UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON
THREE MILE ISLAND
NUCLEAR STATION UNIT 1
RESTART

- - -

Room 1046
1717 H St., N.W.
Washington, D.C.
Friday, June 26, 1981

The meeting of the Subcommittee convened, pursuant to notice, at 8:30 a.m.

SUBCOMMITTEE MEMBERS PRESENT:

D. W. Moeller, Chairman
W. Kerr
W. M. Mathis
H. Etherington

DESIGNATED FEDERAL EMPLOYEE:

R. K. Major

CONSULTANTS:

I. Catton
W. Keyserling
W. Lipinski
Z. Zudans

P R O C E E D I N G S

MR. MOELLER: The meeting will come to order.

This is a continuation of the public meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Three Mile Island Nuclear Station No. 1. The purpose of the meeting, was was stated yesterday morning, will be to review the modifications made to TMI-1 in preparation for restart following the accident at TMI-2.

Mr. Richard Marjor is the designated federal employee for the meeting and will continue with us today.

We will pick up with the agenda where we left off yesterday afternoon or evening, and the first item then will be management and organization. Mr. Clark will address that.

For those members of the public who are here, as well as for the Licensee and the staff and the members of the Subcommittee, we will proceed through the remaining agenda items, and it is my thought that we should be able to finish by noon. In other words, there is no 10 o'clock adjournment or anything like that. We will go through each item until we finish them, and I am very hopeful that we should be able to do that by noon.

Go ahead.

MR. CLARK: From my standpoint and the GPU organizational standpoint, the first step in having satisfactory management and staffing is the organization to

deal with nuclear power and to face up to the issues and the lessons that were learned from the TMI-2 accident.

The GPU system made that commitment announced a year and a half ago to set up a subsidiary which would be dedicated solely to nuclear generation for the GPU system and has been proceeding fairly aggressively ever since then. In terms of the reasons for the changes we made, they come largely from two sources.

First was the recognition before the accident of some of the unique aspects of nuclear power. The Corporation, in fact, was moving towards separating out the nuclear activities even before the accident. The accident reinforced that and provided us with the Kemeny Commission report, the Rogovin Commission report and others, each of which addresses some aspects of the need to organize and dedicate resources to nuclear power.

(Slide)

The main elements or a number of the main elements in the organization. It is a full-time organization dedicated solely to nuclear generation, and we have that today in the GPU Nuclear Group, have had it since last September, and that group is recognized in the licenses for TMI-1 and our other plants.

Increased onsite technical and management resources, and I will show you some numbers and an

organization chart that show what we have done there. Strong central technical control where the design configuration and all the technical aspects of nuclear power are centralized in the Technical Functions Division rather than the practice by us and many other people prior to the accident of having the technical control transferred from the organization that designed and built the plant to the organization that ran it, keeping the central technical control in the same place.

The full-time onsite management at the officer level for operating and maintaining the plant. Support functions, administration, engineering, radiation protection, maintenance are provided by separate divisions so that the officer in charge of running the plant can truly operate and maintain it.

We have an independent Nuclear Assurance Division which has a quality assurance training and a separate nuclear safety assessment department reporting independent of the operation, maintenance design, any of those functions. We have pooled the resources for support of TMI-1, TMI-2, Oyster Creek and, in our case very importantly, the resources that had been dedicated to design and construction of Forked River. That project has been cancelled and all the resources have been dedicated to the support of the three operating plants.

Personnel policies and procedures appropriate for nuclear generation we think is very important. That goes all the way from policies on compliance with procedures to drug and alcohol abuse polices to automatic progression or requalification of people, not only operators but radiation technicians, for example. We have moved to where they have to requalify by formal program every two years in order to stay as rad techs.

Those are examples. There is a lot more we are moving to do there, but that area requires agreement with the union and the bargaining unit people. But as a separate corporation we believe we have got ourselves in a position to be able to pursue those changes, and we have gotten some of them.

(Slide)

There is often a question raised as to, you know, really if you had to trade off safety or keeping the plant on the line, what would you do, and obviously that is judgment at every level. In order to make clear to the organization what the management answer to that question is, the formally published purpose of the GPU Nuclear Group, and this is in the organizational manual and shows up in our training program, is first to manage and direct the activities to provided the required high level of protection for the health and safety of the public and the employees.

Second, consistent with the above, generate electricity reliably, economically, et cetera. So we are trying to send a very clear signal to the organization of what our priorities are and what we believe their priorities should be.

(Slide)

We explained to an earlier meeting somewhat about the organization but I wanted to take just a minute on this one. We have it marked up here to show some of the changes. The basic organization has the office of the president, and these titles are for GPU Nuclear Corporation.

That corporation has been approved by the SEC, the Pennsylvania PUC. It is before the NRC and the New Jersey Board of Public Utilities but not yet approved by them. Prior to that approval we are operating a the GUP Nuclear Group.

The organization chart of the group looks exactly the same but the titles are a little different, and the office of the president shown here reports to the president of Jersey Central to run Oyster Creek, to the president of Met Ed to run TMI, to the president of the Service Corporation for the support. Mr. Arnold and I have three bosses. When we get below that, ever since September, in fact we are operating in exactly this configuration.

The office of the president. This is our General Office Review Board, which is a safety review board of senior people, about half of them outside the company. That board reports here but has direct access to the chief executive officer of the GPU system.

We have an onsite full-time vice president for each of the three nuclear stations. Mr. Hukill, who is here today, is the vice president for TMI-1. He has the operation, maintenance, what we call plant engineering, which is the day-to-day engineering support of operation and maintenance that reports to Mr. Hukill.

We have the Technical Functions, which has the central technical control, Nuclear Assurance, Administration, Communications, which is a big change from before the accident. At that time there was one person in communications. He was at the observation center conducting tours. We have now, I think, 30 people, professional level people dealing with the media.

Radiation and Environmental Controls reports separate from the plants and the other divisions and is the monitor and expertise in that area. Maintenance and Construction.

Now, if you look at that chart, the solid square is new to the organization since the accident and there are five such boxes out of the 12 people on this chart. This

shows the shift from construction, which was really Forked River, to operational activities, and there are five such boxes on the chart.

The final shows scope narrowed to nuclear activities only where Mr. Finfrock and Mr. Herbein prior to the accident had responsibility for all generation for Jersey Central and Met Ed, respectively. They now are focused entirely on nuclear. So certainly at this level not only are we organized better now to deal with nuclear, but the resources applied to the operating plants are just far, far greater than before the accident.

MR. ZUDANS: Could I ask a question? This Maintenance and Construction. Does it handle all nuclear power plants or each of the power plants separately?

MR. CLARK: Mr. Manganaro is responsible for the major maintenance and construction at all three plants. He has at each site a manager who is responsible for the maintenance and construction at that site.

MR. ZUDANS: I see. Thank you.

MR. MOELLER: On this General Office Review Board you said roughly half the members are from outside and you said they reviewed safety matters. Can you give me some for instances of something they have reviewed and the decision they have made?

MR. CLARK: First, their decisions are

recommendations to the office of the president, so they do not have a decision-making authority in that sense. Their charter is to review for safety significance all activities of the company, looking particularly for longer-term things [illegible] trends which have safety implications. They are not required by the tech specs, since everything in our tech specs is accomplished without the General Office Review Board. So this is an additional level.

There is a full-time chairman. They meet on each plant every three months, and their typical agenda is to look at the recent activities of the plant level safety review boards. They have set up subcommittees, for example, on restart of TMI-1. They set up seven subcommittees to go look into engineering practice, training, et cetera.

I am a little hard pressed to describe what they have looked at because it is their choosing, but they go everywhere from looking at LERs of interest to them to the activities of our other safety review groups, to saying we ought to focus on restart of TMI-1 and making up their own agenda to do that.

MR. MOELLER: And they are primarily a technically oriented group.

MR. CLARK: Yes.

MR. MOELLER: And they meet quarterly for roughly how long, one day or --

MR. CLARK: It runs about a day and a half for each plant. There are three boards, one for each plant, a common chairman, and they have staff support which I think this group would recognize as very important. They do not just meet and disappear. The staff support to do the follow-up, the preparation, that sort of thing.

MR. MOELLER: And they issue written reports?

MR. CLARK: Yes. They can issue action items requesting any of our divisions to do anything. They issue written reports and they issue formal recommendations to the office of the president on matters they think warrant that, which we then respond to formally.

MR. MOELLER: Thank you.

MR. CLARK: I have this chart in two forms.

(Slide)

I am going to show it first in this form. I had some of this made up at TMI and some in Parsippany. This is an attempt as of the end of last year to show in these organizations, other than numbers of people, what kind of expertise that we have. So "A" is technical professionals, degreed technical people. The organization as of that time had 416 such people.

Professional experience takes all experience, nuclear and non-nuclear, but the professional level with 5000 man years, 3153 man years of nuclear experience. We

thought it was also important to see how much operational input we had, and through the organization there are 119 people who had senior reactor operator license or equivalent, where by equivalent we mean a Navy engineer officer of the watch qualification.

We have a fair spread of those people, not only in the operating plants but also in the Nuclear Assurance, which is your QA and training people. Tech Functions has a fair number of operator people with operator backgrounds, et cetera. These two, obviously, while they have professionals are not technical professionals and were not counted. We think that that, you know, is a good amount of experience. You know, we are quite proud of the people we have been able to bring in.

MR. ETHERINGTON: The "D" category equivalent, that is nuclear exposure.

MR. CLARK: I am sorry, "D"?

MR. ETHERINGTON: "D" equivalent. Is that nuclear?

MR. CLARK: Yes. It would be Navy nuclear engineer officer of the watch qualification.

(Slide)

If you look specifically --

MR. MOELLER: On TMI-2, do you still have the 24 people -- I mean I had heard that some of your TMI-2 operators had left.

MR. CLARK: There may be one or two, but it is not more than that. We have a very difficult problem with all of our plants with the licensed operators. Everybody does. Over and above that, at TMI you have the problem of people who want to operate and for two years have not been operating, and we are working very hard to go and keep them happy.

MR. MOELLER: Surely.

MR. CLARK: This shows the organization for TMI pre-accident. It starts with the vice president of generation, who was in Reading. Under him in Reading he had 31 in engineering, 5 in maintenance, 22 in licensing and training, administration, operations. At TMI there was a station superintendent responsible for both stations, and he had engineering, rad con, the computer, admin. At TMI-2, operations, maintenance and engineering. TMI-2, operations, maintenance and engineering, 173 people. And then he also had some in the Service Corporation under another vice president. He had some other support.

The total people for both plants, 635 people, and the onsite, you do not separate organizations until you get down to this level, the second level below the company officer.

(Slide)

As of the end of 1980 I have added onto this chart

the total staff level as of the end of 1980. That was 1947 people compared to -- well, that supports all three plants, so let me come back to that for just a minute. As of June that number is now 2149, if I remember it right, so we are on a program of building up our in-house staff to a certain extent, that is, at the expense or an off-set to contractors where we think we get a lot better technical control and operational control by having our own people.

If I look just at the people supporting TMI-1, there are 667 people onsite supporting TMI-1, and while it is a little hard to count some of the support divisions, there are at least 170 people offsite supporting TMI-1. So we have 840 people, roughly, supporting TMI-1, whereas before the accident there were the 637 supporting TMI-1 and TMI-2.

I think it is also important that the amount of technical support has increased by a proportion even greater than that overall. The people we have added have been heavily in technical support or in the rad con, QA and training areas. They are three of the areas where we have made major increases.

I would be glad to go through any numbers if you want, but it did not seem to me that that was too useful.

MR. MOELLER: A question. Several members of the ACRS as well as some of our consultants visited some of the

Canadian nuclear power installations a month or so ago, and one of the impressions I was left with was the larger number of people they have working at a nuclear power plant as compared to the U.S., and you are showing by your presentation this morning that you have deemed it wise to move to larger numbers of people.

The Canadians -- and I wouldn't want, you know, to quote them as if what I am saying is exactly accurate, but the impression I received was that they had long ago been convinced that if you have more than the minimum number of people, you can do better maintenance, you can keep up with things a lot better.

Have you reached somewhat, then, the same conclusions?

MR. CLARK: Certainly we have reached the conclusion that the total number of people needed to deal with these stations was greater than had been applied before. You can say is it two times, two and a half times.

Secondly, things like maintenance, particularly preventive maintenance, we concluded that you need people dedicated to do preventive maintenance.

We also have gone at TMI-1, we think with good effect, to shift maintenance, so that there is preventive maintenance and corrective maintenance going on around the clock and that spreads the people out better. You do not try

to pack everybody in the plant doing everything all on the day shift five days, and it also provides the ability to deal with something immediately instead of waiting for the morning to write it up. We just think that that has been a significant improvement.

The total number of people applied to the maintenance area has been substantially increased, and I do not remember those numbers. I do not know if we have somebody here who does. But there is a very significant increase in numbers.

MR. MOELLER: That is fine. Let me ask the staff a question and then Mr. Mathis has a question. How does the staffing proposed in existence at TMI-1 compare to that for other operating plants?

MR. CROCKER: I do not know that we have really compared numbers on it. My impression is it is probably a factor of about 2.

MR. MOELLER: And has the staff done any studies that would help you set numbers in terms of what is the ideal complement for a certain type plant?

MR. CROCKER: No, we really have not. We are getting closer to it all the time. We are beginning to look at the new plants coming in now to see if they do have numbers that seem reasonable to us based on a comparison with other plants, but TMI-1, I should add, is far and away

heavier staffed than any of the plants we have looked at.

MR. MOELLER: Well, it will be interesting, of course, to follow and see how it proves out.

Mr. Mathis.

MR. MATHIS: Mr. Clark, your number of 2100 plus whatever it was by the end of June, do you consider that a full complement of people or are you still recruiting?

MR. CLARK: Our projection for this year was we wanted to get to 2500 employees by the end of the year. Where it goes after that is not quite as clear. One, with the new organization a lot of evolving requirements, and in our case the one-time kind of prices we are paying for the ASLB hearing, for example. I mean that has been a major d in on our efforts.

Setting up a new organization and trying to upgrade a great many things at once we hope is a start-up cost. My present thinking is that we will be trying in '82 to go to perhaps 2700 people, and we would hope to find we could level off at that level. You know, there are places we ought to be getting efficiencies. We are going to go to a fairly common radiation protection plan for all three stations, and updating one plant with maybe site-specific supplements ought to take less effort and be more effective than having three separate ones. So, you know, we really do not know where we will play out.

Dr. Moeller's comment, we have been looking pretty carefully at how other people are staffed and having a great deal of trouble because it is not clear how many employees plus contractors. Some people subcontract. We are getting close to having a good understanding of that and we have been actively encouraging INPO, who visits every plant, to go get good data on manning and staffing so we can support it.

We are concerned about that and our management properly is concerned. While from one perspective it is good to have twice as many people as anybody else, it from another perspective there is bound to be a question of why do you need twice as many people. You know, who is right? We need to defend ourselves to the PUC on rates, et cetera.

I do not want to leave the impresstion that there is pressure to go cut back. I think obviously we have built up. Our management supports it. We do have the obligation to go and try and be efficient in this whole thing.

MR. MATHIS: You mentioned an increase in your maintenance activity. Are you having trouble recruiting competent maintenance people?

MR. CLARK: Yes, because we have built up. It is hard. There is, you know, kind of a merry-go-round of I&C techs which we are trying to deal with. We have established a policy that we are trying to live with which says we will

not target other utilities for our major suppliers, nor will we allow our search firms to target such people. Now, if somebody contacts us, that is a different question. Then, you know, there are legal and whatnot reasons to do it. But we are trying not to go target those people and obviously hope they will do the same for us.

I think the real answer in the long term is bringing people in at the bottom and having training and progression, and we are working on that.

MR. ETHERINGTON: I noticed that TMI-2 has almost the same staffing as TMI-1. Is it being supervised on a comparable basis?

MR. CLARK: Yes. You know, you have an officer on site., We have an operation and maintenance manager. It is still a licensed plant. The core is in it. We still need the same kind of people on shift from an operations standpoint, and we are now getting into running the SDS system, which I do not know whether they did or did not -- I guess it is this coming weekend. We hope to transfer water into the tanks and get set up to run the SDS to clean up that water.

MR. MOELLER: Mr. Zudans.

MR. ZUDANS: Two questions. You mentioned dedicated maintenance. Could you explain that term? It sounds like a very attractive term.

MR. CLARK: What I mean by that is in the Maintenance Department there are people whose job is preventive maintenance, and they do not do corrective maintenance. Now, obviously if the plant started to fall down or something, you would reallocate them, but by and large they are resources which are set aside and devoted to preventive maintenance, which is the kind of thing that is very easy to get lost. Everybody fixes the thing that is broken and does not do the preventive kind of maintenance.

MR. ZUDANS: You mean dedicated in the sense of function rather than equipment.

MR. CLARK: Yes; dedicated to preventive maintenance.

MR. ZUDANS: You mentioned the SDS. I wonder who built that system? I cannot find it anyplace.

MR. CLARK: Who built the system?

MR. ZUDANS: That is correct.

MR. CLARK: Chem Nuclear designed it under contract to us, I believe, and then I think the construction actually was done under our supervision by Catalytic.

MR. ZUDANS: And who designed the epicore?

MR. CLARK: I do not know. That predates me.

MR. WILSON: Epicore-2, which was the early cleanup system at TMI, was designed by a contractor under GPU's supervision.

MR. ZUDANS: Who was the contractor?

MR. CLARK: Capolapo & Gundal.

MR. MOELLER: Do you want to spell that for the reporter?

MR. CLARK: I will give my recollection of the proper spelling. C-a-p-o-l-a-p-o and G-u-n-d-a-l. That is close.

MR. ZUDANS: That is why I did not know.

(Laughter.)

MR. MOELLER: Mr. Mathis.

MR. MATHIS: I forgot what my question was. Oh, I know. Where in that organization are tech specs written?

MR. CLARK: I like to not get hung up on the word "writte" because depending on what area is involved, you know, you might have a variety of people writing. Within the Technical Functions Group there is a licensing group, and licensing is responsible for, you know, coordinating, seeing that they are properly reviewed and submitting to the NRC the technical specifications.

In that process the technical spec for the plant would have to be approved by the plant by Tech Functions, in most cases by Nuclear Assurance, and then if it got over into radiation and environmental-related things, Radiation and Environmental Control people. So, you know, it is somewhat topic specific who has to be involved. At the

plant the Tech Functions, and within Tech Functions, the licensing people would all have to be involved.

MR. MATHIS: They all have to sign off. Thank you.

MR. KEYSERLING: I have a question on the staffing of the General Operating Review Board. Currently there is no one on that board with an operator's license or with that background. Is there any intention to try to put that type of person on the board?

MR. CLARK: I do not think specifically there is. While those people do not have operating licenses, there are a lot of people or a number of them who have in the past had operating backgrounds. They do -- any topic they get into, they have people come before them and make presentations and provide -- those are largely plant people for a lot of the areas.

We have looked at the composition of the board for each plant separately. At TMI-2 there is a focus on chemical engineering, materials kinds of things which are kind of unique to that plant in its present status, and the membership is a little bit fluid. I guess maybe every year we see one person turning over. We do not have any specific plan to put operating, previously licensed operating background and experience on this board.

MR. MOELLER: Mr. Kerr.

MR. KERR: Mr. Clark, what procedure do you use to

finally determine that an operator is qualified to operate your plant, and how do you determine that he continues to be qualified?

MR. CLARK: There are a number of elements to that. First, we do have in the Nuclear Assurance Division a separate Training Department. Before an operator is considered qualified, he has to complete the prescribed training program, we recommended or signed off by the Training Department, signed off by the operational line people with whom he has stood, you know, kind of training watches, signed off by the director of the plant. That process all includes -- well, it does include through the training program examinations and a final examination which in some respects parallels the NRC examination, although we are working very hard to be sure that it is not just a mock NRC exam: i.e., we are not training to pass the exam.

So, you know, I am very hesitant when I say similar to the NRC exam, but it is of that kind of scope. All right. Then he is considered ready to stand for the NRC exam.

In terms of requalification, there is a requalification training program that goes on through the year. That includes examinations or tests, and then I forget whether it is every year or two years there is an overall company-given examination. Is that every year or

two years that we reexamine the operators?

VOICE: I guess every year.

MR. CLARK: Okay. I guess I wasn't --

MR. KERR: From your perspective, then, you have mechanisms somewhat independent of the NRC licensing mechanism which determine to your satisfaction that a person is or is not qualified.

MR. CLARK: Yes, sir.

MR. MOELLER: A couple of questions. When Unit 1, now, if it is approved for restart, you will have a full complement of ROs and SROs.

MR. CLARK: Yes. I think it is important to discuss what full complement means. The present licensing requirement for us and other plants is one SRO and two CROs as licensed individuals on each shift. It is our plan and we have had in training and still have in the licensing process enough people to staff six shifts with two SROs and two CROs.

You know, there is a little bit of overage. We are in the position where after the accident the company volunteered to have all of its previously licensed operators reexamined by NRC. So, you know, we have that whole population which would not normally be at risk, and we are trying to go to the six shifts.

We have declined to commit to have two licensed

SROs and two licensed CROs on shift at restart on the basis that that is somewhat beyond our control and that it is not required of other operating plants until July of '82. It is our intention to have two plus two people on shift whom we consider qualified. You know, we have thought through a progression which said if you did not have enough for six shifts, what we would do, we probably would go to five shifts, but there is some penalty in five shifts regarding your ability to train.

So our position really is we will meet the license requirement. We intend to have two plus two, and we will have to see how many people there are when the time comes.

MR. MATHIS: One question, I noticed in some of the write-ups you have quite an elaborate shift turnover procedure. How much time is allowed for the overlap of the shifts to perform that function?

MR. CLARK: I have an opinion but I would just as soon see if somebody else back there would say. Hank, can you respond to that? I have not watched very many.

MR. HUKILL: I am H.D. Hukill, Director of Unit 1. Normally, the shifts take about 15 minutes for the turnover period.

MR. CLARK: There is a formal procedure and there are sheets to check off, and I get every day, you know, kind of a summary of that which lists any equipment out of service, what evolutions are ongoing and they are signed off by the offgoing and oncoming supervisor that they have reviewed the logs, they have discussed some list of items.

MR. MATHIS: That was my concern. There is quite a bit to do in a very short period of time, and I just wondered how thorough and how meaningful that procedure may be.

MR. HUKILL: If I might answer that, there is both a turnover to the individual on the watch station and a turnover of the shift supervisor, and then after the shift supervisor turnover, there is a briefing of the entire oncoming watch section that lasts upwards, depending on what

is going on, 15 to 30 minutes, of exactly what is going on in the plant, so the whole new shift coming on gets briefed by the shift supervisor of the oncoming shift.

MR. CLARK: Each of the four operating people would separately go through a turnover in his area, and then there is the coordination of the oncoming shift. The whole process is longer than the 15 minutes. It is pre-planning, pre-thought out, what you have to cover. So, you know, that does not get lost because they are focused on one item.

MR. LIPINSKI: When the NRC reviewed your operators for license they either get a pass or a fail. Is there a procedure now where the NRC is giving you information on the details of the areas of weakness of the individuals?

MR. CLARK: I believe that certainly in the case of a failure, we are told what section is failed when an exam is given by sections. I believe we also have the ability, or the individual has the ability, to get his exam.

I think there is one controversy going on now where one of our operators is testing the grading of his exam.

MR. LIPINSKI: But he has to sign a waiver of privacy of information in order to have that information transmitted to you?

MR. CLARK: We require that anybody going into the

operator program and anybody going up for exam agree in advance to have their results made available to the company.

MR. LIPINSKI: Is that a condition of employment?

MR. CLARK: It is a condition of being in the licensed operator program. I mean, not for some of the other things. But yes, absolutely.

MR. LIPINSKI: Thank you.

MR. MOELLER: You mentioned your training program, and of course, we agreed yesterday afternoon to waive the review in detail. But you could just give us a synopsis on how well it is moving along and what the major problems have been? I know what Mr. Long has listed.

MR. CLARK: I will try to do that.

MR. MOELLER: Is Mr. Long here?

MR. CLARK: No, he is not, and if I get off base here or miss something, I would ask the rest of my people here to support me in that.

First, the staff training at TMI is, I guess, about 90% in place in the sense we are talking about perhaps 30 people; in terms of having our own people I think we are close to having that, and there may still be a couple of contractors.

From a facility standpoint we are building a new training building across the river. It would be about a half mile from the site. That building is supposed to open

at either the end of July or early in August. Also from an equipment standpoint, we have a CRT kind of training device which, for transients, will print out for the operator some of the major parameters. It is related to what we were discussing yesterday. While we do not have it in the control room, we do have it for training programs.

We have ordered a basic principles trainer, which will have in effect the software for a training simulator and some printouts on CRT's, but it does not replicate the control room configuration. We think for many purposes that that is a better training device in terms of principles and how do you keep your eye on what's really happening than the whole control room, and we are committed to go put in a replicate simulator, although that is a number of years away.

The basic principles trainer we expect to have next year, and we see that as a very valuable thing. We have had some of our senior engineering people go down to B&W with the crews for the simulator training, both to critique that and get their own sense. And one of their senses is that if you are standing in that control room with all the things going on, it is hard to keep your eye on the ball. And if you are training people with all that going on, it is hard to keep their eye on the ball. And we want to focus on this basic principles training so that, you know, that really is stuck in the guy's mind, on how do you

keep their mind on what is going on.

In terms of numbers, I am going to fail here, I think. In addition to the licensed operator training, we have been getting maintenance training going. We have an upgraded rad tech training program and radiation worker training program, and that is getting into practical things.

I have seen a major evolution from talking with the guy about radiation protection where now the practical training for radiation workers, you take three or four guys and you give them an RWP radiation work permit with the job and you say go to it. And, you know, they have to select the clothing, read the RWP, plan the job, know what they are going to take in with them. So that has been upgraded in a major way.

I guess another major element is supervisory training we are providing, which we think is safety related even though at first blush it may not be. But the ability to really manage and direct and have control over your people we think is a safety-related item.

MR. MOELLER: I think that is adequate. Are there questions? Mr. Zudans?

MR. ZUDANS: Yes. I did not quite get it. Did you say that the CRT's for the training purposes now fit the actual state of the plant?

MR. CLARK: No, I did not intend to state that.

What we have in the CRT training thing is pre-programmed, what the plant parameters will do in a transient, and the operator observes those, knowing what transient is going on. He has other information provided to him. But it gives him a chance to observe what really is happening to the major plant parameters and, for example, how to distinguish from those parameters whether he has a loss of coolant or an over-cooling or -- .

MR. ZUDANS: Eventually you will have the CRT's in the power plant that will do that on the real plant. I remember last time there was a presentation on that.

MR. CLARK: That is what I'm talking about for training. What we told you last time is that we are looking at putting that in the control room, but that is a little while away.

We have some concerns with regard to how much you want the operator paying attention entirely to the computer, which is, you know, kind of pre-digested and perhaps ignoring the basic instrumentation which is out there. And, you know, we have some human engineering kinds of concerns as to how far you want to go. But we are developing, you know, the methods, the software and whatnot to be able to do that.

