UNITED STATES OF AMERICA
MEETING OF THE

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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STAFF STATUS REPORT RE

HYDROGEN CONTROL AT SEQUOYAH

Saturday, November 8, 1980

Washington, D. C.

The meeting came to order, pursuant to notice, at 11:10 a.m., where were present:

ACRS MEMBERS PRESENT:

M. PLESSET, Chairman
J. C. MARK
C. SIESS
S. LAWROSKOI
M. BENDER
D. MOELLER
W. KERR
M. CARBON
D. WARD
W. MATHIS
J. RAY

DESIGNATED FEDERAL EMPLOYEE:

R. FRALEY, Executive Director

ALSO PRESENT:

J. M. JACOBS, Secretary

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MR. PLESSET: Now we are going to have a little interruption in the second half of writing letters to get a discussion on Sequoyah Nuclear Plant. Mr. Stahle is kind enough to come down here on Saturday, and we certainly appreciate it. We would like to be able to let him get back to his weekend activities as soon as possible.

Carson, do you want to introduce the people?

MR. MARK: I think, as you remember, Sequoyah, which has its license, was early in the business of starting a test exercise on igniters for igniting hydrogen in vessels, presumably in containment vessels. We had not heard very much. But the first observations they had been able to make, at the same time the staff was working on a program in support or in parallel at Livermore. I am not sure, there may or may not be some work also under the staff's guidance at Sandia, either being or planned.

And along with all that, there is the terms of the license that Sequoyah has that, by January 31st, they have to have demonstrated to the staff something -- it was not too clear what -- and that they have adequate safety margins. And I think it is of interest to the Committee, some of us on the Subcommittee in particular, just to get as much of a warning as possible as to how that program is going and what it is, if it is going to be available or needed come January 31.

So to the extent that is what you can tell us, it would help. Thank you very much.

MR. STAHLE: My name is Carl Stahle. I am the NRC project manager for the Sequoyah plant. This morning I will provide a brief status report of the work going on on hydrogen control measures for Sequoyah.

I would like to start basically where we left off in September. As you recall, September the 8th you did provide us a letter. First and foremost, you reiterated the conclusion that you had made in July that we could license Sequoyah for full power license.

Secondly, you did mention in the September letter that it would be prudent to provide additional hydrogen control measures and studies ought to be continued and intensively carried out.

You further indicated that we should demonstrate -- and I shall read here, to put this in perspective: The effectiveness of candidate measures should be pursued effectively on a time scale that would permit their application for more than a few additional reactor years of operation of an ice condenser plant."

A week after the letter was received we met with the Commissioners and they did approve the licensing of Sequoyah for full power operations. However, there were stipulated three licensing conditions. I regard these as a

mandate from the Commissioners, and therefore it set the stage for the program we are embarking on.

Because of its importance, let me again read the license conditions, and this is the basis for proceeding:

"First, by January 31, 1981, TVA shall do testing and analysis to show to the satisfaction of the NRC staff that an interim hydrogen control system will provide with reasonable assurance protection against breach of containment in the event that a substantial quantity of hydrogen is generated."

The second condition: "For operation of the facility beyond January 31, 1982, the Commission must confirm that an adequate hydrogen control system for the plant is installed, and it will perform its intended functioning in a manner that provides adequate safety margins."

The third, more administrative in nature, but: "During the period of operation, TVA shall continue a research program on hydrogen control measures and the effects of hydrogen burns on safety functions, and shall submit to the NRC quarterly reports on the research programs."

That is the charter we began with when we licensed Sequoyah for full power operations on September 17, 1980. My purpose today is to provide you with an outline of the

programs that are under way for meeting our first goal. Later on we will describe at subsequent meetings our full-term program to meet our second license objective.

Secondly, today I do not intend to give you a detailed discussion of the results, principally because it is premature to do so. What I shall do is briefly provide a scoping of the efforts that are under way. Secondly, I shall provide you a schedule here of extreme importance, and principally I will identify the roles of the various people, organizations and people who are involved here. The idea of the schedule is to make you aware of the extensive work that is under way.

Additionally and most important today, I will make the Committee aware that it should plan for its participation in this effort.

Now, at this point I would like to state that we believe, in view of the mandate we have from the Commissioners and the intensive interest that has been expressed in this area, we will ask for your continued participation in this matter. And secondly, we will be requesting a letter from you on the results of this program, the first phase, which must be completed no later than January 31, 1981.

