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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

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7 SUBCOMMITTEE ON RADIATION PROTECTION AND

8 NUCLEAR MATERIALS

9 ISA/PRA COMPARISON

10 + + + + +

11 TUESDAY

12 JANUARY 11, 2011

13 + + + + +

14 ROCKVILLE, MARYLAND

15 The Advisory Committee met at the Nuclear
16 Regulatory Commission, Two White Flint North, Room
17 T2B1, 11545 Rockville Pike, at 1:00 p.m., Michael T.
18 Ryan, Chairman, presiding.

19 SUBCOMMITTEE MEMBERS:

20 MICHAEL T. RYAN, Chairman

21 J. SAM ARMIJO, Member

22 SANJOY BANERJEE, Member

23 DENNIS C. BLEY, Member

24 DANA A. POWERS, Member

25 JOHN D. SIEBER, Member

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2 P-R-O-C-E-E-D-I-N-G-S

3 12:59 p.m.

4 CHAIRMAN RYAN: Okay. I guess we're at the
5 appointed hour. So, this meeting will now come to
6 order, please.

7 This is a meeting of the Advisory
8 Committee on Reactor Safeguards, Subcommittee on
9 Radiation Protection and Nuclear Materials.

10 I'm Michael Ryan, chairman of the
11 subcommittee. Members in attendance are Dennis Bley,
12 Dana Powers, Sam Armijo, Jack Sieber. And we may be
13 joined by Harold Ray, we may not. We may also be
14 joined by Sanjoy Banerjee, or may not.

15 So, we also have a consultant, Mohammad
16 Modarres, who's with us today from the University of
17 Maryland. Welcome all. And John Flack is the
18 designated federal official for this meeting.

19 DR. FLACK: Well, actually -

20 CHAIRMAN RYAN: I'm sorry. Michael
21 Benson's the designated federal official for this
22 meeting.

23 MEMBER POWERS: John is just totally
24 useless.

25 (Laughter.)

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1 CHAIRMAN RYAN: The purpose of today's
2 meeting is to compare two analytical methods for the
3 use in safety assessment in fuel cycle facilities;
4 Integrated Safety Analyses and Probabilistic Safety
5 Assessment.

6 The subcommittee will gather information,
7 analyze relevant issues and facts and formulate
8 proposed positions and actions as appropriate for
9 deliberation by the full committee.

10 The rules for participation in today's
11 meeting have been announced as part of the notice of
12 this meeting previously published in the Federal
13 Register on December 29th, 2010.

14 A transcript of the meeting is being kept
15 and will be made available as stated in the Federal
16 Register Notice.

17 It is requested that speakers first
18 identify themselves and speak with sufficient clarity
19 and volume so they can be readily heard.

20 We have received no written comments or
21 requests for time to make oral statements from members
22 of the public regarding today's meeting.

23 Today's meeting will include briefings on
24 the following: One, NRC staff's White Paper entitled
25 "A Comparison of Integrated Safety Analysis and

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1 Probabilistic Risk Assessment," and stakeholder views
2 regarding the choice of safety assessment methods for
3 fuel cycle facilities and, third, the NRC plans and
4 future activities on ISA and PRA methods.

5 We will now proceed with the meeting, and
6 I call upon Marissa Bailey from the Office of Nuclear
7 Materials Safety and Safeguards to open the
8 presentations.

9 Welcome, Marissa. Nice to see you again.

10 MS. BAILEY: Good to see you, too. Thank
11 you.

12 As Mr. Ryan said, I'm Marissa Bailey. I'm
13 the deputy director for the Division of Fuel Cycle
14 Safety and Safeguards in the Office of Nuclear
15 Materials Safety and Safeguards.

16 And with me is Dennis Damon. He is a
17 senior level advisor for risk assessment in NMSS. And
18 we're here today to present to you our comparison, our
19 ISA/PRA comparison paper.

20 Dennis will be doing most of that. But
21 before he does, what I'd like to do is just take a few
22 minutes and give you some background information.

23 First, though, I'd like to thank the staff
24 from the Office of Research, NRR and Region II who
25 contributed to this paper, who peer reviewed it and

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1 reviewed it for technical accuracy and provided input.

2 I'd also like to thank NEI who met with us
3 while we were developing this paper, and gave us their
4 perspective and gave us the industry perspective.

5 NMSS conducted the ISA/PRA comparison in
6 response to Commission's direction, which in turn was
7 in response to a plan that we presented to them for
8 revising the fuel cycle oversight process.

9 Okay. I have to figure out how to do
10 this.

11 So, why did the staff propose to revise
12 the fuel cycle oversight process?

13 First, I'd like to point out that the
14 current oversight program, in our view, is adequate
15 for ensuring safety and security. But it's also the
16 staff's view that it could be better, that we could
17 take the risk insights gained from the ISAs and make
18 the oversight process more risk-informed, performance-
19 based, predictable and transparent. That was the goal
20 for revising the fuel cycle oversight process.

21 This view has been supported in previous
22 Commission SRMs that were issued between 2005 and
23 2009. In those SRMs, the Commission essentially
24 directed the staff to make the oversight process more
25 transparent and risk-informed, and also to examine

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1 whether objective, quantitative measures for
2 performance were feasible.

3 MEMBER POWERS: What kind of risk
4 information did the Commission want -

5 MS. BAILEY: I'm sorry?

6 MEMBER POWERS: What general type of risk
7 information did the Commission want the staff to take
8 into account?

9 MS. BAILEY: I think - well, Dennis, you
10 might need to supplement this, but I believe they
11 basically wanted the staff to take a look at the
12 results of the ISAs and see whether that could be used
13 for a more -

14 MEMBER POWERS: That does surely look at
15 the results of the ISAs.

16 MS. BAILEY: Excuse me?

17 MEMBER POWERS: The staff surely does look
18 at the results of the ISAs.

19 MS. BAILEY: Yes, we look at the results of
20 the - we review the ISA summaries and we also do a
21 more detailed review of selected portions of the -

22 MEMBER POWERS: No, the ISAs do not yield
23 anything that could be legitimately called "risk."

24 MS. BAILEY: Do you want to -

25 MR. DAMON: I mean, it's information about

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1 what can go wrong in the -

2 MEMBER POWERS: Yes.

3 MR. DAMON: Right?

4 MEMBER POWERS: Yes.

5 MR. DAMON: So, in that sense it does, but

6 -

7 MEMBER POWERS: But, I mean -

8 MR. DAMON: - they don't calculate risk.

9 MEMBER POWERS: But if the Commission wants
10 you to take into account risk and - they must surely
11 have some idea of what kind of information that comes
12 from a risk analysis that they want you to take into
13 account.

14 MR. DAMON: Well, it's not clear what - one
15 of the awkward things here is most of the instances
16 where there was interaction with the Commission on
17 this subject, was prior to the terms of most of the
18 current commissioners.

19 MEMBER POWERS: Oh.

20 MR. DAMON: Okay. So, now we have a whole
21 new set of commissioners. I mean, Commissioner -
22 Chairman Jaczko has been here that long. He caught
23 some of the tail end of it.

24 But this process of interacting between
25 even the ACRS and the Commission and the subject of

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1 possibly revising the fuel cycle oversight program
2 goes back to before the ISAs were done. In other
3 words, back to around the year 2000 or so when they
4 were just in the process of doing them.

5 So, the staff's been thinking about it.
6 The commissioners thought about it. The Inspector
7 General mentioned it. So, it's been a long process.
8 So, it's not really clear what the current
9 commissioners think about this.

10 POWER MEMBERS: Well, the previous
11 commissioners when they ask for risk, to take into
12 account risk information, I would presume they could
13 be questioning sequences or they could be questioning
14 bottom line quantitative results or they could be
15 questioning things like risk metrics or importance
16 metrics. I just wonder what they had in mind.

17 MR. DAMON: Well, one point of reference is
18 the current chairman before he became chairman, wrote
19 a paper or delivered a speech, I forget which, at a
20 conference in which he discussed briefly the idea that
21 he liked - he liked the predictable, more or less,
22 objective method by which the reactor oversight
23 program marches through and assigns performance
24 metrics to the licensees. He liked that and he said
25 we ought to do that for fuel cycle facilities.

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1 So, we have that one piece of information
2 that the chairman thought that was a good idea.

3 MEMBER ARMIJO: I'd like to get some just
4 basic stuff of why is this happening.

5 You've got an effective process that
6 ensures safety and security and you want to make it
7 better by risk informing it, make it performance-based
8 and predictable.

9 These are all nice words, but what
10 improvement in safety are you going to make by virtue
11 of these changes, and then how much is it going to
12 cost in time and effort by the staff and by the
13 industry to make this, what I suspect, is an
14 incremental improvement?

15 Well, you can argue it's a great increment
16 or a small increment, but it's going to - nothing
17 comes free. And I'm just trying to see what the gain
18 is and what the cost is to get that gain.

19 MS. BAILEY: Yes, I think that, you know,
20 as I said before, that we feel that the current
21 oversight process is sufficient for ensuring safety.
22 So, we're not really looking at necessarily an
23 improvement in safety.

24 What we're looking at is more an
25 improvement in the efficiency and in the effectiveness

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1 of our oversight process. It's more, probably, a way
2 of helping us focus where we want to put our
3 inspection resources given that we don't have
4 unlimited resources.

5 And, also, to make the process more
6 structured and more predictable.

7 MEMBER ARMIJO: So, just let me follow up
8 to make sure I understand it.

9 So, this is really to help the staff do a
10 better job.

11 MS. BAILEY: I guess you could put it that
12 way, yes.

13 MEMBER ARMIJO: That's what I'm hearing,
14 but I just want to make sure I understand.

15 MS. BAILEY: It's to help the staff do a
16 better job. It's to help the staff do its job more
17 efficiently in the oversight arena, and also to be
18 more predictable.

19 MEMBER ARMIJO: Okay.

20 MEMBER POWERS: Now, you said "efficient,"
21 but "efficient" doesn't appear on this slide.

22 Is efficiency a consideration?

23 MS. BAILEY: Efficiency in terms of
24 maximizing our resources in terms of putting the
25 resources where we think the risk are.

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1 MEMBER POWERS: I think that in recent
2 explorations of fuel cycle facilities that I've been
3 privy to, I think "efficiency" is not the word that
4 came to mind. They were rather dogged examinations of
5 highly-detailed and arcane documents and plans and
6 things like that.

7 Efficiency in the sens of identifying
8 those things that were of greatest importance to
9 safety at the beginning and plunging detail into those
10 was not a hallmark. Rather, it took quite a little
11 effort to identify the things that were most important
12 to safety.

13 And we spent quite a little while
14 understanding how that was done and assuring ourselves
15 collectively that it was done well, and it was. I
16 mean, you've seen our letters. We were very - we
17 praised highly all the work that was done.

18 But efficiency, I don't think, was the
19 word that came to mind when I looked at that.

20 CHAIRMAN RYAN: If I look to the slide, you
21 know, I see four things; risk-informed, performance-
22 based, predictable and transparent.

23 And I guess I second Dana's thought that
24 efficiency isn't really the word I would use to
25 describe how one gets through to those end points.

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1 MS. BAILEY: Okay.

2 CHAIRMAN RYAN: Sometimes it is a daunting
3 task to get through it. But at the end of it, you
4 know, I take away the insight that in trying to
5 improve fuel cycle facilities, understanding of the
6 facility's risk profile, if I could just use that word
7 loosely, so that they could do a better job of
8 managing their facilities that they're licensed to
9 operate.

10 And in turn, maybe that gives the
11 inspection process some leg up on understanding if
12 there's a common currency for operator thinking, there
13 might be a common currency for inspection. But that's
14 sort of a side benefit to the fact the facilities are
15 operated with some line toward more efficient or more
16 improved operation. That's at least the way I'm -

17 MEMBER ARMIJO: Well, I still think we
18 would like to get -

19 CHAIRMAN RAY: I'm reaching for that.

20 MEMBER ARMIJO: - even a qualitative
21 response on the benefits of going through this change.

22 MS. BAILEY: Okay.

23 MEMBER ARMIJO: And the cost. And who does
24 the work? Is this work going to be done by the staff
25 to make all these improvements and provide all the

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1 data and analysis to achieve your goal, or will it be
2 done by the industry?

3 And, you know, I'm just trying to find out
4 is this trip really worth taking?

5 MEMBER BLEY: Can I ask it a little
6 different way, Sam?

7 MEMBER ARMIJO: Okay.

8 MEMBER BLEY: I sat through the - I tried
9 to work my way through the ISA for the MOX facility.

10 MEMBER ARMIJO: That's a tough one.

11 MEMBER BLEY: I guess I'd ask the question
12 having seen PRAs of other process facilities besides
13 better information about understanding the risk and
14 risk comparisons of different approaches, do you have
15 any real feel for the level of effort between a PRA
16 and at least an ISA like the one we saw in the MOX
17 facility?

18 And if you do, maybe you can give us a
19 little bit of the reasons for the difference in level
20 of effort. I have my own opinions, but that's not
21 what we're after here.

22 MR. DAMON: Yes, it - that subject is
23 broached, I would say, in Section 5 of the paper. I'm
24 trying to communicate how I see it. And that is
25 there's a big difference between trying to do an

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1 assessment of the risk of every single process in a
2 plant and capture that and structure it and present it
3 and everything else.

4 Big difference in the orders of magnitude
5 between that and a violation occurs at one facility in
6 one process, and you take a few staff members and they
7 communicate with a few staff members at the facility,
8 and they do a little risk assessment of the impact of
9 that one deficiency.

10 So, that's what the example is in Section
11 5 is to illustrate how small a scale you're normally -
12 normally, not always, but normally operating at.

13 Because I've been here - I came to FCSS in
14 1994 before the ISA rule was in place. I participated
15 in the process. So, having worked for Sam Armijo at
16 GE for 15 years before that -

17 MEMBER ARMIJO: Oh, God. I feel so old.

18 (Laughter.)

19 MR. DAMON: Having done PRA for 15 years
20 before that, naturally when I came here every time
21 something would happen, I would sit down with my
22 little envelope, back of the envelope and do a little
23 risk assessment of what the impact is, because it
24 informs me about whether or not the thing is important
25 or not.

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1 And so I've been kind of playing this game
2 for 15 years, and that's what I'm trying to
3 communicate in Section 5 is, in general, that's kind
4 of the scale of the problems you work.

5 Now, it's not always true. Sometimes you
6 run into something that's complicated, you know, more
7 like a reactor PRA-type thing that, you know, you
8 can't easily do in a short time with small resources.

9 But this business of trying to do an
10 assessment, I mean, we have done - I'll give you an
11 example of the range of difference in scale of these
12 ISAs.

13 At least one of the centrifuge enrichment
14 plants only had sixty IROFS. The number I keep
15 hearing quoted for MOX is 12,000. There's this huge
16 range in terms of complexity of the facilities.

17 And when you go and you want to do a - if
18 you want to do like a risk profile like Dr. Ryan is
19 talking about, and you want to know, okay, what in all
20 this stuff is - and do a profile of everything, well,
21 if you're going to do MOX, you better bring your
22 checkbook, you know. It's a big, huge, complicated
23 thing.

24 Whereas for the centrifuge plants, we
25 actually did that. We actually sat down and went

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1 through and rated all the IROFS in the centrifuge
2 plants because there's only sixty of them, but you
3 can't do it for MOX, you know.

4 MEMBER ARMIJO: Too many processes. Too
5 many -

6 MEMBER SIEBER: Isn't the level of -

7 MEMBER ARMIJO: It's not even, you know,
8 it's not UF6 -

9 MEMBER SIEBER: -- this some proportion
10 to the consequences of the effect that you're trying
11 to utilize?

12 For example, pretty hard to have a problem
13 in a fuel cycle plant that affects offsite populations
14 to a major degree.

15 And, you know, this - but all this gets
16 down into the area of industrial safety that we're
17 concerned about as opposed to radiation exposure to
18 masses of people.

19 Now, where is the balance between the
20 amount of effort that you put in to figure out what
21 the risk is versus if the accident occurs, what's the
22 harm to the public and what's the harm to the worker?

23 How do you come up with that balance?

24 MR. DAMON: Well, of course the rule itself
25 is structured to point the licensees in the direction

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1 of, you know, focusing on things that have high
2 consequences.

3 MEMBER SIEBER: Right.

4 MR. DAMON: And that's the way the rule is
5 structured is it talks about high - in fact, I was
6 going to get into that, you know, the definition of
7 what is a high consequence event.

8 But as you point out for fuel cycle
9 facilities, the number of scenarios where you would do
10 that where you would get to the point where you might
11 actually seriously affect the health of the public
12 offsite is, you know, just a few. There are just a
13 few scenarios where that can happen.

14 MEMBER SIEBER: But the NRC is responsible
15 for radiological events as opposed to chemical mishaps
16 or -

17 MR. DAMON: Well, that's another thing.
18 The rule itself, that was actually promulgated - one
19 of the two major reasons for the ISA rule was because
20 Congress directed - after the Sequoyah fuels event
21 where there's a cylinder rupture and a worker was
22 killed, we were directed that we would regulate the
23 chemical consequences of licensed material.

24 MEMBER SIEBER: Of licensed material.

25 So, it's the consequences of a chemical

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1 that contains a licensed material as opposed to fuel
2 oil in some emergency generator someplace that might
3 flood.

4 MR. DAMON: Right. So, that's what the
5 rule does is it delineates what that scope of NRC's
6 authority is.

7 And the ISA concept actually came from a
8 technique called process hazard analysis that was -
9 had already been put into the regulations by OSHA to
10 regulate chemical facilities.

11 MEMBER SIEBER: All this stems from the
12 chemical industry, right?

13 MR. DAMON: Right.

14 MEMBER SIEBER: Okay.

15 MR. DAMON: So, that's how this all came
16 about was we were told to regulate chemical safety.
17 So, it was consciously decided and it says so in the
18 statement's consideration for the rule, that it was
19 done in a way to be congruent with the way OSHA was
20 already doing it. So, we weren't reinventing the
21 wheel.

22 So, that's really why it has the flavor it
23 does. And if you read the OSHA rule, which actually
24 is the last - the citation of it is the last slide in
25 my SlideShow. They actually list the analysis

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1 techniques right in the regulation, you know. You can
2 use these techniques. It mentions fault trees
3 explicitly in the rule.

4 So, they already were doing this in the
5 chemical industry, and we were just hitching onto the
6 same concept.

7 MEMBER SIEBER: Well, is it also not a fact
8 that in a lot of places the responsibilities under the
9 OSHA rules are carried out by the NRC?

10 For example, if you had an accident in a
11 power plant that was not radiation-related, OSHA would
12 often use an NRC inspector to carry out the OSHA
13 requirement for an investigation.

14 MR. DAMON: Well, we have a - there's a
15 written memorandum of understanding between OSHA and
16 NRC on this specific subject. And in there, it says
17 something like if an NRC inspector sees something
18 that's -

19 MEMBER SIEBER: OSHA.

20 MR. DAMON: - OSHA, a thing that's
21 exceptionally hazardous, they'll inform OSHA, you
22 know.

23 MEMBER SIEBER: And they take it from
24 there.

25 MR. DAMON: Yes.

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1 CHAIRMAN RYAN: And vice-versa. If there's
2 a radiological something that an OSHA inspector sees,
3 they'll notify NRC.

4 MR. DAMON: Yes, so there is that kind of
5 an agreement.

6 MEMBER SIEBER: Okay. Thank you.

7 MEMBER ARMIJO: Okay. Well, maybe in the
8 course of the discussion, I'll understand it, but I
9 still want to get a feel for the magnitude of the work
10 that has been done, the magnitude of the benefit that
11 the staff -

12 CHAIRMAN RYAN: Dennis, you may want to
13 take your microphone out from under your papers so the
14 reporter doesn't go deaf.

15 MS. BAILEY: Yes, we'll try to answer that
16 question as we go through our presentations.

17 CHAIRMAN RYAN: Before we move on, I'm just
18 going to check is there anybody on the bridge line?

19 MEMBER BENSON: They probably can't talk.
20 It's probably muted.

21 CHAIRMAN RYAN: Okay.

22 MR. GODY: Yes, I'm on. This is Tony Gody.
23 I'm from Region II. I am on the bridge line.

24 CHAIRMAN RYAN: Thank you, Tony.
25 Appreciate you being with us today.

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1 MR. KENNEDY: Al Kennedy from Global
2 Nuclear Fuels is on.

3 CHAIRMAN RYAN: Okay. Anybody else?

4 All right. Thank you.

5 MS. BAILEY: Okay. I think the only other
6 thing I want to point out on this slide with respect
7 to why were down the path of revising the oversight
8 process, is that in 2007 in a OIG audit report the OIG
9 did recommend that the staff develop a more structured
10 oversight process that would be similar to the reactor
11 oversight process or using the reactor oversight
12 process as an example.

13 And so in March of 2010, we put before the
14 Commission a plan for revising the oversight process.

15 That's in SECY 10-0031. And what's up there is
16 basically the elements of that plan, which I'm not
17 going to go into.

18 What I'd like to point out is that in the
19 plan, the staff did propose to use the result with the
20 ISAs to prioritize the focus of our baseline
21 inspection program similar to what we did for new
22 facilities where we used the ISAs to prioritize the
23 focus of our operational readiness inspections of the
24 Items Relied On For Safety.

25 In that plan, we also proposed to build a

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1 significance determination process that would use the
2 existing ISAs.

3 Ultimately, the Commission disapproved of
4 the staff's plan to revise the fuel cycle oversight
5 process. Instead in the SRMs that followed, the
6 Commission directed the staff to first prepare a paper
7 comparing ISAs for fuel facilities to PRAs for
8 reactors, and submit that comparison to the ACRS for
9 review.

10 The Commission also directed the staff to
11 develop cornerstones that could be applied for a fuel
12 cycle oversight program. And once the ISA/PRA
13 comparison was completed and the Cornerstone Project
14 was completed, to basically take the insights gained
15 from those two activities and assess them and then
16 provide to the Commission a recommendation for a path
17 forward.

18 The Commission also directed the staff to
19 make incremental enhancements to the oversight process
20 to enhance its effectiveness and efficiency, including
21 providing incentives for licensees to maintain a
22 strong corrective actions program.

23 MEMBER ARMIJO: Marissa?

24 MS. BAILEY: Yes.

25 MEMBER ARMIJO: I'm not familiar with all

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1 the fuel cycle facilities, but I am familiar with
2 quite a few, and I don't know any that don't have
3 corrective action programs.

4 And we can argue some are better than
5 others, but are there licensees that don't have
6 corrective action programs in place -

7 MS. BAILEY: Maybe some -

8 MEMBER ARMIJO: - and how can that be?

9 MS. BAILEY: - of the staff members here
10 can address that. What I know is that it's not
11 necessarily a regulatory - it's not a regulatory
12 requirement under Part 70.

13 Patti, are you aware?

14 MS. SILVA: It's not a regulatory
15 requirement.

16 MS. BAILEY: Use the mic.

17 MS. SILVA: I don't think it's on.

18 CHAIRMAN RYAN: It is on.

19 MS. SILVA: Oh, it is on. Okay.

20 There's no regulatory requirement, plus we
21 don't - we haven't provided any kind of guidance of
22 what we would consider to be an adequate corrective
23 action program.

24 And it's not - it's also not used in
25 enforcement or - so, we would need to identify what

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1 would be considered a good corrective action program.