We are trying to evaluate how far we want to go. One possibility would be to have that available to the STA

or the shift supervisor and have your operators focus on the control boards. I am not saying that is what we will do. We are looking at how to best utilize that kind of thing.

MR. ZUDANS: I hope your evaluation does not come up with a result that says you shall not have -- .

MR. CLARK: We are putting a lot of attention in human engineering, not only ourselves but we have some very good people. A guy from MIT whose name escapes me right now, and others who are assisting us in that. I see Mr. Wallace wants to correct me or something.

MR. WALLACE: I do not want to correct you. But the first thing, the fellow from MIT, his name is Tom Sheridan. And secondly, with regards to -- I had a couple of additional comments to make with regard to full use of the simulators. Whenever you are done I can add that.

MR. ZUDANS: Because last time when I heard your people discuss how you plan to use the computer for diagnostic purposes, it is to get the information, the state of the plant and so forth. It sounded very good.

You also had some very interesting decisions already made. What are you going to watch and how you can tell where the plant is and where it is going. And I think while they are practical aspects, like you said, human factors and whatnot, other people are doing similar things.

MR. CLARK: We think it very promising. I do not

want to be too negative. We are pursuing it actively. It has progressed from what we showed you last time. We are putting it into the training program. I am just stopping short of saying that that is the way we are going to run the plant, for example.

We are working on how best to use it. One of the most interesting things out of the human engineering review of the TMI 1 control room to me was that the original design was rated quite good. And where it fell down was all the little things that got added piecemeal, you know, on their own merits without going back and looking at the whole thing. And you know we are very conscious of that, and if we go make a change, we want to be sure we have brought out what else goes with it.

MR. ZUDANS: Do you talk to other utilities that are as progressive in this respect as you are? For example, have you ever talked to Waterford No. 3? We were there last week in a meeting and I was extremely impressed. They really do it in a very professional way.

MR. KERR: Gary, have we talked to Waterford No. 3?

MR. ZUDANS: Or Louisiana Power and Light Company.

MR. CATTON: Sixteen CRT's that make up the panel.

MR. BROUGHTON: We are not familiar with what Waterford No. 3 is doing. We are familiar with some of the work that NSAC and EPRI are doing in this area.

MR. ZUDANS: Waterford No. 3 is about ten years ahead of everybody. They have a real professional team assembled. You are way in the background compared to what they are doing.

MR. CLARK: Avis will agree to talk to go to Hertz for advice.

MR. KERR: I just want to warn you people not to be influenced too heavily by these computer freaks.

(Laughter.)

Make sure what you have works.

MR. MOELLER: We are going to have to -- .

MR. CLARK: My Navy background biases me on that subject.

MR. MOELLER: We are going to have to move along. Mr. Wallace, you had a couple of comments, and then let's wrap it up.

MR. WALLACE: Yes, sir. Bob Long asked me to mention just a couple of items that Mr. Clark touched on. With regard to use of simulators, I wanted to make a few points.

We have use extensively a B&W simulator for operators and we have expanded the use of the simulator for shift technical advisors and selected management personnel; all those involved with engineering and design and those that are involved with emergency planning activities to give

them more of a firsthand view of what the plant operations and accident performances are via the simulator.

The second thing that Mr. Clark touched on the part task simulator which represents the pressure temperature plat program capabilities we described before to you. We do have the capability, and I think it is our intent at this time, to put that function in place before restart.

Another thing Mr. Clark mentioned was the basic principles trainer, which we have provided purchase orders for, and the last item is the intention in the longer term to provide a full-scope replica simulator for TMI 1. The purchase order for that activity is scheduled to be issued in early 1982.

MR. MOELLER: Thank you. Well, I think we had better move on to the next item on the agenda, which is the control room design review, and according to my agenda, the staff will have some comments.

MR. SILVER: We have Ray Ramirez to make a short presentation. Ray was the team leader of the NRC control room design review effort.

MR. MOELLER: And then when he finishes, Dr. Keyserling will have some questions.

MR. RAMIREZ: My name is Ray Ramirez, I am in the Human Factors Engineering Branch. As the team leader, I was

responsible for the human factors engineering control room design review we conducted on TMI-1. Participants included five NRC persons and one expert human factor consultant from the Biotechnology Corporation.

Our review was rather intensive, very comprehensive, for what we could do in five days. The design review team made a tour of the Unit-2 control room sufficient for us to determine that Units 1 and 2 control rooms were significantly different from a human factors standpoint and a firm comparison could not be made.

Our review then concentration on assessing the Unit-1 control room to determine the deficiencies in the design of the operator instrumentation interface, which could lead to potential operator error.

The TMI-1 control room was reviewed and evaluated essentially as an NTOL applicant's control room. In conducting our review we used draft guidelines which we were in the process of developing a checklist that later became NUREG/CR 1580, and with the appropriate revisions will become NUREG-0700, which is titled Guidelines for Control Room Design Reviews, and we expect to publish this in the fall of this year.

All licensees and applicants for operating licenses will be required to conduct a design review of their control rooms using the guidelines after we publish

them, and we are planning on giving about a year or -- for these to be completed.

The design deficiencies that we noted at TMI-1 are documented in the staff report which was sent to the licensee on September 16, 1980, also in NUREG-0752 titled the Control Room Design Review Report, and in a supplement to 0752.

I would like to note here that the licensee did employ the services of a human factors engineering consultant to provide recommendations to them for improving their control room.

Our control room review included evaluation of the control room layout, the adequacy of the information provided to the operators, the arrangement and identification of important controls and instrumentation displays, usefulness of the audio-visual alarm systems and information recording and recall capability, lighting and other considerations in human factors that have an impact on operator effectiveness.

The way we performed this review was by means of detailed inspection of all control panels. We relied quite heavily on interviews with operators, and we also observed and videotaped operators as they walked through selected emergency procedures.

A number of human factors design deficiencies we

noted during our review had previously been identified by Met Ed and their consultants, and they were in the process of being corrected at the time we were there.

The purpose of our review was to identify the most or more significant human factors deficiencies that could be identified during the short time we were there, and to require prior to restart these be corrected.

MR. MOELLER: You say you were there for five days. Was this Monday through Friday? One week, I presume.

MR. RAMIREZ: Yes, we were there Monday through Thursday. We conducted the review -- .

MR. MOELLER: And when roughly was that?

MR. RAMIREZ: July of last year.

MR. MOELLER: Go ahead.

MR. RAMIREZ: Yes, sir. We reviewed the TMI-1 control room in July 1980.

MR. MOELLER: Thank you.

MR. RAMIREZ: You are welcome. In categorizing the deficiencies we considered both the potential for error and the consequences of the error. We categorized these deficiencies in the following manner.

Observed human factors design deficiencies were given a priority rating of one to three; high, moderate and low, based on the increased potential for operator error and possible consequences of that error.

We identified some deficiencies we considered to be significant. The deficiencies were then evaluated on the basis of if they could precipitate or contribute to unnecessary operator error during both normal and emergency operations and also, their potential impact on safety.

Although our review identified some human factors design deficiencies, in general we found that the control room was designed to promote effective operator actions, and we -- .

MR. MOELLER: Hold it a minute.

(Discussion off the record.)

MR. RAMIREZ: I will probably be repeating a little bit of what I said, but I will go back to the statement where our review identified such human factors design deficiencies in general. We found the control room was designed to promote effective operator actions.

There were a number of these we identified. We required that most of the deficiencies identified be corrected prior to restart. The schedule for corrections permitted later than restart is contained in the SER and the supplement. Deficiencies which we identified were in the following topical or system areas, as I have identified on the board here.

I have a list of them here, but I do not think it is necessary for them to go through them unless you would

like.

MR. MOELLER: No, the list is fine, but we will have questions. Do you want to ask some questions?

MR. KEYSERLING: I do have some specific questions pertaining to the categories on the list. We might just as well start at the top.

Under the annunciators and alarms, at least in the NUREG there is a description of what type of system is needed in terms of silencing versus the acknowledging alarms. It is not clear to me exactly how that system works specifically in the case of multiple alarms.

Would it be possible for an operator to silence a master alarm in the event that several things happen simultaneously, and therefore, not be aware of the fact that there is more than one abnormal condition?

MR. RAMIREZ: As I recall, and correct me if I am wrong, let me just make a general statement first. We are finding that the alarm systems at different plants are different. There are no two -- I visited myself personally 14 or 15 of the 21 plants that we have gone to in the past year and a half, and I have yet to find two alarm systems that are identical.

MR. MOELLER: Well, Mr. Keaten, I see you are listed. Could you answer that question?

MR. KEATEN: Mr. Broughton will do it.

MR. MOELLER: Okay. Could you answer it, then, please, and perhaps the interaction can be between Mr. Keyserling and you as well as Mr. Ramirez.

MR. BROUGHTON: Yes. With regard to the alarm system acknowledgement at TMI-1, the main alarms that monitor the process conditions that sit over the control panels have an acknowledge and reset function. So when alarms come in and annunciate, the horn can be silenced and the flashing indication of a new alarm can be changed to a solid indication by pressing the acknowledge button.

Some of those alarms have a reflash capability. For example, the alarm might monitor two or three different things, and if one of those has caused it to alarm when it is acknowledged and a second one occurs, it could cause a reflash. That feature is not on all of them; it is on selected alarms.

So if there are multiple alarms that come in at one time, when the alarms are acknowledged all of those will turn solid. When an alarm clears and the reset button is pushed, then all the alarms which have cleared will reset at the same time. Does that answer your question?

MR. KEYSERLING: To some extent. Is there any general abnormal status display such as a display of how many abnormal conditions exist other than the fact that there are solid tiles following the acknowledgement?

MR. BROUGHTON: With respect to the annunciator system, there are just individual windows for various process parameters. There are status indications for certain select systems. For example, the safeguard system has a separate status panel that indicates what the overall system condition is and then, what the status of specific components within the system is.

MR. LIPINSKI: When the annunciator clears, does it flash before you hit the button for reset? Let's say there are a bunch of windows that are lit, and I just pushed a button. One is going to go out, and if I am not watching I will not necessarily see which one went out. Does it flash before you can clear it?

MR. BROUGHTON: Yes, there is a flashing. I forget exactly what the difference is in flash rate between the new alarm and the clearing alarm, but there is a difference.

MR. LIPINSKI: Is there also another horn that comes in?

MR. BROUGHTON: No.

MR. LIPINSKI: It is a silent action? If you look at the panel, you might see a tile flashing indicating a clear condition.

MR. BROUGHTON: That is my understanding. There may be a different horn. I'm not sure.

MR. MOELLER: Well, take a moment and get the answer.

MR. BROUGHTON: One of our people who is familiar with the control room from startup work indicates there is a difference between the two tones of a new alarm and a clearing alarm. We are real handicapped today because we do not have one of our operations people here.

MR. LIPINSKI: Is there a test button to test the lights?

MR. BROUGHTON: There is a test button.

MR. LIPINSKI: Okay.

MR. KEYSERLING: Although it is not clear to me from another section that all lights are equipped with a test button, that is rather an unusual condition, other than the norm that some of the lights will be tested as to whether they work or not during periodic maintenance. But there is not a push to test button on those panel lights. Is that true?

MR. BROUGHTON: All the annunciators have a light test feature, and some of the individual indicator lamps for, say, valve status have some sort of way to test and make sure that that is an indicator that is capable of functioning.

In general, there is not an overall lamp test capability for all of the indicators that are in the control

room.

MR. LIPINSKI: How are your valve indicators wired? Does the lamp go on when the valve reaches the limit to say open or closed? Both lamps are not on if it is neither open or closed?

MR. BROUGHTON: In general, there is both an open indicator and a closed indicator per valve.

MR. LIPINSKI: And it will be on when it is at the limit? What do you see when it is in between the stroke?

MR. BROUGHTON: At TMI-1 both of those indicators would be on if the valve is traveling.

MR. LIPINSKI: Okay. Will you have a lamp check? You should always have a lamp on on the valve. If there are no lamps, one of the two lamps is burned out.

MR. BROUGHTON: Yes, that is correct.

MR. RAMIREZ: In direct response to Dr. Keyserling's question, what I was leading up to is that some plants have three buttons; some plants have four controls. This plant here does not have a separate silent and acknowledge button.

We have established policy in NUREG-0700 from a human factors engineering standpoint on how we think a system ought to work, an alarm system. And all of the licensees and applicants, as I said earlier, will be required to respond in their long-term review to all of

these items in their report.

MR. LIPINSKI: What does 0700 say on the buttons? Three buttons at least?

MR. RAMIREZ: It recommends a silence button separate from the acknowledge button so that you maintain the flashing lights after you silence the audible alarm.

MR. KEYSERLING: And each light would have to be acknowledged separately under that new system?

MR. RAMIREZ: We are suggesting that you can silence the audible from anywhere in the room, but you have to go to the panel to acknowledge it.

MR. ZUDANS: And you do not -- the TMI-1 does not feed the information from alarms to the computer?

MR. RAMIREZ: I think that is one of the questions I am asking and something we have to resolve. I think they do monitor a percentage of the overhead alarms, but not 100%.

MR. ZUDANS: For example, at the other plant I mentioned they have a dedicated CRT, in fact, for them on the main console that are dedicated to alarm systems. And it flashes the value of the parameter of the last annunciator that came on, and it has the capability to recall the history of alarms with some four or five parameters normally, and you get at parameters, too.

MR. RAMIREZ: This is at Waterford?

MR. ZUDANS: Waterford No. 3. Maybe in NUREG-0700

you should look at what they do. I think they are way ahead of you.

MR. MOELLER: Okay, go ahead, Dr. Keyserling, with your questions.

MR. KEYSERLING: Okay. Switching to a slightly different area, Item No. 3 on your slide there talking about controls. One of the things that was mentioned in NUREG-0752 was that there were no security settings on the Bailey controls and that they could be accidently rotated, and I believe the licensee stated that to overcome this problem they would train operators to frequently check these controls as they monitor the panels.

Is there any reason why set points could not be put on the Bailey controls so that accidental rotation could not occur, or is there some other reason why a decision was made not to set these controls or not to have that capability?

MR. RAMIREZ: Okay. One of the reasons we did not push for having locking devices placed on these was that the controls themselves were not in a location where they could inadvertently be actuated. And I believe in some discussions we had with Met Ed people, they felt that the operator -- that they had locking devices on controls in the past and some of them had locked it where they could not get them loose and the operator, you know, from their past

experience, would have difficulty in opening the device when he would have had to open it in a hurry.

MR. MOELLER: Again, could the licensee comment?

MR. BROUGHTON: Yes. I would also add that virtually all of these controllers are ones in which during normal operation, the setpoint would be adjusted. It is not that you do a periodic calibration to set this and it is a setting you want to preserve in the system indefinitely.

The setpoint controllers are actually used during operation to change various plant control processes.

MR. KEYSERLING: Is there agreement from the staff that these controls are in a position where they would not be accidentally rotated?

MR. RAMIREZ: I believe so. Yes.

MR. KEYSERLING: Okay, thank you. Staying in this same area of controls, under 3C there was a comment made during the review that plant convention is violated for auto/manual positions on some multiple rotary position controls. The proposed solution here is to improve the labeling as opposed to trying to come up with some type of plant standard or plant convention.

And I guess I have never been overly faithful in the capabilities of labels, that it would be possible to have some sort of standard or convention. I am curious as to why the staff felt that labeling would be satisfactory in

this condition.

MR. RAMIREZ: Okay. What we are doing is that we are -- since this is relatively new within the NRC and the industry with us interfacing with them from the human factors engineering standpoint, what we are doing is some of these deficiencies that we are finding -- most of them have more than one solution. And since some of these seem to be common throughout the industry, we are, with the advice of our human factors experts, looking at interim fixes or corrections that will suffice for a period of time until we complete the one-year review where all of these things are going to be required to be addressed again.

So when we make a decision on what to do, we want to do it on an industry-wide basis. And we ought, you know, to try to do these things, apply these things on a -- some of these things on a plant-by-plant basis.

MR. KEYSERLING: Are these recommendations going to be part of NUREG-0700 when it comes out?

MR. RAMIREZ: Yes, NUREG-0700 addresses stereo-typical and plant convention, as far as controls displays and everything else in the control room.

MR. KEYSERLING: Okay. Moving on to labeling, which was Category 5, this is actually something that was brought up today, saying that makeshift labeling was observed on many components, including penciled-on switch

number plates or hand-lettered labels and vertical meter scale values with the use of dymo tape. And it says that makeshift labels will be replaced with permanent labels.

My question here is has there been any type of policy adopted, and hopefully implemented, to do away with the use of makeshift labels in the future, because makeshift labels do have a way of reproducing themselves in very vast quantities if you do not do something about it.

MR. BROUGHTON: Yes, there is such a policy to be implemented when the relabeling of the control room is completed. The control room is currently being relabeled now using approved plans which show what labels and demarcation belong on the panels. Those will be controlled plans, and in order to make changes to the control room, we will go through the normal process of engineering reviews and plant changes to alter any labels or demarcations.

MR. KEYSERLING: How is this different from previous procedures which allowed proliferation?

MR. BROUGHTON: Previously, there was not set of plans which specified what the labeling and demarcation would be in the control room. The labeling for a component was specified as part of the system plans and drawings for that component. There was not an integrated control room labeling plan, so that is being established by this program. That is what will give us the control.

MR. KEYSERLING: Those were really all the specific questions that have not come up during previous presentations.

One general comment that I have regarding the review that has been completed is that it really looks at the conditions of the control room at the time that the review was held, and it does not propose any recommendations as to how to prevent some of these human factors problems from coming up in the future.

I think control rooms are a dynamic environment and tend to change rather quickly. Because of this change, makeshift things may get implemented, and it could also be the case if the review was imperfect when it was conducted. I am really addressing this more to the Licensee than to the Board, but I am curious as to whether there are any procedures in the future for trying to prevent human factors problems from resulting in accidents.

For example, is there any plan to implement a critical instance recall program among operators or to meet with operators on a regular basis to try to detect human factors deficiencies that come up during the operation of a plant?

MR. BROUGHTON: I will start with your last question there as to how we interact with operations people on things that might give us insights into human factors.

As part of our procedures for reviewing abnormal events at the plants, part of the data collection and evaluation of that will be structured interview which will look into human factors related areas such that we can properly evaluate them as part of the technical concerns of the incident. So we will have a program that will start to gather data there.

From the standpoint of how would we prevent changes to the control room in the future that might be detrimental from a human factors standpoint, the control room human factors responsibility has been assigned within the Technical Functions group, to a part of the Systems Analysis Department.

So in order to alter things in the control room in terms of additions of instruments or alarms or controls, that particular group now passes on the design of those changes such that the change is properly integrated into the existing control room.

MR. KEYSERLING: In terms of minor events, those which may go unnoticed, is there any way that operators will be quizzed or interviewed to find out have you ever made a mistake reading a display or operating a control that could have led to a problem that you detected immediately and corrected? Is there any kind of critical instance program?

MR. BROUGHTON: That was an element of the control room review which we performed independently of the NRC's

review, and we did have access to operators who have long operating histories at TMI-1 and, in fact, did uncover some problems in the control room using that method. We have not yet established that as an ongoing program for us, but since it was valuable, it is the type of thing we would do again after we began to operate the unit and got more operating experience.

MR. KEYSERLING: I think it is a good idea and a good type of program. The Air Force has been very successful in using it in designing and upkeeping their airplanes, and I do think that should be a regular part of human factors design in the future.

MR. MOELLER: Mr. Zudans and then Mr. Lipinski.

MR. ZUDANS: Probably I will repeat myself. I thought this was a point to put a plug in for dual-scale gauges.

MR. MOELLER: Right.

(Laughter.)

MR. ZUDANS: And to see what is your thinking about that. Do you understand what I mean by that?

MR. MOELLER: Were you here yesterday when this was discussed?

MR. RAMIREZ: No, I was not.

MR. ZUDANS: Okay, I will tell you. You have a pressure gauge, and I suggest that you put the pressure

gauge, pressure scale and the associated --saturated scale on it, the same gauge. And you have next to it a temperature gauge. I suspect you put regular temperature scale and p-saturated under it.

You can, of course, by consulting with human factors experts color them differently, make them different sizes so they do not interfere with each other, and that is a good way of eliminating the need to fish for saturation tables to know where you are exactly.

MR. CATTON: I like an X,Y plotter better.

MR. RAMIREZ: I still think human factors people would disagree with that kind of scale.

MR. ZUDANS: They would disagree with the scale?

MR. RAMIREZ: I do not think they would have a problem with having the scales maybe side by side, but you know, it all depends on the size of the scale, how clearly it is marked. There are other factors you have to consider.

MR. ZUDANS: But has anyone on your staff thought about it, analyzed it, or are you just off the cuff deciding that human factors would be in conflict? Isn't there anyone you know that uses such a scale?

MR. RAMIREZ: Maybe not that particular scale, but there are many plants that have dual scales.

MR. ZUDANS: That particular scale.

MR. RAMIREZ: I have not seen that particular

scale.

MR. ZUDANS: I thought -- but maybe not.

MR. MOELLER: I guess you will just have to keep pushing it, Mr. Zudans.

MR. ZUDANS: Just like computers. Same thing, except this is so simple. Your subcooling meter. It is the same thing. But it needs the hardware in there, a microprocessor to compute saturation temperature, measure pressure. Now, that is an active element, an active instrument. This is just passive. Just nothing to it. And now I am darned sure that you can lay out the scales in such a way that they do not lead to a confusion. You know, if you read temperature, then you know that is the parameter you are reading and pressure is only for your reference.

I feel that human factors experts would probably be able to design the scale that there would be no chance of confusing what are you reading. That would be the only concern, as I understand it. Why don't you think about it?

MR. RAMIREZ: We will.

MR. MOELLER: Mr. Lipinski.

MR. LIPINSKI: You have issued your report with recommendations. Do you plan another site visit to review the control room to see whether changes have been made and do they conform to what you think your recommendations state?

MR. RAMIREZ: We stated in the SER supplement that

we will either arrange for the resident I&E inspector to verify the corrective actions of all that have been implemented, or a member of the HFEB, Human Factors Engineering Branch, would do that.

MR. LIPINSKI: I assume in many cases there is judgment involved in fulfilling the recommendations.

MR. RAMIREZ: In the past what I have done is I have dealt with a resident inspector, for instance at Sequoyah and a couple of other plants, by telephone. I have answered his questions and explained to him what we are looking for for those that he did not understand or did not feel he understood.

MR. MOELLER: Okay, thank you. Thank you, Mr. Ramirez.

MR. RAMIREZ: You are welcome.

MR. MOELLER: We will move on now to the next item. I hope perhaps this is one where we can pick up a little time. It is item 9 on our agenda, and it is the items whose resolution can be delayed until after restart and covering the dates for completion of review and implementation. This will be a staff presentation by Harley Silver.

MR. SILVER: I have prepared one two-page slide which covers the items that in fact are expected to be completed after restart. In the interest of saving time,

perhaps I could -- I did not bring the handout, though.

MR. MOELLER: Is it back at the table?

MR. SILVER: John, perhaps it is the top item in that pile, I hope it is, called Open Items or Requirements Remaining After Restart. I am sorry.

MR. MOELLER: We have it, so go ahead.

MR. SILVER: Fine. Thank you.

The first item is a plant-unique item from the Commission's order. It involves separation of the units insofar as they can be separated in the fuel handling building. There has been a restart modification and there will be a further modification at the first refueling. It is described in Supplement 3 of the SER, and unless you wish to discuss it, I would just as soon leave it at that.

MR. MOELLER: Any questions on this item?

(No response.)

Go ahead.

MR. SILVER: The remaining items on that page and the following slide are items in NUREG-0737 whose date falls due after the anticipated restart date on TMI-1, which for this purpose we have assumed to be October and it is probably now November, but actually I do not believe there are any dates that fall between October and January 1. So that nothing would change on the slide.

MR. MOELLER: Now, on each of these items, though,

I presume you will be maintaining monitoring of their progress.

MR. SILVER: After restart and, in fact, essentially at this time, but especially after restart, TMI will be considered an operating reactor and will be monitored in the same way as all other operating reactors.

MR. ZUDANS: Do you believe --

MR. NOVAK: One point of clarification, and I think it is only for the record I want to state this. What Harley is really saying, if restart is approved, we have been criticized that restart is a given and let's not get that confused. The staff has been reviewing the requirements, the order to see if in fact they were established.

There is a board which will make an initial decision and the committee is, in fact, here dealing with the subject of whether there is a basis to authorize restart; and I think we should just sort of leave it as a statement that it is intended to be carried on if restart is approved. When it does occur, we would certainly treat this plant like any other operating reactor.

Thank you.

MR. MOELLER: Good point. Thank you.

Yes, Mr. Zudans.

MR. ZUDANS: On this slide the 0737 date of

January '82, is that likely to be shaky?

MR. SILVER: I do not know if "likely" is the right word, but I would suspect that many of these dates are subject to change, yes.

MR. MOELLER: Zenons, you were referring to II.F.2?

MR. ZUDANS: All of those that list January 1, 1982, like ICC, for example.

MR. MOELLER: Thank you.

MR. SILVER: To my knowledge, the staff has not yet reconsidered these dates to see if they are reasonable, feasible, possible, or whether they should or should not be changed. To complete the picture I will just put the second slide on.

(Slide)

As noted, in the asterisked notes in the bottom, many of the items, the ones with the asterisks have been evaluated for reasonable progress during the course of our review under the terms of the order. The last item, that is, number 3 at the very bottom of the table has to do with Comission Order CLI-80-21, which deals with environmental qualification of equipment. This is not part of NUREG-0737, but the date there is June 30 of 1982.

That review is in progress, and again, TMI-1 will be treated as another operating reactor.

MR. MOELLER: Now, the two items above number 3

are both dates to be determined? Those are to be determined for all operating plants.

MR. SILVER: That is correct. These are NUREG-0737 dates which were applicable to all plants. There are some minor modifications which I believe are indicated where the staff has recommended slight variations from 0737 in the SER.

MR. MOELLER: Any questions on this page?

MR. ETHERINGTON: I think there was a difference of opinion between you and the applicant on the need for level measurement.

MR. SILVER: That is correct. It is shown on the first slide, II.F.2, just above the middle of the page. The 0737 requirement, of course, remains, and we have discussed this previously and I am sure we will be discussing it again.

MR. MOELLER: Any other questions on the first two pages?

(No response.)

Okay, let's go to the third.

MR. SILVER: That is all I have on this item. In fact --

MR. MOELLER: We had three pages but two pages are the same. Okay.

MR. SILVER: Yes.

MR. LIPINSKI: I have a question.

MR. MOELLER: Mr. Lipinski.

MR. LIPINSKI: Having seen your list of the items that can be deferred, I now conclude that the vent valves are to be finished before restart. I did not go look at the other list, but in looking at the list that the Licensee supplied on May 6 with respect to the special low power test program, they included a table on the restart test planning, and only the remote operated pressurizer vent valve is in that list. The Candy Cane high point vents and reactor vessel remote vent was not on this list.

MR. SILVER: My recollection is that the reactor system vents will not be installed prior to restart but rather in accordance with NUREG-0737 schedule.

MR. LIPINSKI: But that is not on your list for deferment.

MR. SILVER: I believe it is.