You will see the schedule mandated again. One must be completed by January 31. Utilizing that as the very

end date, we anticipate that we will have an SER on this matter, phase one, to be completed in mid-December. We will be requesting a meeting on the 1st of January, the first week of January, 1981, to assist us in this matter.

Secondly, we anticipate to go before the Commissioners again some time in the middle of January to present our findings and recommendations on the use of the interim distributor ignition system.

Now, at this point in time the system is installed and operable. But the NRC has not authorized its use. And its use is pending the results of this first phase of efforts that is under way.

Now, let me take you to phase one effort here.

(Slide.)

The first listing I have here is the industry programs being carried out. Phase one, called the Fenwal phase one, these tests, were completed September 22. The purpose of these tests is to determine if the igniter would burn hydrogen in hydrogen concentrations of between 8 to 12 percent for various environmental conditions of pressure, temperature, air flow across igniter, and humidity, and to demonstrate the igniter durability.

The Applicant stated -- and I think we agree at this point -- that the pressure, temperature, humidity and air flow across the igniter have little effect on the

ability of the igniter to perform.

The first effort on phase one was encouraging, and it is sufficient to proceed now to the more intensive effort, which is now called phase two scheduled. As noted in this chart, completion is expected on or about the 24th. It is an extremely ambitious schedule.

Some of the material may not be fully completed, as you will see as we get into the work. The way of defining the tests here obviously is an extension of phase one. What our intent here is in phase two is, one, to establish the lowest hydrogen concentration at which the igniter would initiate burning; much more detailed, of course, than we have been able to accumulate in the first phase; determine the igniter's ability to function in a spray environment; three, confirm the multiple burns due to continuous addition of hydrogen; and, fourth and most important is to measure the effect of hydrogen burns on representative samples of material and equipment inside of containment.

Now, this last item mentioned is under intensive investigation both by TVA and the staff, recognizing its importance here to assure ourselves there are no adverse effects from hydrogen burns inside of containment. And so the Applicant and ourselves are going through detailed analyses of lists of equipment necessary for operation of

the plant.

Materials at this point have already been inserted in the chambers, looking at tables, some switch-coating materials. And from this we hope to determine, if necessary, what equipment may have to be hardened against any hydrogen burn. Again, this matter is under review. Nothing more can be said at this point in time other than to recognize its importance and that we must have a reasonable assurance that there are no adverse effects prior to its use in January.

MR. MARK: Just to get a feeling here, they have a tank, a fair size, I believe. It does not matter, the exact size. It is not a containment, but it is an experimental tank with gauges and so forth. How long does it take them to get one data point?

Let's pretend that you have told them, we want you to feed in hydrogen at some rate and store it, and run the igniters and find out at what concentration it burns and how much is burned, and now do that over again when you put in the same amount of steam as hydrogen. How long to get the first data point, then the second data point, that is going to give a feeling how much they are going to know by November 24th, which is exactly 11 days off?

Can they do this before lunch and again before tea time, or does it take until Thursday when they start on

Monday?

MR. STAHLE: I will have Dr. Butler respond to that. He has been intimately involved in the test program.

MR. BUTLER: It is my understanding they can run between two and four tests a day, depending on the parameters that are being changed.

MR. MARK: Things of the sort I mentioned, they could do a couple of those a day?

MR. BUTLER: Yes.

MR. MARK: Okay. They will have a chance, then, to really get quite a spectrum examined.

MR. STAHLE: I think they will be. We feel reasonably assured there will be a substantial amount of data accumulated for such an analysis, certainly by the completion of this period.

MR. LAWROSKI: Can you refresh my memory with respect to the composition that would have been included in the phase one if they found postulated hydrogen, steam and oxygen composition?

MR. BUTLER: I do not recall the particular steam content that Fenwal tests were going to be conducted at. But at Livermore in that vessel we were testing up to about 35 percent by volume steam, with hydrogen up to 12 percent by volume. I expect Fenwal is on the same order.

MR. PLESSET: Are they going to measure pressures

generated?

MR. BUTLER: Yes, they will.

MR. PLESSET: And they will get into detonations?

MR. BUTLER: I think they plan not to intentionally test for detonable mixtures.

MR. PLESSET: I wonder why not.