2 And then we would -

3 MEMBER ARMIJO: When you do your
4 inspections, do you inquire - are you allowed to
5 inquire if whether they have a corrective action
6 program?

7 MS. SILVA: Yes, we do look at their
8 corrective action program. We look at - we look at
9 events and things that they've found. And we look at
10 the corrective action program.

11 We look at how they - how they address
12 what they find that they need to fix, and we look at
13 the process of them doing it, but we don't - I guess
14 we don't inspect against a certain type of corrective
15 action program that that's what it needs to be.

16 MEMBER ARMIJO: It's not a regulation.

17 MS. SILVA: It's not a regulation.

18 MEMBER ARMIJO: Okay.

19 CHAIRMAN RYAN: Do you, therefore, look at
20 non-radiological events?

21 I'm a little confused. If you don't have
22 an inspection obligation under a radioactive material
23 license, you must be inspecting some other aspect of
24 that and so forth.

25 I'm not following what you're actually

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1 doing and what you're looking at in particular.

2 MS. SILVA: Okay. I can bring an inspector
3 up to explain what we look at when we look at the
4 corrective action program.

5 CHAIRMAN RYAN: Sure.

6 MS. SILVA: Dennis.

7 COURT REPORTER: Patti, could I have your
8 last name?

9 MS. SILVA: I'm sorry. I'm Patti Silva,
10 S-I-L-V-A.

11 MR. MOREY: Dennis Morey. I'm a
12 criticality safety inspector in fuel cycle.

13 CHAIRMAN RYAN: Does your inspection extend
14 to things that are not radiological and not under an
15 NRC license, you know, if they have some other
16 corrective action they're taking for whatever reason
17 that's related to - I guess it doesn't make sense as a
18 question, but something outside of what -

19 MR. MOREY: No, the only thing we inspect
20 are the things that they're required to have under the
21 license.

22 I think all they're telling you is there's
23 no - there's no license requirement to have a
24 particular type of corrective action program, but they
25 - all of the licenses require them to correct

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1 deficiencies.

2 So, when we're inspecting them, we're just
3 checking - we're just looking to see if they're
4 correcting known deficiencies.

5 CHAIRMAN RYAN: So, you might see a broad
6 range of approaches to corrective action for
7 deficiencies in the licensees you look at.

8 MR. MOREY: Right.

9 CHAIRMAN RYAN: Okay.

10 MEMBER ARMIJO: So, they could correct
11 their deficiency just on an ad hoc basis, or they
12 could have a formal corrective action program that
13 takes all the deficiencies routinely in their
14 facility?

15 MR. MOREY: Like, they could correct it ad
16 hoc, but all the licensees I go to have a program.

17 MEMBER ARMIJO: So, that's where I'm
18 confused here about corrective action programs do
19 exist at least -

20 MS. BAILEY: Yes, and I think what the
21 Commission is wanting us to do is to basically
22 incentivize a strong corrective actions program and
23 develop, basically, a strategy for allowing credit for
24 licensees having a corrective actions program when we
25 disposition or take - when we disposition violations

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1 or take an enforcement action.

2 MEMBER ARMIJO: I just misinterpreted that
3 sentence to mean that these programs were haphazard or
4 didn't exist, and that's not what you're saying.

5 MS. BAILEY: Right.

6 MEMBER ARMIJO: Okay.

7 MS. BAILEY: And I think the point of the
8 slide that I'm trying to make here is that because
9 we're here to present the ISA/PRA comparison, is that
10 the ISA/PRA comparison is one piece of the staff's
11 overall efforts to implement the direction that the
12 Commission has given us that's related to revising the
13 fuel cycle oversight process.

14 MEMBER POWERS: If you don't have a
15 standard to use for your examination of a corrective
16 action program, how do you know that they should get
17 credit for that program in enforcement actions and the
18 like?

19 MS. BAILEY: I think that that's probably -

20 MS. SILVA: That's what I was talking about
21 that we need to provide guidance on what would be a
22 good corrective action program and to incentivize
23 using corrective action programs and having an
24 adequate one that we could inspect against and
25 actually formally do that versus just looking and see

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1 something happened, what did you do with it.

2 We're looking at more of the what did you
3 do with it and whether you have that program in place.

4 So, we need to develop kind of the best practices for
5 corrective action programs across the board.

6 MEMBER POWERS: I would think that the
7 biggest challenge that I could think of in a
8 corrective action program for a fuel cycle facility is
9 root cause analysis. I would think that would be a
10 real challenge.

11 MS. BAILEY: Got a staff member in the back
12 there.

13 MR. CAMPBELL: This is Larry Campbell.

14 Keep in mind that even the - some fuel
15 cycle facilities have committed to an Appendix B-type
16 QA program and NQA-1.

17 Those facilities that have not, there's
18 management measures. And one of the management
19 measures is incident investigation. That's as close
20 as they come to corrective action.

21 So, under the incident investigation, that
22 - I think that's what - that Marissa and Dennis is
23 saying we want to enhance a bit, that particular
24 management measure.

25 MR. DAMON: I think - I think we're maybe

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1 miscommunicating, because my feeling of what the
2 commissioners were alluding to in the statement about
3 the corrective action program wasn't that the
4 corrective action programs needed some kind of work.
5 It's that they wanted to use them in the same way that
6 they use them in the reactor program.

7 And I'll give you an example. We already
8 sort of tried this out. And that is in the reactor
9 program, what they do is if they identify something as
10 a - they do a risk significance determination on an
11 inspection finding. And if it's a green, it's turned
12 over to the licensee to correct and the - it's not a
13 violation and the staff doesn't follow up on it very
14 much. They just check to see in the end, whether it
15 got corrected or not.

16 Whereas if it's a violation currently, we
17 have a whole process we have to go through, an
18 enforcement process. And so, they're alluding to the
19 fact you -- what I see as the corrective action
20 program. We'll take these low-risk significance
21 things and let them take care of them and not spend
22 our resources, you know, tracking them.

23 MEMBER ARMIJO: And if they don't, then it
24 has to go into the enforcement kind of - turns into a
25 violation that you have to -

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1 MR. DAMON: Well, if there's a dispute of
2 some kind, I guess, yes, you have to go through the
3 process. But, I mean, normally, you know, the kind of
4 things they find, they're going to fix them.

5 We actually, like I say, we tried this out
6 with all the - we looked at all the criticality and
7 chemical safety violations at the fuel cycle
8 facilities for the last five years.

9 I sat there and went through every single
10 one of them and we developed qualitative criteria for
11 screening for low-risk significance. Half of them
12 screened to low significance on these qualitative
13 criteria.

14 The next step would be if you have a
15 quantitative process, you do a quantitative evaluation
16 like in the example in Section 5, and then you could
17 screen some more of them to green.

18 And then those greens, they go in the
19 licensee's corrective action program and they're not
20 processed through our enforcement process anymore - or
21 there is some processing, but it's not - we don't
22 treat it like we currently do.

23 MEMBER ARMIJO: So, that's kind of your
24 vision of how this thing would work?

25 MR. DAMON: That's what I think is the -

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1 was the vision of where to put that in the SRM.

2 MR. TSCHILTZ: If I could interject, my
3 name is Mike Tschiltz. I'm the acting director of
4 fuel cycle revision.

5 And I think just to give you some more
6 context of where this whole issue came up, I believe,
7 is if you look at the reactor oversight process, one
8 of the principles that it's based upon is that
9 licensees have strong corrective action programs that
10 they can rely upon to correct minor deficiencies
11 without the NRC going in and providing strong
12 oversight in those areas.

13 So, I think the context that this comment
14 was provided in was that, okay, well, if you're going
15 to move toward a more risk-informed oversight process
16 in the fuel cycle arena, then you need to figure out a
17 way to incentivize or build a program around this
18 basic premise that licensees have very strong
19 corrective action programs that you can rely upon to
20 correct minor deficiencies before they escalate into
21 more serious problems.

22 CHAIRMAN RYAN: Thank you.

23 Should we proceed, Sam?

24 MEMBER ARMIJO: Yes.

25 CHAIRMAN RYAN: Okay. Continue, please.

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1 MS. BAILEY: Okay. The next slide
2 basically just points out what the focus of the
3 ISA/PRA comparison paper is on it. And, basically,
4 we're focusing on comparing the ISAs and PRAs for two
5 different applications.

6 One is the demonstration for safety under
7 10 CFR Part 70, and the other is for performing risk
8 significance determination. And Dennis will go into
9 the details of the paper.

10 What I'd like to do is I'd like to just
11 point out or emphasize some key points from the
12 ISA/PRA comparison.

13 First, I'd like to point out that the fuel
14 cycle ISAs and the reactor PRAs are performed for
15 different purposes. The PRAs for reactors are
16 performed to provide risk estimates, and the ISAs
17 really are not.

18 An ISA is performed to identify the
19 potential hazards at a facility, to identify the Items
20 Relied On For Safety, to basically prevent or mitigate
21 those hazards, and then to identify the management
22 measures that would be put in place to ensure the
23 availability and reliability of the IROFS. So, the
24 ISA is really a part of a fuel facility safety
25 program.

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1 The second thing that I'd like to
2 emphasize is that we believe that based on, really,
3 ten years of experience in implementing the ISA rule,
4 we believe that the ISAs are sufficient for
5 establishing the safety basis for a fuel facility.
6 That they are sufficient to support safety decisions.

7 A fully quantitative analysis like a PRA,
8 the processes might give you more information, but it
9 would likely come at significant cost and resources
10 both to the licensees for developing them, and also
11 for the NRC for - to the NRC for reviewing them.

12 MEMBER BANERJEE: Can I just ask you a
13 question?

14 MS. BAILEY: Sure.

15 MEMBER BANERJEE: Pardon my ignorance. Are
16 these partly batch processes?

17 MS. BAILEY: Yes.

18 MEMBER BANERJEE: So, operating procedures,
19 I mean, are very important, right?

20 CHAIRMAN RYAN: Yes.

21 MEMBER BANERJEE: So, typically in a
22 chemical plant, one has procedures to do this using
23 HAZOPs, as we all know.

24 How do you do that in a PRA?

25 MR. DAMON: I'm not sure what you mean.

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1 MS. BAILEY: Yes.

2 MEMBER BANERJEE: Well, for example, let me
3 give you - imagine I'm running a batch plant to make
4 something. Doesn't matter. A pharmaceutical.

5 You fill one vessel. So, there's a
6 procedure, okay, which is empty this, put it in there,
7 you know, the typical - and you can do a HAZOP on each
8 operating instruction and go through it in a
9 systematic way.

10 There are procedures for doing this. We
11 know how to do this because we build chemical plants,
12 which are batch plants.

13 PRAs are not typically used in situations
14 like that, that I know of. You might enlighten me.
15 Dennis might, actually.

16 MR. DAMON: Well, you can - you can do
17 both, you know.

18 MEMBER BANERJEE: It's not that easy
19 because it doesn't fall into the -

20 DR. MODARRES: There is human - there are
21 human actions in the control room which are
22 essentially proceduralized and step by step. You go
23 through many steps.

24 MEMBER BANERJEE: Okay.

25 DR. MODARRES: Those are all considered in

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1 the PRAs as sequences of events done under human
2 action.

3 MEMBER BANERJEE: And you sort of add it
4 for the probability of success, of failure or -

5 DR. MODARRES: With a probability of
6 success, which is conditional upon previous tasks
7 being done. So, that's done.

8 MEMBER BLEY: I've never seen a PRA of a
9 process facility done that did not do HAZOP to help it
10 define the scenarios it was going to evaluate.

11 MEMBER BANERJEE: HAZOP is the first step?

12 MEMBER BLEY: Absolutely.

13 DR. MODARRES: Yes.

14 MEMBER BLEY: Absolutely.

15 MEMBER BANERJEE: I've never seen a PRA
16 done for a chemical plant.

17 CHAIRMAN RYAN: Sanjoy, I think the idea of
18 a simple batch process where you mix three ingredients
19 and you get some product out the bottom end of the
20 tank after stirring it for five hours, is pretty
21 straight forward in a simple batch. But very quickly,
22 a batch process really becomes a continuous process
23 when you start having lots of feeds, lots of mixing
24 and, you know, continuous feed of product. So, you
25 very quickly get out of a batch process.

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1 MEMBER BANERJEE: Yes, but a lot of the
2 issues are related to the operations.

3 CHAIRMAN RYAN: Yes.

4 MEMBER BLEY: Absolutely.

5 MEMBER ARMIJO: They may be fairly long-
6 term batch processes, but they're still batch
7 processes.

8 CHAIRMAN RYAN: Sure.

9 MEMBER ARMIJO: Phase changes are
10 important, you know, but it's really a simple thing.
11 Take UF6, evaporate it, turn it into UO2. There's a
12 whole bunch of little steps.

13 And do you really need PRA and will PRA
14 really help you do a better job with respect to safety
15 or even assessing the risk? I don't know.

16 CHAIRMAN RYAN: Well, one phase we haven't
17 mentioned yet is, you know, a process hazards
18 analysis, which is an OSHA process.

19 As Dennis said, you know, it has a lot of
20 the same attributes as a PRA without the probability
21 part as much.

22 MEMBER BANERJEE: Well, that must be based
23 on a HAZOP, right?

24 CHAIRMAN RYAN: Yes.

25 MEMBER BANERJEE: The process hazards

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1 analysis.

2 CHAIRMAN RYAN: But it's designed, you
3 know, to kind of be tailorable to a wide variety of
4 processes, not just batch processes.

5 MEMBER BANERJEE: I think what Dennis said
6 is useful. You can use a HAZOP as a basis, and then
7 put some probability on each of these.

8 MR. DAMON: Yes, the probability modeling
9 is usually - it's different, you know. Like you said,
10 a HAZOP is a useful thing to - it's a nice structured
11 thing to help you try to think of what can go wrong.

12 What I found in looking at HAZOP results
13 is they usually - they're parameter oriented in the
14 following sense they still - they'll say, well, what
15 if the flow is too high, what if the temperature is
16 too high?

17 Okay. And then at that point, you say,
18 well, then I've got something to protect me from the
19 adverse consequences of that or I've got something to
20 control that parameter.

21 But when you get into PRA, you usually end
22 up modeling things of a more refined level of detail.

23 How did - how did you get that high temperature?
24 What exactly went wrong?

25 And then you've got to specify that much

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1 more precisely because you're going to want to
2 quantify how frequent that is.

3 So, my view is the PRA, you do the HAZOP
4 first, and then you start talking about making a
5 quantitative model, you know. Some kind of a
6 probability model that would come out of a fault tree
7 or event tree or some other kind of probability.

8 MEMBER BANERJEE: But that's an enormous
9 amount of work.

10 MR. DAMON: It could be, yes.

11 MEMBER BANERJEE: Right. Because, I mean,
12 that's really what people don't do if they can help
13 it.

14 MEMBER BLEY: Take a look at the MOX ISA
15 and take a look at the 12,000 or however many IROFS
16 that have been beefed up and re-expensed to ensure for
17 every one of those there was coverage with no risk
18 ranking to decide some weren't important and others
19 were and, you know, it's expensive either way if it's
20 a complex facility.

21 I have a question back to where you were a
22 little bit ago talking about your confidence in the
23 current oversight process.

24 Have there been complaints about your
25 oversight process either from the Commission or from

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1 the regulated, of the kind that we used to have for
2 the previous reactor oversight process that it was -
3 it was too arbitrary and random based on the
4 judgements of the people involved in the particular
5 reviews that were there?

6 Do you have that kind of problem that
7 existed that led to the rope that we've now got for
8 reactors?

9 MS. BAILEY: You know, I'm going to let the
10 industry answer the part about complaints from the
11 industry.

12 MEMBER BLEY: Well, can we interpret what
13 the Commission told you that you're getting that kind
14 of complaint from the Commission?

15 MS. BAILEY: I think from the previous
16 Commission, you know, I mentioned SRMs being issued
17 between 2005 and 2009. So, that really was the
18 previous Commission.

19 But I think from the previous Commission,
20 that there was a sense that the oversight process
21 could be more structured, that it could be more
22 predictable or less arbitrary in how we disposition
23 our -

24 MEMBER BLEY: And we haven't heard from the
25 new Commission on these issues yet, as far as I know.

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1 MS. BAILEY: I don't think so.

2 Do you recall?

3 CHAIRMAN RYAN: Not yet.

4 MEMBER SIEBER: Latest SRM was in
5 September, I think.

6 MS. BAILEY: And, again, the OIG
7 recommendation back in 2007 to make our oversight
8 process, the framework of it to follow a more
9 structured framework similar to -

10 MEMBER BLEY: We'll hear from the industry
11 later, I guess.

12 CHAIRMAN RYAN: We do have -

13 MEMBER BLEY: Yes. Okay.

14 MS. BAILEY: But the discussion previous
15 basically feeds into, I think, the second point that I
16 was trying to make, which was that the cost of
17 developing a PRA for all the processes in the fuel
18 facilities, I don't think that it's clear that the
19 cost can be clearly justified given that we believe
20 that the ISAs are adequate for ensuring safety and
21 that the facilities are relatively low risk compared
22 to power reactors.

23 And I think the third point that I wanted
24 to make that I think is emphasized in the ISA/PRA
25 paper is that as I mentioned before, the ISAs were not

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1 intended to provide risk estimates.

2 And so, we acknowledge that the
3 methodology, the ISA methodology may not be fully
4 right for use in a quantitative significance
5 determination process.

6 However, we believe that if we did decide
7 to go with a quantitative SDP, that we could perform
8 that quantitative analysis for that specific violation
9 to determine its risk significance. And that could be
10 done on a case-by-case basis.

11 We believe the -

12 MEMBER ARMIJO: Excuse me. Is that the
13 example that Dennis is going to go through?

14 MS. BAILEY: Dennis will get into that,
15 yes.

16 MEMBER ARMIJO: Okay. Just so I understand
17 it, how would you do this.

18 MS. BAILEY: Right. But basically believe
19 that based on the review of previous violations, that
20 the number would be very few that we would have to do
21 that quantitative analysis.

22 And so, a pre-evaluation or a quantitative
23 pre-evaluation of all sequences for all processes we
24 don't believe is sufficient or necessary.

25 And then my next slide gets into the next

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1 steps which I'll get into later. And so, I'll turn it
2 over to Dennis now.

3 MR. DAMON: For the record, my name is
4 Dennis Damon. I work for Marissa in the Division of
5 Fuel Cycle Safety and Safeguards.

6 The next slide. This is the same two
7 points that Marissa mentioned. What I'm going to very
8 briefly do is just go over the structure of the paper
9 and why it's structured the way it is.

10 When I read the SRM, it said perform a
11 comparison of ISA to PRA, a comparison and critical
12 evaluation. And so, I interpret that to mean not
13 simply - not simply describing ISA as an apple and PRA
14 as an orange, but rather comparing points in the
15 context of how good a job they do at some function.

16 So, the two functions I - that occurred to
17 me - and there are others. There are other many other
18 ways of using PRAs, for example. And, in fact, we
19 have used them for other purposes than these two.

20 But the two - one are - the first one is
21 establishing the safety basis, which is what basically
22 the ISA and the rule is trying to do.

23 And then the second application is this
24 business of quantitative analysis to do risk
25 significance determination for inspection findings,

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1 which is what's done in the reactor oversight program.

2 So, there's these two different contexts
3 of where I'm going to look at ISAs and PRAs and how
4 they play out.

5 And the obvious - kind of the obvious
6 conclusions this was pointing is that, well, we put
7 this ISA concept in place in the rule to do the first
8 thing. And now if you want to do this, if you want to
9 do quantitative risk significance determination, these
10 ISAs were not done for that purpose. And as Dr.
11 Powers says, they don't really calculate risk in the
12 ISA.

13 So, when you go and you want to do that
14 second function, you're going to have to do something
15 - you're going to have to - it's not that the ISAs
16 don't have any risk information. They give you a
17 basis to start from, but they weren't done for that
18 purpose.

19 Consequently, what you'll find are little
20 - not little, but in some cases big flaws where you
21 have to be careful that you use that information and
22 supplement it with other information in order to get a
23 true risk significance of some finding that you -

24 MEMBER BANERJEE: So, I don't know exactly
25 what's in an ISA, but it doesn't incorporate things

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1 like risk indices like, you know, typically one would
2 use a Dow Index or a Mond Index or something.

3 MR. DAMON: Yes.

4 MEMBER BANERJEE: Does it have that stuff
5 in it?

6 MR. DAMON: Yes, they do.

7 Of course, like I said, there's like about
8 ten ISAs that are currently approved.

9 MEMBER BANERJEE: Right.

10 MR. DAMON: One of them was done non-
11 quantitatively. Two of them were done quantitatively.

12 So, the accident - they identify accident sequences
13 and they assign frequency of initiating event,
14 probabilities of, you know, occurrence of the
15 subsequent events, and they get a frequency of that
16 accident sequence quantitatively. Two of the
17 licensees do that.

18 The rest of the ten, they use a Risk Index
19 method which is - it's structured like a quantitative
20 evaluation. It's very rough.

21 Its starting point is to say that, for
22 example, that a human error has an index of minus one,
23 which stands for 10 to the minus one. And active
24 controls of minus two, and then a passive controls
25 minus three. So, as frequencies of events.

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1 So, most of the licensees use that method,
2 but they don't - they don't always just go with this
3 simple assignment of indices. They look at actual
4 plant experience, too, you know.

5 I know - I don't know to what percentage
6 of the time they do that, but I have - I know of
7 specific instances where I've been - I've sat in on
8 how they did that.

9 They adjusted - came up with a number
10 based on their own experience that this - there's
11 really much more or less frequently occurring than
12 whatever came out of this Risk Index thing.

13 So, that's what the licensees do. There
14 is information there.

15 CHAIRMAN RYAN: Dennis.

16 MEMBER BLEY: Given the two, though, the
17 quantitative assessment for each of these scenarios,
18 as far as I understand, none of them have found a way
19 to aggregate those in a way to give you meaningful
20 comparisons.

21 Is that true or am I -

22 MR. DAMON: Yes, they're not - I'll go into
23 that.

24 MEMBER BLEY: Oh, okay. We can wait.

25 MR. DAMON: The rule actually dictates to

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1 them that they're going to do it sequence by sequence
2 and they're not going to sum up anything.

3 And if we did, we'd have to tell them how
4 to sum it up and what to sum up and, you know, what
5 metric do we want out of this, you know?

6 We didn't do that. The rule was
7 structured on a sequence-by-sequence basis because it
8 wasn't intended to be used for something like this
9 risk significance thing.

10 And if you'll notice in the example in
11 Section 5, there are two accident sequences. And I
12 did that deliberately so that you had to add them up
13 to get the total to show that, yes, if you do the
14 significance stuff, yes, you have to add things up.
15 And so, yes, they don't add things up even when they
16 do it quantitatively.

17 So, an ISA is never like a PRA. It's a
18 different animal.

19 MEMBER BANERJEE: If it uses the tools of
20 the chemical industry as - I get the impression it's
21 sort of a potpourri of tools that have been put
22 together that they use in some way, which includes
23 many of the tools which are used.

24 The chemical industry does get, you know,
25 maximum probable property damage and fatalities and

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1 all that sort of stuff comes out of the analysis. So,
2 there are quantitative measures, certainly.

3 MR. DAMON: Yes.

4 MEMBER BANERJEE: I mean, they go through
5 this systematically area by area, vessel by vessel. I
6 mean, all this is done, right?

