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NRC STAFF WITH PACIFIC GAS & ELECTRIC COMPANY

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TITLE COMPONENT COOLING WATER SYSTEM
DIABLO CANYON UNIT 1

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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MEETING OF NRC STAFF WITH

PACIFIC GAS & ELECTRIC COMPANY

REGARDING

COMPONENT COOLING WATER SYSTEM

DIABLO CANYON UNIT 1

- - -

Bethesda, Maryland

Friday, January 28, 1983

The meeting in the above-entitled matter convened at 9:10 a.m.

PARTICIPANTS:

FOR THE COMMISSION STAFF:

Harold Denton, NRR	D. Eisenhut, DL
R. Mattson, DSI	H. Schierling, DL
R. Bosnak, DE	O. Parr, DSI
J. Crews, RI	L. Rubenstein, DSI
L. Chandler, OELD	J. Goldberg, OELD
H. Polk, DE	D. Lasher, DST
R. Kirkwood, DE	J. Wermiel, DSI
W. LeFave, DSI	R. Buckley, DL
J. Knight, DE	

PARTICIPANTS: (Continued)

FOR PACIFIC GAS & ELECTRIC COMPANY

R. Locke
J. Bergler
G. Pruett
G. Maneatis
R. Palm

FOR DIABLO CANYON PROJECT:

R. Anderson
J. Tinlin
T. Crawford
B. Lew
J. Hoch
G. Moore
T. Tinlin
E. Connell
C. Ward
H. Friend

FOR BECHTEL CORPORATION:

C. Aronson

FOR WESTINGHOUSE:

J. Schlonski
J. Hoebel
D. Popp
R. Loose
W. Gangloff
K. Handerhan

FOR TELEDYNE:

W. Cooper
D. Stratouly

FOR SWEC:

F. Sestak

ON BEHALF OF PACIFIC GAS & ELECTRIC:

Bruce Norton, Esq.
Norton, Burke, Berry & French

ALSO PRESENT:

K. GOLDENBERG

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PROCEEDINGS

MR. DENTON: Let's begin.

The purpose of this meeting today is to discuss the design and operation of the component cooling water system, including its seismic, nonseismic interfaces, safety and nonsafety interfaces and systems, and the application of single failure criteria design of the system.

It came to our attention a few weeks back that questions such as these had arisen during the course of the internal review of the system. As a result of these questions, I had the Staff go back and review what had been submitted about the system and what we had said about it in our safety evaluation report.

The timing of this plant was such that it was not reviewed against the current version of the standard review plan. It was reviewed against an earlier version.

What we would like to do today is to have you describe the system and its design and its design philosophy and operation and why you think it will perform its intended function. And there is an agenda that has been passed around that looks like an adequate way to begin the meeting, and I would suggest we follow the agenda to the extent we can to allow you an opportunity to cover all the points you want to make.

We have a number of people here today that have not been involved in the most recent independent design verification effort, and I think it would be useful to go around the table and perhaps make sure we all know each other.

I am Harold Denton of NRR.

MR. EISENHUT: I'm Darrell Eisenhut.

MR. MATTSON: I'm Roger Mattson, Director of Systems Integration.

MR. WATT: I'm Richard Watt, PG&E.

MR. HOCH: John Hoch, PG&E Diablo project.

MR. FRIEND: Howard Friend, Diablo Canyon project.

MR. NORTON: Bruce Norton, representing Diablo Canyon project.

MR. MANEATIS: George Maneatis, Pacific Gas & Electric Company.

MR. ARONSON: Chuck Aronson, Bechtel Corporation.

MR. CONNELL: Ed Connell, Diablo Canyon project.

MR. CRAWFORD: Tom Crawford, Diablo Canyon project.

MR. TINLIN: Jim Tinlin, Diablo Canyon

project.

MR. MOORE: Gary Moore, Diablo Canyon project.

MR. ANDERSON: Dick Anderson, Diablo Canyon project.

MR. RUBENSTEIN: Les Rubenstein, Assistant Director for In-Plant Systems.

MR. CREWS: Jess Crews, Region V.

MR. BOSNAK: Bob Bosnak, DE.

MR. PARR: Olin Parr, DSI.

MR. SCHIERLING: Hans Schierling, Division of Licensing.

MR. EISENHUT: I think that is probably enough.

MR. DENTON: Roger, do you have any opening comments?

MR. MATTSON: Well, maybe just to elaborate a little bit on what Harold said. The systems people, the people that look at the functional performance of safety systems, have not really concentrated on this plant in a number of years. The principal review was completed back in the SER stage, maybe 1974.

Since that time there have been some advances in the way that we looked at systems reliability, safety systems reliability, safety system function and assurance. The standard review plan is the current manifestation of how we look at the system.

So when we began to become involved in the Diablo Canyon project in the last few months, it was an expanse to phase two, and the most recent questions have come up on the missile cooling water system. The easiest charge for us to put our hands on is the standard review plan. That is how our Staff is trained. That is how we think today.

Now, the Commission's requirements on the implementation of the standard review plan are somewhat different than just go forth and use it blindly. We can't do that. We don't intend to do that. Nevertheless, the best way for us to get some feeling for how good a safety system is on any plant -- an old plant, a new plant, a future plant -- is to start with the standard review plan.

So don't jump to the conclusion, just because we have asked you questions or will ask you questions that flow from today's standard review plan, that you necessarily have to meet it. You may or may not, depending on how good your system is and how it stacks up reliabilitywise, the assurance of its functionwise, as we go along here and dig into it and explore it.

But we had a judgment that, given that there were questions raised on component cooling water system, we might as well start from the beginning, looking at it according to the best available light. And that's why you will hear some things that may be different in the criteria against which the component cooling water system was reviewed in 1972, 1973, 1974.

MR. EISENHUT: With that, I understand, Mr. Maneatis, you have a number of people to go through a presentation. So at this point why don't you go ahead.

OPENING REMARKS

MR. MANEATIS: Well, Harold pretty much covered my introductory remarks as to the reason we are here. Since we have a long and hopefully interesting agenda ahead of us, I'm going to turn the meeting over immediately to ick Anderson, the engineering manager of the Diablo Canyon project, who will provide you with an overview of the presentation and introduce our presenters.

INTRODUCTION AND OUTLINE
OF PRESENTATION

MR. ANDERSON: As you can see from the agenda and outline we passed out, we have a rather broad and comprehensive presentation to make on the component cooling water system, how it is, how it was designed, its requirements, the philosophy, if I could use that term, how it operates. And we plan to go through in some detail and explain that to you today.

This is of course in response to Mr. Eisenhut's request at the January 13th meeting to describe the CCW system in all of its different aspects. In introducing this subject, I think it would be worthwhile to go back and briefly, very briefly, review the history of how this issue developed on the project.

Certain concerns about the CCW system were raised by one of our own engineers who was reviewing the system in connection with the phase one design verification program. On November 24th, after considerable review and discussion, the engineer's concerns were formally documented in a memo to his supervisor, which in turn triggered a potential nonconformance report being initiated on December 1 in accordance with the project procedure.

Again in accordance with the procedures, the project engineer established a technical review group and this technical review group was made up of both on-project and off-project personnel. It was a mixture of on-project and off-project people and also a mixture of Bechtel and PG&E people, to try to get the broadest and most comprehensive review of the issues.