MR. CLARK: The first page, II.B.1.

MR. SILVER: Yes, the third from the bottom. I am not sure what the 10/1/81 date is. That may be an error. The Licensee had previously committed to installing the Candy Cane vents prior to restart. They did change the commitment, which we accepted in light of the Commission's order declaring them an operating reactor, so to speak, and did not find sufficient justification to continue.

MR. CLARK: The 10/1/81 is for the pressurizer

vent.

MR. LIPINSKI: That is on your test list. I did not find the other two. Okay, thank you.

MR. CATTON: You ought to go get a DP cell at the same time and be prepared for January 1, 1982.

MR. MOELLER: Any more questions or comments on this item?

(No response.)

Did the Licensee, Mr. Clark, did you have any questions or comments?

MR. CLARK: No.

MR. MOELLER: Fine. Okay, let's move on, then, to the next item, which is item 10 on our schedule or agenda, and this is listed as being one where I guess we will call first on the staff and then the Licensee. Most of the discussion will probably be with the Licensee, but it is a response to the ACRS recommendations contained in our December 11, 1980 report, the status report on restart of the TMI Unit 1.

MR. SILVER: Dr. Moeller, in discussing this with the Licensee we agreed it might be better for the Licensee to go first on this item.

MR. MOELLER: All right, let's do that.

Mr. Clark.

MR. CLARK: On the reliability assessment it will

be Mr. Broughton.

MR. MOELLER: Fine.

MR. BROUGHTON: I intend to go through these slides fairly rapidly because some of the material has been previously covered.

(Slide)

The item we are addressing is the comment that we should perform reliability assessments of the plant as it has been modified, and there are several reasons given for that. It is recommended that this work be undertaken but not necessarily be a requirement for the restart of the plant. What I had intended to cover was what we have done at TMI-1 with regard to evaluating how these many changes have affected the power plant, a few key results from our evaluation, and also discuss our future plans for work in this area.

(Slide)

Briefly, the things that we have accomplished include reviewing each individual modification prior to implementing it to make sure that in fact the net impact on the plant is positive. We have reviewed the collective effect of all these modifications with respect to the licensing basis for the plant as documented in the final safety analysis report, and we have also evaluated the collective effects of these modifications to see what type

of impact they will have on the integrated plant operation, the normal operation that we would expect on a day-to-day basis.

The work that we have planned for the future includes through the test program making sure that our predictions of how the changes will affect the plant are in fact accurate predictions. We are planning to do an integrated probabilistic risk assessment for the TMI-1 plant. That would be initiated later this year. And I will mention some studies that we have under way, which I have referred to here as systems interactions for specific events.

We do not intend to imply that this is the comprehensive systems interaction study that has been discussed in some detail in the past.

(Slide)

Here I have tried to group some of the major changes to the plant in the area of additional alarms and additional indications in the control room. Rather than go through each of these in detail, let me simply point out that looking individually at changes, it is clear that there has been some benefit to it or we would not have put the change in.

When we start to look collectively at the changes we start to see some detrimental attributes. For example, we have added probably on the order of 80 alarms to the

control room during the shutdown period, so in order to accommodate those we have had to add an additional enunciator panel and tried to integrate that into the existing control room so that the additional alarms are really useful to the operator. That presents quite a few challenges in the proper implementation of the design.

The item that I have at the top, the significant improvement, was discussed yesterday by Mr. Chisholm. I would just like to reiterate why we think the changes we have made to the NNI/ICS power supply system are in fact significant. If we look at the configuration of the power supplies prior to the modifications, we found that there were several different failures of individual power supplies which would require that the plant be controlled in a feed and bleed cooling mode, injecting primary coolant into the primary system and exiting it, say, through a relief valve.

The modifications we will have installed before we start up will now allow us to deal with the same power failures, but instead of having to use the primary feed and bleed will allow us to continue to use the steam generators to remove decay heat. So we feel that is significant because it dramatically changes the consequences of one of these power supply loses.

MR. KERR: Will you still be able to use feed and bleed if you need to?

MR. BROUGHTON: We would still be able to use feed and bleed if we needed to. It would now take multiple failures before we were in a situation where we were required to use feed and bleed.

The next two slides I have in there simply summarize that, and I will skip over those.

(Slide)

This group of changes here are ones that could have some effect on the performance of the plant. By that I mean the dynamic response to various initiating events. What we found was that some of the dynamic response changes could be predicted fairly easily ahead of time. There are almost separate effects on how the system might work. But some of the changes were very interactive, and in order to evaluate how that would effect the plant, it was necessary to do some dynamic analysis considering these modifications.

So the ones I have listed on the lower portion of the slide are specific changes which we considered in dynamic plant analysis. They include things like changing the setpoint of the reactor protection system for the high pressure trip, a change in the power operated relief valve setpoint, anticipatory trips on loss of feedwater, and turbine.

MR. KERR: You said these modifications were considered in the dynamic analysis. These are modifications

which have occurred or modifications that you are considering.

MR. BROUGHTON: These are modifications we have made to the plant and will be in effect at the time of restart. And since we did not have any experience in operating the plant with these modifications, we set up dynamic models to study how the plant should respond given these new setpoints and flow rates.

MR. KERR: Thank you.

(Slide)

MR. BROUGHTON: The results of this analysis work is documented in the report that we filed on the restart of TMI-1. We looked at two things. First of all, given these changes, would we effect the licensing analysis as indicated in the FSAR? The conclusion was the licensing analysis still remained valid for the plant. However, we did see quite a few changes in the expected plant response.

The first item under the setpoint inversion of the relief valve and the protective system we did discuss in some detail yesterday, the fact that we will now have more events which will cause reactor trips because of this change.

The last item is one that I want to spend a minute or two on because it is something which we were not aware of until we actually got the analysis results. The change in the emergency feedwater system which initiates all three

emergency feedwater pumps whenever that system is required, versus one pump which was the initial design, does increase the reliability of having the emergency feedwater system on demand.

However, because of the increased flow rates that result from the emergency feedwater system, . also increases the potential for overcooling the system when it is initiated.

MR. ZUDANS: Have you done on this last item any analysis to show how serious it is?

MR. BROUGHTON: Yes, we have. The next slide is an indication of what I mean when I say overcooling.

(Slide)

This is the cold leg temperature in the reactor coolant system, and this would be the time since the plant was tripped and the reactor coolant pumps were stopped. The initiating event might be a l ss of off-site power or a failure of the reactor coolant pump power supply. To take a look at the plant response prior to making this modification, it is this trace labeled one EFW pump.

The plant stabilizes at its design temperature following the initiation of the transient. In the case where three feedwater pumps are started, if they are allowed to develop full flow then we will wind up with a much reduced cold leg temperature which is a result of filling up

the steam generators at a much faster rate than would be the case with one pump.

If this is continued out, the system will come back to the proper design temperature. The transient may take on the order of 15 minutes or so.

MR. ZUDANS: This only shows about a 30 degree difference.

MR. BROUGHTON: Yes. In this case the difference is about 30 degrees.

MR. ZUDANS: It is rather slow.

MR. BROUGHTON: It takes 5 to 10 minutes, that is correct.

MR. ZUDANS: Significant.

MR. KERR: What did you conclude, that it would be better to have automatic initiation with three pumps or one pump?

MR. BROUGHTON: We feel that this is an undesirable situation to have operationally, so we are looking at ways to prevent the overcooling while starting the three pumps.

MR. KERR: I do not understand what that means, an undesirable situation to have operationally.

MR. BROUGHTON: Some of the things that can happen to you in this situation, for example, is since the plant is going to respond differently following this event than the

operator is used to seeing, he may not realize that he has some other malfunction occurring. For example, on top of this problem I have a turbine bypass valve that malfunctions or a steam safety valve that malfunctions. That abnormal performance may be masked, so it may not be possible for the operator to determine whether the plant is doing what it should or not.

So from that standpoint it is undesirable.

MR. KERR: You mean your operators are used to seeing one feedpump come on.

MR. BROUGHTON: That is correct.

MR. KERR: What is to prevent them from getting used to seeing three?

MR. BROUGHTON: With analysis, with training on the simulator we hope we can get them ready to see three before we operate the plant. We prefer to have them ready when we operate the plant rather than let them gain experience through plant operation.

MR. KERR: What are the other negatives of having three come on?

MR. BROUGHTON: If this overcooling is severe enough, pressurizer level can be lost. You can actually [illegible] in the pressurizer.

MR. KERR: Is that the way you expect the plant to perform?

MR. BROUGHTON: This is the way we expect the plant to perform.

MR. KERR: Is that severe enough to affect pressurized operation adversely?

MR. BROUGHTON: It may, depending on the initial conditions For example, if it is a very low decay heat situation, if you have just started up from a long shutdown, this overcooling could be severe enough to cause a loss of pressurizer flow.

The last item that I have on the list is when you do recover and bring the system temperature back up to the normal value, that causes an increase in primary system pressure which may challenge primary relief valves. So again, that is an undesirable aspect of performance that we would like to avoid. Based on these analyses we have --

MR. MOELLER: Let me ask, has the staff examined this in the same manner and do you have any comments?

MR. NOVAC: Dr. Moeller, the specific analysis here we have not seen before. We recognize a number of operating reactors that have what I would call more or less one of a kind steam drive turbine feedwater pumps, for example, that the automatic initation may in fact inhibit the kind of performance they would like to see. We are looking at those plants individually.

The capacity of the feedwater pumps may be more

than you would normally want to see. In other words, there are a number of transients where it would be desirable not to have 300 percent feedwater capacity come on automatically.

On the other side of the coin, we want to make sure that in the event feedwater is required, consistent with a variety of events which may occur where you have had loss of some trains of emergency feedwater, that there are systems that still will come on automatically and it is not required of the operator to bring on a system manually.

Now, what I am really saying in a summary statement is that the staff is reconsidering a number of these requirements individually on operating reactors as the design of the plant as it exists today suggests particular problems, and we have in effect modified this position on plant-specific reviews.

MR. KERR: I think he is saying no. Has the staff looked at this analysis?

MR. NOVAK: For this analysis the answer is no.

MR. BROUGHTON: Based on what we learned from this analysis, we developed some actions --

MR. ZUDANS: Could I make here a remark? Do you have to start one, two, or all three of the pumps? I mean it is automatic starting. The logic --

MR. BROUGHTON: One of the problems with what you need is the decay heat history.

MR. ZUDANS: You know that.

MR. BROUGHTON: I don't know that because it varies. If I have been running for a long time at full power with a very high decay heat level, then starting all three pumps will not give me this severe overcooling.

On the other hand, if I have been operating a very short period of time, after refueling, for example, and I have very low decay heat, this becomes a fairly serious problem. It is a very difficult parameter for the system to measure.

MR. KERR: It is clear they need a computer, Zenons.

MR. LIPINSKI: One pump does the job in all cases, correct?

MR. BROUGHTON: One pump is sufficient in all cases.

MR. LIPINSKI: There is logic that says if I have three pumps, one out of three is sufficient. If the first one up does not succeed, you start a second one up. If it does not succeed, you start the third one, and you can design very simple logic that does not involve computers to do that, automatic start.

MR. BROUGHTON: That is an option. We have considered some other options, and I have listed those on the next slide.

MR. KERR: As I said yesterday, we also design automobiles around this table, so --

(Laughter.)

MR. ETHERINGTON: You mentioned loss of level in the pressurizer. I think in fact a cooldown to 515 degrees will not lose level, assuming you are starting from the middle of the range. Am I wrong on that?

MR. BROUGHTON: I think in this particular transient we did not lose pressurizer level; you are correct. I think it went down to 10 or 20 inches, which is normal.

MR. MOELLER: Go ahead.

MR. BROUGHTON: On this next slide I have indicated what actions we feel are adequate to deal with this over-cooling potential both at the time of restart and in the longer term. We believe that by limiting the flow to the generators, this over-cooling potential and there are three different ways that we are looking at. The first would be to install a passive device in the line, a cavitating Venturi case.

We have modified operating procedures such that they will deal with this event, and operator training has been commenced. In the longer term, the only additional change we might make is to look at the selection of the steam generator level that we feed to following a loss of coolant pumps to ensure that if that is higher than it needs to be, that it is reduced to some point such that we can minimize this over-cooling potential.

MR. LIPINSKI: Your proposal of the Venturi's, is that single Venturi from all three pumps?

MR. BROUGHTON: It would be a Venturi in each of the three lines that feed the steam generators, so we would be limiting flow to the A generator and to the B generator.

MR. LIPINSKI: What is the probability that the Venturi will plug? Do you have any idea what the size of that Venturi is?

MR. BROUGHTON: It is a large Venturi. It is an eight-inch line.

MR. LIPINSKI: I know, but what is the cross-section of the Venturi?

MR. BROUGHTON: I do not know for sure, but it is several inches. It is a fairly large orifice. It is not a series of large holes, for example.

I mentioned that we have planned a probabilistic risk assessment for TMI 1. This is a brief outline of the types of things we would intend to get out of this study.

We would be trying to look at things that were potential risks to the public and also, ways of improving the reliability and availability of the plant. We would try to, in addition to looking at random failures and common mode failures, we would try to address also some common cause events and external hazards. And we would intend to use the results for addressing these areas of public risk and availability.

We would hope to be able to get some feel from this study as to what the relative benefits of one particular modification might be as opposed to another.

MR. KERR: Do you plan to evaluate the relative risk of your old PORV set points and trip points versus the new, which produces trips?

MR. BROUGHTON: We had not gotten to that level of

detail in the study, but I think because of some of the questions that have come up about these things, those are the types of details that we will specify.

(Slide.)

So in summary, while we have not done any quantitative analysis yet, it is our assessment that some of the modifications we have made have resulted in increased complexity to the plant and reduced availability, and perhaps have caused some degraded plant performance.

MR. KERR: What do you mean by degraded plant performance?

MR. BROUGHTON: By this I particularly mean the increased over-cooling potential due to the emergency feedwater system changes.

In order to really be able to quantify the effect of these changes we will need to do a probabilistic risk assessment. The systems interactions studies that we have done are things like the ICS/NNI study. There is a DC power reliability study that we will talk about later today.

I believe those are subsets of what is really intended to be covered by the systems interaction program. What we feel, by studying and looking at specific events, we can gain a lot of the benefit from that type of an approach. And it is our intention to continue to do this same type of integrated analysis that led to the

investigation of emergency feedwater system problems on future changes we make to the plant.

MR. MOELLER: Okay, thank you. Do we have questions on this topic, which really is addressing the first item, then, in the ACRS letter.

MR. ZUDANS: I have one question. I know in the very beginning you talked -- your planned activity in the evaluation and safety and reliability includes systems interaction for specific events. Have you any example that you plan to do that?

MR. BROUGHTON: Yes. One example I gave of something that falls into that category was this NNI/ICS power supply study. We will be talking later today about a DC power reliability study, which I think falls into that category. So we would be focusing on specific events that could have an overall effect on the plant.

MR. ZUDANS: You are not going to, for example, look at control air system, RHR system, versus the reactor coolant system?

MR. BROUGHTON: That is not what I meant by that specific comment on systems interaction.

MR. ZUDANS: Okay.

MR. MOELLER: Other questions or comments on this item?

(No response.)

Okay. The second item listed in the letter was the additional consideration for an unambiguous indication of water level in the reactor pressure vessel. I think we have pretty well finished that yesterday.

The third item was the instrumentation to monitor the position of the pressurizer PORV and safety valves in an unambiguous manner. Does the subcommittee or consultants have comments or questions on that?

(No response.)

Do you want to hear more about that?

MR. CATTON: We heard about that yesterday.

MR. MOELLER: All right. The fourth one is a review of a broader spectrum of accident scenarios to assure better bounding of thermal mechanical effects on the RPV. Now, we have not -- do you want to cover that?

MR. ZUDANS: He just mentioned now -- .

MR. MOELLER: The overcooling. Do you have a presentation on that?

MR. CLARK: Yes, Mr. Croneberger will speak to that.

MR. MOELLER: All right, fine. What we primarily want to do is go over each of these items and just assure ourselves that they have been adequately responded to. I can read while Mr. Croneberger is getting ready the quotes; "that the ACRS believes that the licensee should review a

broader spectrum of accident scenarios with regard to the thermal mechanical effects of high pressure injection or reactor vessel integrity. These studies need not be a condition for restart."

MR. CRONEBERGER: What I am prepared to discuss today are twofold; the actions taken by us on behalf of TMI-1 in both status of the activities to date on the subject of reactor vessel pressurized thermal shock, and also, an indication of what our plans are as far as future actions.

I was also asked and can dispense with it if you choose to recap from a technical standpoint the work that has been submitted to date.

MR. MOELLER: Do the subcommittee or the consultants want to hear the latter part? What does this encompass, primarily?

MR. CRONEBERGER: A summary of the work that was contained in BAW-1648, which was the last report prepared for the B&W owners and submitted here.

MR. MOELLER: All right, we will forego that.

MR. CRONEBERGER: Fine.

(Slide.)

The work to date has all been based upon the transient described here for critical overcooling which involves repressurization, being a small break unmitigated

LOCA with extended loss of feedwater. This investigation is documented in two B&W documents; BAW-1628 and BAW-1648, both of which have been submitted to the NRC for TMI-1 application.

There is also ME-12, B&W owners' group status report, which was submitted to the NRC and there was a follow-up on May 26th which identified our plant-specific plans.

MR. CATTON: Is your plant considered an older plant?

MR. CRONEBERGER: In what context?

MR. CATTON: The staff concluded that pressurized thermal shock is a concern for older PWR vessels having high copper content. Do you fall into that category?

MR. CRONEBERGER: I am under the impression that we do, yes.

MR. CATTON: Okay.

MR. CRONEBERGER: Now, to try to summarize, which is really going back to the last page, then, of what we included that May 26th report, was an indication that there had already been incorporated changes in operating procedures dealing with the thermal shock question.

(Slide.)

That is addressing the throttling backup, HPI flow after achieving a certain sub-cooling margin at the exit to

the core. As was disussed at the prior meeting, we have pursued the upgrading of the emergency feedwater system, trying to minimize the potential for this transient.

We have been involved with the program as far as the reactor vessel material surveillance program, and coupled with that, continued to work with the B&W owners' group on the reactor vessel materials program which they are pursuing.

We are proceeding with a plant-specific evaluation of TMI-1 as it relates to the HPI cooling mode. Item 6 is simply a fact that has already been accomplished. The TMI-1 has always been operated with higher BWST temperatures than were assumed in the B&W analysis. This is simply a recognition of that fact. EPRI is involved with the reactor vessel thermal shock problem and we will be following the EPRI activities.

As Mr. Broughton has discussed earlier, there is work relative to the ATOG effort and guidelines of ATOG as they relate to thermal shock. That is really all I have to say as far as the status of our activities.

MR. ZUDANS: One question. TMI 1 did not have any of that material that gave problems previously.

MR. CRONEBERGER: TMI does have some welds with copper contamination. The TMI situation is different than the exteme case analyzed in the B&W report in that the

critical welds, as concluded in that report which are longitudinal welds directly under the code; that is, the injection point for the HPI flow, indeed, TMI does not have that configuration. The longitudinal welds are located -- .

MR. ZUDANS: I thought you did not have any longitudinal welds.

MR. CRONEBERGER: I have a figure which is not included in the handouts.

(Slide.)

MR. ZUDANS: Oh.

MR. CRONEBERGER: That is the configuration of the welds, and again, HPI flow coming in through here. The cold leg nozzles, and I am not sure which is the worst weld. Longitudinal weld on TMI-1. I think it is one of these two welds, which is well away from the nozzles, and therefore the very conservative, non-mixing type of analyses which were in that B&W report are not too terribly relevant as far as the TMI 1 case.

TMI 1 is going to have to be evaluated making different assumptions as far as mixing up HPI flow, plus the flow coming through the vent valves and down the downcomer. So the situation is substantially different, it we do have some copper-contaminated welds.

MR. ZUDANS: What is the BWST temperature?

MR. CRONEBERGER: Between 75 and 80°.

MR. ZUDANS: You do some heating?

MR. CRONEBERGER: It is insulated. There are heaters in the tank, yes.

MR. ZUDANS: That is substantially different.

MR. MOELLER: Any other questions or comments?

(No response.)

Thank you. We will move on, then, to the next item pertaining to the letter and that is the status of additional studies to identify possible events which might lead to the loss of both battery trains. And I gather Mr. Chisholm is going to handle this.

MR. CLARK: Yes.

MR. ZUDANS: Mr. Chairman, I forgot to ask a question. B&W plants have specific calculations that show you have no problem through aging?

MR. CRONEBERGER: For the worst case, which was Rancho Seco -- .

MR. ZUDANS: For your plant.

MR. CRONEBERGER: To date, B&W activities have been looking at bounding cases and the most critical case evaluated, which was a conservative evaluation, was Rancho Seco. That was either a 1983 or 1984 date for that plant.

MR. ZUDANS: They had similar weld material?

MR. CRONEBERGER: Yes, they had copper-

contaminated welds. In their particular case, the longitudinal weld which was critical was directly below one of the cold leg nozzles.

MR. ZUDANS: You have two things in your favor. One is you have a tire temperature in the water, plus you do not have the weld located in that critical location.

MR. CRONEBERGER: There are some other conservatisms, also. For instance, HPI flow, the pump head -- .

MR. ZUDANS: The cutoff head is lower, right?

MR. CRONEBERGER: Right. A lot of it was bounding, so that the worst conditions as far as HPI flow were concerned derived from one plant the worst possible location, worst possible weld. There were a lot of conservatisms in there, and a number of those conservatisms obviously had to be cut out as they relate to TMI 1 configurations.

MR. ZUDANS: Thank you.

MR. MOELLER: While the next speaker is coming up, did staff get the g value for the Susquehanna plant?

MR. NOVAK: Yes, it did.

MR. MOELLER: What was it?

MR. NOVAK: On the rock it was .10, and for soil it was .15.

MR. MOELLER: Thank you. .10 and .15. Thank you,

those are comparable.

This next topic, at the November 28 and 29, 1980 subcommittee meeting, the licensee reported that you had a study underway to identify possible sources of events which might lead to losing two batteries. So this is what we will be hearing, the progress on that study.

(Slide.)

MR. CHISHOLM: We do have a study underway. It is a formal ongoing study to look at our DC power system. Last January, the ACRS Subcommittee on Electrical Power Systems reviewed a presentation by a staff consultant, I believe, which was on -- it was a probabilistic analysis of the loss of both DC systems. And it was presented as a draft version of NUREG-0666. And we have chosen to make this presentation as a response to that report, and we have prioritized the work we have been doing in our DC system study to take into consideration the issues that were raised in that report.

To summarize the important conclusions of that report, the report broke the types of failures up into two different types called Type 1 and Type 2. Type 1 failure is the failure of the battery, the DC system, the batteries, I guess, on demand and the demand would not occur until there was a loss of offsite power. So typically, that would mean that the batteries are not available for one reason or another, and that would not result in any kind of an

undesirable occurrence until such time as you had a loss of offsite power.

So the probability -- well, first of all, the report stated that in their review of LER's and other data, they concluded that the probability of unavailability of multiple batteries on demand is four times 10^{-4} per demand.

And then they looked at offsite AC power sources, and they concluded that the mean of the system that they had looked at would suffer a loss of offsite power at the rate of .22 per reactor -- per year, per reactor. So that therefore, the unavailability of multiple batteries on demand would be, combining these two numbers it would give you nine times 10^{-5} per reactor year.

I would like to point out that that number is heavily dependent upon what the probability of a loss of offsite power is at a particular plant.

The Type 2 failures would be failures which were directly caused by either an operational or a maintenance error that directly led to a loss of both DC power systems. And their judgment was that the probability of that was six times 10^{-5} per reactor year.

I think there are two significant points that ought to be brought out here. One is that these are roughly in the same order of magnitude. The other thing is that the dominant failures that lead to these events are common mode

failures. In other words, it is not individual failures which happened to occur at the same time, but things that are common mode in nature.

The conclusion was that taking these Type 1 and Type 2 failures, they, by themselves, represent 50% of all of the core damage probability for all the accident sequences that are studied. So that was a very significant conclusion leading to the conclusion that this is a very significant matter.

MR. ZUDANS: What does 50% in this context mean? Does it mean the probability of core damage will be reduced by half -- by a factor of 2, if this is not the case?

MR. CHISHOLM: Yes, yes.

MR. ZUDANS: Now, in absolute -- that is all right.

MR. CHISHOLM: These are the conclusion from the staff report.

MR. ZUDANS: The NUREG .

MR. KERR: Have you reviewed that NUREG carefully enough so that you believe or disbelieve or are skeptical or not skeptical of the results?

MR. CHISHOLM: We have not yet done a similar probabilistic analysis for TMI 1, although as Gary Broughton pointed out, that is something we ought to do.

However, in similar work we have done, for example, at Oyster Creek, our conclusion is that we do not

think that it is quite that high; that this type of failure represents merely 50% of the total.

MR. KERR: Is that because -- well, do you disagree with the numbers or the allocation of this to the total core damage contribution?

MR. CHISHOLM: I will get into this a little bit as we go through it. I think there are features in TMI 1 where I would reduce some of these numbers. And I guess -- I do not have the Oyster Creek data at hand but I did talk to the people who did that study and they do not disagree with this allocation of percentage, 50%.

MR. MOELLER: In the Type 2 failures, if I follow what you are saying, you are talking about the unavailability of multiple batteries to do test operational and maintenance errors. If you make a mistake on one, you probably will make the same mistake on all of them. Is that what you are saying?

MR. CHISHOLM: That is the type of failure.

MR. MOELLER: So you did take that into account?

MR. CHISHOLM: Yes. These are not by numbers. These are the numbers from NUREG-0666.

Okay, what I would like to do is essentially two things. First of all, to describe some of the positive steps we have taken as a result of conclusions and recommendations, and secondly, in order to address this in a

somewhat, you know, quantitative way to point out some of the differences between the TMI 1 plant and a plant that was studied for this report.

MR. MOELLER: Could you move your mike closer or something? You are fading out periodically.

MR. CHISHOLM: There were certain recommendations in NUREG-0666; specifically, they concluded that if certain things were accomplished, the contribution of this DC power failure could be reduced from 50% to about 1%. And these items were prohibiting certain design and operational features such as bus ties between the redundant systems, and I will discuss how we are addressing that.

(Slide.)

Augmenting tests on maintenance activities -- and I will have a little discussion about that -- the third was to incorporate requirements for staggered test and maintenance activities. That is a little more difficult to address.

I think my own conclusion as to what that means, the test that presents the most hazard for losing both batteries is the battery discharge test that is done about once every 18 months. There is a possibility there that somebody discharges one set of batteries, puts them back without restoring the full charge, and then goes ahead and does the same thing on a second set of batteries.

I think what the report was recommending as that that kind of test not be done one after the other, but staggered some months apart.

MR. KERR: Has anyone given any thought to whether that test should be done at all or not?

MR. CHISHOLM: We are looking into that. We are trying to talk to talk to some battery manufacturers to see what the benefits and drawbacks are of those tests. It is a little difficult to stagger those tests because the only time we can run them is during an outage, and it means, like, we do them once every 18 months or something like that. To stagger would mean doing them less frequently.