7 It's not done with the infinite level of
8 detail. There's a lot more qualitative stuff there
9 where you get credits for having this and debits for
10 not having it and having hot oil or not hot oil. It
11 goes on.

12 But it's a qualitative method which comes
13 up with numbers, right, based on experience?

14 MEMBER SIEBER: Yes, but that's for
15 individual accidents, which there could be quite a
16 few. There is nothing equivalent to the reactor-type
17 core damage frequency -

18 MEMBER ARMIJO: No. Criticality event,
19 that's -

20 MEMBER SIEBER: And so what you end up with
21 is -

22 MEMBER ARMIJO: That will put you out of
23 business.

24 MEMBER SIEBER: - a lot of little PRAs.

25 CHAIRMAN RYAN: Correct me if I'm wrong,

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1 Sanjoy, but there's a lot of uniformity across
2 chemical industries.

3 For example, just on things like pumps, I
4 mean, people have a pretty good, large database on the
5 reliability of pumps of a certain type, you know,
6 vessels of a certain construction and materials and
7 all that.

8 So, I mean, to me, that helps the chemical
9 side of the house do what you're describing in coming
10 up with something that if they do it in one plant and
11 do it in another, they're going to come up with
12 something close if they have the same process.

13 MEMBER BANERJEE: But, you know, a
14 reprocessing plant is a chemical plant. It's not a
15 nuclear reactor.

16 MR. DAMON: Right.

17 MEMBER BANERJEE: I don't see why you would
18 not use the methodologies used, why one would move in
19 a different direction.

20 MR. DAMON: Well, like I said, that's in
21 fact what the licensees have done. And, in fact, if
22 you go to Slide 17, what the licensees do on the
23 consequence end is quantitative.

24 Consequences are quantitative because the
25 rule requires it. It defines high and intermediate

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1 consequences to the workers and the public.

2 And so, you know, as you see, this slide
3 is all high consequences. The top group there is to
4 the workers. And the bottom is for the outside
5 public.

6 So, an event producing a hundred rem dose
7 to a worker or endangering the life of a worker to a
8 chemical exposure, that's a high, quote, high-
9 consequence event for the workers.

10 So, this part here is quantitative. And
11 what that means is, is that when the licensee
12 identifies something such as a large chemical release
13 that might actually - and, by the way, these chemical
14 endanger the life and stuff, the licensees define
15 those quantitative. They set quantitative criteria
16 for how they will evaluate that phrase "endanger the
17 life."

18 So, they establish quantitative criteria
19 and then they do calculations, you know. And they
20 usually do - what they usually do for a chemical
21 release is a worst case weather dispersion analysis,
22 stability Class F, you know, two meters a second wind
23 or something. The wind blowing right at the nearest
24 offsite person.

25 And they'll do that, calculate that

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1 number. And if it reaches the threshold number that -
2 and in this case for offsite public, it's irreversible
3 chemical injury - then that's a high-consequence
4 event.

5 And that's all they want to do is identify
6 is this a high-consequence event or intermediate? The
7 next slide has the criteria on it for intermediate.
8 And so, that part is quantitative.

9 Now, for a criticality event, you really
10 don't have to calculate anything. Okay. If you're
11 standing within ten feet of it, you're going to get a
12 fatal dose. And so, there's no need to calculate
13 anything.

14 A criticality is basically assumed to be a
15 high-consequence event if somebody is standing there.

16 But these offsite things - the onsite
17 chemical releases are problematic, you know. Endanger
18 the life of the worker. Some licensees have in order
19 to simplify their analysis, they assume if they have
20 any chemical release in a room, the worker - it could
21 endanger the life of the worker. So, they just take a
22 hit on - it's conservative assumptions, basically,
23 what it is.

24 And I've been told that some of those
25 licensees have gone back now and sharpened their

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1 pencil and they're trying to, you know, figure out
2 which ones of these really are endangering the life of
3 the worker.

4 But, initially, some of them would just
5 say, okay, if I get a chemical release in this room
6 and there's workers there, it's endanger the life.

7 And so, that's all they do is this front
8 part, you know, so they go through - the ISA does the
9 three things that you do in a risk triplet.

10 They identify what can go wrong and they
11 use HAZOP a lot. They use what-if checklists. They
12 have other checklists for dependancies. Checklists
13 for human factors. They go through these things and
14 some of them use fault trees and some of them use
15 event trees.

16 So, they use these structured techniques
17 and identify what can go wrong. They do this
18 consequence analysis to see what bin it goes in. It
19 either goes in high, intermediate or low.

20 If it's low, they're done. If it's high
21 or intermediate, that triggers other requirements in
22 the rule. And finally we come - let me back up here
23 to Slide 5.

24 An ISA basically just - it's part of the
25 structure of the regulation in Subpart H of Part 70

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1 and it has a role to play in that. And its role is to
2 do two things; identify and evaluate.

3 The identify part is I've just walked
4 through. It identifies sequences that may be
5 intermediate or high consequence.

6 The evaluate part is to see if those - is
7 to see if it meets what are called performance
8 requirements. And the performance requirements are -
9 that basically the performance - two of the
10 performance requirements are that high-consequence
11 event sequences shall be highly unlikely, and
12 intermediate consequence events shall be unlikely.

13 But the rule does not give any guidance as
14 to what constitutes highly unlikely or unlikely. But
15 such guidance as exists, is in the standard review
16 plan for fuel facilities. There is some guidance in
17 there. But, basically, licensees have decided how to
18 do that themselves, what they're going to define as
19 highly unlikely and unlikely.

20 And the staff has said in the standard
21 review plan, what we would consider - what we think
22 about that. And each licensee has submitted a method
23 for making these likelihood determinations. The staff
24 has reviewed it, and ultimately approved the ones that
25 have been approved.

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1 So, that's - the process is that the ISA
2 identifies what can go wrong, it categorizes it, and
3 it evaluates compliance where the objective here is to
4 assure that, yes, the safety design of the plant is
5 adequate to make these more consequential events
6 sufficiently unlikely, which is the goal.

7 That last stage is the thing the chemical
8 industry - some of the chemical people do that kind of
9 thing, and some of them don't, is my impression.

10 MEMBER BANERJEE: As part of the HAZOP,
11 what you do is you fix the plant as you go along,
12 right?

13 It depends when it's done. If it's done
14 at the design freeze stage or the commissioning or the
15 design stage. So, it's sort of an active process.

16 You have all these engineers working
17 together and they - so, say, okay, we gotta do this or
18 gotta do that to make sure we don't have this high-
19 consequence event.

20 It's a bit qualitative, but it doesn't
21 work always, but it can handle a very different
22 variety of plants.

23 MR. DAMON: And that's basically what we
24 were trying to achieve with this rule. We just, you
25 know, framed it in a - slightly more in terms of

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1 likelihood and consequences than you might see in the
2 OSHA rule, but it's basically the same thing.

3 They go through and identify what can go
4 wrong. And they make sure that what - they've got
5 stuff in place to prevent it or mitigate it and that
6 they believe that that's adequate.

7 MEMBER BANERJEE: Right.

8 MR. DAMON: The whole point of - I've
9 taken the OSHA, you know, the classes and the OSHA
10 technique. And, I mean, the whole point here is to
11 get somebody to sit down, like you say, with a bunch
12 of knowledgeable people and make that decision that
13 this is an adequate design, you know. That's the
14 whole point. And put it down in writing, right?

15 MEMBER BANERJEE: Systematically vessel by
16 vessel, line by line, auxiliary by auxiliary.

17 MR. DAMON: Right.

18 MEMBER BANERJEE: You go through every
19 piece of it.

20 MR. DAMON: Yes. So, the real basic
21 objective of the ISA was to make sure that this
22 process was not only gone through, but documented.
23 And then what happens at the end of the process is an
24 ISA summary gets sent to the NRC.

25 That was an important thing in this. I

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1 can tell you from having been one of the staff
2 persons, that's what they really wanted.

3 The problem with the previous way of
4 regulating was that - was licensees were - licenses
5 were renewed every five years. And so, in between
6 license renewals the NRC didn't get any information
7 about what the design changes might be made except by
8 the inspection process.

9 Inspectors going out and they can
10 determine that, yes, some changes have been made, but
11 we didn't get regular reports.

12 I mean, now we get an annual report called
13 an ISA summary that lists all the Items Relied On For
14 Safety in the plant. And so, that was really what -
15 that was what the staff wanted.

16 The rule wasn't written to make the plant
17 safer. It was written so the NRC staff got more
18 information and more current information about the
19 plants. That's really what was desired.

20 DR. MODARRES: Dennis, I have a question.

21 In evaluating the frequency part, you
22 develop sequences of events, I presume. Does the ISA-
23 type sequences of event any different from the PRA in
24 level of detail in the types of things you consider or
25 -

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1 MR. DAMON: I would say usually they're the
2 same as what you might do if you do a PRA model. Of
3 course, remember two of the plants do in fact use
4 fault trees and event trees. So, they're doing it the
5 same way.

6 But I would say level of detail is usually
7 similar to what you would do if you would do a
8 quantitative model. But sometimes like I was saying
9 about HAZOP, the events are not - they're not refine
10 enough. It's just occurrence of low flow or high
11 temperature without saying, okay, well, how did this
12 happen exactly, you know?

13 So, if you did a PRA, you would have to
14 try to figure out what exactly - how this exactly
15 happened so that you could get some idea of how -

16 DR. MODARRES: So, technically speaking you
17 would be able to find at least at the level of
18 sequence, what contributes to that sequence. Either
19 qualitatively if you analyze it or quantitatively, you
20 are still able to say what contributes to that
21 frequency from those elements of the sequence, can't
22 you?

23 MR. DAMON: Yes, that's what I was trying
24 to communicate is that even though, as Dr. Powers
25 says, the ISAs don't calculate a risk metric, they've

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1 got all this information about what's going on.

2 They've got the sequence there and the
3 events that are happening and so on. So, it's telling
4 you what they've figured out could happen.

5 DR. MODARRES: The area I was - actually I
6 was getting to, because you commented on that the ISA
7 is not identifying the contributors to risk, I'm
8 saying that if you identify all these scenarios,
9 either evaluate them qualitatively or quantitatively,
10 you might as well do that also.

11 I mean, you have all the material. You
12 don't add them up, but at least sequence by sequence
13 you can do that analysis. And at the end, certainly
14 then appear very often and you say so, these are
15 probably the most significant ones.

16 MR. DAMON: Well, you can like I - like I
17 said, the example that's in Section 5 of the paper
18 marches through a qualitative analysis of a risk
19 significance determination in which you do that.

20 And what you're doing is you're saying -
21 it's a criticality accident. And in that accident,
22 people might not notice this, but there's a reasoning
23 process here in which you say, well, if a criticality
24 accident happens in this process, the operator who's
25 standing there could get a fatal dose.

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1 So, by having said that, there's a
2 fatality involved in that example in Section 5 that's
3 not emphasized, but that's what we're talking about.

4 Criticality happens, operator dies, and
5 what's identified in the example are there's two
6 sequences that could cause that, that particular kind
7 of criticality. The one that's due to a leak in a
8 safe - a geometrically safe process. It leaks.
9 There's a containment dike underneath the process, but
10 the containment dike also has a leak in it. The
11 liquid goes somewhere and collects and goes critical.

12 So, that's the - and there's two different
13 ways in the example that that can happen. So, yes,
14 you can - if - an ISA would not calculate the sum of
15 the two things. Even if they did it quantitatively,
16 they wouldn't add the numbers up.

17 But when you go to do this significance
18 determination, you do add the numbers up, you know.
19 That's what I'm saying is you have to - if you want
20 the right answer, you have to add things up.

21 And so - but your - typically if an ISA
22 was done with some quantitative information, you would
23 have in front of you quite a bit of information to
24 work with.

25 One of the peculiar things, though, is if

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1 you try to do sort of a comprehensive PRA-like thing,
2 it's not quite as - it's not often as easy as that.

3 I did the easy one where I'm only going to
4 look at the operator standing in front of the process.

5 If I really want to know what the total risk is to
6 that person, because that's what you would do in a
7 PRA, you would want to know the total risk to that
8 person not just from a criticality, but a chemical
9 accident or anything else that could happen for that
10 individual.

11 Well, when a criticality happens in a
12 room, if the guy that's standing close to it gets like
13 thousands of rads, right, the guy that's standing on
14 the other side of the room might get hundreds. Okay.

15 That's still a serious health effect.

16 And so if you try to do a true PRA to
17 calculate sum total risk, you've got a summation
18 problem here. You've got multiple sources and
19 multiple receptors, you know.

20 The plant consists of a whole bunch of
21 processes, a whole bunch of operators all spread all
22 the way around the plant. So, it's not a trivial
23 thing to add up the sequences, is what I'm trying to
24 say.

25 A reactor PRA is much simpler. You got

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1 one source. Now, you've got multiple receptors.
2 Okay. And that's more tractable, but this one is
3 multiple in both.

4 DR. MODARRES: You mean the health effects
5 are difficult to compute -

6 MR. DAMON: No, no.

7 DR. MODARRES: - because of the multiple
8 exposures or what?

9 MR. DAMON: I would have to calculate the
10 magnitude of the criticality, find out what the doses
11 are to these various individuals and add them all up.

12 DR. MODARRES: Okay.

13 MR. DAMON: Then do another criticality. A
14 criticality in that process. A criticality in this
15 process. A criticality in that - and all again I'm
16 adding up.

17 So, I'm adding up over all accidents and
18 over all personnel in the plant to get the total risk.

19 DR. MODARRES: More difficult, but it's not
20 undoable.

21 MR. DAMON: No, no, it's not undoable, but
22 I would want to program it on a, you know, a computer.

23 MEMBER BANERJEE: Also, I think the - if
24 you - when you do the HAZOP-type thing, what happens
25 is somebody says this is credible, but they don't - so

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1 that what passes is either it's credible or we just
2 discount this, whether this Chemical A can come into
3 this line or not.

4 If there's another line into that line,
5 you say it could be substituted Chemical B by A,
6 because A could come out of this, but you don't give a
7 probability or anything.

8 You just say credible or not. Should we
9 consider it or not, you know? So, it's sort of like
10 an on/off decision to a first approximation.

11 You're not assigning a likelihood to this
12 happening. You're simply saying it can happen. Let's
13 guard against it in some way.

14 CHAIRMAN RYAN: I mean, my experience,
15 Sanjoy, is that everything - those are exactly what
16 happens, but it starts with what's the worst thing
17 that can happen. Okay. It's a criticality. Or the
18 other is, let's say, a spill of very large quantities
19 of, you know, of acid, concentrated acid.

20 And they say, okay, well, those are the
21 end points we want. And now when we back up, can
22 those happen by all these different routes?

23 And, again, it's without the probability
24 part of it. It's either on or off.

25 MEMBER BANERJEE: That's a different

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1 analysis from what -

2 CHAIRMAN RYAN: But it's the same kind of a

3 -

4 MEMBER BANERJEE: Right. It's very
5 qualitative.

6 CHAIRMAN RYAN: There's qualitative
7 information, but it's not in any way analytic with
8 regard to the risk probability.

9 MEMBER BANERJEE: Yes, it doesn't normally.

10 I mean, you could -

11 CHAIRMAN RYAN: Could.

12 MEMBER BANERJEE: - make it more
13 structured and make it - put a risk - I mean, put a
14 probability so that you could get a frequency, but
15 it's not normally done.

16 DR. MODARRES: Isn't it possible to
17 actually go through the HAZOP and find out what dose
18 sources, which of those sources are really
19 contributing in this, in the PRA, on those source
20 terms that are actually of significance?

21 MR. DAMON: Well, we want, like I said, the
22 rule, like I said, on Slide 17 and following, there's
23 some quotes from the rule.

24 Unlike what's done in OSHA in a PHA
25 analyses, we have this extra step. It's likely - we

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1 call it the performance requirements in 70.61. So, we
2 want licensees to make a finding that all the high-
3 consequence sequences are highly unlikely.

4 So, we do want them to look at everything
5 that comes out of the HAZOP and take this one extra
6 step, which they typically don't - like I say, they
7 don't necessarily do in a chemical plant, but our
8 regulation requires it that they do this one extra
9 step. And that is make a finding that each accident
10 sequence that ends in high consequences is highly
11 unlikely.

12 But it isn't, as I say, exactly a risk
13 calculation. It's identifying the -

14 MEMBER BANERJEE: That can be done. I
15 think what you're asking for it could easily - or not
16 easily, but can be done as a part of the HAZOP.

17 MR. DAMON: Could be, yes.

18 MEMBER BANERJEE: It could be part of it
19 because you do have a determination as to whether, you
20 know, something happening meets to a high consequence
21 or not. You're supposed to do that as part of that.

22 MR. DAMON: Right.

23 MEMBER SIEBER: Is it appropriate, though,
24 to say - let's say there's ten possible accidents with
25 ten risk profiles.

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1 Is it appropriate to add those all
2 together to determine what the overall facility risk
3 is?

4 Because you're only going to get one at a
5 time. And once you had one, that's the end of the
6 operation.

7 MEMBER BLEY: But the risk is that any one
8 of these might happen.

9 MEMBER SIEBER: Right.

10 MR. DAMON: It's like - yes, it's like when
11 you go out on the highway, you know, you can get hit
12 by any one of those cars.

13 MEMBER SIEBER: Actually, you can run into
14 a building.

15 MR. DAMON: You're probably only going to
16 get hit by one, you know.

17 MEMBER SIEBER: Right.

18 CHAIRMAN RYAN: The first one is the only
19 one that will matter.

20 MEMBER SIEBER: You haven't been on the
21 Beltway recently.

22 MR. DAMON: You can get hit by multiple,
23 yes.

24 So, let's go to Slide 1.

25 (Laughter.)

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1 MEMBER SIEBER: Dennis, you're doing great,
2 but you're awfully slow.

3 (Laughter.)

4 MR. DAMON: So, it's the list of the
5 supplied sections in the paper here. Yes, that one.
6 So, this is - I mean, what we've been talking - the
7 structure of the paper is the first two sections sort
8 of say what an ISA is, where they came from, what PRAs
9 are like and what they're used for.

10 And then Section 3 is just this evaluation
11 of ISAs and by implication, also, should we be doing
12 more PRA-like stuff for compliance for safety of the
13 fuel cycle facilities.

14 So, it's the use of ISA and PRA in the
15 context of safety. So, there's a discussion of that
16 subject. There's a table in there that goes through
17 the different technical points of ISAs and PRAs and
18 says what - says some things about, you know, what you
19 might see in an ISA for assuring safety.

20 Then Section 4 is kind of an introduction
21 to Section 5. It does what Marissa did. It sets the
22 context that risk significance determination is just
23 one element of an oversight program revision that was
24 envisioned in the SECY paper.

25 So, Section 4 just does that, it

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1 introduces. And Section 5 is to do an evaluation of
2 using ISAs or, quote, PRAs in doing risk significance
3 determination. And it has an example.

4 So, I put the example in so that you could
5 - when you got into saying things about this
6 application, we want to have something very concrete
7 to think about. So, there's an example of a risk
8 significance determination.

9 It's done basically the same way you do
10 reactor risk significance determination. It's
11 calculating what happens when you have an inspection
12 finding.

13 Inspection finding is some kind of a
14 deficiency that has a risk significance. If it
15 doesn't, it will have been screened out previously in
16 a qualitative screening, but it has some kind of
17 impact on risk.

18 And what you do is you - and what I mean
19 by impact on risk is usually what happens is you have
20 some Item Relied On For Safety that has been disabled,
21 and that's what happens in this example, the dike is
22 found to have been in a leaking condition, and that
23 fact that that defect exists has elevated the
24 frequency of accident sequences that could affect the
25 worker. And that elevated frequency of accident

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1 sequence of an accident exists for some period of
2 time.

3 So, you calculate the elevated - the
4 change in frequency and you multiply by the length of
5 time that it existed, and you get a metric that is
6 what I would call the incurred probability of the
7 outcome, in this case, high consequences to the
8 worker, that was caused by that inspection deficiency.

9 So, it's a metric of how serious the risk
10 impact of the deficiency was. So, we're doing the
11 same thing basically doing in the reactors, only of
12 course our consequences are quite different.

13 In this example, you know, typically it
14 would only be one or two workers that would be at risk
15 of fatality from an event like that, whereas a reactor
16 accident you've got a big offsite contamination, maybe
17 many, many people offsite affected by that one event.

18 So, it's different in that sense, but it's
19 conceptually the same thing. To get a significance
20 metric, you do this calculation.

21 And of course it's like it's sort of
22 tautologous. I mean, it's like if you want a
23 quantitative evaluation, you got to do it
24 quantitatively. Well, ISAs don't necessarily give you
25 all the quantitative information you may need.

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1 I don't know where in here I've got the
2 example, the list of things that can go wrong, but
3 basically I've looked at enough of the ISAs to say
4 that there's a certain set of kinds of things that are
5 not - that you have to supplement the ISAs with to do
6 this kind of risk significance thing.

7 One of them is when licensees don't - they
8 don't necessarily credit all their safety controls
9 because they're not required to. The rule only
10 requires that they identify a sufficient number of
11 IROFS to make the argument that the sequence is highly
12 unlikely, and then they're done. So, they sometimes
13 choose not to tell you of additional safety controls
14 they have.

15 Well, that affects risk significance. I
16 mean, if you've got another safety control there to
17 protect you, you want to know that.

18 Another one is the one I also previously
19 mentioned for offsite consequences, is frequently they
20 calculate that if a release occurs, a - they'll do a
21 worst case weather calculation.

22 Well, in point of reality, it wouldn't
23 always be worst case weather. So, there's a big factor
24 of frequency that you're not taking credit for.

25 Another thing that's often not credited

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1 are safety margins that are built into the criticality
2 area. Very often if you lose - when I got - first got
3 here years ago, the division director had me do a
4 study of all the, what they called, 9101 criticality
5 reports that had occurred in that time. There were 64
6 of them.

7 I found six instances where - out of the
8 64, there were only six instances where the parameter
9 that was being - in all 64 cases, some control had
10 failed. There was a failure of a control.

11 But in only six out of the 64, was the
12 parameter that was being controlled actually exceeded
13 safety limit. That's what I mean by a safety margin
14 is these things are built with big safety margins.
15 So, even though you lose control, you don't
16 necessarily go into an unsafe state.

17 And so, those are normally - those are not
18 credited in the ISAs. There's no credit taken for
19 this margin - these kind of safety margins.

20 So, what I'm trying to say is if I were to
21 do a risk significance determination of something that
22 was put in front of me, I would want to go down my
23 checklist and make sure that I was, you know, doing it
24 properly and giving credit for everything that's
25 there.

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1 And of course there's things that you
2 don't give credit for, but those are the big ones that
3 I can say from experience, those are the ones that,
4 you know, will make a big difference in the outcome of
5 an evaluation.

6 So, anyway, basically that's the story.
7 As Marissa said, the - I mean, I could go over all the
8 stuff that's been done over the last 15 years to - the
9 licensees have done these ISAs. They've spent a lot
10 of money doing them. They've done - they've put a lot
11 of staff to work.

12 I counted one licensee had 128 people on
13 his staff work on an ISA, you know. These are not
14 undertaken lightly, you know. They did a good attempt
15 here at doing this analysis. We had workshops. We
16 learned - the licensees were learning how to do these
17 things. The staff was learning.