The group was chaired by the project engineer, Gary Moore. It had on it Paul Schmitz, who is the chief nuclear engineer from Bechtel's Power Management Group. It had Charles Aronson from the chief nuclear engineer's staff. He is the supervisor of the safety group. It had Ray Ashley, who is the licensing manager for the Diablo Canyon project and former chief nuclear engineer of our Gaithersburg office.

It had Dan Brand, who is the assistant project engineer, systems; Dan Hardy, who is the assistant project engineer, quality. It had Ed Connell, the mechanical group supervisor. It had Russ Lesardy, who is the engineer on the project who raised the original concern. It had Jim Tinlin, who is a senior reactor operator and the training coordinator for PG&E's nuclear power operations.

It had Mike Jacobson, who is project QA engineer; Jim Hickley, who is PG&E QA engineer; and myself as engineering manager for Diablo Canyon project.

Now, when a technical review group is formed, in accordance with the PG&E and project procedures the technical group must vote unanimously before an issue can be resolved. So this group had to have unanimous consensus on any issue that was to be resolved completely.

MR. EISENHUT: Dick, can I ask one question of something you said? I think you used the word "nonconformance." You said in December or something you reached an internal determination of a nonconformance.

MR. ANDERSON: We opened a potential nonconformance report and then established a technical review group to review the merits of the issue. That was in accordance with the procedures.

MR. FRIEND: When was that, Dick?

MR. ANDERSON: Well, the nonconformance report was taken up on December 1 and the written notification from the engineer to the supervisor was November 24th. So this has been going on for some time.

MR. EISENHUT: My question was, how does that relate to a nonconformance where you notify the NRC of the nonconformance? I mean, you have a potential question, you call it a potential nonconformance or a nonconformance. How does that relate to a nonconformance in the normal jargon that we use?

MR. ANDERSON: Maybe Gary can answer that better than I can.

MR. MOORE: Well, as a result of the technical review group, it first assesses whether the issue is a nonconformance against a set of criteria, whether that be nonconformance against licensing criteria or other requirements. Once it determines it is a nonconformance, it identifies an active description of the problem, it identifies the cause of the nonconformance, it identifies a resolution to that specific nonconformance. It also identifies any corrective action that might be associated with that nonconformance in regards to other areas outside of the specific issue on the nonconformance.

Another action that the TRG performs is it reviews that nonconformance against the various regulations with regard to reportability.. On Unit 1, since we have an operating license it was reviewed against 50.59. It was also reviewed against Part 21-type reportability. Since Unit 2 is not having an operating license, the Unit 2 organization would review it against the requirements of 50.55(e). And I think Dick's remarks will get into actually how the process has worked with regard to this particular nonconformance, but that is the general procedure.

MR. CREWS: Can I follow up just a bit on that?

MR. DENTON: Perhaps each speaker, Jesse, should give his name.

MR. CREWS: Jess Crews.

The question I have is really very much related to Darrell's and it regards reportability. Now, I know that you have established procedures within the company, and I'm sure PG&E has as well, for handling compliance with Part 21 to be sure that matters that may involve defects or other conditions that must be addressed in Part 21, and ultimately that leads to the notification of the corporate officer, who is responsible then to promptly report to the Commission.

And I guess my question is, with regard to Part 21 per se, is how you incorporated or adapted those company internal procedures to the internal, to the VPP and to the internal technical group as items are washed up that should be considered.

And then I would like to add to that one other, that beyond those mentioned the technical specifications associated with the Unit 1 license have specific requirements for reportability as well, and I know that is a big question. But can you describe generally how that is handled in the framework of procedures you established formally in the past as it relates to this special effort by VPP and the internal Bechtel program?

MR. MOORE: Yes, Jess. I think I remembered all the parts of your question.

Number one, with regard to how the technical review group addresses Part 21 reportability, it itself does not determine reportability. It only makes a recommendation as to taking the matter to the corporate Part 21 committee. And as a function, I said, with regard to reportability, the technical review group does not determine reportability; it just determines whether it should be recommended on up to the corporate Part 21 committee.

Secondly, with regard to the internal verification program -- excuse me, the independent verification program, we treat those set of procedures separate from the quality program set of procedures, and in specific with regard to this issue, the project initiated open item 34 in our semi-monthly report, which I believe was the second semi-monthly report in December, with regard to this issue, and that is how we reported it under the internal verification program procedures.

Now, with regard to how the tech spec aspect of the nonconformances is reviewed, I may not have correctly cited the regulation, but when I mentioned that we reviewed the nonconformance against 50.59 requirements, it is in that review that the tech specs are addressed.

MR. ANDERSON: Maybe as we go along you'll see what we did and that is in accordance with the procedures. Remember now that the letter of concern --

MR. CREWS: Dick, before you get to that, the TRG, I guess for my clarification, is the TRG an ongoing function or is it something that is a TRG that is formed to deal with specifics?

MR. ANDERSON: This was set up specifically to deal with this issue. The people on the TRG were chosen specifically to be able and capable of dealing with this issue.

MR. CREWS: But is there generally a charter for TRG's? And you mentioned the TRG has responsibilities for reporting, that sort of thing. Is that on a case by case basis?

MR. MOORE: When a nonconformance is initiated, each time that is done a unique TRG is formed. The chairman is always myself in Unit 1's case and there are a set number of members based upon their organization. We have a member of the PG&E quality assurance department on the committee, we have a member of PG&E's operating department on the committee, we have a member of the project quality assurance department on the committee, and also a member of the quality engineering group within the engineering department on the committee.

Then I have the responsible technical area represented on the committee, depending upon what the subject is, and then I have the freedom to add anyone else that I feel is appropriate to the committee, either based upon their experience or their understanding, and it is unique depending upon what the subject is.

MR. DENTON: I hoped we could get into the technical side. But having gotten into the procedural side, let me explore this just a bit. Who selects the membership on this committee?

MR. MOORE: I do. In the case of Unit 1, the project engineer does.

MR. DENTON: Now, I take it some concerns come up the line that you agree with and you never establish such a committee. So what is the basis for establishing that committee when a concern exists?

MR. MOORE: At the lowest level, if we can take it that way, a concern is identified to the responsible supervisor. In this case it was the mechanical group supervisor.

MR. DENTON: Suppose the supervisor says right on, I agree?

MR. MOORE: He has basically three options when the concern is raised to him. Based upon his judgment, he can determine that the issue has no significance and indeed it is not an issue and dispatch it. If he determines it is of a minor nature, a procedural nature, he can open what we call a discrepancy report. And if he determines that it is significant or has potential significance, then he goes and gets the PG&E chief to initiate a nonconformance that addresses the issue and then the TRG is formed.

But the initial judgment of whether -- what classification, if you will, the issue should be given is made by that supervisor, and I think it is fair to say that that process is monitored by the quality assurance organization in the project. They look at DR's, they look at nonconformances, to make sure that reasonable judgment is given.

MR. DENTON: Does the supervisor's judgment automatically get reviewed by a TRG, then, if it is classified in the most severe significance?

MR. MOORE: Yes. With regard to this specific issue, the group supervisor came to me, advised me of the issue, and it was my recommendation, and he concurred, that the issue had enough significance that we shouldn't make the determination ourself and should allow the TRG to make that determination.

MR. DENTON: And has the group completed its review?

MR. ANDERSON: Maybe I could go on, then, and tell you a little bit about what happened with the TRG. They held meetings on December 10th, December 22nd, January 19th and January 21st to evaluate the issue. In addition, the established a subcommittee to perform specific investigations and report back to the larger TRG group.