I think what that test does tell you is, it does give you a good benchmark on where our battery condition is. So I think the way we feel about it right now is that this is a good test to run. We would not want to do it any less frequently than on refueling outages.

MR. MOELLER: I guess you could stagger it as well as have different people do it, both of whom, of course, are qualified.

MR. CHISHOLM: Yes.

(Slide.)

I would like to put up one simplified view of the DC system at Three Mile Island. It has been drawn in such a way as to emphasize some of the things we have been talking

about; bus ties and so forth. The one thing that may not be very clear in here is this is a four-battery system, and I would like to briefly put up another slide to show how these batteries are tied in.

(Slide.)

This gives one-half of the battery system, and this is a full line diagram. One side is a red and yellow battery. Each one is 115 volts. Each one has a separate charger, a red and yellow charger. There is a standby charger which can be switched to back up either one of these.

They are tied together so they are not completely independent. You cannot call it a four-battery independent system. There are 230 volt loads; in fact, most of the distribution panels have three wires going to them.

These lines represent lines to invertors which come off of 115 volts.

(Slide.)

So I will go back to the one line again. I think one of the significant pluses in this system is that we do have standby battery chargers which precludes the need for, for example, if you had to service one of these battery chargers and take it offline. That would mean that this battery was not being charged. That would be a reason for tying these systems together.

So the fact that we do have standby battery

chargers eliminates a lot of the need for tying the system together. The major culprit in the NUREG-0666 study was this type of bus tie. It would be nice if we could eliminte it. There are certain times when we need it. One time when we need it is when we run this battery discharge test.

MR. KERR: In your review of 0666, do you agree that that common tie is a big a contributor to malfunction as that study concluded?

MR. CHISHOLM: Yes, I think it is. I guess I am not prepared to either accept or -- .

MR. KERR: I am not trying to get you to be critical of that study, but that study, the allocation of risk there is a matter of judgment because experience with that is limited. Hence, one, it seems to me in order to use the results, has to examine the basis for that risk allocation before one uses it with much confidence.

MR. CHISHOLM: Without -- you know, without -- I would say for the Type 2 failures, that is the major contributor to it; operational errors that could lead to degradation of the batteries.

What we have done to address that is to first of all, we have put administrative controls on these switches. They are going to be padlocked open. And we have procedures in place that will not allow those switches to be closed except at cold shutdown when the battery discharge test is

run.

I guess there is a certain tendency that if you lost one bus, the operator might try to get certain loads back on. He might then tie these buses together, which leads to the kinds of situations that could leave to failures of both.

MR. KERR: It seems to me -- and I apologize for saying the obvious -- but, it is not enough just to know that something is possible. One needs some sort of feel for how probable it is.

If a man from Mars came down and looked at a two-lane highway which permits traffic to flow in two directions simultaneously, it seems to me he could find all sorts of common mode failures there, and indeed, such common mode failures do occasionally lead to head-on collisions. But it is rather remarkable how many automobiles move past each other going in opposite directions at 55 miles an hour without head-on collisions.

So it seems to me, one, I am simply suggesting that people with operational experience ought to look at those kinds of conclusions fairly carefully before they use them.

MR. CHISHOLM: Okay. I believe that if one had a failure of one system and the operators did not have instructions to the contrary that their first reaction might

be to try to restore some of these loads by tying these two systems together. And we concluded that that is not the right thing to do.

So one thing we have done is we have written two sets of procedures, one for the failure of this bus and one for the failure of that bus. We have given them specific instructions on what he should do to restore power. He takes particular note of not using that bus tie to possibly propagate failures from one system to another.

So, you know, with the procedures that have been written, the administrative controls placed on those switches, we think we have pretty good assurance that those switches will remain unclosed except at cold shutdown.

There is another way that the buses can be tied together. We have two distribution panels down here which feed the 230 kV substations. The reason that they were put in there in the original design was that there was -- it was felt there was a need to make the trip circuits on certain circuits very reliable. However, in reviewing that, we found those breakers already had dual trip coils on them and they were already fed from diverse sources.

So we concluded that the ability to tie these two things together was not needed, and we are disabling this bus tie. That is being removed.

The other reason we are removing it, although this

bus tie is in an area which is a controlled area of the plant where access is controlled, this one was not. It was out of the switch yard.

The other area that we looked at were these two disconnect switches. There was a recent event at Palisades where an operator left both of those switches open after doing some tests. And we looked at that and felt that there was a need also to administratively control the switches. So these switches are being locked closed, and there will also be procedures in place that they can only be opened during cold shutdown. They have to be opened as part of this battery distribution test that we talked about before.

MR. MOELLER: How much more do you have, Mr. Chisholm?

MR. CHISHOLM: Okay, I can go through the rest of it rather quickly.

MR. MOELLER: I think we had better wrap this up.

MR. ZUDANS: We have some -- .

MR. MOELLER: You have some questions? Why don't you ask those?

MR. ZUDANS: Maybe it comes from ignorance but let's take a chance anyway. You have a set of batteries on the extreme right and a set of batteries on the extreme left.

MR. CHISHOLM: Yes.

MR. ZUDANS: Why couldn't you direct the power

from these batteries selectively to either one bus or the other bus and eliminate that other completely? What is the reason you couldn't do that and interlock them in such a way that you can only feed the given bus from one of the battery sources and not from both at the same time?

MR. CHISHOLM: The reason that we need this switch is that when we are discharging these batteries, we open this switch, put a load on here, and then in order to feed these other loads we only have this one battery.

MR. ZUDANS: Which is which? Did you disconnect that one?

MR. CHISHOLM: This one.

MR. ZUDANS: You would have a battery discharge position on, that switch, then. You could read by the similar position of the switch on the other side, both pluses. You do not need the connection where you have it. You have the selector connection at the battery.

Supposing that was a three-way or so switch?

MR. CHISHOLM: Remember, we are talking about switches that --

MR. ZUDANS: But so that the impact connecting switches do the same, don't they? The ones that you have problems with, they also carry 1,000 amperes.

MR. CHISHOLM: I'm afraid I do not understand.

MR. KERR: Are you suggesting that the two buses be connected together permanently?

MR. ZUDANS: In the middle of the picture cut it completely, no connection whatsoever. Take the battery power and send it to either one or the other bus selectively with that switch that is about the battery line.

MR. CHISHOLM: If I understand you correctly, I do not think --

MR. KERR: Tell him it will not work.

MR. CHISHOLM: I do not think it will work.

MR. ZUDANS: I said I should not ask the question.

(Laughter.)

MR. MOELLER: Any other questions?

(No response.)

MR. MOELLER: Why don't you just wrap it up then on your final conclusions?

MR. CHISHOLM: We did come to some conclusions, and I will be very brief here.

(Slide.)

Taking credit -- I did not get into what we have one in the way of surveillance and maintenance testing, but ignoring that and just taking into account several factors restricting the use of the bus ties, the fact that we have a standby battery charger, we also took credit for the fact that I think we have much more reliable offsite power source than is given credit in the report.

We felt that this is a relative reduction in the system unavailability from the numbers in NUREG-0666; but we felt we can reduce that by a factor of .003.

MR. MOELLER: Okay. Well, thank you.

I think this is a good point for a break. We will take ten minutes.

(Recess.)

MR. MOELLER: The meeting will resume.

Prior to taking up the next item, let me remind the subcommittee members th . at the end of the formal exchange of information, I will be polling you not only as to whether -- first as to whether you think this review has reached a stage at which it would be the subcommittee's recommendation for the Licensee to appear before the full committee to have the full committee consider the restart. And secondly, if indeed you agree that the Licensee is ready to appear, what are the topics that will be discussed or

should be discussed.

And then I would also want to prepare for, with your help and that of the consultants -- the consultants would assist on what topics should be presented to the full committee if the subcommittee votes to have them appear, plus what topics would we recommend the committee consider putting in a letter, if indeed the Licensee appears and such an ACRS letter or report is prepared.

We do have a number of items remaining to be covered, and several subcommittee members I know need to leave about 1:00; so I am hoping we can move along.

The next couple of items I think we will take up rather rapidly or cover them rather rapidly. The first one is the response of the Licensee to the additional comments that were in the ACRS letter of December 11, 1980, and these pertain to hydrogen control and filtered venting systems.

Who will be responding on that? Okay, Mr. Wallace.

MR. WALLACE: Sir, if I could indicate just briefly, with regard to that issue there have been a number of intervening events since the last meeting with regard to generic rulemakings and other industry activities, the establishment of the AIF in-core task force and subsequent activities sponsored by that industry group.

GPU has not undertaken any specific activities since the last committee meeting, and I would indicate that

our initial activities really were only in two very limited areas. The first was the hydrogen study which Dr. Catton asked about earlier, and secondly, a very, very microscopic assessment of the capability of the containment to withstand limited hydrogen detonations.

MR. MOELLER: Okay. We will relay that information, of course, on to the full committee. I would offer one comment, that the two items we are discussing are listed as added comments or additional comments to the letter. Even so, however, they simply quote recommendations that the committee had made, you know, in the past in other reports.

So I do hope and encourage you to give them due consideration. And undoubtedly you will be asked, if the subcommittee votes for you to appear before the full committee, you undoubtedly will be quizzed on these two items at that meeting.

Okay. The next thing then on our list is agenda item 11, which is miscellaneous items, several of which we have already covered. The first one though is internal flooding, and there we are referring to the event that occurred particularly at Indian Point, and we want to know -- we talked about it very briefly yesterday, but we would like a report from you, very brief, on what you have done to assure you do not have flooding of your containment.

MR. CLARK: Mr. Wallace will also speak to that.

MR. MOELLER: All right.

MR. WALLACE: Let me summarize first that there was some consideration in the original design of TMI-1 for flooding not only in the containment building but also in other areas of the plant. In that context it was associated with hydrogen pipe break criteria that was developed as a basis for the FSAR.

Since that time we have done a number of other narrow evaluations, but no broad evaluations of flooding. Those narrow evaluations have included considerations of river water system flooding potential within the building. We found there is no river water system failure that we think would be a particular hazard within the building. The systems in themselves are all fairly concentrated in location and go through a heat exchanger vault where subsequent internal systems and heat exchangers are located. So the localization of that flooding would take place in the heat exchanger vault for safety systems.

MR. MOELLER: You say none that you think. Have you done some quantitative analyses to give yourself some confidence?

MR. WALLACE: To the extent we have evaluated -- and I do not mean to propose that this has been an all-inclusive evaluation of all possible flooding sources.

We have evaluated the heat exchanger vault to the extent that for an 8,000 gallon leak, which is equivalent to the largest capacity pump in the river water systems, there would be approximately 30 minutes before you would flood the heat exchanger vault. And we think that that is an adequate amount of time to take the necessary actions for the operator to stop the flooding.

MR. MOELLER: And he would note that this event is underway.

MR. WALLACE: Yes, sir, he would.

MR. MOELLER: And you have looked at the Indian Point event and analyzed that in terms of its implications on your plant.

MR. WALLACE: We have looked at the potential for flooding in the containment building in two ways. There is the capability for non-primary system flooding in the containment building, and Mr. Slear yesterday described our short-term and long-term plans for instrumentation to detect that type of flooding.

We have also looked at major primary and secondary system ruptures and the associated ECCS or secondary fluid additions that could occur to ensure that all the safety equipment in the containment would survive that flooding, and it would not be submerged.

MR. MOELLER: Okay. Do we have any questions or

comments on that topic?

(No response.)

MR. MOELLER: Okay. Let's move on to seismic interaction. Have you studied that?

MR. WALLACE: Again, we have not done a comprehensive study. As Mr. Broughton indicated, there will be certain common cause events that will be considered in our probabilistic risk assessment.

MR. MOELLER: So whatever has been done is being done in your probabilistic assessment.

MR. WALLACE: Yes, sir, I think that is correct.

MR. MOELLER: Okay.

MR. WALLACE: I would mention the other discussion on masonry block walls is the other activity that might fall in that category.

MR. MOELLER: It would, okay.

MR. ZUDANS: Are there considerations in your design where the nonseismic systems might affect the seismic Category 1 structure systems; in other words, the proximity to and interaction in that sense?

MR. WALLACE: Excuse me one moment.

(Pause.)

MR. CRONEBERGER: If I could try to respond to that, for the modifications, the seismic interaction question is being explicitly addressed.

Now, as once mentioned in one area on the masonry block walls, some of the previous design is being reassessed. There has not been any comprehensive re-evaluation of the nonseismic interaction with the seismic or the seismic systems done, although there is no known substantial deficiency in the design either.

MR. MOELLER: Okay. That is helpful. I think I have a basic question that initially I thought applied to both the first two items, but now it applies primarily to the item on the hydrogen control and filtered venting, as well as on some other studies that we discussed yesterday.

It seems to me in reviewing with you a range of different studies that the staff has asked to be done by certain dates and so forth, plus the additional remarks relative to the hydrogen control and filtered venting studies, that several members of the committee asked be looked into, your progress is not all that -- what is the word I need -- it is not sufficient, let's say that, or it does not appear to be sufficient.

Why? I mean is this a shortage of people to assign to it, or simply that it has not ranked high enough in your priorities? What is the -- you know, that is the flavor that I get; and I need to know why.

MR. CLARK: I think two comments on that. On the hydrogen and the vented containment, which are really

generic kinds of issues --

MR. MOELLER: They are?

MR. CLARK: And which are being addressed on an industry-wide basis, and which are the subject of rulemaking, and you know, we are supporting the industry efforts. But I guess we felt that it was not appropriate, considering all the constraints we have, for us to undertake by ourselves a study of those issues in parallel with the industry efforts.

MR. MOELLER: Okay. Then I will take your answer that you are participating in the generic approach on an industry-wide basis, and you are saying, too, that you really did not feel that individually or alone you could necessarily contribute a whole lot to that, is that it?

MR. CLARK: I do not think we feel by making an individual study we could contribute a whole lot more than by being part of the industry study, and I think we felt it would be a significant commitment of resources which is better applied elsewhere.

MR. MOELLER: Okay. That is a response.

MR. CLARK: Also, we felt that since the ACRS letter, since those comments were generated that there have been developments with regard to the industry study and with regard to the rulemaking which in our minds might even, you know, change the opinion of the committee members as to the

need for us to proceed on our own.

MR. MOELLER: All right. Let's go on to the next item which is the status of reliability analysis. We have already covered that.

Now we are going to pick up five or six items which were submitted to us by Mr. Marvin Lewis, a member of the public who has written us several letters, and they represented concerns to him; and therefore, in response to his inquiries we wanted to put them on the agenda, which we have done. And a number of them we have already covered, but those which we have not we wanted to take up at this time.

The first one, the hydrogen gas control, we have already covered. Now, he did comment on the environmental impact assessment for TMI-1, and I realize we do not -- the committee does not make that a part of their reviews in general.

Does the staff have any comments on this that could help us or help Mr. Lewis?

MR. SILVER: Mr. Lewis, of course, is an intervenor in the hearing, and as such I presume is knowledgeable of the discussion that ongoing right now before the Board in fact.

The staff feels that it was not required to produce an EIA or an EIS --

MR. MOELLER: For the restart.

MR. SILVER: For the restart.

MR. MOELLER: Because one had been done already.

MR. SILVER: One had been done during the original licensing. We prepared an EIA which told us that there were no significant impacts beyond the original EIS, and therefore, no further EIS was required. This has been challenged by various of the intervenors, and the Board has not yet ruled on this matter.

MR. MOELLER: Okay. That helps us. I did not have the background on that.

The next one is the status of the block valve investigation. We have discussed that.

Next, the overcooling transients. We have discussed those.

He raised a question which we did not cover in the emergency plan review, the care and feeding of farm animals during an evacuation. Does FEMA -- I guess we should have asked the Pennsylvania group what they were doing.

Do you have comments?

MR. SILVER: This is a contention in the emergency planning portion of the hearing and has in fact been litigated or been heard since the writing of the letter. I can discuss very briefly the outline of what was said.

MR. MOELLER: All right.

MR. SILVER: The thrust of the contention is since farmers have such a huge investment in livestock that they would not leave the -- that is, the farmers would not leave unless the stock is protected.

The testimony presented did discuss ways to protect livestock and sheltering and so forth, and it was made clear that of course the rules do not cover property, which livestock of course is, and that the farmers -- and no one is forced to evacuate, and farmers do have an unfortunate choice of staying with their stock of leaving. And several farmers did testify that they would judge for themselves the severity and threat and make their decision at the time.

MR. MOELLER: Well, might there even be a situation where they could leave and return daily or something to take care of them.

MR. SILVER: This in fact was pointed out by several of the witnesses.

MR. MOELLER: Okay. Thank you.

The next item was a review of the emergency plan. We have certainly done that.

The last item which I will ask the Licensee, if I understood Mr. Lewis' letter properly, he said that the TMI-2 containment was designed and hardened to withstand an airplane crash, and as I read it -- and I hope I interpreted

his remarks correctly -- he said the TMI-1 containment was not so designed.

Is that true?

MR. WALLACE: No, sir, that is not true. TMI-1 was given similar consideration for airplane crash.

MR. MOELLER: The two containments are roughly the same then.

MR. WALLACE: The design basis is the same.

MR. MOELLER: All right. Let's move on then to the last major item on the agenda. Then we all know we have several smaller items that we wanted to cover. That is the startup testing program, and the Licensee will be discussing that for us, and that is Mr. Behrle.

Okay. Thank you.

While he is organizing, you are doing hot functional tests, nonnuclear right now, are you not?

MR. CLARK: No, we are not. We will start at the end of July, I think July 27 or something.

MR. MOELLER: I see you have permission to do those.

MR. CLARK: Yes.

MR. MOELLER: Okay.

(Slide.)

MR. BEHRLE: In an attempt to be as brief as I can, I would like to say that our test program basically

consists of construction testing to verify adequate modification and installation, functional testing to verify adequate design, and then integrated plant testing which verifies adequate system interaction.

Some of the functional testing that we are doing beside modification are to repeat some of the portions of the old functional testing on nonmodified systems, and there was a list of them here. The basis for selection of nonmodified systems for testing was based on important to safety considerations and also how much testing is included in our surveillance program and preventive maintenance program that we now conduct.

(Slide.)

Okay. Our integrated plant testing is broken down into various phases. We have the hot functional test phase, the zero power test phase, and now we have incorporated this low power, natural circulation testing phase and our power escalation test phase.

MR. MOELLER: Now, the low power test, natural circulation testing and so forth then is essentially identical to what is being done on the NTOLs, is that right?

MR. BEHRLE: It is some derivative of that, that is true. There is a list in your handouts of 20 of the major hot functional tests that will be performed. I can quickly run through these, or I can pass them.

MR. MOELLER: All right. Do that, if you will.

MR. BEHRLE: Okay. We checked out the in-core thermocouples that had been added as a modification, set the main steam safety valves. We tested the main steam safety valve acoustic monitors, and we verified the proper operation of the pressurizer heater, level pressure interlocks, and the spray valve flow pressure interlocks, determined pressurizer heat losses and ability to control pressure and saturation margin on one heater bank.

MR. MOELLER: On second thought, I think we probably can read through them. Why don't we just pause a moment?

MR. ZUDANS: Can you explain what "Mod" and "Surv" and other parenthetics are?

MR. BEHRLE: One is modification testing; that is a change that has been made to the plant. The second type of testing we do is the actual plant surveillance testing, so we will verify their surveillance procedures or run the plant surveillance procedures.

MR. ZUDANS: Then you have "RI."

MR. BEHRLE: That is reinitialization testing; that is, you know, the systems had surveillance testing done to it, but we tried to check it out, recheck it. And then the fourth type of testing is the "PMT." That is the preventive maintenance testing where there has been a

maintenance item done.

MR. CATTON: Are you going to take any special precautions to ensure that you get good data?

MR. BEHRLE: We do have test procedures that are approved, reviewed and approved by a technical review and approval group, and that group consists of members of the plant operating staff.

MR. CATTON: That is not what I am referring to. I'm wondering if the fact that you are going through a testing program, you are going to try to get data that would be useful in maybe checking out a RETRAN model of your system.

MR. BEHRLE: I see.

MR. CATTON: Normally the plant process information is not good enough, and you need a little bit of digital recording or something. Has this been looked at at all?

MR. BEHRLE: Yes, yes. We have brought back the reactimeter computer which was used during the initial startup program, and that monitors various plant parameter on the two-tenths of a second scan rate. So we do get very good scanning of the data points.

MR. CATTON: Good.

MR. CLARK: There is in the handout a page with the bases of selection of tests which Mr. Behrle skipped

over in order to save time. At the bottom is plant transient analysis verification.

MR. CATTON: I am really pleased to see that. Most of them that I have seen just run the tests, and I think that is a very important aspect. If you run the tests and do not get that information, I think you are losing something very valuable.

MR. MOELLER: Okay. Any other questions on that?

(No response.)

MR. MOELLER: I think, Mr. Behrle, we are interested in your -- I see your supplemental material here comparing your lower power test program with that of Sequoyah. That we would be interested in.

MR. BEHRLE: All right.

MR. MOELLER: And I guess you have a slide here, your low power nuclear testing.

MR. BEHRLE: I could discuss this slide if you like. That is the bases for selection of tests.

(Slide.)

When we devised our test program, we considered input from various areas and looked at other test programs' test requirements and this other consideration. We looked at normal refueling testing, modifications that were made to the plant, the initial TMI-1 startup program, which complied with Reg Guide 1.68, the natural circulation testing

performed at the NTOL plant, Reg Guide 1.68, testing performed at new plants, plant re-initialization, operator training, procedure verification, surveillance, and plant transient analysis verification. So those form the bases for performing our tests.

MR. MOELLER: Why don't you move on to the comparison with Sequoyah, and then we will see if there are questions.

MR. BEHRLE: Okay.

(Slide.)

MR. MOELLER: You will be the first B&W plant to do lower power tests, will you not?

MR. BEHRLE: To some extent. Davis-Besse in 1978 did some natural circulation testing with the reactor critical at about 4 percent power, and they did lower steam generator levels to see how reduced steam generator levels affected the natural circulation flow rate. And what they really found was they could go to 50 percent on the operating range down to about 35 inches on the startup range without reducing natural circulation flow significantly. They went like from 5 percent to 4 3/4 percent.

MR. CATTON: Pressure is your other parameter, isn't it, in this kind of test? Are you going to be able to put together a map that is going to tell you pressure-temperature boundaries at which you lose the

natural circulation pressure in the steam generator, delta t really?

MR. BEHRLE: I think within the bounds of normal operating pressure that Davis-Besse also determined that that did not significantly affect their natural circulation flow rate.

MR. CATTON: If it is equal, you know that it will.

MR. BEHRLE: There are two things -- I am not exactly sure what you are saying.

MR. CATTON: Two things that drive natural circulation -- elevation and temperature difference between the primary system and the secondary system; that delta t is controlled by your steam generator pressure. You can make a little map of that.

MR. BEHRLE: Actually, what Davis-Besse determined is as long as you have an emergency feedwater flow coming into the steam generator at the high thermal center that the actual water inventory in the steam generator is not that material. I think they also found the pressure variations do not affect natural circulation flow that much either.

(Slide.)

Here is a comparison with the Sequoyah program. There were ten tests required by the NRC for Sequoyah, and then in later considerations the additional NTOLs were required to do eight of these tests with simulated decay

heat, that is, with reactor critical at 3 percent; and then one test was postponed until real decay heat existed, and that was the boron mixing test.

So looking at those tests, the first item was to establish natural circulation conditions, and we included that in our program. The second was to establish natural circulation with simulated loss of offsite power, and we did not include this directly in the program because this was verified during the loss of offsite power tests and initial startup that we did in 1974.

Item 3 was the natural circulation with loss of pressurizer heaters, and we included this in the program. Item 4 was the effect of steam generator secondary site isolation on natural circulation flow, and this was not included in the restart program, since this was verified really in TMI-2.

We operated for several months, quite a few months on natural circulation one steam generator. Natural circulation flow at reduced reactor coolant system pressure. Unlike the Westinghouse plants we do not have an auxiliary spray that is operable without reactor coolant pumps operating at rated RCS temperature and pressure. So therefore, five is kind of an extension of item 3.

We do not use the pressurizer heaters. We let pressure decay, and we let it come down to close to 1,800

pounds. The two are kind of related.

Item 6 was cooldown capability of the makeup and letdown system, and this is not really a natural circulation test; and we did this in the initial startup in 1974, and we have this included again in our startup program in test procedure 651/1; that is the intermediate cooling system flow balance test.

Item 7 was simulated loss of all onsite and offsite power, and we do this in TP 700/2 to some extent. We do it with a secondary heat sink. Okay. So we verify operation of the emergency feedwater system. It is totally independent of AC power. We really do not do that with the primary side because of the degraded conditions you would suffer with loss of reactor coolant pump seals.

(Slide.)

Okay. Item 8 was to establish natural circulation from stagnant conditions. This was the test that was deleted on all the NTOLs thus far.

MR. MOELLER: Could you help us? We can ask the staff, but can you quickly tell us why or what the reasoning was?

MR. BEHRLE: I do not know specifically what the reason was.

MR. MOELLER: What was the reason?

MR. NOVAK: I guess the staff believed on balance

the test was not warranted for the risks involved.

MR. MOELLER: Okay. Thank you.

MR. ZUDANS: How can you establish stagnant conditions?

MR. NOVAK: I would ask Dr. Catton. He seemed to know about that.

(Laughter.)

MR. MOELLER: Number 8, how do you establish stagnant conditions so you could start the test?

MR. CATTON: Let it sit for quite a while.

MR. MOELLER: Go ahead.

MR. BEHRLE: You could do this, just coming up with hot functional test conditions. Stop the coolant pumps and let the plant sit.

MR. CATTON: You could increase the pressure in your steam generator side.

MR. MOELLER: Okay, yes.

MR. CATTON: There are a number of ways you could do it.

MR. BEHRLE: Okay. Items 9, 9(a and (b). 9(a) was forced circulation cooldown, and 9(b) was boron mixing and cooldown. And these items, let's see, the forced circulation cooldown is included in the TP 700/2, so we do have that in the program, and the boron mixing again was verified on TMI-2 because we went from 2,000 to 3,000 ppm of

boron while in the natural circulation mode.

There are two additional tests that we are doing that were not included in the Sequoyah program, and Gary Broughton made some reference to the overcooling potential. So with a very low level of decay heat following our 40 percent reactor trip -- that is, when the set point, level control set point in the steam generator changes from 30 inches to 50 inches in the operating range -- at that time we verified that the operator can adequately control the overcooling using existing plant procedures.

The second test we performed is following a reactor trip from 100 percent power, we cut off the emergency feedwater flow and verify or try to determine what level, if any, lower than 50 percent on the operating range will sustain natural circulation.

MR. ZUDANS: I have a question. I do not quite understand. You do not have a heat sink. How can you expect natural circulation or is it --

MR. BEHRLE: In this last test here.

MR. ZUDANS: You do not have emergency feedwater, so you have no feedwater flow at all.