MR. MARK: It takes two months to get the safety evaluation report experimental apparatus.

(Laughter.)

MR. PLESSET: Is that supposed to be a reason?

MR. MARK: Sandia is proposing to do something. They are going to get a steel tank, bury it, and then do some detonations in it after they are sure that everybody is standing back far enough.

MR. PLESSET: What are they afraid of?

MR. MARK: Regulations.

(Laughter.)

MR. PLESSET: Okay. Go ahead, Mr. Stahle.

MR. STAHLE: All right. The second item, of course, the halon systems and studies here are the backup to the interim distributor ignition system. This work will be completed by January 1, obviously a late date, but nevertheless the results we anticipate having earlier than that.

MR. MOELLER: Could you expand on that, please? I

do not understand what the halon system study -- what is the objective or the goal? It is to put out the fire or --

MR. BUTLER: No. The objective is to assess the feasibility of using halon as a mitigative measure where, when you detect substantial amount of hydrogen and before any combustion of that hydrogen, you quickly inject the necessary concentration of halon to prevent any combustion. It is an inerting mechanism.

MR. MOELLER: And the igniters would not be on at this time?

MR. BUTLER: It would be a separate -- of course, if the igniters were proven unacceptable for whatever reason, then we would have to go to a backup mitigation system.

MR. MOELLER: Thank you. That explains it.

MR. MARK: It is an idea in which you inert the atmosphere on the spot with the thing that is more effective than getting the oxygen out quicker.

MR. MOELLER: Okay.

MR. PLESSET: Do you have any idea of the lifetime of the igniters? How long will they last? Will they find that out?

MR. BUTLER: They do intend to run the igniters for extended periods. But whether they can define the ultimate number of hours or not, I do not know if they

intend to carry it that far. But I think they will have information that will make them comfortable that the igniters can stay on for at least a month without adverse damage.

MR. PLESSET: Fine.

Steve, did you have a comment?

MR. LAWROSKI: On your point, if they don't have the kind of data that you were asking about, then the people should have some schedule of getting it or replacing the igniters at some predetermined point.

MR. FRALEY: This is once they get turned on during the accident. I don't think replacement is feasible. It is a matter of how long they last once you turn them on.

MR. LAWROSKI: They won't turn them on until --

MR FRALEY: That is right, until the accident.

MR. PLESSET: I think the question is a little broader. There might be alternate types of igniters that could last indefinitely. Is that being considered in the longer term?

MR. BUTLER: Well, the TVA and the ice condenser owners group, they do have a program to study alternative igniters. Also, EPRI has a contract with Rocketdyne to study alternative igniters, including spark igniters.

MR. PLESSET: Okay. We've interrupted you too

many times.

MR. STAHLE: That's fine. The last item identified is EPRI. We understand they are planning or proposing these four studies. The information at this point is somewhat sketchy. Its impact or use for the first phase, I think we do not feel will be considered or will be useful. But for the long term the program itself certainly by 1982, this data may, in addition to what we are doing, be useful.

It is an identification of what is involved in industry and a recognition that this program is a very intensive, broad-based type of program on the whole hydrogen control measures.

(Slide.)

The second slide here is a continuation. As mentioned before, the Lawrence Livermore National Lab here is working on a program that is complimentary to the TVA program, in that they are testing igniters like TVA and planning a spectrum of tests in the varying percentage of hydrogen, steam, and so forth.

In addition, I understand at this point their objective is also to look at current hydrogen analyzers in the plants.

The second -- third item on the chart here, the Sandia study of course is self-explanatory, an overall study

related to the halon, interim distributor ignition system, water fogging, all possibilities to hydrogen control or mitigation systems.

The last item identified here on this chart is the Zion. Indian Point studies, of course, originally began back in January 1980 and continuing on. Three parts of work presently under way will be of use to us in incorporating into our own evaluations.

(Slide.)

I put this schedule -- this schedule has been drawn up and illustrates two things I wish to point out to you, namely the number of participants, of course, involved in this program: TVA, Livermore, Sandia, as well as six branches of NRC that will be actively involved in this program.

The second point that this schedule shows is mainly the very ambitious type schedule which we are dealing with. You will recall that we do still have a mandate from the Commissioners that all of this be done no later than January 31, and therefore the schedule has been drawn together and all of this data we hope to be completed, most of it to be in by the 1st of December.