The project engineer instructed the TRG to do three things. The first was to answer the question, does the CCW system meet the licensing commitments. That was the first question.

Secondly, should the issue or any part of the issue be sent to PG&E's 10 CFR Part 21 committee? In other words, does the TRG believe that there is anything reportable under 10 CFR 21, whether or not the system meets the licensing commitments.

And then thirdly, should any additional work be done on the system even if it meets the licensing commitments and is not a 10 CFR Part 21 issue.

So it was a rather broad-based challenge to the committee to do all of these, to address all of these questions. At this point the TRG has been making good progress in its evaluation of the CCW system, but it has not completed its work. Conclusions and findings, however, have been reached as follows:

It was unanimously agreed that the small post-LOCA sample cooler added in response to the TMI backfit requirements does not meet design class 1 requirements as required by the FSAR, although it subsequently has been qualified for seismic category 1 requirements.

It was also unanimously found that the loop C heat exchangers meet the pressure boundary requirements of the FSAR.

It was also unanimously agreed, based upon all of the information available to date, that further action under Part 21 would not be recommended. That is, the issues raised were not reportable under Part 21 in the judgment of the technical review group.

Unanimous agreement, however, was not achieved on the remaining two issues: the design classification of the surge tank level switch, it voted that it did meet by 11 to 1; and the issue involving heat loads other than design basis accident conditions, voted 10 to 2 that the licensing commitments were met.

In those two issues, we have referred those to a management level technical review group within the PG&E organization. The technical review group has not yet made its recommendations on further action, the third question that the project engineer wanted answered. However, the project has already initiated some further action to be described under Section 8 of our presentation today.

In accordance with the verification procedures, as Gary mentioned, open item number 34 was initiated on December 13th, 1982, and the issue was reported in our semi-monthly report.

Now, getting to today's agenda, we have given a great deal of thought as to how to present this broad and comprehensive subject matter. We received on Tuesday a list of your examples of topics and questions to be included on a presentation. We could go directly to those issues and give you a series of kind of one-liner answers, like the CCW system including loop C doesn't meet the seismic category 1 requirements in the piping.

However, if we did that I'm afraid we might leave a confused record and might not be responsive to Mr. Eisenhut's rather broad charge give in our January 13th meeting.

MR. DENTON: I would prefer that we get the complete description and understanding of the system before we go to detailed questions.

MR. ANDERSON: Very good. Then if we could go over the agenda, and you all have that in front of you, I would like to kind of point out where we're going, so we get a feel for how this is going to progress.

First we want to give a description of the component cooling water system, and Ed Connell is going to go over the system diagram and he's going to give a system description in a somewhat unique way. He's going to use the standard review plan format, even though that was not required for this plant. That certainly is your point of reference and we could use your point of reference to describe the system.

Then we're going to show some color slides with emphasis on the C loop piping and components. Now, obviously we run somewhat of a risk in doing that. Color slides do not show up well in the record, and we also in showing color slides, we can have endless questions on the details of the slide. Now, we have all of the slides indexed and we can come back to them later on if you want to discuss a certain picture.

But what we want Gary Moore to do is to go through the slides showing the system and point to both the component and the diagram, so that everybody gets a picture in their mind not only of what the diagram looks like but what the plant looks like at the same time. I think that will be interesting for you.

Then we have asked Chuck Aronson to give a rundown on the criteria and design philosophy, the general background, the specific component cooling water requirements for licensing basis, the safety-nonsafety related interfaces, the seismic-nonseismic interfaces, the single failure criteria and the heat loads.

And then, since instrumentation is woven throughout this, it is hard to put that in at various different points. We have asked Tom Crawford to give a presentation on the instrumentation itself as a separate subject.

And then finally we're going to talk about operation, how the system is operated and particularly how contingency modes of operation are handled. And then, since you sent us your questions just recently, we will respond under item 7 of the agenda to those specific questions.

At that point I think we can open it up to your questions and discussions, but up to that time we really would prefer to be able to get through the whole presentation. It won't take too long, but it will give a broad base from which further discussion can be then developed.

We have handouts that we will be handing out of each presenter's presentation, and I think they are going to follow the written handouts pretty carefully. So if you have questions you can certainly make comments in the margin or something like that and we can come back to the questions.

What we want to avoid is getting bogged down in some particular detail without having the broad perspective and understanding of how this particular component cooling water is designed and what the basis for it really is.

MR. DENTON: Can you estimate the length of time required for the presentatio if it were reasonably uninterrupted?

MR. ANDERSON: If it were reasonably uninterrupted, I think maybe an hour and a half to an hour and 45 minutes would be enough to cover the three fundamental presentations and give the whole background, and then we could get into the detailed discussions after that.

And then finally we will make a very brief statement about the future project action that we plan. It is listed here as item 8 and you can see by the titles that are given what we plan to do. We do believe that we will demonstrate in this meeting that the system as designed and constructed meets any reasonable interpretation of the design requirement for Diablo

Canyon.

However, to confirm some of the original judgment regarding seismic capability of loop C components and to evaluate proper operating conditions beyond the FSAR evaluations, we are performing additional evaluations in those specific areas. Obviously, if these further evaluations indicate that changes should be made we will be making changes accordingly.

So at this point I would like to turn it over to Ed Connell. He is the mechanical supervisor on the project. He is from Bechtel. He has been involved in the project since March of last year. He has had close to ten years experience in the nuclear industry. And with that I will just turn it over to you, Ed.

MR. CHANDLER: Before Ed picks up on it, one question of Gary Moore on the procedures regarding the TRG, if I can. You mentioned earlier that the basic decision as to whether to establish a TRG is, I guess, left to the supervisor based upon a determination of the significance of the concern raised. What is the procedure if there's a dispute between the individual raising a concern and a supervisor as to significance?

MR. MOORE: Okay, just one minor correction. He doesn't decide whether a TRG is to be formed or not.

He decides whether a potential nonconformance should be filed or not. Then he has, the individual with the concern has, the normal recourses, to go to his supervisor's boss either up through the project organization or in this case he has really two functional organizations he can also go up through, namely to his chief and, if that isn't good enough, on up into the corporate management of the respecdtive organization.

And if he's still not satisfied, the ultimate recourse that he has is going to the NRC.

MR. ANDERSON: It may seem strange the way we are organized in having always two bosses. The people work for the project group for daily direction and the project team is put together, but they still have their functional chief. In the case of Bechtel people they have the Bechtel chief engineer, who is responsible for that person's career, for their development, and for their salary.

So there is a double supervision kind of an organization here and the engineer always has recourse to go to the chief engineer if he feels the project people, the supervisor or the project engineer or whoever else is on the project is not giving a technical issue the proper attention.

AGENDA ITEM 3. DESCRIPTION OF CCW SYSTEM

MR. CONNELL: Let me describe the component cooling water system in general, and I will discuss its basic arrangement, its components and various operating modes, performance requirements and the interfaces to the other supporting systems. Afterwards I will get into a discussion of principal design considerations of the component cooling water systems.

(Slide.)

The system is designed to remove waste heat from the primary plant equipment and components during normal operation, plant cooldown and following a loss of coolant accident. The components and equipment served are either engineered safety features or have a potential for leakage of radioactive fluid into the CCW system.

The system serves as an intermediate system between normally radioactive systems and the auxiliary salt water system. This double barrier design reduces the possibility of the leakage of radioactive coolant to the ocean.

(Slide.)

MR. EISENHUT: I think what you're going to have to do is a couple of you are going to have to move back a little bit so we can see where you're pointing on the slide. That's fine, I think.

