T-0845

ORIGINAL

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In the Matter of: 252nd GENERAL MEETING Original

RECEIVED APR 28 1981 U.S. NUCLEAR REGULATORY COMMISSION

DATE: April 10, 1981 PAGES: 350 - 56

AT: Washington, D. C.

Delete: B. White

TROA S0/1

Note: Send Original To, Renea Bailey 1021 H St

ALDERSON REPORTING

400 Virginia Ave., S.W. Washington, D. C. 20024

Telephone: (202) 554-2345

8104290486 T

POOR ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

- - -

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
252nd GENERAL MEETING

Room 1046,
1717 H Street, N.W.,
Washington, D.C.

Friday, April 10, 1981

The Committee met at 8:30 a.m., pursuant to notice, J. Carson Mark, Chairman of the Committee, presiding.

PRESENT FOR THE ACRS MEMBERS:

J. Mark
P. Shewmon
M. Plesset
C. Siess
M. Bender
D. Moeller
W. Kerr
M. Carbon
W. Mathis
D. Ward
J. Ebersole
D. Okrent
J. Ray
H. Lewis

DESIGNATED FEDERAL EMPLOYEE:

R. Fraley

PRESENT FOR THE NRC STAFF:

H. Denton
D. Eisenhut
E. Jordan
R. Knop
D. Boyd
B. Jorgensen
D. Quick
R. Tedesco
R. Mattson

- - - - -

P R O C E E D I N G S

(8:30 p.m.)

MR. MARK: Well, something tells me we might a. well blast off.

(Laughter.)

MR. MARK: The meeting will now come to order. This is a continuation of the 252nd meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting the Committee will hear reports on and discuss the independent design review of nuclear plants, some nuclear power plant operating experience, the passive containment system proposal. It is written here that we will meet with the NRC Chairman, but that is certainly wrong because he is down in Cape Canaveral.

Will we meet with some of the Commissioners?

MR. FRALEY: We will check this morning to see if they are available.

MR. MARK: If they are available, we will meet with them after lunch.

We shall receive reports from several ACRS Committee Chairmen on Subcommittee activities. We shall also, in closed session, have a discussion with Pierre Zalesky of the -- I'm not sure of what -- he's from France. He's not Electricite de France and he's not the safety authority, but he knows the present position of those groups. This will have to be in closed session, because he would not be free to talk about their position if it were in a public forum.

I think those are the items scheduled for today.

Ray Fraley is the Designated Federal Employee for this portion of the meeting.

We have not received any requests to make statements from members of the public regarding today's session. A transcript of the meeting is being kept and it is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard, which implies that they should get the help of the microphone.

The first item on today's schedule, when we get to that, will be a report by the NRC's staff regarding their independent design review of nuclear power plants. Just before going into the regular schedule, I think I should mention that Jim Hasslestein of the Senate Committee on Environment and Public Works, a staff member thereof, is interested in the nuclear aspects of the environment and public works, or of energy and water development, but also connected with appropriations, has requested that the Committee -- I guess they have requested the Chairman of the

Committee up here in front of them on April 28th for a couple of hours, asking for comments on the 1982 program, it says here, but I believe that's research program, on the long-range research planning, on the LOFT facility, and on the general state of the research program.

I propose to appear at that time. I think I am fairly comfortable to say what we think about LOFT and what my own inclination to say will be, that we have recommended an early cutting back on the LOFT program because of its inordinate cost compared to other things we think need doing.

Although we have used a particular date in our recommendation and the Commission seems to have used a slightly different date, it doesn't help us a great deal, since we regard those as having about the same effect and being about right.

The long-range planning, I think there, if it were up to myself, I would say that that is a ridiculous concept. All you can do is forecast the continuation of the programs you are now aware of, and you don't know what to say about the programs you are not now aware of except, you know, they will be there.

But the efforts of the staff to forecast the programs which they are aware of look reasonable.

MR. [illegible]: I think "ridiculous" is strong. I would say generalized nonentity.

MR. MARK: Okay. Anyway, it's the wrong concept when you don't know what the problems of next week may be. And we had a beautiful example again yesterday with Carl Michaelson's presentation and a beautiful example a month ago with the source term presentation, a beautiful example last fall with hydrogen.

All of those are important and deserve study and none of them can be forecast more than about a week in advance, or two months after.

MR. BENDER: I may have misinterpreted what you were saying. But while I fully agree that you're not going to be able to predict what goes on on research over a long period of time, it seems to me it would be an overstatement to say that long-range planning cannot be done and that it isn't necessary.

MR. MARK: Oh, no, I would want to give approval to the attempt to plan as well as you can. But all you can do is to forecast what you will do with the programs you have now got in hand or in sight, and the problems, and to say it is going to tail off in '83 applies to those problems, but not to the general thing.

And that's really all I would have had in mind.

MR. BENDER: I want to press the point I tried to make yesterday and probably didn't get across very well.

The main value of the research program is to be sure that there is a level of expertise around to deal with problems that are unanticipated. I think we need to remind the Congress of that every time we can.

Other than that, the research program is not worth much.

MR. MARK: I will be happy to have that in the picture.

MR. SIESS: Just be sure it's said in such a way they can't misinterpret it, though.

MR. MARK: Well, the general state of the research program -- I really don't have any clear ideas as to what we are going to say about that. It's spotty, but I don't think we want to say that, because although it is true it's impossible to make sense of it.

MR. FRALEY: I think a comment about the need for flexibility would be appropriate, because these problems do keep cropping up and you have got to be able to move money around. They did not give the agency the degree of flexibility the Committee recommended.

MR. SIESS: We recommended flexibility --

MR. FRALEY: But they actually cut down the amount.

MR. SIESS: That's between offices. The Udall markup only moves between offices. And I asked Bob Minogue yesterday, what are the limits of transfer between decision units, and he was not sure. He is going to find out and let me know. It is not in the Udall markup.

MR. MARK: I guess the other thing that would cross my mind to try to bring up --

MR. SIESS: The appropriations, the Office of Nuclear Regulatory Research and Nuclear Regulation, et cetera. Those are the items for which the transfer is related.

They think in the past some other bill or markup has put limits. But it may simply be a Commission rule.

MR. MARK: I think the other thing I would want to attempt to say would be that the expected budget for the research program is not lush. It's not clear that it's adequate. But one can live within it, providing work which is thought to be interesting on gas-cooled and metal-cooled reactors is added to that, rather than absorbable. And if they don't do that, they are making a mistake.

Yes, Bill?

MR. KERR: There is a problem that doesn't just affect research. But I think it's going to get more severe, and that is pay for people who work for the government. I am sure in research and in other levels, the quality of people that one would want to stay around or would want to recruit is not going to be available if something isn't done about the pay scales. And they are frozen.

MR. MARK: When we try to interest consultants we think we need?

MR. KERR: Consultants and employees. The market for scientists and engineers now is such that I think government service is not competitive. It was for a while, but I doubt if it is now.

MR. MARK: I feel certain that it is not. I think it's a point that makes more sense to them than talking about one-dimensional versus three-dimensional codes.

MR. SHEWMON: Important as that is.

MR. MARK: I don't think I wanted to discuss this in particular. I just wanted to mention it.

I think any of you who feel you would like to attend this session to make sure that whatever got said represented your point of view should do so. I am trying to make clear the general approach that I would be having in mind in connection with the discussion, which may or may not follow the lines laid out at this moment anyway. And cautions, criticisms, suggestions, I would like to have before close of business tomorrow, which will have to be around 2:30.

And that, unless you have something else, was all I meant to raise in connection with that request we have. So I would like now to proceed to calling for a report by the NRC staff regarding independent design review of nuclear power plants.

Who will lead that off? You, Harold? Thank you.

MR. DENTON: First I would like to inform you that the reason that Roger Mattson is sitting with me this morning is that he rejoined the staff. We were very lucky to have him come back. He replaces Denny Ross as Director of Systems Integration. Maybe the grass really wasn't greener, I don't know.

What I want to talk about this morning is a concept that we have been trying to nourish over the last six or nine months. We called it the independent design review. It's not a new one to you. We talked about this kind of thing, Roger tells me, back when we began to look at the Westinghouse control concept, after we spent so much effort on, I think it was, a Combustion computer control system; the idea being, rather than having the utility sit on the sidelines while the staff and the ACRS do battle with the designer of these systems, the utility should play a major role and get an independent review of the systems that they buy.

So I will discuss a little bit of the background and how we evolved to where we are today and where it's being applied and some of our experiences.

(Slide.)

MR. DENTON: It's still an experimental concept within the staff. It's not mandatory and we're trying to use it where it makes sense.

(Slide.)

MR. DENTON: My involvement began at the IEEE meeting held in Washington last year, a joint IEEE and ANS meeting. And we had representatives at this from the military and the utilities trying to identify what were some of the different techniques used in successful technologies that weren't being picked up within the nuclear power industry.

We had task forces on everything from risk assessment to human factors. One that I was involved in was the independent design review concept.

What we concluded was that many utilities do something of an independent review of the systems they buy, but they don't do it rigorously. They don't cover all the systems or document the result. And it is very hard for the staff and the public to see to what extent a utility really does review the designs that they are procuring against Commission standards and otherwise good technology.

So we set out on a trial basis to work it into the system.

(Slide.)

MR. DENTON: The scheme that we have evolved goes like this. We select a system where it does seem to make sense. The utility hires a panel of independent experts who have got the right background and training to participate in the review. We make sure that team really is qualified, that they understand and are provided copies of our standard review plans and Commission rules.

It's a diverse panel. They don't have just designers, but they have people involved in maintenance and operations on the panel.

Then they meet, much as your meetings go on. And the designer of the system presents the design of the system and tries to justify why it works. For example, one of the first meetings we held was on the DC battery system. There was a panel of eight or ten people the utility had hired to review the DC battery system.

We put on the panel our branch chief of the instrument branch. Bechtel presented the design of the DC battery system. I think the meeting went some eight or ten hours. The panel was really effective in grilling the designers about all aspects of the design, not just our rules and review practice, but things they knew to be good practice.

I think we identified like 15 issues that needed resolution. Eventually, Bechtel came back and provided the utility with their resolution. And the panel somehow met and agreed with that resolution.

A transcript was made and eventually a report was provided to the Commission that included the transcript and the resolution of the open issues that were provided.

Based on all that and our participation in it, we were able to complete our review of the DC battery system in a lot less time. And I think it was a much more thorough review than if the utility had played a minor role, as they often do with these reviews, and just let us and the architect-engineer exchange questions and answers about the battery system.

(Slide.)

MR. KERR: Harold, it sounds interesting. But just one detail. Were there people who were utility employees who were part of the panel, as well as the people that the utility had hired specifically for that purpose?

MR. DENTON: Yes. The constraints that we thought were necessary was there could be no one on the panel directly involved in the project, but it was quite all right to have people from the power company who were not involved, but who were old hands, so to speak, at these kinds of systems.

So the panel was chaired by a representative of the power company. Normally the power company makes up a lot of representation on the panel, but they may get people from either the industrial or the academic world. EPRI occasionally sits on the panel. So it's been a different group, depending on what's being reviewed.

The principal advantage I see is that it puts the responsibility in the first instance for finding that this plant really does meet the Commission's regulations and is a safe plant back on the utility, where they make the finding plant by plant. And it's looked at in an integrated fashion, not by technical boxes, as we sometimes seem to do.

It involves a lot more people in the process, and I think will result in a better review.

It costs the Licensee, whose principal concern in getting involved in this is what will he get out of it, and apparently it is not uncommon to spend $40,000 on one of these reviews, because he has to assemble all of the information get it out to the panel in advance.

The first few meetings the panel met in trial run before the NRC got involved, to make sure they could make it go properly. I think the rough edges have smoothed out and the few utilities who are participating are quite enthusiastic about it.

There have been some problems getting it received on the staff, but some members of the staff are quite enthusiastic. Other members tend to think it is just one more input and we'll still do all the things that our standard review plan calls for.

I hope to cut back the scope of our review so that the panel is done properly and really well documented, and our men on the panel make sure that all the issues we are interested in get aired and covered. Then we ought to be able to audit that result very easily. And it ought to require less manpower.

MR. SIESS: Two questions. One is, you said it cost them $40,000 for a meeting. What do you think it costs a utility to send six people to Washington for a one-day meeting and prepare all the letters before and after?

MR. DENTON: I think it would cost the same amount.

MR. SIESS: A more serious question. The evaluation is made against NRC criteria?

MR. DENTON: That's part of it. It's got to include our criteria. Whatever other criteria the company has in mind for a 40-year life and good design practice is fine, too.

MR. SIESS: Then the experts on the panel, not just the company?

MR. DENTON: Yes.

MR. SIESS: It seems to me there is a potential here for feedback to the NRC, that changes in the SRP might result in either direction as a result of these reviews. Is NRC looking at that aspect of it? You may not be at this stage, but will you be?

Could one of these review groups maybe come up with a good suggestion that something on the staff review plan ought to be approached differently?

MR. DENTON: I think it well could be. We have not had enough experience to get that feedback yet. But we put very senior people on the panel, section leaders or branch chiefs, and I am sure they come back from these meetings knowing more than they did about the systems when they went to some of them.

It's intended to be a rather rigorous examination of the slice of the plant.

MR. SIESS: So is the standard review plan.

MR. DENTON: But the difference being, the Q's and A's is not a very good information exchange, if you will.

MR. MOELLER: Are there any limitations, Harold, on the topics that are best subject to such reviews? And also the timing, I presume, in the life of the particular problem?

MR. DENTON: I think there are, and I will cover them in a moment.

(Slide.)

MR. DENTON: The utilities who are most interested in the concept are the ones where we can offer some schedule advantage. The plants who are at the end of the '82 line, for example, that would not otherwise be getting any attention, have volunteered they will participate in this and we'll make staff available and we can begin to move.

The program has been most active on Palo Verde 1, 2 and 3. They were the first to be interested.

I think we've completed four reviews. We used as our consultant Herman Wago, who chaired these panels for NASA during the Apollo days. So he helps us with the format and evaluates the performance for the panel.

We will probably be having one such meeting a month on the Palo Verde docket.

The next case we looked at was the San Onofre review. You remember their plan to resleeve the steam generators using gold bronzing tubes. When we first --

MR. SIESS: Is it "resleeve," Harold? They already sleeved them once and they have to go back? Or is it "sleeve," then?

(Laughter.)

MR. DENTON: They're putting one additional sleeve on. Apparently there is a patent already out for fabricating a steam generator with an additional set of sleeves in it, so they're pre-sleeves.

(Laughter.)

MR. DENTON: But on that concept, the staff wanted to hire its normal battery of consultants and lay out a six or nine-month review process for the San Onofre repair. And I called the president of Southern Cal and volunteered that if he would do a really bang-up job of independent review, to expedite our review.

He agreed to do that. He assembled a panel. The panel met in Pittsburgh. They looked at not just the metalurgical properties, but the heat transfer effects of resleeving, the radiation dose aspects, every issue that we would be concerned with.

I understand that review cost the company on the order of a quarter of a million dollars by the time it was completed. All the issues were resolved, but it did enable us to issue an SER about 30 days after the panel met. And far more knowledge was brought to bear on the aspects of that than we would have been able to in 30 days.

Midland is trying this on one of their systems, St. Lucie 2, who is in some schedule difficulties, proposing a slight variant of this. They have hired three different companies to provide them an independent technical assessment of how certain systems comply with the Commission's requirements.

These companies came over and met with our branches, and the intent is that these companies will act sort of as project managers to the company for these systems. They will do a review using the standard review plan and the Commission's regulations and obtain the information missing in the docket from the designers themselves. They will provide these technical reports to the utility.

The utility then will submit them to the company -- to us. And if they are well done and really lay out item by item the extent to which that system complies with our regulations, identifies the deviations and justifies those or describes the changes, I think it has a potential also for reducing the amount of effort I have to put into it in approving the overall review.

I am not locked into any particular sort of review, and we are giving people as much credit for these things as the quality of their product warrants.

(Slide.)

MR. DENTON: The areas that seem to work best, I think, are the systems area where it involves various disciplines and you need to take a broad look at it. These are the types of systems that we in the agency to date have identified as being the highest payoff.

I guess in theory there is no reason why you couldn't extend it through a large branch of the plant, but areas like auxiliary feedwater systems, for example, we spent a lot of time looking at the reliability of those. And it's gotten to be sort of an understood art. And I think that kind of review is paying off in the PWR's.

So these meetings are public meetings. They are noticed. They are held occasionally here and occasionally at towns around the site. Palo Verde may well be the first SER you will see that will reflect the results of these kinds of reviews.

I want to continue in this experimental mode for a while. It really seems to have a high payoff, and we might attempt to formalize it somewhere down the road.

MR. BENDER: Harold, it occurs to me, if this is a good idea and if the Commission still expects to pursue the matter of standardized plants, that it would be the right way to get some comfort that a standardized plant is one you would like to have.

And I wonder if you have given any thought to whether some of those plants that are alleged to be standardized could be subjected to this kind of review, so that there could be a broader treatment or use of the review than is the practice when you're dealing with the plants on a site by site basis.

MR. DENTON: We have in the Palo Verde case, which references CESAR, we had some growing pains deciding who was going to run the CESAR review meetings. Was it to be run by

CE, who would have one perspective, or was it to be run by the power company.

Bob or Frank, do you know how we are planning to handle the review of the CE part of the Palo Verde plant?

VOICE: It's being developed as a mixture of both. For example, on the instrumentation and control systems, we have been meeting with both Combustion Engineering and Palo Verde to try to clearly define the interface between the nuclear steam supply and the balance of plant, with the perspective being what is gained in the CESAR review would be generally applicable to the other plants that will reference CESAR.

And the interface will be clearly worked out with Palo Verdem, and there is a series of stage meetings, I think it is five or six meetings, predominantly I would say about two of them with CESAR and two of them with Palo Verde. And I think we will get a better feeling how to integrate these kinds of reviews with the standard plan and the balance of plant.

MR. BENDER: I have in mind something that may be akin to this. If there are three utilities that are using CESAR-80, I don't see why --

MR. EISENHUT: CE has in fact asked us, and we are looking at the options. The one CE has taken the lead on is the environmental qualification area. They want to come in on the CESAR docket and they would come in and cover that area generically.

And they would propose the panel consist of all the utilities referencing CESAR. They would have their representative on the panel, plus you would bring in some experts in that area. They are proposing doing just that and we are receptive to that. It's just slightly behind. This is the only reason it doesn't show here.

There's a whole number along that line. We are working on it. It has a big payoff.

MR. BENDER: As an order of magnitude --

MR. EISENHUT: We say once you have resolved the issue, you have resolved in and you have resolved it on CESAR for about a half a dozen plants.

MR. DENTON: The one area I wanted to focus on is that normally the process insists that we have a reviewer who has in his head all the details of the system, he has reviewed all the nuts and bolts in the design basis. This idea really pushes that responsibility more to the utility, to make sure that he has had somebody review all these, and my reviewer audits it.

Now, if I still have to have a reviewer who understands A to Z of the system himself, then we have no manpower saving. So what it does, I think -- it is far more important for the utility to understand the nuts and bolts of their systems over the 40-year life than for me to try to get an employee up to speed who understands this widget thoroughly and who wouldn't be around when it breaks down in the future.

I have sent this proposal to the Commission and asked them to focus on this aspect. I think we can assure that we can get in this process a high degree of assurance that all the important aspects have been looked at by highly competent people and it's documented. But in order to save myself any time, I've got to do something different than what I normally do.

Now we're just letting someone spend 180 days reading about it.

MR. BENDER: There is something wrong with the logic of what you're saying and it goes like this: First, if you're relying on one man to know all you need to know, more than likely you're only getting some small percentage of the total knowledge really examined well, because it's very unlikely that one individual could know enough to be able to deal with it.

And what you do, really, is amplify a few problems and miss a lot of problems. And if you're going to make the point to the Commissioners, I think it has to be on the point that you get a broader base.

Certainly my view is that if you get professional, qualified people on a broad enough spectrum and they are professional competent and have some integrity as well, they will do a good job, and then the staff can do an audit, which is the only thing it is ever able to do.

MR. DENTON: That's right. But I think even the Committee at times tends to expect the staff to be able to answer any question about that system.

MR. BENDER: Of course.

(Laughter.)

MR. DENTON: So that drives my staff man then to say, I can't depend on that expert panel, I've got to review every aspect, and therefore the review time is lengthened, because he doesn't want to be asked a question he doesn't know the answer to.

MR. BENDER: I think your staff is dealing with the Committee in a way in which we don't expect to be dealt with. It doesn't restrict itself in the questions it asks. But I think more often than not the staff tries to get an answer when I don't know whether it's as good an answer, an answer that has no substance behind it.

MR. DENTON: If we take the DC battery system, for example, when it comes to the Committee the people who answer your questions in that area should be representatives from the panel that the utility put together. They will have spent far more hours and days looking at it than my staff person has.

I will look at my staff man to make sure he has audited it and they have done their job.

MR. BENDER: That's what we're doing, too. We're asking a few questions to see if some things have been examined. And if it turns out it hasn't been looked at and the guy says, we're going to go back and look at it, I don't think we're surprised at it.

But if every question we ask turns out to be a blank stare, I think we're entitled to say the review is not very good, and that often happens.

MR. DENTON: We are now putting up to 20 man-years, for example, since TMI, just as a numberon each reactor. A lot of pressures are inflationary on the staff, especially the hearing process, and our --

MR. MARK: Harold, let me pretend that Congress fails to underwrite any support for gas-cooled reactors. There would then be in GA 100 or 200 people who have spent a reasonable fraction of a lifetime studying various and many aspects of reactor problems. They would be a resource, in one way of thinking of it.

Would you be in a position to use such a resource -- and when I say GA, I don't have any connection with GA -- use this resource for technical assistance in conducting your own end of the review process? Or would it be that you would have it in mind that they might be a resource for a utility to use in the context you've just been describing to us?

MR. DENTON: I think clearly they fit the latter. They could be a resource for Fort St. Vrain.

MR. MARK: No, I mean --

MR. EISENHUT: Let me make a couple of observations on that. The people at GA at San Diego have in fact formed a -- I don't know whether it's a corporation or not -- the GA Associates. It's a group of technical people, a multi-disciplined group, and we are actually using them as a subcontractor under our Livermore operating contract. They are helping us out somewhat on a number of items.

We do have the problem, since it may be somewhere between 40 people upwards to 60, 80 or 100 people in the organization, in a unit they either have to work for the industry or the staff. That has already come up as a problem, since we are using them as a subcontractor.

MR. MARK: I just invented the case.

MR. EISENHUT: It's a real case we looked into a year or so ago. And it likely could be a resource for the industry. They are in fact forming a company or they have formed a company, which is basically a technical consulting firm.

MR. MARK: They have all the know-how which you have been referring to when you talk of the activities called for here.

MR. DENTON: I would like to have a surrogate nuclear steam designer and architect-engineer under contract. We have eight national laboratories and about three government labs that we go do.

MR. MARK: They are not as close to the power business as the GA people. They know all the physics and chemistry, but not the application.

MR. DENTON: That's right.

MR. RAY: Harold, in your trial runs you've restricted your efforts to particular systems and not necessarily the same one in each case. With your concept of the procedure, would you subject all the systems within an entire plant to this type of review?

MR. DENTON: Some branches don't think it would be as productive as others, and I guess so far everyone we have tried seemed to have worked out fairly well. People go and do it with trepidation, that it is not going to save time, it's going to cost staff resources, the utility won't get any payback for its money.

I don't know how far we can extend it. It may be in areas like geology or something all the knowledge has been brought to bear on the problem through other consultants. It seems to work best when it gets to the operational areas like systems. But fundamentally there is no reason why they couldn't do an independent review of any part of the plant.

MR. RAY: It would seem to me from the utility viewpoint they would ultimately like this, because they participated in the review and had something to do with it, even though the individuals within the organization who are famliar with the plant weren't involved.

MR. DENTON: I think there are some contractual barriers in this. Normally the utility buys this material from the AE and the nuclear steam supplier with an understanding that they will make any changes required by the regulatory system, but not required by the utility. If the utility requires it based on something they've learned, usually they pay for it.

MR. RAY: They pay for it regardless.

MR. DENTON: That seems to be one kind of internal problem that develops, is that if the panel finds problems and they want it changed, it does lead to contractual questions, whereas if we say change it then somehow it's clear who pays for it.

If I were a utility I would embrace this concept wholeheartedly. I would rely on -- as Dr. Lewis has said, the sufficiency of the normal process, because it adds both to reliability and safety.

MR. BENDER: In listening to what you just said, I'm reminded of the fact that Jerry's right, the utilities pay for it no matter what. Review panels tend to take away the obligation of the designer to be right. And I think that, as much as anything, is part of the problem, that if the designer's judgment is overridden or held back by the fact that he has to wait for some group to bless what he has done, then it does get in the way of his getting the job done.

MR. SHEWMON: He's already done it once before it's come up for review.

MR. BENDER: That's the question, how far can he go before he gets the thing reviewed. Now, at the moment there is some understanding that, having gotten something through what is alleged to be the standard review plan kind of evaluation and having been put through the mill once, it's not necessary to do it again.

But if you're going to superimpose on this a second review process, then the designer says, I would like to have that done before I put the final design touches on things.

MR. DENTON: One area where I think it really worked well was the Palo Verde meeting on equipment qualifications, because they are far enough away from submitting anything on it that what they really presented was their plan to qualify, which equipment would be qualified by analysis, and which by actual testing. So they were able to get agreement on the scope of the program to qualify equipment, which should minimize the hassle when it finally comes in. So that one we did catch early and not after everything had been put on paper.

MR. RAY: It seems to me that this would preempt an objective response by the NSS supplier or the architect-engineer and so on. It's been my experience in the industry that in the electrical domain, where some deficiency in equipment developed and you went to the manufacturer with it and had a maloperation of a particular relay or a circuit breaker or something like this, he will say, you're the only system that's ever had this trouble, it's never happened with anybody else.

But if you have a review panel like this, which is comprised predominantly of other utilities, and they find this, it seems to me he's got to face up to it without a lot of reneging and obstructiveness in his attitude. I should think it would be an improvement in that regard.

MR. DENTON: I guess so far all I can say is there have been two or three or four maybe utilities who are sort of enthusiastic about the concept. Probably more than that number are somewhat doubtful as to what the payoff is.

MR. EBERSOLE: Could you tell us the utilities they were?

MR. DENTON: Palo Verde, St. Lucie 2, Consumers Power. Have I missed one? And Southern California Edison.

MR. EBERSOLE: Not TVA?

MR. DENTON: To date not TVA. In fairness to them, we have not urged it on anyone whose review is almost completed. So we are attempting to work with the people who have not started the review process.

Thank you.

MR. EISENHUT: Dr. Mark, one clarification. I was reminded that the company, GA, is the Toy Pines Associates, for the record.

MR. MARK: No, I didn't know anything about that. It just occurred to me that either from the point of view of the staff, they could conceivably be asked to go over the pumps or whatever you like. They did not understand about pumps ten years ago, but I suspect that they know a lot more now, for instance.

They're not in the LWR business, so there is no really obvious problem there, and they could work for the industry and I think you would accept them as knowledgeable on the things they claim to be, or they could work for you, either way.

Now, whether they are available or not may depend upon Congress.

Are there other things on this? I think that was very interesting, Harold. It doesn't bear on the thing you were going to tell us yesterday had we had more time, about going into overdrive on the licensing process. On the other hand, it relates to that.

Were there things on that point which you thought you would like to bring out? Because there is a --

MR. DENTON: The Commission's consideration of how to expedite the casework process is going on unabated. We transferred 26 people from other offices in the NRR into casework in the last three or four weeks.

MR. MARK: I'm glad you didn't attempt to transfer any from our staff.

MR. DENTON: I did try, but --

(Laughter.)

MR. DENTON: We did not disturb the staff in I&E or the AEOD or the Commission offices. Most of the people came from a combination of Research and Standards, and they were made available by that consolidation and a few other offices.

All the schedules that we provided last time I think in the report, I think we are batting about .800 in meeting those schedules and producing either -- producing an SER each week. This week we have Shoreham about to go out, Susquehanna about to go out.

I might mention that Shoreham is only a partial SER and tends to address only those issues which are in contention. So that by issuing it and getting that out, the hearing can begin, because the remaining issues are not at issue in the hearing.

But there has been no change made yet in the hearing process.

MR. MARK: When you say not a contention in the hearings, are they a contention between the staff and the applicant?

MR. DENTON: I don't know if it's in contention. When we moved these schedules up, many utilities were not able to supply information on the accelerated schedule in many areas. So we tried to complete the SER just on those things that were in contention, so that would start the hearing process. And now we will begin to work on the remaining ones.

MR. MARK: I don't want to speak for the Committee, but I have the feeling that we could probably bring ourselves to comment on an SER if we thought we had all the uncertainties, unresolved things, in sight, and it would not have to necessarily include too much of those things which were not interesting or in debate anyway. On the other hand, I don't think we want either of two things, or could use well either of two things: an SER which, although limited to those things in contention, did not include all those things under technical uncertainty or still requiring resolution.

And as I am sure you know, we are not really terribly happy to have an SER which considers items one through ten, when we know that there is 10 through 20 which you will be bringing in next month.

MR. DENTON: I think Shoreham will only be about 60 percent complete. But that 60 percent, when it is closed out, we and the applicant have come to a resolution, and it does include the issues which other parties to the proceeding are concerned about. So the 40 percent that remains has a large share where we and the applicant may be in dispute on some of that ultimately.

But it does serve the purpose of getting the hearing started, because if we waited another three or four months to resolve the last 40 percent, that just comes off the --

MR. MARK: I am sure we're sympathetic to that. But I'm sure you're sympathetic to our feeling that it would be really nice to look at the thing. Since we are not particularly politically oriented, we want to try and make sure we have seen all the technical points that are going to require discussion.

MR. EISENHUT: Could I amplify on what Harold has said? Shoreham and actually Susquehanna are on the same order, that you're going to be getting this week, are nominally 60 or 70 percent SER's. And if you look at the number of open issues, depending upon how you count, you may find 100.

MR. DENTON: And I don't think we're asking you to write off on this, except on the ones that are before you. In other words, it's not saying that you're happy with the 40 you haven't seen. I think we would like your opinion on the 60 percent that you have seen.

MR. MARK: I understand that you would like it and we would probably be sympathetic, but still not necessarily enthusiastic.

MR. EISENHUT: That's right. But characterizing the open issues, the vast number of those is where it takes a commitment from the Licensee to close out an issue. I expect by next month's ACRS meeting most of those will be resolved and we will be able to report them.

We don't really have any major technical issues where we are in dispute yet with the Licensee. Most of them are over closing up pieces of the application, certainly the vast majority. There is one area still outstanding on these plants, and that is the TMI issues.

The one issue that came out -- they feel, anyway, late for them to respond is their response to all the TMI issues. So that is the single biggest issue that's outstanding.

MR. BENDER: Since I find myself right in the middle of the Shoreham thing, and having just been in the San Onofre one, my memory is pretty fresh about how these problems had to be dealt with. I wonder if you couldn't give some thought, as long as you are interested in doing rulemaking, to get the Commissioners to establish some procedural rule having to do with how these operating licenses are carried to the hearing process.

I could see very well the logic of looking at the plants and establishing that they had been constructed in accordance with what was agreed to at the construction permit stage, as being something that is a prerequisite to the operating license; and that requires the ACRS to take a look at a plant and you to make the statement thereof.

It seems to me if you are going to go trying to expedite the hearing process, you get that out in front fairly early and into a more careful -- "careful" is the wrong word -- a review of those matters that have to be addressed by the operating complement as a second stage and prescribe it as such, which would get done before the hearing process has ended, and let that be the way in which it is done, so that we have a fairly good understanding of what we are trying to do.

Right now I think we have to sort of guess at what things are TMI issues, what things are construction permit unresolved issues, and what things have been invented that fit in between those two categories.

MR. DENTON: We do need to re-examine the process. I think the Commission and the Congress have some ideas. The first one goes to what is the threshold for admitting contentions. In other words, today a perfectly valid contention would be that inerting with nitrogen is not an adequate provision for preventing combustion. That is specific and relevant. That's the only requirement for getting a contention in. There is no merit test that has to be passed to get a contention before the board.

So Shoreham now has 70 contentions admitted. Then the burden falls more or less on the applicant and the staff to prove it the other way. So then we have to write great reams of testimony and provide witnesses.

I think if the contentions that were admitted, were admitted with some finding of merit, that there was a material dispute of fact instead of a piece of paper that some technical person came forward and pointed out a different view, it would be a lot easier to tackle it than the present process.

MR. BENDER: You are addressing it in a legal sense. And frankly, I think what the Committee is trying to do is to decide when it is supposed to make its technological judgments and what is it judging, and trying to write a letter piecemeal which allows the hearing process to go forward and not knowing what part of it is to be covered just confuses the whole process.

MR. DENTON: If the boards did not have sua sponte power, if they stuck to contentions and we provided you a report that covered all the matters that were in contention, and you wrote a letter that said, only for those matters, you don't see any barriers to going forward, I think the boards could then act on the basis of your partial letter and the staff's partial letter, because we cover all the matters in contention eventually. We would have to cover the whole project.

But now the Commission has also given the boards the ability to ask any other issues they want, so that if they bring up something that's not in the partial SER you will not review it and we will not review it, and it does have a potential to drag the process out.

MR. BENDER: We can't solve that. I'm just speaking for myself, but I don't think I'm apart from the Committee's views. The problem really is, the Committee is not sure what it is telling either the staff or the board when it writes its letter, and if what it is saying is, we have read the boilerplate and the boilerplate looks like the last package of boilerplate, that's all right, and that's generally what the first step seems to be.

And I think you have to look and tell us a little better what you expect from us in order for the boards to have something to use as the basis for judging what the ACRS letter is supposed to be saying. If they can tell anything from a partial review right now, it has to be because they have some sort of ethereal conversation with us that isn't going through the correspondence.

MR. DENTON: It goes to the role of the ACRS in the adjudicatory proceedings, I think, just what you have said.

MR. MARK: Bill?

MR. KERR: I am also faced with the Susquehanna situation, and I understand that the LER will come to us with over 100 open issues. You tell me that most of these may be resolved by the time one comes to the full ACRS and perhaps that could be true.

Is ACRS going to be asked to write an interim letter on the basis of this or has that decision been reached or --

MR. DENTON: I guess my own view would be, if the SER is no more than 60 percent complete, I don't see how you can write anything but an interim letter or a partial letter covering just part of the plant that you have the benefit of reviewing, and that would suffice then to kick off the hearings, provided that SER covered the contentions. Then eventually we would have to come back on all those other 100 open issues and discuss those and you can finish your review.

MR. KERR: It appears to me, then, that because of a scheduling idiosyncrasy, that the staff and the applicant are going to be constrained to have two meetings with the ACRS where, if one waited a while, one would suffice. Now, I'm willing to recognize the exigencies of scheduling, maybe that's just the way it has to be.

But I would guess that had one another month or so as far as the ACRS is concerned, the issues could be narrowed sufficiently that one meeting would suffice, because this is a plant like other plants that we will have seen by then. And if indeed most of these open issues are procedural rather than technical difficulties, we may be having -- I can't judge whether it's more efficient to have two meetings where one would suffice or not.

MR. DENTON: I haven't seen the list of the outstanding issues yet.

MR. KERR: I have not, either.

MR. DENTON: Once we see those, we could conclude, are these the type of issues which are routinely closed off like these or are they new and novel and will require a second meeting? I'm not trying to prejudge it. I think we will have to see how it turns out.

MR. EISENHUT: We will just have to wait and look at the SER, and also look at the time we get to the Subcommittee meetings, the number of issues that are outstanding, the number of issues that are resolved and where it really stands. I think when you look at it in perspective you will find it's not much different than San Onofre, for example. So I think we will have to look at it on the merits of each case.

MR. KERR: I don't know how to look at it. If I get an SER that says, here are 104 open items and I'm told this is what we're going to get, and we are at a point now by which* by tomorrow I'd say it's almost too late to turn back, we sort of have to decide what we're going to do, and I don't know -- I cannot come to the Committee with 104 open items and say, we ought to close out on this.

If it turns out there are ten items left by the time one comes to the Committee, almost certainly these will not be discussed in the SER.

MR. DENTON: My view is that the schedules presently are controlled at the start of the hearing, so that we are able to get a document at the start of the hearing. And then six months later we've got a second ACRS meeting which closes out the remainder. If none of those issues were in contention --

MR. KERR: Does the law say there has to be an ACRS letter before hearings can start?

MR. EISENHUT: No.

MR. KERR: Why is the schedule controlled by the hearing?

MR. EISENHUT: It's controlled really by the issuance of the SER. However, one thing that's used in the process is that these are the views of the ACRS. It doesn't necessarily follow that there has to be one ACRS meeting. There could be two.

MR. KERR: My point is that to some extent I think it is an inefficient use of our time if one is all that's necessary. But even more important, it's a terribly inefficient use of your time and the applicant's time. You send a lot of people here who are sitting and listening to us for one day, and the applicant sends even more.

MR. DENTON: But in the overall view, if the hearing can start three months quicker on Shoreham --

MR. KERR: Are you telling me there isn't anything in the law that says there has to be an ACRS letter for the hearing to start? Is that the case or not?

MR. DENTON: I'm not a lawyer, but it's been the practice to require the letter before the hearing starts.

MR. EISENHUT: That has been the practice, but there is nothing I know of from the hearing standpoint that it's required. In fact, in the Shoreham hearing they're going down the path of planning to start the hearing wherever they feel they've got sufficient information. It's not tied to a specific ACRS letter or what-not.

I think it's fair to say it's our objective to have both Shoreham and Susquehanna resolved at the next ACRS meeting. We are trying to resolve all 100 issues for next month's meeting.

MR. BENDER: I want to repeat again the point I tried to make and didn't get across too well. I don't know what the ACRS letter is supposed to be telling either you or the boards when we write it and there are a lot of open items.

MR. DENTON: Well, I would like to see your closing line for a partial SER to say that for those items which you have reviewed you see no barriers to going forward. I think that's the part of the letter we look for in the completed review, and if you get a partial review you would have to hedge it and qualify it.

MR. BENDER: I don't think the board would know what we had reviewed.

MR. DENTON: It would be the document you identified, you reviewed NUREG-0661 or something, and that's what we would be submitting in evidence along with testimony.

MR. RAY: Harold, it seems to me that the real objective should be the earliest possible issuance of the OL in the best interest of the public, and I wonder if that's the reason why you want to start the hearing board procedures as early as possible. Does this contribute to that?

MR. DENTON: Yes, because even when the Commission issues for public comment a modification on the immediate effectiveness rule, the two options in there would knock off either a two or three-month saving in the hearing time.

The other modifications in the hearing process hopefully will cut down the length of hearings a little bit. But we have been asked to schedule by the Commission for an 11-month duration from the time we issue a document which starts a hearing until an OL actually issues. So in effect we have to then produce a document which will start the hearing 11 months before they finish the plant, in order to avoid delay.

Now, plants like Shoreham are going to be impacted by a number of months even if we issue this partial SER. And if we waited several months, then the delays just add up down at the end.

MR. RAY: So the integrated effect does set up the possibility of an earlier OL?

MR. DENTON: That's correct, month by month.

MR. LEWIS: I disagree a little bit with what Jerry said. I think the real objective ought to be the safest possible reactor consistent with the earliest issue of the OL. And in that context, you defined earlier the requirements for a contention to be admissible. Is that a matter of practice or is it written down somewhere?

MR. DENTON: It's in our regulations now, and the Commission is considering changes.

MR. LEWIS: Do you have the reference? I'd love to see it.

MR. DENTON: Somewhere in part two. We'll provide it to your staff later.

MR. LEWIS: Thank you.

MR. MOELLER: Perhaps you've already covered this, but the discussion raises in my mind the question of whether the mechanism of the independent design review could be applied to the unresolved safety issues. Do you intend -- or did I just miss it -- do you intent, if it works out on reviews of systems to perhaps try it, or are you already doing this?

MR. DENTON: When we were able to complete the hearing before the plant was completed, we didn't pay a lot of attention to the contentions. And the practice that grew was that we produced the same-looking SER regardless of the number of contentions that got admitted. Then we argued the contentions separately in testimony, so that if someone had a contention on nitrogen we might write

30 or 40 pages about nitrogen as the hearing testimony, but the SER would only have the standard one page.

Now that we are in this situation, I have had the lawyers send to the project manager all of the contentions on each case. And it turns out they average about 25 contentions per case, although some have a few and some have a lot, and it only takes one contention for us to kick off the hearing process. And it would be possible on plants like Palo Verde to take the contentions and treat those in the independent design review process specially, so that they got extraordinary attention, and that's a good idea.

We really hadn't coupled that. But I was thinking, now that the contentions are getting paced, and make sure, if we could discuss it in the SER, that would be the proper way to handle a really valid contention.

About four-fifths of the contentions get dismissed and never get to hearing. We move for summary disposition and file affidavits from the staff. So that about 80 percent that get admitted don't seem to ever result in a contest. But it takes staff effort to get them out of the proceeding.

MR. MOELLER: In this same regard, with all of the emphasis in Congress and the several statements recently by the NRC Chairman about expediting the licensing process, has anyone done a study in which you how much time theoretically could be saved by that IDR approach? I would think that would be a real selling point. Not that you're having any trouble selling it, but at this particular time.

MR. DENTON: We don't have enough experience to quantify it yet. But the fundamental issue that appears to be on the table with regard to the hearing process is that if you believe the review process the staff does and you do is fundamentally flawed and inadequate, then you would want a hearing process that admitted as many contentions and provided as much opportunity as possible for public participation, whatever the cost would be. And that's one school of thought.

The other school is, the review done by the ACRS and the staff leaves a few issues which could be meaningfully adjudicated, and a lot of the hearing process does not have that much, and therefore you would be willing to restrain the hearing process. And the present Commission is divided on some of those fundamental philosophical issues about how far to go.

MR. LEWIS: Harold, do you have in your ancestral memory a number of splendid examples of cases in which the hearing process has actually contributed substantially to the safety of a reactor?

(Laughter.)

MR. DENTON: Yeah, I've gone back and looked at a large number of decisions at the OL stage over the last decade. You find very few historical examples where the board decision resulted in any change at all.

MR. LEWIS: There are some cases where there is changes. I'm asking for substantial contributions to safety.

MR. DENTON: It's hard to find one where I would call it a substantial contribution to safety. One that comes to mind was a condition to maintain higher temperature on the pressure vessel supports in North Anna. It's a case of fracture toughness that was litigated. And I think it did result in a different condition on the supports. I'm a little hazy about that one.

Another one was, St. Lucie focused atention on looking at procedures for emergency diesel operation.

So you can pick out a few cases. The debate seems to center around not the actual findings of the board, but on the effects of the board in requiring that the staff be articulate and rational in the presentation of their views, and whether that occurs without the board or not.

Now, my own view is that about half the plants that are operating did not have a hearing and I think they are just as safe as the plants that did have a hearing. So the boards are probably cost effective if they don't cause big delays.

If you take a plant like Diablo Canyon, where the hearing on lower power isn't to start until May, the staff finished its review last August, and a decision isn't expected until next year on low power, you have to ask yourself how cost effective for society those five contentions are, regardless of how they turn out to be decided.

MR. LEWIS: Well, as you know, I am concerned, apart from the fact that I know in some cases there have been changes in the design of the plant which are simply giving a little bitwith the forces at work and for which the contribution to safety is at best hard to document. But I'm also very concerned that in having the kinds of conversations we are having here and doing the kinds of jobs that your staff has to do to meet contentions which are in some cases without merit, and perhaps in some cases with, whether one isn't so diluting the process that one is making a substantial negative contribution to the safety of nuclear power.

I am more concerned about that than with getting the plants on line.

MR. DENTON: That is certainly true. And to have to turn to one of our senior staff to write an affidavit rebutting something that he knows just from his knowledge and training is not a problem, when there are really serious problems he would prefer to be working on, does tend to make him wonder how we set our priorities.

But at present any contention that comes in the door and meets those present very low threshold requirements requires staff attention. And with the limited staff, that's taking it away from issues that we all think are much higher priority items.

MR. MARK: Harold, you say that the hearing on Diablo will start in May. To what extent was that possible? Why didn't it start last November? What made it out of reach for that to have happened or to happen again, if we should face this again?

MR. DENTON: Well, after we filed our low power SSER, then the applicant -- then the intervenors get to propose contentions for the low power hearing. And I think they've proposed some 60 or 70, and they have 30 or 60 days to file what they want to be in contentions. And all the parties have 30 days to propose there their own contentions and to argue. So it's prehearing time, which has gotten to be five to seven months now, and sparring over the contentions.

We will file affidavits and testimony trying to move for summary disposition.

MR. MARK: Couldn't that agency action be cut back to no more than three months, 30 to 60 days to file and 30 days to augment?

MR. DENTON: We used to have those very tight time frames and that's what we scheduled with. It turned out no board was meeting them.

The Commission has before it a recommendation from General Counsel that has, from the time we issue the SSER to a board decision, would be eight months. And they say that if you adopt regulations that say -- that hold it to eight months, it probably won't take more than ten in the average case.

Part of that time is prehearing. Then there's the hearing time and then there's the post-hearing time. And in each one of those, all parties have to have opportunity to file their views and rebut the other parties' views.

MR. MARK: But still, some of that is within the agency's control.

MR. DENTON: A lot of it is.

MR. MARK But the agency has a uniform intention to do so.

MR. DENTON: Yes. The present scheme would say five months after an SSER to the start of the hearing. That's sort of pretrial time to decide what the contentions are. Then the hearing is one month, and then five months after the hearing for the board to reach a decision on the hearing. So something on that order.