18 As a result of that process, there were a
19 number of interim staff guidance documents written on
20 various topics that came up as to how to treat various
21 things in an ISA. Those documents are now
22 incorporated into Rev 1 of the standard review plan.

23 MEMBER BANERJEE: Did they incorporate some
24 of this in the design process?

25 When you say 128 staff, I mean, were they

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1 actually there during the design process or -

2 MR. DAMON: No, these are -

3 MEMBER BANERJEE: No, these were post-
4 design.

5 MR. DAMON: These are post-design.

6 MEMBER BANERJEE: Post-design freeze
7 they're doing this.

8 MR. DAMON: Right. And the reason you get
9 a large number of staff is of course you have to put
10 together - you have to get the staff engineer that
11 knows that process, the operator who operates that
12 process, and maybe the criticality safety engineer who
13 did the criticality safety evaluation of that process.

14 So, you have to get all the people that
15 apply to that process. So, you've got multiple, large
16 numbers of processes. So, you'll have a whole bunch
17 of teams to cover the whole plant.

18 CHAIRMAN RYAN: I mean, even the
19 maintenance folks that maintain the equipment -

20 MR. DAMON: Yes.

21 CHAIRMAN RYAN: - have insights into
22 failure rates and things of that sort.

23 MR. DAMON: Right. So, they put together
24 these teams. And so, it tends to involve just about -

25 CHAIRMAN RYAN: Everybody.

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1 MR. DAMON: - everybody, yes. And they
2 sit and they do these - they march through the ISA
3 process trying to identify what could go wrong.

4 MEMBER BANERJEE: And how long does this
5 take, typically? I mean -

6 MR. DAMON: Well, the existing plants were
7 given four years. Some of them had a heard start a
8 little bit, but it took, you know, four, five years to
9 do the existing plants.

10 MEMBER BANERJEE: So, they normally would
11 do an area or a process or something at a time, right?
12 And they would sort of write this -

13 MR. DAMON: Right.

14 MEMBER BANERJEE: - and then they go away
15 and then come back and do it again and it would go on.
16 So, the process is protracted.

17 MR. DAMON: Right.

18 MEMBER BANERJEE: Even though it's taking
19 four years, not 128 people involved in it -

20 MR. DAMON: No, no.

21 MEMBER BANERJEE: - during these four
22 years.

23 MR. DAMON: No, the team - yes, the teams,
24 like I said, you got -

25 MEMBER BANERJEE: Five or six people,

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1 right?

2 MR. DAMON: - five or six people.

3 MEMBER BANERJEE: Yes.

4 MR. DAMON: And I don't know how long it
5 takes to do one process, but, you know, you have to
6 gather all the information and talk about it and
7 analyze it and -

8 MEMBER BANERJEE: You probably can do one a
9 week or so. I mean, it takes - depends on what it is,
10 but it takes a fair amount of time to get the
11 information together and to brainstorm.

12 DR. MODARRES: The level of effort doesn't
13 seem to be compatible with the PRA level of effort.
14 Maybe even more unless you -

15 MR. DAMON: You don't do all, you know, the
16 quantitative - there's certain quantitative things you
17 don't do. But, yes, the level of effort is quite
18 substantial.

19 MEMBER BLEY: But those things you don't
20 do, much of that you can automate.

21 MR. DAMON: Yes, once you reach a certain
22 point. See, that's the other thing I didn't - I
23 didn't get into that, but the NRC did not spend any
24 money to develop any methodologies, tools, computer
25 codes. We didn't have the staff sit down and try to

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1 do ISAs ourselves before we had the licensees do them.

2 So, licensees were just tossed into the
3 lake and they had to swim, you know. And so, we
4 didn't develop - I mean, like you say, you could do
5 PRA of these facilities, but nobody has spent the
6 money to develop the tools.

7 MEMBER SIEBER: Is there any kind of a
8 standard doing these things?

9 MR. DAMON: No, there is not an industry -

10 MEMBER SIEBER: Like the chemical
11 engineering -

12 MR. DAMON: - that sets the standards, no.

13 MEMBER BLEY: There's guidance.

14 MR. DAMON: Guidance, yes.

15 CHAIRMAN RYAN: And there are tools that
16 have been developed commercially. There are, say,
17 tools.

18 MEMBER BLEY: But no standard.

19 CHAIRMAN RYAN: There are tools out there.
20 I don't know if they're standardized as much as they
21 are commonly used.

22 MR. DAMON: Yes, the chemical industry had
23 - I mean, they had those reg books before we even had
24 the rule.

25 CHAIRMAN RYAN: Yes.

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1 MEMBER BANERJEE: But they have software to
2 guide you through the process -

3 CHAIRMAN RYAN: Oh, sure.

4 MR. DAMON: Yes.

5 MEMBER BANERJEE: - and, you know, teams
6 have access to that.

7 MR. DAMON: Yes, the licensees use that,
8 use some of these software products that came out of
9 the chemical industry to march through the structure
10 of the process.

11 Yes, so there's - it's not that there
12 aren't any tools at all. But when we talk about PRA,
13 nobody at the NRC spent any money to help licensees
14 develop tools.

15 DR. MODARRES: The AIChE has the guide for
16 doing a quantitative risk analysis.

17 MR. DAMON: Yes. Right. They do.

18 DR. MODARRES: Which essentially has the
19 data and the guide that comes with it.

20 MR. DAMON: Yes.

21 MEMBER BANERJEE: They use the fault trees
22 and things.

23 MR. DAMON: Yes.

24 MEMBER BANERJEE: And a few risk analyses
25 are done already or something.

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1 MR. DAMON: Oh, yes. There's no doubt.
2 Like I say, two of our licensees have done
3 quantitative. They call them QRAs just the way they
4 do in the chemical industry. They call them - that's
5 what they call them.

6 But I might mention something. They don't
7 have criticality accidents in the chemical industry.
8 Okay?

9 MEMBER BLEY: But they have BLEVES.

10 (Laughter.)

11 MR. DAMON: Well, but as I say, a
12 criticality accident is a peculiar thing if you try to
13 quantify, because I thought about this. Being a PRA
14 guy, I said how would I do a PRA with criticalities,
15 because you got this thing.

16 If you have a criticality-given magnitude,
17 there's this essentially 1 over R-squared dose
18 dependence here that's dosing a whole bunch of people,
19 but the other thing is what's the magnitude of the
20 criticality?

21 Criticality magnitudes vary by orders of
22 magnitude depending on how the - what exactly
23 happened. How you entered into the process.

24 MEMBER SIEBER: Plus the geometry and -

25 MR. DAMON: So, now you've got to - if I

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1 want to do it right, I mean, you know, I would model
2 the probability distribution on the magnitude of the
3 criticality. I've never seen anybody try anything
4 like that, you know.

5 There are people out there, Tom McLaughlin
6 and a couple others, who have done criticality
7 modeling, you know, to determine what the magnitude is
8 if something is this way, but nobody's done it
9 probabilistically.

10 MEMBER BLEY: If you were to move toward
11 PRA, that doesn't say you would have to mandate doing
12 all of those things to all the detail one could
13 imagine either. We don't do that for reactors.

14 MR. DAMON: No.

15 DR. MODARRES: Just for critical scenarios.

16 Just for -

17 MEMBER BANERJEE: Yes, I think that is -
18 that is certainly possible. I mean, in fact, the
19 chemical industry does that for a few critical plans.
20 That's certainly feasible, but not for the whole
21 plant, I don't think.

22 But there's another issue. I suppose you
23 could add sort of an expert elicitation as part of
24 this process where these people are getting together,
25 you know, and you could get numbers out of them.

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1 MEMBER BLEY: If they were the right guys.

2 MEMBER BANERJEE: If they were the right
3 people who - well, usually these guys have a pretty
4 good idea of how often something can happen or not.

5 MR. DAMON: Yes.

6 MEMBER BANERJEE: That's how they make
7 their qualitative decisions as to whether -

8 MR. DAMON: I mean, the thing is there's no
9 formal database that was -

10 MEMBER BANERJEE: No.

11 MR. DAMON: - maintained by somebody that
12 fed failure data from all these plants because - the
13 other thing to point out about these plants is they're
14 commercial competitors with one another. The ISAs are
15 proprietary information.

16 MEMBER BANERJEE: Right.

17 MR. DAMON: So, they don't share the entire
18 contents of their ISAs with each other. Now, they do
19 talk to each other, but they don't - you can't
20 entirely share everything.

21 CHAIRMAN RYAN: Dennis, just on the
22 criticality question, there are a fairly finite number
23 of criticalities that have occurred probably
24 worldwide.

25 Is that database sufficient to, you know,

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1 bound what a criticality accident might look like?

2 MR. DAMON: For solution criticalities it's
3 pretty good information.

4 CHAIRMAN RYAN: Yes.

5 MR. DAMON: Because they were all solution
6 criticalities -

7 CHAIRMAN RYAN: Right.

8 MR. DAMON: - except for one. Okay.

9 CHAIRMAN RYAN: Right.

10 MR. DAMON: But the other ones like a
11 criticality - there's never been a criticality in wet
12 powder or there's never been, you know, whatever other
13 scenario you can -

14 CHAIRMAN RYAN: All right. So, for that
15 specific set of liquids, solutions, you'd be okay, but
16 maybe others not.

17 MR. DAMON: Yes, like I say, if I want to
18 know what the magnitude of the criticality is, I have
19 to go out and hire somebody like Tom McLaughlin to do
20 a calculation to tell me what the magnitude is if a
21 certain scenario unfolds, you know.

22 I think like Dennis Bley says, you don't
23 have to do everything, you know, as detailed, but
24 there's a certain amount of modeling there that would
25 have to be done to try to capture what actually might

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1 happen.

2 Now, if all you're interested in is doing
3 what we do for our Step 1 here, which is making sure
4 the operator is safe, all we really care about is that
5 the criticality doesn't happen with a certain
6 frequency. And then we're done, because that's all we
7 need.

8 But if we really want to know what the
9 number is, then you get into all this other stuff.
10 And, like I said, the probabilistic offsite weather
11 calculation stuff, I think there are codes that do
12 that kind of thing. I'm not sure they exactly
13 calculate the risk metric that I think they should
14 use, but -

15 MEMBER BANERJEE: Well, in the Netherlands
16 you have to get risk contours around your plants. So,
17 what they do is they have codes that move fairly
18 rapidly to the different class weathers, wind
19 directions, you know. They do some sort of
20 consequence analysis around the plant.

21 So, they don't - these codes are fairly
22 fast, I mean, because they can be reasonably
23 empirical. They use these Pasquill, you know, weather
24 classes and just zap around and do this. Gaussian,
25 too.

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1 MR. DAMON: Yes. I mean, I had a guy -
2 before I came here to the NRC, I mean, I actually went
3 to two iterations. I had a guy write a code like that
4 that implemented a model like that.

5 And then I wrote or got involved in
6 writing one myself for space applications, which is
7 different because you - these are - ground-based
8 releases are different than releasing up in the
9 stratosphere someplace. So, you have to -

10 MEMBER BANERJEE: Well, you have to take
11 into account elevated releases because a couple of the
12 worst accidents that have occurred, actually, is when
13 emergency release systems have vented through that
14 didn't get flared.

15 In Bhopal, for example, the flume that
16 came out was from the emergency release system. And
17 Seveso was the same out of the flare.

18 So, elevated releases need to be treated,
19 but you can treat that too. It's not such a big deal.
20 Yes, it can be done.

21 MR. DAMON: So, I think I've basically
22 presented our, you know, story of what is in the paper
23 and why it's structured the way it is.

24 CHAIRMAN RYAN: So, you're on Slide 5 now.

25 (Laughter.)

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1 MEMBER BLEY: Dennis, could you go through
2 that example?

3 You have them back here in the slides. I
4 just -

5 MR DAMON: Yes, it's way back there at the
6 very back. Slide 29.

7 MEMBER BLEY: Can't read the slide numbers
8 in here.

9 ME. DAMON: I didn't really put a lot in
10 the slides. The example is a process that has
11 enriched uranium in solution. Because as I mentioned,
12 all but one of the actual criticality accidents in the
13 world have been in solution - fissile solution
14 systems. Most of them high-enriched or plutonium, but
15 you can do it with low-enriched uranium as well.

16 So, that's what the process is imagined to
17 be is some kind of process that's got a substantial
18 amount of enriched uranium in solution. And it's
19 subcritical because its geometry is subcritical,
20 because that's the usual - in other words, what I mean
21 by saying that is that regardless of the contents of
22 the thing, it's subcritical.

23 You can put in the worst case
24 concentration of the worst, highest enrichment
25 material you can find, and it won't go critical. So,

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1 that's what I mean by subcritical by geometry.

2 And that's a common - it's the most
3 important, I believe, technique that's used to make
4 things safe for criticality is to use safe geometry
5 equipment.

6 So, you don't have to be - if you make a
7 mistake with concentration or something else, amount
8 of material or whatever, you don't - still won't go
9 critical.

10 So, that's what I'm imaging the process
11 is, is some kind of process tank, equipment, that is
12 safe by geometry.

13 And then in addition if the - so, how
14 could you get in trouble?

15 Well, you could get out of that safe
16 geometry and go somewhere else. And so, typically, a
17 process like that would have a containment dike under
18 it for multiple reasons.

19 But one reason is if it does leak, it
20 leaks out into a flat geometry which, again, is
21 subcritical.

22 So, the thing has two safety features.
23 It's safe by geometry where it is. And if it leaks
24 out, it's still safe by geometry.

25 And the deficiency that's modeled or

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1 postulated is that for some - somebody did something
2 wrong and they caused this containment dike to have a
3 leak path through it.

4 And this condition was eventually
5 discovered by an NRC inspector and found to have been
6 in this condition for - I think it was four years is
7 what's -

8 CHAIRMAN RYAN; Four years, yes.

9 MR. DAMON: - assumed in the example. So,
10 then what I do is I march through this risk
11 significance calculation and say okay, what was the -
12 what was supposed to be there was that I had - that in
13 order to have the accident, I have to have a leak or I
14 have a process overflow when you're transferring into
15 the process. You put too much into the - try to put
16 too much into the process.

17 So, those are the two initiating events is
18 a process overflow or a leak in the process. So, you
19 get liquid down in the dike.

20 And of course the frequency of having each
21 of those accidents is of course the frequency of those
22 two initiators times the probability that the dike is
23 in a leaking condition at the time that that happens.

24 DR. MODARRES: Is it possible you have any
25 source of water, for instance, a sprinkler or

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1 something else that could spray on that dike?

2 MEMBER SIEBER: As a moderator.

3 DR. MODARRES: As a moderator. Any, like,
4 sprinkler up there or something that could be -

5 MR. DAMON: Yes, I don't see - I'm not sure
6 what you're thinking in terms of how that would affect
7 the accident scenario.

8 DR. MODARRES: Well, just add water
9 moderator and you could go critical even in that
10 space.

11 MR. DAMON: Well, normally the way the
12 things are arranged is they - that's what the crit
13 engineers do is they find out how much material is in
14 that process. And they put it on the floor. And then
15 they set the concentration to the optimum. They look
16 for the optimum, okay, of all conditions.

17 You know what I mean? The maximum amount
18 of material that could be in there and at optimum
19 moderation.

20 So, it would be like 400 grams per liter
21 is usually around where the optimum is or something.
22 And they'll make it so that that - in that geometry at
23 the optimum condition, it's still subcritical.

24 DR. MODARRES: Even if water falls on it?

25 MR. DAMON: Right, even if you get

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1 additional water. It's subcritical for - that's the
2 usual trick with criticality safety is pick one or two
3 parameters to control. All the rest of them are
4 analyzed as their optimum possible reactivity so that
5 you don't have to control those.

6 DR. MODARRES: Yes.

7 MR. DAMON: Anyway, that's the scenario is
8 that you - the example marches through these two
9 accident scenarios. The leak and the overflow goes
10 into the dike.

11 Well, normally the dike, there's a certain
12 probability that it could be failed under normal
13 conditions. But in this case, it was failed due to
14 some fault of somebody's and it was left in that
15 condition for an extended period of time.

16 So, the example calculation goes through
17 and finds, well, how much risk was actually incurred,
18 you know, how much additional risk was actually
19 incurred because of this defective condition?

20 And that's the same kind of process you
21 march through when you do a risk - significance
22 evaluation in the reactor oversight program. They do
23 the same thing.

24 They say given the deficiency, what was
25 the additional incurred probability? Usually it's a

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1 delta LERF is what they're looking at times the length
2 of time.

3 CHAIRMAN RYAN: Dennis, for the NRC or
4 agreement state licensees, are there any that are
5 highly-enriched uranium or plutonium driven or - I'm
6 thinking of the case where there might be accumulation
7 of fissile material in air ducts or some other kind of
8 air pathway as opposed to a liquid pathway.

9 Are there any criticality issues on that
10 side of the house?

11 MR. DAMON: Oh, yes. There are two high-
12 enriched, you know -

13 CHAIRMAN RYAN: Licensees.

14 MR. DAMON: - licensees that make naval
15 reactor fuel.

16 CHAIRMAN RYAN: Yes.

17 MR. DAMON: And then to that, that exact
18 scenario actually happened. I mean, we didn't have a
19 criticality, but there was an accumulation of uranium
20 oxide powder in ducts, ventilation ducts.

21 Yes, we have all kind of - there are all
22 kinds of scenarios. All I'm saying is in actual
23 practice, all of them have been in solutions. One was
24 a deal with uranium bricks, I think, but that's just
25 because that's an easy way to do it, you know.

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1 And the other thing, I've read all the
2 cases of the actual criticalities. In the old days,
3 these are the bad old days, all this stuff was back in
4 the '50s and '60s. They were not using safe by
5 geometry. That's why they had the criticalities.

6 They were working in unsafe geometry
7 vessels -

8 CHAIRMAN RYAN: So, how long has it been
9 since a criticality accident occurred in the United
10 States?

11 MR. DAMON: '79. 1979.

12 CHAIRMAN RYAN: '79.

13 MR. DAMON: It was in Idaho's reprocessing
14 plant. They had several criticalities up there, but
15 they didn't - nobody gets killed because you got
16 shielding. There were some doses, but not - whereas
17 these other events that happened where you're in a
18 completely unshielded condition about - of those,
19 about one out of every three you get a fatality. And
20 usually about two out of every three somebody gets a
21 big dose, you know. Not us.

22 That's about what the statistics are.

23 MEMBER SIEBER: I would imagine that PUREX
24 processing of plutonium would be more difficult
25 because you can bury the concentration of fissionable

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1 isotopes by chemical means as opposed to separation by
2 mechanical means like a centrifuge or diffusion plant.

3 MR. DAMON: Are you saying that it would -
4 are those kinds of accident scenarios that -

5 MEMBER SIEBER: Probability would be more
6 variable because there is - there are chemical ways to
7 change the concentration as opposed to enriched
8 uranium where it's more stable.

9 Know what I mean?

10 MR. DAMON: Yes. Well, yes, the enriched
11 one is hard to - enrichment changes slowly, right?

12 MEMBER SIEBER: Right.

13 MR. DAMON: Yes. Although, there was one
14 criticality which it took them literally decades in
15 Russia to build up the material until it got to the
16 critical point.

17 MEMBER SIEBER: Concentration.

18 MR. DAMON: So, some of these - that
19 actually does happen where the - whatever is going
20 wrong, goes wrong for a long, long time until finally
21 it builds up to the point where something bad happens.

22 MEMBER POWERS: Lets you know about what's
23 going on.

24 (Laughter.)

25 MEMBER POWERS: That's not good. The

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1 criticalities would cause one biggest - biggest number
2 of sleepless nights or actually moving materials,
3 because the potential of human error could violate
4 criticality standards.

5 At the plutonium finishing plant, you're
6 moving around pucks of plutonium metals. And you have
7 carts that are listing how many pucks they can take.
8 Well, those numbers tend to get overlooked when you're
9 in a hurry to move things.

10 MEMBER ARMIJO: Dennis, I can see the value
11 -

12 MEMBER BANERJEE: Do you know was Mayak a
13 chemical explosion?

14 MEMBER POWERS: I really honestly don't
15 know.

16 MEMBER BANERJEE: Nobody really knows. But
17 I think what I have heard is it was a chemical
18 explosion, not a criticality incident.

19 MEMBER POWERS: I don't know why it would
20 be, but -

21 MEMBER BANERJEE: Yes.

22 MEMBER POWERS: I mean, I don't study it.
23 So, I don't know.

24 MEMBER BANERJEE: Well, nobody really
25 knows.

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1 MR. DAMON: When you say "Mayak," there
2 were multiple incidents at Mayak.

3 MEMBER BANERJEE: Well, I'm talking about
4 the `57 --

5 CHAIRMAN RYAN: It was a waste tank that -

6 MEMBER BANERJEE: Yes, it was a waste tank,
7 I think, that went.

8 MEMBER ARMIJO: Dennis, criticality is -
9 risk significance, you know, you've already got it.
10 It's a huge thing. But for the lesser things, you
11 know, what do you do with this?

12 For example, you find an accumulation of
13 UO2 in low-enriched stuff. It's a big deal to any
14 plant that gets that. It's not supposed to be there,
15 but let's say that was a finding in a fuel cycle
16 facility.

17 How would you use this approach to make a
18 risk significance -

19 MR. DAMON: It might not actually get to
20 this stage of doing a quantitative thing. Because if
21 the significance - we have these - what we did with
22 the actual violation the last five years, we divided
23 them into chemical and criticality. And we had a
24 bunch of criticality guys sit down and go through
25 them.

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1 We developed a set of criteria, screening
2 criteria, that are qualitative. And one of them would
3 probably be the where are you with respect to the
4 control parameter, you know?

5 If you just exceed the control parameter
6 as just a little bit off, well, that's obvious that's
7 not as significant as one where, yes, you got a
8 critical mass there.

9 And so -

10 MEMBER ARMIJO: It's leading and it
11 shouldn't have been there in the first place.

12 MR. DAMON: Right.

13 MEMBER ARMIJO: So, how do you treat that
14 with this quantitative approach?

15 MR. DAMON: Well, like I say, if it's the
16 one you're saying and they're really nowhere near
17 critical, then there's not much risk significance to
18 it. And you know that right off up front. So, it
19 would be screened - it would be screened to green.
20 Something like that because -

21 CHAIRMAN RYAN: But three or four of those
22 on the same inspection, you might say, well, it looks
23 like there's something systematic there and you might
24 elevate it someday.

25 MEMBER ARMIJO: There would have been about

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1 three or four different managers it would have gone
2 through before they got there.

3 MR. DAMON: I mean, there are occasional
4 recurrences of similar kind of things, but I don't - I
5 don't know. It's hard to generalize. Each plant is
6 different.

7 Some plants have certain kinds of
8 violations that are similar to one another. There's
9 other ones, every time it's something different, you
10 know.

11 MS. BAILEY: I think what you would do,
12 Dennis, if you didn't screen it to green, then you
13 would do the calculation to sort of understand where
14 the delta is in -

15 MEMBER ARMIJO: See, where I'm at is if so
16 many things screen to green, you don't really need to
17 do more.

18 MS. BAILEY: Right.

19 MEMBER ARMIJO: And then the big ticket
20 items, it's obvious that it's highly significant, you
21 know.

22 So, what are the things in between where
23 this process would really be useful?

24 MR. DAMON: Well, the way you get the in-
25 between things is what was the - what was - what it

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1 really comes down to was what was the reliability of
2 the control that was left?