On the right-hand part of the schedule it shows additional Fenwal, additional Lawrence Livermore work, additional TVA submittals. This is in anticipation that

testing work will probably still be going on, particularly in the area of survivability of critical components and materials. We factored that in at the last moment, and we will make this material available to you as well as the Commissioners. We simply identified that on a schedule chart to recognize the fact of, again of the work and the tightness of the schedule.

Six branches are identified. The most important branch was the fact that that is my branch. The involvement here is all of this material will need to be put together and form a safety evaluation report.

Last but not least, findings and recommendations that we provide to the director and of course to the Commissioners at that time.

MR. MATHIS: So far on the results to date, have you had any surprises?

MR. STAHLE: The Applicant provided me some information on phase two, all of which seems to be quite encouraging. I could briefly go over this if you wish. But to my knowledge -- and maybe I could check with Walt Butler -- have there been any surprises in the program that you are aware of?

MR. BUTLER: No.

MR. MATHIS: Fine.

MR. MOELLER: Let me ask, if I may, supposing --

hey are going to need a hydrogen analyzer which acts on line and warns them, you have two percent hydrogen in there, or some -- I'll pick a number. That doesn't mean they are required. That will presumably be one of the things that will have to be in place before January 31. They know they have hydrogen.

And then they will have tested with the igniters to show that, we usually ignite at whatever you like, 6 percent, we are absolutely sure we will ignite before 8, or words to that effect.

Is that then going to meet the kind of requirements that will have to be met in January, that kind of information?

MR. BUTLER: I am not sure I heard the very first part of your question.

MR. MARK: Since they don't turn on the igniters until they think they are having hydrogen, they must have a hydrogen analyzer, I suppose.

MR. LAWROSKI: I thought they might turn on the igniter even before they suspect hydrogen, if there is some --

MR. BUTLER: Their procedures call for turning on the igniters as soon as they have a genuine LOCA on their hands.

MR. MARK: Okay.

MR. STAHLE: It is a safety injection signal that would be the basis for turning on the igniters, not necessarily --

MR. MARK: Very good.

MR. STAHLE: This matter has still not been fully resolved.

MR. MARK: It is a packet of that kind that is expected to cover the needs of the current phase?

MR. BUTLER: I'm not -- would you repeat that, please?

MR. MARK: They have experience that says we almost always ignite at 6 percent, and we are absolutely sure we ignite before 8. They have enough experimental data to have established that. That was what you wanted?

MR. BUTLER: That is correct. We have some concerns about the degree of mixing, the distributions, about the effect of sprays on cooling the igniters. These things we have to -- we have to determine the effects of these things as part of the task. And when we satisfy our concerns in that regard, we then conclude our review.

MR. PLESSET: I think Bill, Dade and Steve.

MR KERR: What happens if you don't meet the schedule?

MR. BUTLER: Well, it depends on which schedule. You are talking about the January 31 date?

MR. STAHLE: I think at this point we have not crossed that bridge. The mandate is -- circumstances may require us to request some relief of that date, and therefore we would go back to the Commission possibly for the basis of why we need relief on this date. There is a date targeted, a degree of arbitrariness in that, in the sense we feel the plant can still operate without the interim distributor ignition systems.

But at this point, and from Project Management's point of view, we regard that as a mandate and we will meet it.

MR. BUTLER: It depends on why we don't meet the schedule. For example, if we find unacceptable results, I think you have to wait until you get to that point and find out why you are missing the schedule. Is it simply because reports cannot be published in time? I think then the consideration of relief might be appropriate.

MR. PLESSET: If things look very black, I think there will be some motion upstairs to ask that the license be suspended.

MR. STAHLE: There is the element of adequacy of our evaluation.

MR. PLESSET: It seems to me it looks quite hopeful right now, as I expected before the start of the tests, I must say.

MR KERR: And it was your view that hydrogen and a suitable mixture of oxygen could be ignited.

MR. PLESSET: Yes, that was my position, Dr. Kerr.

MR. STAHLE: I have seen, and the Applicant feels very confident at this point, the data he has to date. He is very encouraged that the igniters are reliable, will work, and so everything is -- again, I emphasize, probably the most difficult area is the question of survivability of equipment. They are working very hard on that, because that is a very difficult area, very difficult.

MR. PLESSET: Dade and then Steve.