MR. MARK: And there is some slack in that that could conceivably be --

MR. EISENHUT: That is the proposed accelerated schedule already. That's down from the 15 to 18 month scheme. And in fact the -- the proposed new procedures woul get it down to the five-month approach.

MR. MARK: Well, I think probably we have imposed on you -- unless there are some other specific points in this attempt to keep the licensing process moving rapidly before going on to our next item, which will be some reports by staff members on some recent operating experience, I have a question.

We are scheduled this afternoon some time for meeting with the Commissioners. The only Commissioner who will be able to meet with us, and it doesn't sound as if he's irrepressibly anxious to do so, is Commissioner Bradford, who says he will come if we want.

MR. SIESS: But his feelings wouldn't be hurt if we didn't want?

MR. MARK: But he would probably enjoy watching the TV to see if the launch goes off or something if we don't want.

I guess I feel myself that under those conditions we should let him be free to proceed on other matters. There may be some things we want to bring to the Commission, but we won't have a chance to see more than Bradford this afternoon. It's not that we shouldn't see him if we have a reason for wishing to do so.

MR. SIESS: I will move that we do not meet with the Commissioners at this meeting.

MR. MARK: I second that.

MR. SIESS: And see how the experiment works.

MR. MARK: Has anyone got a wish that we should try to get Bradford to come down? He isn't absolutely anxious to do so, since he doesn't have any questions he himself wants to bring.

MR. RAY: It's hard for me to see where you really communicate with the Commission when only one member attends the meeting.

MR. MARK: We can communicate with one member perfectly well as long as either he wants to push questions at us or we want to push questions at him. But as you say, that is not communicating with the Commission necessarily.

MR. LEWIS: Would it be interesting to communicate with him about his views on speeding up the licensing process?

MR. MARK: I will ask Ray to free him from his commitment, in which case it might be a good idea, before starting our next item, to plan to run around the halls until ten after 10:00.

MR. SIESS: Carson, does that eliminate also the pre-Commission meeting?

MR. MARK: Well, you can talk to that.

(Recess.)

MR. MARK: We should resume.

I believe it is not quite settled but expected that Commissioner Bradford may nevertheless show up for a short discussion here. We wanted to be sure that he came. We will still have time left over from the hour that is scheduled, or the half-hour that is scheduled, to talk about whatever we want to talk about.

Should we then proceed and ask the staff to tell us about some of these more unlikely recent experience items? I believe Sequoyah has had one that was to be discussed.

MR. SIESS: Would you like to qualify that?

MR. MARK: Well, they used to be unlikely, and now they have had them.

MR. SIESS: Is that like 10-2 or 10-4?

MR. JORDAN: Ed Jordan, from the Office of Inspection and Enforcement.

I would like to introduce Dick Lewis, who is acting division director for the inspection program at that region. And he will give you discussion on the Sequoyal plant.

MR. D. LEWIS: I have asked Don Quick to come in with me, who is the section chief responsible for Sequoyah. Let me give you a little background information.

Initial criticality was achieved on July 5, 1980, and 100 percent power was achieved for the first time on January 11 of 1981. On February 5 of '81 the unit was shut down to check on excessive vibration of the main generator excitor shaft. And on February 6, the next day, the decision was made to take the unit to cold shutdown, and it was taken to cold shutdown and remained in this condition until the event that occurred on February 11th.

A cold shutdown temperature was 180 degrees F. at 310 p.s.i.g. At time of event, the core history, the burnup was 40.14 effective full-power days. When the event occurred, of course, the normal notification was made through the Response Center. The resident inspector was informed and he responded to the site.

Early the next morning, about 8:00 o'clock, we had a regional supervisor on the site with additional inspectors to review the event itself. The plant was to remain down for some period of time, so there was time then to put another inspection team on the following Monday to look into other areas and the nuances that were associated with the event.

And we put Don Quick, who will address you in a few minutes, in the area that he looked at. We looked at the operator training, since we have a history of operator performance undesirable. We looked at plant communications which appeared to have resulted in the event. The management controls the operator response to the event, and the adequacy of procedures.

Having said that, Don Quick, who is our team leader, who responded to the site the following week with an inspection team and did the specific review of the event. So I would like for Don then to give the details of his review and findings.

MR. MARK: Proceed.

MR. QUICK: Thank you, Dick.

The February 11 spray event was the second spray event that occurred at Sequoyah. There was one previous to that, on February 2 of 1980, which occurred during preoperational testing. I will go over the February 11, '81, event first and then cover any similarities there might be between the two events, following that.

One thing I would like to mention before I get into the event is the systematic assessment of licensee performance was accomplished at Sequoyah from the issuance of the operating license date through April of 1980. That assessment reflected a couple of areas of concern, which were the primary reasons why we took a very hard look at this particular event.

One of the things it showed was an excessive rate of noncompliance for the relatively short period of time that the plant had been operational. The second thing it showed was an apparent lack of procedural --

MR. KERR: That is when measuring excessive rate of noncompliance, Don?

MR. D. LEWIS: As compared to the rates for similar plants within the region.

MR. KERR: Well, what plant, for example?

MR. QUICK: The other plants would be plants like Farley, North Anna, and so forth.

MR. KERR: Those plants certainly are not similar. None of those are ice condensers, for example.

MR. QUICK: No, they are not. But they are under standard tech specs with relatively the same reporting requirements.

MR. KERR: You mean similar in that sense, then?

MR. QUICK: Right. From a reporting requirement standpoint.

MR. MARK: They're all plants which are below the average excessive?

MR. QUICK: No, I wouldn't say that. But in this particular case, on Sequoyah, as I recall, the specific number, Sequoyah was running double the average of the region for the other type plants that were under the same reporting requirements. But I temper that with the fact that this was an evaluation conducted over a relatively short period of time, approximately four months.

MR. BENDER: One other point in connection with this matter. I suspect these violations, or whatever you call them, are sensitive to the status of the plant, whether it is in its early startup or in a continuing operational mode. Does the staff have some way of tracking violations as a function of how long the plant has been running? And can it make any statements about how that varies?

I remember a few things about North Anna, for example, over the years, that wouldn't lead me to believe its record was always a very good one.

MR. QUICK: Well, as you all know, the systematic assessment program has just been started last year, and although we had been doing things similar to that in the past, we did in the past trend the noncompliances and the reportable occurrences on these facilities.

I would like to point out that although this first period of licensee assessment indicated these concerns to us, that we have since trended the reportable occurrences on Sequoyah, and the rate of personnel error at Sequoyah has been cut in half since that time. It was during the first assessment period running about 29 percent of all of the reportable occurrences attributed to personnel error.

The more recent trend indicates that they are now running about 16 percent up to the point at which we presented them with the facts of the assessment program.

From that point, which was October of 1980, through mid-March of this year, their rate of personnel error is only running 11 percent, which is less than the national average.

MR. BENDER: That reinforces the point I was trying to make, that it seems to me the staff when it makes these public pronouncements, it would serve the public well if you would point out there is a learning process associated with starting a plant up, and the response would not be distorted so much if it was understood that the new plant is likely to have more such occurrences than one that has been running for a while.

MR. QUICK: I think if you take a look at the report for the assessment on TVA, you will find those very facts brought out.

MR. KERR: Do you attribute this decrease in reported personnel errors to a change in the number of personnel errors or just to perhaps a different attribution of the cost of a particular incident? Because one has a certain amount of freedom in attribution.

MR. QUICK: I think that for the most part, although it is very difficult to pinpoint it to any one particular cause, I think it is a learning experience.

MR. KERR: One way of learning is to discover that the NRC staff thinks you are having too many personnel errors. But then when you report the cause of a particular answer, you do not attribute it to personnel error, but to something else.

MR. QUICK: I would like to point out when we get these reportable occurrences, we do not necessarily always agree with the licensee's coding, and we change the coding accordingly within the region to reflect the true root cause of the event.

MR. KERR: I thought you might. And that is why I asked whether you thought the change was due to less personnel error or change in attribution.

MR. QUICK: No; I think it is actually less personnel error, which is attributed to the fact that the operators are now learning how to deal with tech specs more effectively. Most of these errors we have seen are things of the nature of missurveillances, taking one piece of equipment out of service for maintenance on the A train, for example, safety injection pump, while at the same time a diesel generator is out of service for maintenance on the B train.

MR. EBERSOLE: That is a classical problem that was recognized many years ago, and there was a matrix set up by GE to prevent it, but the staff turned it down, in a vacillation of one thing and another, until finally the whole thing was disabled.

We do not have the matrix, and I want to complain about it.

MR. MOELLER: In your presentation, you have already pointed out that you carefully reviewed the LERs at the regional level. Now, in the February 2, 1980, LER reporting the containment spray inadvertent actuation, I presume an LER was submitted, and I presume you reviewed it at the regional level and I presume that you noted the corrective action taken. And you said this is a good corrective action. Sequoyah solved that problem.

Now, when you reviewed the February 11, 1981, LER, presumably again they had a corrective action. Did you go back and find out who reviewed the February 2, 1980, corrective action and said it was okay and found out what mistake they made?

MR. QUICK: I think, in order to thoroughly answer your question, you should listen to the presentation first. And I will point this out right now. The February 2, 1980, event was prior to licensing of the unit. Therefore, the reportable event recording scheme was not in effect at the time.

MR. MOELLER: Even under a construction permit this was not a reportable event?

MR. QUICK: It was not a construction deficiency that occurred. It was a personnel error that was attributed to inadequacies in procedure as well as inexperienced personnel performing the procedure. And I will get into that a little bit later.

This event, February 11 of this year, we did review the event quite thoroughly long before the LER ever reached us. We have since reviewed the LER, and, of course, the corrective action that was taken in response to this event was as a result of confirmation of action later and agreement between the region and the licensee which was adopted within a week following the event.

MR. EBERSOLE: To add a little perspective to this, how much incidences have occurred prior to these? Have there been many?

MR. QUICK: There have been several others. I do not recall the specific ones right now. But there have been several others, yes.

MR. SHEWMON: Jesse, why don't we let him get through his talk.

MR. EBERSOLE: One minute, please. I am not quite through. I want to emphasize one other thing. This accident was carefully identified early on, because it has serious potential. It could, if not defined, will implode that thin-walled containment. Therefore, it has prewarmed water and should have very a high-grade vacuum relief valve. It is this latter thing that bothers me most because these were found rusted and locked shut on the Watts Bar project. And I don't think we have any code requirements on vacuum relief valves.

But there is a potential for imploding that whole vessel if cold water is thrown into this thing and the reliefs don't work. So it is not just a simple spray incident.

MR. QUICK: I agree.

MR. PLESSET: You meant "containment," didn't you? You said "vessel."

MR. EBERSOLE: I meant "containment." It carries with it the mechanical apparatus, the RHR.

MR. QUICK: As far as the February 11th event itself is concerned, as Dick pointed out, the resident inspector arrived on the site within an hour and a half following the event itself and started the investigation at that point and accompanied the licensee in the containment on the first entry and observed firsthand what the conditions were inside the containment.

The following day, then, a team from the region arrived which looked into the technical aspects of the event. The following week I arrived with another team of inspectors to look into the operational aspects of the event as well as the management controls, procedural adequacy, and so forth.

(Slide.)

As far as the event itself is concerned, we point out it is an ice condenser containment, which in this particular event is somewhat of a saving grace, in that the containment itself is designed in three distinct volumes: the upper volume consisting mainly of an open area with very little equipment contained in it; the lower volume which is separated by the operating floor, which houses all the NSSS equipment such as the vessel itslef, the steam generator, pressurizer, and so forth; and intermediate volume which consists of the ice condenser, which extends some 300 degrees around the containment. And the only pathway between the lower volume and the upper volume other than floor drains themselves is the ice condenser.

The spray rings that we are talking about are located obviously in the upper part of the dome. And their function is to spray down the upper volume of containment. As I say, it is somewhat of a saving grace in that there being very little equipmment located in the upper volume, that limited the damage and the recovery process that the licensee had to go through following the event.

MR. MARK: The communication between upper and lower, you said floor drains, they allow stuff in the upper compartment to go down. Do they correspondingly allow stuff in the lower to come up?

MR. QUICK: No. There are check valves in these floor drains which obviously would stop that.

MR. EBER/OTE: At this point in time, I would like the committee here to view this incident as though it were occurring at :he North Anna 2 plant, where there is an unprotected RHR system sitting on the floor.

MR. QUICK: That is why I made that specific point, that there is very little equipment up there to be damaged.

MR. EBERSOLE: Like there would be in North Anna.

MR. QUICK: Yes.

(Slide.)

The event itself, I guess we would have to say, really started at shift change about 4:00 o'clock in the afternoon on February 11th, in that periodic testing had been accomplished on the preceding shift which required the operators to stroke a number of automatic valves associated with safety-related systems, including the RHR system. One of the valves in particular that was stroked was the spray valve in question, which was later manually opened.

The instructions that the unit operator gave his auxiliary unit operator or auxiliary building operator, whichever way you want to term it, were that sometime during the shift he was to realign and open several RHR manual valves, which would allow the unit operator to restore letdown flow from the RHR system into the CVCS system, which is the normal mode of letdown during cold shutdown conditions such as this.

In addition to those instructions, he also told the auxiliary unit operator that he wanted him to check close to the spray valve which had been stroked on the preceding shift, the main reason being that is the only boundary valve between the spray system and the headers. And this was a standard practice at the plant. So with that in mind, the auxiliary unit operator wrote down the valve numbers that he was supposed to manipulate but he neglected to write down the positions that he was supposed to put those valves in.

Some time later, at about 7:00 o'clock Central Time in the evening, the auxiliary unit operator called the operator back and asked him if he was ready for him to open these valves. He said yes, he was. Details of that conversation are rather sketchy. But the general reply was in the affirmative, that, yes, he was ready for him to open the valves.

The specific valve numbers were not mentioned in that conversation. As a result, the auxiliary unit operator -- and this is a very busy diagram, so you will have to bear with me on this -- but the auxiliary unit operator opened a couple of manual valves here in the RHR system which would allow discharge from the RHR system to be introduced into the CPCS system as their normal letdown flow.

At the time, the A RHR pump was running, it is aligned to take suction from the hot leg on one RCS leg. And it discharged back to, of course, the cold legs. Since the auxiliary unit operator opened these manual valves, the unit operator noticed that the temperature on the A train had changed significantly, indicating that, yes, in fact, these valves had been opened, and he paid attention then to establishing letdown flow and getting that system balanced out properly.

Some 40 minutes later the auxiliary unit operator had in the meantime dressed out and gone into another penetration area where the spray valve was located, and, in fact, some 40 minutes later, at 7:40 Central Time, opened the spray valve right here, which leads from the A train RHR discharge directly to the spray headers in containment.

Now, this plant, you have to understand, has two separate spray systems. This from the RHR system is considered to be the long-term containment spray which would normally be used at some day after an event. The other containment spray system itself is totally separate and removed from the system. And there is absolutely no interface between the two, except that both of them are capable of taking suction from the recirc pumps, and that is the only connection between the two systems.

Once the auxiliary unit operator opened this valve -- and I might mention at this point that he recognized the fact from his former training that he thought it was a spray valve. He read the name tag on the valve, and, yes, in fact, it was an isolation valve of the spray header.

But he told himself that the unit operator knew more about the condition of the plant than he did, and he went ahead and opened the plant anyway.

Also, recognizing when he opened it that it was like a freight train going by, with the amount of water, of course, that would flow through an eight-inch line like that as you throttle that valve open, he then left the penetration area and removed his protective clothing, came out of the auxiliary building, and returned to the control room.

But in doing so, some 35 minutes had gone by. So the valve was opened for quite a while before he got back to the control room and alerted the unit operator to the fact that he had opened that valve.

MR. SHEWMON: The operator did not know for 35 minutes that spray was on in containment?

MR. QUICK: They knew something was wrong, but they felt they had a LOCA and they responded as if they had a LOCA.

MR. SHEWMON: The plant was in shutdown?

MR. QUICK: In cold shutdown. The pressure was 310 pounds gauge and temperature was 180 degrees, which is also a saving grace in this particular event.

MR. SIESS: Were there people in containment?

MR. QUICK: There were 13 workers in containment.

MR. SIESS: And didn't they know whore the water was coming from?

MR. QUICK: Yes, b-- they had to come out of containment and remove their protective clothing as well. And I might point out also that those people who were in containment were construction or maintenance crew-type people rather than operators.

MR. BENDER: Excuse me. Did the operator who opened the valve have any way to communicate directly with the control room when the event occurred?

MR. QUICK: No, he did not. That was one of the points that we found in our inspection of this event. There were two telephones within fairly close proximity to the penetration area where this valve was located. But both of those telephones were inoperable at the time.

MR. SIESS: Did he try to use them?

MR. QUICK: He tried to use one of them then. It was inoperable. And then proceeded down into the penetration area.

MR. BENDER: I don't mean to interrupt your discussion, but it seems the time to ask it: Are there rules for communciations?

MR. QUICK: There were not at the time. There are now.

MR. BENDER: Okay. Fine. Thank you. I am sure there ought to be. So the event started at 7:40, within the first minute of the event, of course, the unit operator took the actions required by him in response to a LOCA situation, by shutting down reactor coolant pumps. He at that time had the A train of RHR recirculating from the hot leg back to the cold leg through the loops.

He started the B train RHR pump and shifted his suction for these pumps to the RWST by opening this section. And actually, there is only one valve here with the check valve in front of it. By opening the section from the RWST to the RHR pumps in hopes that at this low pressure obviously the RHR pumps would draw water from the additional source and put it into the reactor coolant system.

He had lost pressurizer level within the first ten minutes of the event and pressurizer level indication, and that remained off-scale for approximately ten minutes in the event.

MR. EBERSOLE: Was that because he diverted flow through the spray?

MR. QUICK: Yes, because the spray valve was open and the RHR pump was making suction from the hot line and drawing water up from the reactor coolant system, discharging it through the spray headers, thereby draining the reactor coolant system.

MR. BENDER: Let me go back to what the operator was doing. Had he been told what he should expect when he opened the valve?

MR. QUICK: No, he was not.

MR. BENDER: Did the control room know what to expect?

MR. QUICK: The control room was not sure when he was going to open the valve. He had been told to check that valve closed specifically and open several others. And as I pointed out earlier, he had written down the valve numbers but he had not written down the positions that the unit operator wanted him to place those valves in.

MR. BENDER: I think my point really is -- and I am sure I asked that question -- that he should have been told what he was trying to accomplish and what he should have expected. And the control room should have had a similar understanding as to what kind of responses they should be getting. And I wondered whether that communication channel had been open.

MR. QUICK: I agree wholeheartedly. That was not in existence at the time. It is now.

MR. BENDER: Fine. Thank you.

MR. EBERSOLE: As a matter of fact, he did have a LOCA. It was a pump LOCA.

MR. QUICK: That is right.

MR. SIESS: In trying to follow Mr. Ebersole's admonition to think of this in terms of other than an ice condenser, you pointed out the spray system was quite different and completely separate from the other one. The other one takes its suction from the RWST?

MR. QUICK: Yes.

MR. SIESS: And is this peculiar to an ice condenser?

MR. QUICK: No, it is not. Westinghouse plants, in general, have spray valves of the RHR system.

MR. SIESS: For long-term what?

MR. QUICK: For long-term spray of containment.

MR. SIESS: To take primary system water and spray it back through heat exchangers somewhere rather than sump water?

MR. EBERSOLE: For North Anna, this is the only way.

MR. QUICK: It would simple to pull through the heat exchanger, spray it back into the containment, back into the sump. That would be the recirculation pump.

MR. SIESS: But in this case the line took the section of the primary system then?

MR. QUICK: Yes. That's the normal shutdown cooling alignment for the RHR system. It discharges back to the reactor coolant system.

MR. SIESS: But if that spray were being used deliberately with that valve open, the suction would be taken from the sump rather than from the --

MR. QUICK: Not necessarily.

MR. SIESS: No?

MR. QUICK: It really depends on the situation of the system at the time.

MR. SIESS: Okay.

MR. QUICK: Normally, with a break in the primary system, you are correct, yes, the system would take suction from the sump and discharge back to the reactor coolant system as well as to spray.

MR. SIESS: But then normally you wouldn't use the spray unless you had a break in the system.

MR. QUICK: That's right.

MR. SIESS: Okay. I hate to use the word "normally" in that respect.

(Laughter.)

MR. QUICK: On many Westinghouse plants the spray arrangement from the RHR system is the only one capable of taking suction from sump water for the long-term recirculation-type spray. The other spray systems on some Westinghouse plants, the pumps do not have this capability of taking suction from the pump.

So all of the Westinghouse -- maybe I should not use the word "all," either, because they usually get caught on that. But most of the Westinghouse plants do in fact have the same arrangement, with spray valves coming from the RHR system.

Getting back to the event itself, within two minutes of the start of the event, the RCS pressure was zero atmospheric. And, in fact, water was being drawn from the RWST as soon as the operator opened the suction valve from the RWST and discharged back into the reactor coolant system, as well as out through this open spray valve.

That valve from the RWST was open some six minutes into the event. This created a problem in itself, in that as water was taken from the RWST and put back into the reactor coolant system, pressurizer level started recovering. When it started recovering, RCS pressure started increasing.

And we found in this particular event, from looking at recorder traces of the RHR suction, temperature as well as RCS pressure recorder charts that a phenomenon occurred at about the point where the RCS pressure reached 15 pounds.

At that point, the temperature here in the suction of the RHR pump came back to almost the same temperature that the RCS was at at the time, indicating that the suction of the RHR pump was no longer from the RWST, or at least that the flow from the RWST was severely degraded and that flow was now again coming from the hot leg of the RCS leg.

This indicates that the combination of pressure and head from the RCS to the suction point was greater than the head of the RWST, backseating this check valve, or at least severely hampering the flow through the check valve.

I said before, the fact that the temperature in the system was 180 degrees was some saving grace. Had the temperature been above boiling in this event, it may have been a much more complicated event and taken much longer to straighten out.

I will address the recommendations that we have in this particular area a little bit later.

MR. SIESS: What is the probability they would have been going through these particular maneuvers at that temperature? That is hot shutdown, isn't it? And they were at cold shutdown.

MR. QUICK: It is very probable that a mode for a lot of surveillance is being accomplished on systems that are required to be operational prior to the time you enter Mode 3 during startup.

MR. SIESS: So you would in fact be doing valve strip test and things similar to this during a startup, when the temperature of the system would be above boiling. A result could have been at 400 pounds, couldn't it?

MR. QUICK: Yes. And as high as 350 degrees and still been in Mode 4.

MR. EBERSOLE: Because they would have been standing in this containment.

MR. QUICK: That's right. The pressure would not have decreased as it did below boiling. A result, it would just flash?

MR. QUICK: That's right. It would flash the temperature but stay at boiling as check valve seated and prolong the entire event, discharging much more water out of the RCS before you could get any makeup water from the RWST.

As I said, about 35 minutes later, the auxiliary unit operator that had opened the valve had opened the control room and all this time he thought he may have created a problem, especially when he saw -- he ran into the people exiting the containment.

(Laughter.)

So he went directly to the control room and informed the operators there as to what he did. At that point the operator recognized the elimination of the open light on the spray valve and immediately closed it remotely from the main control board, which terminated the so-called "LOCA." And then the system was rapidly brought back under control, the pressure restored, and level in the pressurizer restored and so forth.

And at 2015, I think it was, which was exactly 35 minutes after the start of the event, he started closing that valve.

MR. KERR: Did you say he recognized a light which said his valve was open?

MR. QUICK: Yes.

MR. KERR: So he had simply not noticed it before then?

MR. QUICK: That's right. And I might point out that we found a problem in that area as well, with control board design. And this is as good a time as any to get into it, I suppose.

There are two indications for this control. One is the open-and-close lights which are located right on the valve control switch itself. The other is one of many postage stamp-size alarm lights which are located on what Westinghouse calls the "group status panels," or group status monitoring panels.

These panels are designed to very quickly alert the operator to a valve that is mispositioned or a pump that is not started properly under an actual ECCS actuation condition in Mode 3 or above, when the systems are normally aligned for injection phase, the waiting and automatic injection signal.

And the theory behind this is that the group status monitoring panel should be completely dark if all valves are aligned properly and during normal operation. Once the injection signal is received when the pumps start and the valves reposition properly, the entire group panel should be eliminated. So the operator can tell very quickly at a glance that yes, everything is positioned properly and the pumps are started.

However, when you go into a cold shutdown condition, starting in Mode 4, there are many valves that have to be realigned to place this system into a shutdown cooling mode similar to what they were operating in at the time of this event. That means a number of these valves will be repositioned into a condition that would be contrary to that required for injection in Mode 3 but would be normal for operation in Mode 4.

So there are a number of these slots onthat particular panel that are already eliminated. When the Sequoyah design, the enunciator, audible enunciator alarm that is connected with this status panel, does not have a reflashability, it will alarm audibly when the first valve has been repositioned that is associated with that group status panel. Any other valves that are repositioned beyond that point it will not alarm.

That we saw as a problem for operation in Mode 4, primarily. When temperature of the system is above boiling and so forth in Mode 4 and Mode 5 both, but particularly in Mode 4, we believe that if the reflash capability had been incorporated into the design of that enunciator, that the operator would have been alerted much quicker to the fact that valve was open and certainly been able to take action, appropriate action, a lot sooner than he did.

By 2024, which was some 39 minutes after the start of the event, they had restored normal pressure and level and so forth and had the system back to normal in shutdown cooling.

Now, as far as the conclusions that we drew from our inspection of this event, we had a number of things. But I would start first by saying we have some short-term concerns as well as some longer-term concerns associated with it.

The short-term concerns were addressed immediately following the inspection by conveying to the licensee what these concerns were and getting agreement on corrective action from the licensee through the use of a confirmation-of-action letter. This confirmation-of-action letter addressed areas such as the administrative controls and procedures that assure their responsibilities and authorities were clearly delineated for the shift engineer as well as any other operations personnel who were involved in safety-related activities.

We found in that area that in particular the duties and responsibilities and authorities of the auxiliary unit operator were not addressed very well at all. In fact, there was very little there. There were no established watch station routines for the auxiliary unit operators to follow.

In addition to that particular thing, we found that in several cases outage maintenance groups had entered the plant, performed maintenance without the knowledge of the shift engineer, and things such as that.

So we then had to revise their management controls in that area to more clearly delineate the authorities and responsibilities of all the operations personnel.

We also addressed the area of communications and had TVA develop procedures which addressed policies and procedures which addressed the methods by which the operations personnel would communicate with one another as well as with other groups that had an interest in the plant from a maintenance standpoint or whatever.

They also addressed the upgrading of the in-plant on-the-job training aspects of the training program for hte auxiliary unit operators. In this area, the training program that was established called for some 800 hours of on-the-job training before an individual be fully qualified as an operator on an operating unit.

In the particular case of the operator that was responsible for opening this valve on this event, this was the first watch that that operator had stood in the auxiliary building at Sequoyah. He had received no break-in training at all on the Sequoyah unit. He had, however, been transferred to Sequoyah from Watts Bar and he had stood numerous watches at Watts Bar. But Watts Bar, of course, being a pre-op plant -- and in the fairly early stages of pre-op, I might point out, he did not get the kind of operational on-the-job training at Watts Bar that he needed to stand a watch on Sequoyah.

We had TVA then review the certification of all their nonlicensed personnel and assure us that only those personnel would be used that were experienced in the operating unit and to develop a procedures and certification process that would assure this in the future.

All of this was the subject of confirmation-of-action letter. We held a meeting with TVA on February 27 to discuss the content of this letter and to gain agreement from them to resolve these issues that we had raised in this area.

We did get agreement at that meeting. We had our resident inspectors verify all of these items prior to restart of the unit on March 12.

Some of the longer-term resolution that we needed on some of the items that we identified were things in the area of inadequate training for nonlicensed personnel. Region II is recommending that this item be transferred to the Division of Human Factors Safety and NRR to determine what changes, if any, should be made to our current requirements in this area.

Operations staff communication policies and procedures, this is another area that is not addressed very thoroughly at this point in time. This also will be looked at by NRR, Division of Human Factors Safety.

Manual seating of motor-operated valves, this is another issue that needs to be evaluated and resolved, in that with operators being what they are, with torque switches in the design and so forth, the manual seating of a valve of this type could in fact inhibit the automatic actuation of that valve at some later time when required. That needs to be looked at.

I might point out that TVA has a general operating procedure that addresses that, but it simply states something to the effect that the valve will not be turned more than one-quarter turn beyond the point where the disk comes in contact with the seat. "One-quarter turn" does not tell us very much about the torque that is being applied to that valve or whether it will be capable of breaking loose from the seat under the automatic operational conditions that may be required.

This particular valve does not have an automatic function, but there are many other valves in the system that do have to reposition automatically on an injection signal. The RHR pump suction check valve seating problem that I described before that is apparent during that needs to be resolved.

MR. EBERSOLE: The point you just made that they permit hand closure on remote valves, whether they be automatic or not, seems to be a procedure that should be totally outlawed because you never know whether the water-operated hammer blow device will operate if it has been hand closed. Should that not be generically prohibited?

MR. QUICK: That is our concern. However, I guess I have to point out that this being the only boundary valve between the RHR system and the spray headers themselves, they want to be sure that that particular valve is shut tight.

MR. EBERSOLE: But if the motor doesn't close it --

MR. QUICK: I agree totally. We have raised this as an issue with TVA. TVA is currently evaluating it. All I am saying here is that any automatic valves are not being manually torqued at this time. All I am saying here is that we want NRR to look at this as well.

MR. EBERSOLE: Is that a common practice, not merely a TVA?

MR. QUICK: I hesitate to answer that generically except from the standpoint that I am sure that I am aware of some other facilities that may use it as a practice on a valve similar to this where it is the only isolation valve.

MR. EBERSOLE: I see this as a very dangerous practice.

MR. QUICK: I do, too, and that is the reason why we are raising the issue.

MR. BENDER: On almost every motor-operated valve, it has some way to crank it closed doesn't it?

MR. QUICK: Yes.

MR. BENDER: Are you saying you should not allow that kind of action to occur or that there are circumstances under which it shouldn't be allowed to occur?

MR. QUICK: What I am saying is once you close a manually-operated valve you are no longer certain that that valve is capable of functioning within the context of its design function.

MR. BENDER: Well, that is true whether it is motor operated or manual.

MR. EBERSOLE: No. Manual will close it against its stated torque level.

MR. QUICK: Right.

MR. BENDER: The motor will too if the torque switch goes out of whack, which often happens. I think the point I was trying to get at, and I will just try to sum it up quickly, is unless there is something in the valve that senses its capability, it doesn't make a darn bit of difference whether it is manually or motor operated. So you really have to deal with it in the context of how do you know whether the valve can operate period.

MR. QUICK: You have to assume, I guess, from the valve stroke test that the limit switches are set properly on the valve, because it did operate under the surveillance test that it was designed or that was designed to test its operability when it is operated by the motor. When you manually close the valve there is no way for sure that you have not exceeded the set limit on the valve.

MR. SIESS: Is that what a valve close test is? You close it and then open it again?

MR. QUICK: Yes. If the valve was normally opened, then the valve would be closed and reopened and it would be timed as far a stroke time and made sure that that is within the limits of the tech specs.

MR. SIESS: Why would you ever have to close the valve manually if it has a motor on it?

MR. QUICK: Only because you want that added assurance on a single boundary isolation valve such as this. In something as important as the spray header itself, you want to be sure that that valve is seated tight so that over a period of time it is not weeping fluid through there.

MR. SIESS: And the valve stroke doesn't give you that assurance?

MR. QUICK: In my opinion it does.

MR. SIESS: So in your mind there is no reason to do it manually? Not only is it undesirable, it is unnecessary?

MR. QUICK: That is correct. That is the regional position on that issue. We have conveyed that to TVA as well as conveying it to headquarters.

MR. BENDER: When you operate the valve manually, can you see the stem move?

MR. QUICK: On this particular valve, yes.

MR. BENDER: And that is about as meaningful an indication as having something that tells you by electrical contacts whether the valve is moving, isn't it?

MR. D. LEWIS: Remember, it was checked to see if it was firmly closed.

MR. QUICK: That is correct.

MR. BENDER: Again, I am just trying to understand what the operator is seeing when he looks at this stroke. He is looking at the movement of the valve, open to close, and whether the motor does it or he does it manually, he is still observing the stroke that you were interested in. I think you are putting the emphasis on the wrong part of the job.

I will stop there.

MR. SIESS: How does the operator determine that it was firmly closed? Does he look at the position of the stem, listen for leakage?

MR. QUICK: No. In this particular case he was instructed to shift the motor control to manual, take manual control of the valve and firmly seat it.

MR. SIESS: At a quarter?

MR. QUICK: That is what their general instruction is, not to exceed a quarter turn.

MR. SIESS: They don't trust mechanical things and now they don't trust operators, so that really puts you in a bind, doesn't it.

MR. KERR: Let me go back to what I think you said, that the region has a position that valves that can be motor operated should not be manually operated?

MR. QUICK: Valves which are required to automatically operate as a part of the ECCS system within a specific time limit as required by technical specifications should not be seated manually because by manual seating of the valve without a proper evaluation of this, we are not convinced that the valve will not be made inoperable to the point where the motor cannot overcome the torque that was applied manually without tripping.

MR. KERR: This language implies that that is a Region II position but is not necessarily an NRC position or what?

MR. QUICK: The issue has not been raised NRC-wide as yet. We are recommending at this point that this issue be resolved at the headquarters level for an NRC-wide position.

MR. KERR: But in the meantime it is an NRC Region II position. What does it mean to have a Region II position, not an NRC position?

MR. QUICK: I think what it means is we would not tolerate it in plants in our region.

MR. D. LEWIS: NRC is having a fit back there.

MR. JORDAN: I don't want to interrupt, Don. He is doing a tremendous job. We are evaluating whether we should have an NRC-wide position on this. It is my personal view, I think, in agreement with Don's, that to manually seat valves that are normally motor closed is a bad practice and can lead you to decreasing reliability.

We have not had, to my knowledge, a number of LERs that say that is a problem for valve inoperability, so we don't have a good statistical base at this point; but as a practice, it is not a good practice.

MR. BENDER: Have you talked to any valve manufacturers?

MR. KERR: I guess I am a little puzzled that one establishes a position in the region that has not been reviewed by the NRC on the safety question. It would seem to me that that could lead to some inconsistency, but maybe inconsistency is okay. I don't know that that is a great virtue.

MR. JORDAN: The inconsistency would only be in a short time frame. I believe there has been an experience in this case and the region is using its judgment, and I am not arguing with it in this issue for the plants in that regin.

MR. EBERSOLE: May I make a comment?

MR. SIESS: Excuse me. Let me finish on this. It would not be NRC policy to maintain for any length of time different positions in different regions? Is that what you are saying, that you have the option of either telling Region II to change its position back or to adopt that position for all regions?

MR. QUICK: That is correct. When we have something we want to be reviewed by NRC, we put it to the headquarters level, they evaluate it and they come out with a generic position on the problem.

MR. SIESS: But in the meantime you can have a region position that would be different, Region I' than Region I, say?

MR. QUICK: I don't think our regional position 's anything different thann that required by the technical specifications presently. All we are asking the utility is that they operate the valve as they're designed to operate, by the motor.

MR. SIESS: I guess then I have a complete misunderstanding of what the term "region position" means.

MR. JORDAN: I would say that is a poor choice of words in this case.

MR. SIESS: That helps.

MR. EBERSOLE: I want to point out an aspect of valve operation that seems appropriate here. Valves opening and closing exercises should be recognized as giving no evidence of the margins to operate. Years ago we recognized that if a valve opened and closed and was being exercised, you could easily do it ten times and never do it under real loads. The real reason is there is no monitoring of the spike current that you have in the motor when you attempt to unseat it against the torque, or any other output that tells you in a quantitative way what the margins were.

It is simply a kind of a slave test and you don't know whether you have opened or closed on the last inch-ounce of torque or whether you had a hundred to boot.

MR. MARK: I think Region II would put it much the same. Did you have new or different things on this, Mr. Quick?

MR. QUICK: I had gotten down to the enunciator reflash capability. As far as the total event, our evaluation of the total event was obviously the cause of the event was due to operator error. However, I have to temper that fact with the fact that the AUO who opened the valve had not received adequate training in the area even though the training program had defined adequately what his training should be. He did not receive adequate on-the-job training.

The communication policies and procedures as well as communication equipment were inadequate at the time. The lack of an enunciator reflash capability contributed to the event. Inadequate management controls in the area of delineation of authorities and responsibilities contributed somewhat to the event, and there was somewhat of a morale problem indicated among the auxiliary unit operators as a result of a number of these areas that I just previously described with respect to communication duties, responsibilities and so forth and the lack of interaction with management at the higher level.

As far as the auxiliary unit operators are concerned, I think this morale problem as well contributed somewhat to the event.

As far as the current status of operational capability of the unit, I believe that, or Region II believes that the actions taken in response to action letter and verified by resident inspectors were sufficient to allow restart of the unit. I think that the trending we have done in the area of reportable occurrences since October indicates that TVA is taking a very rigorous view toward operator error at this point in time and they have significantly reduced the number of operator errors that are occurring at that facility. And as I pointed out before, I think that is partially due to a learning process on the part of the operators becoming more familiar with the requirements of the tech specs and the standard operation of the unit, as well as improved procedures and management controls in the areas.

I do think that the management controls that have been instituted now by TVA will contribute to better morale of the operators in the future, and that is a position that Region II has taken in allowing the restart of the unit.

MR. MARK: Thank you very much. It will encourage you to know that you have probably reassured one of our more imaginative members who feared that the 35 minutes was perhaps to be attributed to the plethora of bulletins and orders which the management might have received, or possibly to the need of convening the local Reactor Safety Committee before daring to push the button.

(Laughter.)

MR. QUICK: We did not find any evidence of any reluctance on the part of the operators whatsoever involved in this event.

MR. BENDER: Could I ask whether -- I am a little vague on the subject, and Dr. Mark has reminded me that bulletins and orders have something to do with this. Was there any bulletin in the past that said there must be a communications channel between operators doing things and the control room stemming from the TMI-2 accident?

MR. QUICK: No.

MR. BENDER: Isn't that the root cause of the TMI-2 accident? Wasn't that what happened, that in fooling around down there with the water treatment system --

MR. QUICK: I think many people have evaluated the TMI accident and I don't believe I want to stand up here and second guess all of the various committees.

(Laughter.)

MR. BENDER: If that wasn't the root cause, it is hard to find any other that was.

MR. SIESS: It was an initiator. Your last comment about the operator training seemed to be bothered a little bit by the fact that the operator is on his learning curve at the same time the plant is on its learning curve. You know, the idea that we are letting the operators learn during the startup period during the first few months of operation where I think we know the plant is more likely to have problems.

I don't know whether there is an answer to it, but it would be --

MR. QUICK: That is what I was going to point out. I am not sure what the answer to it might be in that it takes them at least two years to train an operator in the first place to receive a senior operator license.

MR. SIESS: This wasn't an auxiliary operator down at that level.

MR. QUICK: That is the extent of the training program, as I recall, 112 weeks.

MR. SIESS: Let's take an example. Once we are in startup do you think TVA would take an experienced operator from Sequoyah to use on that phase of Watts Bar. Would they use that as a training program for the Watts Bar operators?

MR. QUICK: They are currently doing that. TVA right now, having the training center operated at Sequoyah, is providing on-the-job, in-plant training for Watts Bar operators as well as other plant operators down the line further, Bellafont and so forth, on the Sequoyah operating unit. So they should be in much beter shape when Watts Bar starts up than they were with Sequoyah..

MR. MARK: Is that everything? Charley?

MR. MATHIS: I have one other question. If you look at this chain of events, if you will, it all started by following a surveillance procedure. I think each time you go through one of those you run the risk of having something go wrong in the following of the procedure.

I guess my question then is are we looking at the frequency of such procedures, their necessity and doing anything to really analyze and say that we are on the right track, we are doing it too often or not often enough? I think that is a question that we should continually review and look at and it applies to all these kinds of surveillance procedures.

MR. D. LEWIS: Let me throw in a little bit of trivia. On a plant that was licensed back in the early seventies without standard technical specifications, ballpark there are some 16,900 surveillances that have to take place on that plant over the year. Looking at the same plant that was licensed in the late 1970s, that comes to about 169,000 individual surveillances that have to take place on that plant over the year by our requirements.

MR. MATHIS: And that number is too big.

MR. SIESS: Those numbers are very interesting, but I am looking at a different set of numbers, on page 6 of something.

MR. D. LEWIS: Those numbers are not official numbers. They were run up by someone who went through the tech specs.

MR. SIESS: This is a memo to Mr. Jordan dated March 10, 1981 from Mr. Woods, and it says 8400 a year at Sequoyah versus 1400 a year at Browns Ferry, and it refers to surveillance activities. Is this different than what you are talking about in here? And what I just read, there is a long-term concern expressed in that letter just about that, are there too many surveillance procedures.

But the 8400 and 1400 do not seem --

MR. QUICK: I don't know that I am qualified to answer that question as to whether there are too many or not.

MR. SIESS: Can somebody answer the question as to the difference in numbers?

MR. QUICK: I think those numbers that you cited from that report are roughly the numbers that TVA has evaluated for the two units.

MR. SIESS: And how do we account for the factor of ten difference?

MR. QUICK: I think Mr. Lewis was going back to the early seventies on plants of the vintage of Robinson and Connecticut Yankee and that sort of thing.

MR. SIESS: This was 1400 a year at Browns Ferry and 8400 a year at Sequoyah, and he gave 169,000, I think, for Sequoyah. That is 20. So we must be talking about something different.

MR. LEWIS: The number we came up with, the number I gave you was before Sequoyah. It was a 1978 Farley Review that we had a summer intern run for us.

MR. SIESS: Then I would say there has been a tremendous improvement since Farley if we are down from 169,000 to 8400. I was upset at 8400, I am appalled at 169,000, but I don't know which one to believe.

MR. JORDAN: I think the problem is how you are counting, whether a shift for surveillance --

MR. SIESS: I'm not counting. I'm trying to find out how you are counting, I guess.

MR. JORDAN: I am saying there were apparently two different counts in these data. I think the only thing that would be important would be the relative difference between the two plants in each case based on the same counting scale. I think there were two separate counting scales. However, we have had previous evaluations.

We had a statistical sampling program that we were looking at in about 1976, and we had identified some population of 3000 requirements based on a particular plant tech spec, and there was a counting procedure there that we were comparing numbers of requirements, which included surveillance requirements, so we do not have an absolute number.

MR. MARK: When you use a number like 3000 or

300,000, are those to be thought of as the number of communications that you receive and pretend to look at in the course of a year?

MR. JORDAN: No, no. In this case as far as the surveillance items it would be the number of tests with the frequency applied to them for a given year for equipment in the plant required by tech specs.

MR. MARK: But they don't have to tell you that we did this thing ten minutes ago and the next one, we have just done two?

MR. JORDAN: No, indeed. They maintain records for themselves and us that they have done them.

MR. MARK: So there is a record that has to be kept?

MR. JORDAN: That is correct.

MR. QUICK: And they have to tell us if they miss one of the surveillance intervals. That is a reporting requirement. So it is just the opposite.

MR. MATHIS: And probably write an LER.

MR. QUICK: Yes.

MR. MARK: Well anyway, you think things have been improved by virtue of this spraying of the 13 maintenance people?

MR. QUICK: Yes, sir, I believe they have. I might point out -- that was one fact I didn't bring up in their discussion. The 13 people that were sprayed were only slightly contaminated due to the fact that they were inside the ice condenser at the time and were not in the direct spray path of the water. They did get wet. They did have a maximum of some 14,000 disintegrations per minute on hands and beards, but they were easily decontaminated by a shower.

MR. MARK: Don't you have to have protective clothing over a beard in particular --

MR. EBERSOLE: Had this occurred at equilibrium levels of nuclide concentration in the coolant later on in life and they had been elsewhere, do you know what kind of contamination level they would have seen then?

MR. QUICK: I can't address that at this point.

MR. EBERSOLE: I think it would be pretty sticky.

MR. QUICK: Yes, it would be quite a lot different than what we saw this time.

MR. MARK: I think we should get on. Thank you very much.

Is someone here to tell us about the recent things at Palisades? You were interested in that, Charlie, I think.

MR. JORDAN: We have representatives from Region III here to give a discussion. Dick Knop is the branch chief for the projects and Resident Inspection Branch. He will be giving an introduction. Duane Boyd is the section chief that includes the Palisades plants. Bruce Jorgensen is senior resident inspector for the Palisades facility.

MR. KNOP: We are going to give a discussion of enforcement actions taken by our office relative to four events which occurred at the Palisades Plant during the period of 1978 to the present, culminating in the confirmatory order that was issued to Consumer Power Company on March 10, 1981. We are also prepared to discuss the individual four events if you so desire.

In concluding my introductory remark I wish to state that the saquence of events that occurred at the Palisades Plant during that period caused us to look hard at a number of weaknesses that we had identified during the previous several years on the staffing of these programs and the implementation of those programs with the Consumers Power organization.

When the opening of the two redundant battery of breaks occurred on January 6, it was felt by the region to be the last straw, and we felt that strong action must be taken to preclude a serious safety accident occurring at the site. The safety concern was the overriding motivation in the immediate action letter that we issued in conjunction with Consumers Power on January 9th, 1981, delineating the actions to be taken by the Licensee on a short-term basis to improve safety of the operation, and it was also confirmed and an order issued on March 9, 1981 to confirm the short-term actions that had been under way and also to formalize the long-term actions taken by the licensee. Mr. Jorgensen will also be addressing these items.

MR. JORGENSEN: Thank you, Dick.

