12 approach.
13 The summary of the approach is to take
14 advantage of some of the claims where we have
15 better monitoring programs. If we limit the
16 applicability to more recent employment, and
17 specifically after 1970 time frame at DOE
18 facilities, the radiation protection programs were
19 at least somewhat more mature than they were in
20 the very early days of operations in the late
21 forties and fifties. There were some evidence of
22 active air monitoring programs, bioassay programs,
23 that sort of thing. And so we could take
24 advantage of that.
25 We can also apply these maximizing factors

1 where instead of having a number of different site
2 profiles for all these sites, we could take, for
3 example, the highest detection limit for any site
4 in 1975 and use that as the missed dose for the
5 worker. So we go through the whole complex and
6 use the maximum assumptions by default, and then
7 apply that to the worker, knowing that they're
8 more than likely above what the worker had been
9 exposed to.
10 In a similar fashion we'd use the maximum
11 credible undetected intake. What is the largest
12 intake, given that there were some RAD protection
13 controls and processes in place that could have
14 occurred and not been detected.
15 And as usual, to be claimant-favorable, these
16 things would choose parameters that maximize
17 probability of causation. Examples of that are
18 things such as claimant-favorable solubility
19 classes. If you're calculating a dose to the
20 gallbladder, you would assume that it was soluble
21 uranium, so it was absorbed from the lung and
22 deposited maximally in that organ.
23 Okay. Just to go over a little -- a single
24 example, and I tried to pick something which is
25 typical, kind of mid-range of this approach.

1 Here's an example of a claimant or an Energy
2 employee who worked somewhere in the Oak Ridge
3 reservation as a security guard for 16 years and
4 he worked from the late 1970s through the early
5 nineties. Subsequently developed prostate cancer,
6 which was diagnosed two years after end of his
7 employment, and he was 63 years old at that time.
8 So we requested the information from the
9 Department of Energy from the Oak Ridge
10 reservation and we received a reported DOE dose
11 for his entire 16-year period for external
12 exposure of 84 millirem.
13 The individual was monitored, though, every
14 quarter, and obviously most of those quarters came
15 back with a zero dose, no detectable dose. So
16 what we did was we reconstructed the person's dose
17 assuming that all 70 dosimeter readings that were
18 taken for the person were equal to the detection
19 limit that's in the profile -- or in the document
20 -- not necessarily the detection limit for the Oak
21 Ridge reservation, but for the highest one of the
22 DOE sites that we've evaluated. So doing so, 70
23 dosimeter exchanges times detection limit ended up
24 assigning 2,840 millirem external dose to the
25 prostate, just based on a missed dose calculation

1 using an upper limit for the detection limit.
2 Okay, in the internal dose area, the worker
3 had no evidence of urinalysis bioassay at all, but
4 there was one non-detectable in vivo exam, which
5 was below the detection limit of the measurement
6 system. So the complex-wide approach would assume
7 that the worker inhaled -- had a hypothetical
8 intake of a mixture of 28 separate radionuclides
9 that were likely to be present on DOE facilities
10 during these time period. So there was an acute
11 inhalation intake of 28 radionuclides that were
12 equal to ten percent of the maximum permissible
13 body burden at that time. In doing that, it was -
14 - the estimate -- the overestimate or the dose was
15 11,923 millirem to the prostate gland.
16 I will say that when we do these, we take
17 into account any existing bioassay data that we've
18 received, such that the predicted intake must be
19 above the value of the bioassay levels, so you'll
20 never assign a dose lower than what the bioassay
21 would predict. You're always going to be on the
22 high side, the curve would be on the top of it.
23 So the results of this dose reconstruction --
24 did I miss a slide? Yeah.
25 Okay, occupational medical dose. Of course

1 we're including that in our dose reconstructions,
2 so we assume that there was an annual medical X-
3 ray for this worker for each year of employment,
4 whether or not we actually had any evidence of
5 that. We would just automatically assume that at
6 the most he would have had an annual medical X-
7 ray. We would have no evidence that there was any
8 more frequent than that, let's put it that way.
9 And we would assign the highest dose received by
10 any organ from that X-ray other than skin. So
11 what I mean by that is an X-ray is taken with a
12 collimated beam -- a collimated beam. Other
13 organs that are not in the field of view would be
14 irradiated. In this case we would have taken the
15 lung dose as the highest dose and assigned it, and
16 that ended up assigning 1.4 rem -- 1,411 millirem
17 to the prostate gland from the X-rays -- the
18 hypothetical medical X-ray.
19 So the results of this are that the total
20 assigned dose to prostate was 14,922 millirem
21 versus the record that was provided by Department
22 of Energy for his occupational monitoring of 84
23 millirem, which resulted in a probability of
24 causation of 10.4 percent at the 99 percent
25 credibility level. I always -- it's sort of