MR. MOELLER: I note, and you have just shown us on those charts, that Lawrence Livermore, Sandia, and TVA are involved. What about the utility that operates D.C. Cook; aren't they involved?

MR. STAHLE: They are part of the owners group here.

MR. MOELLER: I see. Okay. I guess the other question -- and it is just a thought to add to Mr. Kerr's -- and that is what would be the implications for D.C. Cook if you do not meet the deadlines?

MR. STAHLE: I cannot address that.

MR. BUTLER: Let me try to respond to that. We are dealing with the hydrogen issue on all the plants on a case by case basis. Now, the license condition that exist

today is one that applies to Sequoyah only. Now again, if the reason for not satisfying the license condition is because we find that we are not satisfied safety-wise, then that would have an impact on D.C. Cook and the other ice condensers as well.

We have issued a 50.54(f) letter to D.C. Cook, basically suggesting that they consider the license conditions on Sequoyah as to applicability for D.C. Cook. And we are taking steps to get the D.C. Cook people up to speed with the Sequoyah people. They will be treated in much the same way.

MR. STAHLE: I might add, they have been not participants but observers at meetings, and they are tracking this very closely, obviously for reasons that are self-evident.

MR. PLESSET: Steve?

MR. LAWROSKI: Assuming you find that the igniters are acceptable with you, will your tests on the factors that influence the performers of the igniters include enough to be able -- for you to be able to determine whether or not the igniters have to be replaced or not, depending on whether you have a core spray actuation, first without the additive having been added and then, in the second instance, if the additive has been added?

MR. BUTLER: Okay. Clearly, once you have the

igniters in containment and you need them, you turn them on, you do not have access to them for any replacement. So that if it turns out that the chemicals mixed in the containment spray system would have an adverse effect on the igniters, then we would have to have a resolution to that problem.

Now, we do have a second phase to this igniter review program. We have a 1981 license condition which is the interim program. We are also under way with a final program for Sequoyah which has a January 31, 1982, concluding date.

Now, we could well look into this longer-term item of yours as part of that second phase.

MR. LAWROSKI: You see, it is quite possible that the igniter may function well shortly after spray has been actuated, with or without the additives, but six months later, as a result of -- I want to make sure you know whether or not you plan to test them, bound that. For example, if you don't conduct tests for beyond six months after you won't know.

MR. PLESSET: It is a facetious remark, but I think you have made the point, Steve.

Okay, go ahead, Mr. Stahle.

MR. STAHLE: I just wanted to indicate, I know there is a surveillance program associated with the igniters, and therefore that would ensure continued

operability.

MR. PLESSET: He is commenting -- his comment relates to your question.

MR. STAHLE: There has been and will be in place a surveillance program with respect to the igniters, and they will be periodically tested to assure continued operation over the period of time. So I think -- I know that is under way with TVA and will be part of a surveillance program, if this is what you are alluding to.

I think TVA is considering this. This is not to say we won't be running duration type tests. So I think your point is, what happens over some long period of time. The answer is, they will assure, through the surveillance program, they are operable and continue to do so.

MR. BUTLER: But basically, the igniters are not planned to be used unless there is an accident. Any use of the igniters will be just for test purposes prior to an accident.

MR. PLESSET: Is that it? Let me ask one different questions. There are two ice condenser plants in Japan that have been operating for a while. Have they shown any interest in this?

MR. BUTLER: We have not had any communications with them.

MR. PLESSET: I did not think that they cared

about it, from my contact with them. They are not interested. Okay.

MR. STAHLE: I promised to keep it down to this period of time. I could go into the various functions and responsibilities of the branches. But I think it is fair to say that we now have a very involved, intensive program, and with a very tight schedule, all of which culminates coming to you with an SER, again hopefully to be able to sit down with you the 1st of January in expectation of getting a favorable letter.

MR. PLESSET: Okay. Well, thank you, Mr. Stahle. We appreciate it.

(Whereupon, at 11:50 a.m., the reported portion of the meeting was concluded.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

ACRS/247th General Meeting

in the matter of: Staff Status Report re Hydrogen Control at Sequoyah

Date of Proceeding: November 8, 1980

Docket Number:

Place of Proceeding: Washington, D. C.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

David S. Parker

Official Reporter (Typed)

(SIGNATURE OF REPORTER)