You should have received a handout. I have got it in the form of a Vu-graph but I just intend to hit the high points. I will start first by discussing the kind of evaluations that we do briefly; secondly, what we found based on the evaluations that we made at Palisades Nuclear Plant; and conclude with some discussion of the actions we have taken based on the findings of our evaluations.

We do both routine and non-routine evaluations, not only at Palisades but at all plants, particularly the non-routine type evaluations which relate to potentially significant regulatory problems.

Our routine evaluation program, as Don has mentioned, has existed for a number of years. It has been formalized recently in the systematic assessment of licensee performance programs, but it is similar in nature and content to the kinds of evaluations that have been going on for a number of years and it looks at some of the same areas.

Now, prior to 1980 the evaluation process resulted in an end-of-year report, and that was prepared by the principal inspector. The kinds of things looked at were what kind of regulatory problems were identified, what kind of event reports were received as to the causes, the consequnces, et cetera. You can see the list there.

(Slide.)

The same kind of thing is done in the systematic assessment process. It is just that in the systematic assessment process there is this increased formality and you do end up with a formal published report. In all cases of routine evaluation, findings are discussed with licensee management, typically within two to four months after the conclusion of an assessment period.

So that is our routine assessment activities. They have gone on for a number of months, or a number of years.

(Slide.)

We also do non-routine assessments, if you will, when events occur, and that is just the discussion we have had as relates to Sequoyah that have some potential regulatory significance. The purpose of these evaluations would be to support conclusions or recommendations relating to the actions that NRC should take regarding the particular event.

Examples of specific event-related evaluations have occurred for Palisades include the containment integrity evaluation event of some possibly 18 months wherein two manual purged line valves were left open resulting in an approximate 4 to 6 inch hole in the containment.

This item still is under adjudication and the licensee has cause to believe apparently that information can be developed indicating that the valves were not opened for 18 months, and we are continuing to maintain contact with the licensee on that process.

The second examples, there are two instances in the summer of 1980 wherein the valves were mispositioned in the suctions of emergency core cooling system pumps, in one instance only briefly as a part of a stroke test, which should not have been done with the plant in operation, and in another instance a condition existed for about 36 hours.

The most recent event of January 1981 involved disconnection of both the station battery breakers in the performance of the surveillance test.

(Slide.)

MR. MOELLER: A question on the evidence for the containment integrity violation. Can you maintain containment pressure with the openings that you described for reduced pressure?

MR. JORGENSEN: If you are talking about in an accident scenario --

MR. MOELLER: You said this may have occurred over an 18-month period and that, you know, the licensee was attempting to --

MR. JORGENSEN: That would probably follow barometric pressure. There is a control valve downstream but it is not an isolation type. It is basically a damper.

So that had the valves been open, containment pressure would have cycled with barometric pressure just a little behind it.

MR. MOELLER: That is one way of checking.

MR. JORGENSEN: That is one of the things being looked at, of course.

MR. MOELLER: And for this plant, what do they try to maintain as a containment pressure? Is it below --

MR. JORGENSEN: That is a consequence of the normal heatup with the isolator. Approximately 1-1/2 pound positive pressure would have resulted prior to the last outage, and as a result of the evaluations that were done at that time, they now equalize containment to atmospheric at about or just before exceeding the 200 degrees and are operating at slightly less than a pound typically now.

MR. MOELLER: Okay, thank you.

MR. JORGENSEN: The results of our evaluation, the routine process, are as follows.

(Slide.)

First, that Palisades has had a history that has existed for a number of years wherein the number of non-compliance weighted with the significance of the non-compliances that have occurred makes them stand out as compared to other licensees in Region III. Not only have they stood out but they have not improved the relative position that they have had over the course of the passage of time, this despite conversations in meetings with licensee management on an approximate annual basis to discuss the results of our routine evaluation process.

We also looked at the immediate action letter or at the licensee events. Again, the number of licensee events in the case of Palisades in raw numbers, Palisades does not stand out when the significance of the events are considered and some weighting mechanism that has been used within the region for all licensees for a number of years is applied.

(Slide.)

They do stand out above average, and again the history is that they have stood out above average for a number of years.

(Slide.)

MR. MOELLER: Excuse me. You are saying this chart is for significant LERs rather than total? Is that what you are saying?

MR. JORGENSEN: It was the total LERs wherein some have been multiplied by a multiplier based on their individual significance.

MR. MOELLER: Thank you.

MR. JORGENSEN: The problem areas that have been identified as part of the routine process have not undergone the kind of change we might have hoped with respect to the results of meeting with company management on this approximate annual basis, and some of the specific areas which we consider to the problematic at the present time or at least through the completion of the systematic assessment process in September of 1980 were identified as much as four years ago and discussed with licensee personnel as areas wherein additional management attention needed to be directed or areas that required some improvement in regulatory performance.

You can see particularly that there have been problems with personnel errors. There has been incomplete implementation of training programs, et cetera.

MR. MARK: Does "†" here mean noticeably worse than average?

MR. JORGENSEN: It means it was identified. It is the absence of a mark that indicates it was not a problem at a given time.

That summarizes the conclusions we have reached based on our evaluations. I would add that in the special cases, the other than ordinary evaluations, there were some additions to this list that related to evaluation of the specific events. The instance of the containment isolation valves led us to the conclusion that there were difficulties, there were problems with the procedures which controlled certain of those activities.

The valve mispositioning in the emergency core cooling systems led us to conclude that there were problems in control of personnel or preventing personnel error. The same is true of the situation most recently with the disconnection of the station batteries. That was caused primarily by operator error.

(Slide)

It could be characterized that his error was not following the procedure. In this case the procedure we think was adequate to the task but the individual performed other than as the procedure indicated he should perform and ended up in disconnecting the station batteries.

We have got a summary, then, on what we feel needs to be done with respect to strengthening management control of activities at the plant and with respect to improving the performance of personnel who are engaged in jobs wherein they can interact negatively with safety-related equipment.

MR. SIESS: I am convinced that there are indeed significant differences in the performance at various plants. Have you come to any conclusion as to why there are such differences, what are the real contributors?

MR. KNOP: I think the answer was that not any one simple thing, and it goes back to many of the weaknesses that were shown on that figure 4 chart that there were a number of weaknesses culminating in an overall assessment that the management control of this is not up to snuff.

MR. SIESS: Is management control a cause or a result?

MR. JORDAN: You are looking for a more philosophical answer in terms of whether it is morale or educational level or those kinds of things?

MR. SIESS: Or management attitude or commitments to something else. I mean I can have the best management control system but it may not be used or it may not be enforced effectively, and I would think that poor management control might be a symptom of something else that is a root cause rather than the ultimate cause.

MR. JORDAN: I agree with you, Dr. Siess. This particular facility has gone through a number of plant managers over the past seven years and there have been ups and downs. There is a lag time in the licensee's response to a significant change in management.

MR. SIESS: Let me ask you something else. I am subcommittee chairman for Palisades and I have been following it ever it got a construction permit. When they reported that last incident, the ECC systems, this, I think was about the first time I saw I believe it was the LER that had about a four-page attachment to it saying all the things they were going to do, and I said, my goodness, how things have changed.

Was that written after your meeting with them or before?

MR. KNOP: During.

MR. SIESS: So it wasn't spontaneous, then?

MR. BOYD: Many of the things they did by their own judgment.

MR. SIESS: I was very much impressed by their response to that incident as compared to what I had seen previously as that response to certain incidents, and I was quite heartened at this what appeared to be a real change in attitude.

MR. KNOP: The licensee has been into our regional office on a number of occasions, including the new president and executive vice president. They have made it very clear that they see the light and that they are taking every action. This confirmatory order confirms a large number of actions that are taken across the company, quality assurance, training, everything else, and they are committing large sums of staff and money to corrective action.

MR. SIESS: So you think there is a real turnaround here?

MR. KNOP: I think it would be too early to say there is a turnaround. They are certainly expanding the effort, and if you can do it on sheer effort, it sounds like they would, yes.

MR. MARK: Are there other things on this? Is there a representative of Palisades here?

MR. BUCKMAN: Yes, sir. My name is Fred Buckman. I am the Director of Nuclear Activities at Consumer Power Company. I had not intended to make any particular presentation. I would be happy to answer any questions the committee may have.

I would point out that I do agree that the company has made a top-to-bottom commitment with regard to upgrading both the quantity and the quality of the staff and the commitment to management controls at the site.

MR. MARK: And that would date from early this year?

MR. BUCKMAN: In my opinion, the turnaround started with the identification of the breach in containment isolation that was identified in September of 1979. At that time it was, I believe, both the company's position and the position of Region III that the most serious defect in our operation was that of the management controls at the site.

I was the chairman of the task force that devoted about six months to upgrading the procedures, the checklist, the drawings and things that were used from a procedural control standpoint to run that site. I think we have those controls in good shape.

What we found during the intervening 15 months or so is that even with good procedures, good checklists, good controls, that we have had some difficulties with failure to follow the controls and that what we have decided to do as a result of that is to go into a program that is in much more depth than simply upgrading the management controls. It includes increasing the staff, it includes upgrading the training both of the licensed operators and the non-licensed personnel at the site, and it includes a review and probable reorganization of some of the corporate involvement in the site operation.

MR. MARK: I am not familiar with Consumers Power. Is Palisades a large fraction of their corporate concern or only an item?

MR. BUCKMAN: Consumers Power Company has installed capacity of about 7000 megawatts, which Palisades is 750 megawatts. The electrical capacity represents about 55 or 60 percent of our business. We are also in the gas distribution business.

MR. MARK: I guess you are telling us that the nuclear component is receiving more and more serious attention from the top on down?

MR. SIESS: Of course they are also in the business of building Midland.

MR. BUCKMAN: In my opinion the nuclear part of our business has always received serious attention. I think the attention has changed in focus with what I might characterize as regulatory performance and also with regard to a commitment to do it right.

MR. MARK: What you tell us I think is very encouraging, and thank you very much.

Was there more that you would have for us?

MR. JORGENSEN: I had a partial list which indicates what is currently going on, if you will, and that does include some of the things Consumers Power is doing. I think Dr. Buckman mentioned some of them, and as I say, this is a partial list of activities that are in progress or planned.

(Slide.)

I would also indicate that for some figures that have been longstanding, there are some that have gone away as well. Of particular interest there would be concerns that relate to deficiencies in the procedures. We think we have taken care of that problem.

Now, that led to some additional difficulties because of the magnitude of the overall procedures. It was somewhat like starting over and people were given procedures with which they were not familiar after having operated under a different process for a number of years, and that did cause some difficulties in and of itself.

MR. MARK: Yes, Dade?

MR. MOELLER: I think the comments by the representative of Consumers Power concerning the fact that they are upgrading the attention or increasing the attention they are giving to these matters is good, but I think equally useful, certainly to me, would be some explanation of why previous to now there was so much apparent inattention.

I mean it is good to know that it is being improved now, but why was the situation the way it was earlier?

MR. BUCKMAN: If I can take you back to that period of time which Palisades went into commercial operation, it would be about the end of 1971, we had been through a protracted hearing, one of the first that resulted in substantial delays in bringing the plant on line.

Shortly after going into commercial operation we started struggling with what I would characterize as some very serious technical problems in the operation of that facility, the first of which was our ability to control water chemistry in the steam generators through a normal power operation.

Shortly following that came the history of rather sad experience with steam generator tube failures. In 1973 we shut the unit down with a steam generator tube leak and went into a combined generator repair and combined shutdown where we also found that some reactor noise that we had been monitoring for a period of time was the result of core internal vibration. That outage lasted for almost two years where we struggled through.

To my knowledge the only instance where steam generator corrosion was also observed to be occurring with the reactor in a cold shutdown condition as a result of a polytheonic acid attack.

We also found that we had a condenser that was in need of complete retubing. The result of that early operation combined with normal equipment problems that one might expect from the first of its kind facility -- Palisades was the first of Combustion Engineering's nuclear supply systems -- I think led Consumers Power Company to devote a great deal of its attention to the resolution of very difficult problems, and in a sense the period we are in now is in a period where we are capable of changing our focus of solving technical problems associated with the facility operation to solving managerial and training and employee qualification problems associated with managing it in what I would characterize as an excellent fashion.

MR. MARK: I believe from the way you have described this you have personally seen through a large part of this experience.

MR. BUCKMAN: I started with Consumers shortly before Palisades went into operation.

MR. MARK: Is there a reasonable continuity in the senior personnel connected with the plant or has that also suffered?

MR. BUCKMAN: I think there has been substantial change in senior personnel at the site. Right now the plant manager, the operations and maintenance superintendent, the chemical and rad protection superintendent have all been there less than two years. There is a thread of some long-term experience but there is also a lot of what I would characterize as new personality on the site.

That new personality is there largely, I think, because of the attention that Consumers is giving to its -- the management attitude it would like to have at this point, and I think that you might recognize that for those people who have suffered through some of the very tough problems that we have had to go through and the stress associated with some of those long outages, that it would be perhaps asking too much to ask those people to also conduct nearly a 180 degree turnaround in the way they conduct their business.

MR. MARK: But would you characterize the present situation as perhaps providing a base for a continued experience direction of things?

MR. BUCKMAN: I am not without concern with regard to the base we have. There is not as much history at the site as I would like to see, but we do have very good people, I think, in the management slots at Palisades. I think that they make up in their technical skills and in their power plant knowledge what they lack in specific facility history.

MR. MARK: Thank you.

I will ask you to get to what we were supposed to have been doing an hour and a half ago. I believe our next item, which is scheduled here before lunch, was dependent on Dave, who is not here, so we might take your item as the last one.

MR. PLESSET: All right. Shall I go on, then?

MR. MARK: Why don't you go ahead with your introduction and then we will have Ivan come on and then perhaps have a break.

MR. PLESSET: Well, let me introduce this subject of the passive containment system that was reviewed last November 13 by the Thermodynamics Subcommittee.

At the conclusion of the meeting I asked that our consultants, Dr. Zudans and Catton, to make brief reports of their views.

MR. KERR: It is just that he is sort of a mild sort of a fellow that he won't speak up.

MR. PLESSET: Well, before going to their verbal comments I would like to indicate a bit of background. This passive containment system, PCS, undergoes changes and you might keep that in mind. I don't make this statement in an entirely negative sense since it is not being critical to say that the system is not completely engineered or analyzed to obtain the necessary degree of completeness. It is clearly a large task.

My own comments are as follows. Clearly, the initial approach of the passive containment system was to handle large break LOCAs, and if we look aside a moment from its capability to do this, let me say that my impression is that small break LOCAs and other transients are more probable than a large break LOCA to not be effectively treated with the PCS in place.

There may be some dispute regarding this conclusion but at least it has not been made a serious risk analysis in comparison with conventional PWR containment.

Another point I would like to make is that the design proposed would, in my opinion, not cope in an adequate or safe way with the quench tank discharge condensation load. We have had considerable discussion of this kind of a load in a suppression pool of BWRs, and I think the consultant will return to this point.

MR. MARK: When you say that things other than the large break will not be as effectively treated, do you mean it won't treat those as effectively as it does a big break or as effectively as existing means treat them?

MR. PLESSET: I would say it does not handle them as well as conventional design, and I would say the large break LOCA is not necessarily treated as well either.

MR. MARK: Not necessarily, but it is focused on that, and the small ones it has not paid as much concern to, and do you think present treatments are at least as good?

MR. PLESSET: Let me finish. I am almost through.

Another significant point which is important, in my opinion, arises from the capability of the steel tank surrounding the pressure vessel to withstand the blowdown loads in the LOCA. These and similar questions will be discussed by Drs. Catton and Zudans.

A final general point is perhaps the increased cost of construction of the PCS and the increased difficulties with maintenance, which is not a minor point. I also have a general reservation on the question. Is this passive containment system really passive? I do not make this point more specifically since the design of the system is not really complete, but it is a general point to be kept in mind.

With all of these criticisms I would like to add in my introduction a word of praise of Mr. Falls, from whom you will hear later. I am sure he has pursued this with the belief that it would contribute to the public safety.

Now, do you have any questions of me before we have the consultants' reports?

MR. RAY: Only will the presentation bring out why it is less effective for the small break than it is for the large break?

MR. PLESSET: No, I am telling you that that is my opinion.

MR. RAY: But the presentation will not tell you why?

MR. PLESSET: I doubt it. You may get that conclusion yourself. If you don't, at the end of Mr. Falls presentation we can consider it if you like.

MR. BENDER: One small point, or large, depending on your viewpoint. Since the term "passive" has been used in connection with this concept for a long time, I wonder if you have any -- if you understand any more about what leads you to raise a question about its passive nature.

MR. PLESSET: Well, truly passive means that no system needs to be operating and no operator action is needed to cope with a LOCA. Now, actually I think you will find, unless the system has been changed further, that you need to maintain a large reservoir of water at a very high pressure, and this it won't do by itself. You have a large number of valves which need operating properly, and these may be a little bit dubious.

MR. BENDER: I see.

MR. PLESSET: Now, the other thing that I might mention, this discharge of a large volume of water only takes place wherein there is a considerable drop in pressure, which won't necessarily occur with a small break, to answer your question a little more specifically. Do you see the point?

Any other questions? I want to call on Catton and Zudans too before we go to Mr. Falls.

MR. KERR: My inquiry was more procedural than factual. It was whether the schedule was such that the chairman would consider a brief break before we launch into this interesting topic.

MR. PLESSET: I was going to propose to the chairman that we have Ivan and Zudans make their presentation, which I have been assured will not extend 10 to 15 minutes each, and then you might have a break for lunch if you like. That would put the lunch at the right time. The program is not at the right time but the lunch would be at the right time. But that is up to your chairman.

MR. KERR: I have no objection to that suggested procedure.

MR. PLESSET: Is that all right?

MR. MARK: Let's see if Ivan and Zenon hold to their brief --

MR. PLESSET: We will go alphabetically. Dr. Catton will have his report and then we will have Dr. Zudans.

MR. CATTON: It is not very often I have the opportunity to stand up here.

(Slide.)

These slides were actually prepared some time ago for the subcommittee meeting. I had sort of hoped that Paul had erased the top part before he reproduced them for me.

MR. BENDER: Was everybody's Xerox copy put in backwards? It was printed backwards.

MR. PLESSET: Mine is backwards.

MR. KERR: It is really only bent, isn't it?

MR. CATTON: I will try to put it up here correctly. I am sure Mr. Falls will have a better diagram. I am only going to go through some of the thermal hydraulic aspects and I will leave the structural to Zenon.

Basically the system as far as I can tell has four features, the --

MR. KERR: Ivan, your mike ought to be closer.

MR. CATTON: I can talk louder.

MR. KERR: It might help.

MR. CATTON: The system consists of four subsystems: a refill system, deluge, quench and a post-accident decay heat removal system, and the way they are put in there -- this is better, I believe, than the one that was handed out.

(Slide.)

It was crammed into a bunch of cells. There are cells for each component and then they are interconnected with holes that the pipes go through. One of the concerns I had was the flow of steam and water counterflows through all these passages.

(Slide.)

With this in mind, the way the system was hooked together you have the refill system first. It activates at 1000 psi through a check valve and dumps into both the cold and hot legs. When the pressure gets down to 55 psi, you have the deluge tank. The deluge tank actually does two things.

Any of the steam that is in the containment goes down through these tubes, and this can act as a quencher. There is also a quench tank that acts as a quencher. The volume of the deluge tank is 15,000 cubic feet, and the quench tank as well. There are four refill tanks, each of 6000 cubic feet. The temperature is maintained at 50 degrees.

MR. RAY: Would you take questions?

MR. CATTON: Sure.

MR. RAY: The tubes or lines that go up to the deluge tank ceiling, are they open in that fashion or do they connect to something else?

MR. CATTON: These are open to the containment.

MR. RAY: How do you channel steam in there to quench it? If the atmosphere is filled with steam, is there something to suck it in?

MR. CATTON: Yes, temperature, low vapor pressure.

MR. RAY: Oh, I see. Excuse my ignorance.

MR. CATTON: One other thing on the quench tank. They have it hooked up in a kind of unique way to the steam generator. There is a valve that sits in this line, and this can act sort of as a buoyancy-driven auxiliary feedwater system. I will come back to some of these things.

MR. EBERSOLE: Doesn't air get entrained in those tubes and it also goes into those things and fills up slowly?

MR. CATTON: It certainly could. It certainly could. I actually hadn't thought about that. I was more concerned about the process of condensation that would take place in these. They looked like awfully long downcomers.

MR. EBERSOLE: But it will not be entirely steam.

MR. PLESSET: That will make it worse, Jesse.

MR. CATTON: That ties back into the calculations of pressure that were done where the clearing was ignored, and that is where the comment of Milton came from about the peak pressure -- I believe he said something about peak pressure.

(Slide.)

The final system is the heat removal system. Basically what it is is a cooling pond outside, some heat exchangers inside and this acts on a natural circulation, the heat exchanger through this loop and then outside by natural circulation to a pond. So it is passive.

(Slide.)

Just to go back over these systems again so you have them in mind, the refill system now provides core flood water following depressurization of the primary system to 1,000 psi. This is one of the reasons it misses a small break. Unless you dip down below 1000 psi, nothing happens.

The refill system operates on secondary side steam, which means if you don't have a steam supply, you don't have the refill system. It does have a lot more water than the usual ECC accumulators. I am a little bothered by the use of steam rather than the nitrogen. I think the nitrogen is more sure.

MR. EBERSOLE: You could make it happen with small breaks if you put more -- you can make it operate it if you had a smoke blowdown system analogous to the boilers. You could cause this to happen with small breaks as well.

MR. CATTON: I think there are a lot of things that can be done with it.

MR. BENDER: You are saying automatic depressure.

MR. EBERSOLE: Put a PORV on to deliberately lower the pressure below that of the small break.

MR. PLESSET: More valves.

MR. CATTON: Change the check valves.

(Slide.)

The deluge system at the outset operates as a depression pool. Further it acts as a suppression pool for the pressurizer and the steam generators. Now, the deluge system is connected to the refill tanks via check valves, and there is about a 700 psia above the check valves. There were the other set of check valves between the refill system and the primary system.

There are also check valves associated between the steam generator and the refill system.

(Slide.)

The quench system acts as a passive heat sink or suppression pool following the LOCA and other accidents involving steam and feedwater systems. It also acts as a source of emergency feedwater following a loss of feedwater. This also operates on secondary side steam, and you can look at it as sort of a PWR suppression pool with feedwater capability at low pressure, and it is going to have all of the problems that suppression pools have when there is a check valve in the line to steam generator.

So there is a tremendous number of check valves in the system.

(Slide.)

Post-accident decay heat removal system. It is a heat exchanger inside the primary containment connected to a heat exchanger in the cooling pond, and the operation is by natural circulation.

Now, wherever you have natural convection you have to have surface area, and with the small containment the way the things are packed in there, I am not sure about the surface area availability.

What I did after going through this was just try to list concerns and things, and these concerns are not necessarily incurable. It is just that as far as I can tell they have not been looked at very well, and unfortunately, I just received Mr. Paul's response to these concerns today. But I might mention that in going through them, the response to the concerns is more words than analysis, and one of the things this system has is a lot of words and not much analysis, which is one of the drawbacks, as far as I can tell.

(Slide.)

The first thing, rather obvious, is the large number of check valves between the various systems and the primary system, and they are all different pressures. The operation of the high pressure flooding system, the refill system depends on the steam from the steam generator. I don't know that this is bad, but it surely needs some attention.

The quench and deluge systems may not survive their mission as steam suppression pools.d The water is very cold, the downcomers are very long. The steam bubble collapse in subcooled water may cause damage. I don't believe this has been looked at.

The internal design pressure of the containment system may be too low for the large breaks, and the calculation of the peak pressures, such things as clearing times were ignored. If you recall from the BWR, the peak pressure occurs when you get the vent clearing. This was not a part of the in-house as it was done.

The passive heat removal system depends on natural circulation within the containment. That is not bad. It is just that natural convection of water through a heat exchanger requires a lot of surface area, and you require a lot of surface area in the cooling pond as well. I am not sure you have the space in containment to handle it.

The system is not operable unless the primary system drops below 1000 psi, and this excludes many of the small breaks, but as Jesse suggested, that might be a design error.

MR. PLESSET: I am a little worried about Jesse's fix. This may make the system dangerous.

MR. CATTON: Jesse's fix is like a lot of the other fixes. It is easy to say, but how to carry it out.

MR. EBERSOLE: I don't believe you would ever have let the BWR blow down, would you?

MR. PLESSET: How's that?

MR. EBERSOLE: I don't think you would have ever let the boiler blow down as it presently does. Would you?

MR. PLESSET: Oh, yes.

MR. CATTON: There were some arguments made in one of the latest reports from a company that is sponsoring this system indicating that Class 9 accidents with vessel failure will be controlled. It is my view looking at the system that they will be more difficult to control if they occur because of the cross-sectional area in the cavity. If you do get a core meltdown, you are going to have deeper beds and core melt penetration of the concrete. Things like that are going to be much more aggravating.

MR. MARK: Tell me about that small cross-section. I can draw the same thing with a bigger cross-section.

MR. CATTON: That would be fine. That would alleviate some of the difficulties.

MR. MARK: But what would be --

MR. PLESSET: There are problems brought out by one of the engineering companies, I think, that was financed by a grant from DOE that there is even a difficulty in getting what they have now into a containment without making it enormous. That is what makes the maintenance so hard, all these isolation boxes around.

MR. MARK: You are saying making a comfortably large containment would be prohibitively expensive or mechanically monstrous or something?

MR. CATTON: Well, if you make it comfortably large you have a large dry containment again.

MR. PLESSET: I think Zenons will come back to some of this, isn't that right? So why don't we wait on that?

MR. CATTON: Just let me conclude on the negative side. A great deal has been claimed for the passive containment system without sufficient backup calculations. I think when you start doing your calculations there are going to be a lot of surprises before you get to a final design.

I would like to end on a positive note.

(Slide.)

The auxiliary feedwater system using the quench test looks like a useful contribution. It could give you significantly more time if you wound up in a situation where you lost all power because this thing could cycle. Now, now none of the calculations have been done as far as I can tell to demonstrate that it is even workable, but it sounds like a good idea.

A passive heat removal system would be an asset in Class 9 accident mitigation. Again, I am not sure there is a design even within the system that is appropriate. I like the idea of removing the post-accident sensible heat without phase change because there is a lot of margin in phase change.

On the surface the passive containment system appears to be the answer to the large-break LOCA loss of coolant accident from the thermal hydraulic point of view. On the other hand, the present system, particularly in light of the LOFT tests, seems to answer the question as well.

I like the idea of isolating the steam generator that has a problem, but it wasn't clear on reading the description as to how they were going to do that.

Finally, steam relief valves that do not exhaust to the atmosphere, I think that is a nice idea, particularly in light of TMI 2 when they were within a steam generator tube with dumping the contents outside.

Are there any questions? I will entertain them. If not --

MR. BENDER: Just one point, Ivan.

It looks to me like exhausting everything into the containment continues to add to the pressure requirements of the containment. You didn't say very much about that.

MR. CATTON: First, by starting out with everything very cold, they can soak up a lot of energy and sensable heat. Second, they have a passive heat removal system that would take that heat outside the cooling mode. So they handed that problem, assuming that the pieces work.

MR. BENDER: I was thinking of it in terms of flowing down the steam generator. Blowing down the steam generators into the containment may impose its own pressure requirement on the containment.

MR. CATTON: That's correct.

MR. BENDER: I wasn't sure that question had been addressed. Has it been?

MR. CATTON: None of these kind of questions have been addressed.

MR. PLESSET: There's been an important heat removal problem in general that Xenon is going to talk about. I think we ought to hear that first before we get into too much more detail.

MR. CATTON: Okay.

MR. PLESSET: I don't think we have an idea of how much structure is being put into the containment now. Maybe Xenon will indicate that.

MR. MARK: What you are describing for us, Ivan, is PSC-2?

MR. CATTON: Well, it depends. I wasn't trying to describe any one of them in particular. The kind of changes that have occurred haven't changed the fact that there are four systems that they put into the containment.

The containment has grown by a factor of f... in volume. They have changed the kind of quench tank. But basically it's still a quench tank.

MR. ZUDANS: Mine will be a continuation of what Ivan said with some elaborations of points he made. It may be another slide showing the total system, because I think I had a problem in fully understanding how those different volumes are connected where those things sit.

So I went to the problem of it is better now?

(A chorus of yeses.)

What is referred to primary out of containment is shaded in yellow.

(Slide.)

And different systems that Ivan described are each one in its own color. I'll come back to this one here, but first I would like to show you the plan view of that.

(Slide.)

Here you have a better view of how things are placed. There are a total of four refill tanks -- red ones (indicating) -- there is a pressurizer. You have two on this side and two on this side. And there are also four quench tanks (indicating).

Now all the yellow shading areas in the plan view represent the PCS-2 containment -- primary containment. The important fact that wasn't mentioned at this time to this containment is kept in vacuum -- the entire containment, the entire 100,00 cubic feet.

(Slide.)

Now my concern is really not a concern that would disqualify or qualify the idea. I only want to make a specific point. I think that any idea can be engineered and can perform. The question is what it will take to do so.

Now the other things that may not have been clear from those individual slides that show the individual systems are these. This is the quench tank and these are the pipes that are open to the primary reactor containment. There are many of them (indicating). I only showed one, which also is not clear on this picture -- that this volume and this, and this, and this -- all of them are connected in just one simple, complicated volume.

And all of these volumes (indicating) are in essence steel shells. They are tight steel cylinders or pipes and they are all tightly connected because they are all evacuated. There is also the fact to be remembered that the reactor coolant system is not insulated. So the metal temperatures will be those of the primary coolant -- somewhere around 600-some degrees. And it also should be remembered that all of the walls of the primary containment system are insulated in one fashion or the other to avoid heat losses from primary system -- from primary coolant system -- to the containment wall.

There is no specific design as yet developed for that insulation. Discussion is made in terms of reflection -- reflective type of insulation, which would prevent radiation heat transfer.

MR. SHEWMON: Xenon, is the vacuum in each of these tanks for insulating purposes or to absorb steam, or what?

MR. ZUDANS: The vacuum is for insulating purposes, yes, yes, to eliminate heat conduction. And the radiation is supposed to be eliminated by providing reflective insulation on the walls, and plus at least in some of the writeups there is a statement that the styrofoam or some such materials on the other side of the containment shell to protect the concrete.

Now this should give you a better picture. Now the quench tank and the deluge tank, the deluge tank is mainly supposed to absorb 90 percent of blow-down energy. And the quench tank is supposed to absorb 10 percent of blow-down energy.

In the process of doing that, the deluge tank will increase its temperature by about eight degrees -- from 50 to 58. I did some simpleminded calculations and it works about to be 60. So the numbers are pretty close. That increases up to 128. I'm sorry. 128, according to their calculations. According to my calculations, 260. This one increases by 8 degrees, and this is about correct, as far as my calculations are concerned.

There are certain things that are not completely discussed. There are also certain things that are very, very, very, very positive, in my opinion. I am going to take the position that the system has merit and I will continue my discussion of things that I think can be improved. And in some cases I will show how I think they can be improved.

(Slide.)

Now it's called a passive system. Here is the list of active systems that must function for the containment to maintain its integrity. I also already talked about cell wall cooling, cell evacuation system, and there is another active system, refill tank pressurization system.

(Slide.)

I think all of these problems, in my opinion, are minor and it is really the question of engineering that has not been put in. I mean, it's like having an idea and then working around it and every day you have a new idea.

I think cell wall design can be easily improved because we have an example of a similar situation in HTDR. They have high temperatures to cope with and they have radiation insulation. They have a cooling system imbedded in the concrete. And that could work here, in my opinion.

Refill tank, I think the arrangement of the refill tank is wrong. It doesn't have to be pressurized at all. I will show you, and if I am wrong I will accept it. If I'm right, Mr. Falls will thank me.

Water chilling I think is about as good or as bad as the refrigeration system in the ice condenser. I don't really quarrel about that. And besides, it's not necessary to keep it at 50 degrees, in my opinion. And I will tell you why.

(Slide.)

My real concern, as it stands now, is the structrual complexity and redundancy. I made the first two colored slides for the purpose of trying to impress upon you how complex that containment volume is and upon the fact that the walls of the containment are supposed to stay below 160 degrees all the time, whereas the primary coolant system is around 600 degrees all the time or so. So there is a significant temperature differential which creates significant structural problems.

There will be local hot spots everywhere. You want to provide the support for anything that you want to attach to it. This was discussed in the report by Gilbert Associates, I guess -- the subcontractors to Sandia. And they proposed new solutions which I do not consider adequate either.

I don't think you can maintain a free space between primary containment steel shell and the concrete that is provided there.

The other thing that I agree with, Ivan, and we discussed it before, the blowdown load handling, deluge and quench tanks really needs a very careful engineering. And, for that matter, I have a recommendation at least to eliminate the injectors from the forces that might develop there. When I talk about quench tanks -- and I'll talk about it a little later --

MR. BENDER: Before you take that off, the second item -- I know we've always worried about hot spots and penetration supports, but why is it any worse than the reactor system itself that's been dealing with those kinds of things?

MR. ZUDANS: The reactor system itself provides supports against solid concrete. This has to support pipe elbows against freestanding shells.

MR. BENDER: You're talking about thermal expansion as opposed to --

MR. ZUDANS: Also some structural loads, if you can postulate a break at some locations. Although the claim is made that all pipe supports can be eliminated, there are some that cannot be eliminated.

MR. BENDER: I see. It just had not come through.

MR. EBERSOLE: Xenon, I remember at Sequoyah there were a lot of problems with what were called subcompartment pressures compounded by blowing off of insulatic and cramming it into the relief interstices. Wouldn't you have that here, too?

MR. ZUDANS: I made that comment in my written report. I don't know if you got a copy.

But if the insulation is used on the inside surface of that steel shell that represents the primary containment, in the case of blowdown it can be blown off and lost capacities and you don't really know what would happen.

In response to that comment, Mr. Falls, I don't think the precise answer amounts to saying nothing like that will ever happen, but this is a significant concern. Therefore, you cannot just hang sheet metal around there for deflection.

(Slide.)

I was also concerned about injector. Because I was concerned about the injector I did some work on that. I must say that the calculations that they did on injector confused me initially because they talked about an economy. And economy, by the definition, is the number of pounds of water delivered per pound of steel.

Now by itself that number tells you nothing about how much of that mixture goes to the destination you want it to go. However, the calculations that they gave for economy are correct. The only thing that they do not consider is the fact that the injector, as such, has a mechanical efficiency of one to two percent at most, and all the rest of the energy that comes in from the steam generator is converted into heat.

And, therefore, that means that the entropy that they used to convert the heat should have been multiplied by .98. So that's of little difference and it's no concern.

Now here are the numbers for what they call economy and I will show you why we need that later. If you keep the discharge pressure the same as the pressure of steam, then at this pressure you can get 1.24 pounds of water per pound of steam, and at the low pressure you can get as much as 6.86.

Surprisingly enough, the same essential thing happens if you keep the pressure of steam at 1,000 and just vary the back pressure. That's surprising in the beginning, but that's the way it works out.

(Slide.)

That means that the curve we gave is like that. This is just a number and this is quite correct and adequate. Now I raised the question myself how much steam and water mixture can we get to reactor coolant system?

(Slide.)

Now here is a typical injector. This is your steam inlet. This is your outflow of the mixture. This is your water inlet (indicating). Now this is that economy factor that I talked aboutl and here are the pressures of the steam as it comes from steam generator and here are the pressure of the reactor coolant system.

The injector is supposed to begin to operate at

1,000 PSI. The reactor coolant system drops to 1,000 and we will get about 4,050 pounds per square foot of cross-section of the nozzle.

This (indicating) is the steam flow. This is the water flow. This is the total flow. So this is the steam flow, water flow, total flow. And this is the pressure at which the mixture is delivered. It is interesting to note that if this is the case then what the reactor coolant systems will see is saturated water -- 544 degrees instead of 1500 degrees. And saturated water is the absolute limit. It cannot be steam, so it could be slightly subcooled too.

In other words, it could deliver more water than that, but at any rate in the beginning the reactor will see 544 degrees and the pressure in the reactor drops to 500. The temperature will be 467 degrees. When the pressure drops to 100, 327, and here it would be 193 (indicating). I like this very much because that will eliminate cold water shock to the structural parts. That's a very good postulate, but what does it tell me?

I think Ivan has to confirm. It tells me I've lost all sensable heat removal capacity and the only heat removal capacity I have now with this water that's being delivered from the refill and is latent heat. Because it comes in at the saturation pressure of the reactor, so that is something I wonder whether it's being factored in or not in calculations.

So although Mr. Falls did lots of calculations in this last report, I did not check this particular aspect. So that means if you take a loss of heat from steam generator and bring it back into a reactor, in fact 98 percent of that heat shows up in the reactor and only two percent of that total energy to get out of steam generator pumps water in the reactor. That means you have to boil the water -- the reactor, in my opinion, all the time.

Now these calculations are --

MR. KERR: I'm sorry. That means that you have to boil the reactor? Is that what you said?

MR. ZUDANS: Well, if you remove the sensable heat by preheating the water to saturation temperature and send it at the same pressure to the reactor as the reactor is, the only further heating will boil it. There is nothing else that can be done. Is that a correct statement?

MR. CATTON: That's right.

MR. KERR: So that makes all reactors into boiling water reactors.

MR. ZUDANS: At that point. As soon as the refill system starts running, they're boiling water reactors.

MR. EBERSOLE: That's what it has to do in the feed and bleed mode anyway.

MR. ZUDANS: Yes, that's right. And I think this penalty has to be judged by sizing the system. I mean you can size the refill tank in a system such that it isn't a penalty, but the gain from this aspect is in the temperatures that I get to see in the reactor. I don't ever see anything cold in there. So my problems related to fracture and other things simply go away.

But the sizing of the system, I do not believe this aspect has been considered.

MR. EBERSOLE: Are those injectors all that reliable?

MR. ZUDANS: The injectors are very unreliable.

MR. EBERSOLE: I know on the old iron horse you could almost never get them started.

MR. ZUDANS: That's right. First of all, no injector is known to operate with the water above 115 degrees, so there is a limited temperature. But then there is another threshold temperature at which it stops, and each particular set of conditions, meaning this and that (indicating), require different design injector, because there is no injector that works under old conditions.

So injector is not a minor problem. It's a major problem. But hopefully, if you succeeded in developing one that really succeeds and works.

MR. PLESSET: Xenon, if you are taking this water out of the core and absorbing heat from it through the latent heat you've got to have another supply of water when you boil off the load that you bring into it. It has to be a continual supply. Where is that going to come from?

MR. ZUDANS: The water is in the refill tank with about 54,000 gallons of water in it.

MR. PLESSET: That's not going to last forever, though.

MR. ZUDANS: It lasts for an hour or so. That's what I'm saying. You have to consider that in sizing. The calculations that Mr Falls has done show that they can absorb the energy in the steam generator, the energy in a blowdown, and the energy of metal-water reaction. That's what they say -- how much water there is without boiling.

I didn't make the checks on those statements. I think they can be made. But I think this aspect is the only one really important -- that you get saturated water in the reactor and what it does to the reactor and the rest of the system.

MR. PLESSET: But you do run out of water?

MR. ZUDANS: Eventually.

MR. PLESSET: And this doesn't -- your system is not very passive now.

MR. ZUDANS: Yes, I think when you get this far down with the pressure (indicating), the so-called deluge tank opens and dumps water directly then, without benefit of the steam generator pressure.

But in the meantime the deluge tank is already close to boiling point. It's at atmospheric pressure because it was heated up to 160 degrees in the first few seconds. That's how much blowdown there was in it.

In other words, the heat balances and things of that nature on flow rate and sizes are definitely not completely resolved in this situation. Certainly a lot more has to be looked at. There are good features and I'd like to take the position that that's a point I am working on.

(Slide.)

Now I will show you the system again and tell you why I do not like this refill tank.

There are four aspects that bother me on this one here. I wouldn't say bother -- one of them is good. In looking at the refill tank, first of all the effect on structures is very good because it delivers high temperature water to the reactor. This sizing has to be reconsidered.

Now this tank is closed (indicating) and it pressurized at the pressure slightly above steam generator pressure. Therefore, this tank here (indicating) presents a nest of three different fluids. One is the primary coolant fluid -- around 2200. The other one, say, around 1200 and maybe this is at 1150 or 1180. So that it feeds into the system.

The other thing is if the refill tank begins to operate when this pressure drops below that pressure (indicating) this pressurization is instantly lost and the pressure in the space that's left open here will be the saturation of the water pressure at fifty degrees.

So the purpose of the pressurization escapes me. Plus placing the injectors inside that tank essentially would make, if not impossible, impractical to do anything to them, because they require attention. They are not as passive and automatic as the name might imply. They require constant, they have to be provided the special drains and God knows how many million things.

So I think that these four points that I mentioned, or three points, require attention.

(Slide.)

And I am suggesting that item number one, there is no need to pressurize the tank at all. In fact, that tank should be opened to the primary containment system just like all these other tanks are (indicating). Now by strategically placing the same number or less check valves, this system will only be a system with two fluids.

Here you have a cold leg at 2200 PSI, and you have a steam generator pressure. You have a check valve that protects this tank. And even if this check valve would leak you can tell by chilling load on your system that something is going wrong and you can take care of it.

Now this is open to containment. As soon as the condition materializes, when you begin injecting water to the primary coolant system, this water will move through that check valve and will be blown out. And if this is open to containment there won't be any condensation of steam that goes in here because this surface area is simply too small. It's insignificant. And if it does condense this water will be further used into supplying primary reactor water coolant system. So no pressurization, open to primary containment system, and an injector outside, in its own cell where you can look at it and see what's happening to it.

(Slide.)

Obviously, the same recommendation applies to the quench tank. There is absolutely no reason to put the injector in a quench tank. In particular that doesn't have the ghost of a chance to survive the first blowdown. So here it's a must and the refill tank maybe you could play either way. Here you must take it out.

And then I have the following conclusions.

(Slide.)

I think it has attractive features. I think I delineated them. I think it is absolutely necessary to do a very good, detailed thermohydraulic analysis to establish various parameters. You have to consider things, as I mentioned, with respect to saturated water being pumped from the primary reactor coolant system.

I don't think that the ECCS should be designed around the existing NSSS because it really results in awkward layout. There is nothing wrong with asking the NSSS people to design NSSS that accommodates the principles of NSSS, not the current design.

Injector performance has to be studied experimentally. I think it probably can be developed, but is not being developed now. I think that systems like refill, quench and deluge merit consideration with or without the rest of the PCS-2 as a system.

I personally like the refill if it can be worked. I like the refill if it can be worked, and there is no need to do it in the context of a complete ECCS system.

MR. PLESSET: But you have to remember that the containment is getting larger and larger, right?

MR. ZUDANS: Right.

MR. PLESSET: And you still have these heat problems that you touched on.

MR. ZUDANS: Well, supposing I said that I like the refill system so much that I implement it. I replace all the accumulator tanks with the refill system.

MR. PLESSET: This still a lot bigger than what we have now.

MR. ZUDANS: Sure, it's much better and it's much better from a thermal stress point of view, but it may require a lot more water than we have now.

MR. CATTON: Then it's just another refill system.

MR. ZUDANS: It's another refill system, except I'm not dumping water in the primary.

MR. PLESSET: Well, if you could warm that water and maybe that's too big a price to pay for making the containment twice as big or taking care of a lot of insulation problems and the like.

MR. ZUDANS: This has been studied to some extent by Gilbert Associates for construction, and they think that the way it is now would be almost impossible to build. It would be very difficult.

(Slide.)

This is what these pictures are intended to show. Maybe I got too taken with the other aspects.

MR. BENDER: Xenon, what is the containment peak pressure supposed to be?

MR. ZUDANS: It's really slightly above atmospheric pressure. It very quickly gets down to sub-atmospheric if the vacuum can be maintained.

MR. BENDER: In a way this is a pressure suppression that we're getting.

MR. ZUDANS: This is nothing but BWR, except broken up in pieces.

MR. EBERSOLE: As a matter of fact I don't think this will work with a B&W boiler, will it?

MR. ZUDANS: Yes. They did a writeup on it.

MR. EBERSOLE: It worked for a boiler?

MR. ZUDANS: They claimed they had more water than for a BWR.

MR. PLESSET: Well, let me -- we're running out of time and -- let -- Mr. Falls wants a brief break. We will come back and get his presentation and hopefully we will still have lunch after his presentation.

That's not sure, but Mr. Bradford is coming down at 2:00. We're trying to get that changed to 2:30. Let's take a short break and let's not let it run too long. Let's say let's start back again at 1:00.

(A brief recess was taken.)

MR. MARK: The meeting will come to order.

I might mention that Commissioner Bradford, who is coming down, has found it possible to relocate his time to 2:45, I think, which means that we can proceed and let Mr. Falls make his presentation before Bradford comes.

MR. SEISS: Will we have a discussion of what we will discuss with him before he comes?

MR. MARK: If we can get back in time, yes.

MR. PLESSET: We're hoping to end at 1:30 and come back at 2:30.

MR. MARK: Mr. Falls.

MR. FALLS: Thank you, sir.

I am O. B. Falls, Jr., consultant of NucleDyne Engineering Corporation, Jackson, Michigan. This opportunity to appear before the full panel of the Advisory Committee is deeply appreciated. It was 62 months ago that we first presented the passive containment system to the Nuclear Regulatory Commission.

In the interim we have appeared four times before the NRC/ACRS and ACRS subcommittees to discuss PCS in various contexts. You will find attached to the text material some support of that statement. The latest such appearance was on November 13th, 1980, before your Subcommittee on Fluid Dynamics..

