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OFFICIAL TRANSCRIPT OF PROCEEDINGS

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Agency: U.S. Nuclear Regulatory Commission
Advisory Committee On Reactor Safeguards

Title: 370th ACRS General Meeting

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PUBLIC NOTICE BY THE

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

DATE: February 8, 1991

The contents of this transcript of the proceedings of the United States Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards, (date) February 8, 1991, as reported herein, are a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected or edited, and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

370TH ACRS GENERAL MEETING

Nuclear Regulatory Commission
Room P-110
7920 Norfolk Avenue
Bethesda, Maryland
Friday, February 8, 1991

The above-entitled proceedings commenced at 8:30 o'clock a.m., pursuant to notice, David A. Ward, Committee Chairman, presiding.

PRESENT FOR THE ACRS SUBCOMMITTEE:

Paul G. Shewmc   ce Chairman
James. C. Carroll, Member
Carlyle Michelson, Member
Ivan Catton, Member
William Kerr, Member
Harold W. Lewis, Member
Charles J. Wylie, Member
J. Ernest Wilkins, Jr., Member
Herman Alderman, Cognizant ACRS Staff Member

PARTICIPANTS:

R. Fraley	S. Duraiswamy
C. Haughney	J. Roberts
T. King	B. Burson
J. Murphy	M. Taylor

PROCEEDINGS

[8:30 a.m.]

MR. WARD: The meeting will now come to order. This is the second day of the 370th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting the Committee will discuss or hear reports on the following. First, spent nuclear fuel storage casks; second, containment criteria for future light water reactors; third, primary systems piping integrity; fourth, definition of a large release for severe accidents; and, five, ACRS activities.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Herman Alderman is the designated Federal official for the initial portion of the meeting. We have received no written statements nor requests for time to make oral statements from members of the public.

A transcript of portions of the meeting is being kept, and I will ask each speaker to use one of the microphones.

Our first topic is spent nuclear fuel storage casks, and Bill Kerr will lead the discussion.

MR. KERR: Thank you, Mr. Chairman. On the 29th of January the Subcommittee on Defueling and Fuel Pool Storage of Spent Fuel met with members of the NRC staff to discuss a proposed standard review plan which has been promulgated to assist in the review of safety analysis reports for dry metallic spent fuel storage casks.

The 1982 Nuclear Waste Policy Act gave utilities primary responsibility for interim storage of spent fuel, and these casks turn out to be one of the vehicles being used by some utilities for that purpose. In this Nuclear Waste Policy Act the DOE was also given responsibility to conduct research and development of such storage facilities, and to assist in cooperative demonstrations of their capability.

In 1986 the Surry plant was issued an ISFSI -- which I think is interim storage of spent fuel or something or other --license for storage in horizontal concrete modules. In 1990 the Oconee Plant of the Duke Power Company was given a license for storage in a spent fuel storage facility.

In 1990, also, the 10 CFR 72 which was the regulation under which fuel storage was described and the regulations associated therewith, was amended to permit use of certified cask designs. A licensee who wanted to store fuel could refer to this certified cask design and would not have to undergo any further review of the design itself. They would, of course, have to be local reviews of the site and the operation of the facility.

Rather detailed criteria which are in 10 CFR 72 have been established for the licensing of these cask designs and, of course, for the operation of the casks. Among these are the licensing period that is now 20 years with the possibility that an extension can be applied for and received. There is one step licensing of their site boundary doses established for both normal and accidental situations.

Licenses for such facilities have now been issued to three facilities. There are five applications from other utilities now under consideration. Nine topical reports submitted by the vendors of casks describing their designs have been approved by the NRC staff, and three are being reviewed. A regulatory guide associated with 10 CFR 72 but specifically aimed at the way in which one must prepare a request for licensing has been issued. This standard review plan that was discussed, there are plans to publish that as a NUREG and eventually to also formulate a standard review plan for concrete storage casks as well. This is one of at least two standard review plans that we can expect to see.

Mr. Ward, who was the other member of the Subcommittee present and I received a very well organized and detailed presentation on the standard review plan. Previously I think all of you have received a copy of the standard review plan. Because it was rather detailed and because of the detailed presentation and because I believe we found no particular difficulty with it, I decided not to ask for a presentation by the staff this morning but to ask them to have representatives here who could respond to questions that you might have.

I have prepared a draft letter, copies of which you have with essentially comments I would want. I don't think Dave Ward had a chance in time to add to or subtract from the comments. At this point, I will stop and ask if he has any further comments on the Subcommittee meeting. Following that, we will ask for questions from any of you which either I will try to answer or will ask staff assistance in answering.

MR. WARD: Maybe since the staff is here if we could ask them to comment. I see you mention that in your letter. One of the comments or observations we had was some concern or question over the format content of the regulatory guide and the relationship of the regulatory guide to the standard review plan.

It seemed to be unorthodox or different from what we are used to seeing in regulatory guides and standard review plan. I guess that is what Bill says in the letter, that the standard review plan seemed to contain material that had been expected to be found in a Reg Guide. I don't know whether that is an important problem or whether it really is different, or it's just our perception that it is different.

Does the staff have any comment on that?

MR. HAUGHNEY: Good morning, Mr. Chairman. I am Charlie Haughney, Chief of the Fuel Cycle Safety Branch. I remember the comment well, and I have had a chance to reflect on it. I haven't been able to really compare both documents yet to come to a final decision in my own mind.

My preference would be to publish the standard review plan as a NUREG -- it's still in a draft status and not out in the wide circulation yet -- but to take that comment under advisement and consideration to see if we need to adjust the content of both documents to a more traditional arrangement. I would prefer not to reset the entire process back to zero at this stage because I think we have a compelling need to have all the information in wider distribution.

MR. SHEWMON: Could you tell me what in here or where, what limits the age of the fuel that can be put into this facility?

MR. ROBERTS: Specifically two things. One, the rule itself, Part 72 says that fuel shall have age decayed at least one year. The other is design dependent, and that gets into how you design the shielding for your cask for example and other factors that would set effectively the age of the fuel. Typically people are designing casks for five to ten year old fuel, and it is moving toward ten because of the perception and the reality that higher burn up is also being seen.

Those are the factors that enter in.

MR. SHEWMON: It's primarily radiation -- how much shielding you want to put there and not necessarily the temperature of the fuel as it sits in there.

MR. ROBERTS: The temperature is also a factor in the sense that we maintain the temperatures -- of course, this fuel is stored typically in helium so there's no oxidation -- you do wish to maintain the temperatures sufficiently low and generally around below 400 degrees C.

MR. SHEWMON: That 400 degrees C, does that appear in this document someplace?

MR. ROBERTS: No. Again, we are talking -- methodology to address that does. It is, again, a design-dependent phenomenon dependent on the fuel and the design of the cask baskets. It does appear the methodology for arriving at the correct temperature -- I mention that as an example.

MR. KERR: This comes about, Paul, through field degradation --

MR. SHEWMON: Tell me again, what parameters in here limit the age of the fuel? It's a minimum of one year, and you say it all depends on the design. But, something has to fix the design. If that's radiation dose on the outside, that's one parameter but that wouldn't define --

MR. ROBERTS: That's right.

MR. SHEWMON: -- the temperature particularly.

MR. ROBERTS: That's right. The temperature is defined in terms of looking at the long term storage of the fuel and what damage to the fuel cladding could occur.

MR. SHEWMON: I can appreciate that. Is there a temperature limit in here?

MR. SHEWMON: It is not a set limit because it depends upon the fuel itself. In other words, the --

MR. SHEWMON: What is in here to limit the age then?

MR. ROBERTS: There is an analysis dependent upon diffusion cavity growth for the fuel cladding in terms of the zircloid cladding. There is an analysis for arriving at a temperature, and this involves looking at integrated damage to the fuel over the period of storage.

MR. SHEWMON: Diffusion cavity growth.

MR. ROBERTS: Yes. That is essentially the only mechanism that has been seen for storage because you are storing in helium. Hydrating and other effects have been basically eliminated.

MR. SHEWMON: All those are words that I am vaguely familiar with, but I am not familiar with the phenomena. What cavity are we talking about?