1 interesting to me to just keep track. The
2 probability of causation at the 50th percentile in
3 this particular case is one percent, given even
4 these very extreme -- we believe -- overestimates
5 for this particular case.
6 So that's an example of what we do with these
7 AWE -- or the DOE complex-wide. I'd like to now
8 talk about what we do in the AWE area. It's a
9 little different.
10 There's a technical basis for estimating
11 maximum plausible doses to workers at AWE
12 facilities that's out on our web site, as well,
13 and it includes an internal dose evaluation
14 protocol that covers all the major modes of
15 exposure. That would be internal, both inhalation
16 and ingestion; external exposure, and residual
17 contamination being present at this facility.
18 The approach here -- most of the -- this
19 approach for complex-wide only is applicable to
20 Atomic Weapons Employer facilities that handled
21 natural uranium. A lot of the facilities handled
22 natural uranium -- hang on, I think I have a
23 number here. About 100 of the AWE facilities
24 handled only natural uranium, and a large number
25 of those -- more than 70 percent -- operated less

1 than five years. So you've got a situation with a
2 natural uranium exposure, similar processes or
3 maximized -- processes that you could maximize,
4 and you're actually only covering five years of
5 exposure, and then any residual contamination from
6 that exposure up to the point of diagnosis.
7 So in looking at a number of the AWEs that
8 were out there, and in particular the ones in the
9 early years, the seven that were evaluated early
10 on, it was decided that if we assumed a constant
11 internal exposure to 100 times the maximum
12 allowable air concentration during the entire
13 period of operation, we would overestimate the
14 internal exposures for these workers. What we
15 mean by that is we would assign -- and many of
16 these operations only happened for like a six-
17 month period, two days a week, six months,
18 something like that. We assumed for the entire
19 year that the person received 100 times the
20 maximum allowable air concentration, eight hours a
21 day, five days a week, 52 weeks a year. That
22 covers the internal exposure.
23 And the external exposure is modeled by -- it
24 turns out that there were maximum-size cylinders
25 that were handled at these facilities, and so it

1 was actually a Monte Carlo model to model the
2 external exposure coming off of a big block of
3 uranium metal, essentially. And so that was
4 modeled both as a cylindrical and a rectangular
5 ingots, and I believe the rectangular one came off
6 higher, so we ended up using that one. There's
7 not much difference between these two. So the
8 worker was also assumed then to have been exposed
9 external at a distance of one foot from this
10 uranium metal for the same time period, the entire
11 year, eight hours a day, five days a week.
12 We also made provisions in this document for
13 external exposure from contaminated surfaces. If
14 you generate this huge amount of air
15 concentration, there's a certain settling that
16 happens that one can calculate with a certain
17 terminal settling velocity of the particles that
18 will accumulate on the surfaces. We assumed no
19 removal of that material, and then calculated,
20 using standard models, the external exposure from
21 a person walking around all these hypothetically-
22 contaminated surfaces.
23 And then we also -- there's a model in here
24 for ingestion of contamination on those surfaces.
25 There's certain assumptions for transfer factors,

1 settling into coffee cups, that sort of thing. So
2 we tried to do a -- covering all the bases here
3 with some fairly maximized assumptions to see how
4 we could use this for these claimants.
5 As I mentioned, it was restricted to uranium
6 only, and it does exclude dose reconstructions for
7 the lungs, skin, breast, eyes and tissues. It
8 just won't work for those. Obviously for lung
9 cancer, if you're breathing this type of a air
10 concentrations, it's just not going to work.
11 Okay, let me just briefly go over one case.
12 This is a person who worked at an AWE that was
13 located in Pennsylvania. He was employed as a
14 millwright from the mid-fifties through the late
15 seventies. The DOE operation only occurred in one
16 year during that employment. And in fact, this is
17 one of those facilities where it was for six
18 months, and they actually only worked two days per
19 month -- or they were contracted to work two days
20 per month.
21 We assumed for this particular dose
22 reconstruction, though, that the person worked the
23 entire year, eight hours a day, five days a week,
24 52 weeks, breathing that 100 times the maximum air
25 concentration. That's pretty -- that's fairly

1 typical of how we would process these claims. The
2 person did have -- was diagnosed with colon cancer
3 one year after the end of his employment at the
4 age of 54.
5 In the external dose area -- we have no
6 external dose measurements for this facility at
7 all, but as I mentioned before, there was a Monte
8 Carlo simulation given these large blocks of
9 uranium -- natural uranium present in the
10 facility. What would be the continuous exposure
11 for one year at one foot from the uranium metal
12 itself -- basically that's what I said. If we do
13 this calculation, we would assign 4,100 millirem
14 to the colon from exposures from working right
15 next to this derby for the entire year. The
16 residual radioactivity model, which is walking
17 around these theoretically-contaminated surfaces
18 for the entire year, adds another 1,032 millirem.
19 And -- oh, this is from -- this is from the
20 contaminated surfaces, 43 millirem. This is from
21 residual -- ingestion of residual radioactivity.
22 I think these are somewhat different than
23 your slides. I apologize. I'll make sure that we
24 get copies of this out. These numbers are a
25 little higher. What I neglected when I was