Before I go any further, and this isn't included in the paper, let me define what we mean by "passive". It does not mean that it is going to operate during normal circumstances passively. It means that while you are in trouble, like a LOCA, there are no energy sources required to drive machines, to operate controls and so on. It is really not a good term, but it is expressive of the condition of the system as of the time, for example, of the design basis LOCA. That is the way we use the term.

It will remain passive for a substantial period, somewhat controlled by design factors as to whether it would be several hours before any active system would be required for long-term cooldown. But that is a case of design, depending on the NSSS specifically being considered.

Now as the result of the discussion and questions hat were asked at the Subcommittee on Fluid Dynamics meeting, NucleDyne prepared a substantial response document. I think you have it. It's this document here (indicating), which responded in detail to every one of the points, both positive and negative, that the two consultants faced us with in California in November.

As I listened to you this morning I say that I heard nothing different. I can't see that they have added anything in the way of either negative or positive, and we feel that there is adequate response to every one of their points -- good and bad -- and we would recommend that you read this document carefully. Copies of the publication have been provided to ACRS together with all previously published documents describing the PCS both structurally and functionally.

We assume, therefore, that you are familiar with the technical and structural and functional aspects of the PCS, and I do not propose at this time to go further into a discussion on the technical matters simply because of the time constraints that are placed on me.

I did not come here prepared to give an engineering dissertation, but I wanted to walk you down to the end of where we stand at the moment and to tell you what we think needs to be done in the future. This will at least partially respond, I believe, to some of the comments that have been made by the two consultants.

(Slide.)

I would like to limit myself, therefore, to a number of the tasks that we believe should be performed. The positive results of these tasks could be the basis of a pre-license approval for the PCS concept by the ACRS and NRC. These tasks are ones that have been identified by NucleDyne. Others could be added as might be suggested by ACRS or others. And I think you will find, within this list of tasks, certain ones that will respond specifically and provide information as indicated that it was necessary to have by the two consultants.

As you are aware, Sandia Laboratories has prepared a PCS evaluation report for the Department of Energy. I believe you also have copies at least of the draft of that, although you may not have the final printed copies as yet.

Their investigation was substantially more limited than we had been led to believe 36 months ago when the study was first authorized. A research and development R&D

program is not spelled out in the Sandia report, contrary to what we had understood was to be a part of that report.

At various times in the past, the latest being the November 1980 meeting of the Subcommittee on Fluid Dynamics, questions have been postulated about NucleDyne's engineering and its use of "engineering judgment" in the conclusions drawn and statement made.

For the record, we wish to state that the engineering of the PCS has been basically performed by an individual who has had over 31 years of direct full-time experience in numerous categories of nuclear engineering. This practical experience has involved him the design features of some 23 nuclear reactor facilities. These facilities include three graphite piles, three hearvy-water research, five pool-type, two liquid-metal cooled, two gas-cooled, one organic cooled heavy-water moderated, four boiling water, and five pressurized water reactors. The organizations involved for which he was working at the time this was done include Argonne National Laboratories, ACF Industries, Curtiss-Wright, Combustion Engineering, Gilbert/Commonwealth and Bechtel.

My personal involvement is to review Mr. Kleimola's work and particularly his conclusion on the validity of the engineering judgments. My nuclear experience includes approximately ten years with General

Electric starting in 1953 GE's studies of various reactor types leading to its decision to market the BWR type and the sale of Dresden I, Big Rock and Humboldt Bay; seven years with Commonwealth Associates, Inc., which performed architect-engineering work on Fermi 1 and on a conceptual design of a 300 megawatt LMFBR; two years with Ralph M. Parsons, where a conceptual design of a 500 megawatt LMFBR prototype was prepared; and ten years of personal consulting work, mostly overseas, including two years with the International Atomic Energy Agency as Project Manager to prepare a study of the economics of nuclear power for the developing countries of the world.

We assert that our combined experience and background provide an unquestionable capability to produce sound engineering and two arrive at adequate and acceptable engineering uudgments. We assert this, to the contrary, notwithstanding some of the comments by two of ACRS's consultants at the Fluid Dynamics Subcommittee meeting.

It is true that you have a lot of words. The words have been backed up by analysis calculation. There have been some detailed calculations submitted to you in the past. We have not attempted to come before you or the NRC or the other Subcommittees at any time and try to walk through a series of detailed calculations, but I can assure you that they are there.

We would not make these statements as professional engineers, which both of us are. I'm registered in six states. We wouldn't make these statements and claims unless we had a sound basis for doing it. And I think you will see in the responses to the Fluid Dynamics consultants' comments that there are statements there that can be backed up and we would be very happy to provide you with a detailed calculation if you should so wish to have them.

I might also point out that both Westinghouse and Gilbert/Commonwealth have done a substantial amount of work on this concept. Westinghouse -- well, contrary, I think, and I don't mean to take umbrage with the statement which I believe it was Dr. Plesset made, Gilbert/Commonwealth did point out a number of areas that they thought would be difficult to construct, but only difficult.

We went back to them and they have said we are not saying they can't be built that way. And we're not saying that your engineering is wrong. We are simply saying that it is probably going to be more difficult than it would be to construct a nuclear power plant under the present concept. Westinghouse has done a substantial amount of work only recently and have indicated to us that they would be willing to undertake the engineering of a complete NSSS system. And again I would like to comment in this connection with one of the comments that was made that we should not attempt to relate this concept to a standard NSSS.

Westinghouse has assured us, in looking at both their two-loop and their four-loop PWRs that they will have no problem in adapting their NSSS with minimum changes to be used in the PCS. And they have offered to us -- offered to NucleDyne that they would be willing to undertake the engineering of a complete balance of plant -- not balance of plant but the complete NSSS system, including the containments, the cells and the entire steam-producing end of a nuclear power plant.

They have had experience. They didn't commit themselves to this extent. They have had experience, however, in designing the steam-producing end of the plant and I'm assuming that they could do that. But they have agreed that they would be willing to do the engineering and I assume that they would not make such a statement unless they had convinced themselves that it was reasonable to expect that they could do the engineering.

NucleDyne agrees that a licensing program is required to confirm the claims of improved safety provided by the PCS. The proposed program consists of seven task areas. We are looking at recommendations from Sandia. It's our judgment that the information developed from the following tests should be the basis for a pre-license approval of the PCS concept. Although these tasks immediately relate to a four-loop PWR, the task areas will provide information for other PWR configurations and for the BWR.

(Slide.)

Here you see listed the seven task areas and we will walk through them one at a time and just a few comments on each one of them.

(Slide.)

Research and development. Research and Development task is essential to verify the calculated performance for the innovative components and systems comprising the engineered safety features in the PCS. This task includes verification studies of steam jet injectors -- I'm sorry, it's indicated that this must be done -- the reactor vessel refill system, the emergency feedwater systam and variable orifice vent system.

This task includes a state-of-the-art search involving the lead manufacturers of injectors. The information obtained is factored into the preliminary performance tests of injectors in the applicable 'resure and temperature range.

(Slide.)

For the past 130 or more years, steam jet injectors have had a wide range of applications. Yet their application has been limited to a pressure range below 300 psia. Performance tests are needed for steam pressures approaching and possibly exceeding 1200 psia.

These tests are required in that steam does not conform to the natural laws for perfect gases. The enthalpy of saturated steam peaks at about 455 psia; it is of interest to learn if the peaking of the enthalpy affects injector performance markedly.

(Slide.)

Injectors are utilized in the reactor vessel refill system. This system lends itself to the performance testing of an injector typical of the 24 or more injectors used for emergency core cooling and the quenching of the fuel elements in the LOCA.

(Slide.)

MR. ZUDANS: Mr. Falls, could you bring that slide back? I see you already adopted one of my recommendations.

MR. FALLS: Dr. Catton.

MR. ZUDANS: I'm not Catton. I'm Zudans.

MR. FALLS: Dr. Zudans, I'm sorry.

Might I point out that this concept has been underway for nearly two years at least.

MR. ZUDANS: Not in your report, though.

MR. FALLS: If you look at document NEC-6, which is a description of PCS-2, not PCS-1.

MR. ZUDANS: Yes.

MR. FALLS: PCS-2 has this --

MR. PLESSET: Let me intercede here. Mr. Falls, you told us your presentation would take twenty minutes. Nearly fifteen of this have gone and we have to stop at 1:30. I'm very sorry. That is a directive from our Chairman.

MR. FALLS: All right.

In both systems the injectors are subject to operation with steam pressures starting at 1200 psi and reducing to the atmospheric pressure range. Comparative performance tests with injectors are required for the range of secondary system steam pressures and reactor coolant pressures encountered.

In the postulated design basis LOCA, the reactor coolant system depressurizes rapidly. Thus the injectors in the reactor vessel refill system operate with high pressure steam against the back pressure..

In contrast, the injectors in the emergency feedwater system operate against a back pressure slightly higher than the steam pressure entering the injector nozzle.

(Slide.)

A series of tests on the variable orifice vent system are specified as an R&D task. The vent system is utilized at the deluge and quench tanks. The vent system lends itslef to the performance testing of one module typical of the 1600 modules utilized in the variable orifice system.

(Slide.)

(Slide.)

(Slide.)

I am going to skip this, but I would recommend it to you highly, because it answers some of the questions and points that have been raised by the consultants.

This walks you through what happens in uncovering the vents on this vent pipe as the pressure builds up in the free port space. And I would point out to you that when you get down to the bottom on that bottom line you will have more vent space than either the Mark III or the ice containment.

(Slide.)

Optimization studies -- a series of optimization studies are specificed for the second task area. These include access space, supports and restraints, and cell wall cooling. These studies are an outgrowth of the evaluations of the PCS performed by Gilbert/Commonwealth and Westinghouse. These tasks are essential for the analyses of postulated accidents and transients.

(Slide.)

For the third task listed, the use of computers and the computer programs developed are essential. Some modifications to these programs may be required for the PCS. Programs should be verified for the study of design basis accidents and transients.

(Slide.)

For licensing purposes the preparation of select chapters of a safety analysis report are required. These mainly include design of structures, components, equipment and systems; engineered safety features; instrumentation and controls; electric power; accident analysis. These select chapters encompass the innovative features of the PCS, and can be dovetailed to the standard safety analysis report for a four-loop pressurized water reactor.

(Slide.)

Task five cn be performed in conjunction with tasks three and four to assess the innovative sa ety features in the PCS -- design basis accidents and transients.

The task areas for the two remaining tasks can be performed on a comparative basis with a recently constructed four-loop PWR.

(Slide.)

Here we need to determine the critical path analysis for PCS and the comparison to the dry-type, full-pressure containment.

(Slide.)

Construction costs. We need a cost evaluation fo:

structures, systems and components eliminated, modified and added and a cost comparison to dry-type, full-pressure containment. I might point out that on PCS-1 Gilbert/Commonwealth ran a detailed cost analysis and comparison with a four-loop Westinghouse PWR that they were designing at the same time.

Their conclusion was that on the steam generating end of the plant, even on the steam generator end the PCS concept would result in a ten to fifteen percent reduction in capital costs.

In conclusion, these are the tasks we perceive that may be required in order for license approval to be provided by NRC. We recognize that ACRS's responsibilities are not usually extended to undertake a program such as has been described. However, there is no doubt in our minds that an ACRS recommendation to DOE and NRC to jointly undertake an R&D program leading to pre-license approval of PCS would be favorably received.

In the event of NRC's failure to undertake that evaluation, we sincerely request the ACRS to undertake that evaluation on their own, in view of the very substantial improvements in safety provided by the PCS.

The preponderance of evidence agrees with NucleDyne's claims concerning the PCS and its potential importance to a revived nuclear power industry. The chief executive of a major utility with long experience in the nuclear industry stated that if the PCS concept had been available fifteen years earlier it would have been today's standard.

At this juncture in time, with the positive stance of the new federal administration toward nuclear power, this country needs innovative ideas, and we submit that the PCS concept could act as a major catalyst to the revival of the industry.

On October 2, 1980, NRC announced a proposed rulemaking that would consider "the need for nuclear power plant designs to be evaluated over a range of degraded core cooling events with resultant damage and need for design improvements to cope with these events." We contend that the PCS provides these improvements. We see no need to repeat at this time the extreme importance of energy and the economic wellbeing of our nation and the world and the major role that nuclear power must take in the basic supply of energy.

One of the present NRC Commissioners stated, in a letter to NucleDyne dated November 10, 1979, that "Your passive containment system has in principle the possibility of being engineered into a light-water power reactor system."

Gentlemen, we at NucleDyne believe the time has come to fish or cut bait after some five and a half years of consideration of this concept by NRC and ACRS. We suggest that all the bait needed has been cut and it's now time to start fishing. Accordingly, we are asking you to undertake either your own complete review and evaluation of the PCS or sufficient examination and review of NucleDyne's claims regarding PCS so that you could recommend to DOE and NRC such a complete evaluation. We trust your response will be favorable and we stand ready to respond to any comments or questions.

That's the conclusion of my presentation. We will analyze the transcript of the comments made by the consultants and also the other questions and comments that have been raised here and we will provide you with written responses to those.

MR. PLESSET: Thank you, Mr. Falls. You did well in the time. I have to compliment you.

Let me assume one prerogative of the Chairman and say there is time for a question or so for the next five minutes or so.

MR. EBERSOLE: How does this system work if I have a main steam line break, in view of the fact that you then don't have a steam reservoir for your pumps on the context of containment pressure? How does it work for a main steam line break, not a primary loop break but a main steam line break?

MR. FALLS: Inside the containment?

MR. EBERSOLE: Yes.

MR. FALLS: This will pressurize the containment and will dump into the quench tanks through the open injector, go through the open vent tubes.

MR. EBERSOLE: You only have one steam generator now. You don't need injection for that case, but I'm curious about what the main containment pressure would be -- what the internal pressure would be. It would be whatever it would be, considering the free volume.

MR. FALLS: This is right.

MR. EBERSOLE: You get a little suppression but probably not enough. It would probably be the mechanical load you would have.

MR. FALLS: I guess. Well, we took a look at that and we had some calculations on it, and I think it does result in the worst case from the mechanical loading standpoint.

MR. PLESSET: Mike?

MR. BENDER: Mr. Falls, you indicated one of the staff's tasks to be a risk analysis. In the sequence of things that needs to be done, when does the risk analysis get performed?

MR. FALLS: Well, there are certainly some of the research and development work that needs to be done first.

In other words, you don't want to go through a complete risk analysis unless you know that the steam jet injector is going to work.

MR. BENDER: Is it important to know that the steam jet injectors will work at the entire range of pressures -- excuse me, end temperatures?

MR. FALLS: It's important to know how well they will work over that full range. Will they work at all?

Our look at the injectors and doing some extended calculations admittedly they are difficult and we could find no backup test information or operating information above about 300 degrees -- 300 pounds.

MR. BENDER: If the steam jet injectors are shown to work, are there any other uncertainties that would have to be established technologically?

MR. FALLS: We think that perhaps the clearing of the vent tubes with the vent holes in it, as I have indicated. There should be a test on that. We think that an operating test, properly conducted, on one of those would be all they would need.

MR. BENDER: Would you argue that it is quicker and easier to perform these tests than it was to do a comparable set of tests with the BWR-3?

MR. FALLS: Yes. I think it would be much easier to conduct.

MR. BENDER: Why?

MR. FALLS: They are a much simpler device. If you take a look at the BWR torroidal system --

MR. BENDER: I'm talking about the BWR-6, which is not a torroidal system. I'm sorry -- Mark III.

MR. FALLS: You're talking about the Mark III containment?

MR. BENDER: Yes. Or the Mark IIs for that matter.

MR. FALLS: We think that to test this one vent and to test over the full range of possible operations of the steam jet injector would be no more difficult than that. It would probably be simpler than the tests which they ran ultimately on the Mark III.

MR. EBERSOLE: Is it not true that after an evolution such as you describe that virtually all of the containment atmosphere would be inside the tanks --that you would transport it inside along with the steam?

MR. FALLS: That is really the concept.

MR. EBERSOLE: But that's probably good, not bad, isn't it?

MR. FALLS: It is good and that's the reason we designed it that way.

MR. PLESSET: Well, thank you. I'll turn the meeting back to the Chairman. Thank you again.

MR. ZUDANS: Could I ask one question, or is it out of order?

MR. MARK: No, it's not out of order, but I wanted to read that I believe you have given the opinion that some features of the PCS, perhaps major features, could be considered even for retrofit to some existing plants?

MR. FALLS: Yes that's right.

MR. MARK: Have you discussed that with the people who might perhaps be on the retrofitted end?

MR. FALLS: Yes, we have. And, as a matter of fact, we took a very close look at one specific plant that was down for some major changes and went through this but from an engineering standpoint and from a construction standpoint. And we came to the conclusion that there were some aspects of this that could have been added to that plant.

Now the cost of doing this, according to their reaction, could have been substantially more than it was going to cost them to get the plant back in operation within the existing concept. So they felt that despite the fact they accepted our conclusion, let's put it that way, that it would be substantially safer, the felt that it would be safe enough with their system fixed up according to the NRC Mark Is.

MR. MARK: But they did not consider it unfeasible?

MR. FALLS: They did not consider it unfeasible.

As a matter of fact they agreed it would be feasible.

MR. MARK: Xenon.

MR. ZUDANS: From your report and the remark that you made, you claim that the vent area is substantially larger than Mark III. How did you calculate the vent area? Did you calculate all those little holes that you plan to drill in the pipe? That's not the vent area. The vent area is the original opening in the pipe. That's all the vent area.

In other words, if you have a vent pipe that is how much you can put steam through the end of it. You can't use those other holes as being vent holes. That's what goes on top. That's your available vent area. That's why I was surprised when you said more than Mark VI, Mark III.

MR. FALLS: Might I suggest that you read our document NEC-9, which is the response document?

MR. ZUDANS: I have it here. That's why I asked the question. It's not the detail. It's just the plain statement that you have many times more vent area than in Mark III that surprised me. That's why I wanted to know how you defined vent area. You gave the answer and I said that's not vent area.

MR. FALLS: How do you know it's not the vent area? The opening at the top of the pipe could be bigger than the sum totalof all the little vents.

MR. ZUDANS: Well, that's the only thing that counts, is the vent area opening --

MR. FALLS: Well, I'm telling you our calculation of our vent area is the sum total of those small orifices.

MR. ZUDANS: Oh, then you are --

MR. FALLS: Would you please go back and take a look at these two documents? It's detailed in there.

MR. MARK: Are there other questions? If not, I would like to thank you, Mr. Falls.

MR. FALLS: Thank you for your time.

MR. MARK: And if you'd send in anything further we certainly want to consider it.

You said you would probably.

MR. FALLS: Yes, as soon as the transcript is available. I haven't attempted to take notes here, but as soon as the transcript is available we will analyze it and provide you with a response.

MR. MARK: We'll consider anything you think should be added.

I think at this point we have to break off, but I hope we can be back here in one hour.

(Whereupon, at 1:30 o'clock p.m, the meeting was recessed, to reconvene at 2:30 o'clock p.m. the same day.)

AFTERNOON SESSION

(2:50 p.m.)

MR. MARK: By an event of almost fortuitous happenings, we're back on schedule.

MR. RAY: You're not apologizing, are you?

MR. JACOBS: We missed an hour from this morning.

MR. MARK: Yes, but that was Okrent's.

I think that if we strive, the next thing that we had put down here was a discussion with Jesse on the decay heat removal systems, where there is some material in tab 12.

MR. EBERSOLE: I want to say I am pleased to be on what I think is one of the matters which I regard as most important to the safety of these plants. I have long regarded, along with improved siting and containments, that integrated attention to the shutdown heat removal systems at our plants would bring us the largest measure of safety that we can get for the money.

I think that such systems, the failure of such systems, really represent the locus of by far the bulk of the accidents that we can have, as evidenced by the recent findings that just one part of these systems, the DC system, was stated to have approximately 50 percent of all the failures within it. And of course, that's only one-half of the elements of the shutdown heat removal system.

The particular part of this problem that I have in scope here is mainly the matter, the one I was going to go into, of what I consider the worst of all heat removal systems, the set of those beginning with North Anna and related systems of that kind. You all will recall the discussions in the past about the North Anna system, and I have been attempting, along with Bill Baldwitz, over the last several months to gather several arguments which would not be simply the acquisition of -- rather, the meeting of regulatory minimums, but above and beyond this, to coax somebody, the applicant and the staff to do better at North Anna and similar plants than has been done at that plant.

This has been driven to a great degree by comments of Dr. Gilinsky about his concern when he first issued the operating permit for that plant.

To this end, I have pulled these arguments together and w[illegible] a draft of a letter that contains a number of ideas we might carry forward to the staff and hopefully have another meeting. And that is a really small beginning, I must say, toward the solution of general residual heat removal problems. We could begin, perhaps, with the worst and see what we can patch it up with.

I want to emphasize, however, in doing this I am doing the thing I need to do most, which is really just patching. However, under the pressure of time and getting something done I think justifies getting something done better at North Anna and its related plants before we get really an integral plan in motion to improve all of these.

And the integral plan I talk about, of course, is the dedicated shutdown heat removal system, whether or not it be bunkered. Only in his configuration, I think, and not in simply a patchwork of improvements, can we get the needed reliability to regain what I think once was a sort of a reputation that these plants had that they were safe.

That's about all I have to say before suggesting that you read the letter that I have, except that before that, we are privileged to have here --

MR. KERR: Do you have it, Jess?

MR. EBERSOLE: Yes. You should have it.

MR. RAY: Is it in tab 12?

MR. EBERSOLE: No, no, it's not in tab 12. It's being circulated. Where is it?

Savio has got it.

MR. PLESSET: While it's being circulated --

MR. EBERSOLE: While we're circulating that --

MR. PLESSET: Could I just ask a short question? Is your emphasis on the dedicated part or the bunkered part?

MR. EBERSOLE: The dedicated part. I think the bunkered part is just sweetening on the cake. Really what I'm after is a system which in its own right will perform as a cohesive unit without the need for external power supplies or water or batteries or whatever, and one also that can be invoked freely at any time, without jeopardizing the normal function and which if necessary can have features such that a failure itself would not impact on the normal operation of the plant.

So that's the essence of what I see in this. Actually, of course, this is part of A-45. And we have one of the staff here, Mr. Marchese -- where is he -- who has this important task to meet I consider of first-rate importance. And he has agreed to come down and talk to us about many aspects of the A-45 test.

Remember, the North Anna case is a small beginning. I again say, I don't like to patch things. But here I think your patch is in order before we get on with the big business, which is really doing it right.

MR. KERR: Jesse, would you repeat those characteristics you wanted the system to have?

MR. EBERSOLE: I want it to be integrally competent to have its own water supplies, to have its own small power supply. I regard this one as being something on the order of 700 horsepower. Its own DC system, its own building.

MR. PLESSET: Would it be capable of remote operation?

MR. EBERSOLE: It could be. It could be

automatically started, if necessary. It could also be manually started.

MR. PLESSET: Independent of the control room?

MR. EBERSOLE: Right. The control room failure could in fact instigate its starting, because its starting would not introduce a hazard in its own right. It should fold into the system and not disturb it, other than rob its fraction of heat removal from the primary process and go right on.

This means on-line full field testing. It should be a system not bringing with it the usual measure of risk other than the extension of certain pipes, which you must argue can fail.

MR. KERR: The reason you want it completely separate and have its own water supply, power supply, and DC system is you're convinced this makes it more reliable than if it shares these with others?

MR. EBERSOLE: Right. I don't want it shared in the design context where it's distributed out among the great teams that you have. I want an integrated engineering package. I want it roped together by a dedicated team in all disciplines to do the job, who all know in the long run what the whole thing is. And it's in a package.

And I don't think it's impossible to consider it as a reasonable appendage to present designs. It would certainly be easy to put in and I think it would be vastly cheaper than the present effort to try to protect a dispersed system scattered all over the place, with each element subject to a host of other influences, such that it's impossible to cover.

MR. BENDER: Jesse, I haven't read your letter, and I think I have an inclination to concur with your approach, what you're suggesting. But I want to ask about a few things that might be associated with it.

One, what part of the system do you envision it being coupled to? And secondly, how do you judge its testability?

MR. EBERSOLE: Mike, I would judge its testability in this context. I guess I've been influenced by Eppler. We should be able to test it on line without undue disturbance to the running process and test it in a full-line capacity in its own right. It would of course rob the system of its fraction of heat removal.

MR. BENDER: That means being able to deliver its heat removal capability under operating conditions?

MR. EBERSOLE: Right. You could test it without disturbing the main functions.

With regard to what system it should be connected to, it's a little bit different from the boiler to the PWR.

In an original study I worked on a long time ago on this, I connected it to the primary loop of the BWR and cooled directly there with isolation condensers.

However, I did, and I must say I was pleased the other day to see Westinghouse introduce a new feature which is better than the one I suggested. I did use the steam generator as the main heat removal process in an earlier study. So I connected it to the secondary side.

However, the system had primary loop makeup, and other supplementary systems to keep the primary loop full for natural convection cooling. So it was capable of operating on line without bothering anything.

Does that answer your question?

MR. BENDER: Well, yes. But it also raises some reservations in my mind about whether its effectiveness may be influenced some by the kind of capabilities you're imposing on it.

Mr. EBERSOLE: I want to say this. I think in developing this, certainly I hope the staff and the regulatory personnel themselves will consider that in developing such a system we can make concessions to the owner-operators that no longer will we have to impose the rigid stipulation and requirements on what are now vulnerable aspects of the heat removal process.

If we get something which is reliable, which we can point at and say, that will take me in, then surely I can relinquish a lot of the horrible controls we've got over the balance of plant and auxiliary buildings and so forth. They are systems on which we are deadly dependent to get the plant shut down. Those dependencies will be removed if we can point to a system that will do it better and relieve ourselves of a great many complicated problems now which are practically insoluable in the scattered and different environments of the machinery buildings.

MR. BENDER: If your proviso were that those two circumstances were that those two circumstances go together, that by providing this we do in fact take the burden off other portions of the plant, I think the idea is better.

MR. EBERSOLE: Yes.

MR. BENDER: But if it doesn't take the burden off the other part of the plant, I would have to argue that you need to spend more time showing that there is a real enhancement.

MR. EBERSOLE: Yes, I agree. You would have to show that in fact it is a reliable system and it is capable of taking the burden off the control room, the cable trays, the pump rooms, et cetera.

MR. KERR: Jesse, before we go much further, do you have a twin brother?

MR. EBERSOLE: No.

MR. KERR: Then where are we going to find somebody with your ingenuity for picking flaws to review this thing.

MR. EBERSOLE: I'm sure there are people better at it than me.

MR. KERR: See, if somebody else were proposing this, I can be sure that you would pick out all the bugs.

MR. EBERSOLE: I'll send it to Carl.

(Laughter.)

MR. KERR: Carl would find catastrophes, but he might not find minor defects.

MR. RAY: Bill, we can convene an IDR panel.

MR. EBERSOLE: I'm sure there's expertise in the staff out there that's a lot better than mine to get into the details of this. It's just a concept that intrigues me. I think there's a great deal to be had out of this whole idea. I think it might, in fact, lead us back toward a recovery of what we once had as a reputation of safety. Maybe it might make acceptable all those plants we've already built which don't have the benefit of nice isolation in the site context, or in the containment context, either.

We need this since we can't get those two.

I would like to have Mr. Marchese make his presentation. I'm anxious to hear you say what you have to say about this large job.

MR. PLESSET: Before you begin, Jesse, don't the Germans have the kind of system you would find moderately acceptable?

MR. EBERSOLE: Not the kind I would like.

MR. PLESSET: But it's pretty good?

MR. EBERSOLE: Better than we have by a long shot.

MR. MARCHESE: Good afternoon. My name is Andrew Marchese. I work in the Generic Issues Branch in the Division of Technology.

I would like to present to you a brief status report on the unresolved safety issue entitled "Shutdown Decay Heat Removal Requirements."

(Slide.)

MR. MARCHESE: I would like to go over the following items in this brief presentation first of all and get into some background in terms of how Task A-45 is created, the purpose of this task, the objective, the main elements of the task action plan as we see them today, and also to encourage some discussion, questions and feedback, because we're really just starting to kick this effort off in a serious way.

(Slide.)

MR. MARCHESE: By way of background, the Commissioners approved shutdown heat removal requirements as an unresolved safety issue on December 24th, 1980. And I reference the memo that transmitted that approval.

The task manager, which is myself, was assigned to this job on February 17th, 1981. In terms of background references that one can read to sort of get a flavor about what we're thinking about up to this point in time, in our report to Congress, NUREG-0705, which I think has been mentioned a couple of times already, we provide a discussion of what we plan on doing on task A-45.

Other documents that exist -- you are also being given a copy of a memorandum that I just put together through Tom Herley, who is a division director. One of the first things I in taking on this job was to go around to all the different people in the Commission that in one way or another are working on activities related to decay heat removal, find out what they are doing, and make recommendations on how we should integrate and handle these activities in developing our task action plan.

And I was amazed that there was a lot of action going on in one way or another as related to decay heat removal. And in that memo you will find a brief description of these activities and a recommendation on how we should handle them in terms of developing a task action plan.

Okay. We are currently writing the task action plan, and I was looking forward to this meeting because I am anxious to get the kind of input that Mr. Ebersole has just given us. I think that is going to be very useful. And that is basically the last item here.

(Slide.)

MR. MARCHESE: I am going to be prepared to give you today the elements of the task action plan today. And then if you want to get into any of the detail of the main elements, we can also do that. The purpose, the overall purpose of Task A-45, is to evaluate the adequacy of current licensing design requirements, to ensure that nuclear power plants do not pose unacceptable risk due to failure to remove shutdown decay heat.

(Slide.)

MR. MARCHESE: The objective is to develop a comprehensive and consistent set of shutdown decay heat removal system requirements for existing and future LWR's, including a study of alternative means of shutdown decay heat removal and have separate dedicated systems for this purpose.

This will include both pressurized water reactors and boiling water reactors.

(Slide.)

MR. MARCHESE: The main elements of the task action plan as we see them at this point in time are the following main elements, and I am also prepared now to break these down even further, depending on the Committee's time.

The first one is development of criteria to judge the acceptability of shutdown decay heat removal systems in existing and future plans. In fact, let me just stop right here. I can go into each of these in further detail, Mr. Chairman, or just give you the main flavor of the plan, depending on the Committee's desires.

What I do have is some backup slides that grade each of these main elements down even further. Would you like to go into that or --

MR. EBERSOLE: I'll take whatever the Committee would like.

MR. WARD: I would like to hear a little bit more about it.

MR. MARK: I think if you go through them we might rely on the members to call for a discussion of any topic you get to.

MR. MARCHESE: Okay.

MR. EBERSOLE: One thing I would like to bring up in the beginning. Really, shutdown heat removal requirements ought to be broken down under what I guess are accident categories. And I'm certainly not thinking about the set of post-large-LOCA categories. Really, it would be scoped to include small leak LOCA's and leaks and upsets and all sorts of industrial accidents. But it would not encompass a large ECCS system.

MR. MARCHESE: Yes. In fact, one of the things I'd like to flash up here is a definition or a scope as we see it. Let me run through this and then flash up a further breakdown of this and we'll run through it very quickly.

The second main element would be development of means for improvement of existing shutdown heat removal systems. All we are thinking about here is that there may be relatively modest means of improving existing systems, and I will get into that one a little further.

The third item has to do with assessment of shutdown heat removal systems for specific plants, for groups of plants that are similar in design characteristics, to identify those for which DHR improvements are required.

The fourth major task, development of recommendations for shutdown decay heat removal design alternatives for each plant or groups of plants in accordance with the criteria for acceptability. This task will focus on the dedicated shutdown heat removal systems.

(Slide.)

MR. MARCHESE: I would now like to flash some of the slides up that I put here as backup, but I think they will give you a more complete flavor of how these tasks kind of fit together and a further breakdown of what they really mean. We have laid out here the interrelationship of those four major tasks in terms of how they relate to one another in both a time sequence and how they feed into one another.

As we go through the plan, you basically would start off with these three items here (Indicating), develop criteria for existing plants and future plants, at the same time looking at means of improving existing systems. And I am going to go into that a little further.

MR. KERR: When you say "criteria on a risk basis," does that mean there will be quantitative classifications of reliability or of risk, which?

MR. MARCHESE: Both. I think we are going to start off with the ACRS proposal for existing plants. For future plants, we are looking at also using a --

MR. KERR: What ACRS proposal does one have for the risk associated with decay heat removal?

MR. MARCHESE: Well, it sets up quantitative safety goals for three different categories, which I will get into a little later.

MR. KERR: Okay. I'll wait, then.

MR. MARCHESE: If we were to categorize plants in terms of existing or future, divide existing plants into risk assessment groups, what we are hoping is that there is a number of risk assessments going on presently for a number of plants, and we are hoping that for those plants that do not have specific risk assessments that we could at least group them into one of these categories of risk assessments that will be done for other plants.

MR. KERR: Mr. Chairman, it takes me a while to comprehend what I have heard. But having, I think, comprehended it, may I interject something here?

MR. MARK: Yes.

MR. KERR: I think what I'm hearing is that at least one fraction of the staff is interpreting our publication on proposed risk goals as representing numbers that the ACRS has endorsed. Now, I did not think that was the case. I thought what we had proposed was that this was a publication for consideration, with the emphasis on the approach and the numbers simply as representative, but in no case was this to be interpreted as a final ACRS set of appropriate safety goals.

If the staff is planning to use those numbers as ACRS endorsed numbers, I think we need further discussion of that.

MR. MARK: I'm sure you are right on that point. I wasn't quite sure the staff was using them as fix points, but rather the breakdown -- but maybe Mr. Marchese coiuld --

MR. EBERSOLE: My impression is you're just using them as guidance. You can alter them up or down at will. You can use them as an exercise.

MR. MARCHESE: Yes.

MR. EBERSOLE: I think something could be done early on here. One could go back to the WASH-1400 report and better establish what I could call the carrot for doing this. If you can go through that analysis and extract from all those accidents that you see in there those which you could relate to inadequacies of the shutdown heat removal process, I think you'd virtually grab about 95 percent of them.

MR. MARCHESE: That's going to be a very early task.

MR. EBERSOLE: That should be done, because those features that should grab that 95 percent should be incorporated into the system. We are trying to grab the bulk of all accidents and leave just the tiny fraction which we hope will never happen anyway.

Go ahead. Thank you.

MR. MARK: Does that cover the point you made for the time being, Bill?

MR. MARCHESE: We are going to use the ACRS safety goals as the starting point.

MR. KERR: When you said safety goals, I assumed you meant numbers. And the point I wanted to make was I don't think the ACRS ever meant for anybody to use those numbers as representing an ACRS considered set of number.

MR. EBERSOLE: He can add plus X or minus X.

MR. KERR: Well, of course, you can do that with any number, Jesse.

MR. EBERSOLE: But he could still go through the maneuver.

MR. KERR: But I certainly don't want people to begin to think by publication of this kind that the ACRS has arrived at these as final results. Unless I'm completely mistaken, that was not what we had in mind.

MR. MARK: I think you're completely right.

MR. KERR: So if you want to use them, use them. But don't attribute them to the ACRS.

MR. MARCHESE: Okay.

Okay, continuing this line, we are going to assess the adequacy of shutdown decay heat removal systems in existing plants, preferably on a risk basis for existing and future plants.

The next step leads into design and cost improvements for shutdown decay heat removal systems for those what we call high-risk plants. We feel that there will be plants that we are going to have to focus attention on right up front in the program. And then also we will look at future plants. At this point here (Indicating) we look and compare the cost effectiveness for reducing risk basically out there and valuing both the feasibility and cost effectiveness of dedicated shutdownn heat removal systems.

At this point there will be other studies that will be feeding in. As you know, there is a rather significant effort that the staff is performing in terms of looking at mitigation features. It will at this point want to at least consider the results of those studies to see how the systems that are being looked at for prevention versus those that are being looked at for mitigation compare on a cost effectiveness basis.

But I want to emphasize that this study is focusing in on prevention and not mitigation. But at some point we are going to have to consider what the other people are doing on mitigation.

And then the last few things had to do with implementing the recommendations and the comprehensive set of requirements that will come up.

(Slide.)

MR. MARCHESE: In terms of what we mean by shutdown decay heat removal systems and in terms of the scope of the systems, which, I might add, this is still in an evolutionary state and I am anxious to get the Committee's reaction to this. In the context of Task A-45, shutdown decay heat removal system is defined as those components and systems required to maintain primary only or primary and secondary coolant inventory control and to transfer heat from the reactor coolant system and the containment building to an ultimate heat sink following shutdown of the reactor for normal events, off-normal transient events, that is loss of offsite power, loss of main feedwater, and small LOCA's, that is, approximately one and a half to two inches.

The shutdown decay heat removal system does not encompass those emergency core cooling components and systems required only to maintain coolant inventory and dissipate heat during the first ten minutes following medium or large LOCA's.

We are trying to write basically a definition that covers not only pressurized water reactors, but also boilers. And since we feel that the charter of the staff is also to look at upgrading existing systems using equipment that's in place to the maximum extent possible, that is why we feel the definition has to encompass inventory control, containment building coolant systems, and also those parts of the ECCS system that we could use for maintaining inventory control and dissipating heat other than medium or large LOCA's.

MR. KERR: Why does one refer to maintaining primary only? Oh, primary only and primary and secondary, I guess is required to do the job. In other words, you don't propose to maintain the secondary coolant inventory unless you're using the secondary as part of the heat removal system.

MR. MARCHESE: This would be the boilers. This would be the pressurized water reactor (Indicating).

MR. KERR: It could be if you needed secondary to remove the heat. Have you decided absolutely how you are going to design it?

MR. MARCHESE: No.

MR. KERR: So it seems to me, unless you need the secondary inventory to remove heat, you won't require it to maintain the secondary coolant inventory, will you? Or am I missing something? I probably am.

MR. EBERSOLE: It's just my feeling that you will be using the secondary in PWR's.

MR. KERR: I don't disagree with that, Jesse. But is the reason for requiring maintenance of secondary coolant inventory that you expect that you're going to use that decay heat removal or do you need it for some other purpose?

MR. MARCHESE: We're expecting to use it for decay heat removal.

MR. KERR: So in a sense you have already decided how you are going to design it.

MR. EBERSOLE: And incidentally, I think it points out well the characteristics of the system. It will probably not be capable of full cold shutdown, but probably just warm shutdown.

MR. MARCHESE: We feel that we're going from the time you drop the rods down to cold shutdown, we will encompass both auxiliary feedwater and residual heat removal systems.

MR. EBERSOLE: Is the primary method of rejection from this system you propose evaporative to atmosphere? That's the minimum water use you can have. You don't know yet?

MR. MARCHESE: No.

MR. EBERSOLE: Certainly it reduces the horsepower requirements by a factor of ten or larger.

(Slide.)

MR. MARCHESE: Now, I have a further breakdown of each of the main elements that I previously showed to you in terms of the task action plan. Basically, the first element was to develop criteria to judge the acceptability of shutdown decay heat removal systems in existing and future plants. We see the work content of that main task something like the following. And as I mentioned, this is still in a stage of development. It is not fixed. It is what I would call first cut.

We would decide first on a basis of division into existing and future plants, which is rather straightforward in terms of existing plant is where the majority of the hardware is in place. Future plants are just on the drawing boards, and it's relatively easier to alter things.

We think that we're going to have to define acceptance criteria for existing plants and future plants. Now, in terms of defining acceptance criteria for existing plants, our preferred solution, at least at this point in time, is to start out using the risk criteria proposed by the ACRS. Adequate risk assessments are unlikely to be available for all the plants within a useful time frame.

MR. KERR: I can't convince you that the ACRS didn't propose any risk criteria, I see.

(Laughter.)

MR. SIESS: Why don't you just refer to NUREG-0739?

MR. MARCHESE: Okay.

MR. KERR: That's an even more devious approach.

(Laughter.)

MR. WARD: I thought Andy thought he was going to get good response by referring to that.

MR. MARCHESE: Well, it is really the only, what I would call, first attempt to develop quantitative safety goals.

MR. KERR: But it is a suggested approach, and "suggested" should be emphasized very strongly. We did not discuss those numbers as numbers we wanted to endorse. We may have been much wiser than we realized, but I don't think we should take credit for those suggested risk goals.

MR. RAY: It is encouraging, though, to find that someone read it.

MR. EBERSOLE: I don't know of anything better to do. Bill, do you have something better to do?

MR. KERR: Jesse, I'm not suggesting that he shouldn't use some numbers. I am saying that I think it is -- and I raise this issue because I've heard it in other forums than this. People are interpreting this report as a set of numbers which the ACRS has evaluated and approved.

MR. EBERSOLE: There's always that risk, when you turn out a number it gets to be the bible.

MR. KERR: I know it, and I think we need to be very explicit that people recognize that we did not mean -- at least I don't think we meant -- this to be a set of ACRS numbers.

MR. EBERSOLE: We can put a little squiggle at each number that means "more or less."

MR. KERR: And I think, although this may not be the time to discuss it in detail, I may be a little surprised that one doesn't establish reliability goals for this rather than risk goals.

MR. MARCHESE: The problem one runs into in terms of systems interactions, one of the things we like to consider is feed and bleed systems, when you are dumping heat into the containment building, in terms of how the containment heat removal system is affected, one has to look at that.

Also, we envision, you know, the acceptance criteria will focus on reliability.

MR. KERR: I apologize. I was thinking of Mr. Ebersole's approach, which was going to separate this. If you were going to feed and bleed, it is certainly no longer a dedicated separate system. But you haven't committed yourself to that yet.

MR. MARCHESE: We will look at reliability, probability of core melt, and then also risk. We will look at all three of those. And some of the studies going on -- some of them are reliability, some only look at core melt, and some do a full-blown risk assessment.

Okay. We also feel that we need to look at the special emergency situations. And I think the Sandia report, which maybe some of you have a copy of and have read, I think does a pretty good job in terms of separating out the typical transients from the typical sabotage, earthquake, airplane crash-sensitive thing. We need to decide how to handle that.

It is not obvious. The decision required on treatment of emergency situations, the possible solutions are we can ignore it in relation to shutdown heat removal system, we can provide dedicated shutdown heat removal, or there may be some intermediate solution. We will be getting into all three of those.

Decisions required on the treatment of plants for which risks cannot be estimated. And I will talk a little about this a little later, in terms of there is a limited number of risk studies going on. What we're concerned about is there may be some plants that we cannot fit into certain categories where a risk assessment is being done, and we may have to treat them on a case by case basis.

MR. KERR: How are you going to decide how much risk one can attribute to the decay heat removal system? When, let's assume that you can calculate the total risk of the plant, do you calculate that 10 percent of the risk or one percent of the risk would be attributed to decay heat removal?

MR. MARCHESE: We're hoping we can extract that information out of the existing risk assessment.

MR. KERR: That's assuming you're going to use exactly the same heat removal systems that have been used. Apparently you're not. You're going to devise new ones. Are you going to let them have more or less risk than heat removal systems in the past have had?

MR. MARCHESE: If they don't meet our acceptance criteria --

MR. KERR: Your acceptance criteria are going to be put together by you, and my question is how are you going to decide what fraction of plant risk is to be allocated to decay heat removal systems.

MR. MARCHESE: I think I'm going to get into that in the next couple of slides.

MR. EBERSOLE: Well, as a starting point, Bill, I suggested a while ago the first cut might be to look at WASH-1400 and to pull out of it what you could legitimately ascribe to weaknesses in the integral the heat removal process, not just in the scattered accidents that they consider.

MR. KERR: But that would tell you what the existing decay heat removal systems --

MR. EBERSOLE: Then you could build on that.

MR. MARCHESE: We could assume.

MR. KERR: But do you decide that's about the right amount of risk?

MR. EBERSOLE: No. I think it would be too high. I would grab a much larger fraction, and I would do these from that.

MR. KERR: What fraction do you think is now contributed by decay heat removal?

MR. EBERSOLE: I'm going to guess it must be about 90 to 95 percent of everything comes out of weaknesses in this system, considered piece-wise out of WASH-1400.

MR. MARCHESE: I think when I get into Elements 3 and 4 I can give you a better answer on this.

In terms of future plans, we are going to define acceptance criteria, and our preferred solution, at least right now, is to try and establish quantitative target for reliabilities for shutdown decay heat removal, which one can do when the design is on the drawing boards.

Task 2, which will concentrate on development of means for improvement of existing systems. What I mean here is we want to also use existing equipment to the maximum extent possible, upgraded in a modest way, besides looking at dedicated systems, which come under Task 4.

But some of the things we are going to be looking at are, and you have probably heard about these before, feed and bleed, which some plants have the capability to do and others don't. We will be looking at what it takes to give them that capability, how much it reduces risk as cost effectiveness.

MR. KERR: Now, this decay heat removal system, we do anticipate that feed and bleed would be used as the normal mode of decay heat removal, or are you thinking of it as a subsystem of a large system which you would describe as a decay heat removal situation?

MR. MARCHESE: It would be for an emergency situation used only, I would say, in a last ditch effort type of thing.

MR. KERR: Okay. So, when you talk about an SDHR, you are talking about really it could be a number of systems, so you are talking about decay heat removal and not a system for decay heat removal.

MR. EBERSOLE: Let me see if I am wrong or right, whatever. If one of them uses a secondary system on PWRs and envision upgrading the aux feedwater system to a great deal of better reliability than we have now, you are still dependent on the boilers. If you ultimately concede you don't have to have the boilers, only at that time would you invoke a reflux cooling and feed and bleed. That would be a concession of a weakness in the system that you contemplate.

MR. MARCHESE: Right.

MR. EBERSOLE: I think the steam generators themselves are relatively reliable in contrast to the equipment that served them.

MR. MARCHESE: High pressure RHR has been recommended, I think. One ought to look at that. And we certainly will be looking at that. Reflux condensation has been recommended, but I think one of the Kemeny Commission reports recommended the staff do more on that.