MR. ROBERTS: If you look at the polycrystalline structure you can get diffusion of basically your microcavities to the grain boundaries. This is a phenomenon that is temperature and pressure dependent, and this is why I say it's dependent upon the fuel and the temperature and the power history of the fuel and so forth.

You can calculate starting with what initial temperature you would store at which is design dependent and integrate the potential damage factor out. The limit we have generally set is 15 percent damage to the fuel over the period of storage.

MR. SHEWMON: Fifteen percent growth ?

MR. ROBERTS: Fifteen percent damage to the structural strength of the cladding over the period of storage due to this potential --

MR. SHEWMON: The cladding is damaged because the fuel expands when the bubbles come to the grain boundaries, is that it?

MR. ROBERTS: It basically reduces the strength of the cladding, that is correct, because of the diffusion.

MR. WARD: The cavity growth is in the cladding, not in the --

MR. SHEWMON: Fuel.

MR. ROBERTS: No, it's in the cladding. We are talking cladding because --

MR. SHEWMON: What kind of voids are there in the cladding?

MR. ROBERTS: You have microcavities in the metal because of the nature of the material, radiation damage and other things. These diffuse to the grain boundaries of the material, and that's a function of temperature and temperature and pressure on the cladding from the hoop stress.

MR. SHEWMON: What section is all this explained in here?

MR. ROBERTS: I don't have the copy with me.

MR. SHEWMON: I have heard of the phenomena that you are talking about in breeder fuel, but I have never heard of it in light water reactor fuel which I assume we are talking about here.

MR. ROBERTS: Yes, that's right.

MR. SHEWMON: This known only to a few people phenomena you are talking about, there is some presumed model of how it occurs.

MR. ROBERTS: Yes.

MR. SHEWMON: It's this presumed model which limits the temperature which the fuel can rise to; is that correct?

MR. ROBERTS: That's correct. There are publications out on this and so forth. It's been a phenomenon that, as I say, has been examined in dry storage over the last decade.

MR. SHEWMON: I would be interested in seeing some of the references. These are voids?

MR. ROBERTS: Yes.

MR. SHEWMON: Are they helium filled?

MR. ROBERTS: No. Let's see if I -- you have damage in the metal, displacements in the structure. These will migrate under temperature and pressure to the grain boundaries rather than remaining essentially uniformly, if you will, dispersed. It is this migration to the grain boundary that effectively, if you will, makes the fuel less strong or brittles it.

MR. SHEWMON: It makes the cladding less strong.

MR. ROBERTS: Yes, the cladding. This phenomenon has been recognized, as I say, for now many years. It is the only mechanism we have seen where you might have a potential problem.

MR. SHEWMON: It occurs out of pile but doesn't occur in pile?

MR. ROBERTS: That's right. Basically I think when you get below about 300 degrees C, the phenomenon drops off so fast that it becomes effectively non-existent, if you will. It no longer has an effect. A corollary for this for example is, if the fuel had a pinhole in the cladding and released the internal pressure, then this mechanism would not work either so nothing would happen to further degrade the fuel.

It is basically a phenomenon of the interior hoop stress on the cladding and the temperature of storage. Once you get below a pretty much critical temperature at about 300 degrees C, it now stretches out so far that it is no longer a phenomenon of interest.

MR. SHEWMON: In effect this model says stay below 300 degrees C or don't go --

MR. ROBERTS: Or design to assure yourself that you will get there at the appropriate time with a minimum amount of damage to the cladding.

MR. SHEWMON: What drives it is some grain boundary embrittlement phenomena which somebody has found.

MR. ROBERTS: That's correct. Both DOE and Livermore have examined these phenomena.

MR. SHEWMON: What section is that presumed model in?

MR. ROBERTS: Let me go through here and cross-check this.

MR. KERR: My memory is that what is in here is when which one does temperature calculations and the temperature --

MR. ROBERTS: On page 2-7 under Subsection 2.5.1 fuel cladding, it discusses the diffusion control cavity growth mechanism as the primary damage mechanism. Like I say, the --

MR. SHEWMON: The temperature is given where? This says about what you said.

MR. ROBERTS: Yes. There are, as I say, reports out published by Livermore. There is also work by DOE for evaluation of the damage to the cladding.

MR. SHEWMON: The temperature is given where? I don't see a reference in the report.

MR. ROBERTS: That's what I was trying to say, there is not.

MR. SHEWMON: It's a time dependent assumption.

MR. ROBERTS: Yes.

MR. SHEWMON: But there is a time dependent assumed time temperature integral which --

MR. ROBERTS: That's precisely it, and that is --

MR. SHEWMON: Where is that given?

MR. ROBERTS: That is given in separate reports where people have developed a calculation --

MR. SHEWMON: Where is that report referenced? Where can a designer go for this?

MR. ROBERTS: I don't see it here at this point.

Let me check the end of the chapter. It should be referenced at the end of Chapter 2, but I don't see it being done so in this particular document. It leaves it to the designer to provide a calculational model to confirm that, as on page 2-11, that it does not exceed 15 percent reduction in the cladding -- the cross-section is addressed in Chapter 3 here.

MR. SHEWMON: That is extremely model dependent with some deference. Mechanical engineers are fine people, but they probably don't dream up models like this too well before lunch.

MR. KERR: It says the confirmatory analysis is addressed in Chapter 3, so it might be in Chapter 3.

MR. ROBERTS: Let me go further in Chapter 3 here and find it. It is reference 14 in Chapter 3, on page 324.

MR. SHEWMON: There is a well defined model which gives this time temperature integral there?

MR. ROBERTS: Yes. In fact, there is contained in this report a short computer code that allows you to do the time pressure temperature integration for determining the damage.

MR. SHEWMON: In reference 14?

MR. ROBERTS: Yes.

MR. SHEWMON: All right, thank you.

MR. WARD: Could I ask another question? John or

Charlie, I recall at the Subcommittee meeting the criticality analysis was described at the present required for the casking and at the present time is using the reactivity properties of fresh fuel, unspent fuel, no credit for burn up, no credit for presence of fission product cross-sections. As I understood it, their plans in the future to permit maybe some more elaborate calculations but there are complications with that.

My question is, what is done for spent fuel basin criticality in the analysis now? Are the assumptions limited to fresh fuel?

MR. ROBERTS: No, they are not. In fact, I think there are over a dozen pools that have a two region type pools where they have allowed burn up credit. These are all in pressurized water reactor storage pools and, consequently, there is the presence of boron solution in the water. In the type of cask situation that we are looking at, the concern is the intrusion of fresh water. Also, there is a long term concern of being able to ship these perhaps directly offsite. That is certainly the way the newer designs are aiming.

That's a direct requirement in Part 71. We have looked at this ard DOE presently basically has a research project to examine the problem. To be brief the problem is this, that as you get to the end of the active part of the fuel development of course the burn up drops off quite rapidly. In the last foot or so of the active region it becomes a question of whether or not you might have essentially a slab, if you will -- I use that word advisedly -- of material that could go critical.

That is our concern. Consequently, the additional work both in calculational and in measurement systems that DOE is pursuing to try and give us the same essentially degree of marginal safety is as the present assumptions do.

MR. WARD: I can see that it is complex or can be, but I thought if the problem is solved -- if there are methods for deali[illegible]h it in pool storage it seems those same methods could be used in a cask. I guess what you are saying -- PWR pools, boron used and they are so deeply subcritical and there are smear over some of these approximations.

MR. CARROLL: I only remember we did have boron --

MR. ROBERTS: That is correct. The calculations I believe that NRR does in this instance for the normal condition, they use an averaged value to account for the burn up, essentially averaging out the drop off. But my understanding is that for accident cases they do take into account the presence of the boron in the water.

MR. KERR: Are there further questions? Did that answer your question, Mr. Chairman?

MR. WARD: Yes. What sort of penalty is there on the cask designer? I mean, how much incentive is there to make a sharp penciled criticality analysis?

MR. ROBERTS: Well, let me answer your question this way, probably you are talking a difference of 30 percent increased capacity or better if you go to an assumption of burn up credit. There is a strong incentive. The reason DOE is deeply into this is, they are pushing this for the designs for their transportation cask fleet. It is initially from that point of view, a transportation question.

MR. KERR: Is there a requirement that the neutron flux be measured as the cask is loaded in the pool?

MR. ROBERTS: There is no such requirement.

MR. KERR: That would be an easy way to tell whether you were going critical or not.