MR. CONNELL: The systems consist of three component cooling water pumps, two heat exchangers, one surge tank which is internally divided so that in effect it acts as two tanks, a split on the three loops called header A, vital, header C, nonvital, header B, vital. Each of them serve a number of users on that loop. There is also two chemical addition tanks, one in each loop.

When I mention vital components what I mean by vital is that that component is required to perform a safety function. Notice that except for the components on the C loop, chemical addition tanks and the post-LOCA sample cooler, all of the CCW system including the piping and the valves is a Design Class I system. Design Class I means that the design, fabrication and construction is in accordance with the requirements of 10 CFR 50, Appendix B, and it meets the intent of all NRC requirements for safety-related systems.

All users, whether vital or nonvital, are capable of being individually isolated by Class 1 valves. In general, the components inside containment can be isolated from the control room. The other components are isolated by local manual valves. Each of the three loops can also be isolated using only Design

Class I valves.

For example, if you wanted to isolate loop C you could do so by closing that valve FCV-355 on the supply side to the C users, and on the discharge or the suction side of the pump you could close this manual locally operated valve. Each of the other loops works in a similar manner.

(Slide.)

MR. EISENHUT: I'm not sure I heard the last thing you said. They can be closed manually, local or remote?

MR. CONNELL: On the suction side, the pump suction side, those are local manual valves. They are located in the pump room.

MR. EISENHUT: And on the other side?

MR. CONNELL: 355 is remote, manually operable from the control room, as well as, as you can see, it gets a P signal. Those are local manual valves, as Gary just pointed out, on the crosstie header.

MR. MATTSON: The center pump there, that is local manual?

MR. CONNELL: Yes, all the valves shown are local manual unless they have an operator on them.

The three component cooling water pumps are Design Class I horizontal centrifugal, rated at 9200 gpm. They are made of carbon steel. They are located in the lower elevation of the auxiliary building. Each of the pumps is fed by a separate vital 4-KV bus.

The two heat exchangers are of a shell and straight tube design. The auxiliary salt water goes through the tube side. The manufacturer's rating for the heat exchanger is 258.8 million Btu's per hour. They are located in the turbine building. It is carbon steel in the shell and carbon-nickel in the tubes.

The two chemical addition tanks which are used to inject corrosion inhibitor are carbon steel. Note that they are manually, through manual valves. In normal operation the manual valves are closed.

MR. DENTON: I'm still unclear. I think one of the points of confusion when we first looked into this was whether or not header C including the heat exchanger and piping valves were or were not considered class 1 by you, and you say that they definitely are. Is that correct?

MR. CONNELL: The piping and the valves up to the individual components on the header are Design Class I piping and valves. The individual components, and I think we're going to talk about each one a little bit later, they are not required to be Class I. They do not serve a safety function.

Some of the components are built as if they were to perform a safety function. Most of the others have varying degrees of assurance, if you will.

MR. DENTON: Well, let me be clear, then. Everything that is in the box header A is seismic category I?

MR. CONNELL: That is correct. I have broken out one piece there which is really on the A loop, and that is the post-LOCA sample cooler which I am going to talk about a little in depth in a few minutes. Everything in B is -- everything in A except for the sample cooler is also seismic category I.

MR. DENTON: I take it later on you're going to talk about what is inside the box labeled "header C"?

MR. CONNELL: That is correct.

MR. EISENHUT: Just to make sure I understand, you said the piping up to the component which need not be Class I is Class I, and you said the valves. Now, do each of those non-Class I components, do they have their own isolation devices, valves to take them out?

MR. CONNELL: Yes.

MR. EISENHUT: And those isolation valves on those components are Class I?

MR. CONNELL: That's correct. Gary has some good pictures later on.

MR. ANDERSON: We will show this in the pictures and we will show what the breakdown is. The heat exchangers are not designed to Class I, however. Seismic considerations were certainly given to the design of the whole loop. The idea was to have a low stress level at the nozzle and the piping is seismic category I, and we will get into that as we go along.

MR. EISENHUT: My question was a little simpler, though, and that is for each component hooked to that loop there is in fact another set of valves that you can see here?

MR. CONNELL: That's correct.

MR. EISENHUT: That are Class I isolation valves?

MR. CONNELL: Yes. We have a slide to show that. It is Class I isolation valves on each side.

MR. EISENHUT: Of each non-Class I component?

MR. CONNELL: That's correct.

MR. BUCKLEY: Are the chemical addition tanks seismic?

MR. CONNELL: The chemical addition tanks are not required to be seismic because they are manually valved out of the system. Those valves are Class I according to our classification scheme. They are not seismic.

MR. BUCKLEY: The chemical addition tanks themselves, but the valves are?

MR. CONNELL: They are not designated design class I. As I said, we have one surge tank. It has a capacity of 10,750 gallons. The minimum level during normal operation is 4,000 gallons. It's also made of carbon steel, and it is located on the roof of the auxiliary building. And as you can see there, it is split so that each side feeds one of the vital loops.

The valves I guess I talked about. The piping is carbon steel. It is welded with flange connections.

(Slide.)

Now I want to talk about what's inside these three boxes here on the vital loops. On loop A, you see we have one RHR heat exchanger as represented as being inside that box, along with an RHR pump, an SI pump. Two containment fan coolers are on loop A. The post-LOCA sample cooler which is shown outside that box is also connected to loop A, and the component cooling water pump is self-cooled. So they are shown there as coming off of that loop also.

Loop B has one RHR heat exchanger, the RHR pump, charging pump, injection pump. It has three fan coolers on there, and again the pump is self-cooled.

MR. MATTSON: Is the only asymmetry the fan coolers?

MR. CONNELL: And the post-LOCA sample cooler.

(Slide.)

In the nonvital header or the loop C header, none of the components on the header are required to operate for the CCW system to perform its safety function. We have a list there of what is in there: a waste gas compressor, the reactor coolant pumps, and the various coolers off of there, boric acid package, a letdown heat exchanger, a spent fuel heat exchanger.

As I say, none of the components on there are required to operate for the CCW to perform its safety function.

(Slide.)

This is a very simplified elevation drawing to show you the basic arrangements. As you can see, the surge tank is the high point on the loop of the aux building. The heat exchangers are in the turbine building and the pumps are in the aux building at elevation 72. The users and the various loops are both inside the containment, as well as out in the interior building.

(Slide.)

I want to talk about the basic operating modes right now. In normal operation, one heat exchanger is running --

MR. EISENHUT: Excuse me. You went a little fast on that last slide.

MR. CONNELL: On the elevation slide?

MR. EISENHUT: Well, it is an elevation and it is simplified.

(Slide.)

And I'm trying to associate that with where the valving is on the system.

MR. CONNELL: Which valves?

MR. EISENHUT: Well, the isolation valves that would be isolating loop C.

MR. CONNELL: The suction valves are in the pump room and the other valves are all in the heat exchanger room.

MR. MOORE: In the turbine building for the heat exchanger on basically grade level.

MR. ANDERSON: We will see those valves in the pictures, the heat exchangers and how you get to the valves and all of that.

MR. EISENHUT: Okay.

(Slide.)

MR. CONNELL: This is a diagram of a normal operating mode. As you can see, in normal operation one heat exchanger is used, two pumps, all three loops are fed.

(Slide.)

In the cooldown mode --

MR. MATTSON: Excuse me. "Normal operation," you mean non-accident normal operation?