Shock condensers is something I have heard through Dr. Okrent, who sent the staff some material. That may look attractive for future plants in terms of being able to not only dissipate heat in a passive manner but also pump coolant back to the steam generators in a passive fashion.

All right. The next item, we feel that there is going to be some fairly detailed thermal hydraulics work as a result of doing these kind of tasks, and it just identifies that. We are probably going to need some R&D testing and there will be a requirement to look at these on a practical feasibility cost-effectiveness approach also, but some of them are very difficult to do in certain plants where we just don't have the space to put in the system equipment.

Also, for the BWRs I see the scope of alternatives is somewhat smaller, and we really haven't done much on boilers but we are going to be.

MR. EBERSOLE: Let me suggest you look early on at current proposals by Westinghouse and G.E. The former was represented by the lecture they gave us yesterday in which they recommend a near-passive type heat exchange arrangement evaporating to atmosphere which can literally be filled up with a fire hose.

MR. MARCHESE: That is interesting.

MR. EBERSOLE: I understand from G.E. that they robbed the concept from them, so you might have a look at that too. I haven't seen the G.E. similar arrangement.

MR. MARCHESE: Now, this task has to do with assessing existing shutdown decay heat removal systems in existing plants to see whether or not they meet our acceptance criteria as developed in Task 1. What we would like to do here is identify all existing proposed risk analysis, and there is a lot of action going on in this area right now (indicating).

We would like to evaluate the quality of these analyses and categorize them in terms of the effort required to maintain the minimum standard for the present task. We would like to estimate the extent to which the analyses available on these kinds of plants can be extrapolated to other plants. What we are hoping here is that we can categorize all of those other plants where risk analyses are not being performed in two groups for plants for which risk analyses are being done, because to do this for every plant would be a tremendous level of effort. So we are hoping we can at least group the plants.

MR. BENDER: Have you done one yet?

MR. MARCHESE: The way we think this is going to go, we have basically six plants for which we are going to have risk assessments in the next 6 months. We have WASH-1400, Surry, Peach Bottom. And within that program there will be four other plants, Oconee, Calvert Cliffs, and the other two I forget.

MR. BENDER: Why don't you do one and let's see how it is done, and then decide how the remaining ten, it sounds like, are going to get done?

MR. MARCHESE: We are going to start off with Surry.

MR. BENDER: What day is that coming up?

MR. MARCHESE: As soon as we get a technical assistance contract in place because, I might add, I am the only one on the staff working on this, and we are going to need some technical assistance help to do this job. This Item D, I put it up there, it had to do with -- there is a certain group of individuals on the staff that are recommending that we also not only go forward on a risk-based approach but we also do our typical deterministic evaluations to see what extent current plants meet current criteria.

MR. EBERSOLE: I am trying to follow the fact that you are the only one looking at this. How many are working on the large LOCA and its varied tasks? Say a dozen?

MR. MARCHESE: I'm not sure.

MR. EBERSOLE: I think this represents a classic distortion in utilization of manpower.

MR. LEWIS: There is less internal disagreement if only one man is working on it.

MR. BENDER: Look how many lawyers you'd tie up if you didn't have people working on the large LOCA.

MR. EBERSOLE: I'd like to tie them up and put them in the corner.

(Laughter.)

MR. TAYLOR: Excuse me, Andy. Matt Taylor, Research. One more member of the staff has been working on it.

(Laughter.)

MR. MARCHESE: He is looking at the alternative system. That is a very important element.

We are hoping to get some help from the licensees on this Item D. That is partly being done under the systematic evaluation program for eleven of the older plants.

Okay, this Item E. For Plants where adequate risk analyses are available, compare risk with the acceptance criteria. If criteria are not met, estimate the effect of an arbitrary improvement in shutdown decay heat removal system reliability by a factor of 10.

Note, the tests are to determine whether overall any changes to reduce risk are necessary and, if so, whether a change in the shutdown heat removal system alone could produce a worthwhile improvement. I think, Dr. Kerr, that kind of answers your question, I hope.

What we are saying here is that if the present system does not meet the acceptance criteria in terms of reducing risk, we will postulate whether or not an assumed factor of 10 improvement in reliability for shutdown system would improve risk to a point where it meets our criteria. If it does that, we go in and decide what exactly has to be done.

MR. KERR: What are the acceptance criteria?

MR. MARCHESE: They are going to be developed.

MR. KERR: And if the present system -- if Mr. Ebersole is right that the shutdown decay heat removal system now contributes to 95 percent of all the risk, then you don't really need an acceptance goal for D. You just need to decide what risk you are willing to have a plant contribute.

But it does not seem to me that if you are planning to do something about this in the near future, that that goal is going to exist.

MR. MARCHESE: Well, there are people that would argue that there is a finite limit in terms of how much you can improve risk only through shutdown decay heat removal, that you have other faults, failure of reactor coolant system pressure vessel, failure to shut down the plant.

MR. EBERSOLE: Yes, whatever.

MR. MARCHESE: This puts a finite limit.

MR. EBERSOLE: The problem is to find that.

MR. KERR: How will you know when you have gotten the shutdown decay heat removal system good enough? Do you have a point at which you stop working on that and work on something else, or is that going to be something you are going to try to establish?

MR. MARCHESE: That is something I think we will try to establish through the development of acceptance criteria.

MR. MARK: He will be talking to Jesse, so he will be all right.

MR. EBERSOLE: I am looking for a factor of 10, at least.

MR. MARCHESE: Yes, I think a factor of 10 will be reasonable.

(Slide.)

Continuing with Task 3, compare the conclusions about adequacy of existing shutdown decay heat removal systems on quantitative analysis at "E" with conclusions based on qualitative analysis at "D" and proceed as follows: If the conclusions reached are reasonably consistent, well, rely on qualitative analyses for the remaining plants; if they are not consistent, we have to review the situation.

For existing plants in emergency situations, to cover the emergency situations we have to consider whether resistance of a shutdown decay heat removal system is consistent with the policy adopted in Sub-Task 1.2. That gets back to developing acceptance criteria to handle emergencies like sabotage, airplane crash, earthquakes and so forth; and doing something similar for the future plants is the next slide.

(Slide.)

I would like to get into Item 4. Development of recommendations of design alternatives. Now, this is a task that focuses in on dedicated alternative shutdown decay heat removal systems, and I might add that we are drawing heavily on the program that Matt Taylor is managing at Sandia, which is a study that has been ongoing for about a year and a half in which they are looking at alternative systems for both PWRs and boilers.

We think we have at least a good head start, at least on a generic basis, for seeing what type of alternative system makes the most sense for the different types of LWRs, but we feel we need to go further with that. That kind of outlines this kind of major alternative for existing plants.

We will develop and cost conceptual designs for improvement of reliability in shutdown decay heat removal systems in normal conditions for typical plants in which substantial improvements could be obtained by change, and this has to refer back to Item E of Sub-Task 3.2. We will develop and cost a conceptual design for improvement in reliability of the shutdown decay heat removal system, in the case of looking at emergency situations. For future plants this situation is somewhat more flexible.

That is all I have, and like I mentioned, we are encouraging feedback from the committee because this effort is really being kicked off in a serious way and what you see here is a very preliminary first cut of trying to put together a task action plan which I would assume would be written in the next six weeks to two months, and I think we could probably have a draft ready for, say, the subcommittee to review and maybe come down and discuss it with you at some future point in about two months, I would think.

MR. BENDER: Aside from you and your associate in Research, what other resources like money or contracts go at this task?

MR. MARCHESE: I made a preliminary estimate of the technical assistance requirements on this task and the time to do the kind of program we are outlining here, which is a rather broad scope, and I might add that we don't have internal agreement yet on the scope of effort here or management concurrence. I am trying to get -- in fact, that memo that you have copies of is starting the process of trying to get a concurrence on the scope of effort and the time to do this program.

But I see this as I have outlined here as basically a three-year program that would require a technical assistance funding on the order of about a million dollars a year for three years. I am finding out that at least getting internal help is going to be a problem, and everybody claims they are working on higher priority material, and I don't think I am going to get much help from the staff.

MR. BENDER: Would it help some if the committee, for example, were to write a letter saying this was the highest priority item that the regulatory staff should work on?

MR. MARCHESE: Yes, I think it would. I think we already have a recommendation in your NUREG report where you evaluated the research program. You had a recommendation in there that they ought to raise the level, I think, by $2 million to concentrate on alternative decay shutdown heat removal system.

So that just by itself was a big help in justifying the need for some additional technical assistance.

Matt?

MR. TAYLOR: We presently have about $280,000 at Sandia for this fiscal year to look at various concepts, to help gauge both current criteria for the U.S., current criteria for non-U.S. designs, and pull this together, as well as come up with a method to help bring the risk assessment, help weigh the different concepts in terms of risk assessment. That is under way right now.

MR. BENDER: I would very much like to see one exemplary case so I could see how people do the risk assessment.

MR. EBERSOLE: Matt, I was unimpressed by the Sandia study because it seemed to trend toward doing patchwork again. It talked about doing elements of the system rather than treating it as a unified package. That pattern seems to be set and hard to get out of.

MR. TAYLOR: I'm not sure I fully understand your concern.

MR. EBERSOLE: I recall reading that you greatly improved the aux feedwater system. They didn't mention the support systems for that, like DC and AC.

MR. TAYLOR: I don't believe that is the case. I can read the criteria going out to --

MR. EBERSOLE: Maybe I misread it.

MR. TAYLOR: We have certain criteria going out to help us scope out the designs right now. We've already defined the criteria. I'll read those off, if you care.

MR. EBERSOLE: It is an integral package, I hope.

MR. TAYLOR: Yes, it sure is. In fact, we are trying to look at all known threads, those we can quantify and those we can't quantify, as part of the package.

MR. EBERSOLE: I may have only read the wrong part.

Mr. Chairman, I don't know how much time. We can go further on this.

MR. MARK: I think we will have to probably leave this fairly soon, if not now.

MR. EBERSOLE: All right.

Any questions?

(No response.)

MR. EBERSOLE: No questions, I guess. Thank you very much.

MR. MARK: Thank you very much.

MR. EBERSOLE: The second part of this is this letter which is at the very bottom of this process, which is admittedly just some suggestions to patch the North Anna project and projects like that.

Let me say this. If the members haven't read the article by Bill Baldowitz, you will get this letter cold and I don't know whether it would be profitable to read it. It might be more profitable to defer the reading of this letter until I know in fact that people have looked at the source material for it and go over it then, maybe in the morning.

MR. MARK: I think that might be the best plan since we can't really deal with it this afternoon.

MR. EBERSOLE: Let me say what I attempted to do. I cannot, of course, offer to find legal licensing efficiencies at North Anna or their related plants and so use that as a basis for improving those plants. I tried to find reasonable arguments on the fringe of legal minimums and to use such arguments as I could generate by that process and use certain events that have happened recently, certain subcommittee sessions that we have had where arguments were presented, how we do things.

I therefore have written a letter along the lines that say legal minimums are not enough, that one should not consider just meeting minimum legal requirements, that there is more to this business than that, and I use a model for it.

MR. KERR: If legal minimums are not enough, why don't we change the legal minimums?

MR. EBERSOLE: That is what we asked, you will remember, Faust, Rosa, and there was no answer to that.

MR. KERR: Well, we got an answer but it was ridiculous. But it seems to me really if we think present standards are inadequate, we ought to be about trying to change them rather than saying it doesn't meet the legal standards.

MR. EBERSOLE: I think there will always be around a given legal minimum a grey area from good to bad, and I don't see any escaping that. And I think the designs we see here are at the end of the bad level, the bracket, and that is the way I am treating them in the letter that you will read. I am urging that we don't let students get away with a "D" grade.

MR. KERR: Where is the other report along with this?

MR. EBERSOLE: In the folder.

MR. KERR: Under Tab ...?

MR. SHEWMON: 12.

MR. EBERSOLE: I am going to guess you probably haven't read it and it would not be so good for me to go through my letter without having read it.

MR. MARK: Let's try and do this in the morning.

MR. EBERSOLE: Right.

MR. MARK: Our next item, unless there are immediate questions on this -- The study, incidentally, Task A-45, USIA 45, is in the NUREG-0705 described and is estimated there to be able to be stretched out for three years with the objective of deciding or trying to conclude whether the plans are okay as they are, whether they need a little improvement or whether they really should be changed.

Max, the next item I believe is yours. Is Mr. Seleski here? Is it reasonable that we should interpolate a break before we ask him?

MR. CARBON: Yes.

MR. MARK: I would suggest we reconvene in ten minutes for hearing Max and Pierre Seleski, and that will be a closed session.

(Whereupon, the open session recessed, to reconvene in closed session, after which closed session the meeting recessed to reconvene on Saturday, April 11, 1981.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

____

in the matter of: ACRS/252nd General Meeting

Date of Proceeding: April 10, 1981

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.

ANN RILEY

Official Reporter (Typed)

Ann Riley

Official Reporter (Signature)

POOR ORIGINAL

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

____

in the matter of: ACRS/252nd General Meeting

Date of Proceeding: April 10, 1981

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.

Jane W. Beach

Official Reporter (Typed)

Jane W. Beach

Official Reporter (Signature)

POOR ORIGINAL

NRC REPORT ON BWR SCRAM SYSTEM

- SUMMARY OF ISSUE
- ACCIDENT SCENARIO
- IMPACT ON BWR
- NRC ACTION
- TECHNICAL ASSESSMENT
- OPERATIONAL ASSESSMENT
- UTILITY/MEDIA COMMUNICATION

SUMMARY OF ISSUE

- DESIGN BASIS STILL VALID

- NOT A BWR/6 MARK III EVENT

- CONCERN PRIMARILY ON MARK I PLANTS

- OPERATOR PROCEDURES IN PLACE TO HANDLE EVENT

- NRC SAYS "NOT IN HOT ISSUE CATEGORY"
  - NEEDS MORE TIME TO STUDY REPORT

- REGULATORY RESPONSE GROUP (RRG) ACTIVATED BY NRC
  - MEETING APRIL 9
  - NRC DIRECTORS WILL PARTICIPATE
  - KEY MEETING - SHERWOOD WILL ATTEND

- UTILITY/MEDIA INTEREST REMAINS HIGH

POSTULATED EVENT SCENARIO

1. NORMAL SCRAM OCCURS

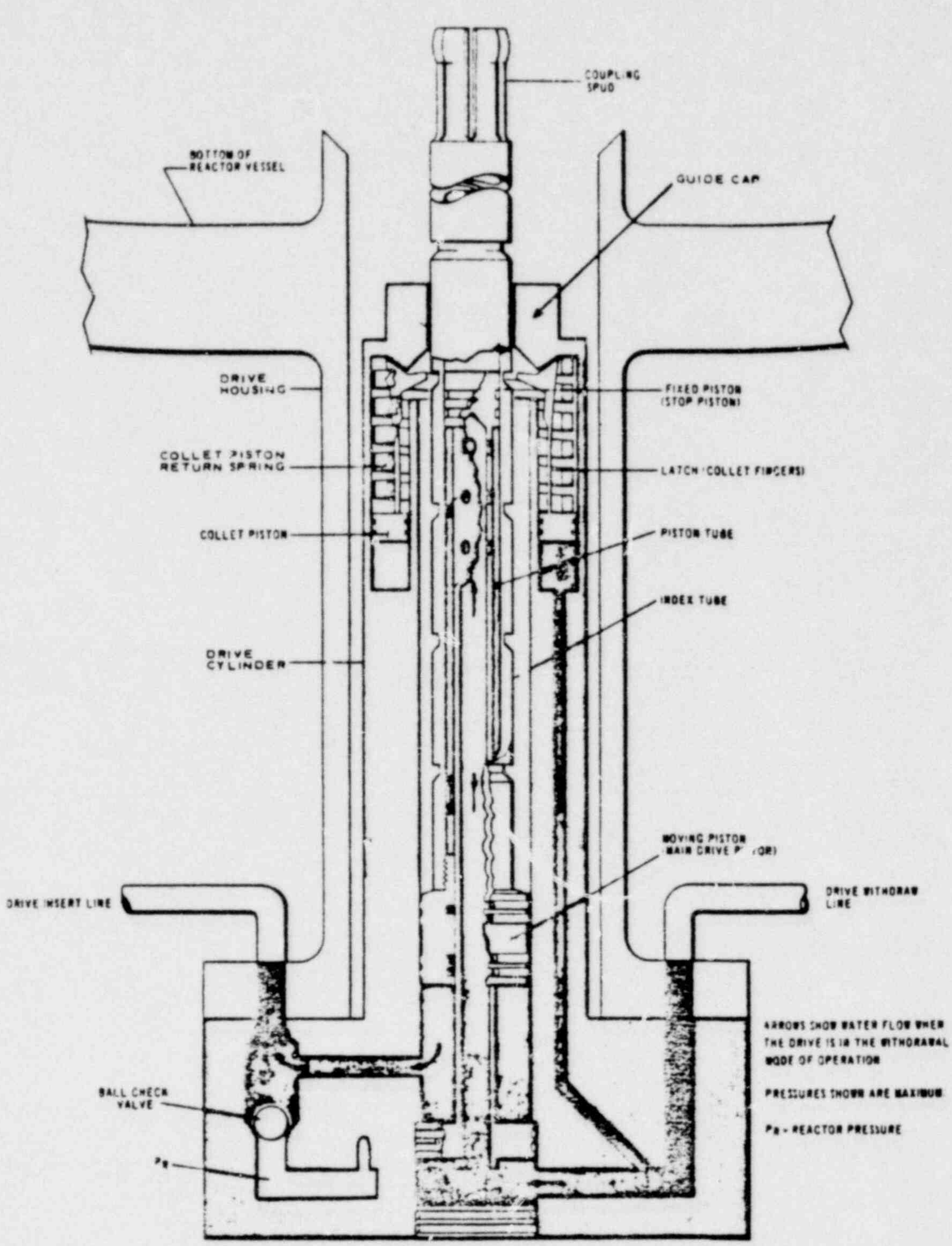
2. BREAK OCCURS IN SDV PIPING
   - o SMALL BREAK (1 HCU WITHDRAWAL LINE), OR
   - o LARGE BREAK (SDV HEADER PIPE)

3. VESSEL CANNOT BE ISOLATED FROM BREAK

4. BREAK FLOW WOULD FLOOD DOWN TO LOWER LEVEL IN REACTOR BUILDING WHERE ECCS PUMPS ARE LOCATED

5. ECCS PUMPS WOULD TRIP DUE TO FLOODING

6. WITHOUT ECCS MAKE-UP, VESSEL WOULD COMPLETELY DRAIN

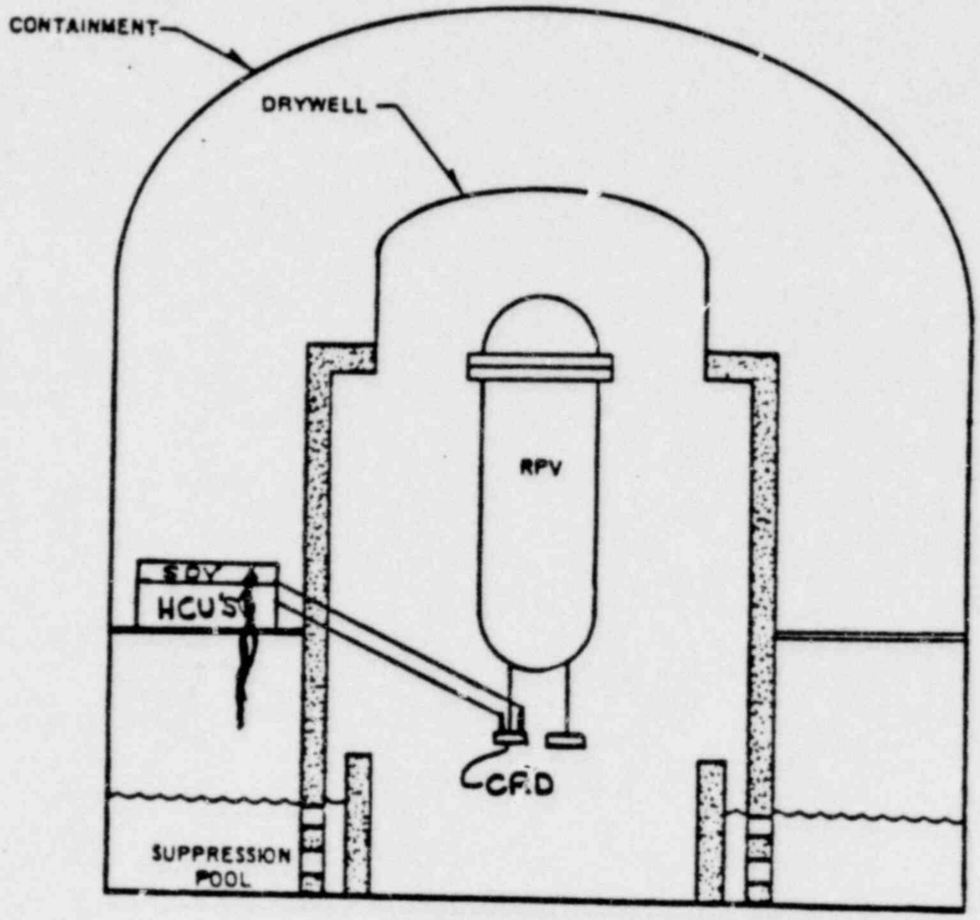


WM. H. ZIMMER NUCLEAR POWER STATION, UNIT 1

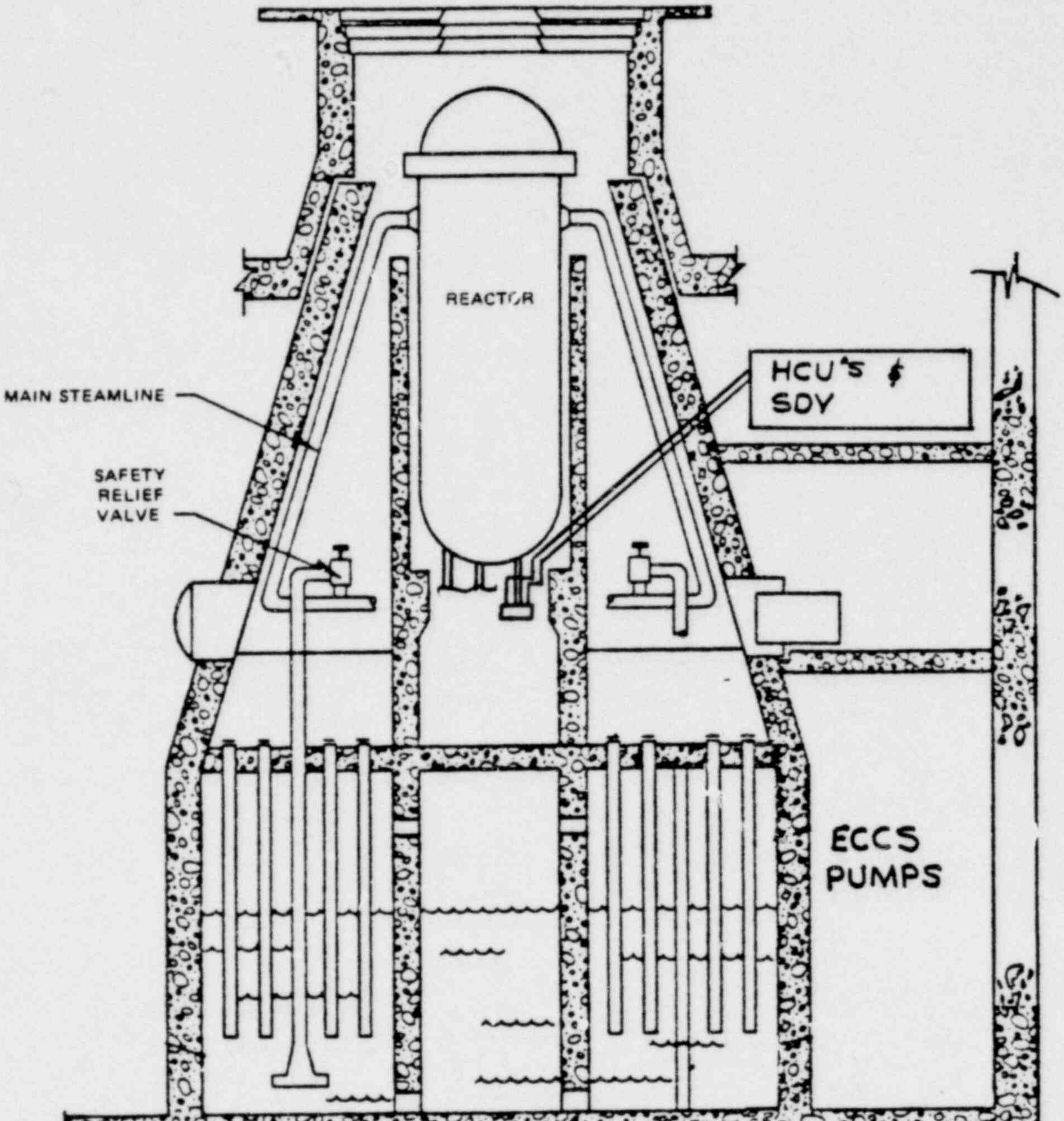
FINAL SAFETY ANALYSIS REPORT

FIGURE 4.2-15

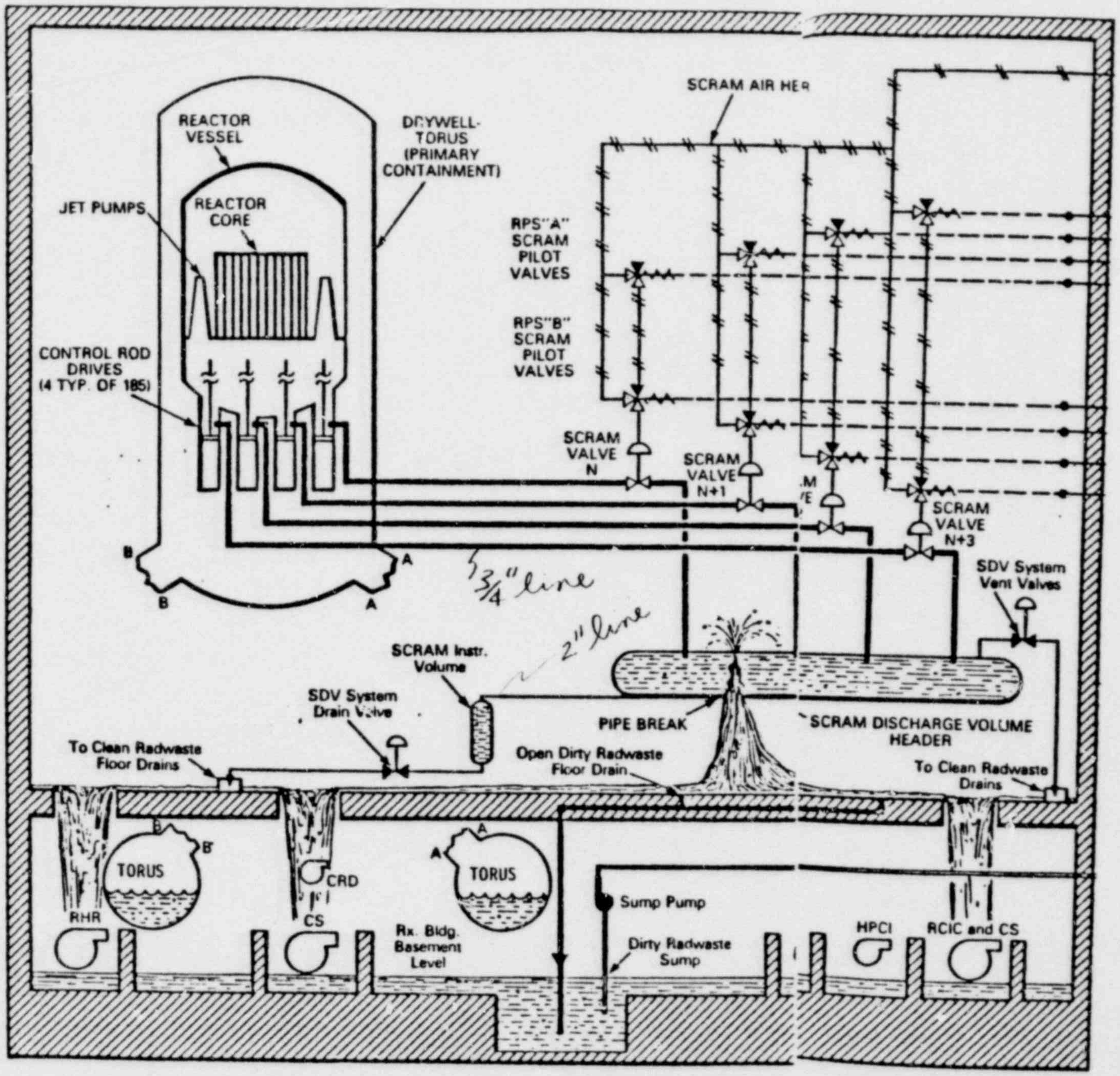
CONTROL ROD DRIVE UNIT



BWR/6 MARK III CONTAINMENT



TYPICAL MARK II CONTAINMENT



TYPICAL MARK I CONTAINMENT

POOR ORIGINAL

NRC ACTION

- CURRENT POSITION OF NRR
  - NOT IN HOT ISSUE CATEGORY
  - DISAGREES WITH REPORT PROBABILITY NUMBER
  - PLAN TO ISSUE LETTER APRIL 9 WITH REPORT
    - WILL REQUIRE 30 DAY RESPONSE
  - NRR TASK FORCE WILL CONTINUE TO EVALUATE REPORT
  - REGULATORY RESPONSE GROUP ACTIVATED BY NRC
    - MEETING IN BETHESDA APRIL 9

NRC SITUATION - BWR SCRAM SYSTEM

- DENTON NEEDS RESPONSE WHICH SHOWS:
  - NOT AN UNREVIEWED SAFETY ISSUE
  - PREVIOUSLY REVIEWED & APPROVED BY STAFF
  - PROVIDES GOOD TECHNICAL ARGUMENT ON PRESSURE BOUNDARY
  - GE CONFIDENT IN TECHNICAL ASSESSMENT

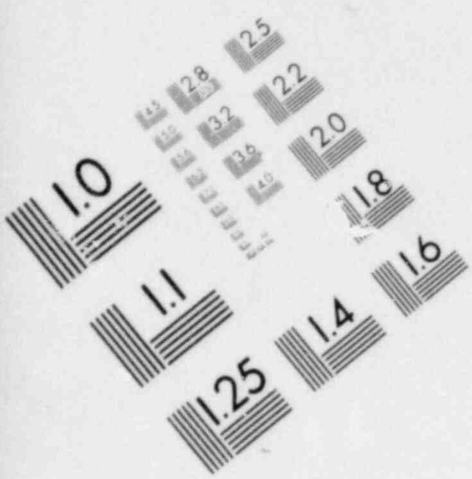
PRELIMINARY

TECHNICAL ASSESSMENT OF POSTULATED EVENT

- BASICALLY A GOOD TECHNICAL PRESENTATION
- PLANTS ARE SAFE
- TECHNICAL ISSUES BEING INVESTIGATED
    - ACCEPTABILITY OF PRESENT DEFINITION OF REACTOR COOLANT PRESSURE BOUNDARY (RCPB)
    - NOT APPLICABLE TO ALL PLANTS
    - PROBABILITY ESTIMATES
    - TIME TO POTENTIALLY FLOOD QUESTIONABLE
    - OTHER WATER SOURCES NOT ADDRESSED

IMAGE EVALUATION
TEST TARGET (MT-3)

6″



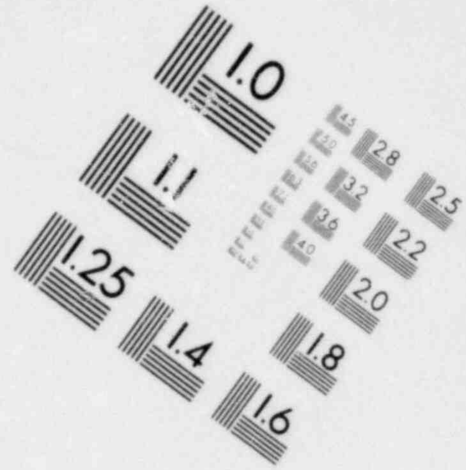
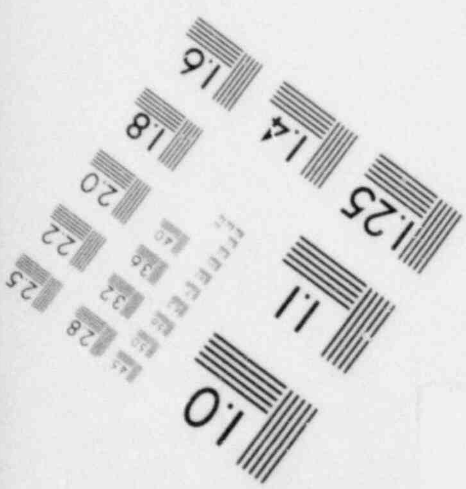
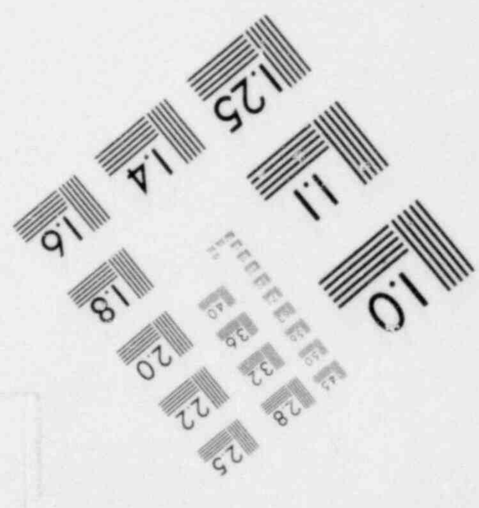


IMAGE EVALUATION
TEST TARGET (MT-3)





ACCEPTANCE OF RCPB/ISOLATION PROVISIONS

- ISOLATION PROVISIONS HAVE BEEN REVIEWED IN THE PAST
  - o TRADE-OFF BETWEEN SCRAM RELIABILITY AND ISOLATION PROVISIONS
- RCPB IS AT THE CRD
- VESSEL PRESSURE AND FLOW IS COMMUNICATED TO SDU DURING SCRAM
- DESIGN OF SCRAM DISCHARGE PIPING COMMENSURATE WITH SAFETY IMPORTANCE
  - o PIPING DESIGN REQUIREMENTS ASSURE NECESSARY QUALITY
    - o EARLIER - B3.1 PLUS SPECIAL REQUIREMENTS
    - o CURRENT - SECTION III CLASS 2 WITH SPECIAL REQUIREMENTS
- LOW SERVICE CONDITIONS
- CARBON STEEL PIPE
- SDV PIPING FAILURE INCREDIBLE (E.G. $< 1 \times 10^{-6}$/YR)
  - o BASED ON GE DESIGN REQUIREMENTS

PIPING DESIGN BASIS FOR BWR

REACTOR COOLANT PRESSURE BOUNDRY

COMPONENTS	PRE JULY 1971	POST JULY 1971
RPV	ASME III	ASME III
MSL	ANSI STDS	ASME III
RECIRC SYSTEM	ANSI STDS	ASME III
ECCS LINES	ANSI STDS	ASME III
CRD INSERT & W/DRAW	ANSI STDS	ASME III
CRD SDV	ANSI STDS	ASME III

SCRAM DISCHARGE PIPING DESIGN REQUIREMENTS

- GE REQUIREMENT
  - DEFINITION OF MINIMUM CODE CLASSIFICATION
  - DESIGN, FABRICATION AND INSTALLATION
  - ADDITIONAL QC INSPECTION REQUIREMENTS
  - ADDITIONAL QC CLEANING REQUIREMENTS
  - DEFINITE SERVICE CONDITIONS
  - RECOMMENDED PIPE MATERIAL AND SIZE
- AE/CUSTOMER RESPONSIBILITIES
  - SATISFY ALL GE REQUIREMENTS
  - PERFORM DETAILED DESIGN AND ANALYSIS
  - INSTALLATION
  - INSPECTION
  - SPECIFY NECESSARY INSERVICE INSPECTION (ISI)

RLG

4/8/81

REPORT DOES NOT APPLY TO ALL PLANTS

ECCS PERFORMANCE	MARK III	MARK II	MARK I
• JEOPARDIZED BY WATER CASCADING INTO ECCS ROOMS	CANNOT HAPPEN ECCS IN AUX. BLDG.	NOT LIKELY TO HAPPEN SDV 2-4 FLOORS ABOVE ECCS ROOMS	VERY LIKELY TO HAPPEN (SOME WATER TIGHT) SDV 1 FLOOR ABOVE ECCS ROOMS
• CONTINUOUS ECCS WATER SUPPLY (LONG TERM)	NO CONCERN	IS A CONCERN	IS A CONCERN

RUPTURED SDV LINE CORE UNCOVERY PROBABILITY

- NRC ASSESSMENT
  - o ESTIMATED AS $> 1.0 \times 10^{-6}$/YR
    - o UNCERTAINTY RANGE 10^{-3}/YR TO 10^{-9}/YR
- GE ASSESSMENT
  - PROBABILITY OF PIPE BREAK SHOULD BE LOWER ($< 2 \times 10^{-4}$/YR)
  - PROBABILITY OF ~~ECCS~~ WATER MAKEUP FAILURE SIGNIFICANTLY LOWER ($\ll 0.25$)
  - OVERALL CORE UNCOVERY PROBABILITY $< 1 \times 10^{-6}$/YR

TIME TO FLOOD (MARK I & II)

- DEPRESSURIZATION WILL SIGNIFICANTLY REDUCE LEAKAGE RATE

- ECCS UNITS RAISED OFF FLOOR 2-3 FEET

- ECCS SHOULD BE AVAILABLE FOR 6-12 HOURS

ALTERNATE PUMPS AND WATER SOURCES

- MICHELSON REPORT CONSIDERED ONLY ECCS SYSTEMS AND RCIC TO KEEP CORE COOLED

- POTENTIAL COMMON-MODE FAILURES DUE TO RELATIVE LOCATION OF SDV AND ECCS/RCIC IN MARK I REACTOR BUILDING

- BWR EMERGENCY GUIDELINES (APPROVED BY NRC) CONSIDER ALSO

PUMPS	LOCATION	WATER SOURCE
• CONDENSATE/FEEDWATER	TURBINE BLDG	HOTWELL/CST
• FIRE SYSTEM	PLANT UNIQUE	PLANT UNIQUE
• OTHER UNITS BY INTERCONNECTION	PLANT UNIQUE	PLANT UNIQUE
• EMERGENCY SERVICE WATER	REMOTE BLDG	ULTIMATE HEAT SINK

INITIAL

REPORT RECOMMENDATIONS/GE RESPONSE

• SCRAM DISCHARGE PIPING TO MEET HIGHER QA STANDARDS	• ORIGINAL GE DESIGN REQ'TS BELIEVED SATISFACTORY: DETAILS INSTALLATION, QA., ETC. IN CUSTOMER SCOPE
• UPGRADE LEAK DETECTION CAPABILITY	• NOT REQUIRED - MAY HAVE MERIT SO AE SHOULD REVIEW
• DEVELOP EMERGENCY OPERATIONS PROCEDURES AND OPERATING TRAINING FOR SDV PIPE BREAK	• AGREE
• IMPROVE CLOSURE RELIABILITY OF SCRAM VALVES	• SCRAM VALVE RELIABILITY
• ISOLATE SDV PRIOR TO ANY HCU REPAIRS	• AGREE, ALREADY PART OF RECOMMENDED PROCEDURE
• LOCATE HCUs ABOVE CORE ELEVATION IN ALL FUTURE PLANTS	• NOT REQUIRED - NO PROBLEM FOR MARK III DESIGN

SCRAM DISCHARGE ISOLATION LICENSING BASIS

1. DOUBLE-ENDED GUILLOTINE BREAK OF ONE CRD WITHDRAWAL LINE CONSIDERED IN ALL OPERATING PLANT LICENSE APPLICATIONS

   - DOSE CONSEQUENCES FOUND ACCEPTABLE

   'PERATOR ACTION WILL RESULT IN SHUTDOWN TO 'OLATE AND REPAIR LINE BEFORE ANY SIGNIFICANT C .LANT LOSS OCCURS

2. ABOVE EVALUATIONS APPROVED IN PAST BY NRC ON PLANT SPECIFIC DOCKETS.

3. GE BELIEVES ABOVE EVALUATIONS ARE STILL VALID AND APPLICABLE.

OPERATIONAL ASSESSMENT

DETECTION CAPABILITY

1. CRD's HIGH TEMPERATURE ALARM
2. AREA RADIATION MONITOR ALARM
3. Rx BLDG. VENT H. RAD ALARM
4. Rx BLDG. SUMP H. LEVEL ALARM
5. Hi WATER LEVEL IN ECCS ROOM ALARM
6. Hi TEMP. IN ECCS ROOM ALARM
7. PERSONNEL OBSERVATION IN Rx BLDG.
8. REACTOR BLDG. SUMP PUMPS RUNNING

OPERATOR ACTION EXPECTED

1. DECLARE LOCAL EMERGENCY AND TAKE ACTION PER LOCAL EMERGENCY PROCEDURE.
2. FOLLOW ANNUNCIATOR RESPONSE PROCEDURES
3. DETERMINE LOCATION OF BREAK-
   ENTER EMERGENCY PROCEDURE FOR LEVEL CONTROL
4. ISOLATE BREAK
   A. RESET SCRAM PER SCRAM PROCEDURE
   B. CLOSE 102 AND/OR 112 VALVES
5. WHEN RPV LEVEL IS STABILIZED ENTER EMERGENCY PROCEDURE FOR COOLDOWN.
6. INITIATE A RAPID, CONTROLLED RPV DEPRESSURIZATION & COOLDOWN
7. ISOLATE BREAK WHEN THE RPV IS DEPRESSURIZED AND COOLED DOWN.
8. CLOSE REMAINING 102 AND/OR 112 VALVES WHICH COULD NOT BE CLOSED AT PRESSURE.

