Presentation by Harold R. Denton:

"Regulatory Needs Which Might be Met by Probabilistic Safety Analysis or Reliability Techniques"

800128

I think Dr. Hendrie has covered almost all the areas in which we are presently using risk assessment. I think what I'd like to do is dwell on two areas as concrete examples of the kinds of things we're doing. I told Saul (Levine) many years ago that what I would really like to have in the Phillips Building would be a risk simulator panel in which, when you walk into your room each morning, you've got all the accident scenarios listed along one column and you see what the major contributors to risk are in each plant that day and you pick those out and you go to work on those. It would be somewhat parallel to the I&E efforts to get the data link back to the plants on the actual operating conditions. It would be nirvana if NRR could have a real time display of the principal contributors to risk each day. But lacking that, we are using risk assessment more than ever in NRR; and the two areas that I ~~thought I'd just~~ will touch on ~~with you that~~ haven't been mentioned so far are ~~is~~ Let's start with new plants. One of the things that I think is missing from our present Standard Review Plan is what I call the ~~w~~holistic approach ~~A~~ (as compared to present) the rather deterministic, ~~the~~ look at single-failure of safety-grade equipment, ~~they don't~~ look ~~much~~ at testing or procedures, the human factor element. which, for example, doesn't

The very next plant down the line - Sequoyah - is going to be handled quite differently than plants in the past. That plant, if and when it is licensed will probably be a low-power license ~~and it will be a license only~~ to conduct a certain number of tests such as natural circulation with loss of offsite power, ~~and~~ These test would be run not one time, but on every shift. ~~Good~~ measurements would be made of plant performance during these off-normal conditions and compared to predictions, ~~and~~ to really get some feedback as to how well the plant matches the predicted behavior. We also intend to follow very closely how the plant performed during this time and make a decision on going to full power ~~really~~ based on ~~how the~~ plant performed during these low-power testing phases. ~~And~~ I see the development of these low-power tests as a way to ~~really~~ debug the plant before making a decision about full power. This means that we can actually put the plant through some of the potential scenarios that we think are high contributors to risk and see how it performs. We are also requiring that the licensee for Sequoyah - and we will probably be requiring ~~doing~~ this for all licensees - conduct ~~s~~ what is called a mini-IREP. This will be discussed with you later today but it's part of the effort to make sure every plant has looked at the principal contributors to risk to try to find outliers, the ones that weren't identified in our Standard

Review Plan approach, and have a possibility of fixing these before the decision is made that the plant can go to full power operation. So I think you will find that for all new plant licenses that will be issued, we're going to be using risk assessment techniques more than ever.

Let me go now to existing plants and mention an example there that I think is a good example of what we will be using in the future for old plants, such as Indian Point 2 and 3 and Zion, and any other high-population sites. When you compare the risks from those sites to the risks from average sites, you find that they dominate the public risk. You can also look at the evacuation times and find that it's much more difficult to evacuate people from the high-population site than from the average site in the U.S. In cooperation with Research, we have identified what are those actions that could be taken to reduce the risks from those type of plants. We've asked them to look at filtered containment venting, at core ladles, at hydrogen control systems, at increased off-site power availability, and have developed a plethora of actions that we're asking those licensees, or will be asking those licensees, to take in the near future in order to compensate for the high risk due to the population.

I think this is an example of using risk assessment to identify what the real contributors to risk are and how they might be minimized. I think, in fact, as we go back through the SEP program, you'll find increasing emphasis in NRR on using risk assessment techniques. I think, as Dr. Hendrie said, risk assessment techniques will complement the deterministic approach, not replace it. I think there is still a need to see that the wall is built to the appropriate standards before you start assessing its probability of failure so that a certain minimum threshold that all plants must meet; and these are the type of standards outlined in the Standard Review Plan. So I see risk assessment as being an orthogonal look, another way to look at the plant, and to pick up outlyers that were somehow missed. Tech specs are another example. Our tech specs have been largely written with regard to system by system, not a great deal of system interaction. In our meetings with Indian Point just last week, we proposed to modify that approach somewhat, and look for system failures where there were two systems in one event tree that if the plant were in a condition that one more failure would put them into a possibility of a core melt, we could write tech specs so as to interlock auxiliary feedwater outage times with emergency power outage times, for example. So I think you're going to find that we do more than ever incorporate risk assessment techniques. The history of why we don't do more is rather muddled. I've

been reading "The Brethren" lately, showing what happens inside the Supreme Court on issues such as abortion and bussing, and I must say that the history of risk assessment and the Commission follow some of those trials and tribulations that the Supreme Court has faced. Let me stop here and answer questions about where we're going.

Question: I heard that there exists the intention to review NRC regulations that are currently on the books as to their usefulness and effectiveness. What are the plans concerning this review?