MR. CONNELL: Normal operation, power operation, that's correct. There is about five of these slides coming, and let me see when I get through all five if I get through the one you're interested in.

This is in normal cooldown. We bring up the three pumps, the valve in the second heat exchanger, and again you run through all three looops.

(Slide.)

This is if you have a safety injection signal. You bring up the three pumps on the safety injection signal. You are still feeding the one heat exchanger that you had in service for normal operation. You are feeding all three loops.

(Slide.)

This is if you have a P signal, P being a high high containment pressure, about 22 pounds. In this case again, you have the three pumps on. They came on at the SI signal. You still have the one heat exchanger. The difference is that this valve FCV-355 closes on a P signal, so the C loop is isolated or the flow through the C loop is isolated.

(Slide.)

Now, this is in the recirculation phase post-LOCA. The system has the capability to valve out loop C or valve it into one of the two separated isolated loops. As I have shown in this particular slide, this shows with the C header isolated as one possible mode. The interesting feature here, of course, is that the A loop and the C loop are not connected.

I think that is the last operating mode slide.

MR. EISENHUT: If I could ask, could you just back up to the S and P signals and the safety injectio for a moment?

MR. MOORE: Do you want to take the S first?

MR. EISENHUT: Yes.

(Slide.)

MR. CONNELL: The difference, if I may say, is this, or the similarity is this: The S signal, which of course is at low pressure, all three pumps are initiated. The heat exchanger that was in normal operation stays there. That valve 355 does not close. No valves close automatically there.

(Slide.)

When the P signal comes along, if the containment pressure does get up that high where the signal gets that high --

MR. MATTSON: What was that pressure again?

MR. CONNELL: It's about 22 pounds.

MR. MATTSON: Gauge?

MR. CONNELL: Gauge.

MR. EISENHUT: So I understand, then, that on both of these modes everything is running through the heat exchanger one.

MR. CONNELL: It is running through the heat exchanger that happens to be in operation at the time, and of course they are rotated.

MR. EISENHUT: I'm sorry. Now, okay, does the seismic -- then the heat exchanger, then, the heat load assumes the A loop, the A loop and the B loop both come on, and is it sized then that all of the equipment on the A and B loops come on, for example all the fan coolers?

MR. CONNELL: That's correct. Let me set that out. Let me talk about heat loads a little bit later. We've got about four or five cases.

MR. EISENHUT: I just wanted to be sure I understood the operating mode here, though, that hangs upon whatever heat exchanger is in fact in operation at the time.

MR. CONNELL: That's correct.

MR. MATTSON: Well, let's go back one slide just to make a point.

(Slide.)

Let's say we got a TMI accident, no high pressure signal in the containment, one heat exchanger, A, B and C all operating off of one heat exchanger. The system is designed to do that?

MR. CONNELL: That is the way the system is designed.

MR. MATTSON: That would be the most limiting heat load case, right?

MR. CONNELL: I don't necessarily know that. What was the heat load in the containment on TMI?

MR. MATTSON: Well, let's just say a small break LOCA.

MR. CONNELL: What was the energy? I understood your question to be was that the limiting heat load case, and I guess I can't answer because I don't know what the heat load was at TMI.

MR. MATTSON: I don't want to go to the TMI event as a design basis. This would be more limiting than the normal cooldown, right?

MR. CONNELL: Yes.

MR. MATTSON: Isn't this the most limiting heat load case? It's more limiting than a normal cooldown because it is also cooling emergency safety features.

MR. ANDERSON: Well, it could be. But there is an alarm on the system and if the temperature goes up over the alarm, and we will talk about that later, then the second heat exchanger would have to be cut in or some of the loads contributing to heat, namely the fan coolers, would have to be cut off.

MR. EISENHUT: Let me ask the question a little different. In your design of this plant, which operating mode is the most limiting from a heat load standpoint for design purposes on heat exchanger, either of the heat exchangers?

MR. CONNELL: Could I set that aside, because there are some subtleties involved and I will talk about that in just a few minutes. But let me just say here before we leave on this particular drawing, this shows an S signal, which means that you haven't gotten to the 22 pounds. So it is not necessarily the limiting case, and let me leave it that way.

MR. MATTSON: You're also going to talk about the flow design capability of the heat exchnger later?

MR. ANDERSON: Yes.

MR. MATTSON: It's clearly three pumps.

MR. MOORE: We specifically answered that question in the section 7, where you asked a specific question in that regard.

MR. CONNELL: I was going to talk a little bit about supporting systems.

(Slide.)

There are two principal supporting systems, auxiliary salt water and makeup water system. The auxiliary salt water system takes heat from component cooling water heat exchanger and injects it into the Pacific Ocean.

(Slide.)

The makeup water to the surge tank or to the component cooling water system is supplied through two redundant makeup valves feeding two redundant component cooling water surge lines. These air-actuated level control valves open automatically in the event of a low level in the surge tank, indicating that system makeup is required. They close automatically when the normal operating level in the surge tank is restored.

The makeup to the system is supplied to the above valves by the makeup water system. The makeup water can be provided from the various water sources and through various pumps and flow paths in the makeup water system.

Under normal operating conditions, makeup water is provided automatically on demand from the outlet of the makeup water demineralizers, which receive water from the raw water storage reservoir. The elevation of the reservoir provides adequate static head to pressurize the outlet of the demineralizers, so makeup is supplied to the CCW without any pumping. This makeup source is Design Class II up to the check valve.

There is a Design Class I source for makeup to the CCW system and that is from the condensate storage tank, which contains 425,000 gallons, with a reserve of 170,000 gallons for the auxiliary feedwater, so that 255,000 gallons should be available for makeup.

The makeup water from the condensate storage tank is pumped by fully redundant Design Class I makeup water transfer pumps. Each pump is energized by a separate vital bus. All piping and valves from the condensate storage tank to the CCW surge lines are Design Class I.

There are many other sources of makeup water available for even further backup. Five other sources are described in the FSAR. Some are Design Class I, such as a crossconnect to the Unit 2 condensate storage tank, while others are Design Class II.

MR. EISENHUT: You mean on this slide, then, that everything above the Class I symbol and to the left of the Class I symbol there, over in that corner everything is Class I including the instruments?

MR. CONNELL: I'm talking about piping, components and valves. The instruments as they form the pressure boundary are Class I.

MR. MOORE: These valves are Class I, and with regard to pressure boundaries the instrumentation associated.

MR. EISENHUT: So all piping, valving, all pressure boundary in the corner is Class I?

MR. MOORE: Tom Crawford will give an explanation of the instrument classification system that goes through what is Class I and what is Class II and some of the permutations of it.

MR. MATTSON: It's Class I because you need this makeup following a seismic event, is that right?

MR. CONNELL: No, it is Class I because the CCW system is a Design Class I system and this provides the water for any leakages that you might have in the system.

MR. MATTSON: But is it Design Class I because you need it following a seismic event?

MR. CONNELL: No, that is not what I'm saying.

MR. MATTSON: You don't need CCW following a seismic event?

MR. CONNELL: No, I wasn't answering that question. The question is why is it category I. It is category I because the component cooling water system provides a safety function and it needs to have a supply of water in the system and this is how it gets there, through the surge tank, through the makeup.

MR. MATTSON: Do you need the component cooling water system following an earthquake?

MR. CONNELL: This component cooling water system is available after an earthquake, yes.

MR. MOORE: I think it would be fair to say that, since this system is normally in service, earthquake or otherwise, that we would expect it to be in service before, during and after an earthquake.