1 pulling these off the dose reconstruction is
2 there's two classes of gamma exposure, 30 to 250
3 keV and greater than 250. I inadvertently only
4 pulled up one column, so that's why these numbers
5 are higher. I apologize for that. I'm glad I
6 caught this looking it over last night.
7 So at any rate, we have these three modes of
8 exposure that we've covered for external.
9 In the internal dose area, no bioassay
10 results were available for this worker. Again we
11 assumed this breathing of 100 times the MAC for
12 the entire year. We used the claimant-favorable
13 solubility class, which means that, you know, all
14 the activity would have been absorbed -- or the
15 more rapid clearance from the lung through the GI
16 tract and absorption. If you do the calculations
17 -- it's always kind of interesting to me to put
18 this sort of on a mass scale -- we would have
19 assumed that the person inhaled 4.7 grams of
20 natural uranium during that year, which is quite a
21 bit of uranium, mass-wise, to inhale. And again
22 we included the dose from residual contamination.
23 Doing that, we ended up with 5,870 -- that
24 should be millirem -- boy -- to the colon. I need
25 to fix these, I'm sorry.

1 Medical dose, we assume one annual medical X-
2 ray during the year of the contract. The highest
3 dose, again, received by any organ other than
4 skin, and that ended up assigning 95 millirem to
5 the colon.
6 So when you add all that up -- I'll get to my
7 last slide -- the total dose to colon was 5,870
8 millirem for the internal exposure pathway, 5,270
9 from external, which resulted in a probability of
10 causation of almost 18 percent at the 99 percent
11 credibility level. Again, I like to look at the
12 50 just to see the spread between these two
13 numbers, and it was three and a half percent at
14 the 50th percentile.
15 I believe that's all I have to say. I'd be
16 happy to answer any questions.
17 **DR. ZIEMER:** Okay, I've got Tony and then
18 Gen.
19 **DR. ANDRADE:** (Off microphone) I'm curious
20 about why --
21 **THE COURT REPORTER:** Dr. Andrade...
22 **DR. ANDRADE:** Sorry about that. I was
23 curious as to why some of these all-ranging site
24 profiles, especially if you're dealing with
25 natural uranium, did not include your radon

1 exposures or radon intakes. If you're going to be
2 dealing with that, you know, and people work, even
3 for a long period of time, it may not add
4 significantly to the POC, but nevertheless, it
5 perhaps would give more credibility to the AWE-
6 wide profiles.
7 **DR. NETON:** That's a good question. I think
8 -- I failed to communicate to you, this is for
9 natural uranium only and does not apply to
10 facilities that processed uranium ore that may
11 have radium-226 in the stream. So if you receive
12 natural uranium, you just can't grow in radon in
13 that decay chain in any quantity that would make
14 any difference in the dose calculation.
15 **DR. ANDRADE:** So this is for processed
16 uranium.
17 **DR. NETON:** Exactly.
18 **DR. ANDRADE:** You're not dealing with ores at
19 all.
20 **DR. NETON:** That's correct.
21 **DR. ANDRADE:** And when you say "natural", it
22 is processed naturally.
23 **DR. NETON:** It is processed uranium, already
24 refined, in either powder or metallic form of some
25 type. We did allow for a 100-day decay so that

1 the protoactinium 234-M beta would grow in and
2 you'd optimize that exposure, but radium's been
3 taken out of this natural uranium already. Sorry
4 for the confusion on that.
5 **DR. ANDRADE:** Thank you.
6 **DR. ROESSLER:** Jim, I want to I guess just
7 comment on the claimant-friendly aspect of some of
8 this. I was particularly struck when you were
9 talking about the DOE site occupational medical
10 dose. Now aren't most of those for the lung or
11 the chest -- they're chest X-rays, aren't they?
12 **DR. NETON:** Correct.
13 **DR. ROESSLER:** So you assumed -- or what you
14 assume is that the primary beam includes the
15 prostate --
16 **DR. NETON:** Correct.
17 **DR. ROESSLER:** -- in that example, which --
18 **DR. ZIEMER:** And no collimation.
19 **DR. ROESSLER:** -- yeah, and no collimation.
20 To me, that's an example of being extremely
21 claimant-friendly or an example of very poor
22 medical procedures. I just wanted to make the
23 comment.
24 **DR. NETON:** I agree with you. The bottom
25 line is that we don't have any information about