MR. BEHRLE: It is the sequence by which you establish your test conditions. In other words, at the 100 percent trip you still have reactor coolant pumps running, so we're still in a forced circulation mode. And we have an

adequate inventory in the steam generator, we are at 50 percent; so then we trip the main coolant pumps and let flow coast down so you've already had forced circulation established. And we have shown by analysis that with a 50 percent level water inventory on the operating range that you have got enough water in the steam generator to continue natural circulation should you have no emergency feedwater at all.

MR. ZUDANS: For how long?

MR. BEHRLE: Well, these are some of the kinds of things that we are going to see.

MR. ZUDANS: For a few seconds?

MR. BEHRLE: No. The 50 percent level, if you get the level at 50 percent would continue natural circulation.

MR. ZUDANS: You do not have anything to feed the water into.

MR. BEHRLE: We would continue feeding in with the main feedwater system. The main feedwater systems comes in at nozzles that are lower in the steam generator, so the thermal center is lower.

MR. ZUDANS: Okay. You have feedwater. If you do not have emergency feedwater, for sure you do not have the main.

MR. BEHRLE: We keep that going, right.

MR. ZUDANS: Okay.

MR. MOELLER: A question. I notice some exchange of correspondence regarding your hot functional tests, and I presume these are the ones that you hope to start in a month or so. And the question was you wanted to do these while by-passing your charcoal filters in the emergency building ventilation system.

Are you familiar with this?

MR. BEHRLE: No.

MR. MOELLER: I gather that they were painting at the same time, and they did not want to poison the filters; and so what they had to get was a tech spec exemption, in essence.

VOICE: That is absolutely correct, what you are saying, and that is to protect really the filters.

MR. MOELLER: Okay. That helps. All right. Any other comments or questions on the startup testing program?

Yes, Tom Novak.

MR. NOVAK: One brief question. Excuse me if you have mentioned it. Do you have any specific tests that will lend any additional information to the vent valve behavior and/or mixing related to the thermal shock problem in the downcomer?

I was just curious because of the fact that you can only use the exit water thermocouples. I wonder if the mixing problem under natural circulation and the cooldown,

whether any insights at all might be gained from some of these specific tests you are going to run.

MR. BEHRLE: We are not installing any special test instrumentation.

MR. NOVAK: I did not suggest you should. I was just wondering if, looking at the spectrum of tests, whether any insights as to the mixing problem, which is a significant consideration in the overcooling transient, might be gained from this.

MR. BEHRLE: Gary might offer some help on this. We had not addressed the program with that in mind.

MR. NOVAK: Thank you.

MR. MOELLER: Any other questions?

Yes, Walt Lipinski.

MR. LIPINSKI: You have a vu-graph labeled "Nonmodified Systems." Instrument air is at the top of the list. Is the instrument air connected to the plant service air?

MR. BEHRLE: There is a connection. That is normally the valve closed.

MR. LIPINSKI: On Unit 2 it was open.

MR. BEHRLE: On Unit 2 I believe it was open, inadvertently opened.

MR. LIPINSKI: There is a cross connection, but it is a normally closed connection.

MR. BEHRLE: I believe that is true.

MR. LIPINSKI: Can anyone answer that? On TMI-2 they shoved the water into the instrument air line.

MR. ZUDANS: Why would the connection be there unless the instrument air is inadequate?

MR. LIPINSKI: It is a backup, I believe.

MR. BEHRLE: There are various levels of backup.

MR. MOELLER: Can we get an answer for Mr. Lipinski?

MR. WALLACE: We can certainly research it.

MR. MOELLER: All right. You do not have someone here. Okay.

Now, on May the 1st you were to submit your low power or your startup testing program. Did you submit that to the NRC?

MR. BEHRLE: We submitted it, I believe, on May the 5th.

MR. MOELLER: Okay. That is all right. And you are now reviewing it.

VOICE: That is correct. We are in the process of reviewing their program.

MR. MOELLER: If they came before the full committee at the July meeting -- when do you plan to have that review completed? I mean, I am curious just in terms of the schedule.

MR. NOVAK: I think we could speak to the committee on the progress of our review.

MR. MOELLER: All right. In the July meeting. Okay.

Ivan Catton.

MR. CATTON: I have a question relating to the air problem. I heard rumors that there was a wiring error lead to the second condensate pump and that this caused the pump following -- the first one was impacted on by the water in the air lines. The second went out because of some wiring error. Is that true or is that just rumor, does anybody know?

MR. WALLACE: I understand what you are asking and I have heard both sides of the discussion, and my recollection is that there was -- there were some condensate system errors which had -- ended up with a different relationship between the condensate pumps and booster pumps that resulted in additional pump trips after the first pump trip.

MR. CATTON: Just for the sake of completeness, if there is anything that is written up on that, I would like to get a hold of it. I have been operating under the assumption that it was just the water in the air, that was the total problem; and now there was a wiring error or something that existed from time zero. Many of us involved

following TMI were unaware of that.

MR. WALLACE: We will look and see what exists.

MR. CATTON: Thank you.

MR. MOELLER: Other comments or questions on the startup program?

(No response.)

Okay. Let's move on. Taking the extra added items, the first one is security for which we have to clear or go into closed session, and the staff is prepared to comment on that.

How long are we talking, ten minutes or --

VOICE: However long you want.

MR. MOELLER: Well, why don't we plan to close the meeting for approximately 15 minutes?

MR. ZUDANS: Mr. Chairman, you have another item that is open. Maybe the sequence should be swapped.

MR. MOELLER: Well, we could do that. That is a good suggestion. It flashed through my mine, too. Let's then, we will close at the very end rather than now.

The health physics appraisal program and your response, do you have someone to spend a few minutes bringing us up to date on that?

MR. CLARK: Yes. We have both Mr. Brazer and Mr. Potts. Mr. Potts is in charge of the radiation program at TMI-1 with his own organization. Mr. Brazer has the TMI-2

radiation program and the general support services such as dosimetry, so he is also involved.

MR. MOELLER: Okay. What we would primarily like is five or ten minutes in which you tell us what changes you have made or implemented in response to the health physics appraisals that the NRC teams performed.

MR. BRAZER: I am Jess Brazer. I am filling in for Dick Heward who is recovering from an operation.

To characterize the program at Unit 1, I think if we go back and give you a few minutes of historical data that says that we compared to a pre-1979 program up to date, I think it would be fair, more than fair to characterize that as an order of magnitude improvement in the program.

This was made possible by a single factor, in my opinion, and that factor is the recognition by management of the need for improvement in the program and the dedication to support the program to see that it was improved and continued to improve.

This began to take place in 1979. The management attitude, the top management attitude that recognized the improvement need, that single factor then permits all of the other shock wave, if you will, of improvements that have taken place in the Unit 1 organization and the dedication of resources to improvement of the program.

There is hardly an area that we cannot quantify as

greatly changed and improved in the program. It began, I think, after the recognition of management and dedication of management to the program with a restructuring of the organization, of pulling it out of the function that it served before into an independent organization with a vice presidential level individual reporting to the president that took charge of the organization.

The organization itself was restructured into greatly expanded personnel, both in technical capability and in size. I believe it has been characterized as a factor of five increase in the program.

At the time of the Unit 1 evaluation last summer the NRC came in and saw literally a moving target, and that target was on the upgrade because all of the improvements that had been incorporated in the program, the procedure changes, all of the many aspects of the program to make an order of magnitude change in the program is obviously not done overnight. So therefore, when the NRC came in, they looked at a dynamic program, an improving program.

I think we basically appreciated the NRC's review, the comments they had, because it is not often we get a free audit and free advice on how to improve things.

MR. SILVER: We can do that again any time.

MR. BRAZER: I am sure you will.

MR. MOELLER: In terms of your staffing are you

moving toward more in-house capabilities as opposed to contractor support?

MR. BRAZER: Yes. I do not have an exact number, but Bill Potts is more prepared to talk about the precise numbers of contractor versus company employees.

MR. POTTS: On the TMI-1 staff it currently employs two contractors. The rest of the staff for rad con are GPU Nuclear personnel. That staff includes myself as manager, the manager of rad engineering, six engineers, the manager of field operations, a requirement or commitment for six foremen -- I presently have seven -- a commitment for 30 field technicians, and administrator, and a group of four clerical support personnel.

MR. MOELLER: What is your educational background and experience?

MR. POTTS: I have a B.S. in electrical engineering from Penn State. I have been associated with the TMI-1 project since about 1970 in various capacities. I have been superintendent of technical support on TMI-1, supervisor of quality control for Met Ed, supervisor of licensing, both fossil and nuclear licensing, for Met Ed.

MR. MOELLER: Thank you.

Any questions or comments on the discussion or the presentation?

(No response.)

MR. MOELLER: Well, thank you.

MR. CLARK: I would like to add just one thing. We feel a fundamental element of the rad con program has been to move from where the rad con people did work, with no offense to Potts and his people, to where the plant staff does the work and the rad con people set the rules and monitor. And you get out of the potential conflict of checking yourselves. So we have implemented that, and we have also separated the rad con people from the chemistry, so we have people whose sole job is seeing that rad con things are done right, and we think that has been very important.

MR. MOELLER: Thank you.

Normally, we would have called on the staff here for their response, but we heard that yesterday during that day of meeting.

Okay. The next item in the open session and the final one is the separation of Units 1 and 2. Who is the discussor on that?

MR. WALLACE: Dr. Moeller, I will address it. In part, I think you heard about 75 percent of the discussion already. If I could just summarize a couple of the points where we have affected separation between the units.

We affected separation in the ventilation systems by adding barriers in the auxiliary building and fuel

handling buildings to isolate any potential hazards that occur in the fuel handling building floor area, Unit 1 or Unit 2; so there could be no effect back into the Unit 1 activities.

We have isolated the sampling systems, which is the previous interconnection Mr. Slear talked about briefly yesterday. We have separate rad waste facilities being established both for Unit 1 and Unit 2, so there is ability to process necessary rad waste in each unit, so there is no dependency between the units.

MR. MOELLER: When you say you have separated on the rad waste systems, you have not cut the lines. What, you put a valve in it and locked it shut or what?

MR. WALLACE: With regard to the process transfer lines, those lines are administratively controlled to preclude transfer, but because of certain concerns in Unit 2 about the contingency storage activities, we have not physically disabled those lines. So under some circumstance in Unit 2 there would be the possibility to transfer, but currently it is not relied upon. It is just not physically disabled.

MR. MOELLER: Okay.

MR. WALLACE: Finally, the only place where there is a shared rad waste facility, there will be some rad waste storage, although it will be segregated storage in the Unit

2 facility for some solid rad waste from Unit 1. That will
2 be administratively controlled, identifiable, recoverable,
3 and so forth.

4 MR. CLARK: After Unit 1 takes its rad waste and
5 operates on it and packages it, then it is shipped down and
6 stored at the Unit 2 end of the island.

7 MR. MOELLER: All right. We understand. Any
8 questions on this?

9 (No response.)

10 MR. MOELLER: All right. Well, there being none,
11 I think then that does bring us down to the discussion of
12 the security for the plant, and we will go into closed
13 session. Give us about 15 minutes, and then we will reopen
14 until the conclusion of the meeting.

15 We will ask that Mr. Clark confirm that only his
16 people are with him, and Harley, if you will confirm that
17 only your people are here.

18 (Whereupon, at 12:20 p.m., the committee went into
19 closed session.)

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(Whereupon, at 12:35 p.m., the committee resumed its meeting in open session.)

MR. MOELLER: Okay, continuing on with the meeting will now wrap things up, and I will first ask the question of our subcommittee members; that is, do you believe this plant is in a sufficient state of readiness to bring the review to the attention of the full committee?

Mr. Mathis.

MR. MATHIS: I think it is.

MR. MOELLER: And Mr. Etherington.

MR. ETHERINGTON: Yes.

MR. MOELLER: And I already had a response from Mr. Kerr prior to his departure, and he expressed the same opinion. Okay. Then having agreed that we would have them appear at the July full committee meeting, the first question is what are the topics that the full committee should hear, what are the prime topics for them to hear?

Let's just take some things like the emergency plan. What are your thoughts there? I notice Mr. Kerr had listed it. It is important.

MR. MATHIS: I think it is particularly important.

MR. MOELLER: All right. Emergency planning status.

MR. MATHIS: They will ask for it if we don't tell them.

MR. CATTON: Particularly some comments about the exercise.

MR. MOELLER: Fine. And the exercise. Okay. Give us some other topics. They have these numerous studies in progress -- the PORVs, the ECCS system outages. We could go forever on the instrumentation for inadequate core cooling.

What are your thoughts there? How much of that do we want?

MR. ETHERINGTON: We might provide a list of some of these items and let it be on a specific question for the committee.

MR. CATTON: Met Ed seems to have rather strong ideas about not meeting the instrumentation. It might be a good idea for the full committee to hear about it.

MR. MATHIS: That is one of the comments I had here. Let's just take this water level problem.

MR. MOELLER: All right.

MR. MATHIS: That one, I think there is going to have to be some give and take in that situation, or the committee is going to be very upset. Now, maybe both sides -- you are not cast in concrete, but that one leaves a very bad impression in my mind. I don't know about the rest of the people around the table, but that one worries me.

MR. CATTON: Some of the committee members have

strong opinions on that as well.

MR. MATHIS: That is true, but we don't count.

MR. MOELLER: As we said yesterday, there was convergence in that the Licensee pointed out that if you are looking at water level inventory or looking at adequate core cooling, they are more receptive than specifically looking at a pressure vessel water level indicator.

Now, I think the staff gave the impression, too, that they are not set on a water level indicator. They are willing to look at other things that might be better.

MR. CATTON: It is inventory that you are looking for.

MR. MOELLER: Right, definitely.

MR. CATTON: The water level is a small piece of it.

MR. ZUDANS: I think it was brought out yesterday, the staff is moving in that direction.

MR. MOELLER: That is right.

MR. ZUDANS: It becomes synonymous with them.

MR. CATTON: If they have it on a screen, it is easy.

MR. ZUDANS: That is right.

MR. NOVAK: My only comment was I think most of the agenda for the subcommittee really came about as the issues still to be resolved. There is still that very broad

area where we effectively reached resolution, and the Licensee is, in our opinion, conforming to the orders; and I think in light of that we should consider what are the topics to be considered.

A number of these we spent a lot of time on. I would consider in their true merit they are residual items; for example, PORV probabilities and so forth. I would not put too much weight on the overall picture. It is an ongoing review, and where we are today it is still under review, and perhaps that was the reason for the discussion in today's meetings.

MR. MOELLER: Okay. Let's put down some things that will not be on it. I do not think they should talk about the masonry walls.

MR. MATHIS: No.

MR. MOELLER: Nor the containment spray additives, and we have just heard maybe not about the PORVs. Okay. We will scratch it at the moment.

MR. CATTON: But people in this question of scrams or --

MR. MOELLER: Oh, yes, that is right. Okay. That part of it is important. Okay, yes. Whether it increases risk and so forth. We will put that on.

MR. ZUDANS: That is really not TMI-1 specific.

MR. MOELLER: No. It is generic. That is why I

wondered a little bit.

MR. ZUDANS: I thought that the main committee might like to hear how the management organization has progressed, and in particular, I was affected by the dedicated maintenance principle. It sounded like worth knowing.

MR. MOELLER: Okay. Let's put that down. Let me just propose that we not cover security.

MR. MATHIS: No.

MR. MOELLER: Okay. We will put security as something we will not bring up. We are going to be crushed for time anyway, really crowded for time at the full committee meeting. I do not know -- I think we will put down the hydrogen control and the filtered vented containment. Dr. Okrent is going to want to ask about it.

MR. ZUDANS: I think purge valves fall in the question of containment isolation.

MR. CATTON: Just the fact that a hundred percent of the time they can be left 30 degrees.

MR. ZUDANS: That is what they affect. It just does not sound right to me.

MR. MOELLER: I do not think we need to talk -- well, I don't know. What about the control room habitability?

MR. MATHIS: No.

MR. MOELLER: Okay. Scratch it.

MR. MATHIS: The battery train discussion I think in an abbreviated fashion. That question comes up all the time.

MR. ZUDANS: I tried to fix the design, but I was shown exactly the same thing.

MR. MOELLER: Do you think that should be on the schedule then?

MR. MATHIS: I would recommend it.

MR. MOELLER: Have the speaker reduce it to about a third.

The reliability assessments.

MR. MATHIS: A brief comment on that would be in order. Again, it is going to be a status report.

MR. MOELLER: You know, I think we will maybe list all of these studies in progress, but just name two or three that ultimately you will present.

MR. MATHIS: One comment in that regard, Dade. I think any of these kinds of things that show -- I will be blunt -- management attitude I think are very helpful. Which direction are you thinking, where are you going? I am sure you cannot have accomplished all these things, but the fact you are moving in a particular direction is very important.

MR. MOELLER: What about the scenarios to assure

better bounding of the thermal mechanical effects? Do we need to discuss that? Let's say no.

Okay. What other things now?

MR. ZUDANS: The startup test program.

MR. MOELLER: Yes. The startup.

MR. CATTON: I think something particular should be emphasized, the reactimeters and so forth.

MR. MOELLER: On the startup test program how you mainly compare Sequoyah to you; mainly that is important, plus what your selectives are, objectives, and the comparison.

Any other things?

MR. ZUDANS: On separation of Unit 1 and 2, it may be not so important, but it is of interest.

MR. MOELLER: It is very important, but you know, I do not know how much we gain by them telling us once again what they have done. We have heard it. I think we can vouch for it.

MR. CATTON: The committee might be interested in the Udall report.

MR. ZUDANS: No. I would be against that. I think there is too much emphasis on that kind of thing.

MR. MOELLER: Okay. What we want now -- yes, Walt.

MR. LIPINSKI: At the very beginning are you going to have the staff present their summary?

MR. MOELLER: Oh, yes, that is automatic. I am mainly trying to get key critical items, particularly in terms of the Licensee.

Let's move on then in terms of any report that we might consider submitting to the full committee for consideration. Of course, the full committee will name -- if after listening to this they decide to write a report, they will certainly decide themselves what to put in it. But what are some items you think -- what are some key questions that should be in the letter?

MR. CATTON: I think a strong statement about management.

MR. MOELLER: What about it? In favor of it?

MR. CATTON: I think in favor.

MR. ZUDANS: Greatly in favor.

MR. CATTON: I've been following TMI-2 since the day it happened. The change has been quite dramatic.

MR. MOELLER: All right. Okay. What else, problem areas that we probably will want to cover?

MR. ZUDANS: Am I allowed to say computers?

(Laughter.)

MR. MOELLER: What do you want?

MR. ZUDANS: In the previous meeting they showed -- I want to point out they are in the forefront of the utilities.

MR. CATTON: Wasn't that presentation made before the full committee the last time?

MR. MOELLER: Yes, I think it was.

MR. ZUDANS: This is the final letter or something like that.

MR. CATTON: I thought the letter was written following that other meeting.

MR. MOELLER: In fact, we commented on management in the last letter, but we will look at what we commented on.

MR. ZUDANS: Management has not become worse; it has improved.

MR. CATTON: That is right.

MR. ZUDANS: The computers are sort of --

MR. CATTON: That is true.

MR. ZUDANS: That is my impression.

MR. MOELLER: What would be your comment about the response of the Licensee to this range of studies that they have been asked to do? Now, Mr. Clark said, you know, that the vast majority of the topics to be covered were generic; they are keeping up with what the owners group, what EPRI and INPO and everyone is doing, and that is why they have not undertaken a separate effort on their own.

What would be your reaction or what would be your comments on that?

MR. CATTON: My own reaction to that is a little

negative. I think depending on others to do your work is not a good idea.

MR. ZUDANS: Yes, but look at the overcooling transient. Now, what could they do?

MR. CATTON: You mean the thermal shock problem?

MR. ZUDANS: B&W has to do the plant specific analysis anyway. They are not equipped to do it. I do not think it is negative on that count.

MR. MOELLER: Well, they could, though, project a better impression if they had brought in an EPRI person or whoever, the B&W owners group or someone brought them in and said we are not doing it independently, but we are supporting them, and here is Sam Smith who is going to tell you the great progress being made.

MR. ZUDANS: Maybe they should be specific.

MR. MOELLER: Right. They should be more specific, and they might consider bringing in someone who is leading the generic study that they are supporting to show the committee that they are aware of what is going on, because we did not get that impression.

MR. CATTON: That is right. Bring some of their own people in who can clearly demonstrate that they are right on top of it.

MR. MOELLER: Right, right.

MR. CATTON: I think we would lean towards the

latter rather than for a very brief appearance bring in EPRI or --

MR. MOELLER: Right.

MR. CLARK: And somebody, you know, demonstrates that we are in fact involved; we are not just saying --

MR. MOELLER: Okay. Show your involvement in terms again like filtered vented containment. There is a subcommittee meeting next week in Albuquerque, an ACRS subcommittee meeting on this, and there have been reports on it. And you know, the Licensee could have shown a lot better where they are up to date with these things.

MR. CATTON: Perhaps they could send someone to attend that meeting.

MR. MOELLER: Yes. The subcommittee meeting next week, yes. It is Tuesday, all day.

MR. CATTON: In Albuquerque.

MR. MOELLER: All right. And for example, design studies of hydrogen control, we had a subcommittee meeting Monday and Tuesday with the NRC staff, and they reviewed a number of novel approaches being considered for hydrogen control as part of their research program which you might get up to speed on.

Other things for the committee report? Any other, you know, major items that any of you can think of that we should have in it?

MR. ETHERINGTON: We might look at our previous letter and see if there is any followup on the previous letter.

MR. MOELLER: Right. We are doing that.

MR. CATTON: I think the relative risk question is important enough. If it is worth reporting, it ought to go into the letter.

MR. MOELLER: Pardon?

MR. CATTON: The relative risk question.

MR. MOELLER: Now, relative risk, be more specific.

MR. CATTON: PORV openings versus scram.

MR. MOELLER: Definitely. It is a generic problem, but we will want to point it out in the letter.

MR. CATTON: It comes up everywhere. It came up when we were looking at pumps on, pumps off.

MR. ZUDANS: Maybe a broader question should be addressed then. There are a great number of various hardware changes. I do not think that they will be ready by July.

MR. CATTON: Here is one where the question has been raised many times.

MR. ZUDANS: I agree. I do not disagree. Just broaden the scope.

MR. MOELLER: Okay. And of course, the subcommittee meeting --

MR. MATHIS: Dade?

MR. MOELLER: Yes.

MR. MATHIS: Tom, did you have a comment?

MR. SILVER: No.

MR. MOELLER: A number of -- as was reflected in the subcommittee meeting, a number of times when we were discussing a leftover problem or remaining area in terms of TMI-1, it was quite clear that we were discussing a generic problem that has been debated for many months, but I felt personally that perhaps we brought the question, at least for me personally, up to date, so that I have a better understanding of it.

Rick, do you have any comments?

MR. MAJOR: No.

MR. MOELLER: You think we have everything we need now?

MR. MAJOR: Right. We have emergency planning.

MR. MOELLER: Yes, yes. Okay. Well, if there are no more comments --

Mr. Clark, did you have a final wrapup comment or something? I am supposed to give you that opportunity.

MR. CLARK: I do have a question on the full committee meeting in terms of how long you think the meeting is, or do you yet know that?

MR. MOELLER: It is probably three hours, and you

are never brief enough. I mean crystal clear, well-organized presentations. Don't let anyone get up and tell his life history.

MR. ETHERINGTON: Don't let anybody interrupt you.

(Laughter.)

MR. MOELLER: Let me thank the staff and thank the Licensee. It has been two or one and a half long, rather grueling days, and we do appreciate your coming in and bringing us up to date on what you have done and are doing. And with that then I will declare this subcommittee meeting adjourned.

(Whereupon, at 12:52 p.m., the meeting was adjourned.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

in the matter of: ACRS/Subcommittee on Three Mile Island Nuclear Station Unit 1 Restart

Date of Proceeding: June 26, 1981

Docket Number:

Place of Proceeding: Washington, D. C.