MR. EISENHUT: But the real question is, and let me see if I can ask it, the component cooling water system you say is Class I because fulfills a safety function, and our question really is, what safety function is it there needed to provide? And you can make a circular argument that it's needed to provide water to the safety system, and the question is for what kind of an event?

Is it for a LOCA, is it for a seismic event, is it for whatever, or what combination?

MR. CONNELL: The safety function is a LOCA, to remove heat from containment after a LOCA and you cool various emergency safeguards pumps.

MR. EISENHUT: Now, the second part now is, is it also needed for a seismic event with no LOCA?

MR. CONNELL: I am a little --

MR. MOORE: Only in the sense of safely shutting the plant down and going to cold shutdown, but not in an accident scenario, a shutdown scenario.

MR. MATTSON: Does that mean you could stay at hot standby without the component cooling water system?

MR. MOORE: John is shaking his head yes. I believe as part of the Hosgri evaluation we also demonstrated that we could go to cold shutdown.

MR. MATTSON: Without the CCW pumps?

MR. MOORE: With the CCW pumps. The system is being qualified. It seismically has been reviewed for Hosgri requirements.

MR. MATTSON: I think the answer that you've given to the question, then, is following earthquake if you stay at hot standby you don't need the system.

MR. CONNELL: We are hung up on the need, do you see, because if you're talking a LOCA, for example, I know what you mean when you say need because you have close consequences and the boundary, et cetera. But I'm not sure what you mean by need here.

MR. MATTSON: Let me say it a little more specifically. Following an earthquake, discounting all Class II equipment, to stay at hot standby I don't need the system. To go to cold shutdown I do need the system.

MR. HOCH: Let me address it very plainly. The original design basis for the plant as stated in the FSAR is that the component cooling water system was only required for a LOCA. As part of the Hosgri evaluation, if you will remember, the Staff required us to come to safe shutdown and interpreted safe shutdown as a cold shutdown.

Consequently, as part of the Hosgri evaluation the requirement was made for cold shutdown. That requires the component cooling water system. So now, including the Hosgri evaluation, we have two design bases, if you will, for the system, accident operation in handling the effects of a LOCA and cold shutdown. In either case the component cooling water system is required; to stay at hot standby it is not.

MR. MATTSON: So that is a different answer to the question. The licensing basis of the plant today is to reach cold shutdown following a seismic event, and in order to do that you need the component cooling water system. So the functioning of the component cooling water system following a seismic event has to be assured to meet the licensing basis.

MR. EISENHUT: With no LOCA. That's two different scenarios.

MR. MATTSON: Given the design basis seismic event, the licensing basis for this plant is required to reach cold shutdown. In order to do that you have to have component cooling water system.

MR. MOORE: Yes.

MR. EISENHUT: There is a nodding of heads around here.

(Laughter.)

MR. MOORE: Yes. I will point out that there are other things that go into that shutdown scenario, namely the time factor, you can take advantage of operator action, that sort of consideration.

MR. MATTSON: Those are details. I understand that.

MR. HOCH: That design basis of cold shutdown, the cold shutdown part is very carefully outlined. Both the Hosgri report and the Staff's safety evaluation report on the Hosgri evaluation described that process of getting to cold shutdown.

MR. MATTSON: Well, that must involve things like the fact that there are air operators and that there are instruments and a lot of details that you have to look at and show why you can depend upon this whole system, given a seismic event. I don't mean to get into that right now, but we are going to get into that later, is that right?

MR. ANDERSON: Yes.

MR. MATTSON: Good.

MR. NOVAK: What specific components would you call on? I would like to know, is there a point in the cold shutdown procedure from which you would draw component cooling water system in operation? For example, do you need it to operate the auxiliary feedwater system?

MR. CONNELL: No. What you need it for is to operate -- I'm not sure you were here when I listed the various users of the system.

MR. NOVAK: But I think the answer to the question --

MR. CONNELL: You have the RHR heat exchangers.

MR. NOVAK: -- sometimes to go to cold

shutdown requires you to bring in the component cooling water system, if your end point is a set of temperatures and pressures. But to stay at hot shutdown, that is to utilize an auxiliary feedwater system as a makeup to a steam generator and rely on that for circulation and remove decay heat through the steam generators, that specific mode of decay heat removal does not require the component cooling water system.

MR. CONNELL: That's correct.

MR. MATTSON: That's what they said.

(Slide.)

MR. CONNELL: Now I'd like to discussed the major design considerations of the system. In the January 13th meeting in San Francisco, Darrell Eisenhut stated that you will be comparing the design against the standard review plan. I of course heard that again this morning from Harold Denton and Roger Mattson.

It should be kept in mind that Revision 0 to the standard review plan came out after Diablo Canyon was built and it was undergoing hot functional testing. Now there is, of course, no requirement for a blanket backfit to the standard review plan.

Nonetheless, for your convenience the format of this discussion will follow Revision 1 to the standard review plan, NUREG-0800. Each of the topics that you mentioned, Darrell, in San Francisco, is included in the standard review plan, and of course it will be included in my discussion.

MR. EISENHUT: But when you said Rev 1 you really meant the latest version of the standard review plan. Is it Rev 1 or Rev 2?

MR. CONNELL: I have Rev 1 to Section 9.2.2, and that is the one I used.

The standard review plan lists 15 areas of review directly related to the CCW design. I am going to go through each of those 15 areas, notwithstanding that the system was designed in 1968, 7 years before the first version of the SRP and 13 years before Revision 1 to the SRP. Nonetheless, all 15 areas were considered in the design and I think the intent of each area is met, and I will discuss that in the next few minutes.

I have broken these 15 areas up into 15 broad groups where I think the SRP -- I'm sorry, the 15 into 3 broad groups.

MR. FRIEND: Ed, when you're talking to the screen I can barely hear you. You've either got to talk this way or get to the podium.

MR. SCHIERLING: And could you also identify the slide by number just for the record?

MR. CONNELL: Yes. This is slide B-5.

(Slide.)

This is the grouping to assure that adequate cooling is supplied, and there are subgroupings in the standard review plan that deal with the functional performance, the multiple functions, the capability of the surge tank, the provisions for providing cooling water and heat loads.

Now, slide B-6.

(Slide.)

The SRP talks about other system aspects. The first one is the interface between seismic and nonseismic portions of the system. We then talk about a leakage requirement for testing and in-service inspection requirements on the reactor coolant pump seals, instrumentation requirements, and they ask for a reliability analysis.

(Slide.)

The third broad grouping is what I've called interactions, and this includes flood protection, protection against internal and external missiles, and consideration of pipe breaks.

Let me go through each of these 15 areas and describe how Diablo Canyon addresses this area.

(Slide.)

The first is called functional performance, and this talks about the ability to withstand adverse environmental occurrences and reviews operability requirements for normal operation and during and subsequent to an accident. Environmental occurrences: Essential electrical components were environmentally qualified for operation in the required modes, as documented in the FSAR.

The qualification program was expanded and updated in response to the CLI-80-21 and NUREG-0588. It was reviewed and aproved by the NRC in September of '81.

Protection from -- again on more environmental occurrences, protection from high winds and tornado missiles is described in the FSAR. Electrical and mechanical system components which perform a safety function have previously been seismically qualified. However, because of the new seismic input data which is currently being generated, the analyses are being reviewed and updated or replaced as appropriate.

MR. RUBENSTEIN: Is the surge tank on the top of the auxiliary building tornado missile-protected?