Answer: "I don't have any plans on this. Standards may have. The actual problem that we face is that the number of actions that we have all collectively identified after TMI represents a workload with a tremendous peak and our resources don't equal that at all. So one of the first things we have to do is sort out ~~is~~ what actions are we going to do and which ones are we going to postpone and do later. You can't do it all overnight. Our prime focus in NRR has been the safety of operating plants ~~, and, as those of you know, once we settle I think there are really two~~ things ~~that~~ are happening in NRR in addition to the use of risk assessment. ~~The other is~~ namely a more formal approach to getting the requirements met. ~~As those of you know~~, about half the utilities did meet the short-term lessons learned by the end of December of last year -- the other half wanted various extensions that ran off into August to coincide with refueling, ~~and~~ we decided that wasn't an acceptable situation and issued orders for everyone to comply either during January or within 30 days after getting the equipment. There were however a few plants ~~around~~ that we ~~gave a slight out~~ allowed, depending on power supply and their availability. But you should look back at ~~some~~ areas like ATWS where we have used risk assessment ~~like ATWS~~. That's a ten-year-old history. It hasn't ever come to a closure between the industry and ourselves and I think that while risk assessment will help lay the issues out, there's still a need for developing a decision-making mechanism ~~to move~~ when there are disagreements among experts.

Question: I wonder if you could amplify on the philosophy or criteria you have on reducing the risks on sites like Indian Point and Zion.

Answer: The goal is to make the risks from those sites ~~look like~~ comparable to the risks from an average site in the U.S. I think I mentioned, depending on how you look at risks, the total risk from a plant like Indian Point or Zion ~~must be~~ is at least ten times the risk from say the average site in the U.S. ~~That's just~~ based on population density alone. Then you've got to look at evacuation times and ~~you can~~ compare either acute health effects or latent health effects and this sort of

thing. ~~but~~ The real intent would be through changes either in design, legislative procedures that the plant operates under, management systems to make those plants look like the average plant. Did I interpret your question properly?

Question: I was wondering if you could put numbers on that. Last Friday we were talking with Con. Ed. and Commonwealth Edison and I think you --

Answer: Well, I think I'm looking for a factor of 3 to 10 in risk reduction, somewhere in that range at those sites.

Question: I wonder if you'd comment on whether you think the state of the art of the reliability analysis is extensive enough to make this sudden switch from a more systematic evaluation to the risk assessment evaluation . . .

Answer: Well, that's why I wouldn't want to use the word switch. I think we've got to preserve the present way of doing it - the standard review plan, the deterministic approach, but supplement it with risk assessment techniques. I'm not proposing ~~at all~~ to abandon the traditional way of reviewing plants but rather to pick out things such as failure of auxiliary feedwater and loss of off-site power. You know, you can come to the conclusion quickly that the best designed plants already exist and this is something that other people have observed, but when we did the loss of feedwater probabilistic analysis and the loss of off-site power analysis, ~~what you find is that while~~ every plant that ~~was~~ looked at met our deterministic single-failure criteria, the reliability of those systems varies markedly from plant to plant, ~~meaning that~~ some engineers had done a better job of designing systems that met our deterministic criteria than others. So there is already out there somewhere a good design of auxiliary feedwater systems, a good design for loss of power, and I was really surprised to find that you can meet our deterministic criteria in an area like this and still differ in reliability or probability of performance by almost two orders of magnitude. Some engineers have really done a much better job in designing some systems that meet our criteria than other engineers.

Question: What is being done to improve the data base, particularly with respect to operator action, which appears to be a really weak link.

Answer: I guess I'm not the right person today to talk about the data base. That's an area that I've stayed out of recently and I'll defer to someone else. Maybe the operational data people that are setting up that new group may want

to address that. But you know, that's an old issue: Failure modes and effects analysis. You've got to collect the successes as well as the failures. When we first began to look at some of these areas we had assumed that the systems were tested only as often as the tech specs called for, ~~and so~~ when you divided the number of reported failures by the number of times that the tech specs had called for the system to be tested, ~~and~~ we came to the conclusion they were much more unreliable than we had thought. Then when we met with the licensees, we found that in some cases they tested these systems far more frequently than the tech specs called for. So obviously in order to have a good data base our old way of getting failures reported was not good enough. ~~You've~~ We have also got to get the number of successes - the number of tests reported in order to come up with a reliable data base. One of the lessons I think I've learned from my brief forray into this ~~recently~~ has been the importance of the balance of plant systems. We tend to think about the nuclear steam supply system as the dominant contributor to risk and what should be looked at closely, but the way these plants are coupled to the balance of plant is very important and, in fact, may be the real driving contributor to risk.