3 Because usually something - what's
4 happened is something has been defective. Usually
5 it's a control has become inoperative. And if the
6 parameter actually, like I say, got out of control and
7 exceeded its safety limit, now it's serious in that
8 sense. So, that's a nontrivial one.

9 But if the control that you've got left is
10 very robust and you may have even redundant backup
11 controls, well, then that's very different from one
12 where -

13 MEMBER ARMIJO: That was your -

14 MR. DAMON: Where you have basically maybe
15 nothing left. Maybe you had no control. There have
16 been instances where there was no remaining
17 criticality control. All of them had failed, you
18 know. And all that - the reason they didn't have an
19 accident is that it was just luck, you know.

20 And so, that's a, you know, that's
21 obviously much more significant. So, there is at
22 least that breakdown of at least three levels, I
23 think, that is fairly clear to me, anyway.

24 For example, I'll give you an example of a
25 chemical one that's like this extreme case, you know.

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1 And that is you have an actual cylinder, UF6 cylinder
2 rupture. But the wind is - the weather conditions are
3 such and the wind is blowing in such and such a
4 direction nobody gets an exposure. Okay?

5 Well, you were just lucky, you know. That
6 was a very significant event whereas something in
7 between would be, you know, maybe they had a - found a
8 defective pigtail or something like that, you know.
9 They used a - hadn't exercised proper procurement for
10 a pigtail or something like that is in between.

11 MEMBER ARMIJO: Yes. Okay.

12 MR. DAMON: So, I think there is - now,
13 that brings up a point which many other people say
14 this, is why do it quantitatively if it's going to be
15 that crude?

16 And I still say even if it's crude, you
17 want to think quantitatively because it leads to
18 clarity of thought. And, you know, lots of times if
19 you don't think quantitatively, you get into fuzzy,
20 fuzzy thinking and I think it's more useful.

21 But getting exact - I think you're right.
22 There's a point to be made here. You don't need, you
23 know, three decimal point accuracy to do this
24 significance determination stuff.

25 It's a rough order of magnitude kind of

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1 process is all we're looking for.

2 CHAIRMAN RYAN: Anything else?

3 MEMBER BENSON: Yes, Dennis, you mentioned
4 that two of the ISAs were quantified to some extent.

5 Does that help you in any way above and
6 beyond the ones that aren't quantified and using it
7 for other applications?

8 MR. DAMON: Well, it - as I say, when you
9 quantify something, you have to say what it is. And
10 that's helpful because you have to be very much
11 clearer about what you're talking about.

12 Whereas some of the other ones, somebody
13 says the Risk Index thing and says, well, it's an
14 active control and gives it a minus two.

15 Well, for that kind of stuff, you kind of
16 have to check and see is that really reasonable, you
17 know? What kind of active control is this? Because
18 that's kind of an awfully broad category.

19 CHAIRMAN RYAN: Dennis, you're making an
20 important point, I think, because in a way it's sort
21 of not qualitative. And if you score things in the
22 same way for yourself each time, you have at least in
23 your own process in mind and outcome kind of the same
24 result for the same case even though they might be
25 different facilities, because you're going to rank

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1 things the same way.

2 Whereas if you're qualitative, you know,
3 what did you get on your test, Johnny? I got a good
4 grade. What was it? 65. So that, I think, is an
5 important part of the rigor of the process.

6 And then it gets to what you were saying,
7 Sanjoy, that folks can come up with these analyses
8 without a lot of variability because they think that,
9 you know, they're doing the kind of analytical
10 analysis, if you will, that you just talked about.

11 That seems to me, to be a real important
12 point in this process that it's not just qualitative,
13 is this okay or not okay, it's wrong, going to rank it
14 this way with this score and, you know, that's
15 something you can carry from one analysis to another.

16 MR. DAMON: Yes, see, in the slides
17 somewhere in here I mention the fact of course all
18 these ISAs have been reviewed by NRC staff.

19 Now, we only get an ISA summary. It
20 doesn't have all the information. And they go over
21 that, but they also visit the plant and look at a few
22 things in detail.

23 CHAIRMAN RYAN: Sure.

24 MR. DAMON: And the nature of those reviews
25 really is to see - is to see if the licensees are in

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1 fact doing what the staff thinks is a good job of
2 doing these evaluations and making a determination,
3 yes, this design is safe enough. That kind of
4 decision.

5 The staff - I read the safety - they call
6 them Technical Evaluation Reports to see what the
7 staff was doing. And they were very - they were very
8 skeptical and critical. And they dug in and they
9 weren't just rubber-stamping whatever the licensee had
10 done. They were looking for things to find to
11 challenge, you know, to say is this really good
12 enough?

13 So, yes, I was - I was satisfied that the
14 staff had done a good job reviewing them. And so,
15 like I say, drawing this conclusion that the ISAs are
16 acceptable isn't based on some theoretical - it's not
17 a theoretical finding. It's based on experience.

18 CHAIRMAN RYAN: Okay.

19 DR. FLACK: Could I just ask another
20 question?

21 CHAIRMAN RYAN: Yes, sure, John.

22 DR. FLACK: On follow-up, I mean, I was
23 involved in the develop of the ROP earlier on. And we
24 actually put together inspector notebooks based on,
25 you know, the results of a lot of the PRAs that were

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1 performed and so on.

2 I guess the question in my mind is without
3 going through that, how do you know what's important?

4 I mean, at the plant or the facility, you
5 have some sort of importance measure to generate
6 somehow to put things in perspective.

7 I mean, okay, criticality is important.
8 Okay. We understand that. But how do you know what
9 else is important at the plant other than - I mean, do
10 you start there? I mean, how do you put it all
11 together?

12 And, like, if you walk through the door
13 and you say well, let me start to look at things that
14 are important to me, you know, from a risk
15 perspective, can you really do that here or do you
16 have to rely on people that just know the business?

17 MR. DAMON: Yes, well, like I said, the
18 ISAs weren't done to provide that kind of perspective.

19 And, consequently, they don't generate the
20 information in a form that helps you a lot.

21 We have, in fact, done something like that
22 for the centrifuge plants, you know. They did have,
23 you know, they did have these Risk Index scores for
24 their sequences. And they only had sixty IROFS to
25 work with. So, we went through them all and did the

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1 deltas.

2 DR. FLACK: So, you could pull it out.

3 MR. DAMON: Yes, we managed to, you know,
4 Chad Cramer from Region II put it all on a spreadsheet
5 and we ground through them all.

6 DR. FLACK: Could you extend that process
7 to something like MOX, I mean, a facility?

8 MR. DAMON: No.

9 (Laughter.)

10 MR. DAMON: There's a difference between 60
11 and 12,000.

12 DR. FLACK: Yes, well, 15,000, I think, was
13 said in the SER.

14 MEMBER BANERJEE: Is it true that 60
15 million was spent on the ISA for the MOX facility?

16 DR. FLACK: 80 million was what they said
17 at the meeting.

18 (Off-record comments.)

19 MEMBER POWERS: The question comes up,
20 then, suppose that I am a manager at NRC because of
21 some crime I committed in a previous life -

22 (Laughter.)

23 MEMBER POWERS: - and I have to marshal
24 the sources to do an inspection on this facility with
25 15,000 IROFS. And I wanted to tell my inspector, go

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1 inspect that subset that's most important.

2 How does this poor inspector understand
3 which ones are the most important?

4 MS. BAILEY: Dave, do you want to take
5 that?

6 MR. TIKTINSKY: Dave Tiktinsky for NRC MOX,
7 project manager. It may give a little more insights
8 into what we tried to do with MOX.

9 Yes, there's 12,000 IROFS, but they define
10 IROFS a little differently than some other facilities.

11 That's 12,000 components that are IROFS.

12 So, in some areas you might have a
13 temperature pressure meter. And that particular meter
14 is 500 of them.

15 Really, the ISA summary had about 200 or
16 so IROFS that recovered the big events. And what we
17 tried to do with those is go through the events that
18 had the most significance, pick out those ISA summary
19 IROFS that related to those, and then go into the list
20 of component types that related to those particular
21 ones and take sampling of the ones that were most
22 important. Things like instrumentation. Things that
23 aren't as common that are used compared to using
24 particular things like maybe if someone uses a pump or
25 something that's, you know, standard in industry. We

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1 would consider that less significant.

2 So, we actually did go through and for
3 helping out in ways we're doing our inspection
4 verification plans that we're writing up for what
5 things we will look at as we do our PSSC review to
6 identify things that are most significant, first, down
7 through the ISA summary IROFS, down through the
8 component types.

9 So, we do have some risk level things of
10 what we're going to focus on in our inspection
11 program.

12 CHAIRMAN RYAN: That sounds a little bit
13 less challenging than 15,000.

14 MR. TIKTINSKY: Yes, going - we learned
15 that quickly you can't go from 12 or 15,000 and come
16 up with the answer. We had to do it a different way.

17 MEMBER POWERS: Well, the only thing that
18 bothers me is that if I - because of some crime that I
19 committed in a previous life, I do get the chance to
20 go through LERs. And I do find pumps that are poorly
21 maintained and poorly operated that are critical to
22 safety. So, it's a standard thing that everybody uses
23 all the time.

24 And so I wonder -- on what things to
25 inspect here because it's unusual versus something

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1 that's normal.

2 MR. TIKTINSKY: Well, I mean, what we tried
3 to do is, you know, with the first step was this, you
4 know, when we did our kind of risk-informed safety
5 review, there were areas that we emphasize in our
6 review for certain events.

7 You know, the way ISA summaries are, it
8 shows something that's an IROF, but it doesn't say -
9 but all IROFS are not created equal. We know that.
10 There's certain events that will have higher
11 consequences, you know, of - like for MOX, having a
12 significant chemical event that caused an explosion is
13 different than an event that has a leak from the waste
14 pipe that goes out to a building that's underground.

15 So, we know that and we did the review.
16 We screened out the ones that we felt were most
17 important. Then we tried to go into the ones - the
18 areas that were of higher importance than others, we
19 would look in more areas. So, we would look at more
20 component types.

21 And we're trying to make it flexible
22 enough that if there were some identified things that
23 particular component types had issues, we would
24 emphasize that.

25 Even in the inspection program as we're

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1 laying it out, we're not setting it in concrete to
2 say, you know, everyone is going to do this and then
3 we're done.

4 If we go through and we find that there's
5 additional things that need to get looked at,
6 additional inspections, additional vendors, then we'll
7 do that, but we have to try and lay out something of
8 what we think is the most important one just to lay
9 out the program that we can get reasonable assurance
10 on that things are as they're supposed to be.

11 CHAIRMAN RYAN: Well, you kind of described
12 what is the process of trying to get to the importance
13 ranking.

14 MR. TIKTINSKY: Yes, that's pretty much
15 what we tried to do.

16 MEMBER POWERS: The only thing that bothers
17 me about that is that if in 1979 I had spoken to the
18 folks at Surrey, they would have assured me that they
19 have done those things.

20 Every PRA that's ever been done in Surrey,
21 and it's been done multiple times, finds something
22 that got omitted in that process. Some combination of
23 things that turns out to be crucial.

24 Mohammad will agree with me that Surrey
25 has been the most analyzed plant by PRA on the face of

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1 the planet, and every one of them finds something.
2 Even the IPE, they found something.

3 Something big, in fact.

4 DR. MODARRES: Well, the kinds of things
5 that - are you referring to the - what event are you
6 referring to that -

7 MEMBER POWERS: Every single Surrey PRA
8 comes up with something, some pipe that turns out to
9 be critical, has a high risk importance metric that
10 nobody recognized before. Some new accident sequence
11 gets identified.

12 DR. FLACK: Yes, the expansion joints, for
13 example, I mean, that was just dominated everything --

14 (Laughter.)

15 DR. FLACK: It was never noticed that the
16 other two big analyses were done.

17 Well, the other thing was that Brookhaven
18 actually did quantify the rad oil at, you know, for
19 the MOX facility. That piece of it, anyway.

20 I mean, there was no surprises there, but
21 how - I mean, did you feel that was a valuable thing
22 to do at this point that it provide value to the
23 review process or are you familiar with that?

24 MR. DAMON: You'd have to ask the MOX
25 project. I mean, I think the gist of having them look

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1 at it was to just get another independent perspective
2 on things, you know.

3 It was really done more for that reason
4 than to do some accurate - to make sure that they had
5 not overlooked something. I mean, it was a pretty
6 straight forward design.

7 MR. TIKTINSKY: This is Dave Tiktinsky. I
8 guess I could actually answer that.

9 What the staff did in its review, it used
10 the Brookhaven information to help it form its
11 decision of reasonable assurance, as well as things
12 like experience from the French facilities, other
13 types of analyses that were done.

14 The SER had about 30 pages of analysis of
15 things that backed it up of why we, you know, the
16 staff thought there was reasonable assurance. And the
17 Brookhaven one was part of it.

18 It was useful to help inform that all the
19 other pieces of things that were looked at, that's
20 just one more piece of information that we thought
21 that was okay.

22 MEMBER ARMIJO: Dennis, I was trying to
23 look at the - well, I looked at the SECY paper 10-
24 0031. And they list the - you listed the deliverables
25 from this project.

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1 And some of these deliverables I don't
2 understand what they are, but I'll read them to you
3 and maybe you can clarify it.

4 MS. BAILEY: Could you tell us what page
5 you're on?

6 MEMBER ARMIJO: It's on the SECY 10-0031.
7 It's Page 1. It's a letter from Mr. Borchardt.

8 MS. BAILEY: Okay.

9 MEMBER ARMIJO: But, anyway, he says the
10 ultimate deliverables will be; one, risk-informed
11 program level documents presented in inspection manual
12 chapters like that explained; two, specific inspection
13 procedure guidance for activities not currently
14 contained in the fuel cycle oversight process; three,
15 a revised enforcement policy and; four, a more
16 objective and predictable performance assessment
17 process.

18 And, you know, we - I just - maybe you
19 haven't thought these things through or haven't - you
20 have to find what they're really going to be, but can
21 you tell me something about each of those items, what
22 that really means?

23 I'm just trying to see, you know, how big
24 a deal is this and how much work and how much effort
25 and how much benefit you get for it.

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1 MS. BAILEY: Yes, I'm going to ask Patti
2 Silva to sort of take a first cut at trying to
3 answer/explain those deliverables.

4 MS. SILVA: Okay. The SECY paper has - is
5 the entire revision to the fuel cycle oversight
6 process.

7 MEMBER ARMIJO: Right.

8 MS. SILVA: Which is a completely different
9 framework from what we're working with now. So,
10 basically the first deliverable is about the
11 inspection manual chapters, and we would have to
12 change the inspection manual chapter to reflect the
13 framework which includes cost-cutting issues,
14 cornerstones, the significance determination process
15 and the action matrix and some other things. So, the
16 inspection manual chapter would have to reflect the
17 new format.

18 The inspection procedures would then need
19 to be changed to focus on those things primarily
20 what's in the cornerstones, and the things that we -
21 the cornerstones are the things we find most
22 important. And so, those - it would change a lot in
23 there.

24 Then I think the next one you have -

25 MEMBER ARMIJO: Revise enforcement policy.

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1 MS. SILVA: Revise the enforcement policy,
2 and that - a lot of that has to do with the corrective
3 action program where you would have the licensees
4 taking care of, basically, the lower risk significant
5 findings instead of having the NRC doing that.

6 So, basically they wouldn't - the
7 enforcement manual, we've already changed it to look
8 at risk informing -

9 MEMBER ARMIJO: The inspection manual, is
10 that the -

11 MS. SILVA: The enforcement manual.

12 MEMBER ARMIJO: Enforcement manual?

13 MS. SILVA: I'm sorry. Enforcement policy.

14 MEMBER ARMIJO: Oh, okay.

15 MS. SILVA: There is a manual that goes
16 with it that says how to use the enforcement policy.
17 I'm sorry.

18 So, the enforcement policy would cover
19 giving credit for the corrective action program and
20 having the licensees actually work on the kind of
21 lower safety significant items.

22 And the next one was -

23 MEMBER ARMIJO: That -

24 MS. SILVA: - the performance assessment, I
25 think you said.

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1 MEMBER ARMIJO: Predictable performance
2 assessment process.

3 MS. SILVA: Right. Right now we have the
4 license performance reviews - the licensee performance
5 reviews, which are the LPRs. And we're trying to get
6 those more structured so that - so that everything
7 that goes through the process you know what's
8 happening and you know what the result is going to be,
9 whether it's going to be more inspection or a shorter
10 time period between when we do the performance
11 assessments and things like that.

12 So, that's all part of like what comes out
13 of the action matrix.

14 MEMBER ARMIJO: And what does a licensee
15 have to do different as a result of all of these
16 changes?

17 What will they have to do differently, and
18 then will you need - this is within the current
19 regulatory -

20 MS. SILVA: Right.

21 MEMBER ARMIJO: You don't have to get new
22 regulations -

23 MS. SILVA: Right.

24 MEMBER ARMIJO: - no new rules, no -

25 MS. SILVA: Right. We don't need new

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1 regulations for this.

2 MEMBER ARMIJO: Okay.

3 MS. SILVA: This is a different way of how
4 we're going to actually do the assessment - do the
5 inspections, how we'll do enforcement and how we'll do
6 assessment of the licensee.

7 MEMBER ARMIJO: So, if I was a fuel cycle
8 licensee and I had a facility, what would I have to do
9 different in order to, let's say, comply or be
10 responsive to what you're going to do differently?

11 MS. SILVA: I think the only thing - I
12 don't know how the licensees react to what we do. So,
13 I -

14 MEMBER ARMIJO: Well, no, they've got ISAs
15 and they're meeting all the current regulations.

16 MS. SILVA: I'm not sure that they would
17 have to do much.

18 MEMBER ARMIJO: Okay.

19 MS. SILVA: But one thing for the
20 corrective action program, they would have to
21 demonstrate their corrective action program is
22 acceptable.

23 MEMBER ARMIJO: Okay.

24 MS. SILVA: And we would inspect it. There
25 would probably be other areas that we're inspecting

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1 that they're already doing these things, but we're
2 just focusing on other areas.

3 I don't know that they would have to do
4 much different.

5 MEMBER ARMIJO: Okay.

6 MS. SILVA: We would be changing the way we
7 were implementing oversight.

8 MEMBER ARMIJO: Okay. And if you had a
9 finding, then you'd use a process similar to what
10 Dennis described to kind of determine its
11 significance. And the licensee really wouldn't have
12 much of a role except to provide information.

13 MS. SILVA: Right.

14 MR. DAMON: Well, yes, that remains to be
15 seen exactly how the - what the interaction is because
16 typically the - because it depends on what the heck
17 the thing is.

18 MEMBER ARMIJO: Sure.

19 MR. DAMON: But typically the - obviously
20 the licensee's engineers know a lot more about how the
21 process actually works. And you have to talk to them.

22 MEMBER ARMIJO: Yes, that's what I meant.
23 Provide information and -

24 MR. DAMON: Yes, you'd have to - my vision
25 of this significance determination thing is it has to

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1 be done at the time the inspector's still there at the
2 plant.

3 It's, you know, he has to sit there and
4 ask questions to get the information to do this kind
5 of a thing.

6 And the SECY paper presented sort of two -
7 they were stated as qualitative and quantitative. The
8 way I look at it, they're just two different
9 quantitative ways of doing it, you know. A simpler
10 way and a completely quantitative.

11 MEMBER ARMIJO: And you'd provide the
12 training or the methods that the inspectors could -
13 not every inspector -

14 MR. DAMON: Right.

15 MEMBER ARMIJO: - will know how to do
16 this.

17 MR. DAMON: No, that all remains to be
18 seen. My view is it is not clear how exactly this
19 will all work. The program that was laid out in the
20 SECY paper, really, the way I look at it is as a
21 developmental project to see if we could do this kind
22 of a thing, you know.

23 MEMBER ARMIJO: Okay.

24 MR. DAMON: Would it work? Would it be
25 efficient? Would it, you know.

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1 And the only way to do that is to, I
2 think, is to test - develop a method for doing this
3 stuff and then test it out on a bunch of actual
4 findings that have happened in the past, plus some
5 hypothetical ones that you would make up that would be
6 - because most of the stuff that's happened in he past
7 has not been of any great risk significance.

8 There are only a handful of risk
9 significant things that have ever happened at the
10 facilities.

11 We have never had a criticality at an NRC-
12 licensed facility. And so, you have to make up some
13 hypotheticals here to test this stuff and see how it
14 will work, you know.

15 MS. BAILEY: Yes, I think -

16 MR. DAMON: See what we'd get into.

17 MS. BAILEY: The program that was laid out
18 in the SECY paper was a framework for what a revised
19 fuel cycle oversight process might look like, you
20 know. I'm not going to say that all of the details
21 were worked out.

22 MEMBER ARMIJO: Sure, but the SECY paper is
23 the staff's marching orders, isn't it?

24 MS. BAILEY: No, it's not the staff's
25 marching orders. It was -

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1 MEMBER ARMIJO: Okay. I didn't understand
2 that. Okay.

3 MS. BAILEY: Let me clarify. It was the
4 staff's proposal for how we would go about revising
5 the fuel cycle oversight process.

6 The Commission disapproved the staff's
7 proposal.

8 MEMBER ARMIJO: That's the one that they -
9 okay. I thought -

10 MS. BAILEY: But as a result of them
11 disapproving our SECY paper, they basically through
12 two SRMs, directed the staff to do the ISA/PRA
13 comparison to develop the cornerstones, and then take
14 the insights that we gained from those two activities
15 and propose a path forward for how we would want to
16 move towards revising - recommendations for moving
17 forward with the revised fuel cycle oversight process.

18 Separate, but related, the Commission also
19 directed us to look at how we can incentivize
20 licensees having a strong corrective actions program
21 and giving credit for that when we disposition
22 violations.

23 MEMBER ARMIJO: Okay. Thank you.

24 CHAIRMAN RYAN: We're kind of at a place in
25 the schedule we're due for about a 15-minute break.

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1 And we'll come back - are you all set now? Is there
2 anything else you guys want to say in closing or are
3 we -

4 MS. BAILEY: You wanted me to go about -
5 talk about path forward. So, I can take a few minutes
6 to do that and -

7 CHAIRMAN RYAN: Why don't we do that when
8 we come back from the break?

9 MS. BAILEY: Okay.

10 CHAIRMAN RYAN: We'll finish up and then
11 we'll hear from NEI and go from there, because I don't
12 want to rush you through that part.

13 MS. BAILEY: Okay.

14 CHAIRMAN RYAN: So, we'll take a 15-minute
15 break and reconvene at 3:30.

16 (Whereupon, the proceedings went off the
17 record at 3:13 p.m. for a brief recess and went back
18 on the record at 3:30 p.m.)

19 CHAIRMAN RYAN: Okay. We'll go back on the
20 record, please. I think on everybody's behalf, the
21 subcommittee in particular, I'd like to thank Marissa
22 and Dennis both for your participation so far this
23 afternoon. It's been very helpful.

24 And by the interaction, you've conveyed a
25 lot of good information to the subcommittee. So, we

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1 really appreciate your time and effort in putting your
2 presentation together. We've learned a lot.

3 I think now we're ready for some comments
4 from the industry. I think Janet Schlueter is here
5 from -

6 DR. FLACK: No, there is another one
7 scheduled. The plans and future activities I think we
8 have to -

9 CHAIRMAN RYAN: Oh, I'm sorry. I skipped
10 over that. Well, in that case please go ahead and
11 let's get started. I went ahead. My error.