MR. CONNELL: It is discussed in the FSAR that upon the consequence of an event -- a consequence analysis for tornado missiles.

MR. RUBENSTEIN: It is not protected? It just assumes it fails?

MR. MOORE: I will show you a slide, a 35-millimeter slide that shows the tornado shielding that has been provided.

MR. RUBENSTEIN: That's a different response.

MR. CONNELL: Some of both, I think is the answer.

MR. MATTSON: In this business on environmental, how did you identify in the station or are you reviewing for the station how the components are to be qualified for a harsh environment? Have you reviewed how the identification of those components occurred?

MR. CRAWFORD: What we did is we took all of the operating procedures involved in accidents that generated harsh environments, we then broke down the instrumentation, our electrical equipment utilized in those procedures under required functions, contingency actions. All of the required functions are environmentally qualified, contingency actions are not. The only kind of confirmation is if it is in Reg Guide 1.97 then it is, if it's not in Reg Guide 1.97 then it's not.

MR. MATTSON: You don't mean to limit your answer to just electrical equipment?

MR. CRAWFORD: We are talking about CLI-80-21 was strictly electrical equipment.

MR. MATTSON: But in --

MR. CONNELL: That includes the electrical stuff.

MR. CRAWFORD: It includes motors, pumps.

MR. MATTSON: Did you also look at equipment that could fail and then affect safety equipment, not just the safety equipment called upon in the procedures or the nonsafety equipment called upon in the procedures, but something that could fail and move in a particular direction and put a stress on the system that you hadn't thought of in the design of the system?

MR. CRAWFORD: Not specifically in the response to CLI-80-21, no. What we did do is, we do have sections in CLI-80-21 dealing with devices that are required to fail in a proper position in order for the safety function -- in other words, we have a number of components in the systems, and I'm specifically thinking of valves, that there is a required failure mode and we had to qualify them to be able to fail in the required failure mode.

We do not address, for example, in CLI-80-21 we did not address th failure of something whose failure mode wasn't required, if you know what I'm saying. We did in our basic system design, not CLI-80-21's response but in the basic system design, obviously failure modes are considered.

MR. EISENHUT: Let me see if I understand that. That would say that any component that is not included in the group that had to preferentially fail one way, you really don't care which way it fails?

MR. CRAWFORD: We assume it fails, okay, or operates properly, okay. In other words, if you have a non-Class I device it is assumed to either fail or operate properly.

Now, the assumption of failure, for example, in our air-operator valve, we assume it to fail in the spring direction. We do not make any assumption about it failing in the wrong direction. In other words, the spring-operated valve, we do not analyze the fact that it failed in the opposite from the spring-pushing direction.

But we do consider in our design, not in response to the CLI-80-21 but in our basic design, the fact that any non-Class I component either fails or operates properly.

MR. MATTSON: Then you look at the condition that that puts on the safety equipment and design the safety equipment to accommodate it?

MR. CRAWFORD: Yes.

MR. MATTSON: You say you didn't do that in connection with CLI-80-21 because that isn't what 80-21 addressed?

MR. CRAWFORD: For example, LCV-69 and 70 are air to open, fail closed valves. It is assumed that they either modulate or they fail closed.

MR. CONNELL: The operability in normal operation. There is sufficient redundancy in components so that in normal operation there is always one pump and one heat exchanger in the standby mode. For cooldown all three pumps are used. If one of the pumps or one of the heat exchangers is nonoperative for a cooldown, then an orderly shutdown is not affected, but the time for cooldown is extended.

(Slide A-10.)

(Slide B-9.)

Operation for accidents. Each of the essential pumps in the CCW system and in the support systems, auxiliary salt water and makeup, are assigned to one of three emergency safeguards busese. The CCW pumps and the ASW pumps are automatically started on a safety injection signal, the S signal.

The limiting failure would be a failure of one bus to energize. In this case there would still remain one makeup water transfer pump with two CCW pumps and one ASW pump. This meets the requirements for the short-term post-LOCA operation.

MR. NOVAK: Question. The emergency power supply system does not require component cooling water?

MR. CONNELL: That is correct.

MR. NOVAK: So the emergency diesel -- well, they provide power to the component cooling water system instead of providing power to the motors?

MR. MOORE: If your question is are they air-cooled or not, they are air-cooled, air-cooled diesels.

MR. NOVAK: Good. That is my question.

(Laughter.)

MR. RUBENSTEIN: How many containment fans or fan coolers are required?

MR. CONNELL: There are five containment fan coolers. For the design basis accident three fan coolers are required.

MR. RUBENSTEIN: Two on one loop and three on the other?

MR. CONNELL: That's correct. Mechanically on the loops, three are piped into loop B, two are piped into loop A.

MR. RUBENSTEIN: Later on you will address --

MR. CONNELL: On the buses, they are assigned as shown here. There are two on bus -- if I can find it, there are two on bus F, two on bus G, and one on bus H.

MR. CREWS: So you're saying a single electrical failure wouldn't get you in trouble. But what about the piping signal failure?

MR. CONNELL: Okay. In the short term you need three, the short term, which means that you postulate a single active failure and not a passive failure.

MR. RUBENSTEIN: Are we going to address this a little later?

MR. ANDERSON: We will get into it.

MR. CONNELL: Except I think what you really want to do is look again at that slide that we had earlier. That's maybe A-8.

MR. RUBENSTEIN: What you need is containment spray?

MR. CONNELL: That's right, and the containment spray is -- I should point that out here, too. As you can see, one is on bus G and one is on bus H, and mechanically there is one in each loop.

(Slide.)

No, what I wanted was the short-term one.

MR. BUCKLEY: If I could pick up on Tom Novak's question, the diesels have their own auxiliary salt water cooling system, right?

MR. CONNELL: No, they are air-cooled.

MR. BUCKLEY: But I thought I recalled a separate salt water system for diesels.

MR. CONNELL: There is an auxiliary salt water system which transfers heat to the ultimate heat sink.

MR. BUCKLEY: I know the auxiliary salt water system, but associated with just the diesels you do have some cooling water.

MR. TINLIN: The diesel generators have a radiator type cooling system. That is a water jacket on the diesel generators and they are cooled by air forced through a radiator.

MR. BUCKLEY: I thought it had a separate salt water cooling system also.

MR. CONNELL: What I wanted to point out here in connection with the bus diagram is that in the short term post-LOCA the flow goes through all three vital loops. For example, the way that's shown, the FCV-430, that's a motor-operated valve that stays open, so you are getting flow through both loops and then you cut off loop C.

But I was going back to your question. That means that the flow goes through all five fan coolers in the short-term.

MR. MATTSON: And that is immune to any single failure?

MR. CONNELL: Any postulated single active failure. That's a motor-operated valve.

MR. WERMIEL: And that could fail, since that's a single activated component?

MR. CONNELL: If it fails in the activated position, the motor-operated valve --

MR. WERMIEL: You're saying a bus failure would fail as is?

MR. CONNELL: That's correct. If it was normally open it would fail open.

MR. WERMIEL: And vice versa for FCV-431?

MR. CONNELL: That's correct.

MR. BUCKLEY: For all motor-operated valves.

MR. CONNELL: That's correct.

(Slide.)

That was for the short-term post-accident. In the long-term post-accident, the system is manually aligned into two separate loops. The valves used for this alignment are located in the component cooling water heat exchanger rooms and the pump rooms. Both areas are relatively low radiation areas post-LOCA.