MR. ROBERTS: You are doing an approach to criticality experiment though, and that is --

MR. KERR: Here you have a classic approach to criticality, you load one element at a time.

MR. CARROLL: Where you put your detectors --

MR. ROBERTS: There is work, as I say, ongoing by DOE on a measurement system. There is also some work being done by one of the cask vendors, Nuclear Assurance Corporation, on a measurement system. That would, as you say, it would probably go a long way towards resolving concerns about misloading of fuel and misidentification of fuel and that sort of thing.

MR. SHEWMON: What kinds of materials construction for these casks are people talking about?

MR. ROBERTS: They are talking about conventional stainless steel and lead with a solid neutron shield, which is usually something like a Bisco material --

MR. SHEWMON: Usually a what?

MR. ROBERTS: A bisco material. It's a hydrogenous material that physically is somewhat the consistency of concrete. It is poured in and solidified. In most transportation casks they are still using water/ethylene glycol in the storage cask because you are assuming that the cask remains there for 20 years. The emphasis has been on solid neutron shields. This bisco material has been used in the NAC casks. It is then covered with an outer metal sheet.

MR. WILKINS: I am not familiar with that material. Is the hydrogen density comparable to that of water --

MR. ROBERTS: Yes.

MR. SHEWMON: It sounds like boron may be part of that or --

MR. ROBERTS: It can be borated as well, that is correct. So, you can also -- it's a p. rietary material so I won't go too far in describing it. The material can be varied and it is used fairly widely now.

MR. SHEWMON: Can it be removed without a jack hammer?

MR. ROBERTS: No. It's a part of the cask.

MR. SHEWMON: I had the impression that you had this fuel cans which you put in there and you are now casting it all in concrete -- it would be removed, which doesn't sound too bright.

MR. ROBERTS: Let me give you an example. At the Oconee site, for example, there was a transfer cask that was not used for storage but was developed specifically for transfer of fuel. You have your major stainless steel and lead, and at the outer perimeter you have your bisco in a steel in a quarter-inch stainless steel jacket. That particular cask was dropped 40 feet at one point before it got to the site. It was on delivery actually. They had to repair it.

Effectively, that meant stripping off that outer husk, replacing it and repouring the bisco. We audited the QA on that. Other types of casks are solid ferretic steel. The Westinghouse MC-10 is an example, and I think it's in our slides there.

MR. SHEWMON: You guys have never backed off on meonite or non-ductile iron?

MR. ROBERTS: In storage the Castor V -- and I think there are now 11 or 12 at Surry -- are all nodular cask iron cask. The wall thickness is about 14 inches thick. Of course, that material contains such a sufficiently large amount of carbon that in effect the material itself constitutes a neutron shield. There is also some shadow shielding of polyethylene rods. As I say, that has been in place since 1986 there.

MR. SHEWMON: But it is not over the road certified.

MR. ROBERTS: No. There is some continuing work at EPRI on that material for getting it into the ASME code as there is on borated stainless steel for baskets and so forth.

MR. WARD: Any other questions or comments?

MR. CARROLL: Did you get your initial question answered, Dave, about how they are we going to put this more in the traditional format?

MR. WARD: Or whether it needs to go into the traditional format. I think they said they are going to think about it. That's all right with me. Anything else, Dr. Kerr?

MR. KERR: I have no further questions.

MR. WARD: We are done with the transcribed portion of the meeting.

[Whereupon, at 9:12 a.m., the transcribed portion of the meeting recessed, to reconvene at 1:30 p.m., this same day.]

AFTERNOON SESSION

[1:30 p.m.]

MR. WARD: Our next topic is on the definition of a large release. We are going to have a presentation from the staff on this. We had a Subcommittee meeting on Tuesday afternoon at which we heard a presentation, presumably similar to what we are going to hear today. Some of the members who are missing now were at that Subcommittee meeting so I thought we could go ahead.

ACRS has been very interested in the development of the safety goal and in the development of a means by which the safety goal might be implemented. One of the parts of the safety goal implementation program that remains to be developed is the so-called definition of a large release. The Committee has had some thoughts on that which we have expressed in previous letters, and I guess in some discussions with the Commission.

The staff has taken account of what we have said and what the Commission has said on the topic, and is working toward the development of a definition of a large release. We asked them to come in sort of early in the process so that if we think they are going off in the wrong direction we can tell them our views in advance of six months of work put into the final development of the definition. So, don't look for a final definition but just for indication of the sort of definition that they plan to develop.

Is there anyone that was at the Subcommittee meeting that has something they would like to say about this before we go to Mr. King and the staff?

[No response.]

We have this pink cover sheet with the large number 12 that has some related material, including some thoughts that Dr. Lewis provided on the bulletin board before the Subcommittee meeting, which he was unable to attend. Are there any comments?

[No response.]

Okay, Tom King, proceed.

MR. KING: My name is Tom King, and I am with the Office of Research, Division of Safety Issue Resolution. We, in that division ended up being assigned the responsibility to implement that part of the Commission's staff requirements memo that came back dealing with implementation of safety goal policy. We got the part dealing with the large release.

[Slide.]

As Dr. Ward said, we are here at your request to give you a status briefing on where we stand and where we plan to go in terms of trying to define a large release. I want to mention at this point in time that we have sent a paper to the Commission which you have seen, SECY 90-405. We have not heard back from the Commission yet. In addition, we have not done any calculations yet, so we don't have any numbers to show you. We will talk about what we plan to do to get some numbers.

In the presentation I just want to give you a little background leading up to what went into the SECY 90-4-5, a brief summary of what is in there and what we plan to do, both the approach and the schedule of what we plan to do. We are not asking for a letter at this time, but we will plan to come back later as you will see on the schedule and at that time we will request a letter, after we get some numbers and some recommendations to talk about.

[Slide.]

By way of background you recall the statement from the 1986 Safety Goal Policy Statement which requested or suggested that the large release -- provided a statement actually that the large release of radioactive materials to the environment from a reactor accident should be less than one in one million per year of reactor operation. The ACRS, in putting forth their hierarchy of safety goal objectives, had that as a level III objective which was really a general plant performance objective.

[Slide.]

In the staff's paper that went to the Commission back in 1089 on implementation of the safety goal policy the large release was discussed. There was a definition that was proposed in that paper, namely that it would be a release that would have the potential for causing one or more offsite early fatalities. In enclosure one to that paper there were four other potential definitions discussed, not in a lot of detail but they were touched upon there.

What we did in responding to the Commission's SRM where they asked us to develop an alternate definition, was to go back and look at those alternate definitions proposed in the original SECY paper. Basically what we ended up evaluating were the bottom three in preparation of our SECY 90-405. The top two were discarded because they were specifically tied to individual site parameters which the Commission was against.

In looking at these alternate definitions we did have a ground rule that basically we felt that a large release should have a connection to offsite consequences; that we chose early fatalities as offsite consequence that the connection should be made to, because it was the more restrictive of the quantitative health objectives.

MR. SHEWMON: Is the one at the bottom of that page the one you will proceed with; is that what I understood?

MR. KING: The bottom three --

MR. SHEWMON: You said you had gotten rid of the first two, so I assume it was the bottom one --

MR. KING: We looked at the bottom three in preparation of the SECY 90-405 paper. We ended up recommending the magnitude of release option. We will talk about that.

[Slide.]

MR. KING: At about the same time the original SECY paper went to the Commission on implementation of safety goals, there was an ACRS letter that commented on the large release definition and had basically four points in it. The large release should be consistent with the qualitative goals and quantitative health objectives; that it should be in terms of the release itself, for example curies, fraction of the core inventory; that it should be independent of the site characteristics; and, that it should provide some criteria against which the design and performance of containments can be tested.

[Slide.]

MR. KING: The Commission, in responding to the staff's SECY paper on safety goal implementation in their item they talked about the large release, basically agreed with the ACRS. They specifically requested that an alternate definition be developed that would be independent of the site; that it should focus on accidental releases; it acknowledged that the large release guideline might be in order of magnitude more conservative than the quantitative health objectives, but they seemed to accept this in order to simplify the goals.

MR. LEWIS: I don't remember that, but did they actually encourage you to make it an order of magnitude more conservative --

MR. KING: No. Not encourage, but I think they recognized the simplification to go to a large release was approximately an order of magnitude -- potentially an order of magnitude more conservative.