12 MS. BAILEY: This should not take very
13 long.

14 CHAIRMAN RYAN: Please take your time.

15 MS. BAILEY: You wanted us to kind of go
16 over our next steps.

17 CHAIRMAN RYAN: Yes, please.

18 MS. BAILEY: And, again, I want to point
19 out that this ISA/PRA comparison is really just one
20 piece of the activities that the Commission directed
21 us to perform as part of looking at revisions to the
22 fuel cycle oversight process.

23 We are scheduled to go before the full
24 committee to present this paper in February, I think,
25 almost exactly a month from now. And so, we'll await

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1 ACRS' review and feedback on the ISA/PRA comparison.

2 In the meantime, we will begin to develop
3 the cornerstones as directed by the Commission. And
4 then once we've gotten your feedback on the ISA/PRA
5 comparison and we've completed the development of the
6 cornerstones, we'll then integrate the knowledge that
7 we've gained from those two activities and provide to
8 the Commission recommendations for the next steps for
9 enhancing the fuel cycle oversight process.

10 MEMBER BLEY: Have you done any work on the
11 cornerstones as yet?

12 MS. BAILEY: We had developed an initial
13 set of cornerstones when we developed the plans. So,
14 we have done some work, but I think that there's still
15 a lot of flushing out to do with the cornerstones.

16 MEMBER BLEY: Well, do you have a schedule
17 for that part of the work?

18 MS. BAILEY: Hopefully we're able to begin
19 that work this month and early next month and have
20 some - and begin engaging our stakeholders on
21 cornerstones later in February or March time frame.

22 MEMBER BLEY: Okay.

23 MS. BAILEY: As far as the schedule for
24 providing recommendations for the Commission for next
25 steps, we expect to do that in July 2011 through a -

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1 in a Commission paper in that time frame.

2 And then separate, but related activity,
3 we start to work with Region II in the Office of
4 Enforcement and also engage our stakeholders as far as
5 looking at what we can do with the corrective actions
6 program basically developing what is an acceptable
7 corrective actions program, and then start to identify
8 and coordinate changes that would be necessary in the
9 enforcement policy.

10 And we want to time that so that by the
11 time the next revision to the enforcement policy is
12 due sometime in 2012, we would have some proposed
13 revisions to the enforcement policy that would
14 incorporate crediting an effective corrective actions
15 program.

16 So, that's essentially the next steps for
17 us and for the fuel cycle oversight revision
18 activities that we're doing.

19 And so, what I'd like to do is I'd just
20 like to leave you folks with two key points that I
21 think I mentioned and that Dennis mentioned. One is
22 that we believe that the ISAs are sufficient for
23 establishing a safety basis for fuel facilities.

24 The methodology can be quantitative. It
25 can also be qualitative. So, we think that it can

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1 handle the variety of processes that we see in the
2 diverse set of fuel cycle facilities that we regulate.

3 The second point, though, is for the SDP.

4 I guess there's still a question mark as far as the
5 utility of the ISAs for a quantitative SDP. And part
6 of the thing that we need to do is really identify
7 what a significance determination process would look
8 like for a fuel cycle facility.

9 We think, though, that if we did go with a
10 quantitative significance determination process, that
11 it's still not necessary for us to have an up front
12 quantitative pre-evaluation of all of the sequences
13 for all of the processes.

14 We think that that qualitative analysis
15 can be done one a case-by-case basis depending on the
16 violation. And so, it's not cost effective and not
17 efficient to have this up front PRA, maybe, of all of
18 the processes. And we think that that type of
19 analysis would only be done for a very few number of
20 violations.

21 So, those are the two points that I'd like
22 to leave with you.

23 CHAIRMAN RYAN: Thank you.

24 MS. BAILEY: Dennis, did you -

25 MR. DAMON: Yes, that last conclusion was

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1 not just a wild guess. We, like I said, went through
2 every single violation for the last five years. And
3 after we screen them, it comes down to two per plant
4 per year that would go through a risk significance
5 evaluation.

6 So, there's no point in - the point is
7 there's no point in evaluating everything in the plant
8 when you're only going to be looking at two things a
9 year. You'll never get around to - 90 percent of the
10 stuff will never show up.

11 CHAIRMAN RYAN: Sure.

12 MR. DAMON: And so, you're just wasting
13 your efforts there. You're better off just do the
14 analysis when - now, the downside of that is if you
15 wait to do the analysis when the thing happens, you
16 may find that it's - you're missing something. You
17 don't have the data. Something impedes you from doing
18 it and you don't have the time because you need to
19 make a determination right then.

20 So, that's the downside of doing it that
21 way, but I'm just saying I think it's the way to go,
22 myself.

23 MEMBER ARMIJO: But you have that situation
24 right now to make a determination on judgment, really.

25 MR. DAMON: Yes - well, sometimes people -

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1 licensees have in fact submitted risk assessments that
2 were on argument that something was a low risk
3 significance.

4 They actually hire a consultant, get a
5 risk assessment, send it to us and say see, this is
6 low safety significance.

7 And so, it's been going on and happening,
8 but just on occasion. It's not done routinely.

9 MEMBER ARMIJO: Yes.

10 MEMBER BLEY: I guess there's just one
11 piece of this that puts me off a little bit. And that
12 is if we do PRA, we have to do PRA for all the
13 sequences for all the systems in the plant.

14 And if we go back to the first PRA that
15 was done on reactors, it was WASH-1400, and they spent
16 - I forget the numbers, but by far the biggest system
17 and the most work they put into that PRA was on the
18 containment isolation system.

19 And after they finished, they realized
20 they misspent and they wouldn't do that again. And
21 nobody has since then.

22 It would seem to me that some thought
23 about how you can go top down given the kinds of
24 things you're already doing and identify and maybe
25 narrow the definitions a little, high-consequence

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1 events, especially anything that have consequences
2 offsite and fairly large numbers of people onsite, and
3 maybe use that kind of top down approach to narrow the
4 scope of what one might do, our priority in PRA.

5 So, if things popped up that affected dose
6 scenarios, you'd have a real good picture of what the
7 risk might be. And it sounds like all the thinking
8 has been if we do PRA, we have to do it in the
9 greatest possible detail for everything in the plant,
10 and that never works.

11 Places where people have tried it, it's
12 gone dry. They've run out of money before they got
13 anything useful. That's all I wanted to say.

14 CHAIRMAN RYAN: All right. Well, thank
15 you. That's helpful.

16 Any other comments as we close this
17 portion of the meeting?

18 DR. FLACK: Well, can I just follow up one
19 thing?

20 CHAIRMAN RYAN: Go ahead.

21 DR. FLACK: Would you expect to develop
22 models in-house to do these kinds of work?

23 I mean, right now you say you're doing
24 back-of-the-envelope-type calculations. Would it
25 require more of an infrastructure on the part of the

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1 staff to -

2 MR. DAMON: Well, that, you know, that all
3 remains to be seen, you know. How much - it all
4 depends on how much you want to spend and how much
5 money you got and, you know, all kind of things like
6 that.

7 I personally would expect - see, you would
8 - what I say is you try to do it. Then you learn what
9 you need by trying to do it, see?

10 And what I think would happen is you'd
11 learn that we need a little bit more work on human
12 error modeling and we need - but - and you need to
13 establish - one of the issues, I call this an issue,
14 something that has to be determined, but if you - what
15 you want is consistency, right?

16 DR. FLACK: Right.

17 MR. DAMON: You want to do a consistent
18 evaluation of risk significance. Then it has to be
19 against one set of criteria and data - failure data
20 that you use, you know.

21 You can't - some people think we can - oh,
22 we can just use whatever the licensees did, you know.

23 But if this licensee is doing something and it is
24 conservative, and this guy is doing something and it's
25 not conservative, then you're unfairly biasing against

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1 the guy who did it conservatively who was being safer.

2 DR. FLACK: Right, right.

3 MR. DAMON: So, you have to have a level
4 playing field to do this significance evaluation.
5 That's my view.

6 DR. FLACK: Yes, I think that's very
7 important because, I mean, we develop spall models for
8 that reason so we can have a baseline across the board
9 with the same assumptions for all the plants, you
10 know. Seal models were important for the reactors,
11 pump seal models. So, you didn't want to have that
12 impact, you know, your decision. You want to sort of
13 work from a generic level.

14 And that's why I raised the question.
15 Seems like you would want to do that.

16 MR. DAMON: Yes, yes. I think if you try
17 to do this, if we didn't decide to do it, the industry
18 would tell us that they wanted it done that way.

19 DR. FLACK: Yes, that's for sure.

20 CHAIRMAN RYAN: Okay. Again, thank you,
21 folks. We appreciate it. You're more than welcome to
22 stay if you want.

23 (Off-record comments.)

24 CHAIRMAN RYAN: Okay. Janet, I guess
25 you're going to start us off.

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1 MS. SCHLUETER: Okay. Sure.

2 CHAIRMAN RYAN: Janet Schlueter from the
3 NEI.

4 MS. SCHLUETER: Sure. I'm Janet Schlueter.
5 I'm the director of fuel and material safety at NEI.
6 I facilitate the Fuel Facility Operations Committee
7 where we have all of the operating committees. And
8 those sites that are under application for the NRC,
9 have routine exchanges of information.

10 And I represent them in instances like
11 this. And Charlie Vaughan will be making the
12 presentation. He has decades of experience at
13 operating fuel facilities.

14 And the slides represent a consensus of
15 position or views of the fuel facilities. They did
16 all contribute to the formulation of the slide content
17 and our remarks today.

18 I'd also like to take a second just to say
19 "thank you" to the staff for having the public meeting
20 back in November. A very productive public meeting on
21 the use of ISA at the fuel facilities.

22 And we've of course read their December
23 15th version of the paper which we thought was very
24 comprehensive. And I think we're generally in
25 alignment with the discussion and the consensus that's

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1 reached in that paper.

2 And Charlie will provide a lot more detail
3 on the use of the ISA, what it is, what it is not and
4 the value of it, and hope that it will influence and
5 you find it informative.

6 And we'll try to be as timely as we can to
7 stay within your constraints and to be responsive to
8 your questions. Okay?

9 CHAIRMAN RYAN: Thank you, Janet.
10 Appreciate it.

11 MS. SCHLUETER: Thank you.

12 MR. VAUGHAN: Okay. For the record, I'm
13 Charlie Vaughan.

14 If I may before I get into the
15 presentation, there were a couple of subjects that
16 came up that I wanted - in the earlier discussion that
17 I would like to make a comment on, in part, based on
18 my interaction with the fuel facilities and, in part,
19 from some personal experience.

20 One, on the oversight process, the
21 licensees generally have not made any kind of a
22 request that says this process needs to be revised.
23 That didn't originate within industry.

24 However, when industry heard that there
25 was some consideration, there were a couple of points

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1 that we suggested if this work was undertaken, that it
2 would be good to look at the reproducible nature of
3 these oversight reports that we get and, also, with
4 the transparency of the information.

5 And we committed that should the process
6 go forward, that we would be willing to work in that
7 endeavor.

8 The other item was the corrective action
9 program question that came up. And all of the
10 licensees at the fuel facilities have corrective
11 action programs.

12 Now, all of those corrective action
13 programs are not precisely the same, but they are all
14 documented, they're all proceduralized and they're all
15 used.

16 I mean, in today's environment, it's very
17 difficult to have a decent compliance record unless
18 you've got a corrective action system that takes
19 things that you identify and others identify, tries to
20 determine the root cause, I'll use that term, for why
21 they happen and correct them.

22 So, while we don't have hard, fast
23 commitments in the license to do that, those programs
24 are in place. They are observable. And the
25 compliance records of the facilities today are, in

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1 part, you know, the result of having that type of
2 assurance program in place as one of the management
3 measures.

4 MEMBER BLEY: Can I ask a question about
5 that?

6 MR. VAUGHAN: Yes.

7 MEMBER BLEY: In the reactor business over
8 the last year, there have been a couple particularly
9 difficult events that occurred in plants. And when
10 they were traced to their root, part of the problem in
11 each of those cases was even though there was a good
12 corrective action program, what was missing was a
13 process to ensure identified problems actually made it
14 onto the program instead of just into a, you know,
15 work-to-be-performed-later file in the maintenance
16 shop.

17 Can you say anything about that? Is there
18 - do these programs have a way to push things onto the
19 corrective action list rather than letting them sit
20 somewhere else?

21 It was kind of surprising, the ones that
22 we saw.

23 MR. VAUGHAN: I'm not sure what you mean by
24 a way to push them onto the list. The programs that
25 I'm familiar with -

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1 MEMBER BLEY: Let me explain a little -

2 MR. VAUGHAN: Okay.

3 MEMBER BLEY: - because the corrective
4 action program at these facilities was a very
5 structured process. And if something got on, it was
6 tracked. And it was evaluated as to its importance.
7 And more important things were -

8 MEMBER SIEBER: Root cause.

9 MEMBER BLEY: Yes, the whole business.

10 Separately, if somebody noticed something
11 broken, instead of getting on there, it could get onto
12 a maintenance list in the maintenance department.

13 MEMBER SIEBER: Maintenance work orders.

14 MEMBER BLEY: Maintenance work orders. And
15 there wasn't, apparently, a good enough process to
16 make sure anything that might have significance that
17 was reported to maintenance actually got onto the
18 corrective action plan.

19 And a couple things lasted for almost a
20 year, and eventually caused major upsets in the
21 plants.

22 MR. VAUGHAN: Right. I won't say that that
23 couldn't happen, but the programs that I'm aware of
24 procedurally dictate the types of things that have to
25 go on into the corrective action program.

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1 Now, that doesn't mean that there can't be
2 a mistake made and something could be missed, but the
3 programs that I'm aware of require certain things to
4 go into the corrective action program.

5 And so if it's a particular event or a
6 situation that by written definition and procedures is
7 required, it has a high probability of going into the
8 program.

9 MEMBER BLEY: Okay. Something to think
10 about.

11 MR. VAUGHAN: Okay. So, if there aren't
12 any other questions on that, we'll get on with the
13 particular presentation.

14 And as Janet said, we certainly appreciate
15 the opportunity to work with the NRC and others on
16 this particular subject.

17 With regard to the NRC's white paper, the
18 industry constituents have looked at that and they
19 agree with the background discussion of the ISA
20 development, the discussion of the roles of the ISA in
21 the regulated safety environment. So, in that regard,
22 we're pretty well in tune with the NRC's white paper.

23 There is one concern that people in
24 industry have. And that is the suggestion that PRA
25 techniques might be used in the significance

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1 determination process.

2 And I think as I go through the
3 presentation, there will be some evidence of why we
4 bring that point up.

5 One of the things that we need to think
6 about is the facilities that are all - that are all
7 lumped together in this group of fuel cycle
8 facilities. And it's quite a broad spectrum of
9 facilities and activities.

10 There is a very significant diversity.
11 It's not just some words to use. There is significant
12 diversity.

13 And if you look at that listing of
14 facilities and the numbers of the different types of
15 facilities, each of which use different equipment,
16 processes, you know, chemical processes, et cetera,
17 there really is not a lot of synergy to be able to
18 develop databases and uniform models and approaches.

19 So, you know, when Dennis talks about
20 these applications and dealing with making
21 significance determinations, I think this lends a lot
22 of credibility to what he's talking about because the
23 frequency of things that the NRC has to look at on an
24 annual basis is fairly low.

25 And when you look at the diversity of the

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1 types of activities that these things may apply to,
2 developing uniform approaches and uniform models to
3 any high degree of detail is - could be relatively
4 time-consuming and difficult.

5 The other thing is these processes, the
6 term "batch" was mentioned. I wouldn't characterize
7 them necessarily as batch processes anymore, but they
8 are sequential and stepwise processes. In other
9 words, there are disconnects along the way so that
10 things are not connected in long chains.

11 And these facilities are not required to
12 run through failures. In other words, if there's a
13 failure in one step, they don't have to run through
14 that failure.

15 And the Items Relied On For Safety that
16 we've been talking about are generally designed to
17 stop accident sequences before they develop.

18 For example, in the criticality area it is
19 required that we not use mitigating types of IROFS.
20 It has to be a positive stop type of situation. And
21 that's the approach that's used for high-consequence
22 events is that we use IROFS that perform a stop as
23 opposed to mitigation.

24 With regard to the ISA methodology, we've
25 talked a lot about that today, but I think industry

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1 would like to highlight a few things that should be
2 taken away.

3 First, it's a systematic identification
4 and evaluation of accident sequences. That's what we
5 do with ISA.

6 The industry uses tools with extensive
7 long-term application by the chemical industry and
8 others. And we've talked about it. HAZOP, fault
9 tree, event trees, what-if, Risk Index. All of those
10 tools are used in the ISA process.

11 The Risk Index that's been discussed is
12 generally based on operational experience, but not so
13 much on formal operational databases as have been
14 developed for reactors.

15 The IROFS are identified and implement to
16 meet the performance requirements of the 70.61
17 regulation. That's what they were - that's the tool
18 that was designed to do that.

19 And then management measures are required
20 to be identified to assure that IROFS remain in place
21 and functional when they're required to perform their
22 duty.

23 And the ISA methodology approach provides
24 a current and adequate safety basis for each facility.
25 And I might mention one thing that is sometimes

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1 overlooked. IROF failures have to be recorded and
2 investigated. And if IROFS fail too frequently, then
3 they have to be looked at in terms of replacement.

4 So, there's a feedback mechanism in this
5 ISA process that it's not a one time through. If
6 things aren't working and you're getting error
7 signals, you're getting feedback that says that you
8 have to go back and look at what's going wrong.

9 MEMBER BLEY: Now, as I understand it, the
10 ISAs are not quite part of the regulatory process.

11 These problems with IROFS, do they need to
12 be reported to NRC or they're just - they need to be
13 tracked internally subject to audit -

14 MR. VAUGHAN: They don't necessarily always
15 have to be reported to the NRC. The reporting
16 criteria is one thing, but IROF failures do have to be
17 recorded -

18 MEMBER BLEY: Internally.

19 MR. VAUGHAN: - internally and the
20 licensee is responsible to investigate them. And that
21 information is available for and open to NRC
22 inspection.

23 MEMBER ARMIJO: Charlie, would you normally
24 provide, let's say, a summary in your annual summary,
25 a chapter or section on IROF failures?

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1 MR. VAUGHAN: IROF failures are not
2 included in the annual report, but they are maintained
3 at the facility. And the inspectors typically look at
4 that list.

5 And, I mean, obviously they don't go
6 through and look at all of them, but it seems that
7 they are somewhat trying to risk inform their effort.

8 In other words, they look at failures and
9 they look at the systems that they're associated with.

10 And some way in their mind, they decide some of the
11 ones that may be of - in higher risk areas than
12 others. And they will typically run through the
13 licensee's treatment of that - those particular ones
14 that they select, but they're not part of the annual
15 report.

16 MEMBER ARMIJO: Okay.

17 MEMBER BLEY: Just an organizational
18 question for you.

19 I wasn't aware that you had a committee at
20 NEI of all these groups. My familiarity with the
21 chemical processing business is very different and
22 there's very little sharing.

23 Through NEI or some other form, is there
24 sharing of problem areas and maintenance ideas -

25 MEMBER SIEBER: Operating experience.

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1 MEMBER BLEY: Yes, operating experiences
2 among the various facilities.

3 MR. VAUGHAN: Yes, this particular
4 committee that Janet heads up and I help out with
5 periodically is very good to share. Now, I mean, this
6 is a competitive industry.

7 So, occasionally you get into situations
8 where you have to draw a boundary to protect some
9 competitive information, but the operation of this
10 committee has actually been, I think, very good for
11 safety in the industry because there is a very
12 significant sharing of the experiences. And people
13 that have problems are - the facilities are quite
14 willing to share, you know, up to the point that you
15 don't get into proprietary type of information. And
16 that's been helpful.

17 MS. SCHLUETER: It's a small community, as
18 you can see.

19 MEMBER BLEY: Right.

20 MS. SCHLUETER: And so there really aren't
21 other forum for them to do this. So, in our biweekly
22 and sometimes weekly calls, we dedicate time to
23 operational experience issues, events, observations,
24 licensing matters, inspections and regulatory issues
25 that are generic to the industry as a whole.

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1 MEMBER BLEY: Good things.

2 MS. SCHLUETER: Yes, I mean, it's a very,
3 you know, timely, ongoing forum. And then we meet in
4 person some as well.

5 DR. FLACK: Is that similar to what INPO
6 does for reactors?

7 I mean, they go into plants every two
8 years, I think, and assess their performance.

9 MS. SCHLUETER: No.

10 DR. FLACK: You don't do anything like
11 that?

12 MS. SCHLUETER: No, no. This is a
13 committee and a forum primarily for the exchange of
14 information between the plants. We do not do facility
15 visits, in part, for the proprietary reasons we just
16 mentioned.

17 DR. FLACK: Thank you.

18 MEMBER SIEBER: You track IROF failures.
19 My understanding of an IROF is like a trip device or
20 relief valve or some instrument someplace.

21 Do you keep track of the basic device that
22 was the root cause that required the IROF to operate
23 or do you just look at whether the protective devices
24 work when they were needed?

25 MR. VAUGHAN: The reason I hesitate - the

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1 answer to that is, in general, the whole aspect of the
2 IROF system, in other words, what would cause it to
3 trigger as well as the protective action, all of that
4 is looked at when the investigation is done.

5 And the reason I hesitate a little bit is,
6 is the licensees have the opportunity to define these
7 IROFS either as individual items or on a system basis.

8 And so, depending upon how the IROF is identified may
9 have a bearing on how the investigation goes.

10 But in general, they get to the
11 information that you were interested in.

12 MEMBER SIEBER: Yes, just as an example,
13 let's pretend for a moment that you had a process
14 where you had to have some pump that had to run.

15 MR. VAUGHAN: Yes.

16 MEMBER SIEBER: And you had a protective
17 device that would sense that it wasn't running, you
18 know. Maybe it's a coolant pump or something like
19 that.

20 And the protective device never failed,
21 but the pump itself was failing once a month or twice
22 a month or something like that.

23 Does your process, your safety analysis,
24 determine that sooner - that this pump keeps failing
25 and sooner or later it's challenging the protective

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1 device over and over and over again, and the
2 likelihood of a failure of both increases sharply when
3 the demand is present on a very frequent basis?

4 MR. VAUGHAN: Yes, it would be hard for me
5 to answer that for everybody because I haven't
6 operated - I haven't performed everybody's process.

7 But, in general, based on the discussions
8 within industry, I think that that is the case.

9 MEMBER SIEBER: Well, I would hope so. And
10 I would think the staff would go and look for
11 underlying causes of IROF operations in order to
12 determine what the overall safety posture in the
13 facility is.

14 MR. VAUGHAN: Right.

15 MEMBER SIEBER: Thank you.

16 MEMBER BLEY: Well, these aren't generally
17 reported to staff. So, it would take, you know, a
18 plan on staff's side to go out and do this
19 proactively, I would think, right?

20 MR. VAUGHAN: Let's go back. Remember, we
21 have routine inspections by the regional office.

22 MEMBER BLEY: Okay.

23 MR. VAUGHAN: And one of the things that I
24 - these records are required to be kept under the
25 terms -

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1 MEMBER BLEY: So, on those inspections they
2 could get -

3 MR. VAUGHAN: And so on the inspections,
4 that is one of the elements that is on their list of
5 things to inspect.

6 And, you know, they have - I don't know
7 what their method is, but they have a method of
8 looking at that list and deciding which ones they want
9 to follow up on. And I think it's kind of a risk-type
10 informed basis.