Question: Looking down the road, do you envision that if we use risk assessment in the licensing process, would we ever reach a point that we would set quantitative reliability goals?

Answer: I would hope so. Now we've got to get over those hurdles of defining acceptable methodology and the data base arguments in order to get to that sort of nirvana. We'll probably get there sooner in some fields, and/or some types of systems, than others. But certainly the important thing and the reason I'm very enthusiastic ~~about~~ today is, we've got to make this first start. We talked about this far too long. What's needed is action, and that's why many of you are here today is to begin to learn more about how to apply risk assessment, and to take it back, and in our day-to-day decisions, begin to incorporate ~~this~~ it as a way of thought. You know, if you look at things from my perspective, we have somehow increasingly become a group of specialists, ~~and~~ the system kind of forces us that way, and I think that what risk assessment provides is the way to back off and be sure you're thinking the broad picture and you put everything in the equation, not just maybe the particular area that you are normally interested in. And I would hope down the road that we'd see a much bigger focus on ~~systems~~ systems engineering, and I see risk assessment as being an integral part of assessments of any systems performance.

Question: You said there is quite a difference in risks, or reliability just between equal systems designed by different designers; is it possible that we might be arriving at a point where we license designers, rather than systems?

Answer: We sure need to find a better way to do business. We're all strapped for resources to continue down the traditional route. If you could somehow license designers and provide the control that society demands, it would be a possibility. But I don't quite see how we'd get to that in the near future. Do you have an idea of how we'd appl that sort of thing? Well, you know we could require that all the designs be done by a former member of NRC, combined with a member of the ACRS and a couple of investigation commission members; that might be the only way to assure a high-quality product (laughter).

Question: Is any thought being given to requiring the reactor manufacturers to perform fault/event tree analyses, and risk assessments for their plants?

Answer: Yes - thought has been given to it. Like some other things, we've got to be prepared to know what to do with it when we get it back. If I thought we had the capability to review it, I think we'd move that way, ~~and what~~ I think we've got to ~~do it~~ get ourselves up to speed so we know how to handle this information when it comes back in. We sure can't keep it all in house. The important thing is to get the industry thinking along these lines and reacting to it, ~~and~~ I've taken the tactic lately, that whenever we hit a troublesome spot, to throw it into the mini-IREP program and send it over to Bob (Bernero) and Frank (Rowsome), ~~and~~ I guess we've got a half a dozen mini-IREPs going around the country now being performed by the various utilities in particular areas. ~~So~~ I am attempting to go that route whenever I see it has a high payoff. But we can't just ask them to do it without giving them some instructions and some methodology so they understand what we want, ~~and~~ then we have to have some capability to look at it when it comes back. I'm eagerly awaiting the results of the Crystal River study which is one of the first big efforts we've made down this line.

Question: Do you have any requests from Congress or the Executive Branch to set safety goals? Are there any plans for setting specific safety goals?

Answer: Well, I don't really think there are. In fact, I think maybe we focused too long in the past on the bottom line of risk assessment, and that got us into

all kinds of arguments in the bottom line. I think even without Congress setting a bottom line there's still a lot that can be done about risk assessment to identify the major contributors. And even if we don't set a bottom line, my goal is to continue to work on those principal contributors. I once talked to CEQ about doing a comparison of energy sources. I talked to DOE about it. The Academy of Science just completed its monumental report on comparing the health effects of various energy sources. I don't see much enthusiasm in town for actually setting a safety goal. I think we ought to have this industry safer than its competitors. ~~Now whether it ought to be 1% of coal, .001% of coal, or how do you measure it.~~ The other thing that you find if you've been around Three Mile Island or other sites where there's a high psychic cost, people don't react just to the numerical values. You've somehow got to factor in these ~~other~~ kinds of costs in your risk assessment. When you're at Three Mile Island and you talk about releasing one Curie of krypton, for example, or a small amount of krypton where the dose would be well within normal limits, and yet you're faced with people on the street and on the telephone who are really hysterical about releasing of that, it says that you can't be just a cold-blooded scientist doing calculations and diagrams. You've got to somehow factor in the feelings of people about the nature of the source that we regulate. So I think even if you were to pick a value relative to coal, that nuclear should be some percentage better than coal. How do you measure that and how do you get anyone to accept it? It's very tough. So I guess I see, while ~~it~~ we keep a minimum effort going in that direction, the important thing is to think what we can do today. we can compare systems today. I'm very pleased with the outcome of these two or three studies made of every plant in some narrow slice. ~~And~~ in those areas we can pick out the high contributors and work on them.

I think my time is up. I just want to wish you a lot of success today. I'm glad we finally got the momentum to get such a prestigious group together. It looks like a very good program, and I look forward to having constructive ideas from all of you on how we can further the use of this technique.

Thanks a lot