MR. LEWIS: It sounds as if they are comfortable with this thing being an order of magnitude more conservative -- not conservative, more strict --

MR. KING: That's the way we interpret their SRM.

MR. LEWIS: That surprises me.

MR. WILKINS: It might be useful to read the exact language. Let me read the exact language.

MR. LEWIS: Yes, I would like to hear it.

MR. WILKINS: This more conservative result is within an order of magnitude, not --

MR. LEWIS: That's rather different.

MR. WILKINS: It is slightly different, I think, of the Commission's health objectives and provides a goal which has generally been accepted. That is the sentence.

MR. LEWIS: Within an order of magnitude is --

MR. WILKINS: A lot different than --

MR. LEWIS: That's right. It's the difference between less than and greater than. That helps a lot Ernest, I appreciate that.

MR. SHEWMON: Is the quantitative health objectives the same as the safety goals, one-tenth of a percent change in--

MR. KING: Yes, that is the quantitative health objectives, the one-tenth.

MR. LEWIS: I think Paul distinguished that the goals are that nuclear power shouldn't hurt anybody very much from the quantitative health objectives, which are the things that give the .1 percent. I think that's the way they make the distinction.

Given what Ernest has read to us, I would challenge the interpretation -- not the words that you have on the viewgraph which are consistent with what Ernest said -- but the intent as I read the additional words is that they didn't want you to get very far from the QHO's.

MR. KING: Yes, I will agree with that. I probably should have just quoted right from the letter instead of paraphrase it.

MR. SHEWMON: Is it true from what Ernest read that it could be either more or less conservative?

MR. WILKINS: No. I didn't read the entire paragraph. It's more conservative. They said that.

MR. LEWIS: But it was certainly not that they were encouraging it, they were just acknowledging that in a different world you might go conceivably that far. If I were staff I would certainly not interpret it as a fishing license to pick up a factor of ten here.

MR. KING: Finally in their SRM, the Commission asked that the staff should advise them on the large release development and its use including with the proceeding of a new definition. That ultimately resulted in our SECY 90-405 paper that went to the Commission in December.

In that paper we talked about two options. Actually, I mentioned earlier we considered three in putting the paper together and I am going to talk about the three. We only put two in the paper because the one was obviously, we felt, a bad candidate and wasn't worthy of being put in the paper.

[Slide.]

MR. KING: The first one discussed was a qualitative statement dealing with early containment failure. It will just read it. Basically it said a large release is any release from an event involving severe core damage, reactor coolant system pressure boundary failure and early failure of significant bypass of containment. The idea there was to come up with a definition that would be independent of site characteristics, would not require detailed fission product release calculations, would be potentially less work for the analyst.

We felt that the biggest problems that it had were in the areas of interpretation. It was subject to a lot of interpretation like, what is early containment failure, what is significant bypass and so forth. Another problem was that it may not in all cases be tied to the quantitative health objective, the early fatality number. Potentially you could have some sequences that would fall under this definition but really wouldn't be tied to an early offsite fatality.

Mainly for those reasons we didn't recommend this one. It also had another drawback, in that it was limited we felt, to reactors with conventional type containments. The biggest drawback we felt was the problem in interpreting it and the potential problems needing a consistent interpretation.

[Slide.]

MR. KING: The second option we talked about in the paper, and the one we recommended was the one based upon a magnitude of release. That was that we would define a large release as a release of radioactivity from the containment to the environment of a magnitude equal to or greater than, and that would either be a number in terms of curies or a percentage of the core inventory. The staff would have to do some work to define that number. What we would plan to do is, using some representative site characteristics and the NUREG-1150 information and calculational techniques to find that magnitude, and we will talk a little bit more later about exactly what we have in mind there.

When I say the word has the potential based in there based upon representative site characteristics for causing one or more offsite early fatalities, again, we would tie that magnitude to one that, through calculation would be tied to an offsite early fatality. Maybe the word potential might be a little confusing. What we really mean is predicted based upon the state of the art techniques and data that we would propose to use.

We felt this definition had several advantages. One, it does tie the definition to an offsite consequence. I think it's fairly easy in concept to understand. It is independent of site parameters. It doesn't require a Level 3, PRA. It could be extended to be applicable to any type of reactor, conventional containment or non-conventional containment. But we would have to define a representative site, and we will talk a little bit more about that.

I felt it could be applied more consistently than the first option that I talked about. That was a big advantage that we felt and one of the main reasons that we recommended this one.

[Slide.]

MR. KING: The third option that we considered, the one that you won't find in the paper but we did do some work on it, was one that deals with offsite dose. By offsite dose I mean fence post dose, a dose at the exclusion area boundary. Again, it was a definition that would basically read a large release is one which causes a dose of -- and we haven't settled in on a dose but it would be a dose that is equivalent to an early fatality -- to an individual located at the exclusion area boundary.

Again, it had some advantages, in that it was based upon an offsite early fatality considerations. You didn't need to consider offsite parameters like population density or evacuation effectiveness. It did have some drawbacks, in the sense that we thought it was a more deterministic type of definition that was not really keeping with the true spirit of the safety goals which are more risk-based and take into account probabilistic considerations.

Plus, when you do the fence post type of calculation you have to make some deterministic assumptions that could cause this thing to be even more conservative than a factor of ten beyond the quantitative health objectives.

MR. SHEWMON: The difference between this one and option two is that option two, the people would be distributed in a more reasonable way and option three they are all sitting at the fence post or something; is that it?

MR. KING: Yes. Option two, you consider the distribution of people offsite. You define a representative site which would include a distribution of people, include the meteorology effects and so forth whereas option three wouldn't do that. It would just look at what is happening right at the fence post.

Because of our concern that this may be more conservative and was more deterministic than probabilistic, we decided not to pursue this one.

One of the other things we did in comparing the definitions was, if you recall in the original SECY paper 89-102 that went up, there was a list of guidelines for the subsidiary objectives that were provided in enclosure one of that paper, there were seven of them. We took a look at seeing how the various definitions, the original one in the SECY paper and the three options that we looked at, stacked up against those seven guidelines. I won't go through all of them.

We felt the one that we arrived at did meet all of the guidelines. On top of that, it was site-independent, which the Commission was asking for and did not require a Level III PRA. So, that sort of led us to the choice of the definition that is in the paper and recommended in the paper.

[Slide.]

MR. KING: Let's talk about what are we going to do. Again, I will mention that we haven't heard from the Commission yet, but we are trying to lay out our plans assuming that they agree with our recommendation. We are trying to finalize our statement of work at this point in time to get some calculations underway.

The whole idea of what we are trying to do is to work backwards from an offsite consequence back to what would come out of the containment building from an accident. We feel there are two basic pieces to that. There's one, what are the radioactive releases we are going to use and how are we going to develop this representative site to do that.

With the radioactive releases we propose to use the source term or release data from the NUREG 1150 plants plus LaSalle. Several reasons for that. One, the data is available and believe that it represents the best state of the art information available on releases. It is available for input into the MACCS code, so that makes it attractive from the time standpoint. We think the 1150 plants plus LaSalle provide a pretty good representative sample of the total population of plants out there. They represent all the containment types, they are large plants, and we figure they cover about 80 percent of the plants that are out there.

So, using those I think is a reasonable choice. Doing the calculations we are not going to pick any one of those as the plant, we are going to use information from all six of them.

For what is this representative site going to be, we plan to coordinate that with the work going on now and looking at updating Part 100, where the staff is developing a proposed rule change to Part 100 to put site parameters in and take out the dose calculation. We would propose that the representative site parameters we use for the large release definition be the same that go into Part 100 in this revision to Part 100. That will deal with things like exclusion area distance, low population zone distance, population density around the plant and so forth.

We will also have to make some other assumptions on the representative site that won't be picked up in the Part 100 update, things that would deal with meteorology, precipitation, emergency planning assumptions and so forth. We would propose to look at those characteristics as they stand now for the 74 sites that are out there and pick some representative value and not a bounding value necessarily that covers everything but something that covers a large percentage of those plants in terms of those other parameters that would factor into the calculation.

[Slide.]