11 MEMBER BLEY: We heard that there are like
12 on the average, two violations a year per facility.

13 MEMBER SIEBER: Per year.

14 MEMBER BLEY: I don't know what I said.
15 That's what I meant.

16 IROF failures, do you have any wild idea
17 of how frequent that happens? Is there four a year,
18 one a day? Wildly different plant to plant?

19 MR. VAUGHAN: They're probably different by
20 plants. There aren't a lot, but there are some. I
21 think Mike had a -

22 MR. TSCHILTZ: Yes, I just want to point
23 out that Part 70 has reporting requirements via Part
24 21 for IROF component failures that could create a
25 substantial safety hazard. So, there is a mechanism

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1 for component failures to get formally -

2 MEMBER BLEY: Public safety hazard, right,
3 if it's Part 21?

4 MR. TSCHILTZ: Well, I'll - it says
5 substantial safety hazard, is what's in the
6 regulation. So, that's kind of like similar to
7 subjective judgment. There is no numerical threshold
8 for that.

9 MEMBER BLEY: Okay.

10 MR. TSCHILTZ: But it is required to be -
11 those failures are required to be reported.

12 MEMBER BLEY: Do you got any of those
13 reports?

14 MR. TSCHILTZ: Yes.

15 MEMBER BLEY: Oh, okay. I just wanted to
16 know how often things got classified that way.

17 DR. MODARRES: I think some of those IROFS
18 are like passive systems like containment.

19 MR. VAUGHAN: Yes.

20 DR. MODARRES: So, I wouldn't see that that
21 fails that often.

22 MEMBER BLEY: Well, some of -

23 DR. MODARRES: And there you could probably
24 see more often failures especially if you are in harsh
25 environments, you know, corrosive and all that.

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1 MR. VAUGHAN: And of course some of them
2 are administrative and, you know.

3 DR. MODARRES: Some IROFS are
4 administrative, right.

5 MR. VAUGHAN: Right. So, the potential for
6 failure is significantly different for different types
7 of IROFS.

8 DR. MODARRES: And how do you record the
9 administrative failures if IROF is an administrative -

10 MR. VAUGHAN: At the facilities that I've
11 worked at, we don't have any administrative IROFS, but
12 some of the licensees do. And so, I can't speak
13 exactly for how they record them.

14 MR. TSCHILTZ: If I can add, Mike Tschiltz,
15 I think if you trip the threshold for no longer
16 meeting a performance requirement, that's a reportable
17 event.

18 So, if you have an administrative IROF
19 that causes you not to meet one of the 70.61
20 performance requirements, that's a reportable event.

21 For other administrative failures that
22 fall below the threshold where you still meet the
23 performance requirements even though this IROF failed,
24 then that's not reportable.

25 MEMBER BLEY: Thanks. That helps.

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1 MR. VAUGHAN: And in some cases,
2 administrative IROF failures may be observed during
3 audit or by an over check.

4 For example, if an administrative routine
5 requires a certain recording and check-off, you know,
6 on a check sheet or something like that and some items
7 have been missed and an over check finds that those
8 items have been missed or an audit finds that those
9 items have been missed, then that would be considered
10 a failure of an administrative IROF.

11 DR. MODARRES: Well, it could be asleep or
12 something in that time. It's not the procedure may
13 not be wrong, the administrative -

14 MR. VAUGHAN: No, it's not the procedure
15 wrong, but the act was wrong.

16 DR. MODARRES: The act was, yes.

17 MR. VAUGHAN: Okay. In terms of the PRA
18 methodology, there weren't a lot of - a lot of things
19 that we wanted to mention here, but there's a lot of
20 similarities in terms of what's done for ISA and
21 what's done for PRA at least in the initial steps.

22 And it really boils down to the results
23 for PRAs are determined differently than they are for
24 ISAs, and the results are typically used somewhat
25 differently for PRAs in terms of ISAs. So, it's

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1 really kind of a different tool to do a different job
2 from our perspective.

3 And we talked a little bit about ISAs.
4 There has been a significant amount of industry effort
5 and expense used in the development of the ISA
6 technology. I mean, performing these ISAs at the
7 facilities was - just the cost alone of the facility
8 was well over a million dollars in, you know, in
9 person effort. And some people have reported, you
10 know, numbers that are way significant more than that.

11 And of course the NRC spent some degree of
12 effort in working out the rules and going through all
13 of the reviews and acceptance criteria. So, there's
14 been a significant amount of effort spent on the
15 development and implementation of ISA technology
16 similar to the effort that was spent by reactor
17 operators and the NRC to develop the PRA methodology
18 that's been used with reactors.

19 So, implementing these different
20 methodologies, these different tools to do things, is
21 an expensive proposition. And that has to be
22 considered in terms of what does it cost to do this
23 and relative to the benefit that comes out of it.

24 MEMBER BLEY: You know, there's a question
25 I have for you. And Sam and I are approaching this

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1 from different ends.

2 The only ISA I've looked at, and that puts
3 me in a lack of knowledge compared to the whole
4 process, is the one for the MOX facility.

5 And given the large numbers of things that
6 were found and the fixes that were added and the total
7 cost we heard for that thing, it just - I can't help
8 but believe that if they had used a PRA method, they
9 would have screened out as low probability, low
10 consequence a number of things quite low compared to
11 others. They would have cut down the number of fixes
12 that they did by an enormous amount.

13 And I just wonder if you've thought about
14 that because it seems that at least in that case,
15 everything that was found, no matter what, got fixed.

16 And that's a really expensive process when you do it
17 that way.

18 DR. MODARRES: Did it include, also, the
19 amount of effort that went into it to do it actually -

20 MEMBER BLEY: I think the \$80,000 we heard,
21 I think - 80 million, I mean, included that. Ten
22 years of effort, from what they told us in the
23 meeting.

24 And I've seen large-scale facilities done
25 with PRA in the chemical business for a heck of a lot

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1 less than that.

2 MEMBER ARMIJO: I think the MOX facility is
3 really an outlier compared to the other fuel cycle
4 facilities as far as complexity and -

5 MEMBER BLEY: Yes, but it's not an outlier
6 in terms of complexity to other kinds of process
7 chemical plants.

8 MEMBER ARMIJO: No, no, I think with
9 chemical plants, I agree. But for typical fuel cycle
10 facilities, I think it's much more complex.

11 MEMBER BLEY: I'm sure it is.

12 MEMBER ARMIJO: Yes.

13 MEMBER BLEY: I'm sure it is.

14 MEMBER BANERJEE: That 80 million, was it
15 only ISA or did it include -

16 MEMBER BLEY: They didn't design. It
17 included design fixes, of course.

18 MEMBER BANERJEE: Yes, because what happens
19 is this is sort of part of the design process, you
20 know. So, it's not that you can separate it and say
21 this is exactly what was spent on that. It's part of
22 an integral bottom line.

23 MEMBER BLEY: If you forget about the cost
24 and look at the documentation of the summary that they
25 gave us, it's astounding.

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1 MR. VAUGHAN: It is. No question about it.

2 MEMBER BLEY: Astounding to me. Maybe not
3 to everybody.

4 MEMBER BANERJEE: \$80 million worth?

5 MEMBER BLEY: Yes.

6 MR. VAUGHAN: One other big difference is
7 that MOX -

8 MEMBER BLEY: But I was wondering if you
9 folks had thought about the idea of if you had a
10 method that would allow you to prioritize what's
11 forced to change, whether that would be valuable.

12 I mean, I know just thinking about, God,
13 if we have to do one more thing, it will cost an arm
14 and a leg.

15 MR. VAUGHAN: Well, most of the - most
16 implementations of the ISA methodologies at the
17 facilities have some degree of screening.

18 Now, it's not the precise degree of
19 screening that you could do with necessarily a PRA. I
20 mean, you can get right down to the decimal point if
21 you've got data to do that, but you may not want to do
22 that anyway.

23 MEMBER BLEY: No.

24 MR. VAUGHAN: But there are ways to screen.
25 and the regulation has performance criteria. And

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1 you're screening to, in a way, to that performance
2 criteria.

3 Now, because most people are using kind of
4 a matrix-type approach to put things in bins, you
5 don't get a fine degree of screening, but you do have
6 some opportunity to put different situations in
7 different bins in terms of priority and in -

8 MEMBER BLEY: Any likelihood function into
9 that?

10 MR. VAUGHAN: Yes.

11 MEMBER BLEY: Okay. I need to see some of
12 the other ones.

13 MR. VAUGHAN: So, most people are looking
14 at a consequence and likelihood type of a matrix, and
15 certain things are screened out depending on where
16 they are on that matrix, but the matrix, in general,
17 is somewhat conservative.

18 So, yes, you probably do a little bit more
19 in a lot of cases than you might have to do if you did
20 a little bit more precise method, but then the
21 question is what's the cost benefit of -

22 MEMBER BLEY: That may well be different
23 for different kinds of facilities.

24 MR. VAUGHAN: The other thing is at the
25 fuel facilities, there are a lot of people there that

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1 understand PRA methodology. And you heard about the
2 teams that have been used to do the ISA. And you
3 bring in the maintenance man, you bring in the process
4 operator and those kinds of people that are familiar
5 with what's going on with the process.

6 And those kind of people don't work real
7 well with PRA methodology. So, you have to have a
8 little different type of person then to work through
9 the PRA part of this.

10 I don't know what the bottom line is. But
11 as you'll see when we go on through the summary, the
12 way the rules were written, the ISA approach was
13 adopted as the tool to demonstrate that the licensees
14 met, you know, the regulation.

15 If we need a different regulation, heaven
16 forbid, then maybe we need to talk about our different
17 set of performance criteria, maybe we need to look at
18 that.

19 But given the task, the tools seem to fit.

20 MEMBER BLEY: Thank you.

21 MR. VAUGHAN: Which kind of leads into the
22 ISA appropriateness slide. And, again, this - we're
23 repeating this an awful lot, but it does demonstrate
24 that the performance requirements of 70.61 are met.

25 And the fuel facilities, I think if we

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1 look at them, are fairly simplistic in nature from an
2 integration viewpoint. In other words, there's little
3 or no domino effect for accidents.

4 An accident is generally fairly localized
5 with a few - there are a few exceptions for
6 facilities. But, in general, the accidents would be
7 fairly localized in the facility.

8 And the source term for accidents in these
9 facilities are somewhat smaller than relative to -

10 MEMBER POWERS: Do you think that a release
11 from a radioactive material from a facility would have
12 lower case type on the front page of the Washington
13 Post?

14 MR. VAUGHAN: Probably the type wouldn't be
15 lower case, but ultimately -

16 MEMBER POWERS: I don't think so either. I
17 think they would have an equivalent headline.

18 MR. VAUGHAN: The type size would be about
19 the same. Possibly. It depends on how well the - how
20 well the release was managed and what the significance
21 of it was. But in terms of doing real harm to people,
22 the offsite impact would be negligible.

23 And if you look at fuel cycle facility
24 accidents, they generally rank low on the INES
25 reporting scale and they're predominantly chemical.

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1 We mention that because one of the - one
2 of the problems that we have is putting risk in the
3 right perspective in total for the industry. And we
4 tend to compartmentalize and don't really look at the
5 whole spectrum of risk and somehow we need a
6 yardstick.

7 And not suggesting necessarily that the
8 INES reporting scale is the right one, because
9 personally I'd just assume stay off the scale in
10 total. But as we're talking about data and we're
11 talking about situations, the Tokaimura criticality is
12 about the worst accident that has happened at a fuel
13 cycle type of facility. And there were actually
14 worker fatalities in that one.

15 And on the INES scale, that ranks a four
16 compared to several reactor-related accidents that
17 rank significantly higher.

18 MEMBER BANERJEE: So, you don't include
19 Mayak as a fuel cycle facility?

20 MR. VAUGHAN: I did not put that on this
21 particular chart. I mean -

22 MEMBER ARMIJO: It's there. Kyshtym and
23 Mayak are up there.

24 MR. VAUGHAN: Yes, Kyshtym, but that -

25 MEMBER BANERJEE: That is the one at Mayak.

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1 It's because they didn't know the name of the town.
2 That's why it was called Kyshtym.

3 MR. VAUGHAN: Okay, but was that actually -

4 MEMBER BANERJEE: It was the waste storage
5 tanks which were dried waste and they had cooling on
6 it. And one of the coolers failed or some of the
7 coolers, and it exploded and it blew the top off the
8 concrete bunker.

9 MR. VAUGHAN: Okay.

10 MEMBER BANERJEE: Was about 70 tons of TNT,
11 roughly, estimated as.

12 CHAIRMAN RYAN: Yes, and tens of millions
13 of curies of mixed fission products.

14 MEMBER BANERJEE: Yes, and it formed a
15 cloud. The immediate vicinity didn't get it, but the
16 cloud moved and deposited.

17 CHAIRMAN RYAN: 70 kilometers across
18 downwind.

19 MEMBER BANERJEE: And then there was about
20 - they estimate a couple of hundred fatalities.

21 MR. VAUGHAN: And the reason this one
22 wasn't put in the fuel cycle facility category is
23 because that was one that involved mixed fission
24 products and -

25 MEMBER BANERJEE: No, no, it was just

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1 radioactive waste. It was the decay heat. It was
2 mainly strontium and cesium.

3 MR. VAUGHAN: Right. But the fuel cycle
4 facilities don't have those types of risk.

5 MEMBER BANERJEE: Oh, you're not talking
6 about reprocessing?

7 MR. VAUGHAN: No, we're not talking about
8 reprocessing here. We're not into reprocessing here.

9 This is -

10 MEMBER BANERJEE: No, that's fine. If it's
11 not reprocessing -

12 MR. VAUGHAN: And of course the Kerr McGee
13 event, which was a chemical event, and it had to do
14 with nuclear activity, but it was a chemical event.

15 (Off-record comments.)

16 MR. VAUGHAN: Anyway, it's not necessarily
17 that we're suggesting that this is the right reporting
18 scale or the right measurement scale, but it just
19 begins to take some information that is available and
20 show how these - accidents at these facilities that
21 are bad stack up on the overall list. But, again,
22 we'd all like to stay off this list, period.

23 Again, talking about the justification for
24 the use of ISAs at the facilities, again, to meet the
25 regulations, source terms are small relative to power

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1 plants and pose a negligible - or a minimal or
2 negligible impact to offsite.

3 There's been a significant amount of
4 effort put forth to develop the ISA process. These
5 processes are simplistic and sequential. And the ISA
6 methodology generally adheres to a risk-informed
7 performance-based philosophy.

8 MEMBER POWERS: If the ISA does not compute
9 risk, how does it conform to a risk-informed
10 performance-based - I mean, I don't understand the
11 statement. Come to think of it, I don't understand
12 any of this statement.

13 Where does performance come into this
14 thing?

15 MR. VAUGHAN: Performance comes into it
16 because you're required to perform so that you don't
17 exceed the requirements in the regulation.

18 MEMBER POWERS: A different definition of
19 "performance" from what I would -

20 MR. VAUGHAN: Well, the regulation there
21 has very specific - Dennis put up some of the
22 definitions of high-consequence events and medium-
23 consequence events. And they are - they are
24 quantified in measurable terms. And that's the reason
25 we refer to them as performance.

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1 DR. FLACK: Just to follow up a little bit
2 on that, that's for licensing the facility. You
3 design your plant to meet those performance
4 requirements.

5 Once the plant is operating, then how do
6 you assess the performance? I think that's the
7 question on how much risk does it, you know, present
8 during its operation. How do you know how much risk
9 it presents?

10 I understand that if you exceed, if you
11 find an IROF that is down and you say, well, this
12 sequence is - will not - no longer meet the
13 performance requirement, I'll go fix it, I mean, you
14 go and fix it, but you don't really know what the risk
15 is of it, you know. That's the thing.

16 You just, you know, kind of -

17 MR. VAUGHAN: Well, you know that the
18 controls that you put in place, the Items Relied On
19 For Safety -

20 DR. FLACK: Right.

21 MR. VAUGHAN: - you know that they have
22 been demonstrated to be if it's a high-consequence
23 event, that means that they have to be highly
24 unlikely, which is - has a definition. And it's a
25 facility-by-facility definition, but the measure of

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1 highly unlikely or unlikely is defined for each
2 facility.

3 So, while you don't have a precise number,
4 you know that in accordance with their procedures
5 those risks have been made to be either highly
6 unlikely or unlikely in accordance with the
7 definitions in their license.

8 MEMBER POWERS: Suppose I'm operating one
9 of these facilities and by dint of outrageous
10 circumstance I find I have to maintain an IROF.

11 Do I have to shut the facility down?

12 MR. VAUGHAN: You have to -

13 MEMBER POWERS: Shut the facility down
14 completely?

15 MR. VAUGHAN: What was the question?

16 You have to do what now?

17 MEMBER POWERS: I find that I have to
18 maintain an IROF and do something with it.

19 MR. VAUGHAN: Oh, if you have to take an
20 IROF out of service while you're operating, then you'd
21 have to shut down.

22 MEMBER POWERS: For any IROF. Any one of
23 them. Temperature control.

24 MR. VAUGHAN: Most likely.

25 MEMBER ARMIJO: Unless you have redundant

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1 ones.

2 MR. VAUGHAN: Unless you have redundant
3 ones.

4 MEMBER POWERS: Oh, if I have redundant
5 ones, how much redundancy do I have to have?

6 MR. VAUGHAN: You don't have to have any if
7 you're willing to shut down.

8 MEMBER SIEBER: In other words, a manual
9 control of redundant IROF?

10 DR. FLACK: So, there is an action
11 statement. You go into an action similar to a tech
12 spec where you have to shut the plant down within some
13 period of time after you IROF?

14 MR. VAUGHAN: You don't shut the plant
15 down. You only shut down that unit operation which
16 the IROF is protecting.

17 MEMBER ARMIJO: And that happens in just
18 normal operation. Let's say you're running a lower
19 level of enrichment through a fuel factory. And you
20 now come in with a higher enrichment level. They're
21 batched. You have to clean out, you've got to shut
22 down, you got to do a bunch of stuff.

23 So, stop and go is not a - nothing that is
24 unusual. So, if you failed an IROF and you didn't
25 have a backup, you'd shut down and it wouldn't be the

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1 end of the world.

2 DR. FLACK: Well, when there's 12,000
3 IROFS, it's pretty amazing you can get them -

4 MEMBER ARMIJO: Well, obviously all -

5 MR. VAUGHAN: I mean, all of the plants
6 don't have - all of the plants don't have this 12,000
7 number.

8 MEMBER ARMIJO: I think it was a little bit
9 misleading that there were 12,000 because there were
10 similar components that were probably labeled as IROFS
11 because they were all the same kind of thing.

12 DR. MODARRES: If one IROF fails and
13 there's a redundant IROF exists, aren't you concerned
14 about common cause failure possibly and continue to
15 operate?

16 MR. VAUGHAN: Again, it depends - it
17 depends on the configuration of the redundant IROF.

18 MEMBER BLEY: You bring up an interesting
19 point. We've had discussions with staff on this when
20 they brought the reg guide to us. There's no useful
21 guidance on treating dependencies or on treating human
22 actions, really.

23 Now, they might be well done in some of
24 the actual ISAs, which I haven't seen, but the
25 guidance in those areas is meager at best.

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1 MR. VAUGHAN: We've had a lot of discussion
2 about independence and -

3 MEMBER BLEY: And leading to?

4 (Laughter.)

5 MR. VAUGHAN: Well, it's hard to - it's
6 hard to establish things as totally independent in the
7 universe. So, the discussion has a hard time finding
8 an end point.

9 MEMBER BLEY: But Mother Nature has a way
10 of showing us independencies sometimes.

11 MR. VAUGHAN: Right. And we're not always
12 as smart as Mother Nature.

13 But, yes, the subject of independence is
14 one that there's been a good bit of discussion. And
15 generally the way we've gravitated in this part of the
16 industry is in the direction of the definition that
17 the criticality people have used for "independence,"
18 which is not perfect, but it's a pretty rigorous
19 definition of "independence."

20 MEMBER POWERS: Once again that leaves me
21 quite confused. It's not rigorous, but it's a good
22 definition.

23 MR. VAUGHAN: Okay. A good definition.

24 MEMBER POWERS: It's an adequate
25 definition.

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1 MR. VAUGHAN: It's a good definition.

2 (Laughter.)

3 MR. VAUGHAN: Anyway, just kind of in
4 summary, some of these points are a little bit
5 redundant, but the one key here is the ISAs are
6 routinely updated and they always contain a current
7 basis of safety for the facility. And as I mentioned
8 earlier, there's a feedback loop in this.

9 If IROFS fail too frequently, they have to
10 be investigated. And if they are proving not to meet
11 the performance requirements, then they have to be
12 replaced with something that will. So, there is a
13 feedback loop that helps out there.

14 And the mixing of ISAs and PRA techniques
15 at the facilities, we really don't embrace that idea
16 that much. It's partly driven by the diversity of the
17 facilities and the fact that it's very difficult, you
18 know, to put any number of facilities together to
19 develop a uniform approach or a model and develop the
20 data to support it.

21 The cost of adding PRA to the ISAs, which
22 we've already demonstrated have been a fairly costly
23 effort for the facility.

24 And, also, what we would consider to be a
25 diversion of effort since both the NRC and industry

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1 seem to feel like that the ISA methodology is adequate
2 to meet the requirements of the regulation.

3 And it would seem that the significance
4 determination for these kind of facilities when you
5 look at the diversity, when you look at the low
6 frequency of things that require significance
7 determinations, should be some form of a more
8 simplistic process than trying to apply any rigorous
9 PRA techniques to them.

10 So, that was the industry side of the
11 message. And I think as we've gone through that, you
12 can see that we're pretty significantly in line with
13 what was in the NRC's paper other than maybe a little
14 difference about significance determination and what
15 might be the right approach there. But we are
16 interested in working on that problem to see if we
17 can't make some improvement there.

18 CHAIRMAN RYAN: Thank you.

19 DR. FLACK: I do have one more question, if
20 I may.

21 CHAIRMAN RYAN: Please.

22 DR. FLACK: Yes, this intrigues me this
23 IROF and where you stopped the - when looking at the
24 MOX similar to Dennis did at - the ISA, there's areas
25 - I mean, there's a discussion on defense-in-depth of

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1 which no credit is taken, but, you know, you meet your
2 performance criteria with the IROFS.

3 If you find an IROF unavailable, do you
4 take any credit for the defense-in-depth in meeting
5 the performance criteria at that time or is it
6 strictly that's it, we stop until we get the item
7 fixed?

8 I was kind of curious about the use of
9 this defense-in-depth piece that's added into or added
10 onto the sequences, you might say, in the ISA.

11 MR. VAUGHAN: The only time that defense-
12 in-depth is fair game in terms of credit, is if the
13 defense-in-depth mechanisms have to meet and are
14 subjected to the same degree of requirements and
15 controls that IROFS are.

16 And that's not -

17 DR. FLACK: Then it becomes an IROF.

18 MR. VAUGHAN: That's not necessarily the
19 case.

20 DR. FLACK: Yes, right, right.

21 MR. VAUGHAN: Well, some people have done
22 that and they don't necessarily identify them as
23 IROFS. Because what that does is, is just drives up
24 the number of IROFS, but there's no - there's no free
25 ticket.