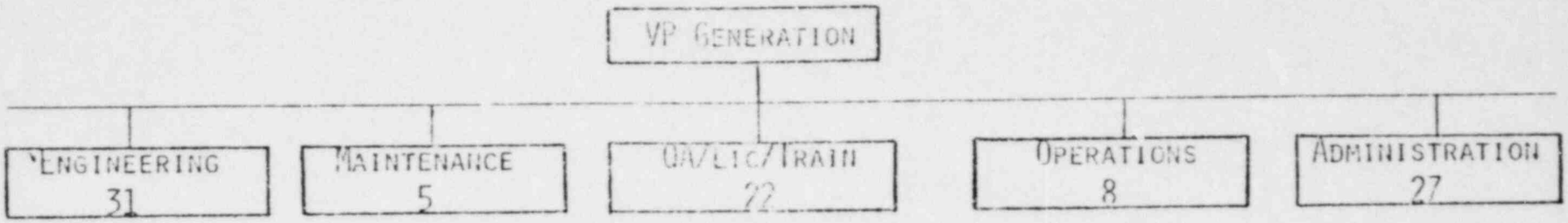
were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

David S. Parker

Official Reporter (Typed)

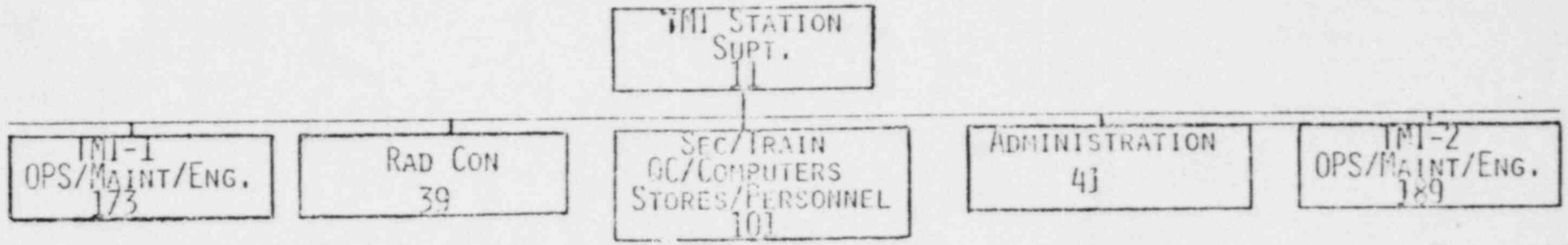
(SIGNATURE OF REPORTER)

MET ED CORP. (3/28/79)



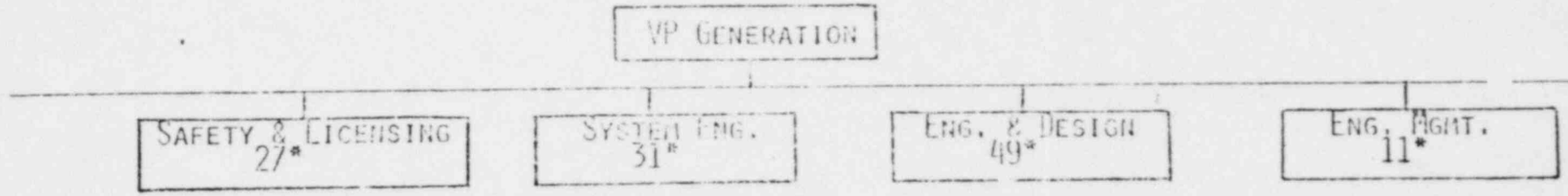
TOTAL - 93

IMI (3/28/79)



TOTAL - 434

GPU SERIVCE (3/28/79)



TOTAL - 108

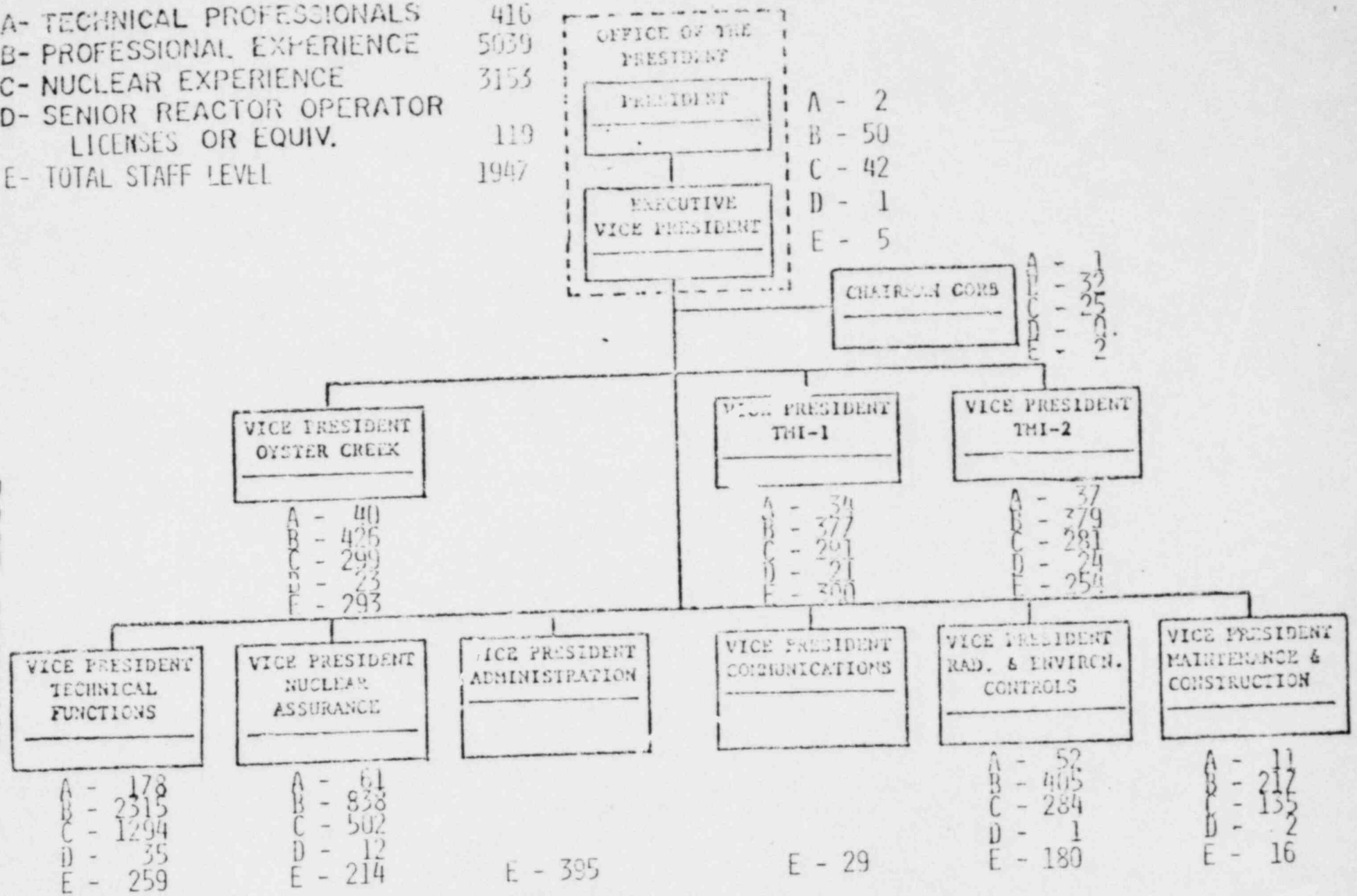
GRAND TOTAL - 635

*TECHNICAL PROFESSIONALS
STAFF LEVEL ONLY

GPU NUCLEAR

SUMMARY

A- TECHNICAL PROFESSIONALS	416
B- PROFESSIONAL EXPERIENCE	5039
C- NUCLEAR EXPERIENCE	3153
D- SENIOR REACTOR OPERATOR LICENSES OR EQUIV.	119
E- TOTAL STAFF LEVEL	1947



GPU NUCLEAR

MAJOR ELEMENTS

- FULL TIME ORGANIZATION DEDICATED SOLELY TO NUCLEAR GENERATION
- INCREASED ON-SITE TECHNICAL AND MANAGEMENT RESOURCES
- STRONG CENTRAL TECHNICAL CONTROL
- FULL TIME ON-SITE MANAGEMENT FOR PLANT OPERATION AND MAINTENANCE - - WITH SUPPORT IN ADMINISTRATION, ENGINEERING, RADIATION PROTECTION, AND OTHER AREAS BEING PROVIDED SEPARATELY
- INDEPENDENT NUCLEAR ASSURANCE DIVISION - ENCOMPASSING TRAINING, QUALITY ASSURANCE AND A NUCLEAR SAFETY ASSESSMENT DEPARTMENT
- POOLING OF RESOURCES FOR SUPPORT OF SEVERAL GENERATING STATIONS
- PERSONNEL POLICIES AND PROCEDURES APPROPRIATE FOR NUCLEAR GENERATION

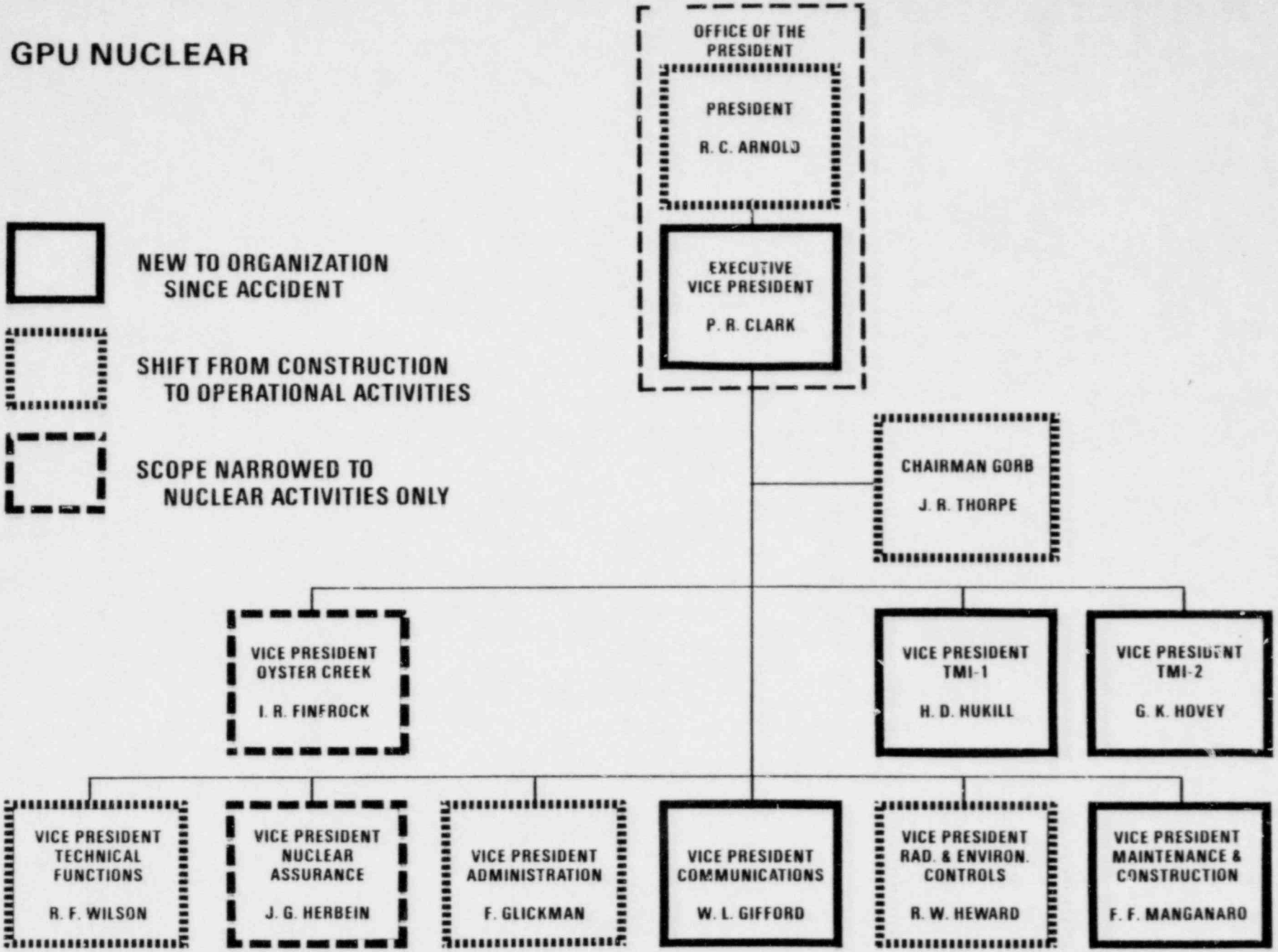
GPU NUCLEAR GROUP

PURPOSE

MANAGE AND DIRECT THE NUCLEAR ACTIVITIES OF THE GPU SYSTEM TO PROVIDE THE REQUIRED HIGH LEVEL OF PROTECTION FOR THE HEALTH AND SAFETY OF THE PUBLIC AND THE EMPLOYEES.

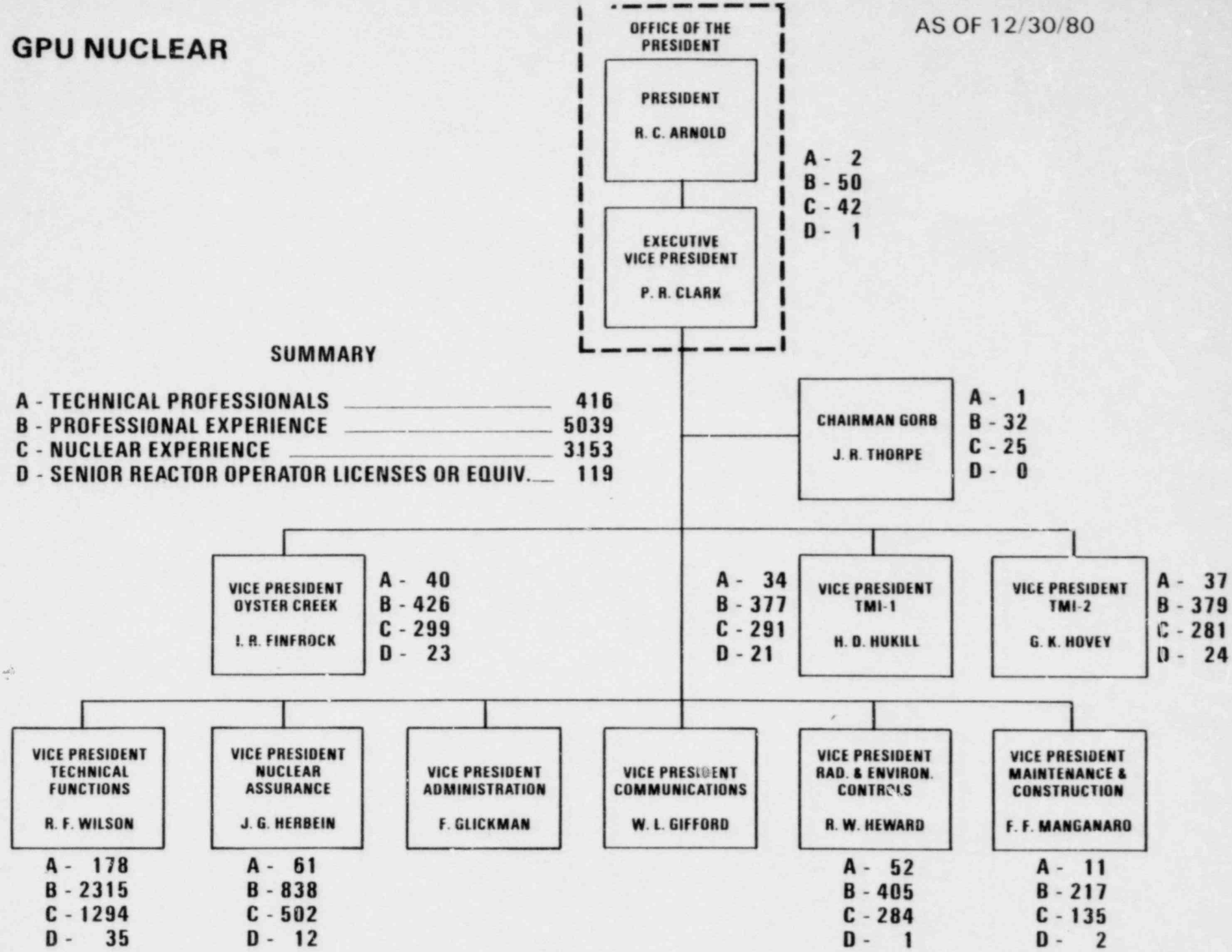
CONSISTENT WITH THE ABOVE, GENERATE ELECTRICITY FROM THE GPU NUCLEAR STATIONS IN A RELIABLE AND EFFICIENT MANNER IN CONFORMANCE WITH ALL APPLICABLE LAWS, REGULATIONS, LICENSES, AND OTHER REQUIREMENTS AND THE DIRECTIONS AND INTERESTS OF THE OWNERS.

GPU NUCLEAR


NEW TO ORGANIZATION SINCE ACCIDENT
SHIFT FROM CONSTRUCTION TO OPERATIONAL ACTIVITIES
SCOPE NARROWED TO NUCLEAR ACTIVITIES ONLY
OFFICE OF THE PRESIDENT
PRESIDENT
R. C. ARNOLD
EXECUTIVE VICE PRESIDENT
P. R. CLARK
CHAIRMAN GORB
J. R. THORPE
VICE PRESIDENT OYSTER CREEK
I. R. FINFROCK
VICE PRESIDENT TMI-1
H. D. HUKILL
VICE PRESIDENT TMI-2
G. K. HOVEY
VICE PRESIDENT TECHNICAL FUNCTIONS
R. F. WILSON
VICE PRESIDENT NUCLEAR ASSURANCE
J. G. HERBEIN
VICE PRESIDENT ADMINISTRATION
F. GLICKMAN
VICE PRESIDENT COMMUNICATIONS
W. L. GIFFORD
VICE PRESIDENT RAD. & ENVIRON. CONTROLS
R. W. HEWARD
VICE PRESIDENT MAINTENANCE & CONSTRUCTION
F. F. MANGANARO

GPU NUCLEAR

AS OF 12/30/80



TMI UNIT 1 CONTROL ROOM

- REVIEW WAS INTENSIVE AND FAIRLY COMPREHENSIVE
- SIGNIFICANTLY DIFFERENT FROM TMI-2 CONTROL ROOM
- EVALUATED ESSENTIALLY AS AN NTOL USING DRAFT GUIDELINES AND CHECKLISTS
- CONTROL ROOM DESIGN REVIEW RESULTS ARE DOCUMENTED IN AN NRC REPORT SENT TO THE LICENSEE SEPTEMBER 16, 1980 AND IN THE SER AND SUPPLEMENT, NUREG-0752 DATED DECEMBER, 1980 AND APRIL 1981 RESPECTIVELY

TMI-1 CONTROL ROOM EVALUATION OF:

- CONTROL ROOM LAYOUT
- THE ADEQUACY OF THE INFORMATION PROVIDED
- THE ARRANGEMENT AND IDENTIFICATION OF IMPORTANT CONTROLS AND INSTRUMENTATION DISPLAYS
- THE USEFULNESS OF THE AUDIO AND VISUAL ALARM SYSTEMS
- THE INFORMATION RECORDING AND RECALL CAPABILITY
- LIGHTING, AND OTHER CONSIDERATIONS OF HUMAN FACTORS THAT HAVE AN IMPACT ON OPERATOR EFFECTIVENESS

CONTROL ROOM DESIGN REVIEW PERFORMED BY:

- DETAILED INSPECTION OF THE CONTROL PANELS
- INTERVIEWS WITH OPERATORS
- OBSERVATION AND VIDEOTAPING OF OPERATORS AS THEY WALKED THROUGH SELECTED EMERGENCY PROCEDURES

SUMMARY LISTING OF DEFICIENCIES IDENTIFIED:

- ANNUNCIATORS
- PROCESS COMPUTER
- CONTROLS
- DISPLAYS
- LABELING
- CONTROL- DISPLAY RELATIONSHIPS
- ENVIRONMENTAL
  - SOUND
  - LIGHTING
- OTHER OBSERVATIONS
- REMOTE SHUTDOWN PANEL
- CONTROL ROOM
- EMERGENCY PROCEDURES
- SUB-COOLING MONITOR READOUT DISPLAYS
- INCORE THERMOCOUPLE READOUT DISPLAYS

COMPARISON OF TMI #1 RESTART LOW POWER TEST PROGRAM

WITH SEQUOYAH LOW POWER TEST PROGRAM

10 Tests required by NRC for Sequoyah
8 Tests required with simulated Decay Heat and
1 Test required with real Decay Heat for all other NTOL's

Sequoyah	TMI Restart
1) Establish stable N/C conditions	1) Included in TP 700/2 - each shift participates/ witnesses.
2) Establish N/C with simulated loss of off-site power	2) Not included in Restart Program. Was verified during actual loss of off-site power in initial startup in 1974.
3) N/C with loss of Pressurizer Heaters	3) Included in TP 700/2 - Low Power Natural Circulation Test Procedure
4) Effect of OTSG secondary side isolation on N/C flow	4) Not included in Restart Program. Single OTSG N/C flow was verified on B&W NSSS on TMI #2
5) N/C flow at reduced RCS pressure	5) No auxiliary spray is available on TMI #1. Any performance of this item in TP 700/2 will be a continuation of item 3.
6) Cooldown capability of Makeup/Letdown	6) Included in TP 651/1 - Intermediate Cooling System Flow Balance.
7) Simulated loss of all on-site and off-site AC power	7) Secondary side heat sink (Emergency Feedwater) availability without AC power is demonstrated with forced RCS flow in TP 700/2 as part of EFW Modification Testing. Primary side response would be no different than Loss of Off-Site Power Test in initial Startup Program and would cause loss of seals to RCP's which could degrade seal life.

Sequoyah	TMI Restart
8) Establish N/C from stagnant conditions	8) NRC deleted this requirement from all NTOL's subsequent to Sequoyah. It is not included in the TMI Restart.
9a) Forced circulation cooldown	9a) Included in TP 700/2 - Low Power Natural Circulation Test Procedure.
9b) Boron mixing and cooldown	9b) Not included in Restart Program. Boron mixing and cooldown were verified on B&W NSSS on TMI #2.
	10) Verify that Plant Natural Circulation Procedures provide adequate guidance to the operator to prevent overcooling as OTSG level changes from 30" on Startup Range to 50% on Operating range.
	11) Determine the lowest level in the OTSG that sustains Natural Circulation flow without Emergency Feedwater flow.

NUREG 666 Conclusions

Type 1 Failures:

Unavailability of multiple batteries on demand — 4×10^{-4}/demand

Assuming loss of off-site power occurrence at 0.22/year, unavailability of multiple batteries on demand. — 9×10^{-5}/reactor year

Type 2 Failures:

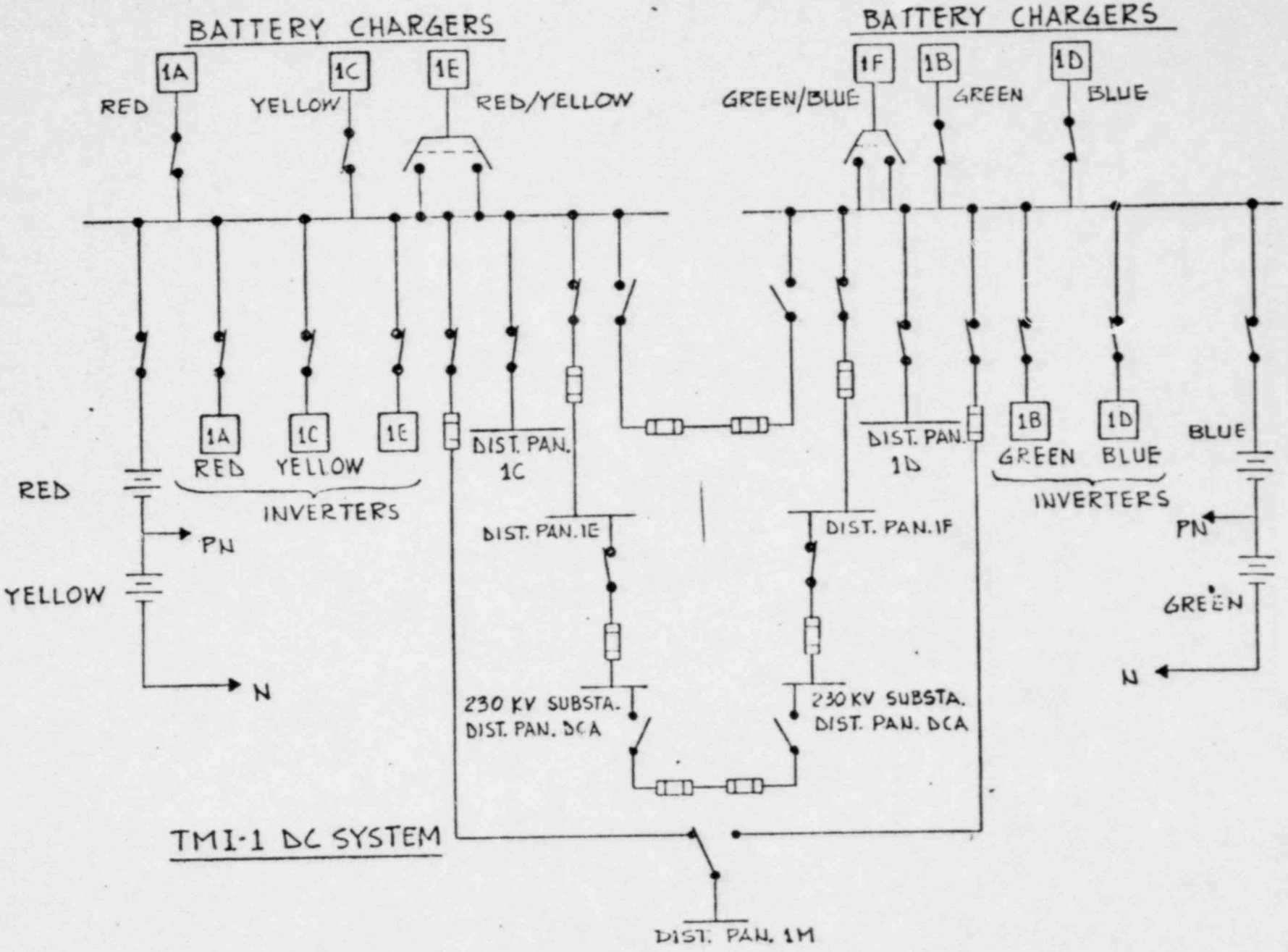
Unavailability of multiple batteries due to test, operational and maintenance errors. — 6×10^{-5}/reactor year

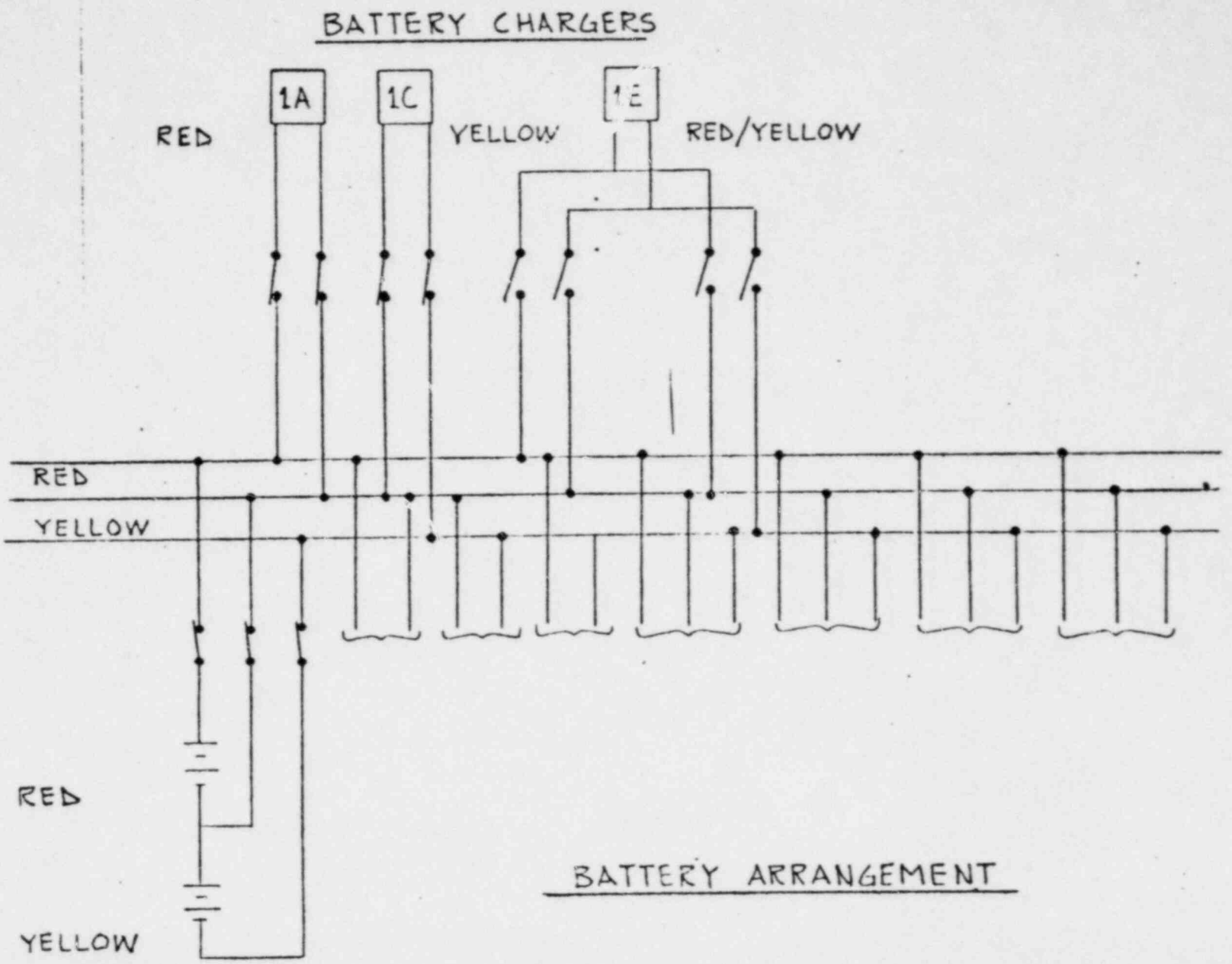
Combination of type 1 and type 2 failures represents a contribution of 50% of core damage probability for all accident sequences studied.