MR. KING: What are we going to do with this information. As I said, we are going to try and work backwards from offsite. What we would plan to do is take each of the source term bins from each of the 1150 plants plus LaSalle and using the MACCS code calculate a series of curves that would look something like this for each plant.

MR. LEWIS: Next time around you should spell effect with an "e" instead of an "a" in there.

MR. KING: Excuse me?

MR. LEWIS: Next time around you should spell effect on the third bullet with an "e" instead of an A.

MR. KING: Okay.

MR. CARROLL: Or, put a six in there.

MR. LEWIS: Or a sic, yes. With a K?

MR. KING: What we would get out of the calculation would be for any given plant you would have a series of curve, one curve for each of the source term bins for that plant, that would be a plot of number of offsite early fatalities versus the conditional frequency of that occurring. The conditional frequency would come out of the meteorology and so forth that the MACCS code calculates.

What we would look for would be where the integral under that curve equals one. In other words, the average value or mean value of when one early offsite fatality is predicted. We probably have curves if the release is large enough, you would be protecting a lot more than one offsite early fatality and some where it is smaller and lot less. We are interested in those that come in right about one. We will do that for the six plants, all using the same representative site characteristics.

Then we want to look for those releases that come in to predict about one offsite early fatality and look at the characteristics of those in terms of what are the fraction and types of isotopes that are being released, what is the timing, is there some common thread among those that we can learn from that would influence the way we would define a large release. If there is no common thread and they are all over the place, I think we would end up having to define the large release in terms of the number of curies or effective curies, or equivalent curies. If there is some common thread among the releases, then we may want to define it differently.

Until we actually run the numbers, we are not going to be able to answer that.

MR. CARROLL: What would be a common thread, for example?

MR. KING: Always have 100 percent of the nobles, 20 percent of the iodine, 20 percent of the cesium. It's always released in one to two hours. I am just speculating, but something like that.

MR. CARROLL: So, it would be an accident?

MR. KING: Yes, these are all accident source terms from accidents or releases from accidents.

MR. WARD: Could I ask you a question? You say you are going to evaluate the extent of land contamination and other effects. Can I ask you a question about that? In the SECY paper, 90-405 I guess it is on page nine you have a section on other considerations.

It refers as a source of typical numbers the Limerick final environmental statement. It says for a release of the order of magnitude of that required for an early fatality -- that is what you are driving at -- these other impacts are about 1,000 latent fatalities, a billion dollars for offsite mitigation measures, and ten square miles of land subject to long term interdiction.

MR. KING: Yes.

MR. WARD: Those are other effects which can certainly be -- I am surprised at the 1,000 latent fatalities. Earlier you said and I have heard before, that the early fatality calculation is usually the more restrictive.

MR. KING: Yes. The 1,000 -- in the FES's they didn't restrict the population to one or ten miles out beyond the plant. They did the calculation out essentially to like 1,000 miles out from the plant. So, there's a lot of people when that 1,000 number is calculated, it is based upon small doses to a lot of people. We are talking millions of people that are getting small doses.

MR. WARD: That sort of thing still shows up in the environmental -- what sort of a number do you have for the -- I take it, it is less than one for latent fatalities for typical cases for the safety goal comparison. I forgot what that definition is.

MR. KING: You mean, would it meet the quantitative health objectives for the --

MR. WARD: Yes.

MR. KING: Yes, it would meet the quantitative health objectives.

MR. WARD: When you make numbers for a particular plant it is true the early fatality number always comes up one before the latent fatality number does.

MR. KING: That is what we found. I don't know if Joe wants to comment on that.

MR. MURPHY: I have never seen a case where it didn't, let's put it that way.

MR. WARD: This 1,000 is just i[illegible]ding those in California and everything --

MR. MURPHY: Yes.

MR. KING: Following up on that, we are going to, besides calculating this magnitude of release, we are going to [illegible] a couple of things as you mentioned, calculate land contamination. We are not exactly sure if we are going to use that at this point, but we do feel that it is a piece of information that is important for the Commission to be aware of when they finally settle in on a large release definition.

The second thing we are going to is, we are going to look at the effect of some different emergency planning assumptions, particularly the evacuation start time and the speed of evacuation. The thought is that probably the large --

MR. SHEWMON: The land contamination would then be site specific because you talk about what would take it out of effective service, or how would you avoid site specificity there?

MR. KING: Land contamination would be based upon this representative site characteristics, the meteorology and so forth associated with that, which we feel covers a fairly broad set of the site characteristics that are out there today.

MR. SHEWMON: But would you state it at a level where they couldn't grow beans anymore or what and sell the beans commercially, or how do you set up a level of contamination, that people couldn't eat picnics there or people couldn't drive through it, or what for contamination level?

MR. KING: You can define it in terms of how far out crops would have to be interdicted, how far out people wouldn't be able to live in there for a certain period of time. There are several different ways to describe it, but I am not exactly sure how we are going to end up doing that at this point, but that kind of thing.

MR. CARROLL: That is an extremely safe dependent thing?

MR. KING: As far as --

MR. CARROLL: Palos Verdes, for example --

MR. KING: If they are not growing crops out it that's true, you don't have to worry about that. Again, it would be based upon this representative site which we feel would cover most of the sites that are out there.

As far as emergency planning variations go, we suspect that early releases from the plant are going to dominate the early offsite fatality. We want to test that through looking at some different emergency planning assumptions and see if that's true. I think that would be one less variable then that we would have to consider in settling in on a final large release definition. So, we are going to do some different set of calculations looking at some different emergency planning assumptions.

The idea is to settle in on a single value when we are all done.

MR. LEWIS: I am beginning to lose track of the logical stream here, so correct me if I say it wrong as I try to put all of this in context. What you are trying to home in on is a particular number of curies or something like that --

MR. KING: Fraction of core inventory.

MR. LEWIS: This whole exercise is to find out what a reasonable number is to suggest to the Commission as a reasonable number of curies.

MR. KING: Yes.

MR. LEWIS: The purpose of the exercise then is to make sure that the number that you propose is consistent in some way with the Commission's other safety goals and quantitative health objectives. Is there any other reason for making these rather elaborate calculations?

Putting it differently, if I were in your shoes, I would invent a number that some multiple of ten, 100 or 1,000 that is defensible in terms of the other objectives and simply propose it to the Commission. You seem to be wanting to do it much more precisely than I would if I were in your shoes, and I think I am missing a logical point somewhere.

MR. KING: If I could just pick a number without doing the calculations I would, but I guess I feel that we need to do some analysis like this to pick a number. I just can't pull one out of the air and suggest it. I don't have an intuitive feel for what that number would be at this point until we go through some calculations.

MR. LEWIS: Since I have interrupted you, the second thing I guess I am also missing is in the paragraph that Ernest was reading earlier from the Commission's instructions to you. They say a conclusion that specifying the frequency as an overall mean value is inherently more conservative than either of the quantitative health effects objectives.

I am not understanding why it is inherently more conservative. In the end it depends on what number you put in. Why is specifying it as a mean value inherently more conservative than the quantitative health objectives? This is related to the other question. I am really not seeing how these things hang together. Does that make sense?

MR. WARD: Yes. Hal, I think it's because we are stuck with the ten to the minus six. If you let it all go and make any sort of credible calculation about how it gets delivered to people as a dose it is going to be less of an effect than the quantitative health effects.

MR. LEWIS: It is going to be less than?

MR. WARD: Yes, less of an effect.

MR. LEWIS: Why does it --

MR. WARD: See, unless you want it back down to ten to the minus seventh --

MR. LEWIS: What it says here is not that the number is inherently more conservative but that specifying the frequency as an overall mean value is inherently more conservative. That's what I don't understand. It seems to say that the technique is inherently more conservative and not the number.

MR. WARD: I don't think so. I think it is inherently more conservative because we are starting with a mandated number of ten to the minus six.

MR. LEWIS: That number which is a probability, has to be combined with an effect before you can speak of consequence.

MR. WARD: Even if you take the worst -- you could make it 100 percent of the core.

MR. LEWIS: I see.

MR. WARD: Dumped out over here with some kind of nasty atmospheric dispersion --

MR. LEWIS: And you are still not doing much damage you are telling me.

MR. WARD: That's what I understand the argument to be.

MR. LEWIS: I suppose that could be. I would have to think about that.

MR. WARD: Let the staff correct me. We have some experts, so go ahead.