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1 In other words, to get credit for defense-
2 in-depth, it has to have the same quality as what an
3 IROF would have, which means it has to meet the same
4 requirements.

5 DR. FLACK: If you'd take credit for it for
6 some reason. It doesn't seem like they take credit
7 for it in the ISAs

8 MR. VAUGHAN: Right. If you take credit
9 for it in -

10 DR. FLACK: Right, right.

11 MR. VAUGHAN: They don't take credit for it
12 in the ISA.

13 DR. FLACK: So, then you don't rely on that
14 as a means of meeting performance criteria during
15 operations should an IROF become unavailable.

16 That was my question. I guess your answer
17 is, no, you don't take credit for -

18 MR. VAUGHAN: Yes, typically not.

19 DR. FLACK: Okay.

20 MR. VAUGHAN: Again, most of these
21 processes are so that if they need to be shut down for
22 a period of time to fix an IROF or replace an IROF or
23 something like that, it can happen.

24 DR. FLACK: Yes, yes. Sure. I mean, if
25 you did a PRA, you would take credit for it. I mean,

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1 that's - but since it's not a PRA, you wouldn't take
2 credit for it because you're simply meeting some
3 regulation. You're saying that - the performance
4 criteria in the regulation.

5 So, it would seem to work against you in
6 that case.

7 MR. VAUGHAN: Right. And it's - it also
8 has to do with the ground rules that are written into
9 the regulation.

10 DR. FLACK: Right.

11 MR. VAUGHAN: I mean, as to what you can
12 take credit for and what you can't.

13 DR. FLACK: Yes. Well, okay. Yes.

14 MR. VAUGHAN: And, you know, if you had a
15 different set of ground rules, you could play to a
16 different set of rules, but -

17 DR. FLACK: Okay.

18 CHAIRMAN RYAN: Any last questions?

19 We had on our agenda that Marissa was
20 going to make some final comments.

21 (Off-record comments.)

22 CHAIRMAN RYAN: I just didn't want to miss
23 an opportunity if you needed to say something else.
24 Any other questions or comments from the members?

25 Thank you for your participation to our

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1 consultant today and to members. I think it's been a
2 real interesting and helpful discussion both with the
3 staff and with the industry. And good dialogue and
4 discussions like this really help us do our job.

5 So, anything else?

6 DR. FLACK: Well, just bringing up before
7 the full committee, are you going to get into that now
8 to talk about the next step?

9 CHAIRMAN RYAN: Well, our plan is to have a
10 briefing, I guess, with the full committee in
11 February.

12 DR. FLACK: Yes, and how much time and that
13 sort of thing?

14 CHAIRMAN RYAN: You know, I would - I would
15 - it was slated for, what? An hour and a half?

16 DR. FLACK: Well, they penciled in an hour
17 and a half.

18 CHAIRMAN RYAN: That sounds about right.

19 DR. FLACK: Yes. Okay.

20 CHAIRMAN RYAN: So, you know, I'm sure the
21 full committee will have some of the same questions
22 and maybe some new ones. So, we'll be prepared for
23 that and I think we can shape the briefings according
24 to that time slot and go from there.

25 DR. FLACK: Okay. And it would just be a

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1 staff presentation, I guess? I mean, I wouldn't
2 necessarily come in for that.

3 CHAIRMAN RYAN: Yes, I think in that kind
4 of time slot, either that or a shorter staff
5 presentation. And perhaps if you felt like you wanted
6 to make comments to the full committee, we could
7 certainly make a slot to do that.

8 You can think about it. You don't have to
9 answer today. If you're satisfied and you're on the
10 record now with what you want to say, that's fine,
11 too.

12 MS. SCHLUETER: Yes, thanks for the
13 opportunity today. You know, the ISA, the corrective
14 action program, the SDP, how the staff plans in the
15 future to enhance the oversight process are all, of
16 course, extremely important to the industry.

17 CHAIRMAN RYAN: Sure.

18 MS. SCHLUETER: And to that degree, that
19 the staff chooses to re-engage industry this spring
20 and begin to work on these matters again as we had
21 back in `08-`09, that we look forward to those public
22 discussions so that we can help inform that process.

23 CHAIRMAN RYAN: Okay. Thanks, Janet.

24 Any other comments?

25 With that, then, we'll adjourn the meeting

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1 and thank you all for your participation.

2 MS. SCHLUETER: Okay. Thank you.

3 CHAIRMAN RYAN: We'll close the record
4 here.

5 (Whereupon, the meeting was adjourned at
6 4:39 p.m.)

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BACKGROUND: FUEL CYCLE OVERSIGHT PROCESS AND ISA/PRA COMPARISON

Marissa Bailey, Deputy Director
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards

January 11, 2011



Why Revise the Fuel Cycle Oversight Process

- ⦿ Existing process is effective and ensures safety and security
- ⦿ To make the process more
 - risk-informed
 - performance-based
 - Predictable
 - transparent
- ⦿ Commission guidance and direction
- ⦿ OIG recommendation



Staff's Proposed Plan for Revising FCOP

- Oversight Framework
- Risk–Informed Baseline
- Significance Determination
- Performance Assessment
- Enforcement



Commission Direction

- Prepare a paper comparing ISA for fuel facilities and PRA for reactors
- Develop a set of cornerstones
- Provide assessment and recommendations for next steps

- Provide incentives for licensees to maintain a strong corrective actions program

ISAPRA Comparison - Focus

- ⦿ Safety Under 10 CFR Part 70
- ⦿ Risk Significance Determination





ISA/PRA Comparison – Key Points

- ◎ ISAs are performed to
 - identify potential accident sequences
 - designate IROFS to prevent or mitigate them
 - describe management measures
- ◎ ISAs are adequate for establishing the safety basis for fuel facilities
- ◎ Quantitative analysis to determine risk significance to be done on a case-by-case basis



Next Steps

- ① ACRS review and feedback on ISA/PRA comparison
- ① Develop cornerstones
- ① Integrate knowledge gained to provide recommendations for next steps
- ① Develop criteria for an acceptable CAP and coordinate changes to the Enforcement Policy

A COMPARISON OF INTEGRATED SAFETY ANALYSIS TO PROBABILISTIC RISK ASSESSMENT

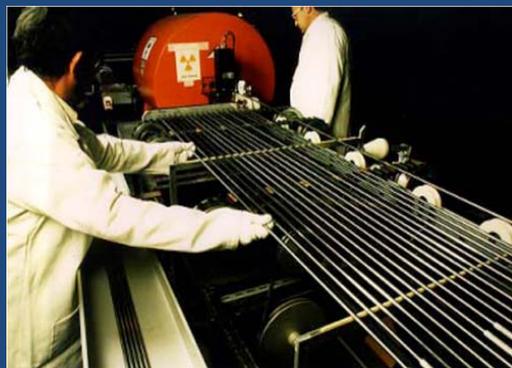
for the
Advisory Committee on Reactor Safeguards

Dennis R. Damon
January 11, 2011



ISA-PRA Key Points

- ⦿ ISAs are adequate for establishing the safety basis for fuel facilities
- ⦿ Quantitative analysis to determine risk significance: a case-by-case basis is efficient





ISA – PRA Comparison

- ⦿ A comparison and critical evaluation with respect to use...
 - for safety under 10 CFR 70 Subpart H
 - for risk significance determination of inspection findings



Contents of Paper

- I. Integrated Safety Analysis
- II. Probabilistic Risk Assessment
- III. Evaluation for safety under 10 CFR 70
- IV. Potential risk significance determination for fuel cycle oversight program
- V. Evaluation for use in risk significance determination, with example



Sections I ISAs and II PRAs

- ⦿ Functions of ISAs under Part 70:
 - Identify hazards, accidents, and items relied on for safety
 - Evaluate compliance with (likelihood / consequence) performance requirements
 - Aid programs to assure safety
- ⦿ Functions of PRA:
 - Quantify risk metrics as needed to inform regulatory decisions





III. Evaluation for Safety under 10 CFR 70

- ISA consequence-likelihood evaluations differ from PRA: conservative evaluation establishes adequate safety
- ISA concept was based on extensive chemical industry / OSHA Process Hazard Analysis (PHA) experience
- ISAs involved substantial efforts by licensees using PHA methods, including PRA-type fault trees



III. Evaluation for Safety under 10 CFR 70

- NRC staff reviewed ISA summaries. Selected processes reviewed in detail on site.
- Development, review, and revision process for ISAs was substantial
- NRC lessons learned are in NUREG-1520 rev. 1 (SRP)
- NRC staff conclusion: that approved ISAs provide an acceptable safety basis under 10 CFR 70



V. Evaluation for Risk Significance Determination

- ⦿ This section has an example quantitative risk significance determination, analogous to reactor oversight SDP
- ⦿ Quantitative risk significance determination requires reasonable quantitative delta risk estimation
- ⦿ ISAs were not done for this purpose, hence sometimes results need to be supplemented



V. Evaluation for Risk Significance Determination

- Example is typical: few accident sequences, out of hundreds in a plant, are affected by one inspection finding.
- Based on staff screening of actual inspections, very few findings per plant per year require risk evaluation. High risk significance cases rare.
- Key point #2: Thus it is efficient to do risk-significance evaluations on a case-by-case basis



ISA-PRA Key Points

1. ISAs are adequate for establishing the safety basis for fuel facilities
2. Quantitative analysis to determine risk significance on a case-by-case basis is efficient



Questions?



Supplementary Slides

- More detailed discussion of ISA-PRA comparison follows.



Contents of Paper

- I. Integrated Safety Analysis
- II. Probabilistic Risk Assessment
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I. What is ISA?

- ◎ 10 CFR 70: ISA is a systematic analysis to identify:
 - (1) hazards
 - (2) accident sequences
 - (3) consequence and likelihood of each sequence
 - (4) items relied on for safety (IROFS);and
 - (5) evaluate compliance with performance requirements of sec. 70.61.



I. ISA defined in Part 70

- ISA results are used by other requirements in Part 70
- 10 CFR 70.62(d): “..management measures shall ensure that...IROFS...are available and reliable to perform their function when needed to comply with the performance requirements of 70.61 of this part.”



I. What is ISA?

- ⦿ ISA was based on chemical industry PHA.
- ⦿ Differences from chemical PHA:
 - Integrated analysis of radiation, nuclear criticality, and chemical hazards
 - Evaluation of compliance with consequence – likelihood “performance requirements” of 70.61



I. ISA Performance Requirements

- ⦿ High consequence accident sequence must be “highly unlikely”
 - Worker high consequences =
 - (1) 100 rem or more (criticality or rad)
 - (2) Chemical – ‘endanger the life’

 - Public (outside “controlled area”) high consequences =
 - (1) 25 rem or more
 - (2) ≥ 30 mg soluble U intake
 - (3) Irreversible chemical injury



I. Performance Requirements

- Intermediate consequence accident sequence must be “unlikely”

Worker intermediate consequences:

- (1) 25 rem to 100 rem
- (2) Irreversible chemical injury

Public intermediate consequences:

- (1) 5 rem to 25 rem
- (2) Chemical transient illness



I. Performance Requirements

- ⦿ Environment (outside “restricted area”)
Conc. > 5000 times 10 CFR Part 20, Appendix B, Table 2 values
- ⦿ Evaluation is of single accident sequences, not the sum to an individual as in PRA
- ⦿ The structure of the evaluation of performance requirements is dictated by the regulation

I. ISA Guidance

- ⦿ NUREG-1513, “Integrated Safety Analysis Guidance Document,” May 2001
 - Accident identification methods based on extensive experience with chemical industry / OSHA Process Hazards Analysis
- ⦿ NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility, Rev. 1”, May 2010



III. Evaluation for Safety under 10 CFR 70

- ISAs identify (hazards, accidents, IROFS)
 - This function is, in principle, the same as PRA
 - But fault/event trees only for complex events
 - Problems are mostly in execution, not methods. (e.g. unanticipated scenarios)
- ISAs evaluate likelihoods and consequences; but not fully quantitative
 - quantitative better in some cases, but generally ISAs are conservative, which is acceptable and efficient.



III. Evaluation of Technical Features

- End states:
 - ISA – high or intermediate consequence sequence,
 - PRA – sum of frequencies
- Completeness: in principle no difference.
- Accident quantification:
 - Most ISAs have some sequence frequency information
 - PRA – quantified sequences
- Human error – Simple error lists, sometimes very conservative.
- Hardware failures – ISA at level of IROFS



III. Evaluation of Technical Features

- ⦿ System interactions – 70.4 Definitions. ISA: “...An ISA can be performed process by process, but all processes shall be integrated, and process interactions considered.”
- ⦿ Dependencies / common cause: Some ISAs evaluate via checklists. Some use dependency factors for likelihoods. Criticality safety: double contingency standard (ANSI/ANS 8.1)
- ⦿ Uncertainties: ISAs usually handle with conservative assumptions
- ⦿ Importance metrics: Not used in the safety program under Subpart H



III. Evaluation for Safety under 10 CFR 70

- ISAs have been developed, updated, reviewed, revised, and improved over an extended time frame
- Methods borrowed from chemical industry
- NRC reviews of ISAs were substantial. A risk-informed selection of process designs were reviewed in detail



III. Evaluation for Safety under 10 CFR 70

- PRA methods have been used in certain areas; and could be applied in others as recommended in NRC guidance.
- Difficulties in doing ISAs: anticipating all credible accidents, large number of processes, errors of commission
- Bottom line evaluation: NRC Staff has approved ISA programs as acceptable for safety



V. Evaluation for Risk Significance

- ⦿ ISAs were not done to provide a good estimate of risk.
- ⦿ Most ISAs do have some quantitative risk information, but...
- ⦿ ISA quantitative results sometimes very conservative
- ⦿ ISA quantitative evaluations not consistent between different licensees



V. Evaluation for Risk Significance

- ⦿ Common large conservatisms:
 - Not crediting a safety control (non-IROFS)
 - Worst case dispersion for offsite releases
 - No credit for safety margins
- ⦿ Other risk quantification gaps:
 - No NRC validated hardware failure data
 - Quantifying human errors of commission
 - Probabilistic chemical consequences
 - Criticality magnitudes



V. Evaluation for Risk Significance

- ⦿ Factors that aid in quantifying risk significance of fuel cycle inspection findings:
 - Very few significant findings per plant per year
 - Simple designs: few accident sequences are affected by one inspection finding
- ⦿ Risk significance metric: Δ frequency of high consequence event caused by deficiency \times duration of deficiency
- ⦿ Fuel cycle needs multiple metrics: worker/public, high/intermediate, other



V. Example Risk Significance Calculation

- ⦿ Example Risk Significance Evaluation
 - Typical simplicity: few affected sequences
 - Only need delta risk for these sequences
 - but has none of the quantification difficulties (failure data is provided for all quantities).
- ⦿ Key point: Quantitative risk significance can often be done for fuel cycle inspection findings on a case-by-case basis. A priori re-evaluation of all sequences by licensees would not be efficient.



V. Example Risk Significance Determination

- ⦿ Process: geometrically safe tank, containment dike
- ⦿ Potential accident scenarios:
 - fissile solution leaks or overflows into dike, dike leaks, solution accumulates into critical geometry, criticality accident
 - Two scenarios: 1) leak initiator 2) overflow
- ⦿ Normal accident frequency = initiator frequencies x dike failure probability



V. Example Risk Significance Determination

- ⦿ Deficiency: dike found to have been in leaking condition for 4 years
- ⦿ Frequency of accident during these 4 years had increased to frequency of initiators
- ⦿ Significance metric = $\Delta \text{frequency} \times \text{duration of deficiency}$



ISA – Chemical Industry

PHA

- 29 CFR 1910.911 Process safety management of highly hazardous chemicals
- 1910.911(e) Process Hazards Analysis (PHA): what-if, what if-checklist, HAZOP, FMEA, fault trees
- OSHA-NRC Memorandum of Understanding

FUEL FACILITY VIEWS ON COMPARING ISAs to PRAs

Presented by Charles M. Vaughan, NEI

ACRS Subcommittee

January 11, 2011



NUCLEAR
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Introduction

- **Industry appreciates the opportunity to contribute publically to the NRC effort**
- **Industry agrees with the background discussion of ISA development and the role of ISAs in the regulated safety environment**
- **Industry is concerned over the suggestion of the potential use of PRA techniques for a yet to be developed Significance Determination Process (SDP)**

Part 40, 70,76 Facilities

- **Broad spectrum of facilities and activities**
- **Significant Diversity – Little synergy in small numbers**
 - U Conversion (1)
 - DU De-conversion (1 *pending*)
 - LWR Fuel Fabrication Facilities (3)
 - Cat I Fuel Cycle Facilities (2)
 - Enrichment – Diffusion (1)
 - Enrichment – Gas Centrifuge (3), (1 *pending*)
 - Enrichment – Laser (1 *pending*)
- **Sequential, Stepwise processes**
- **Not required to run through failures**
- **Items Relied on for Safety (IROFS) designed to stop accident sequences before they develop**

ISA Methodology

- **Systematic identification and evaluation of accident sequences**
- **Using tools with extensive, long term application by the chemical industry (HAZOP, Fault & Event Trees, What-If, Risk Index)**
- **Risk Index is based on operational experience**
- **IROFS identified and implemented to meet §70.61 performance requirements**
- **Management Measures are assigned to assure IROFS remain in place and functional**
- **Provides current and adequate safety basis information for each facility and includes a feedback loop**

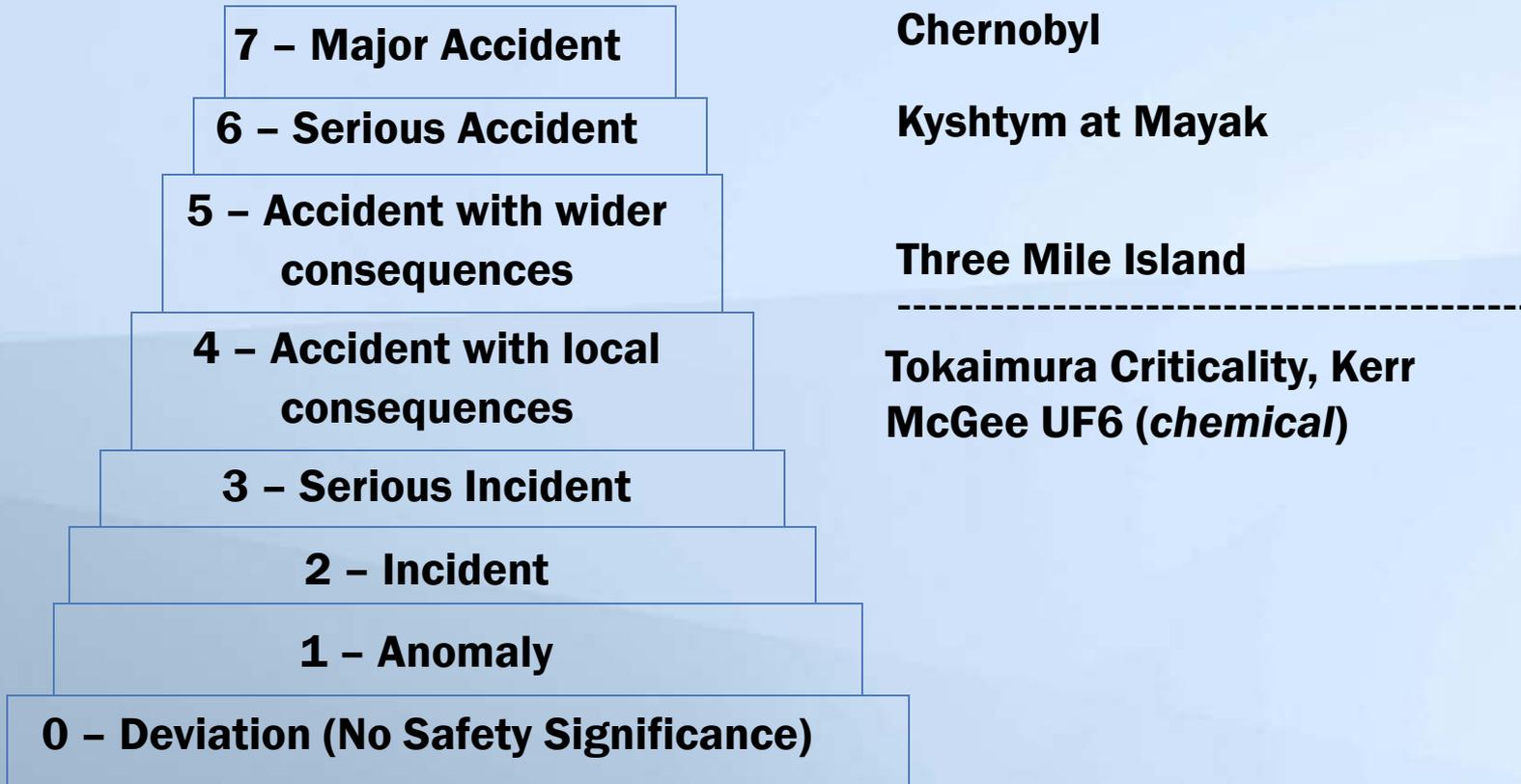
PRA Methodology

- **Identification of potential accident scenarios**
- **Estimates frequencies and consequences to produce risk matrix**
- **Useful where risk must be accumulated**
 - i.e. “sum all accident sequences that can lead to X expressed as a frequency of some outcome”
- **Accuracy dependent on the accuracy and inclusiveness of the supporting data base**
- **Extensive time and resources applied to reactors**

ISA Appropriateness

- ISAs demonstrate that the performance requirements of 10 CFR 70.61 are met
- Fuel Cycle Facility operations simplistic in nature from an integration viewpoint (i.e. little or no domino effect for accident sequences)
- Fuel Cycle Facility source terms are small relative to power reactors - accidents result in minimal or negligible impact to offsite members of the public
- Fuel Cycle Facility accidents have ranked low on the INES Reporting Scale – predominantly chemical risks

INES Reporting Scale



Steps Approximately 10X
on seriousness scale

Justification for Use of ISA at Fuel Cycle Facilities

- **ISAs have been found to be acceptable to meet performance requirements of 10 CFR 70.61**
- **Source terms are small relative to power reactors; accidents result in minimal or negligible impact to offsite members of the public**
- **Significant amount of resources expended by Industry and NRC to meet existing regulations**
- **Simplistic, sequential processes without domino effect**
- **ISA Methodology adheres to a Risk Informed Performance Based Philosophy**

Industry Summary

- **ISA Methodology acceptable to meet 10 CFR 70.61 Performance Requirements**
- **ISAs are routinely updated, always contain a current basis of safety, and include a feedback loop for identifying and correcting deficiencies**
- **ISAs were not performed to produce risk matrix – only to demonstrate meeting performance requirements**
- **ISA Methodology relies on conservative safety assumptions**
- **Accident significance is small when compared to reactors (INES ranks three orders of magnitude less)**
- **Mixing of ISA and PRA techniques at these facilities is not advisable**
- **Significance Determination Process should be simplistic in nature and commensurate with the facility risk profile**

Acronyms

- **ISA – Integrated Safety Analysis**
- **PRA – Probabilistic Risk Assessment**
- **SDP – Significance Determination Process**
- **IROFS – Items Relied on for Safety**
- **INES – International Nuclear and Radiological Event Scale**