NUREG 666 RECOMMENDATIONS

CONTRIBUTION OF DC POWER FAILURE TO CORE DAMAGE PROBABILITY CAN BE REDUCED FROM 50% TO 1% BY:

- PROHIBITING CERTAIN DESIGN AND OPERATIONAL FEATURES SUCH AS BUS-TIES
- AUGMENTING TEST AND MAINTENANCE ACTIVITIES
- INCORPORATE REQUIREMENTS FOR STAGGERED TEST AND MAINTENANCE ACTIVITIES


BATTERY CHARGERS
1A
1C
1E
RED
YELLOW
RED/YELLOW
BATTERY CHARGERS
1F
1B
1D
GREEN/BLUE
GREEN
BLUE
1A
1C
1E
RED
YELLOW
INVERTERS
DIST. PAN. 1C
DIST. PAN. 1D
1B
1D
GREEN
BLUE
INVERTERS
BLUE
RED
PN
YELLOW
N
DIST. PAN. 1E
DIST. PAN. 1F
PN
GREEN
N
230 KV SUBSTA. DIST. PAN. DCA
230 KV SUBSTA. DIST. PAN. DCA
TMI-1 DC SYSTEM
DIST. PAN. 1M


BATTERY CHARGERS
1A
1C
1E
RED
YELLOW
RED/YELLOW
RED
YELLOW
RED
YELLOW
BATTERY ARRANGEMENT

TMI-1 SYSTEM IMPROVEMENTS

BATTERY DISCONNECT SWITCHES TO BE LOCKED CLOSED.

BUS TIE SWITCHES TO BE LOCKED OPEN.

SUBSTATION DISTRIBUTION BUS TIE TO BE DISABLED.

PROCEDURES REVIEWED AND UPGRADED.

- SURVEILLANCE OF TERMINAL CONNNECTIONS
- UPGRADING OF BATTERY DISCHARGE TEST PROCEDURE
- RESTRICT USE OF BATTERY DISCONNECT SWITCHES AND BUS TIE SWITCHES TO COLD SHUT-DOWN
- RECOVERY PROCEDURES WRITTEN FOR LOSS OF A DC SUPPLY

		Relative Reduction In System Unavailability		
		Type 1 Failures	Type 2 Failures	Combined
	System studied in NUREG 666	1.0	1.0	1.0
1.	Restrict use of bus tie to cold shut-down	1.0	0.001	0.5
2.	Stand-by battery charger	0.03	0.2	0.1
3.	More Reliable off-site power	0.2	1.0	0.6
	Combination of 1, 2, & 3	0.006	0.001	0.003
	Improved Surveillance	0.03	1.0	0.5
	Improved Maint. and Test	0.1	0.1	0.1

ACRS PRESENTATION

JUNE 25 - 26, 1981

W. H. BEHRLE

I N D E X

ACRS Presentation
June 25 - 26, 1981
W. H. Behrle

TEST PROGRAM SCOPE

TESTING INCLUDED IN THE UNIT 1 RESTART TEST PROGRAM CONSISTS OF:

- CONSTRUCTION AND STARTUP TESTING OF NEWLY INSTALLED COMPONENTS AND SYSTEMS INSTALLED BY THE UNIT 1 RESTART PROGRAM.

- CONSTRUCTION AND STARTUP TESTING OF MODIFICATIONS TO EXISTING PLANT SYSTEMS AND COMPONENTS BY THE UNIT 1 RESTART PROGRAM.

- TESTING OF SELECTED NON-MODIFIED SYSTEMS AS DETERMINED BY STARTUP AND PLANT OPERATIONS.

- TESTING OF SELECTED MAINTENANCE PROJECTS AS REQUESTED BY MAINTENANCE.

- SELECTED INTEGRATED TESTING DURING PLANT STARTUP AND POWER ESCALATION TO ASSURE PROPER PLANT OPERATION AND TRANSIENT RESPONSE FOLLOWING THE 1979 EXTENDED OUTAGE.

BASES FOR SELECTION OF TESTS

- Normal Refueling Test Requirements
- Modifications Made to the Plant
- TMI 1 Initial Test Program
- Natural Circulation Testing Performed at NTOL Plants
- Reg Guide 1.68 Testing Performed at New Plants
- Plant Reinitialization Considerations
- Operator Training Considerations
- Procedure Verification Considerations
- Surveillance Considerations
- Plant Transient Analysis Verification

MAJOR DOCUMENTS CONSULTED

- NUREG - 0578 - Lessons Learned (Short Term)
- NUREG - 0585 - Lessons Learned (Long Term)
- I&E Bulletins - 79 - 01 and 05
- August 9, 1979 Shutdown Order
- TMI #1 Restart Report (Thru Amendment 25)
- NUREG - 0660 - TMI Action Plan
- NUREG - 0680 - Safety Evaluation Report (of TMI #1 Restart Report)
- NUREG - 0694 - TMI Related Requirements for NTOL's
- NUREG - 0737 - Clarification of TMI Action Plan Requirements
- Reg Guide 1.68 - Initial Test Programs for Nuclear Power Plants
- Draft Reg Guide for LWR Refueling and Startup Tests

TEST PROGRAM ORGANIZATION/CONTROL

THE TMI #1 RESTART TEST PROGRAM IS PERFORMED IN AN ORGANIZED FASHION BY FORMALLY APPROVED DOCUMENTS. DETAILED NUCLEAR SAFETY RELATED TEST PROCEDURES AND RESULTS ARE APPROVED BY A TECHNICAL REVIEW/APPROVAL GROUP.

- TEST MANUAL AND INSTRUCTIONS -

  1) ESTABLISHES THE STARTUP AND TEST GROUP TO PREPARE, PERFORM AND DOCUMENT THE TEST PROGRAM.

  2) ESTABLISHES THE AUTHORITY OF THE TECHNICAL REVIEW/ APPROVAL GROUP AS THE CENTRAL APPROVAL AND COORDINATING BODY.

  3) DEFINES RESPONSIBILITIES OF VARIOUS PARTICIPANTS AND ORGANIZATIONS TO THE TEST PROGRAM.

  4) PROVIDES INSTRUCTIONS FOR TEST PROCEDURE FORMAT AND CONTENT, PREREQUISITE LISTS, TEST ENGINEER'S LOG, TEST BRIEFINGS, ETC.

- MASTER TEST INDEX (MTX) - IDENTIFIES ALL TESTS REQUIRED FOR RESTART. LISTING INCLUDES CONSTRUCTION, FUNCTIONAL AND INTEGRATED PLANT TESTING.

- TEST SPECIFICATION - IDENTIFIES TEST SCOPE AND ACCEPTANCE CRITERIA FOR ALL FUNCTIONAL AND INTEGRATED PLANT TESTS.

TEST PROGRAM ORGANIZATION/CONTROL (CONTINUED)

- o TECHNICAL REVIEW/APPROVAL GROUP - COMPOSED OF REPRESENTATIVES FROM:

  1) ENGINEERING

  2) PLANT OPERATIONS

  3) STARTUP AND TEST

  4) NSSS SUPPLIER

  5) QA

  THIS GROUP REVIEWS AND APPROVES SAFETY RELATED TEST PROCEDURES AND RESULTS.

NON-MODIFIED SYSTEMS

- Instrument Air
- Secondary Services Closed Cooling System
- Secondary River Water System
- Nuclear Services River Water System
- Circulating Water System
- Main and Auxiliary Steam System
- Condenser Air Removal System
- Condensate System
- Penetration Pressurization System
- Fluid Block System
- Penetration Cooling System
- Intermediate Closed Cooling Water System
- Gaseous Waste Disposal System
- Reclaimed Water System

Selection of Non-Modified Systems for testing was based on "Important to Safety" considerations. For example, failure of Condenser Air Removal System (Loss of Vacuum) causes shift from Turbine Bypass Valves to Atmospheric Dump Valves.

LIST OF HFT's

1) Checkout Incore Thermocouples (Mod)

2) Set Main Steam Safety Valves (Surv)

3) Test Main Steam Safety Valve Acoustic Monitors (Mod)

4) Verify proper operation of Pressurizer Heater Level/Pressure Interlocks, Spray Valve Flow/Pressure Interlock (RI)

5) Determine Pressurizer heat losses and ability to control pressure and saturation margin on one(1) Heater Bank (RI/Mod)

6) Lift the PORV and determine adequate response of Elbow Taps, Acoustic Monitor, Tailpipe Thermocouples and Manual Switch (Mod)

7) Run Steam Driven Emergency Feed Pump on recirculation and verify it does not overspeed and comes up to rated speed in less than 30 sec (Mod/Surv)

8) Perform Diesel Generator Loading Test combining ES with Motor Driven Emergency Feed Pump Auto Start (Mod/Surv)

9) Check agreement of various Non-Nuclear Instrument Channels as a function of RCS Temperature/Pressure (RI/Mod)

10) Perform HPI Functional Test to verify Cavitating Venturis and high capacity Makeup Valve (Mod/Surv)

11) Verify proper operation of Tsat Meter as a function of RCS Temperature/Pressure (Mod)

12) Verify ability of RB Coolers to maintain RB Temperature less than design (PMT)

13) Verify operability of RCS High Point Vents (Mod)

14) Verify ability to sample RCS at normal operating temperature and pressure with long-handled tools in an acceptable time period (Mod)

15) Verify acceptable RCP operating parameters as a function of RCS Temperature/Pressure (RI)

16) Flow balance the Intermediate Cooling Water System, as required (RI)

17) Take thermal expansion readings on hangers/supports as a function of RCS Temperature (Mod)

18) Perform RCS leakage measurements (Surv)

19) Perform CRD drop time measurements (Surv)

20) Perform DH-V22A/B, CF-V4A/B & 5A/B Leakage Surv Test (Mod/Surv)

ZERO POWER PHYSICS PROGRAM

AT ZERO NUCLEAR POWER, 2155 PSIG AND 532°F RCS CONDITIONS, PERFORM THE FOLLOWING PHYSICS TESTS IN ACCORDANCE WITH NORMAL REFUELING TESTING PROCEDURES:

1) CONTROL ROD WITHDRAWAL
2) DEBORATION TO CRITICAL
3) DETERMINATION OF SENSIBLE HEAT AND NI OVERLAP
4) PERFORM REACTIVITY MEASUREMENTS
5) DETERMINATION OF ALL RODS OUT BORON CONCENTRATION
6) DETERMINATION OF ALL RODS OUT TEMPERATURE COEFFICIENT
7) INTEGRAL CONTROL ROD WORTH MEASUREMENTS
8) SHUTDOWN MARGIN VERIFICATION
9) TEMPERATURE COEFFICIENTS
10) EJECTED CONTROL ROD WORTH MEASUREMENT

LOW NUCLEAR POWER TESTING
INCLUDING NATURAL CIRCULATION

1) Perform correlation between Out of Core Detector indication vs. Heat Balance Power as a function of T_{COLD} (3% Power)

2) Verify auto start of Emergency Feedwater Pumps and OTSG Level Control at 30" on Startup Range upon loss of both Feedwater Pumps and demonstrate adequacy of flow indication (RM-13B) (3% Power)

3) Verify ability to control level with the new Manual Loader Station (RM-13D) (3% Power)

4) Verify adequate air supply to Emergency Feedwater Control Valves (EF-V30A/B) and Turbine Driven Emergency Feed Pump Steam Control Valve (MS-V6) for 2 hours with loss of Instrument and Backup Instrument Air (RM-13H) (3% Power)

5) Verify smooth transition to Natural Circulation Flow with OTSG Level Conrol at 50% on Operating Range upon loss of all 4 RCP's and demonstrate adequacy of flow indication (RM-13B) (3% Power)

6) Determine effect of loss of Pressurizer Heaters on Saturation Margin (3% Power)

7) Determine effect of SG Level on Natural Circulation Flow (3% Power)

8) Verify that OP 1102-16 (RCS Natural Circulation Cooling) provides adequate guidance to prevent overcooling as OTSG Level Control setpoint changes from 30" on Startup Range to 50% on Operating Range (Following 40% Power Trip)

LOW NUCLEAR POWER TESTING INCLUDING
NATURAL CIRCULATION (CONTINUED)

9) DETERMINE LOWEST LEVEL IN OTSG THAT SUSTAINS NATURAL CIRCULATION FLOW WITH NO EMERGENCY FEEDWATER (FOLLOWING 100% POWER TRIP)

POWER ESCALATION TESTING

Following the Low Power Test Program, escalate power to the 15%, 40%, 75% and 100% power plateaus in steps and perform the following testing, as indicated:

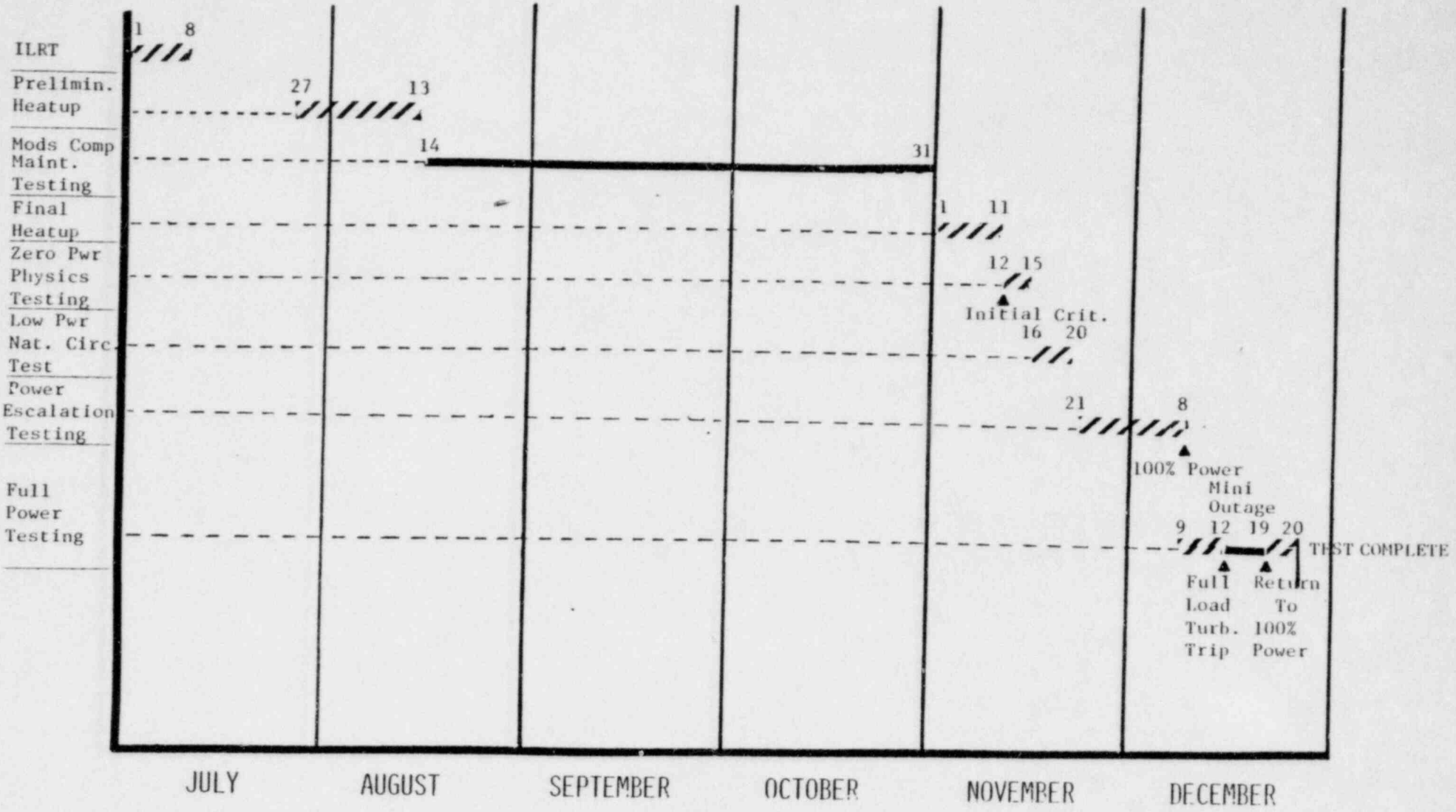
1) Perform Turbine Overspeed Surveillance Test (0-12%-0) (Surv)
2) Perform Nuclear Instrumentation Calibration at power (15%, 40%, 76% and 100%) (Surv)
3) Perform ICS Tuning at power (20%, 40%, 80% and 95-100% and at minor levels between majors)
4) Perform Turbine Bypass Valve Testing at power (% open vs. steaming rate and correct bias from ICS on Turbine Trip) (0-15%)
5) Perform Heat Balance Surveillance Testing and verify computer program as required (15%, 40%, 76% and 100%)
6) Perform Feedwater System Operation and Tuning (40%, 76%, 100%)
7) Perform Turbine Generator Operation and Testing (15%, 40%, 76%, 100%)
8) Perform Power Imbalance Detector Correlation Test (40%) (Surv)
9) Perform Unit Load Transient Testing (40%, 80%, 100%)
10) Perform Unit Load Steady State Testing (15%, 40%, 76%, 100%)
11) Perform Saturation Monitor Checks (15%, 40%, 76%, 100%) (LM-1)
12) Perform Incore Thermocouple Checks (15%, 40%, 76%, 100%) (RM-4)
13) Perform Core Power Distribution Testing (15%, 40%, 76%, 100%) and verify computer programs.
14) Perform Reactivity Coefficients Testing (100%)
15) Verify RCP Flow (100%) (Surv)
16) Perform loss of both Feedwater Pumps (40%) (RM-3) (Verify letdown isolation and bypass - RM-5)
17) Perform loss of one(1) Feedwater Pump runback (100%)
18) Perform Turbine Trip Test (100%) (RM-3)
19) Perform CRD misalignment runback (76%)
20) Check thermal expansion/hanger settings of systems affected by power operation (15%, 40%, 76%, 100%)

TEST PROCEDURE REQUIREMENTS

TEST TYPE	NUMBER REQUIRED*	WRITTEN	APPROVED	PERFORMED
NON-MODIFIED SYSTEMS	15	14	0	0
MODIFICATION FUNCTIONAL	29	19	10	3
HOT FUNCTIONAL	14	12	0	0
LOW POWER/POWER ESCALATION	16	3	0	0
	74	48	10	3

*BASED ON REVIEW/PLANNING OF 57 MODIFICATIONS

TMI-1 RESTART INTEGRATED SCHEDULE



REQUIREMENTS REMAINING AFTER RESTART

1. COMMISSION ORDER DATED AUGUST 9, 1979
   INSTALLATION OF ESF FILTER SYSTEM MODIFICATIONS TO ENSURE SEPARATION OF TMI-1 AND 2 FUEL HANDLING OPERATIONS. REQUIRED BY FIRST REFUELING AFTER RESTART.

2. NUREG-0737

ITEM	DESCRIPTION	CURRENT IMPLEMENTATION DATE
*II.B.2	PLANT SHIELDING (VITAL AREA MODIFICATIONS)	1/1/82
*II.B.3	POST ACCIDENT SAMPLING	1/1/82
*II.F.1	ACCIDENT MONITORING INSTRUMENTATION	1/1/82
*II.F.2	INSTRUMENTATION FOR DETECTION OF ICC	1/1/82
II.K.3.30	SB LOCA MODEL JUSTIFICATION	1/1/82
*II.K.3.5	AUTO TRIP OF RCPs	3/1/82 (IF REQUIRED)
*II.B.1	REACTOR COOLANT SYSTEM VENTS	7/1/82 10/1/81
*II.D.1	R & SV TESTING BLOCK VALVE TESTING	7/1/32
*III.A.1.2	UPGRADE EMERGENCY SUPPORT FACILITIES	10/1/82

REQUIREMENTS REMAINING AFTER RESTART (CONT.)

2. NUREG-0737

ITEM	DESCRIPTION	CURRENT IMPLEMENTATION DATE
II.K.3.31	COMPLIANCE WITH 10 CFR 50.46	1/1/83
*I.C.1	TRANSIENT AND ACCIDENTS PROCEDURES	FIRST REFUELING AFTER 1/1/82
**II.E.1.1	EFW SYSTEM UPGRADE	FIRST REFUELING AFTER 1/1/82
**II.E.1.2	AUTO INITIATION OF EFW (SAFETY GRADE)	FIRST REFUELING AFTER 1/1/82
II.K.3.1	AUTO PORV ISOLATION SYSTEM	FIRST REFUELING FOLLOWING STAFF APPROVAL OF DESIGN (IF REQUIRED BY II.K.3.2)
I.D.2	PLANT SAFETY PARAMETER DISPLAY CONSOLE	TBD
III.D.3.4	CONTROL ROOM HABITABILITY MODIFICATIONS	TBD

3. COMMISSION ORDER, CLI-80-21 — 6/30/82
   ENVIRONMENTAL QUALIFICATION OF CLASS 1E ELECTRICAL EQUIPMENT

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* THESE ITEMS HAVE BEEN EVALUATED FOR REASONABLE PROGRESS UNDER THE ORDER

** II.E.1.2 AND II.E.1.1 IMPLEMENTATION DATES PER NUREG-0737 ARE 7/1/81 AND 1/1/82 RESPECTIVELY. HOWEVER, WE HAVE ACCEPTED LICENSEE COMMITMENT DATE OF FIRST REFUELING AFTER 1/1/82.

RELIABILITY ASSESSMENTS

COMMENT

- o Reliability Assessments of the Plant as Modified
  - Acquisition of Safety Information
  - Basis for Further Changes
  - Technical Insight into Safety of Plant
- o Systems Interactions that may Degrade Safety

DISCUSSION

- o What has been done at TMI-1
- o Results
- o Future Plans

EVALUATION OF SAFETY & RELIABILITY OF PLANT AS MODIFIED

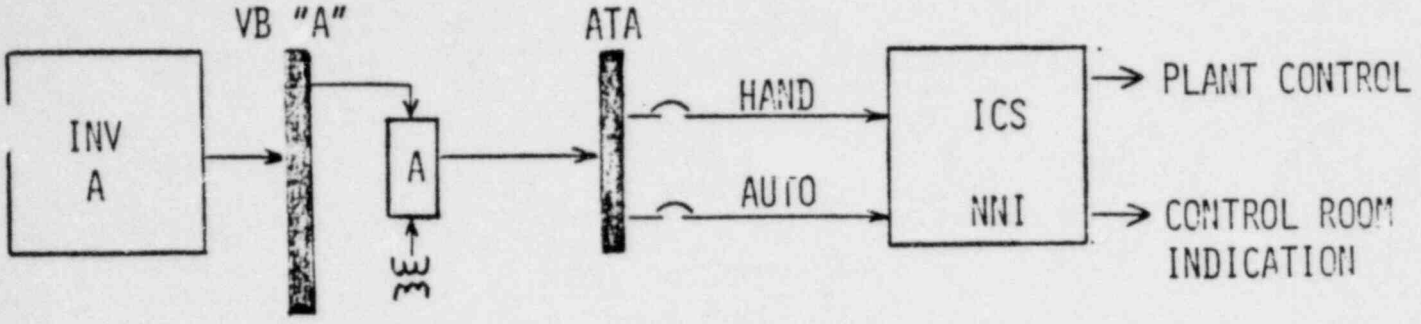
- o ACCOMPLISHED
  - Evaluation of Individual Modifications during Design
  - Review of FSAR Events with respect to Collective Effects
  - Evaluation of Collective Effects on Plant Response by Analysis
- o PLANNED
  - Verification of Plant Response during Test Program
  - Integrated Probabilistic Risk Assessment
  - Systems Interactions for Specific Events

ALARMS AND INDICATIONS

- o SIGNIFICANT IMPROVEMENTS
  - ICS/NNI Loss of Power Indication and Alarm
  - Critical Parameters Independent of ICS/NNI
- o BENEFICIAL
  - Saturation Margin Monitor and Alarm
  - EFW Flow Indication
  - PORV & SV Position Indication and Alarm
  - Incore Thermocouple Indication
  - Wide Range T_H Indication
  - Reactor Building Sump Level Indication and Alarm
  - Post Accident Radiation Monitors and Alarms
  - Condensate Storage Tank Lo-Lo Level Alarm
  - MS Relief Valve Position Indication*
- o NECESSARY BUT DETRIMENTAL
  - Additional Annunciator Panel

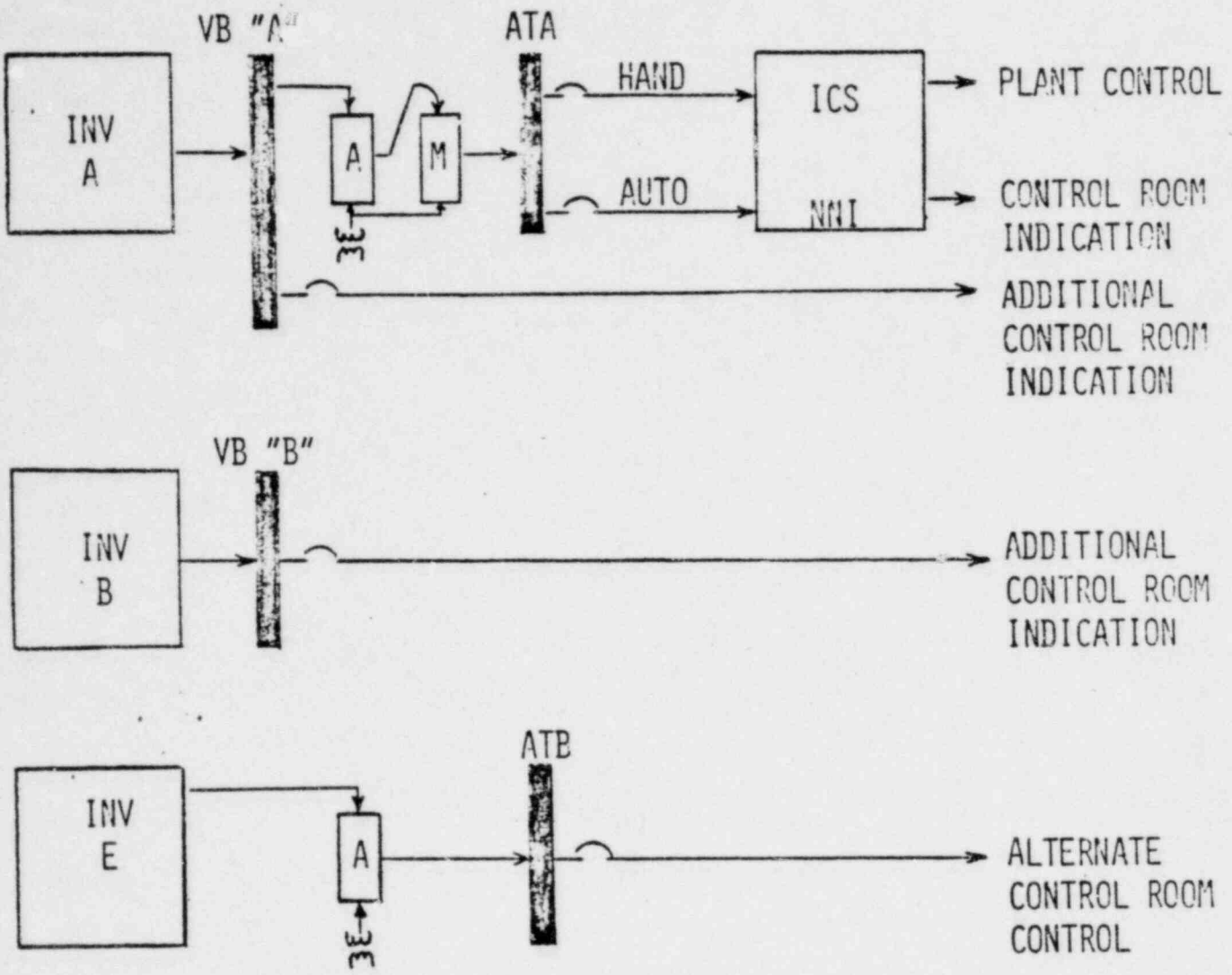
* As modified based on human factors review