MR. MURPHY: I interpret it exactly the way Dr. Ward does. If you have ten to the minus six as the mean value for large release or quantitative health objective when you get quantitative, it comes out five times ten to the minus seven. If I have a large release at ten to the minus six, the quantitative health objective is only a factor of two away from it but I will pick up something approaching a factor of ten or more from Winrose considerations alone.

The ten to the minus six for a large release is inherently more conservative than the five times ten to the minus seven for the early fatality limit that comes out of a tenth of a percent calculation.

MR. LEWIS: I am having trouble with my mathematics. I would have thought that quantitative health objective that is equivalent to five times ten to the minus seven large release is more conservative than a ten to the minus six probability for large release.

MR. MURPHY: What I am saying is if I set at ten to the minus six and say what would it then take to get to an early fatality number, I would get a number lower than five times ten to the minus seven just from Winrose considerations.

MR. LEWIS: I have to believe you.

MR. KING: Let me just wrap this up. Our schedule is that we hope to start this month --

MR. TAYLOR: I am not sure whether I am adding more context or more confusion here. Back a few years ago when I was involved a little more actively with safety goals, we found that an SST-1 which characterizes conservatively -- envelopes a whole host of the most severe reactor accidents and releases --would achieve the 0.1 percent goals. Inherently if you set that release magnitude, that enveloping one, one order of magnitude more conservative than a ten to the minus five that would meet the .1, you inherently have more conservatism. It's an up-front frequency.

[Slide.]

MR. KING: Our schedule for doing this work is to start this month in getting a statement of work out and get people set up and the calculations underway. We hope to have those complete in about four months, in June. We would plan to develop a NUREG to document all of this work and support the recommended definition of a large release. We hope to have that done around September.

We plan to come back to the Committee, we estimate now in October, and provide you that NUREG in advance and come back and present the results and our recommendations. We hope to have something to the Commission toward the end of the year, we are projecting November right now. That's our best estimate of the schedule for where we are going.

[Slide.]

MR. KING: The only other thing I wanted to mention is how this is going to be used. In parallel with our work that we just talked about, doing these calculations, the staff is looking at how to use the large release as part of a broader look at how to implement safety goal considerations into the development of regulations and other regulatory actions.

There was a Steering Group set up last month by Eric Beckjord -- as I understand you have a copy of the letter that set that up -- to take a look not only at the large release but the whole safety goal question, as to how we are going to use that and implement that into the regulatory process. As I understand it, their schedule is shooting for about two months to have an interim position developed as to how that would work.

We plan to interact with that. I talked to Jack

Heltemes who is the head of that Steering Group, and we plan to interact with them on the work we are doing. What comes out of that may have some influence on ultimately where we end up. We will be interacting with them as this goes on.

With that, unless you have any questions, that is where we stand.

MR. KERR: From what I have just heard Mr. Taylor say, are you likely to conclude after doing the calculation that you propose to do that the large release is likely to be bigger than the amount of fission products that are contained in the reactor after having been operated at full power for some significant length of time?

MR. KING: We estimated in the paper based upon the Sequoyah analysis that was done for 1150, just to give a rough idea of the magnitude of a large release, and it was like 100 percent of the nobles, 20 percent of the iodine and 20 percent of the cesium and one percent of the other stuff, just to give people a ball park idea of what that is.

Sequoyah is a fairly large plant --

MR. KERR: It won't turn out to be more than the amount of fission products in the core.

MR. KING: I guess it's conceivable, if you had some small plant out there, that they could release a larger fraction of their core inventory than Sequoyah. I haven't done the math but it would be fairly easy to do.

MR. LEWIS: I am really quite confused. Is that contradictory to what Dave said earlier?

MR. WARD: No.

MR. LEWIS: It isn't?

MR. WARD: It is the same thing.

MR. LEWIS: It takes the whole core at ten to the minus six.

MR. KING: No.

MR. LEWIS: That is what everyone seems to be telling me.

MR. KING: No. That is not true. For Sequoyah it takes 20 percent -- approximately 20 percent of the iodine and cesium and 100 percent of the nobles. If you had a plant smaller than Sequoyah, if you are expressing it in terms of fraction of the core inventory, that fraction would be higher.

MR. LEWIS: For a full size thing like Sequoyah, then it is --

MR. KERR: Some of the earlier plants that are down by a factor of two or three from Sequoyah --

MR. LEWIS: What is bothering me is that everyone seems bothered because that seems to be consistent -- it seems to all hang together that if you put in a number of curies which is comparable with -- I don't care about factors of three or four -- comparable with the inventory of the plant and combine it with ten to the minus six and you are consistent with the quantitative health objectives, and we can all go home. Why is that all wrong?

MR. KERR: My question was not to imply that I thought it was wrong. I just wanted to see if I understood what I was hearing.

MR. LEWIS: I know, and you were helping me understand.

MR. SHEWMON: Tom, in the numbers that you just estimated for Sequoyah, you said you remembered -- was this sort of one hour after the rods went in or one day? It must make some difference.

MR. KING: The release, as I recall from Sequoyah that dominated the large release, were all early releases. You remember what the accidents were -- were they containment bypass events or something -- it happened early.

MR. MURPHY: It was early containment failure type things which would mean the release occurred two to three hours after the time core damage started.

MR. WARD: Tom, you mentioned that I guess Mr. Beckjord has formed the safety goal steering group -- interoffice Safety Goal Steering Group, and you have a couple of memos setting that up in this little package here that Dave passed out. I would like to read to you one point which I am really glad to hear this. This is a memo from Tom

Murley to Jack Heltemes, where Tom is nominating the NRR representative for it.

One of the comments that he makes is that in the spirit of the Commission's guidance -- whoever wrote this for Tom -- in the spirit of the Commission's guidance, we could give the safety goal a more prominent role in our evaluation of generic safety issues. I believe our staff's continue to spend a great deal of time and effort on issues that are of very low safety significance.

That is the Committee's interest, in getting a safety goal out there to help deal with that sort of thing. I think we ought to be interested in following up on how the work of the Steering Group develops. That is not the business of Tom King here today, but I think it should be of interest to the Committee. They are supposed to come up with something in a couple of months, so I guess we will be asking to hear about that.

Are there any other questions? Tom said that they aren't asking for a letter from us now. I don't think it is necessary that we write a letter, unless we think they are going off in a wrong direction with this. We would like to advise them of that and perhaps how we think they ought to go. My personal view is that I think they are going in the right direction.

MR. LEWIS: I agree, Dave. I have no problem with that, but I look forward with anticipation to find out how many curies they come up with.

MR. WARD: Yes. That is going to be some months from now I think.

MR. LEWIS: That is really, if there is any battle, that's when it will be joined.

MR. WYLIE: Do you think, Hal, that they are headed in the right direction to arrive at the number of curies that they come up with?

MR. LEWIS: I guess I have already expressed myself. I think they are working too hard.

MR. CARROLL: Work smarter, not harder.

MR. WARD: I guess you suggested to Tom that you could just cook up a number and tell the Commission this is what we propose, but the problem is that the Commission would come back to him and ask for some justification.

MR. LEWIS: Oh, I know.

MR. WARD: He is trying to develop that in advance, I think.

MR. LEWIS: I know that, and I think there is probably something in between. People have been giving estimates more or less off the tops of their heads involving the whole inventory of a particular plant and that sort of thing.

MR. WARD: Yes.

MR. LEWIS: That sort of argument -- bear in mind, this doesn't have to be precise within 20 percent. I think it would probably do the job, but if they want to work hard I won't discourage them from working hard.

MR. KERR: There is one part of the task that the Commission gave to the staff which has not been mentioned but which we did discuss briefly in the Subcommittee meeting. The Commission not only asked for this recipe but asked how they would use it. If I remember what Mr. King said earlier, they are going to try to decide how they would use it after they have developed it.

Again, I don't know whether we ought to comment on that approach or not, but it is apparently --

MR. KING: I don't think that is quite correct.

MR. KERR: Please correct me.

MR. KING: For the next couple of months the two efforts will be going on in parallel, but the Steering group should have an interim position on how to use this long before we arrive at the number.

MR. KERR: So, it's the Steering Committee's job to come up with how it is to be used.