RLG
4/8/81

COMMUNICATION ACTIVITIES

- NEBG STATEMENT COMMUNICATED TO OPERATING AND REQUISITION PLANT OWNERS
- PRIORITY TELEGRAM TO DOMESTIC AND OFFSHORE SALES REPRESENTATIVES
- NOTIFIED AIF
- FOLLOWING 4/7 WSJ COVERAGE, AP, UPI AND DOW JONES DISTRIBUTED STORY TO MEDIA NATIONWIDE
- RESPONDED TO MEDIA QUERIES FROM:
  - WSJ
  - ASSOCIATED PRESS
  - S.J. MERCURY/NEWS
  - LONDON FINANCIAL TIMES
  - CBS-TV, CHICAGO
  - CINCINNATI ENQUIRER
  - REUTERS NEWS SERVICE
  - TORONTO STAR
  - HARTFORD TIMES
  - PHILADELPHIA ENQUIRER
  - PHILADELPHIA DAILY NEWS

SUMMARY: PCS REMARKS
at November 13, 1980 meeting
of ACRS Subcommittee on Fluid Dynamics
Amfac Hotel, Burlingame, CA.
By: Dr. I. Catton, Consultant

UNIQUE PASSIVE ENGINEERED SYSTEMS

REFILL SYSTEM

DELUGE SYSTEM

QUENCH SYSTEM

POST ACCIDENT DECAY HEAT REMOVAL SYSTEM

Catton

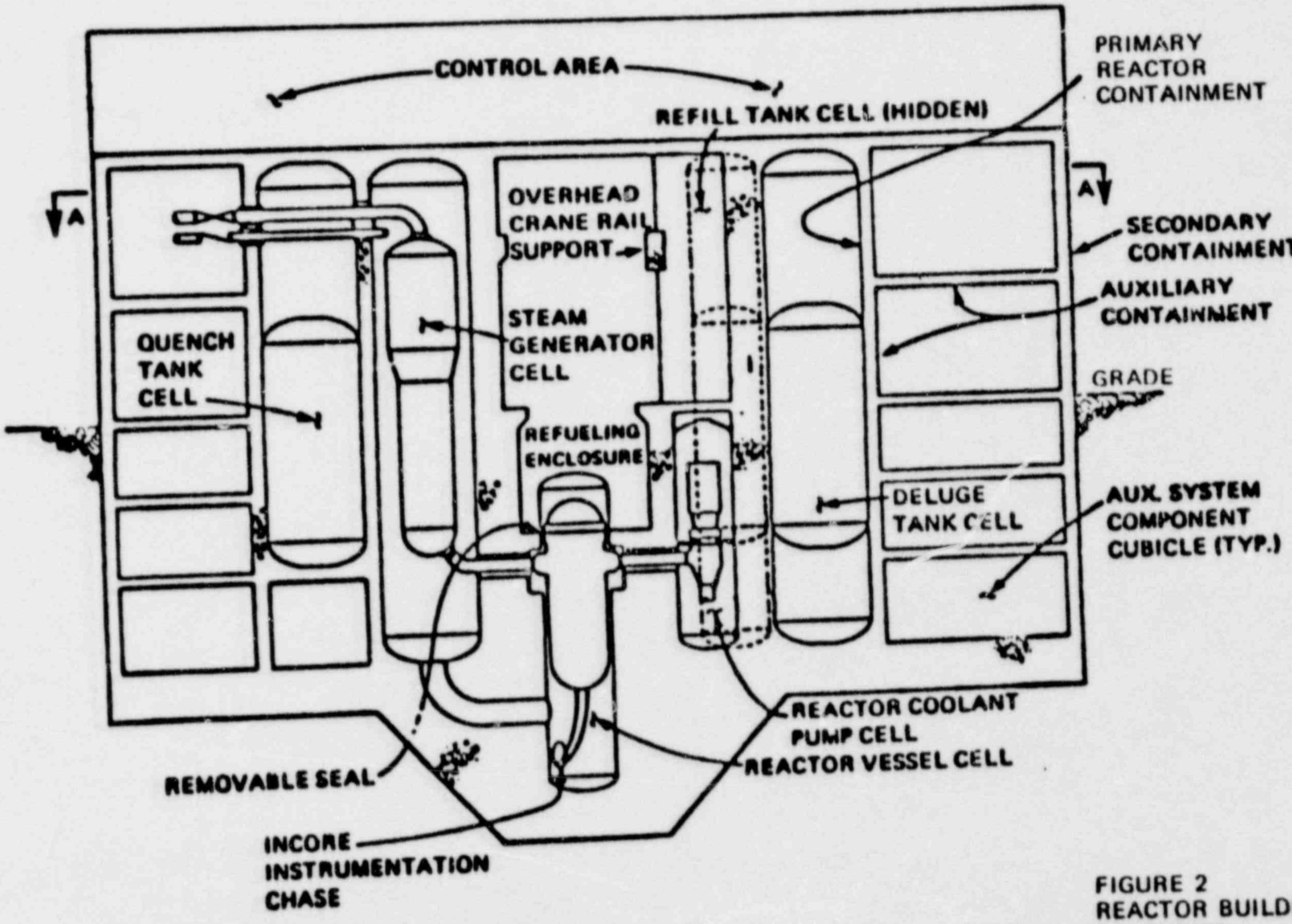


FIGURE 2
REACTOR BUILDING
ELEVATION

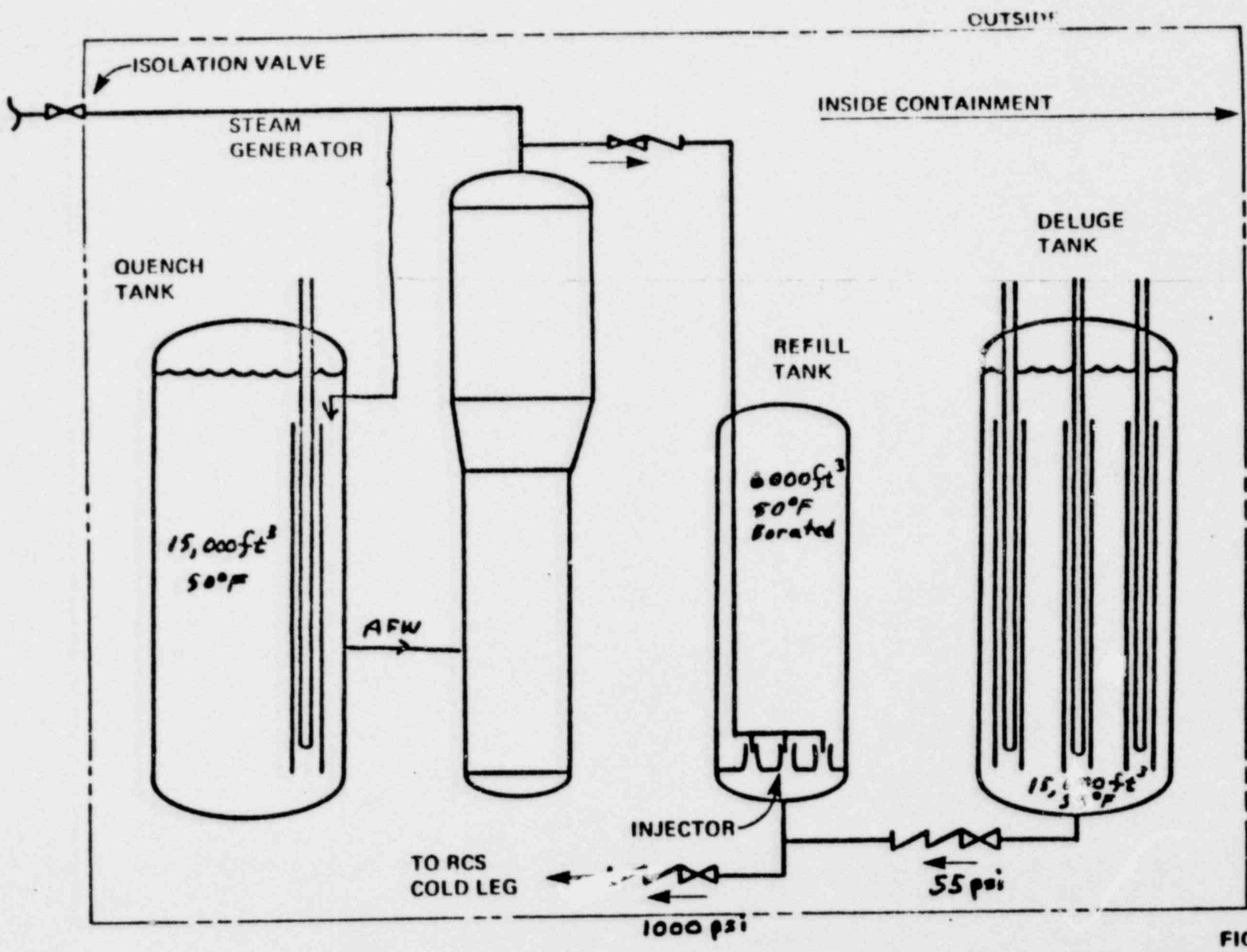


FIGURE 4
ENGINEERED SAFETY SYSTEMS FOR LOCA

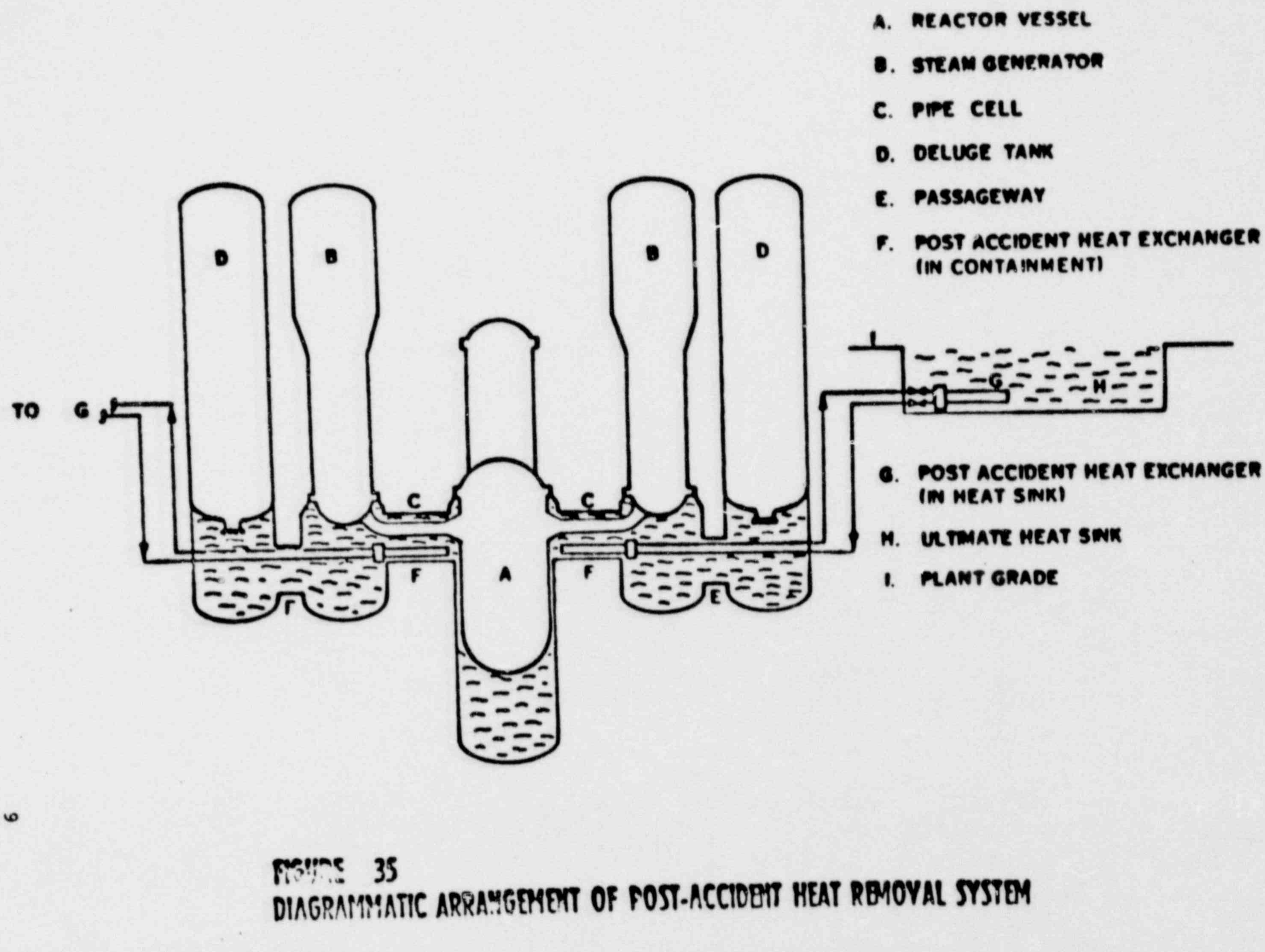


FIGURE 35
DIAGRAMMATIC ARRANGEMENT OF POST-ACCIDENT HEAT REMOVAL SYSTEM

REFILL SYSTEM

PROVIDES CORE FLOOD WATER FOLLOWING DEPRESSURIZATION OF THE PRIMARY SYSTEM TO 1000 PSIA.

OPERATES ON SECONDARY SIDE STEAM

MUCH MORE WATER THAN IN ECC ACCUMULATORS AT PRESENT. OPERATING ON STEAM RATHER THAN NITROGEN MAY NOT BE A PLUS. INJECTS INTO BOTH HOT LEG AND COLD LEG THROUGH CHECK VALVES'

DELUGE SYSTEM

ACTS AS A SUPPRESSION POOL DURING EARLY STAGES OF A LOCA AND LATER AS A LOW PRESSURE FLOODING SYSTEM.

THE SYSTEM REPLACES THE REACTOR BUILDING SPRAY SYSTEM.

THE DELUGE SYSTEM ALSO ACTS AS A SUPPRESSION POOL FOR THE PRESSURIZER AND THE STEAM GENERATORS.

CONNECTED TO THE REFILL TANKS VIA CHECK VALVES. DIFFERENCE IN OPERATING PRESSURES IS APPROXIMATELY 1000 PSIA. (700 PSIA ABOVE THE DELUGE SYSTEM DESIGN PRESSURE.)

QUENCH SYSTEM

ACTS AS A PASSIVE HEAT SINK OR SUPPRESSION POOL FOLLOWING A LOCA AND CERTAIN OTHER ACCIDENTS INVOLVING STEAM AND FEEDWATER SYSTEMS. IT ALSO ACTS AS A SOURCE OF EMERGENCY FEEDWATER FOLLOWING A LOFW.

OPERATES ON SECONDARY SIDE STEAM.

A SMALL PWR SUPPRESSION POOL WITH FEEDWATER CAPABILITY AT LOW PRESSURE.

ONE CHECK VALVE IN LINE TO STEAM GENERATOR.

POST ACCIDENT DECAY HEAT REMOVAL SYSTEM

A HEAT EXCHANGER INSIDE THE PRIMARY CONTAINMENT CONNECTED TO A HEAT EXCHANGER IN THE COOLING POND. OPERATION BY NATURAL CIRCULATION.

CONCERNS

1. LARGE NUMBER OF CHECK VALVES BETWEEN THE VARIOUS SYSTEMS AND THE PRIMARY SYSTEM.
2. OPERATION OF THE HIGH PRESSURE FLOODING SYSTEM, REFILL SYSTEM, DEPENDS ON THE STEAM FROM THE STEAM GENERATOR.
3. QUENCH AND DELUGE SYSTEMS MAY NOT SURVIVE THEIR MISSION AS STEAM SUPPRESSION POOLS. DEEP SUBMERGENCE LEADS TO LARGE CLEARING LOADS. STEAM BUBBLE COLLAPSE IN SUBCOOLED WATER MAY CAUSE DAMAGE.
4. THE PRC INTERNAL DESIGN PRESSURE MAY BE TOO LOW FOR LARGE BREAKS. THE PRESSURE SUPPRESSION CALCULATION DOES NOT APPEAR TO HAVE ACCOUNTED FOR VENT CLEARING.
5. THE PASSIVE HEAT REMOVAL SYSTEM DEPENDS ON NATURAL CIRCULATION WITHIN THE PRC, WITHIN THE FLOW LOOP CONNECTING THE PRC TO THE COOLING POND. AT DECAY HEAT LEVELS OF 1% FULL POWER ONE MUST REJECT 30MW.
6. THE SYSTEM DOES NOT APPEAR TO BE OPERABLE UNLESS THE PRIMARY SYSTEM DROPS BELOW 1000 PSIA. THIS DOES NOT INCLUDE MANY SMALL BREAKS.
7. CLASS 9 ACCIDENTS WITH VESSEL FAILURE WILL BE MORE DIFFICULT TO CONTROL.
   A) SMALL REACTOR CAVITY CROSS SECTION WILL LEAD TO DEEPER DEBRIS BEDS AND A GREATER POSSIBILITY FOR DRY OUT AND CONCRETE PENETRATION WITH ACCOMPANYING GAS GENERATION AS WELL AS CONSEQUENCES OF BASE MAT PENETRATION.
   B) LIMITED FLOW AREAS MAY LEAD TO COUNTER CURRENT FLOW LIMITATIONS.
8. A GREAT DEAL HAS BEEN CLAIMED FOR THE PASSIVE CONTAINMENT SYSTEM WITHOUT SUFFICIENT BACKUP CALCULATIONS. MANY SURPRISES MAY BE IN STORE WHEN SUCH A SYSTEM IS IMPLEMENTED.

POSITIVE ASPECTS

1. THE AUXILIARY FEEDWATER SYSTEM USING THE QUENCH TANKS IS A USEFUL CONTRIBUTION. UNDER TOTAL LOSS OF POWER IT COULD SIGNIFICANTLY EXTEND THE AVAILABLE TIME FOR CORRECTIVE ACTION.
2. THE PASSIVE HEAT REMOVAL SYSTEM COULD BE AN ASSET IN CLASS 9 ACCIDENT MITIGATION.
3. REMOVING POST ACCIDENT SENSIBLE HEAT WITHOUT PHASE CHANGE IS BENEFICIAL BECAUSE IT GIVES A SIGNIFICANT MARGIN OF SAFETY.
4. ON THE SURFACE, THE PASSIVE CONTAINMENT SYSTEM APPEARS TO BE THE ANSWER TO THE LARGE BREAK LOSS OF COOLANT ACCIDENT FROM A THERMAL/HYDRAULIC POINT OF VIEW.
5. ISOLATION OF THE STEAM GENERATOR WITH A PROBLEM IS GOOD. HOW THIS WILL BE DONE IS NOT CLEAR.
6. STEAM RELIEF VALVES DO NOT EXHAUST TO THE ATMOSPHERE.

PALISADES PERFORMANCE
EVALUATION FOR ACRS 4-10-81

I. I.E. EVALUATIONS OF LICENSEE PERFORMANCE

A. END-OF-YEAR REPORTS (BEFORE 1980)-ROUTINE

1. PREPARED BY PRINCIPAL INSPECTOR - SUPERVISORY REVIEW

2. EVALUATION AREAS

(A) SIGNIFICANT OPERATIONAL EVENTS

(B) ENFORCEMENT DATA AND EVALUATION

(C) INSPECTION RECOMMENDATIONS (WEAK AREAS)

(D) PERSONNEL ERRORS - RATE AND SIGNIFICANCE

(E) UNPLANNED RADIOACTIVITY RELEASES

(F) REPORTABLE EVENTS - NUMBER AND CHARACTER

(1) CAUSES

(2) CONSEQUENCES

3. DISCUSSED WITH LICENSEE MANAGEMENT - NO FORMAL REPORT

B. SPECIFIC SIGNIFICANT NONCOMPLIANCE

1. BASIS-SUPPORT DECISIONMAKING ON ENFORCEMENT

2. PREPARED BY PRINC.PAL AND/OR SPECIALIST INSPECTORS

(A) SUPERVISORY REVIEW

(B) ENFORCEMENT COORDINATOR INVOLVEMENT

3. EXAMPLES:

(A) 4/78-9/79 CONTAINMENT INTEGRITY VIOLATION

(B) 7/80-8/80 ECCS VALVE MISPOSITIONINGS

(C) 1/81 STATION BATTERY DISCONNECTION

Jorgenson

C. SYSTEMATIC APPRAISAL OF LICENSEE PERFORMANCE (SALP)-1980

1. INPUT FROM "INVOLVED" INSPECTORS, NRR
   (A) REGION COMMITTEE DEVELOPMENT AND REVIEW
   (B) HQ COMMITTEE REVIEW

2. EVALUATION AREAS
   (A) NUMBER AND NATURE OF NONCOMPLIANCE
   (B) NONCOMPLIANCE EVALUATION BY INSPECTORS AREA
   (C) NUMBER AND NATURE OF REPORTABLE EVENTS
   (D) EVALUATION OF REPORTABLE EVENTS (CAUSES/CONSEQUENCES)
   (E) ESCALATED ENFORCEMENT (IAL, ORDER, CIVIL PENALTY)
   (F) INSPECTION PROGRAM RECOMMENDATIONS
   (G) OTHER OBSERVATIONS (WEAK AREAS INCLUDED)

3. DISCUSSED WITH LICENSEE MANAGEMENT-FORMAL REPORT

II. Evaluation Findings

A. Enforcement history (see Figure 1)

1. above average noncompliance
2. failure to improve performance (see Figure 2)
3. occurrence of significant items since 1979

B. Reportable event history (see Figure 3)

1. About average numbers
2. "preventable" fraction significant
3. no improvement over time

C. Problem area identification-routine evaluations (see Figure 4)

1. training deficiencies-since 1977
2. personnel error rate-since 1977
3. ineffectiveness of corrective action-since 1977
4. procedure nonadherence-since 1979
5. radprotection/radwaste program management problems-since 1978
6. equipment operability control-since 1977

D. Problem area identification-"event" evaluations

1. containment integrity violations
   (a) equipment operability control-procedures
   (b) long-term undetected noncompliance
2. ECCS valve mismanipulations
   (a) equipment operability control-personnel
   (b) procedure nonadherence

3. STATION BATTERY DISCONNECTION

   (A) EQUIPMENT OPERABILITY CONTROL-PERSONNEL

   (B) PROCEDURE NONADHERENCE

   (C) SIGNIFICANCE OF ERRORS-"COMMON MODE" FACTOR

E. OVERVIEW-IMPROVEMENT OF REGULATORY PERFORMANCE

1. STRENGTHEN MANAGEMENT CONTROL

   (A) PROCEDURE DEVELOPMENT PROCESSES/CONTROLS

   (B) AUDITING PROGRAMS

   (C) SIGNIFICANT EVENT REVIEW-CORRECTIVE ACTION

   (D) PERSONNEL MANAGEMENT/MOTIVATION

2. IMPROVE PERSONNEL PERFORMANCE

   (A) ADEQUATE STAFFING (OVERWORK LIMITS)

   (B) TRAINING AND RETRAINING PROGRAMS

   (C) PROCEDURAL COMPLIANCE

   (D) INDEPENDENT VERIFICATION

   (E) INCREASED "DISCIPLINE" OF PERFORMANCE

III I.E. Actions on Evaluated Weaknesses

A. Order 11-10-79

1. Examine and correct procedures for activity control
2. Verify operability monthly
3. Civil penalty

B. IAL 7-31-80

1. Operations personnel retraining
2. Modify shift turnover process
3. Civil penalty

C. IAL 1-9-81

1. Daily auditing of operations activities
2. Testing and maintenance procedural controls review
3. Instruct personnel emphasizing "disciplined" performance
4. Independent verification of proper "manipulation"

D. Order 3-10-81

1. Control licensed operator overtime
2. Corporate review and recommendation on significant events
3. Management evaluation by independent consultant
4. Evaluate/modify procedure development process/control
5. Evaluate/modify training programs
6. Operations staff adequacy evaluation
7. Establish personnel management/motivation to adhere to procedures
8. Management auditing on implementation of 3-6 above
9. Other elevated enforcement action being considered

FIGURES:

1. NONCOMPLIANCE, BY YEAR, COMPARING PALISADES TO "AVERAGE"
2. NONCOMPLIANCE, 1980, COMPARING PALISADES TO OTHERS IN RIII
3. LER'S, BY YEAR, COMPARING PALISADES TO OTHERS IN RIII (IDENTIFYING "PREVENTABLE" FRACTION)
4. PROBLEM AREAS, BY YEAR, IDENTIFIED IN ROUTINE EVALUATIONS (ATTACHED)

Current Status

- The requirements of the 1-6-81 IAL and the 3/10/81 Confirmatory Order remain in effect.

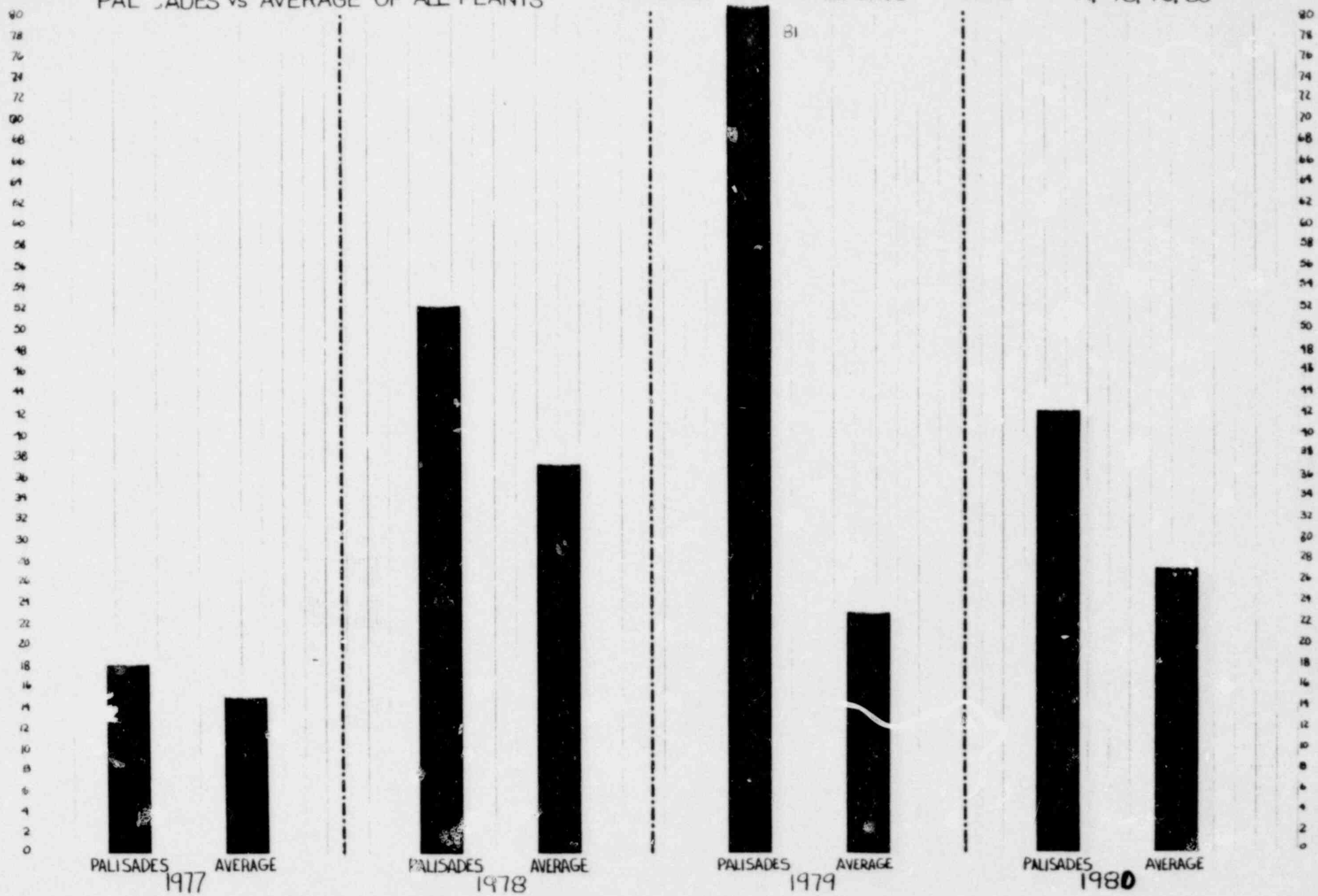
- The company has made a strong committment to develop and implement a program to assure sustained high regulatory performance.

- The development and implementation of this program is in progress. This includes:

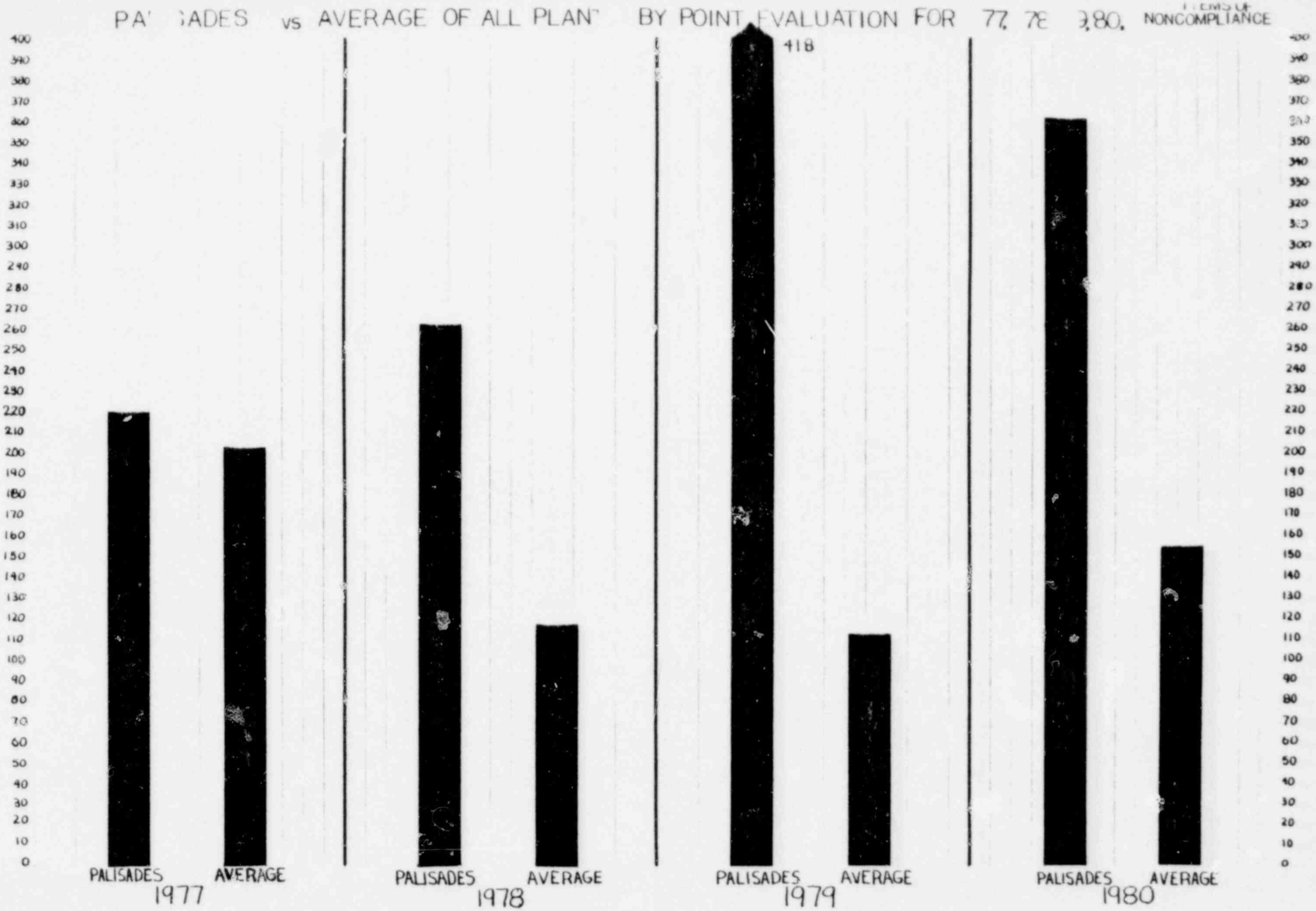
  - A management consultant firm has been hired
  - Significant management changes have been made-corporate and plant
  - Company reorganization is in progress
  - Corporate role in plant operations has been strengthened
  - Staff expansion is in progress
  - Training facilities and staff are being expanded

- Plant regulatory performance has improved significantly. There have been no items of noncompliance since 1-6-81

PAL ADES vs AVERAGE OF ALL PLANTS ICENSEE EVENT REPORTS POINTS 77, 78, 79, 80



PA' ;ADES vs AVERAGE OF ALL PLANT BY POINT EVALUATION FOR 77, 78 9,80.



POOR ORIGINAL

FIGURE 4

PROBLEM AREA		END-OF-YEAR REPORTS 1977	1978	1979	SALP
TRAINING DEFICIENCIES		+	+	+	+
MAINTENANCE BACKLOG		+	+	+	
PROBLEM MANAGEMENT	PERSONNEL ERROR RATE	+	+	+	+
	CORRECTIVE ACTION	+	+	+	+
	PROCEDURE NONADHERENCE			+	+
PROCEDURE DEFICIENCIES			+	+	
RADPRO/RADWASTE MANAGEMENT			+	+	+
SECURITY PROG. DEFICIENCIES			+	+	+
EQUIP. OPERABILITY CONTROL		+	+	+	+

SIGNIFICANT OPERATING EVENTS

PALISADES SEPTEMBER 1979 THRU JANUARY 1981

1. BREACH OF CONTAINMENT INTEGRITY

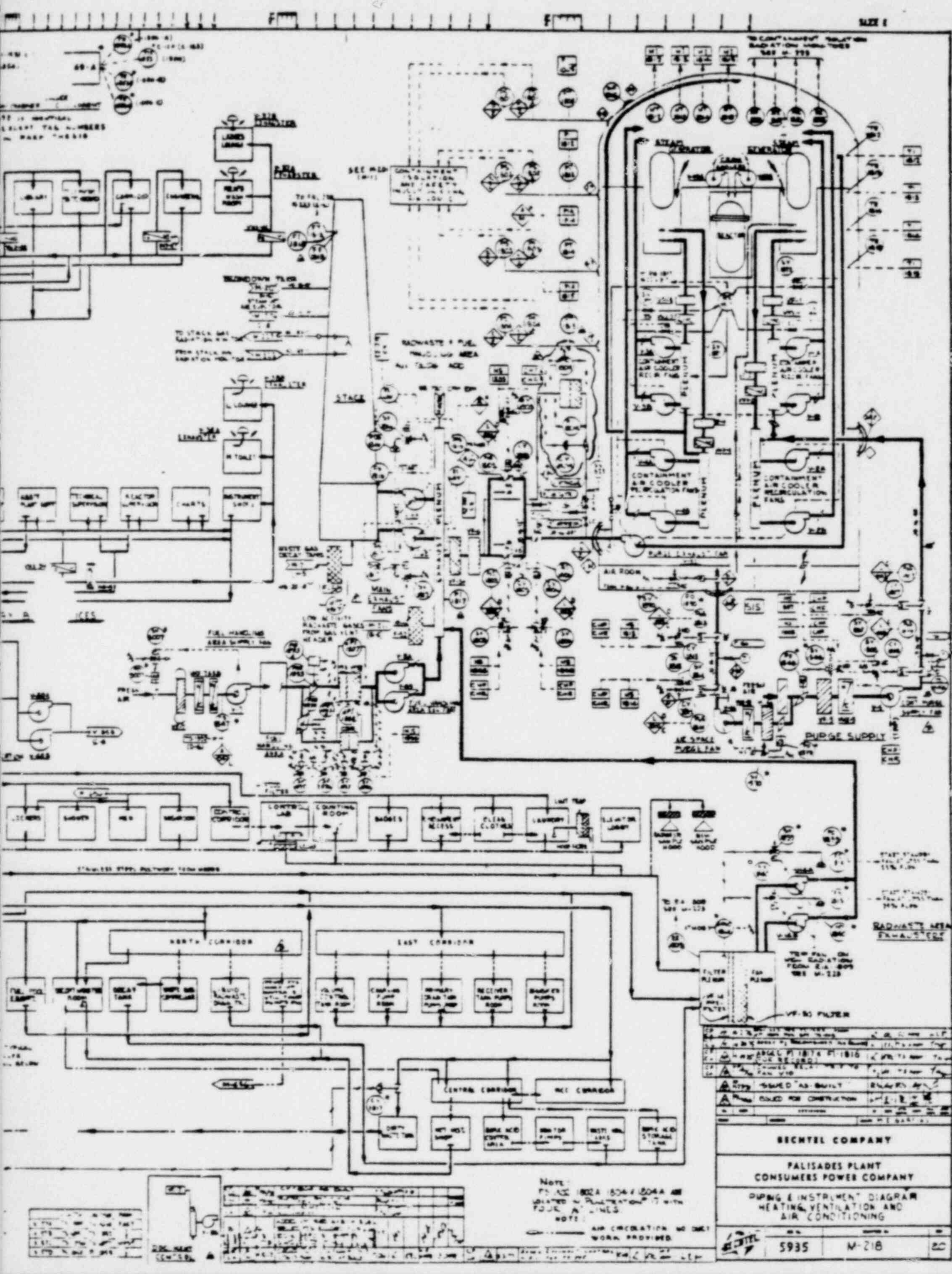
- SEPTEMBER 11, 1979 --TWO 4" MANUAL CONTAINMENT ISOLATION VALVES WERE FOUND LOCKED IN THE OPEN POSITION. INVESTIGATION INDICATED THE POSSIBILITY THAT THESE VALVES HAD BEEN MISPOSITIONED FOR 18 MONTHS.

- CAUSE --INADEQUATE PROCEDURE.
  VALVES NOT IDENTIFIED ON STARTUP CHECK LIST.

CONSEQUENCES

- IN THE EVENT OF A LOCA THERE WOULD BE A NONISOLATABLE FLOW PATH TO THE OUTSIDE ENVIRONMENT. HIGH RADIATION READINGS AT THE VALVES WOULD PROHIBIT MANUAL CLOSURE OF THE VALVES.

POOR ORIGINAL



ACTIONS TAKEN BY NRC

- VERIFICATION OF LICENSEE'S IMMEDIATE ACTIONS TO CLOSE THE VALVES AND CORRECT THE CHECK LISTS.
- ISSUED MORNING REPORT 9-14-79
- ISSUED PRELIMINARY NOTIFICATION (PNO-III-79-138) 9-14-79
- ISSUED POTENTIAL ABNORMAL OCCURRENCE REPORT 9-18-79
- ISSUED INSPECTION REPORT 50-255/79-15 10-12-79
- ENFORCEMENT MEETING WITH LICENSEE AT THE OFFICE OF THE DIRECTOR NRC 11-30-79
- ISSUED ORDER MODIFYING PLANT LICENSE 11-09-79
- ISSUED PROPOSED CIVIL PENALTY OF $450,000.00 (IN AJUDICATION) 11-09-79
- INITIATED AN AUGMENTED INSPECTION PROGRAM TO VERIFY THAT THE ORDER REQUIREMENTS WERE SATISFACTORILY COMPLETED THRU JANUARY 1980

ACTIONS TAKEN BY THE LICENSEE

- UNLOCKED AND CLOSED THE VALVES. BEGAN AN INVESTIGATION. BEGAN AN EVALUATION OF CONSEQUENCES.
- ALL SAFETY RELATED SYSTEMS WERE SUBJECTED TO A "WALKDOWN" VERIFICATION TO ASSURE THAT THE PLANT PIPING AND INSTRUMENT DIAGRAMS (P&ID'S) ARE CORRECT.
- PLANT MASTER VALVE AND SYSTEM LINE-UP CHECK LISTS WERE CHECKED AGAINST THESE P&ID'S TO ASSURE THEIR COMPLETENESS.
- PLANT PROCEDURES WERE CHECKED AGAINST THE P&ID'S AND THE LINE-UP CHECK LISTS TO ASSURE THEIR COMPLETENESS AND ADEQUACY.
- TECHNICAL ADVISORS HAVE BEEN PERMANENTLY ASSIGNED TO EACH SHIFT.

2. <u>Degradation of Emergency Core Cooling System (ECCS)</u>

A. . July 31, 1980---Containment sump valve, CU 3030, Open for 36 hours during reactor operation.

. Cause - Human Error. Operator manipulated wrong valve during surveillance test. Operations failed to notice error for 36 hours.

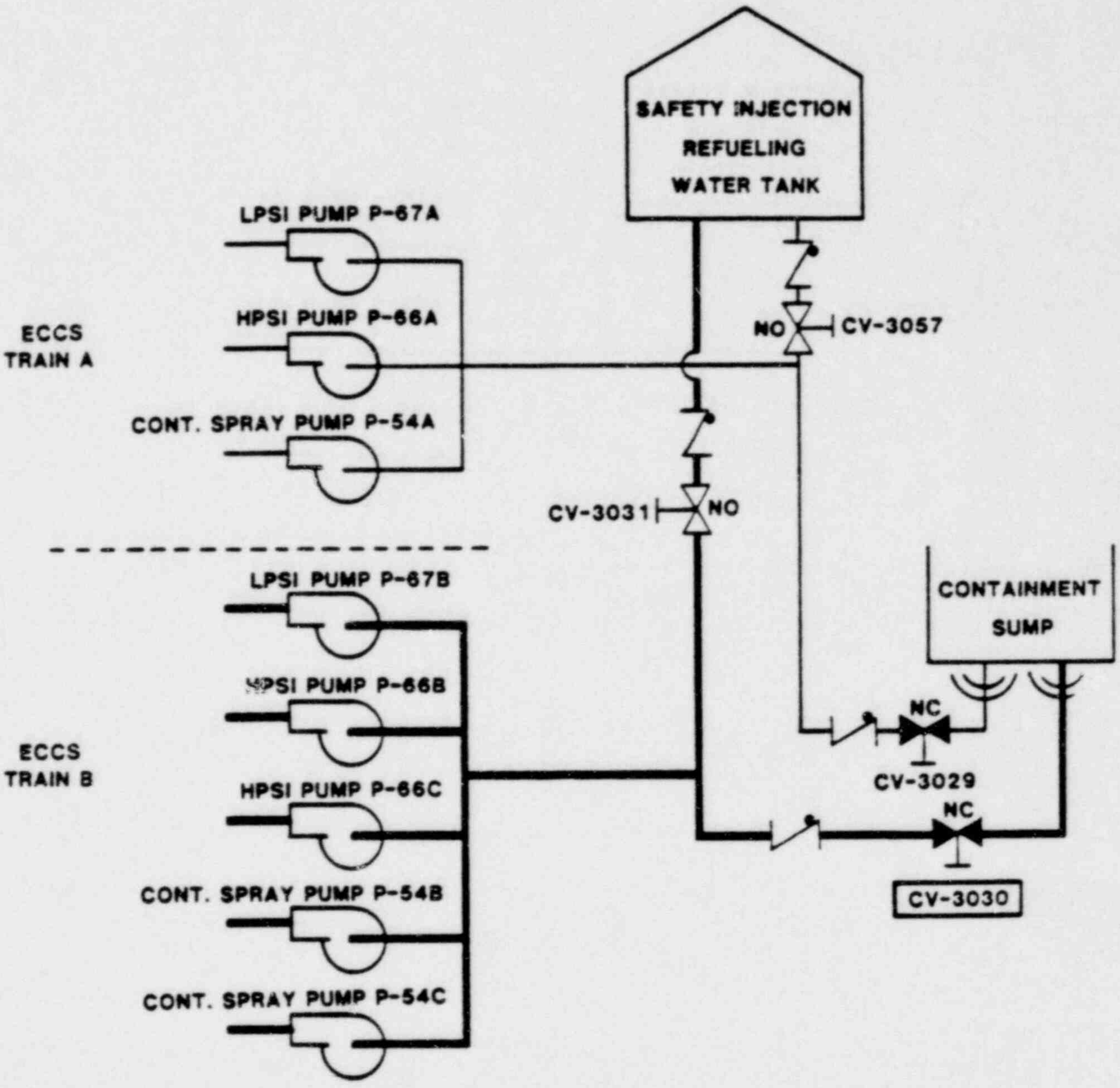
. Consequences---Degradation of ECCS Train B. Potential for damage of ECCS components.

B. . August 19, 1980---ECCS supply valve, (CV 3031), from safety injection refueling water tank closed for approximately two minutes during reactor operation.

. Cause - Human Error, failure to adhere to procedure. Surveillance test should not have been performed during reactor operation.

. Consequences---Degradation of ECCS Train B. Potential for damage to ECCS components.

PALISADES 7/80



NORMAL CONFIGURATION

SAFETY INJECTION & CONTAINMENT SPRAY

FIGURE 1

Actions Taken By The NRC

The following actions were taken by the NRC:

. Verified licensee's immediate corrective actions-specialists dispatched to site	
. Issued Morning Report	7-31-80 8-19-80
. Issued Preliminary Notifications, PNO-III-80-140, PNO-III-80-140A, and PNO-III-80-155	
. Issued Immediate Action Letter	7-31-80
. Issued citations and civil penalty ($16,000.00)	9-16-80
. Issued Notice of Violation letters to licensed operators	9-16-80
. Conducted public meeting at South Haven, Michigan	12-17-80
. Performed independant analysis of consequences - including review by NRR	August 1980
. Issued Potential Abnormal Occurrence Report	August 1980

ACTIONS TAKEN TO PREVENT RECURRENCE - - - BY LICENSEE

THE IMMEDIATE ACTION TAKEN BY THE LICENSEE WAS TO CORRECTLY REPOSITION THE VALVES AND BEGIN AN INVESTIGATION TO DETERMINE HOW AND WHEN THE VALVES WERE MISPOSITIONED, AND TO DETERMINE THE SAFETY CONSEQUENCES OF EACH EVENT. ONCE THE ABOVE HAD BEEN DETERMINED, THE FOLLOWING ACTIONS WERE TAKEN IMMEDIATELY BY THE LICENSEE:

- RETRAINING OF LICENSED PERSONNEL REGARDING STRICT ATTENTION AND ADHERENCE TO PROCEDURE.

- RETRAINING OF LICENSED PERSONNEL REGARDING THE NEED FOR INCREASED SURVEILLANCE AND OBSERVATION TO IDENTIFY OFF NORMAL CONDITIONS.

- UPGRADING OF THE SHIFT TURNOVER CHECK LIST TO INCLUDE THE VALVES IN QUESTION AND SIMILAR VALVES THAT MAY NOT HAVE BEEN ON THE CHECK LIST.

- CHANGING THE SHIFT SCHEDULE FOR THE SHIFT TECHNICAL ADVISORS SUCH THAT THESE INDIVIDUALS HAVE AT LEAST A TWO HOUR OVERLAP.

- INSTALLING COLORED MARKERS (DOTS) ON THE PANEL BOARDS ADJACENT TO THE VALVE POSITION INDICATOR LIGHTS ON ALL SAFETY RELATED VALVES. THE NORMAL LINE UP BEING INDICATED WHEN THE MARKER DOT IS ALIGNED WITH A LIGHTED POSITION INDICATOR.

LONGER TERM CORRECTIVE ACTIONS INTENDED BY THE LICENSEE INCLUDE:

- REVIEWING AND REVISING THE INPUTS TO THE CONTROL ROOM SEQUENCE OF EVENTS RECORDER WITH THE OBJECTIVE OF REMOVING AS MANY NON-SAFETY RELATED SIGNALS AS POSSIBLE AND ASSURING THAT THE REQUIRED SAFETY RELATED INPUTS ARE PRESENT.

- ASSURING THAT THE SEQUENCE EVENT RECORDER DATA SHEETS ARE REVIEWED AT LEAST DAILY, BY A COGNIZANT PERSON NOT DIRECTLY INVOLVED IN THE OPERATIONS TO DETERMINE IF ANY UNEXPLAINED OR ABNORMAL CONDITIONS ARE INDICATED.