ICS/NNI POWER - BEFORE



- Loss of Power to ATA or HAND or AUTO to ICS/NNI
  - Reactor Trip
  - Inadequate Control Room Indication for Hot Shutdown
  - Inadequate Control System Operation for Hot Shutdown
  - CORE COOLING BY PRIMARY FEED AND BLEED

ICS/NNI POWER - AT RESTART



- o Loss of Power to ATA or HAND or AUTO to ICS/NNI
  - Reactor Trip
  - Adequate Control Room Indication for Hot Shutdown
  - Adequate Control for Hot Shutdown
  - CORE COOLING VIA STEAM GENERATORS
- o Loss of Power to VB "A", VB "B" or ATB
  - No Effect on Normal Control or Indication

PLANT PERFORMANCE CHANGES

CONTAINMENT ISOLATION MODIFICATIONS
COMPUTER UPGRADE
CONTROL ROOM HUMAN FACTORS REVIEW AND MODIFICATIONS
REMOTE SHUTDOWN PANEL AND FACILITY
EFW VALVE FAILURE POSITION
EFW VALVE CONTROL INDEPENDENT OF ICS

ICS/NNI VALVE FAILURE POSITIONS
ICS/NNI UPGRADED POWER SUPPLY

HPI CROSS CONNECT

MODIFICATIONS CONSIDERED IN DYNAMIC ANALYSIS:

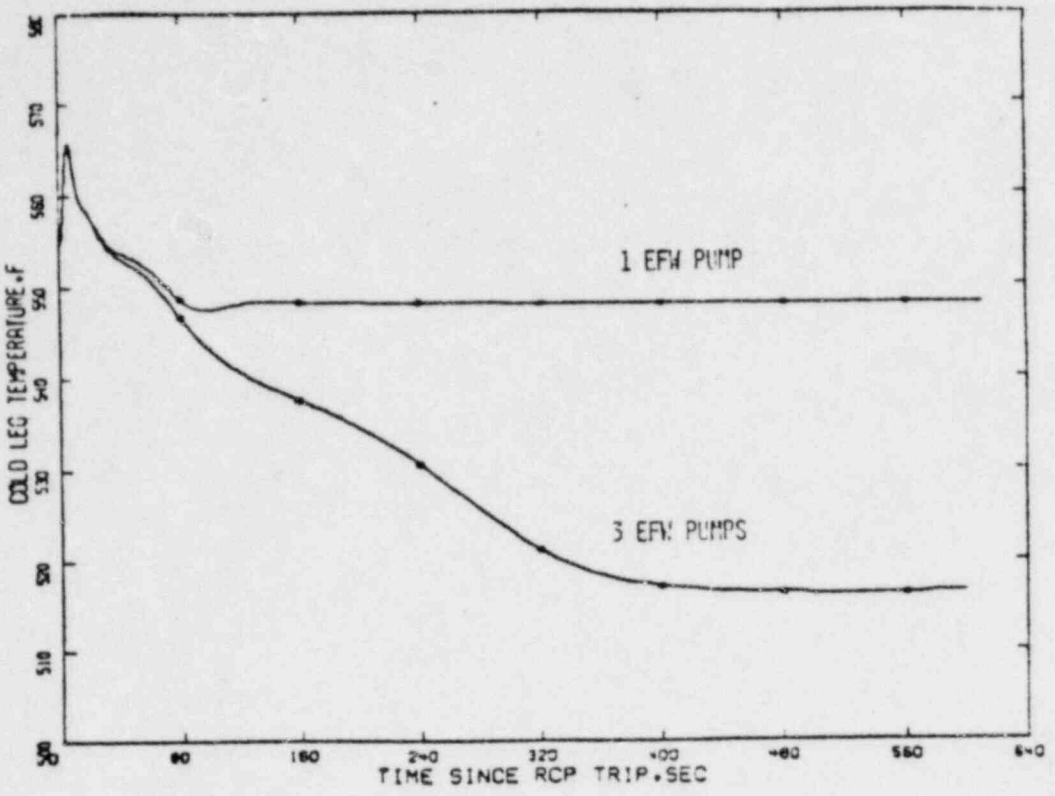
RPS HIGH PRESSURE TRIP	FROM 2390 TO 2300 PSIG
PORV OPENING PRESSURE	FROM 2250 TO 2450 PSIG
REACTOR TRIP ON FEEDWATER PUMP TRIP	
REACTOR TRIP ON TURBINE TRIP	
LETDOWN ISOLATION ON REACTOR TRIP	
EFW AUTO INITIATION	FROM 1 PUMP TO 3 PUMPS

DYNAMIC ANALYSIS RESULTS

(See Restart Report Chapter 8)

- o FSAR Analysis Assumptions - No Change
- o Expected Plant Response
  - RPS/PORV Setpoint Inversion -
    - Increases Safety Margins in Transients
    - Decreases PORV Challenges
    - Increases Frequency of Reactor Trips
  - Reactor Trip on Feedwater Pump Trip -
    - Increases Safety Margins in Transient
  - Reactor Trip on Turbine Trip
    - Decreases PORV Challenges
    - Increases Frequency of Reactor Trips
  - Letdown Isolation on Reactor Trip -
    - Automates Immediate Operator Action
  - EFW Auto Initiation -
    - Increases Reliability of EFW
    - Increases Overcooling Potential

OVERCOOLING POTENTIAL OF EFW



- OVERCOOLING OCCURS ON NATURAL CIRCULATION AS STEAM GENERATOR LEVEL IS RAISED WITH HIGH EFW FLOW RATE
  - UNNECESSARY TO ESTABLISH NATURAL CIRCULATION
  - MAY MASK ABNORMAL PERFORMANCE
  - CAN RESULT IN LOSS OF PRESSURIZER LEVEL AND SAFETY SYSTEM ACTUATION
  - CAN CHALLENGE PRIMARY RELIEFS DURING RECOVERY

ACTIONS TO PREVENT EFW OVERCOOLING

- RESTART
  - LIMIT EFW FLOW RATE (VENTURI, THROTTLED VALVES, OPERATOR)
  - PROCEDURE GUIDELINES
  - OPERATOR TRAINING
- LONG TERM
  - LIMIT EFW FLOW RATE (VENTURI)
  - REDUCE OTSG LEVEL SETPOINT FOR NATURAL CIRCULATION

TMI-1 PROBABILISTIC RISK ASSESSMENT

- o PURPOSE
  - Evaluate Risk to Public
  - Evaluate Plant Reliability & Availability
- o TECHNIQUES
  - Detailed Event Sequence Diagrams & Event Trees
  - Identify Critical Systems
  - Systems Analysis for Failure Paths (Fault Trees)
  - Quantification Using TMI-1 Data where Available
- o SCOPE
  - Random Failures
  - Common Mode
  - Common Cause
  - External Hazards
- o USES
  - Identify Changes Significant to Public Risk
  - Identify Areas for Reliability & Availability Improvements
  - Relative Benefits of Changes

SUMMARY

- o Modifications May Have Enhanced Safety but Have
  - Increased complexity
  - Reduced availability
  - Degraded plant performance

- o Probabilistic Risk Assessment is Required to Quantify Reliability of the Plant as Modified. PRA for TMI-1 is Planned to Commence 1981.

- o Systems Interaction Studies for Specific Events are in Progress

- o GPU Will Continue to Perform Integrated Analyses of Modifications during Design to Evaluate Effects on Likely Events

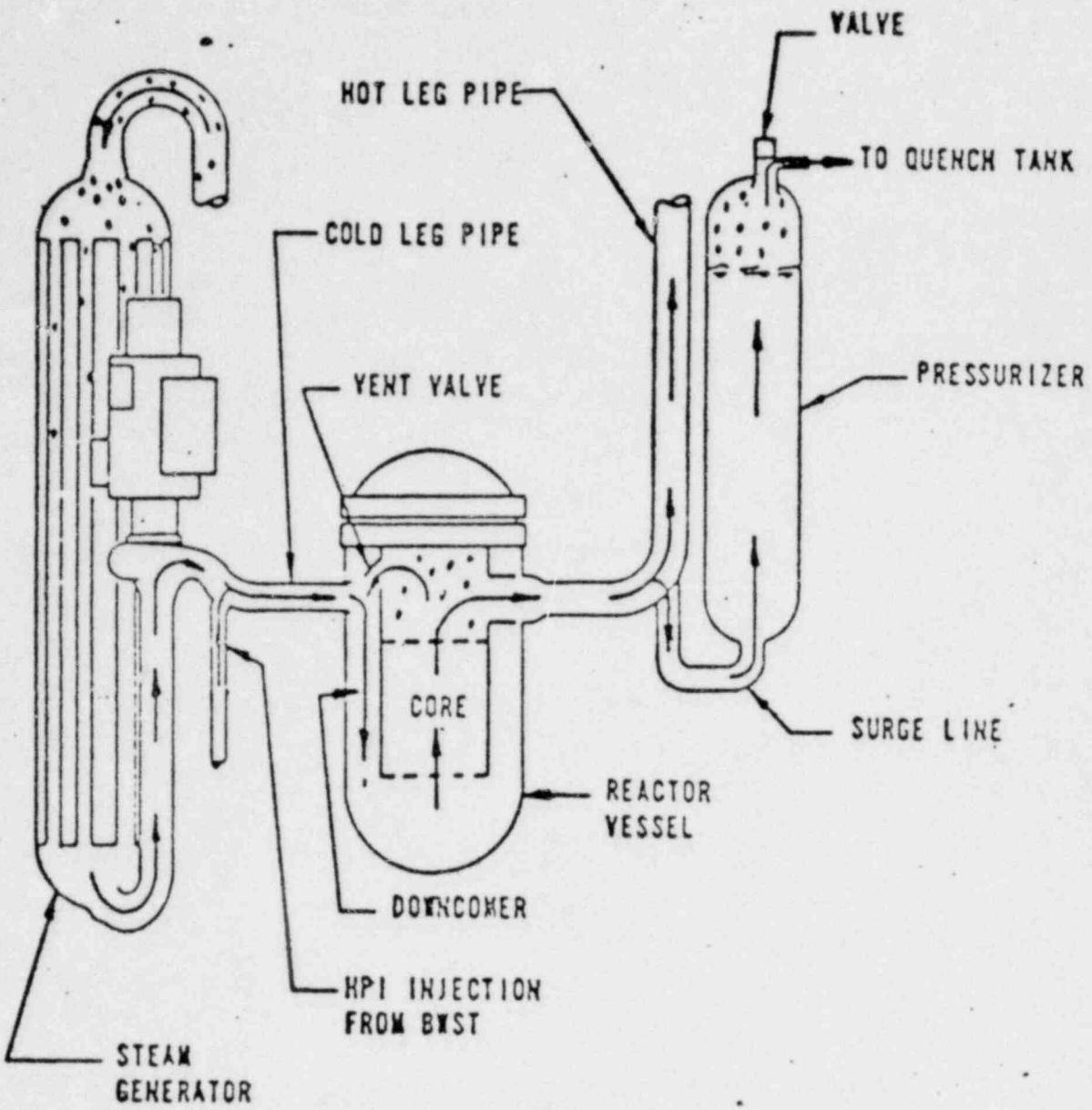
REACTOR VESSEL PRESSURIZED THERMAL SHOCK

CURRENT CONCLUSION - CRITICAL OVERCOOLING TRANSIENT INVOLVING RE-PRESSURIZATION IS SMALL BREAK UNMITIGATED LOCA WITH EXTENDED LOSS OF FEEDWATER.

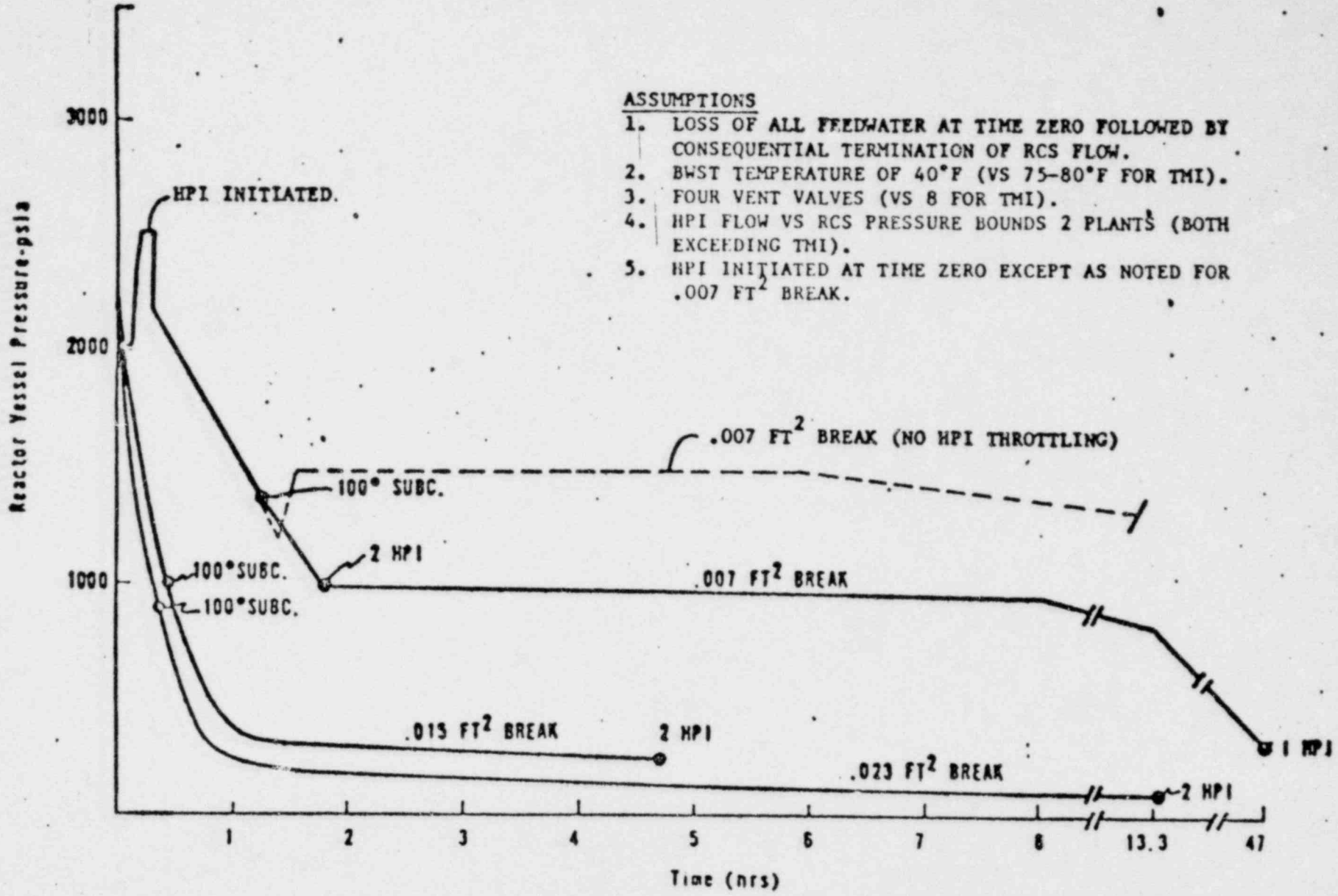
LICENSING STATUS - INVESTIGATION TO DATE DOCUMENTED IN BAW-1628 AND BAW-1648.

- B&W OWNERS GROUP STATUS REPORT SUBMITTED MAY 12, 1981.
- MET ED/GPU LETTER DATED MAY 26, 1981, IDENTIFIED PLANT SPECIFIC PLANS.

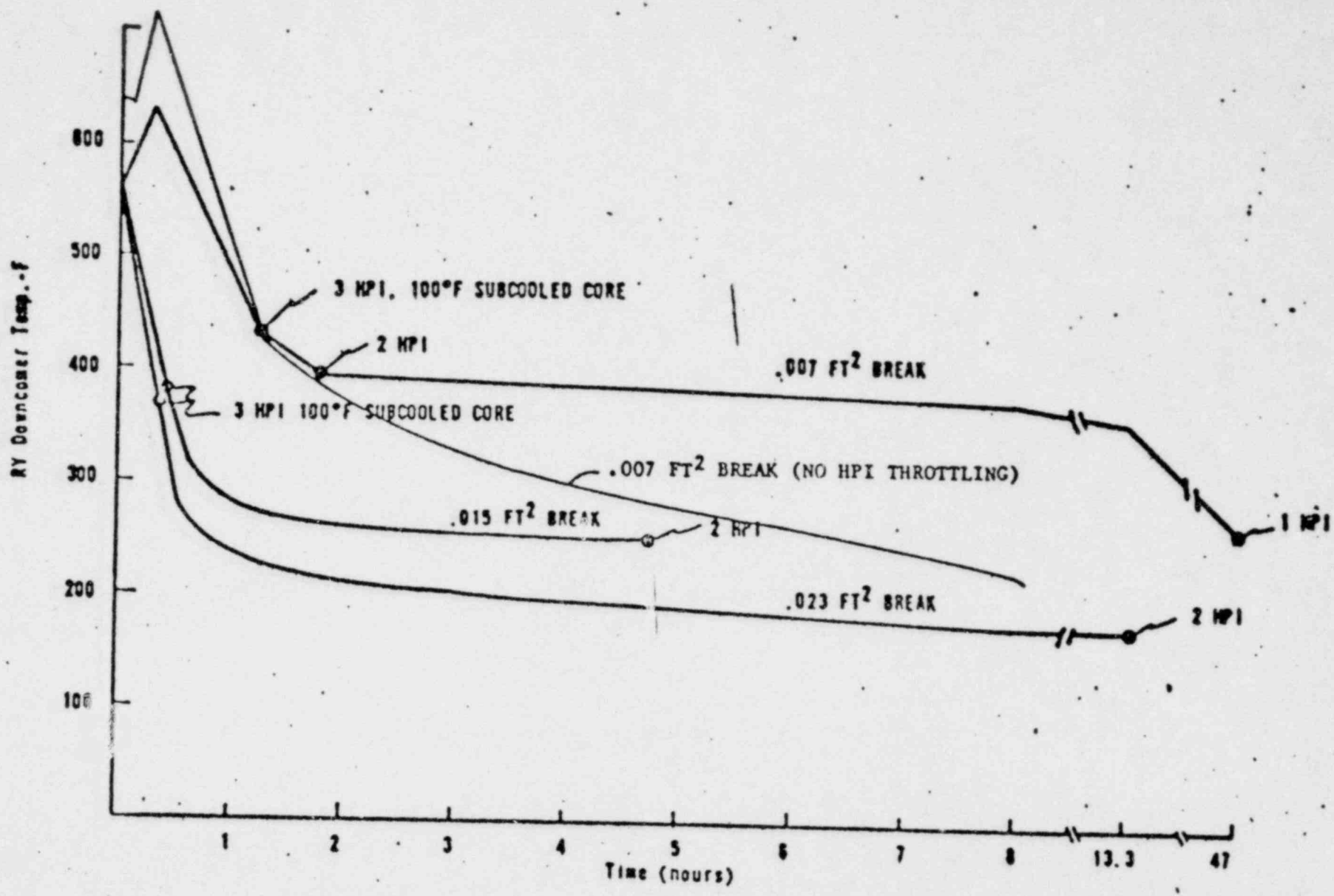
RCS Flow During Total Loss of Feedwater Event With a Small Break



RV Pressure Vs Time, 0.007-, 0.015-, and 0.023-ft² Pressurizer Breaks



Downcomer Temperature Vs Time, 0.007-, 0.015-, and 0.023-ft^2 Pressurizer



Analysis Summary - Cases 1 Through 4

	Case 1	Case 2	Case 3	Case 4
LOCA analysis	0.007-ft^2 pressurizer break, no HPI throttling	0.007-ft^2 pressurizer break with HPI throttling	0.023-ft^3 pressurizer break with HPI throttling	0.023-ft^2 pressurizer break with HPI throttling
Mixing analysis	Complete, perfect mixing (CRAFT)	Distributed vent valve flow, streaming HPI flow (MIX2)	Distributed vent valve flow, streaming HPI flow (MIX2)	No mixing
Reactor vessel cooldown analysis	Constant heat transfer (BEFRAM)	More detailed analysis	More detailed analysis	More detailed analysis
LEFM (fracture analysis)	LEFM at 6 EFPY	LEFM at 3.8 EFPY	LEFM at 3.8 and 4.8 EFPY	LEFM at 3.8 EFPY

FRACTURE MECHANICS EVALUATION CRITERIA

THE CRITERION FOR PRECLUDING CRACK INITIATION IS AS FOLLOWS:

$$K_{IT} + K_{IP} + K_{IW} < K_{IC} \quad \text{AT FLAW SIZE } A_1,$$

AND CRACKS ARE ARRESTED PROVIDED

$$K_{IT} + K_{IP} + K_{IW} < K_{IA} \quad \text{AT FLAW SIZE } A_2$$

WHERE

K_{IT} = APPLIED STRESS INTENSITY FACTOR DUE TO THERMALS,

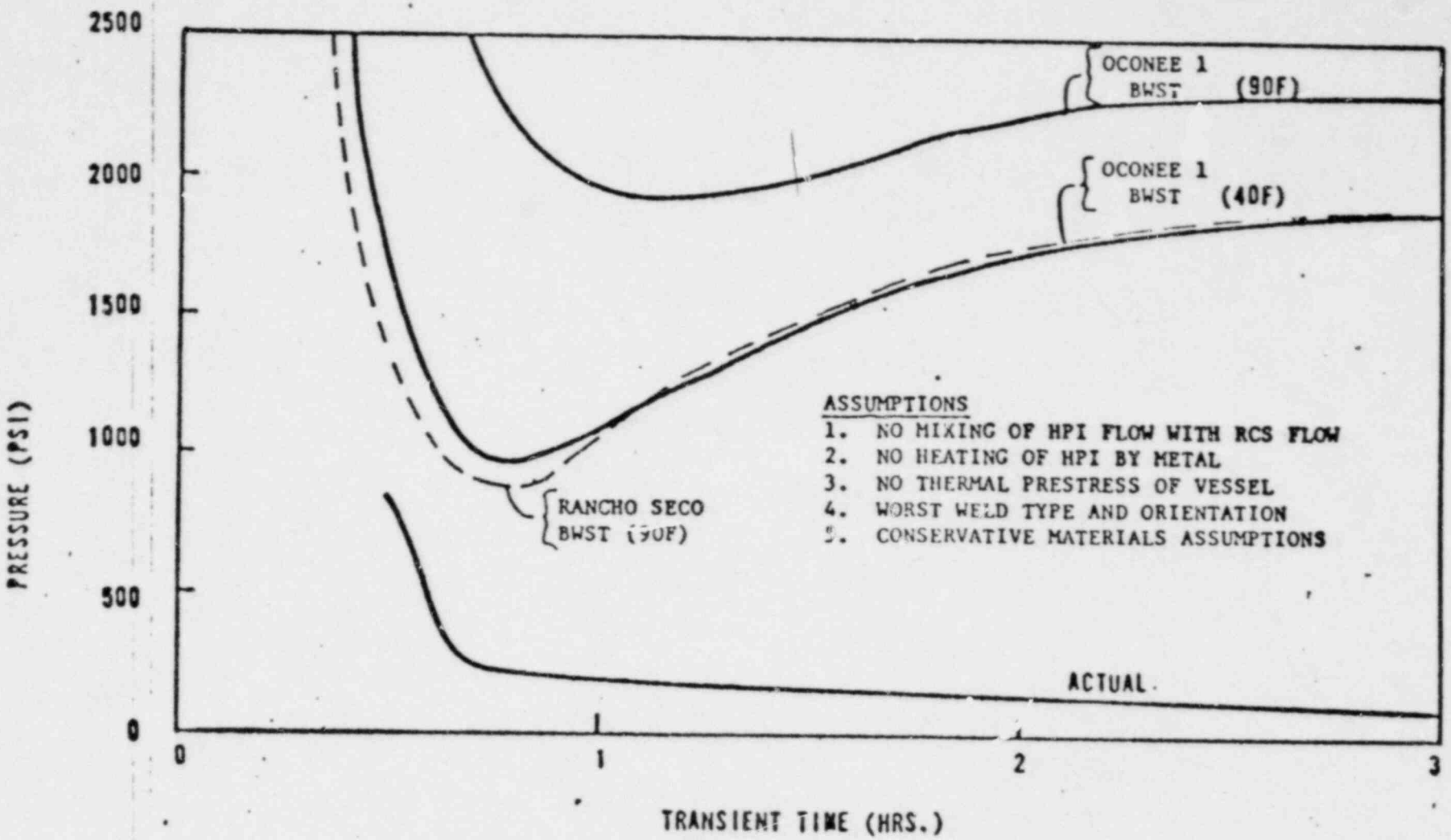
K_{IP} = APPLIED STRESS INTENSITY FACTOR DUE TO PRESSURE,

K_{IW} = APPLIED STRESS INTENSITY FACTOR DUE TO RESIDUAL STRESSES,

K_{IC} = STATIC CRACK INITIATION TOUGHNESS,

K_{IA} = CRACK ARREST TOUGHNESS.

Allowable and Actual Pressure Vs Time, 0.023-ft^2 Pressurizer Break With Operator Action.



MET ED/GPU PROGRAM

1. REVISION OF SMALL BREAK LOCA OPERATING GUIDELINES REGARDING THERMAL SHOCK HAVE BEEN INCORPORATED IN THE TMI-1 OPERATING PROCEDURES.

2. UPGRADING OF THE EMERGENCY FEEDWATER SYSTEM.

3. CONFORMANCE OF RV MATERIAL SURVEILLANCE PROGRAM PER 10CFR50, APPENDIX H.

4. PARTICIPATION IN THE B&W OWNERS GROUP REACTOR VESSEL MATERIALS PROGRAM.

5. PLANT SPECIFIC EVALUATION OF TMI-1 HPI COOLING MODE.

6. MAINTENANCE OF BWST TEMPERATURE HIGHER THAN 40°F.

7. PARTICIPATION IN RESEARCH EFFORT THROUGH EPRI IN THE AREA OF RV THERMAL SHOCK.

8. FINAL ABNORMAL TRANSIENT OPERATOR GUIDELINES (ATOG) WILL INCORPORATE GUIDELINES REGARDING THERMAL SHOCK.