MR. LEWIS: That is going to be much harder, of course. It is easy to buy a tennis racket but hard to learn to use it.

MR. KERR: Well, it seems to me that in order that the Steering Committee know how to use it they have some idea of what it is to be. Maybe having told them what you have told them, at least they can guess what it will be and, hence, how to use it possibly.

MR. KING: We certainly have a ball park number that we estimated for Sequoyah in the 1150 work. So, at this point, at least it is not -- we have a general idea of the size that we are talking about.

MR. WILKINS: Let me follow on Hal's analogy. At least you know it's a tennis racket, it's not a baseball bat.

MR. LEWIS: No, but if you get involved with LaCrosse and these other things you can get mixed up.

MR. WARD: Are there any other questions for Mr. King or any of the rest of the staff?

[No response.]

MR. WARD: Thank you very much, Tom. We appreciate your coming down. Don't look for a letter. We have finished well ahead of schedule. Our next item is a break, and I don't think we need to take that. The next is preparation of ACRS reports. Do we have any reports that are ready? We could start -- we want to get back to the -- we can go off the record at this point.

[Whereupon, at 2:30 p.m., the transcribed portion of the meeting concluded.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission

in the matter of:

NAME OF PROCEEDING: 370th ACRS Meeting

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Mary C. Larkin

Official Reporter
Ann Riley & Associates, Ltd.

RES STAFF PRESENTATION

SAFETY GOAL

LARGE RELEASE DEFINITION

ACRS FULL COMMITTEE MEETING

FEBRUARY 8, 1991

TOM KING (X23980)

PURPOSE OF BRIEFING

- o TO RESPOND TO AN ACRS REQUEST FOR A STATUS REPORT ON THE STAFF'S EFFORTS TO DEFINE A LARGE RELEASE, AS DESCRIBED IN SECY-90-405.

- o STAFF IS NOT REQUESTING A LETTER AT THIS TIME.

BACKGROUND

- IN THE 1986 SAFETY GOAL POLICY STATEMENT, THE COMMISSION PROPOSED A GENERAL PERFORMANCE GUIDELINE FOR FURTHER STAFF EXAMINATION:

  "CONSISTENT WITH THE TRADITIONAL DEFENSE-IN-DEPTH APPROACH AND ACCIDENT MITIGATION PHILOSOPHY REQUIRING RELIABLE PERFORMANCE OF CONTAINMENT SYSTEMS, THE OVERALL MEAN FREQUENCY OF A LARGE RELEASE OF RADIOACTIVE MATERIALS TO THE ENVIRONMENT FROM A REACTOR ACCIDENT SHOULD BE LESS THAN 1 IN 1,000,000 PER YEAR OF REACTOR OPERATION."

- ACRS HAD PROPOSED A 5 LEVEL SAFETY GOAL HIERARCHY:

  LEVEL 1 - QUALITATIVE SAFETY GOALS

  LEVEL 2 - QUANTITATIVE HEALTH OBJECTIVES

  LEVEL 3 - LARGE RELEASE GUIDELINE

  LEVEL 4 - PERFORMANCE OBJECTIVES

  LEVEL 5 - REGULATIONS AND REGULATORY PRACTICES

OPTIONS FOR LR DISCUSSED IN SECY-89-102

- RECOMMENDED OPTION:

  RELEASE THAT WOULD HAVE THE POTENTIAL FOR CAUSING ONE OR MORE OFFSITE EARLY FATALITIES.

- OTHER OPTIONS DISCUSSED IN ENCLOSURE 1 TO SECY-89-102.

  - OFFSITE HEALTH EFFECTS:

    COLLECTION OF ALL RELEASES THAT WOULD RESULT IN ONE OR MORE EARLY FATALITIES.

  - OFFSITE DOSE:

    EXPOSURE TO ANY OFFSITE INDIVIDUAL RESULTING IN A DOSE OF X REM OR MORE.

  - MAGNITUDE OF RELEASE:

    ALL THE NOBLE GASES, AND X% OR MORE OF ANY OF THE OTHER SOURCE TERM ELEMENT GROUPS.

  - CONTAINMENT FAILURE MODES:

    ANY RELEASE FROM AN EVENT INVOLVING SEVERE CORE DAMAGE, PRIMARY SYSTEM PRESSURE BOUNDARY FAILURE, AND EARLY CONTAINMENT FAILURE.

PREVIOUS ACRS COMMENTS ON "LARGE RELEASE" DEFINITION (FROM FEB. 16, 1989 ACRS LETTER):

- o IT SHOULD REPRESENT A LEVEL OF SAFETY CONSISTENT WITH THE QUALITATIVE GOALS AND QUANTITATIVE HEALTH OBJECTIVES
- o IT SHOULD BE IN TERMS OF THE RELEASE ITSELF, E.G., CURIES, LEAK OR RELEASE RATE, FRACTION OF THE CORE, OR CONTAINMENT INVENTORY
- o IT SHOULD BE INDEPENDENT OF THE SITE CHARACTERISTICS
- o IT SHOULD PROVIDE SOME CRITERIA AGAINST WHICH THE DESIGN OR PERFORMANCE OF CONTAINMENTS CAN BE TESTED

COMMISSION GUIDANCE TO THE STAFF

- o COMMISSION REJECTED STAFF PROPOSED DEFINITION IN A JUNE 15, 1990 SRM:
  - LARGE RELEASE SHOULD BE SITE INDEPENDENT
  - LARGE RELEASE SHOULD FOCUS ON ACCIDENTAL RELEASES
  - ACKNOWLEDGED THAT LR GUIDELINE MAY BE AN ORDER OF MAGNITUDE MORE CONSERVATIVE THAN QHOs
  - STAFF SHOULD ADVISE THE COMMISSION ON LR DEVELOPMENT AND USE, INCLUDING A PROPOSED NEW DEFINITION
- o ADDITIONAL LR DEFINITION OPTIONS WERE THEN SUBSEQUENTLY CONSIDERED AND DISCUSSED IN SECY-90-405, DATED 12/14/90

OPTIO[illegible]

QUALITATIVE STATEMENT ON EARLY CONTAINMENT FAILURE:

A LARGE RELEASE IS ANY RELEASE FROM AN EVENT INVOLVING SEVERE CORE DAMAGE, REACTOR COOLANT SYSTEM PRESSURE BOUNDARY FAILURE, AND EARLY FAILURE OR SIGNIFICANT BYPASS OF CONTAINMENT.

DISCUSSION:

- **DOES NOT REQUIRE DETAILED FISSION PRODUCT RELEASE CALCULATIONS**
- **INDEPENDENT OF SITE CHARACTERISTICS**
- **LIMITED IN APPLICATION TO REACTORS HAVING CONVENTIONAL CONTAINMENTS**
- **DIFFICULT TO DEFINE KEY TERMS, e.g., "EARLY CONTAINMENT FAILURE" AND "SIGNIFICANT BYPASS."**

OPTION 2 (Recommended by Staff)

MAGNITUDE OF RELEASE

"A LARGE RELEASE IS A RELEASE OF RADIOACTIVITY FROM THE CONTAINMENT TO THE ENVIRONMENT OF A MAGNITUDE EQUAL TO OR GREATER THAT: (AN AMOUNT, TO BE DETERMINED BY THE STAFF, EXPRESSED IN CURIES OR FRACTION OF THE CORE INVENTORY, WHICH HAS THE POTENTIAL, BASED ON REPRESENTATIVE SITE CHARACTERISTICS, FOR CAUSING ONE OR MORE OFFSITE EARLY FATALITIES.)"

DISCUSSION:

- o TIES THE RELEASE DEFINITION TO AN OFFSITE CONSEQUENCE WHICH IN CONCEPT IS EASILY UNDERSTOOD BY THE PUBLIC
- o INDEPENDENT OF PLANT OR SITE CHARACTERISTICS
- o NO PLANT SPECIFIC LEVEL III PRA REQUIRED
- o USE OF "EQUIVALENT CURIES" COULD EXTEND THE APPLICATION OF THIS OPTION TO ADVANCED REACTORS WHICH WILL HAVE DIFFERENT RADIONUCLIDES IN THE RELEASE
- o REPRESENTATIVE SITE NEEDS TO BE DEFINED

OPTION 3 (Not discussed in SECY-90-405)

OFFSITE DOSE

A LARGE RELEASE IS ONE WHICH CAUSES A DOSE OF (250-450) REM TO AN INDIVIDUAL LOCATED AT THE EXCLUSION AREA BOUNDARY.
DISCUSSION:

- o DOSE SELECTED BASED ON OFFSITE FATALITY CONSIDERATIONS

- o NO NEED TO CONSIDER OFFSITE PARAMETERS (E.G., POPULATION DENSITY OR EVACUATION EFFECTIVENESS)

- o SIMILAR IN NATURE TO THE FENCEPOST DOSE USED IN CURRENT LICENSING ACTIVITIES (E.G., ASSUMES GROUND LEVEL RELEASE, WIND IN ONE DIRECTION, ETC.)