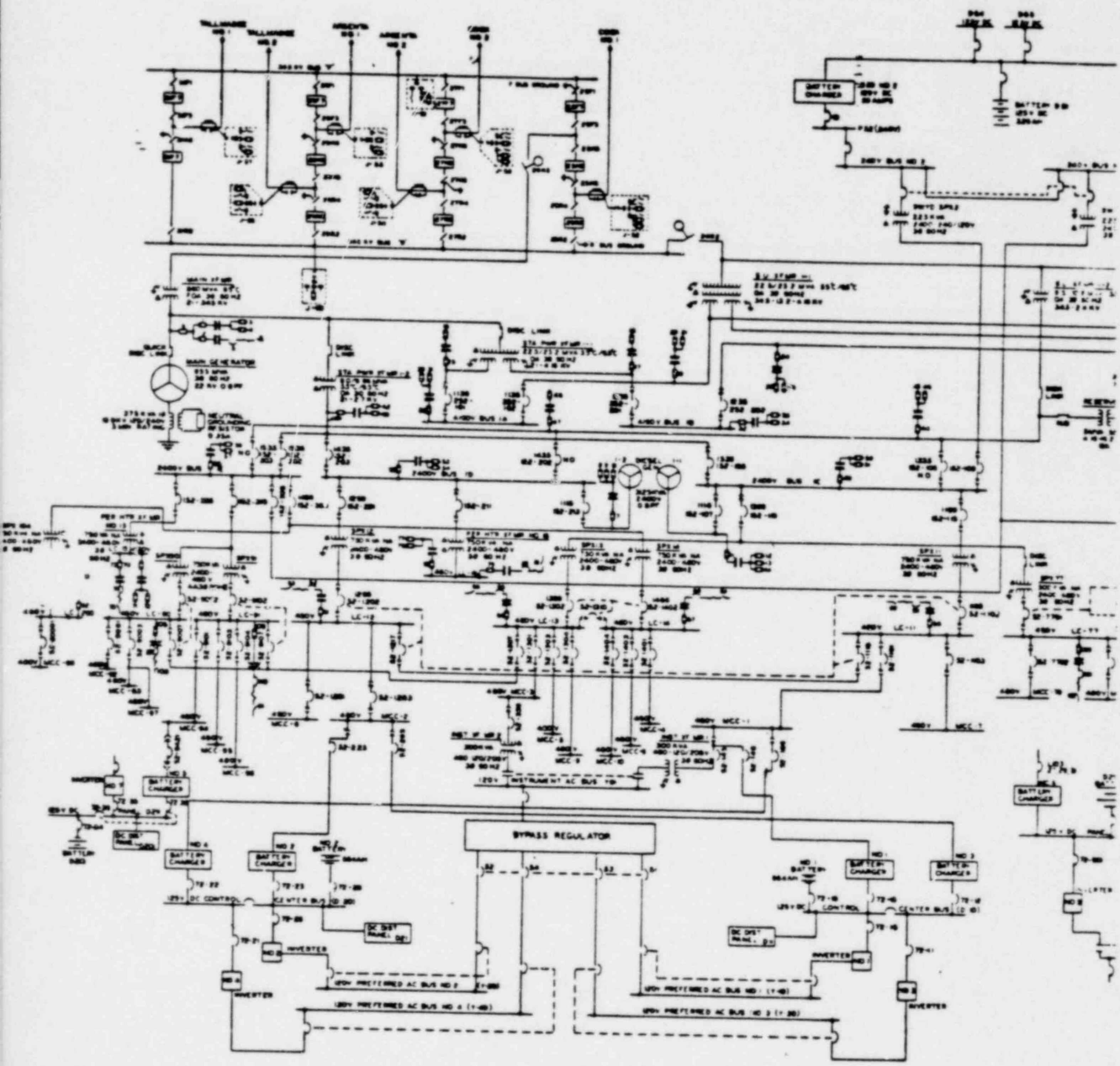
- INVESTIGATING THE POSSIBILITY OF PROVIDING A KEY LOCK POSITION SWITCH FOR EACH OF THE CONTAINMENT SUMP RECIRCULATION SUPPLY VALVES

Degraded Emergency Electrical System (125 volt batteries)

- January 6, 1981---Breakers from both station batteries to their 125 volt D.C. buses were open for approximately one hour during plant operation

- Cause - Human error, failure to adhere to procedure. Electricians (2) failed to adhere to a correct procedure, resulting in an electrical misalignment of the system.

- Consequences - In the event of a loss of off-site power manual operator action would be required to establish emergency power to the emergency core cooling systems.



POOR ORIGINAL

DR	P J STULLER	
APP	E R [illegible]	9-2-78
APP	P [illegible]	9-2-78
APP	[illegible]	9-2-78

CONSUMERS

ELECTRIC ENGINEER

JACKSON

CORRECTED TO

ACTIONS TAKEN BY THE NRC

. VERIFIED LICENSEE'S IMMEDIATE CORRECTIVE ACTIONS	1-6-81
. ISSUED A MORNING REPORT	1-6-81
. ISSUED A PRELIMINARY NOTIFICATION (PNO-III-81-04)	1-6-81
. ISSUED AN IMMEDIATE ACTION LETTER	1-9-81
. ISSUED A POTENTIAL ABNORMAL OCCURRENCE REPORT	JANUARY 1981
. INITIATED AUGMENTED NRC INSPECTION COVERAGE (ALL SHIFTS)	1-9-81
. PERFORMED INDEPENDANT ANALYSIS OF CONSEQUENCES	1-9-81
. ISSUED CONFIRMATORY ORDER	3-9-81
. HELD ENFORCEMENT MEETING IN REGION III OFFICES	2-18-81
. CIVIL PENALTY PROPOSED	IN PROGRESS
. ISSUED IE INFORMATION NOTICE	MARCH 1981

ACTIONS TAKEN BY THE LICENSEE

- REINSTRUCTION OF PERSONNEL ON THE REQUIREMENTS FOR STRICT ADHERENCE TO PROCEDURE.
- PERFORM DAILY AUDITS OF PLANT OPERATIONS BY A CORPORATE MANAGEMENT REPRESENTATIVE
- REVIEW OF PROCEDURES AGAINST STIPULATED CRITERIA. SPECIAL REVIEW COMMITTEE REQUIRED
- DUAL VERIFICATION BY DESIGNATED (QUALIFIED) PERSONNEL WHEN SAFETY RELATED SYSTEMS ARE MANIPULATED
- REVIEW OF BATTERY CIRCUITRY TO PROVIDE ANNUNCIATION WHEN OFF-NORMAL LINE-UP EXISTS
- ANALYSIS OF CONSEQUENCES OF IMPROPER LINE-UP (LER 50-255/81-01)

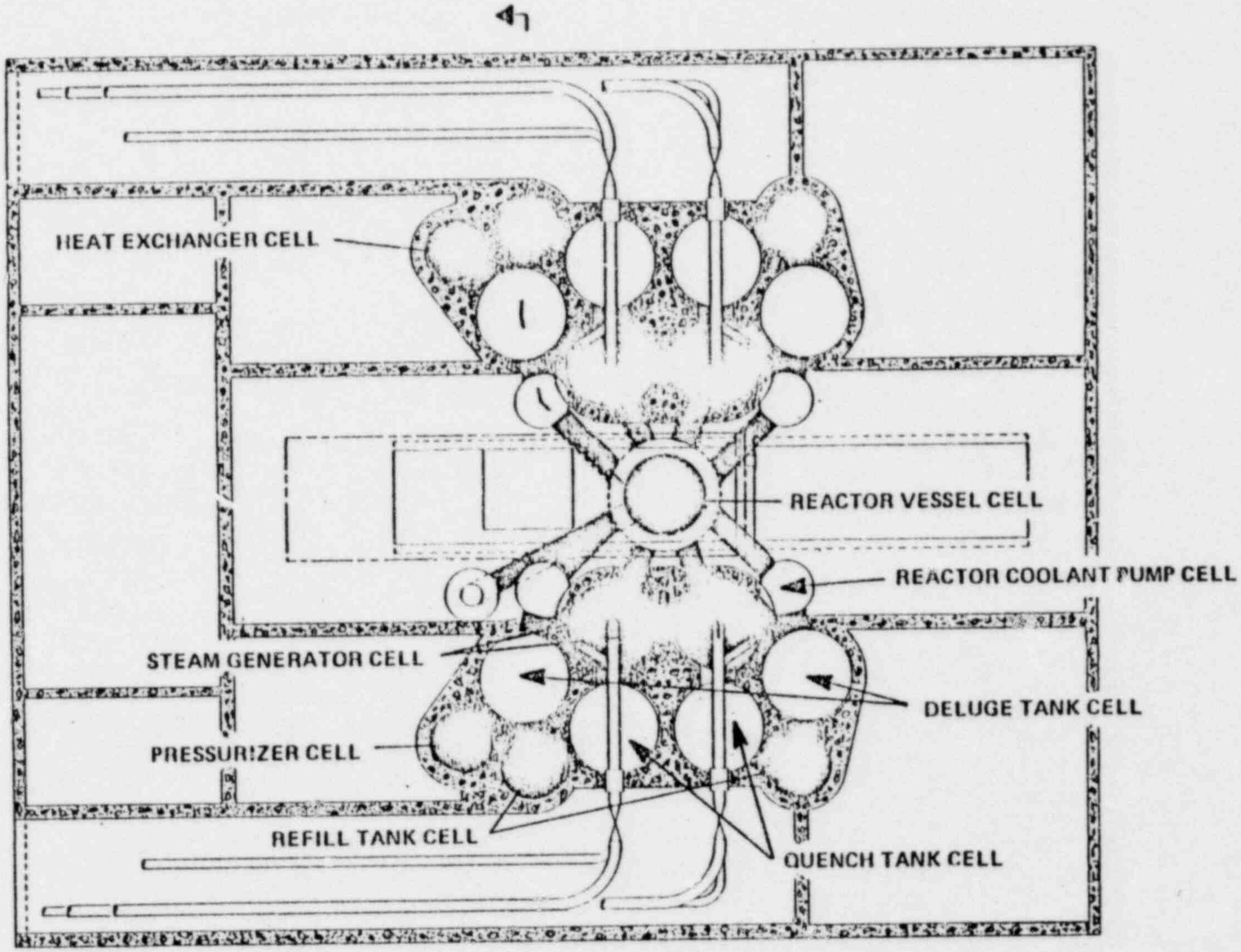


Figure 1.

Cell Arrangement - 4 loop

POOR ORIGINAL

Zudans
T4-6

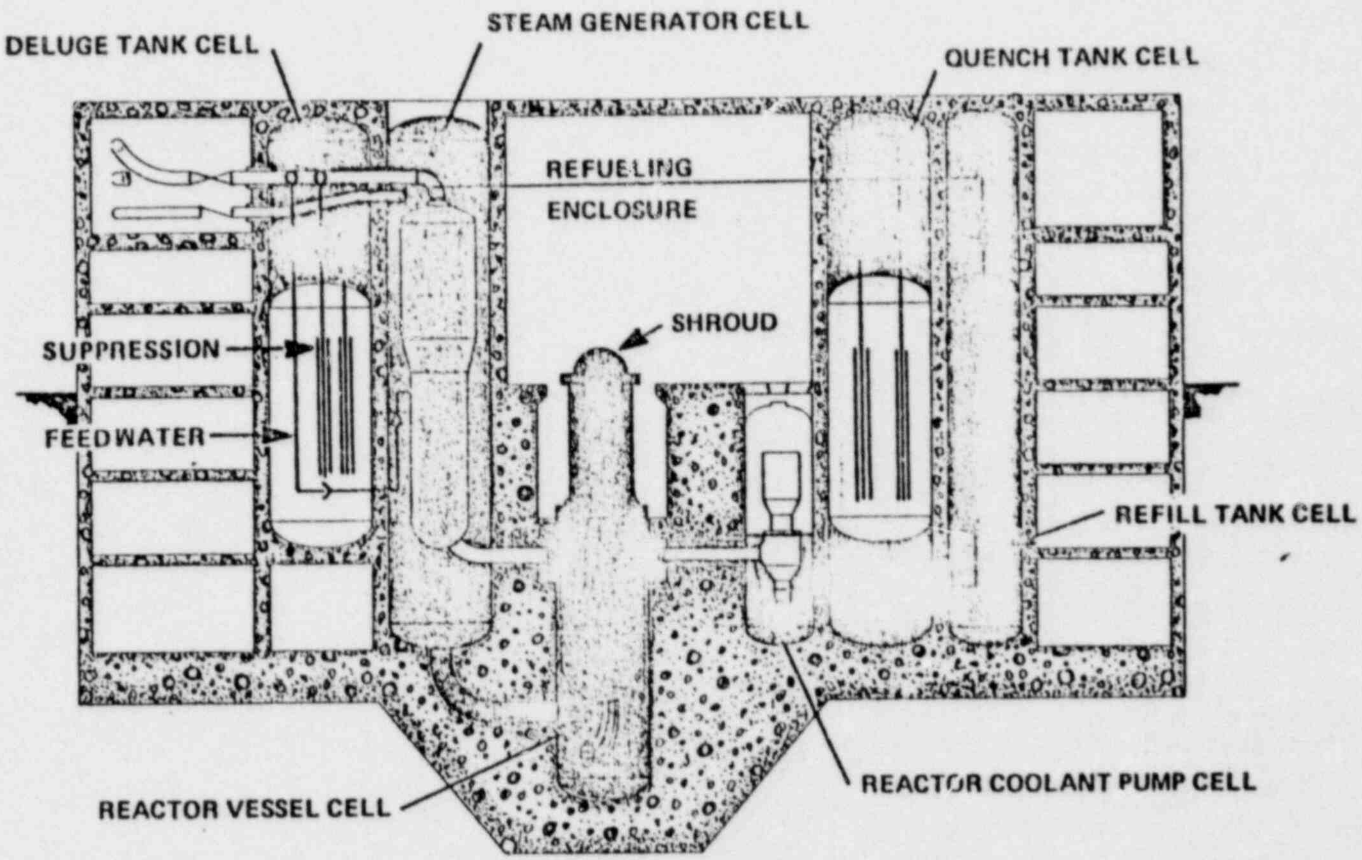


Figure 2.

Cell Elevation - 4 loop

ACTIVE SYSTEMS UPON WHICH PRC INTEGRITY RESTS

- Cell wall cooling
- Cell evacuation system
- Refill tank pressurization system

WHAT CAN BE DONE?

- CELL WALL DESIGN CAN BE IMPROVED TO REDUCE OR ELIMINATE THE EXPOSURE OF COOLING SYSTEM TO BLOWDOWN FORCES.
- REFILL TANK CAN BE REARRANGED DIFFERENTLY REQUIRING NO PRESSURIZATION.
- WATER CHILLING SYSTEM IS ABOUT AS GOOD/BAD AS REFRIGERATION SYSTEM IN ICE CONDENSOR.

STRUCTURAL COMPLEXITY AND REDUNDANCY

- COMPLEX REDUNDANT STRUCTURAL CONSTRAINTS AND ANTICIPATED ΔT BETWEEN PRC AND RCS CREATE CONSIDERABLE ENGINEERING TASKS.
- LOCAL HARD SPOTS AT SUPPORTS AND PENETRATIONS REPRESENT PROBLEM AREAS.
- BLOW-DOWN LOAD HANDLING IN DELUGE AND QUENCH TANKS NEEDS CAREFUL ENGINEERING EVALUATION.

ECONOMY OF INJECTOR VS. DISCHARGE PRESSURE

$E = m_s/m_w$

Discharge Pressure (psia)	h_g at Discharge Pressure	$h_{f\ sat}$ at Discharge Pressure	E: $h_g = h_g$ at Discharge Pressure	E: h_g at 1000 psia
1000	1191.8	524.4	1.24	1.24
900	1195.4	526.6	1.32	1.31
800	1198.6	509.7	1.40	1.39
700	1201.2	491.5	1.50	1.48
600	1203.2	471.6	1.61	1.59
500	1204.4	449.4	1.75	1.72
400	1204.5	424.4	1.92	1.89
300	1202.8	393.84	2.15	2.12
200	1198.4	355.36	2.50	2.48
100	1187.2	298.40	3.17	3.19
10	1143.3	161.17	6.86	7.20

MASS FLOW RATE ESTIMATE FOR INJECTOR

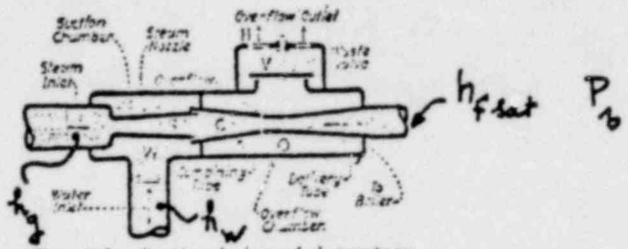


FIG. 215.—Sectional view of elementary injector.

P_b	P_t = 10	100	500	1000	
10	E = 6.86	7.17	7.29	7.20	m_s/m_w
	V/v = 21.2	206.2	998.9	1795.3	lb/sec-ft^2
	EV/v = 146	1478	7282	12,926	lb/sec-ft^2
	(E+1)V/v = 167	1685	8281	14,721	lb/sec-ft^2
100		3.17	3.23	3.19	
		206.2	998.9	1795.3	
		654	3226	5727	
		860	4225	7522	
500			1.75	1.72	
			998.9	3088	
			2747	4883	
1000				1.24	
				1795.3	
				2226	
				4021	

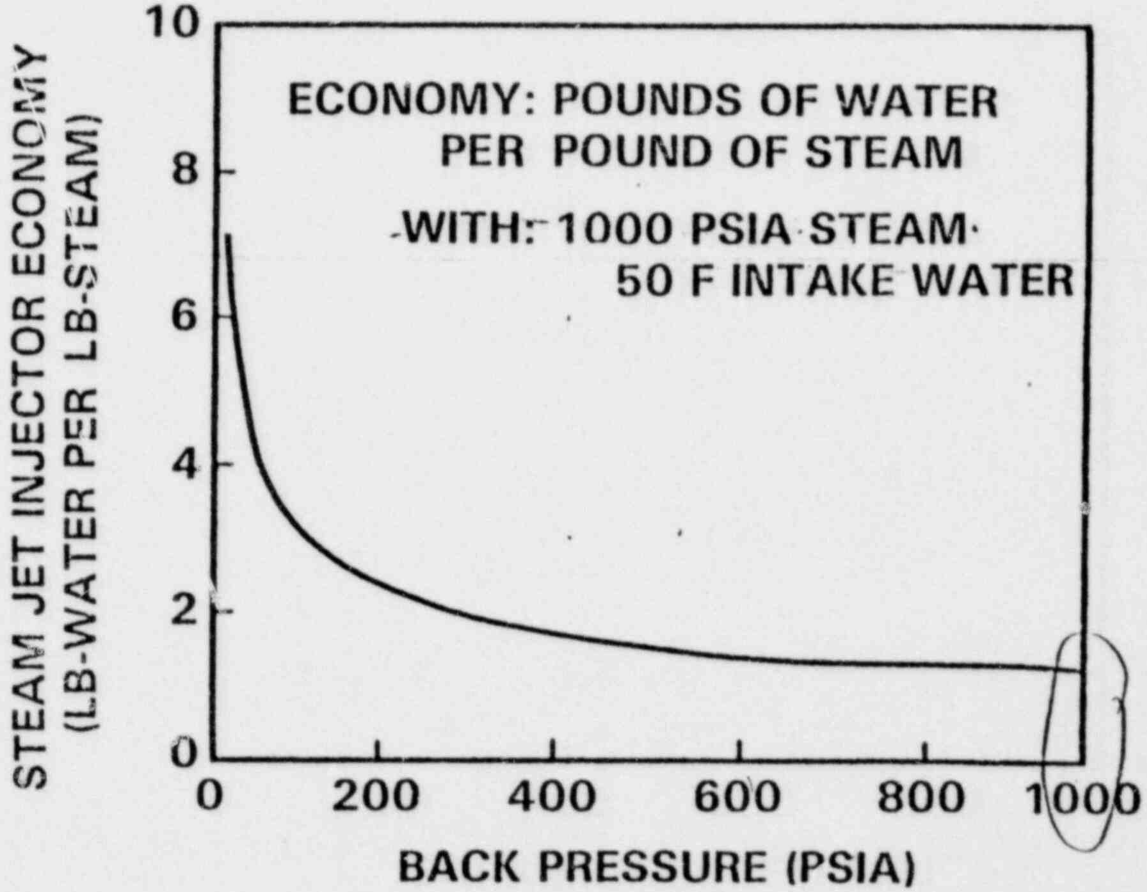


FIGURE 3

STEAM JET INJECTOR ECONOMY

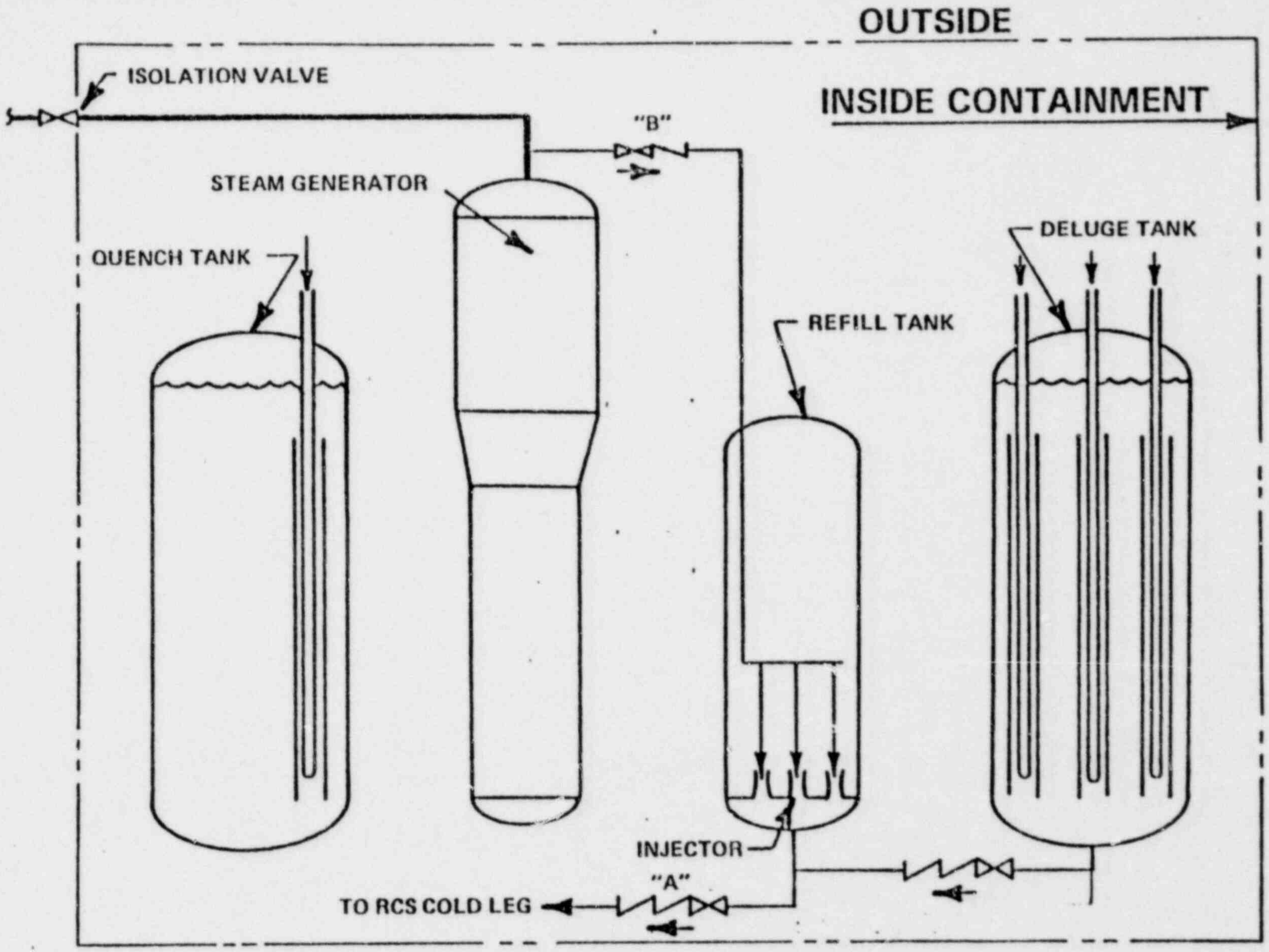


Figure 4

Engineered Safety Systems for LOCA

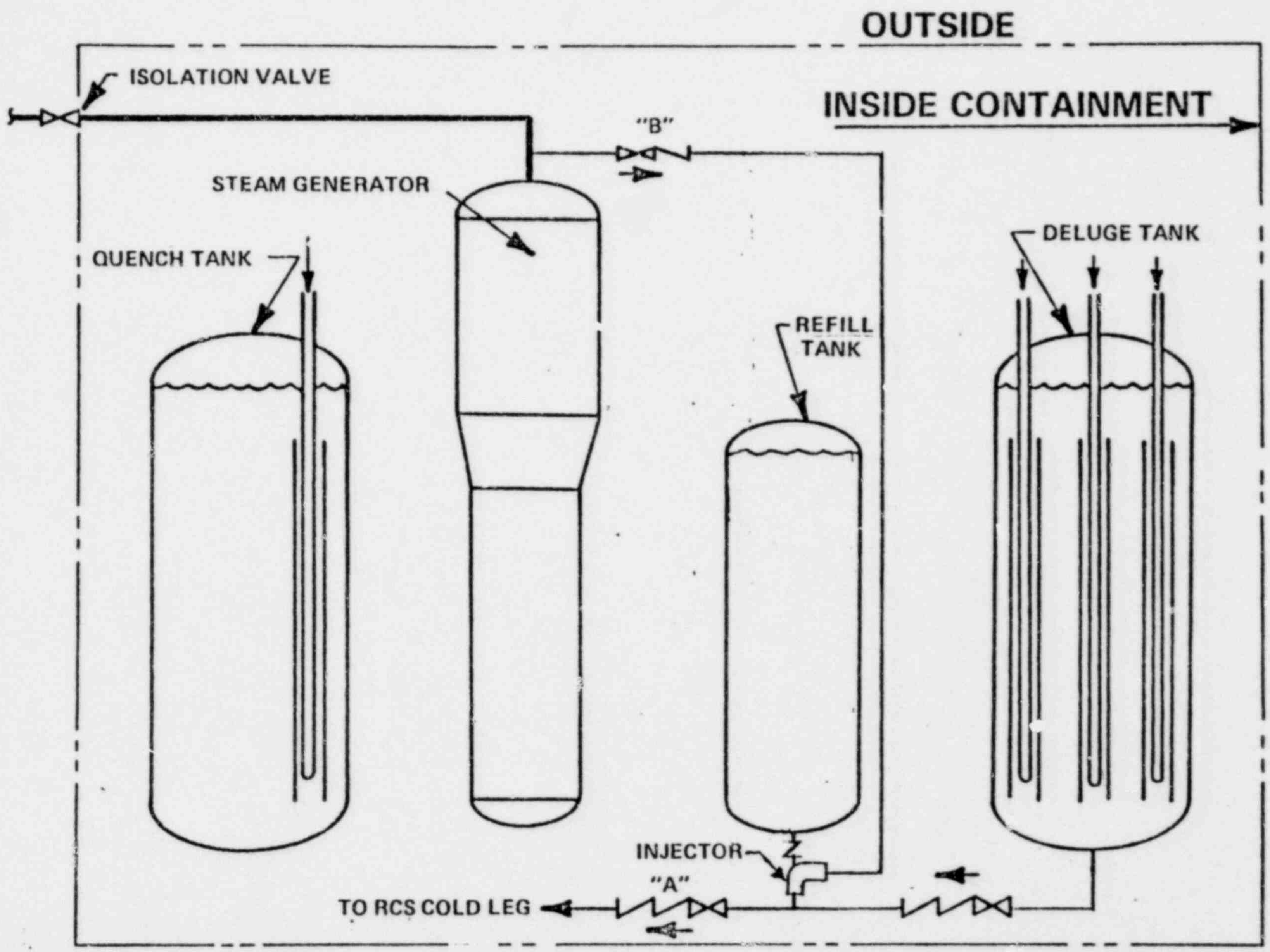


Figure 5

Engineered Safety Systems for LOCA

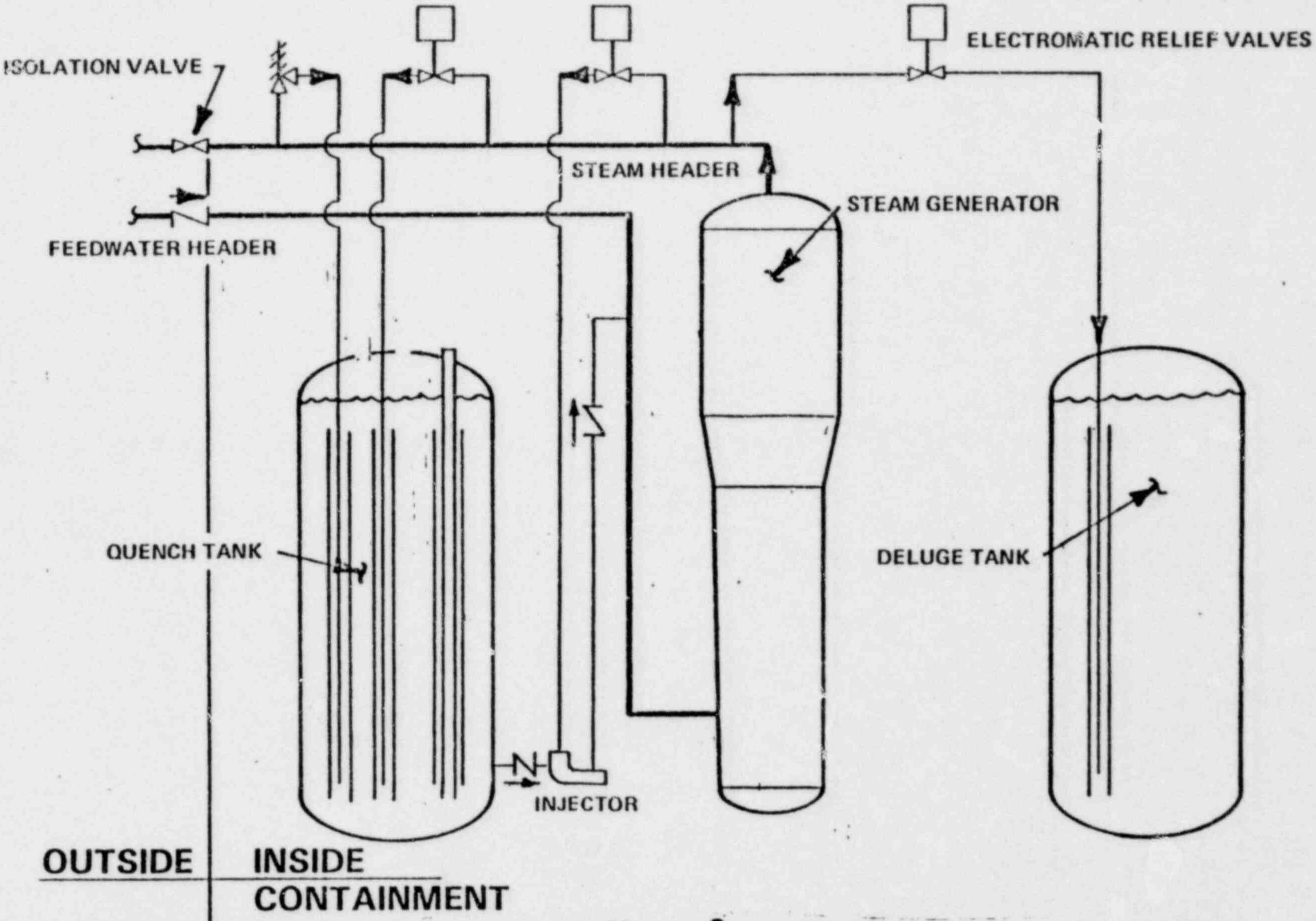


Figure 6

Alternate Decay Heat Removal System

CONCLUSIONS

- PCS-2 BLOWDOWN SUPPRESSION SYSTEM HAS ATTRACTIVE FEATURES.
- DETAIL THERMAL HYDRAULIC ANALYSIS SHOULD BE PERFORMED TO ESTABLISH VARIOUS PARAMETERS.
- PCS-2 SHOULD NOT NECESSARILY BE DESIGNED AROUND CURRENT NSSS, RESULTS IN AWKWARDLY COMPLEX STRUCTURES.
- INJECTOR PERFORMANCE PARAMETERS SHOULD BE ESTABLISHED BY EXPERIMENT (AND ANALYSIS).
- SYSTEMS LIKE REFILL, QUENCH (WITH SG FEED CAPABILITY) AND DELUGE MERIT CONSIDERATION WITH OR WITHOUT THE REST OF THE PCS-2.

PRESENTATION

TO THE

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

APRIL 10, 1981

SUGGESTED TASK AREAS

FOR

RESEARCH AND DEVELOPMENT

OF THE

PASSIVE CONTAINMENT SYSTEM

NUCLEDYNE

ENGINEERING CORPORATION

728 West Michigan Avenue

Jackson, Michigan 49201

T6-Fall9

PRESENTATION

to the

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

April 10, 1981

INTRODUCTION

This opportunity to appear before the full panel of the Advisory Committee on Reactor Safeguards (ACRS) is deeply appreciated. It was 62 months ago that we first presented the Passive Containment System (PCS) to the Nuclear Regulatory Commission (NRC). In the interim we have appeared four times before the NRC, ACRS and ACRS Subcommittees to discuss the PCS in the various contexts, (See Attachment 1). The latest such appearance was on November 13, 1980 before your Subcommittee on Fluid Dynamics. (1)

As a result of the discussion and questions asked at that Subcommittee meeting NucleDyne prepared a substantial (140 page) response document. Copies of this publication (NEC-9) have been provided to ACRS together with all previously published documents describing the PCS both structurally and functionally. We assume, therefore, that you are familiar with the technical, structural and functional aspects of the PCS and we will not take time here to discuss those matters.

We will limit ourselves to discussion of a number of Tasks which we believe should be performed. The positive results of these Tasks could be the basis of a pre-license approval of the

Industries, Curtiss-Wright, Combustion Engineering, Gilbert/Commonwealth and Bechtel, (See Attachment 2).

My personal involvement is to review Mr. Kleimola's work and, particularly, his conclusions and the validity of his engineering judgements. My nuclear experience includes approximately 10 years with General Electric starting in 1953 with GE's studies of various reactor types leading to its decision to market the BWR type and the sale of Dresden I, Big Rock and Humboldt Bay; seven years with Commonwealth Associates, Inc., which performed architect-engineering work on Fermi 1 and on a conceptual design of a 300 Mw LMFBR; two years with Ralph M. Parsons where a conceptual design of a 500 Mw LMFBR prototype was prepared and, 10 years of personal consulting work, mostly overseas, including two years with the International Atomic Energy Agency as Project Manager to prepare a study of the economics of nuclear power for the developing countries of the world.

We assert that our combined experience and background provide an unquestionable capability to produce sound engineering and to arrive at adequate and acceptable engineering judgements. We assert this, to the contrary notwithstanding some of the comments by two of ACRS's consultants at the Fluid Dynamics Subcommittee meeting.

This Task includes verification studies of:

1. Steam jet injectors
2. Reactor vessel refill system
3. Emergency feedwater system
4. Variable orifice vent system

This Task includes a state-of-the-art search involving the lead manufacturers of injectors. The information obtained is factored into the preliminary performance tests of injectors in the applicable pressure and temperature range.

For the past 130 or more years, steam jet injectors (Figure 1) have had a wide range of applications. Yet, their application has been limited to a pressure range below 300 psia. Performance tests are needed for steam pressures approaching and possibly exceeding 1200 psia.

These tests are required in that steam does not conform to the natural laws for perfect gases. The enthalpy of saturated steam peaks at about 455 psia; it is of interest to learn if the peaking of the enthalpy affects injector performance markedly.

Injectors are utilized in the Reactor Vessel Refill System (Figure 2). This system lends itself to the performance testing of an injector typical of the 24 or more injectors used for at the deluge and quench tanks. The vent system lends itself to the performance testing of one module typical of the 1600 modules utilized in the variable orifice vent system.

As shown, at 2 psia containment operating pressure (126F vapor temperature), the liquid level in the vent pipes is approximately 4.2 feet below the liquid level in the tanks. An increase in the containment water vapor temperature to 130F (2.22 psia vapor pressure), the liquid level in the vent pipe is 4.7 feet below the liquid in the tanks and the uppermost orifices are exposed for vapor (steam) carryover to be quenched by the water in the tanks. At 140F water vapor temperature in the containment (2.89 psia), the total orifice area exposed is 209 sq. ft.; at 157F (4.56 psia), 572 sq. ft. (Mark III vent area); at 175F (6.71 psia), 1100 sq. ft. (ice containment vent area); and at 186F (8.66 psia), 1571 sq. ft. Thus, with the containment pressure well below atmospheric pressure, the vent area for steam carryover exceeds that in any existing vapor suppression system.

TASK 2

OPTIMIZATION STUDIES

A series of optimization studies are specified for the second Task Area listed; these include:

These select chapters encompass the innovative features of the PCS, and can be dove-tailed into the Standard Safety Analysis Report for a four-loop pressurized water reactor.

TASK 5

PROBABILISTIC RISK ASSESSMENT

Task 5 can be performed in conjunction with Tasks 3 and 4 to assess the innovative safety features in the PCS.

1. Design Basis Accident
2. Transients

The Task Areas for the two remaining Tasks can be performed on a comparative basis with a recently constructed four-loop PWR.

TASK 6

CONSTRUCTION SCHEDULE

1. Critical path analysis for PCS
2. Comparison to dry-type, full-pressure containment

TASK 7

CONSTRUCTION COSTS

1. Cost evaluation for structures, systems and components eliminated, modified and added.
2. Cost comparison to dry-type, full-pressure containment.

In conclusion: these are the Tasks we foresee that <u>may</u> be required in order for pre-license approval to be provided by NRC.

basic supply of energy. One of the present NRC Commissioners stated, in a letter dated November 10, 1977, that "Your Passive Containment System has in principle the possibility of being engineered into a light-water power reactor system".

Gentlemen, we at NucleDyne believe the time has come "to fish or cut bait" after some five and a half (5½) years of consideration of this concept by NRC and ACRS. We suggest that all the bait needed has been cut and it's now time to start fishing. Accordingly, we are asking you to undertake either your own complete review and evaluation of the PCS or sufficient examination and review of NucleDyne's claims regarding PCS so that you could recommend to DOE and NRC such a complete evaluation. We trust your response will be favorable.

SUMMARY OF CONTACTS WITH NRC/ACRS/DOE RELATING TO THE PASSIVE CONTAINMENT SYSTEM (PCS)

1. On February 13, 1976, Technical documents on PCS were mailed to NRC and ACRS with a letter requesting a design review of the PCS concept.

2. On May 10, 1976, Falls met with Mr. Frank Schroder and four staff members. Arrangements were agreed to for a "Technical presentation" of PCS to appropriate NRC staff.

3. On May 19, 1976, a letter was sent to NRC confirming the request made at the May 10th meeting for a review of the PCS leading to approval by the NRC that PCS could "be engineered to provide an acceptable containment system".

4. On July 21, 1976, NucleDyne made a full day presentation to staff of the Nuclear Regulatory Commission (NRC) concerning the PCS and repeated the 5/19/76 request for a review of the concept leading to ultimate approval by NRC/ACRS that PCS could be successfully engineered into a licensable LWR nuclear power plant.

5. On December 7, 1976, Falls presented to the ACRS Subcommittee on Generic Items a written and oral statement on the manner in which PCS would resolve all ACRS designated Generic Items related to containment and ECCS. Transcript is available.

6. On December 7, 1976, Falls discussed with ERDA the possibility of that agency financing a proposed "unsolicited proposal" covering certain R & D work related to the PCS. ERDA advised such a proposal would not be considered unless some supporting financial source was available. Since no such financial support was available to NucleDyne this effort was abandoned.

7. On May 17, 1977, having failed to receive any response to prior letters and telephone calls to various NRC staff members, Falls wrote to Marcus A. Rowden, Chairman, NRC requesting some evidence of action.

8. NucleDyne received a letter from Mr. Edson Case of NRC dated July 1, 1977 turning down its request for an NRC review of PCS. The basis for the turndown was that such a review "would involve a large input of resources by the Staff" and that there was "no indication that any application employing this concept is being considered".

Summary of Contacts (cont'd)

17. On January 8, 1978, Falls attended a meeting of the full ACRS Committee Members. No presentation was made but several questions were raised and Falls responded. Transcript is available.

18. On February 10, 1978, DOE (Pressesky) submitted to NucleDyne thirteen questions, the answers to which would assist in DOE's evaluation. On March 20, 1978 complete answers to the thirteen questions were mailed to DOE.

19. On February 17, 1978, Mr. Eric S. Beckjord, Acting Director of DOE's Division of Nuclear Power Development wrote to the NRC Division of Reactor Safety Research requesting their review of the PCS regarding (1) thermal-hydraulic performance; (2) possible fission product release if PCS does not work at all or only partially and (3) reliability of the concept.

20. On February 23, 1978, Falls attended a meeting of the Working Groups (ACRS and DOE) preparing the draft report to Congress on Reactor Safety Research and made a statement to the Group concerning the PCS. The draft report, as approved on March 9, 1978, by the full NRC Commission, became NUREG-0438, the Report to Congress, and includes specific reference to a passive containment system. NucleDyne has been told by a representative of NRC that that reference is specifically to NucleDyne's PCS. PCS actually interfaces with each of the five primary research projects referenced in NUREG-0438.

21. On March 1, 1978, a full set of NucleDyne Technical documents were mailed to EG & G Idaho, Inc. (Walter J. Mings). Request for this information resulted from a request from Dr. Stanislaus Fabic of the NRC Reactor Safety Research Division (Washington, D.C.) to Mr. R. A. Wells, EG & G Idaho. Dr. Fabic's request was for the time and cost for containment verification studies on PCS.

22. On April 29, 1978, NucleDyne was informed that the review by NRC had been assigned to the Probabilistic Analysis Staff of the Reactor Safety Research Group. Dr. Raymond DiSalvo was in charge of this work but was diverted to other activities and no work of record was performed by this Group.

23. On May 3, 1978, Pressesky (DOE) informed Falls that Sandia Laboratories would manage any contracts on LWR R & D work authorized and financed by DOE. This would include work on the PCS proposed project which was assigned to Sandia in April, 1978.

REACTOR DESIGN EXPERIENCE - Frank Kleimola

Design, construction and operating experience.