- o MORE THAN AN ORDER OF MAGNITUDE CONSERVATIVE THAN A PROBABILISTIC BASED APPROACH (E.G., CRAC OR MACCS).

- o A SINGLE VALUE COULD BE CALCULATED USING REPRESENTATIVE SITE CHARACTERISTICS.

COMPARISON OF LARGE RELEASE DEFINITIONS

GUIDELINES FOR SUBSIDIARY OBJECTIVES IN SECY-89-102	DEFINITION SECY-89-102	DEFINITION-EARLY CONTAINMENT FAILURE	DEFINITION-MAG. OF RELEASE	DEFINITION OFFSITE DOSE
1) SHOULD BE CONSISTENT WITH LEVEL ABOVE	YES	YES	YES	YES
2) SHOULD NOT BE MORE CONSERVATIVE SUCH THAT IT IS A NEW POLICY	YES	YES	YES	NO
3) SHOULD BE A SIMPLIFICATION OF PREVIOUS LEVEL	YES	NO	YES	YES
4) SHOULD PROVIDE A BASIS FOR ASSURING QHOs ARE MET	YES	YES	YES	YES
5) SHOULD HAVE BROAD GENERIC APPLICABILITY	YES	NO	YES	YES
6) SHOULD BE UNDERSTANDABLE TO PUBLIC	YES	YES	YES	YES
7) SHOULD COMPORT WITH CURRENT PRA PRACTICE	YES	YES	YES	NO

APPROACH TO DEVELOPMENT OF LR DEFINITION

RADIOACTIVE RELEASE:

USE NUREG/1150 PLANTS PLUS LASALLE FOR CALCULATIONS:

- o **CONSIDER THESE PLANTS TO BE "REPRESENTATIVE" OF U.S. PLANTS ACTING AS SURROGATES FOR ALL OTHERS**
- o **DO NOT SELECT ANY ONE AS BEING TYPICAL**
- o **DATA AVAILABLE FOR MACCS AND RELEASE CALCULATIONS**

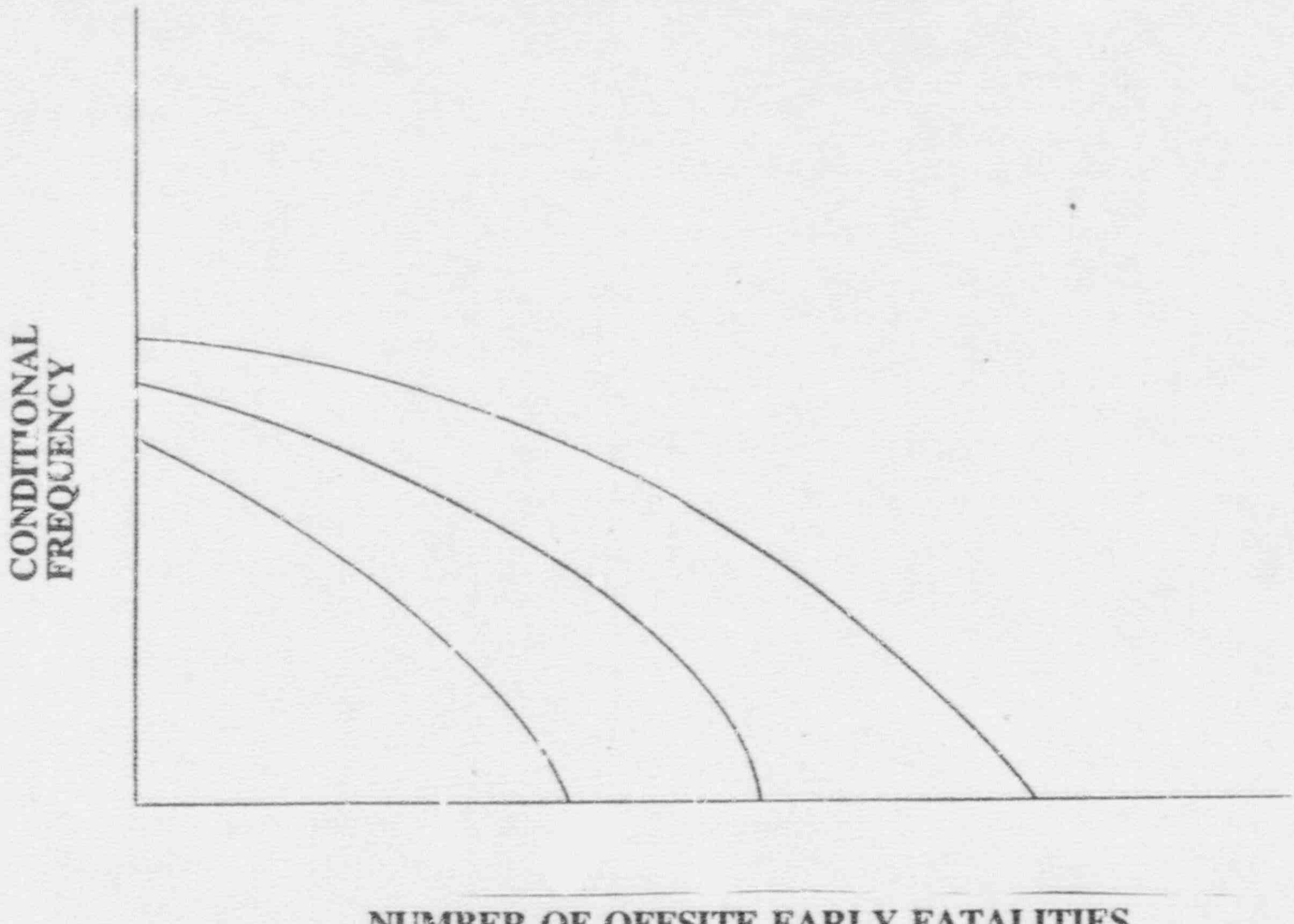
DEVELOPMENT OF REPRESENTATIVE SITE

- o **COORDINATE WITH PART 100 UPDATE**
- o **REPRESENTATIVE SITE CHARACTERISTICS TO BE THE SAME AS WHAT IS SELECTED FOR PART 100 UPDATE PLUS ADDITIONAL ASSUMPTIONS ON OTHER FACTORS, SUCH AS PRECIPITATION, EP, METEOROLOGY.**

LARGE RELEASE MAGNITUDE DETERMINATION

- USE 1150 PLANTS AND LASALLE RELEASE DATA AND MACCS TO DETERMINE RELEASES APPROXIMATING 1 EARLY FATALITY AT THE REPRESENTATIVE SITE
- EVALUATE MAGNITUDE. TIMING, AND COMPOSITION OF CANDIDATE RELEASES
- WILL EVALUATE AFFECT OF DIFFERENT EP ASSUMPTIONS (EVACUATION START TIME AND SPEED)
- WILL CALCULATE EXTENT OF LAND CONTAMINATION
- SELECT A SINGLE VALUE

MACCS CA[illegible]CULATION



SCHEDULE

- START CALCULATIONS - 2/91
- CALCULATIONS COMPLETE - 6/91
- DRAFT NUREG - 9/91
- ACRS/CRGR - 10/91
- TO COMMISSION - 1[illegible]/91

USE OF LARGE RELEASE DEFINITION

- STEERING GROUP ESTABLISHED IN JANUARY 91 TO DETERMINE HOW TO INCORPORATE SAFETY GOAL CONSIDERATIONS INTO THE DEVELOPMENT OF REGULATIONS AND OTHER REGULATORY ACTIONS

- INTERIM POSITION FOR TRIAL USE BY APRIL 91