In-pile/in-reactor high-pressure, high-temperature water loops installed in:

Oak Ridge Graphite Pile	*ANL
Hanford H-Pile	*ANL
Materials Test Reactor	*ANL

In-pile air-cooled test facility

BNL Graphite Pile	*ANL

Experience in reactor design:

Heavy-water research reactors

Chicago Pile - 5 (CP-5)	*ANL
Massachusetts Institute of Technology	*ACF
Ispra, Italy	*ACF
BNL HFBR	*CE

Pool-type research and test reactors

Petten, Netherlands	*ACF
Studsvik, Sweden	*ACF
Dayton, Ohio	*C-W
Cornell University	*C-W
Missouri School of Mines	*C-W
University of Thailand	*C-W

Organic-cooled reactor

Heavy-water moderated, organic-cooled (conceptual)	*CE

Gas-cooled reactors

Oak Ridge (not operated)	*ACF
Erie County - 2 unit (cancelled)	*CAI

Liquid-metal cooled reactors

Experimental Breeder Reactor-2	*ANL
LMFBR-300 MW (conceptual)	*CAI

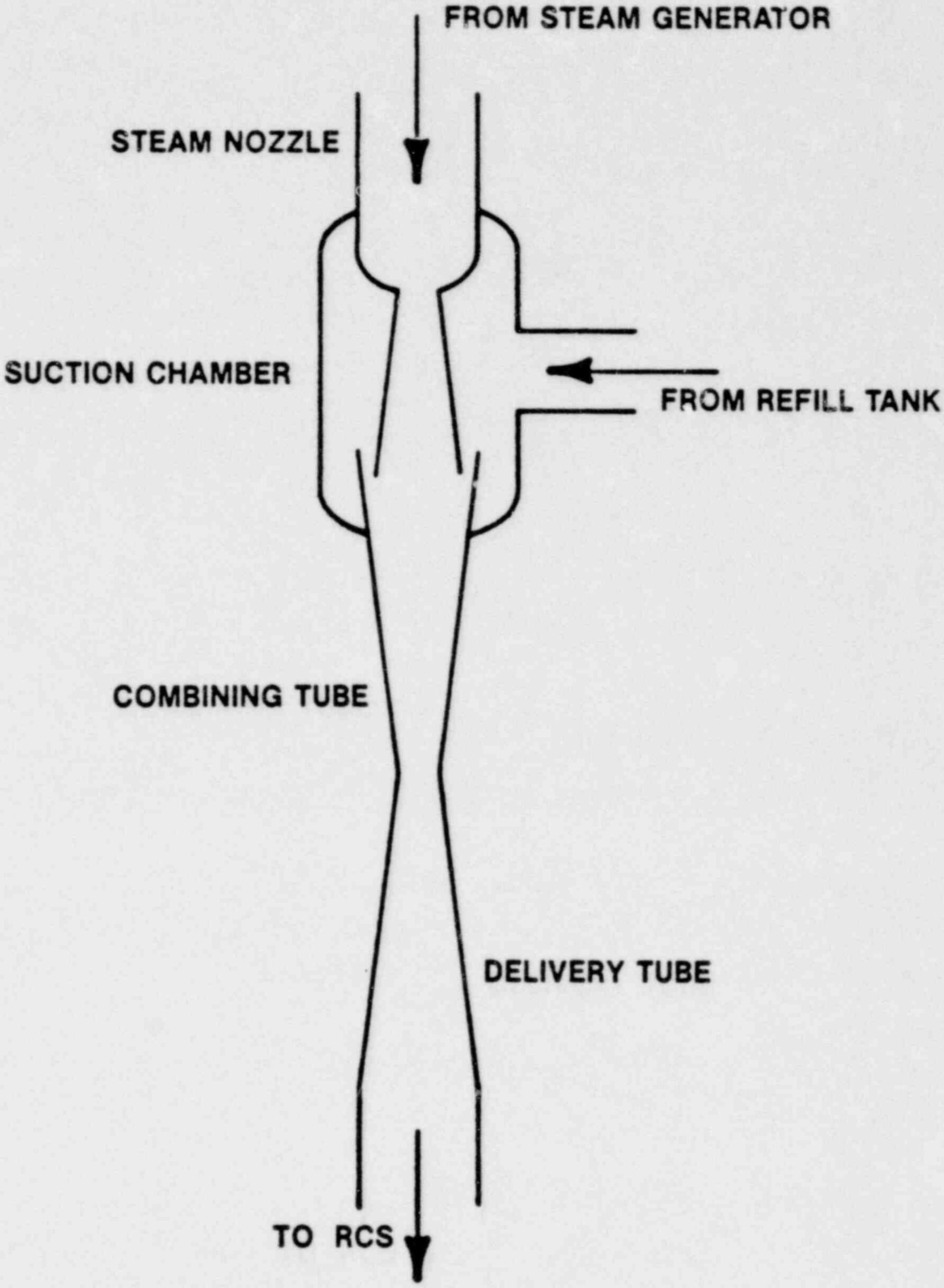


FIGURE 1
STEAM JET INJECTOR

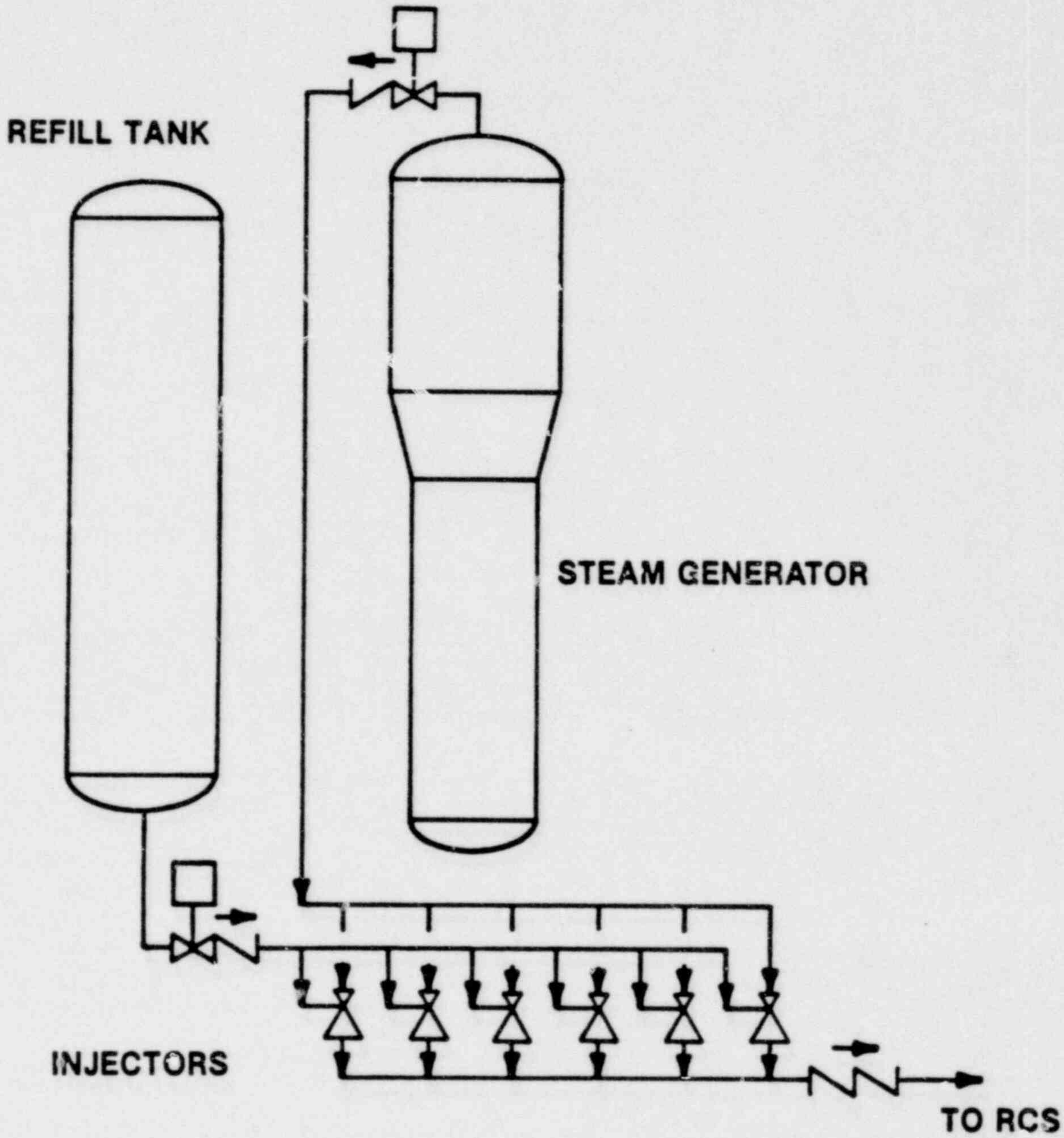


FIGURE 2
REACTOR VESSEL REFILL SYSTEM

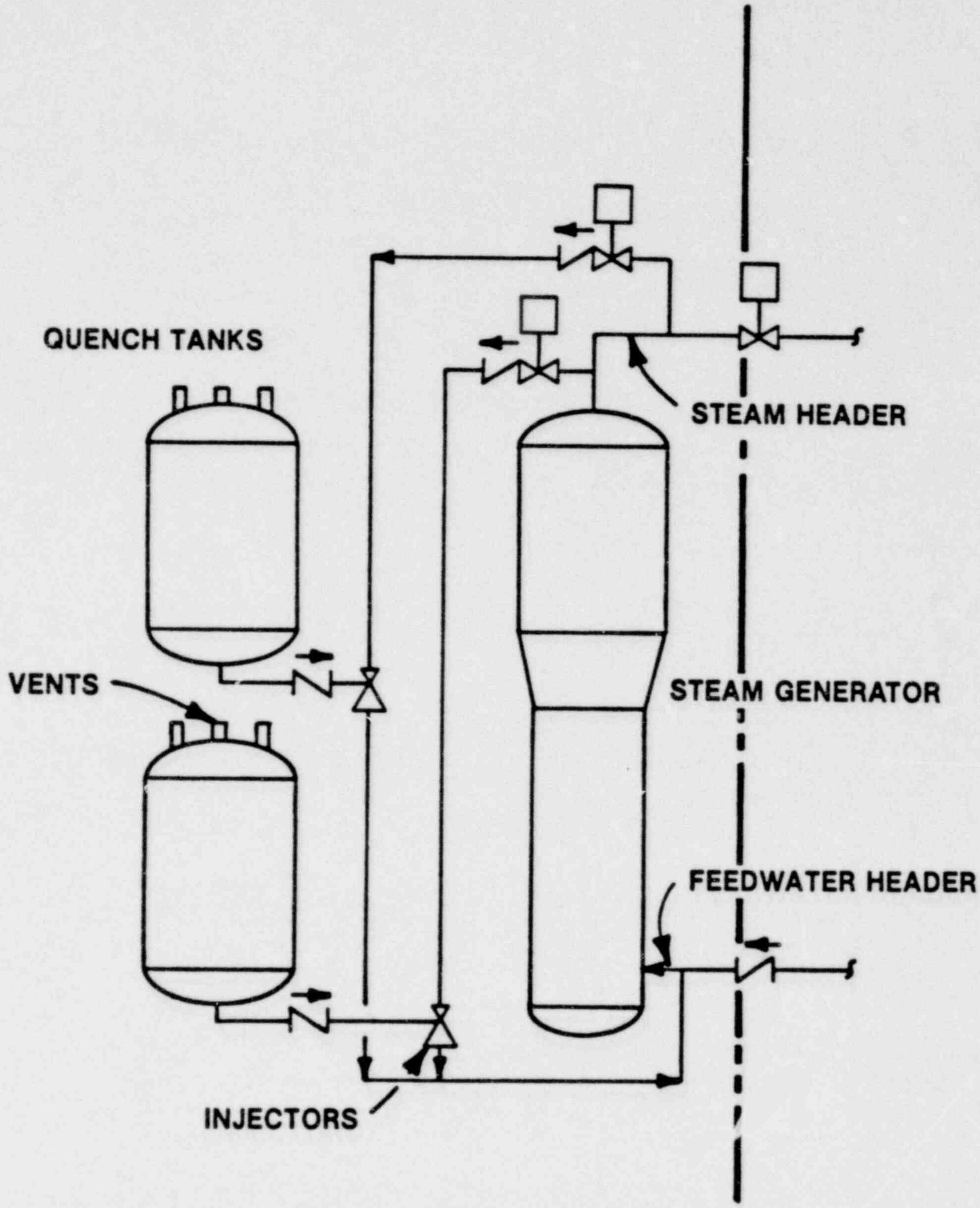


FIGURE 3
EMERGENCY FEEDWATER SYSTEM

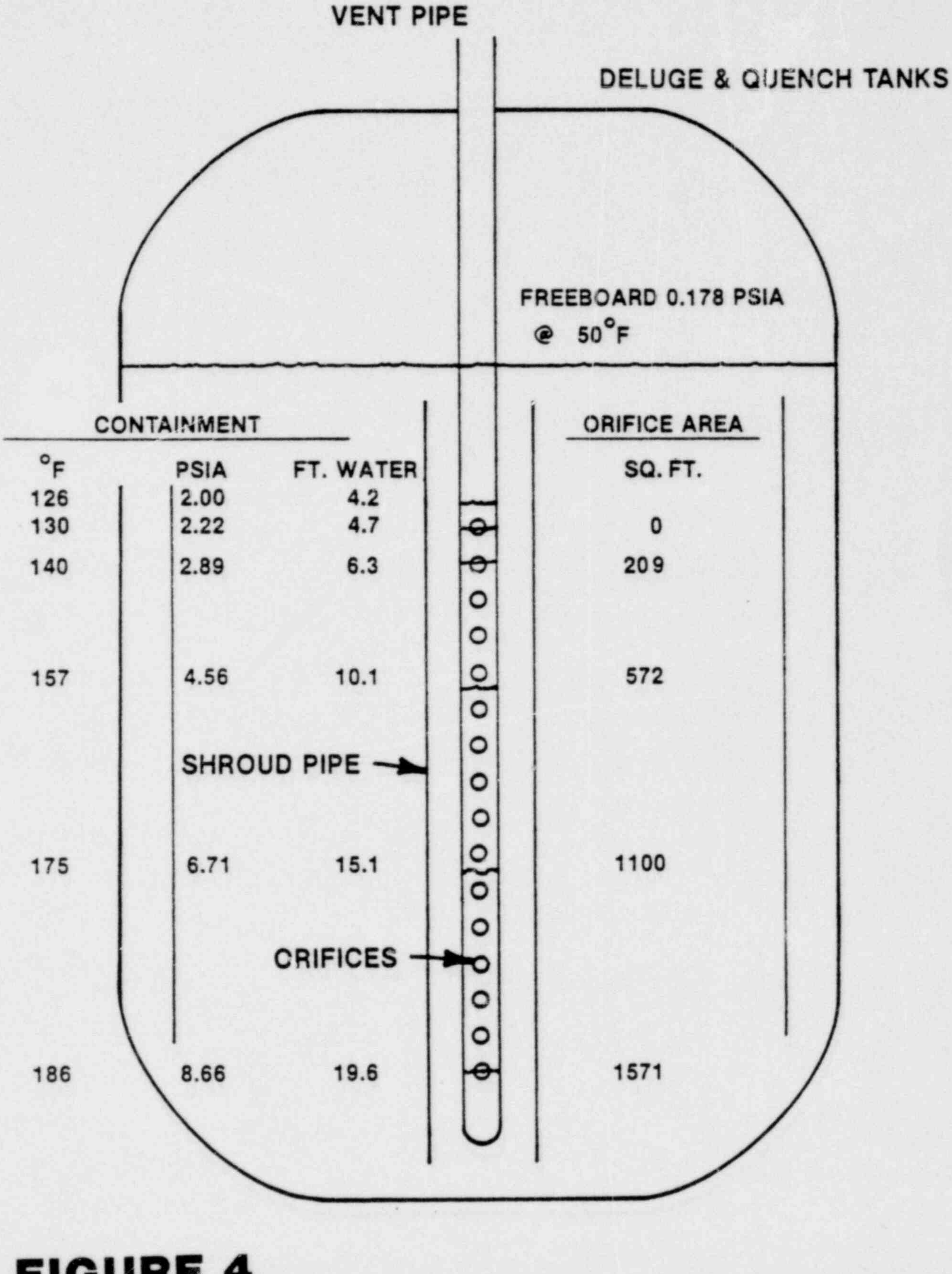


FIGURE 4
VARIABLE ORIFICE VENT SYSTEM

TASK AREAS

- RESEARCH AND DEVELOPMENT
- OPTIMIZATION STUDIES
- ACCIDENT ANALYSIS
- SAFETY ANALYSIS REPORT
- PROBABLISTIC RISK ASSESSMENT
- CONSTRUCTION SCHEDULE
- CONSTRUCTION COST

RESEARCH AND DEVELOPMENT

- STEAM JET INJECTORS
- REACTOR VESSEL REFILL SYSTEM
- EMERGENCY FEEDWATER SYSTEM
- VARIABLE ORIFICE VENT SYSTEM

OPTIMIZATION STUDIES

- ACCESS SPACE
- SUPPORTS AND RESTRAINTS
- CELL WALL COOLING

ACCIDENT ANALYSIS - COMPUTERS

- DESIGN BASIS ACCIDENTS
- TRANSIENTS

SAFETY ANALYSIS REPORT

CHAPTER

3	DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS
6	ENGINEERED SAFETY FEATURES
7	INSTRUMENTATION AND CONTROLS
8	ELECTRIC POWER
15	ACCIDENT ANALYSIS

PROBABLISTIC RISK ASSESSMENT

- DESIGN BASIS ACCIDENTS
- TRANSIENTS

CONSTRUCTION SCHEDULE

- CRITICAL PATH ANALYSIS FOR PCS
- COMPARISON TO DRY-TYPE, FULL-PRESSURE CONTAINMENT

CONSTRUCTION COSTS

- COST EVALUATION FOR STRUCTURES, SYSTEMS, AND COMPONENTS ELIMINATED, MODIFIED, AND ADDED

- COST COMPARISON TO DRY-TYPE, FULL-PRESSURE CONTAINMENT

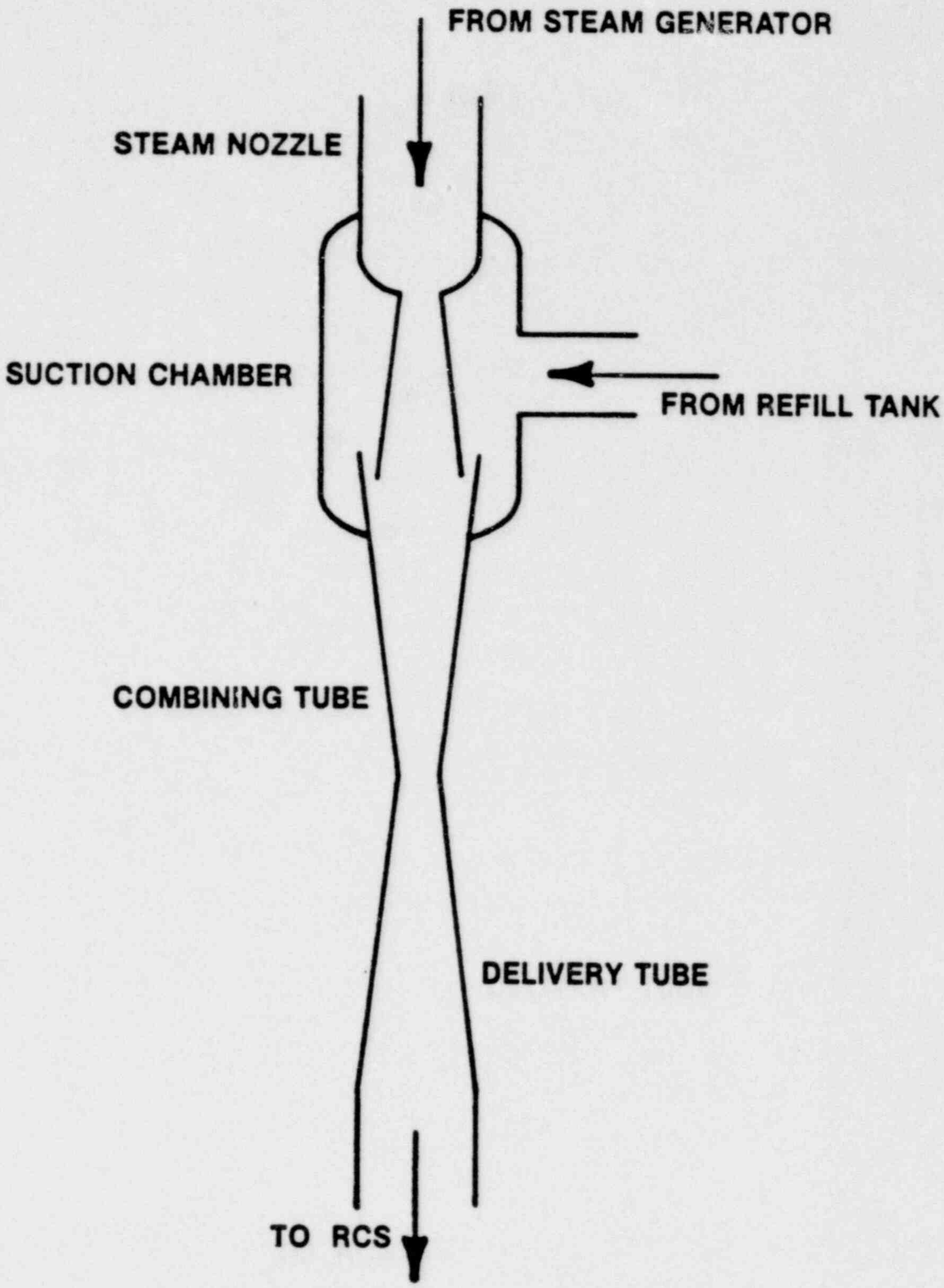


FIGURE 1
STEAM JET INJECTOR

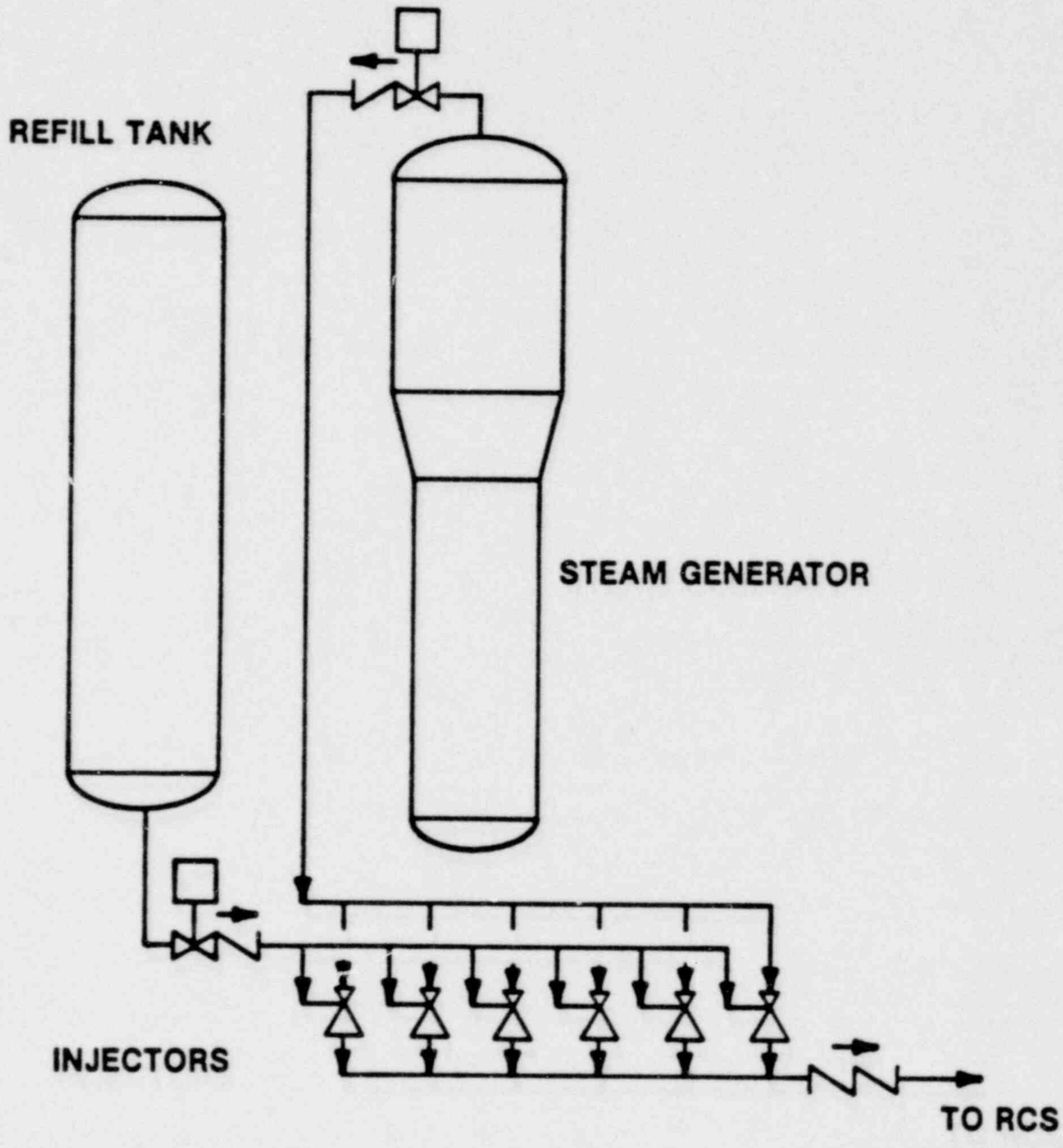


FIGURE 2
REACTOR VESSEL REFILL SYSTEM

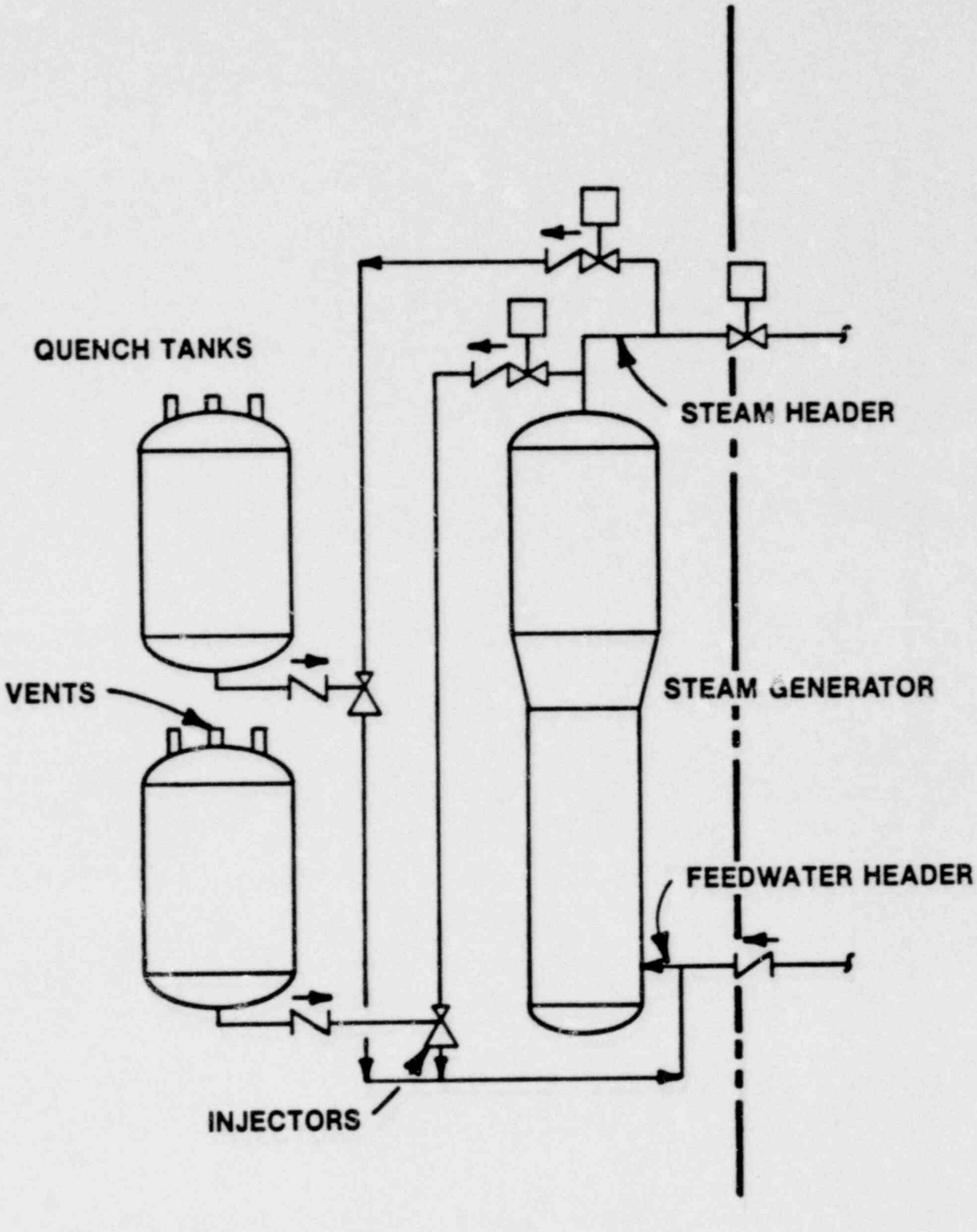


FIGURE 3
EMERGENCY FEEDWATER SYSTEM

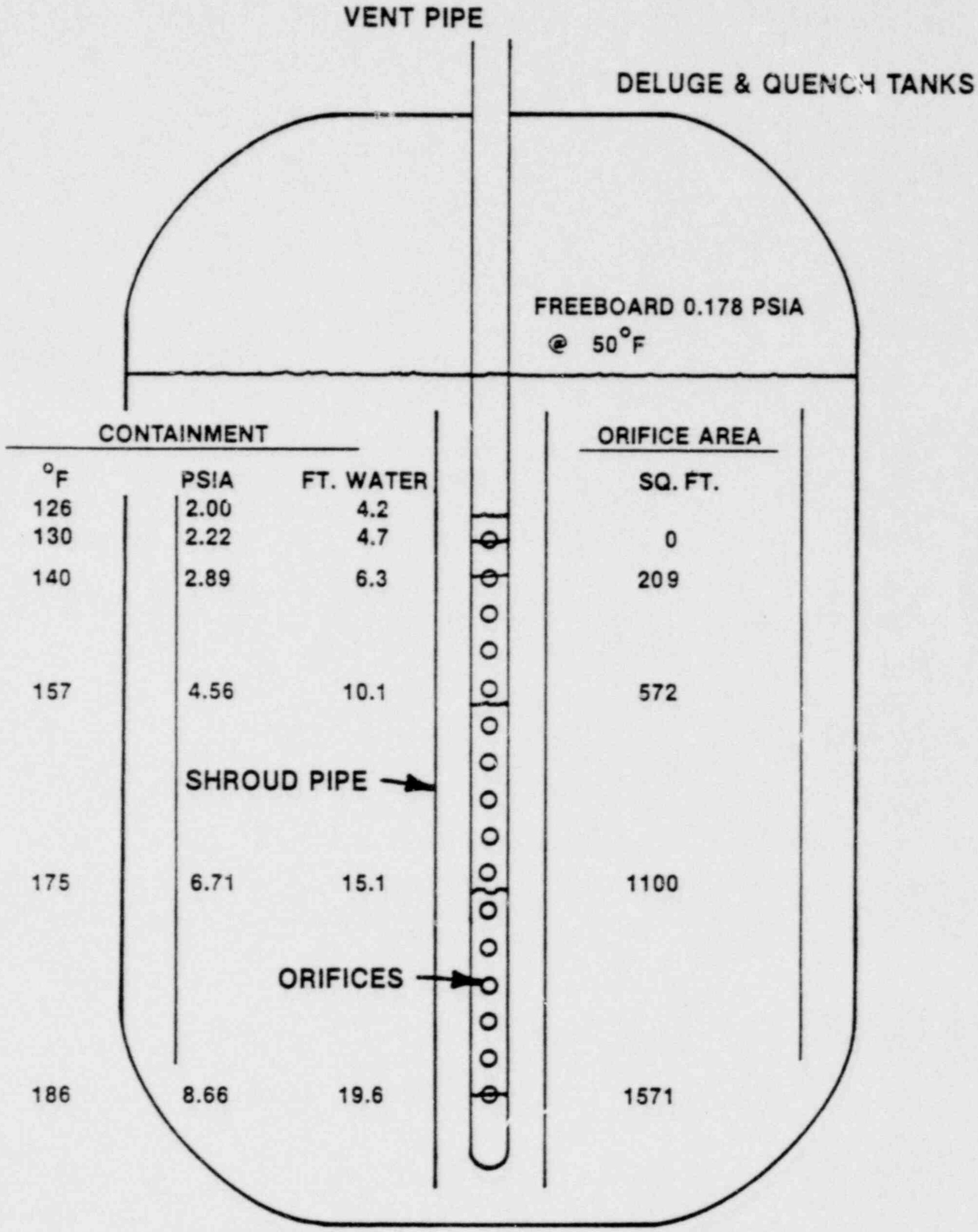


FIGURE 4
VARIABLE ORIFICE VENT SYSTEM

NRC STAFF STATUS REPORT

FOR THE

252ND ACRS MEETING

ON UNRESOLVED SAFETY ISSUE (USI)

ON SHUTDOWN DECAY HEAT

REMOVAL (SDHR) REQUIREMENTS, TASK A-45

APRIL 10, 1981

A. R. MARCHESE
GENERIC ISSUES BRANCH, DST

T8, 9, 10

PRESENTATION OUTLINE

- BACKGROUND ON TASK A-45
- PURPOSE
- OBJECTIVE
- MAIN ELEMENTS OF TASK A-45
- DISCUSSION/QUESTIONS/FEEDBACK

BACKGROUND

- COMMISSIONERS APPROVED SDHR REQUIREMENTS AS AN USI (REF., MEMO, S. J. CHILK TO W. J. DIRCKS, SECY 80-325, DATED DECEMBER 24, 1980).
- TASK MANAGER ASSIGNED TO TASK A-45 ON FEBRUARY 17, 1981.
- NUREG-0705 (MARCH 1981), "IDENTIFICATION OF NEW USIs RELATING TO NUCLEAR POWER PLANTS - SPECIAL REPORT TO CONGRESS," PROVIDES AN EXPANDED DISCUSSION OF TASK A-45.
- MEMORANDUM, A. R. MARCHESE TO T. E. MURLEY, "ACTIVITIES RELATED TO TASK A-45," DATED APRIL 8, 1981.
- TASK ACTION PLAN (TAP) FOR TASK A-45 IS BEING DEVELOPED - ESTIMATED COMPLETION IS JUNE 1981.
- ACRS FEEDBACK DURING DEVELOPMENT OF TAP IS ENCOURAGED.

PURPOSE

- THE OVERALL PURPOSE OF TASK A-45 IS TO EVALUATE THE ADEQUACY OF CURRENT LICENSING DESIGN REQUIREMENTS TO ENSURE THAT NUCLEAR POWER PLANTS DO NOT POSE UNACCEPTABLE RISK DUE TO FAILURE TO REMOVE SHUTDOWN DECAY HEAT.

OBJECTIVE

- TO DEVELOP A COMPREHENSIVE AND CONSISTENT SET OF SHUTDOWN DECAY HEAT REMOVAL (SDHR) SYSTEM REQUIREMENTS FOR EXISTING AND FUTURE LWRS, INCLUDING THE STUDY OF ALTERNATIVE MEANS OF SDHR AND OF SEPARATE "DEDICATED" SYSTEMS FOR THIS PURPOSE.

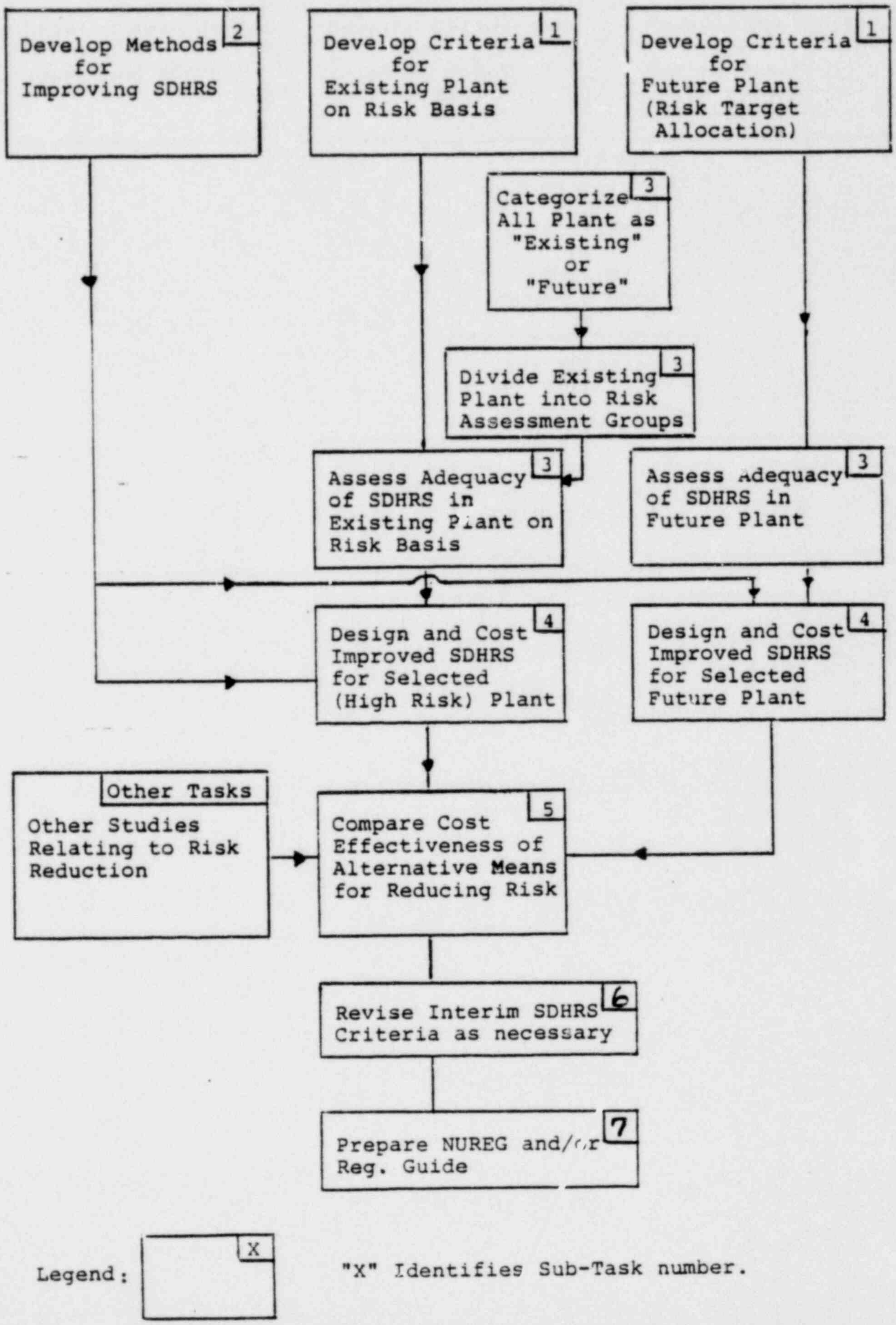
MAIN ELEMENTS OF TASK ACTION PLAN

- DEVELOPMENT OF CRITERIA TO JUDGE THE ACCEPTABILITY OF SDHR SYSTEMS IN EXISTING AND FUTURE PLANTS.
- DEVELOPMENT OF MEANS FOR IMPROVEMENT OF EXISTING SDHR SYSTEMS.
- ASSESSMENT OF SDHR SYSTEMS FOR SPECIFIC PLANTS, OR GROUPS OF SIMILAR PLANTS, TO IDENTIFY THOSE FOR WHICH DHRS IMPROVEMENTS ARE REQUIRED.
- DEVELOPMENT OF RECOMMENDATIONS OF SDHR DESIGN ALTERNATIVES FOR EACH PLANT, OR GROUPS OF PLANTS, IN ACCORDANCE WITH THE CRITERIA FOR ACCEPTABILITY. (THIS TASK WILL FOCUS ON SEPARATE, DEDICATED SDHR SYSTEMS.)

BACKUP

VIEWGRAPHS

FIGURE 1. INTER-RELATION AND RELATIVE TIMING OF SUB-TASKS IN TASK ACTION PLAN A-45



DEFINITION OF SHUTDOWN DECAY HEAT REMOVAL (SDHR) SYSTEM

- IN THE CONTEXT OF TASK A-45, SDHR SYSTEM IS DEFINED AS THOSE COMPONENTS AND SYSTEMS REQUIRED TO MAINTAIN PRIMARY ONLY OR PRIMARY AND SECONDARY COOLANT INVENTORY CONTROL AND TO TRANSFER HEAT FROM THE REACTOR COOLANT SYSTEM AND CONTAINMENT BUILDING TO AN ULTIMATE HEAT SINK FOLLOWING SHUTDOWN OF THE REACTOR FOR NORMAL EVENTS, OFF-NORMAL TRANSIENT EVENTS (E.G., LOSS OF OFFSITE POWER, LOSS OF MAIN FEEDWATER) AND SMALL LOCAS (I.E., 1/2" TO 2"). SDHR SYSTEM DOES NOT ENCOMPASS THOSE EMERGENCY CORE COOLING COMPONENTS AND SYSTEMS REQUIRED ONLY TO MAINTAIN COOLANT INVENTORY AND DISSIPATE HEAT DURING THE FIRST 10 MINUTES FOLLOWING MEDIUM OR LARGE LOCAS.

WORK CONTENT OF MAJOR TASKS

TASK 1 - DEVELOPMENT OF CRITERIA TO JUDGE ACCEPTABILITY OF SDHR SYSTEMS IN EXISTING AND FUTURE PLANTS

SUB-TASK NO.	WORK CONTENT OF SUB-TASK
1.1	DECIDE ON BASIS OF DIVISION INTO "EXISTING" AND "FUTURE" PLANTS (E.G., "EXISTING" - MAJORITY OF HARDWARE IN PLACE, EXPENSIVE TO ALTER. "FUTURE" - DESIGN ONLY ON PAPER, RELATIVELY EASY TO ALTER.
1.2	DEFINE ACCEPTANCE CRITERIA FOR EXISTING PLANT/PREFERRED SOLUTION - USE OF RISK CRITERIA PROPOSED BY ACRS. LIMITATIONS ON PREFERRED SOLUTION A - ADEQUATE RISK ASSESSMENTS UNLIKELY TO BE AVAILABLE FOR ALL PLANTS WITHIN A USEFUL TIME. B - DIFFICULTY OF QUANTIFYING RISK IN "SPECIAL EMERGENCY SITUATIONS" IDENTIFIED BY SANDIA.
EARLY ACTION	I. DECISION REQUIRED ON TREATMENT OF "EMERGENCY SITUATIONS" POSSIBLE SOLUTIONS: (A) IGNORE IN RELATION TO SDHR (B) PROVIDE "DEDICATED" SDHR (C) SOME INTERMEDIATE SOLUTION II. DECISION REQUIRED ON TREATMENT OF PLANTS FOR WHICH RISKS CANNOT BE ESTIMATED (SEE (F) OF SUB-TASK 3.2) POSSIBLE SOLUTIONS: (A) DEFER ACTION UNTIL RISK ASSESSMENT AVAILABLE (B) USE CURRENT QUALITATIVE CRITERIA

SUB-TASK NO.	WORK CONTENT OF SUB-TASK
1.3	DEFINE ACCEPTANCE CRITERIA FOR FUTURE PLANT PREFERRED SOLUTION - ESTABLISH QUANTITATIVE TARGET FOR RELIABILITY OF SDHRS.

TASK 2 - DEVELOPMENT OF MEANS FOR IMPROVEMENT OF EXISTING SDHR SYSTEMS

SUB-TASK NO.	WORK CONTENT OF SUB-TASK
2.1	IMPROVEMENT OF SDHR FOR PWR (A) SELECTION OF POSSIBLE METHODS (E.G., - IMPROVED RELIABILITY OF AUX. FEED SYSTEM - SOME HP INJECTION AT FULL SYSTEM PRESSURE - "FEED AND BLEED" CONCEPT, WITH AND WITHOUT BOILING IN CORE - HP "RESIDUAL" HEAT REMOVAL SYSTEM - REFLUX CONDENSATION - SHOCK CONDENSERS (B) THERMAL HYDRAULIC ANALYSIS OF SELECTED SYSTEMS TO ESTABLISH FLOW, POWER AND INSTRUMENTATION REQUIREMENTS TO MAINTAIN SAFE CONDITIONS IN CORE AND TO IDENTIFY ANY TEST WORK REQUIRED. (C) FORMULATION OF TEST PROGRAM CONDUCT AN ANALYSIS OF TESTS (D) RANKING OF POSSIBLE METHODS FOR PRACTICAL APPLICATION
2.2	IMPROVEMENT OF SDHR FOR BWR WORK CONTENT IS SIMILAR TO SUB-TASK 2.1 BUT SCOPE FOR DEVELOPMENT OF ALTERNATIVE CONCEPTS IS SMALLER.

TASK 3 - ASSESSMENT OF SDHRS IN EXISTING AND PROPOSED PLANTS

SUB-TASK NO.	WORK CONTENT OF SUB-TASK
3.1	CLASSIFY PLANT INTO "EXISTING" AND "PROPOSED" (NOTE: THESE CLASSES ARE TREATED DIFFERENTLY.)
3.2	FOR EXISTING PLANT, IN NORMAL CONDITIONS (A) IDENTIFY ALL EXISTING AND PROPOSED RISK ANALYSES (B) EVALUATE QUALITY OF EXISTING ANALYSES AND CATEGORIZE IN TERMS OF EFFORT REQUIRED TO ATTAIN MINIMUM STANDARD REQUIRED FOR THE PRESENT TASK. (C) ESTIMATE EXTENT TO WHICH ANALYSES AVAILABLE IN A USEFUL TIME CAN BE EXTRAPOLATED TO OTHER PLANTS (D) PREPARE QUESTIONNAIRE FOR LICENSEES, TO ESTABLISH EXTENT TO WHICH THEIR PLANTS MEET CURRENT <u>QUALITATIVE</u> CRITERIA FOR SDHRS. (E) FOR PLANTS WHERE ADEQUATE RISK ANALYSES ARE AVAILABLE, COMPARE RISK WITH THE ACCEPTANCE CRITERIA. IF CRITERIA ARE <u>NOT</u> MET ESTIMATE THE EFFECT OF AN ARBITRARY IMPROVEMENT IN SDHRS RELIABILITY BY A FACTOR OF 10. (NOTE: THE TESTS ARE TO DETERMINE WHETHER, OVERALL, ANY CHANGES TO REDUCE RISK ARE NECESSARY AND, IF SO, WHETHER A CHANGE IN THE SDHRS ALONE COULD PRODUCE A WORTHWHILE IMPROVEMENT.)

SUB-TASK NO.	WORK CONTENT OF SUB-TASK
	(F) COMPARE CONCLUSIONS ABOUT ADEQUACY OF EXISTING SDHRS BASED ON QUANTITATIVE ANALYSIS AT (E) WITH CONCLUSIONS BASED ON QUALITATIVE ANALYSIS AT (D) AND PROCEED AS FOLLOWS: (1) IF THE CONCLUSIONS REACHED ARE REASONABLY CONSISTENT RELY ON QUALITATIVE ANALYSIS FOR REMAINING PLANTS. (2) IF NOT CONSISTENT - REVIEW SITUATION.
3.3	FOR EXISTING PLANT, IN "EMERGENCY SITUATIONS" CONSIDER WHETHER RESISTANCE OF SDHRS IS CONSISTENT WITH THE POLICY ADOPTED IN SUB-TASK 1.2 (ITEM I)
3.4	FOR FUTURE PLANT, IN NORMAL CONDITIONS EXAMINE RISK ANALYSIS TO DETERMINE WHETHER RELIABILITY OF SDHRS IS CONSISTENT WITH THE ACCEPTANCE CRITERIA IN NORMAL CONDITIONS
3.5	FOR FUTURE PLANT, IN "EMERGENCY SITUATIONS" CONSIDER WHETHER RESISTANCE OF SDHRS IS CONSISTENT WITH THE POLICY ADOPTED IN SUB-TASK 1.2 (ITEM I)

TASK 4 - DEVELOPMENT OF RECOMMENDATIONS OF DESIGN ALTERNATIVES

SUB-TASK NO.	WORK CONTENT OF SUB-TASK
4.1	FOR EXISTING PLANT (A) DEVELOP AND COST CONCEPTUAL DESIGNS FOR IMPROVEMENT OF RELIABILITY OF SDHRS, IN NORMAL CONDITIONS, FOR TYPICAL PLANTS IN WHICH SUBSTANTIAL IMPROVEMENT IN RISK COULD BE OBTAINED BY THIS CHANGE (SEE (E) OF SUB-TASK 3.2, ABOVE. (B) DEVELOP AND COST CONCEPTUAL DESIGNS FOR IMPROVEMENT OF RELIABILITY OF SDHRS IN "EMERGENCY SITUATIONS," FOR TYPICAL PLANTS (SEE (B) OR SUB-TASK 3.3).
4.2	FOR PROPOSED PLANT (A) FOR PLANTS IN WHICH ACCEPTANCE CRITERIA ARE NOT MET, DEVELOP AND COST CONCEPTUAL DESIGN TO MEET THE ACCEPTANCE CRITERIA, IN NORMAL CONDITIONS. (B) FOR PLANTS IN WHICH RESISTANCE OF SDHRS IN "EMERGENCY SITUATIONS" IS NOT ADEQUATE, DEVELOP AND COST CONCEPTUAL DESIGNS TO MEET POLICY ADOPTED (SEE I OF SUB-TASK 1.2)