Only one loop is required to operate, so that the system can accommodate a single active or passive failure in the long-term with both loops going.

(Slide B-10.)

There is a requirement, I guess of GDC-44 as stated in the SRP, that there be component redundancy so that safety functions can be performed assuming a single active component failure coincident with a loss of offsite power. This system meets that design requirement.

(Slide A-11.)

(Slide B-11.)

I will go to the second area in the SRP, multiple performance functions. GDC-5 speaks to the sharing of systems and components between units. There is no required sharing of the CCW system or its support systems, with the exception of emergency safeguards diesel F. This is a swing diesel that is assigned to the local unit. As discussed earlier just a minute ago, if this bus fails to energize there is sufficient redundancy to safely shut down the plant.

Although sharing is not required, it is part of the design philosophy of this plant to provide additional flexibility. With this in mind, the plant has been piped up so that by manually opening the valves it is possible to crossconnect various systems from the two units. For example, as I said earlier, you can manually crossconnect the two condensate storate tanks.

MR. MATTSON: You listed that as one of the backup seismic Class I water supplies.

MR. CONNELL: That is correct.

All of the components that require CCW for normal operation only are located on the C headers. None of these are components that are required to shut down the plant. That is on the nonvital.

Now, radioactivity control, another multiple performance function of the system. The double barrier design reduces the probability of radioactive water escaping to the environment. Leaks of radioactive water into the component cooling water system are detected by radiation monitors which are located in two CCW pump discharge headers. Once again, any leaking component can be isolated by Design Class I valves.

(Slide B-12.)

MR. MOORE: Excuse me, Ed. Is there a problem with this slide here?

MR. CONNELL: No. It is on the pump discharge.

MR. BUCKLEY: The surge tank, is that vented or pressurized?

MR. CONNELL: Vented.

MR. MATTSON: Let me make sure I understand some of the words you're using. I am following your written presentation and I think you are at about page 14. At the top of that page you say, "None of these components is required to shut down the plant."

You mean, I think, in that sentence that in order to meet the Commission's regulations you can use equipment other than what is on the C header to shut down the plant. But isn't it true that in some design basis events you would prefer to use equipment that is on the C header?

MR. CONNELL: Yes.

MR. MATTSON: Like the reactor coolant pump.

MR. CONNELL: Yes.

MR. MATTSON: Like for a steam generator tube rupture.

MR. CONNELL: That's correct.

MR. MATTSON: That is perfectly acceptable. I just wanted to make sure what you meant when you said "required to shut down the plant."

MR. CONNELL: That is what I meant.

MR. MATTSON: You meant required in order to show that you meet the Commission's regulations?

MR. CONNELL: That's correct. The reactor coolant pumps I guess are the best example of something that you would like to have them available.

MR. MATTSON: You would prefer to go that way?

MR. CONNELL: That's correct.

MR. MATTSON: And your procedures probably call for you going that way.

MR. CONNELL: Yes.

MR. TINLIN: I'm sorry, I didn't get that question.

MR. MATTSON: Well, the procedures probably call for you to go in the preferred way first, and if that doesn't work, that is if you've lost offsite power for example, reactor coolant pumps aren't available, you go to some other mode of shutdown. The Commission's regulations generally fall back to some small island of equipment that is the bare minimum needed to assure safe operation or safe shutdown of the plant following a design basis event.

MR. TINLIN: Right, which I believe Ed said are all of the vital headers.

MR. CONNELL: The surge tank, the surge tank is internally divided, thus providing an entirely independent surge volume with supporting instrumentation, feeding one of the redundant vital CCW headers. This meets the standard review plan requirement that in the event of a header rupture the loss of the entire contents of the surge tank will not occur.

As I said earlier, there are many makeup sources to the surge tank for the requirement to provide cooling water.

(Slide B-13.)

As I discussed earlier, because of the use of redundant Design Class I components backed by emergency power supplies and considering the capability for isolation of the system into independent trains, an adequate supply of cooling water is assured for all operating modes.

(Slide A-12.)

(Slide B-14.)

Heat loads. During normal operation, the heat load is approximately 72 million Btu's per hour. This is well within the capability of one CCW heat exchanger.

Now I want to talk about three or four cases. Let's consider the case when you have a safety injection signal but you don't have a P signal. The major heat load, assuming there is an accident when you get these signals, is probably fan coolers. All other loads amount to about 40 million Btu's, 39 of which are on the C header.

It is difficult to estimate the heat load in containment for this case, that is the case where you are above an S signal but you are below a P, because this does not correspond to any of the supposedly postulated design basis accidents. Let's assume that the heat load inside containment is 50 percent of that that is calculated for the design basis accident and the resulting heat load of the system is about 230 million Btu's per hour.

Again, this is -- you can handle this with one heat exchanger. In this case that I just described, I just assumed that all of the five fan coolers are working. You have fewer fan coolers and the rate of heat rejection in the CCW system will be less.

MR. NOVAK: Would this result in loss of SPSH or how has this fed back into the CCW performance? In other words, if you get elevated temperatures I would assume you are concerned about 10 NPSH requirements. What margin do you look for?

MR. CONNELL: NPSH on the pumps themselves?

MR. NOVAK: Well, assuming that the water is continuing. I would assume that might be one concern you would have if you are exceeding the heat load.

MR. CONNELL: Well, we are not exceeding the heat load yet.

MR. NOVAK: Let me leave the question for now.

MR. MATTSON: Well, this is not a bad question. If you throttle back in essence on the component cooling water system and temperature and pressure stay up in containment and it's a small LOCA instead of a design LOCA, then you want to know if the recirculation system for a low head, recirculation system for emergency coolant, has an NPSH problem or not.

That part of the design has been considered? I think you agree, right?

MR. HOCH: Jim Tinlin I'm sure can answer that.

MR. TINLIN: I've been confused as to where we're worried about NPSH, because is that in the component cooling water system?

MR. NOVAK: Yes.

MR. TINLIN: All right. As far as that is concerned, having that surge tank up on the 152-foot level and the pumps down on the 73-foot level, as I'm sure -- and I can be corrected if I am wrong -- there is plenty of static pressure. So that even if you do get up to whatever the design temperature of the CCW system is, you're not even going to be close to losing NPSH on the pumps.

MR. MATTSON: I was thinking of a different NPSH problem. In order to protect the component cooling water system, you were talking about not bringing the heat out by the fan coolers as fast. If you don't do that, I mean follow that course, then temperature stays high in the containment longer than if you didn't do that.

If the containment temperature stays higher, then that is a design challenge to the emergency core cooling system from an NPSH point of view. Is that within its design basis?

MR. HOCH: A chapter 15 analysis is conducted with three fan coolers, Roger. So that solves the problem.

MR. MATTSON: You ought to be able to show that if you stay within design pressure of containment in saturation you have an NPSH problem on the ECCS, right?

MR. CONNELL: On the ECCS pumps, certainly.

MR. MATTSON: And there's no systems interaction with this mode of operation?

MR. CONNELL: Not that I see, no.

MR. TINLIN: As far as this mode of operation is concerned, the supply of water is not from containment?

MR. CONNELL: No, he's talking about the SI pump. You're talking about a header on the SI pumps?

MR. MATTSON: You see, you are rather callously deciding what to do with these fan coolers and there are other systems that depend upon those fan coolers operating too, right?

MR. HOCH: That is exactly correct. But since the design basis accident is analyzed with three fan coolers, the fact that you're going to cut two of the fan coolers out just puts you in the situation of the analysis.

MR. EISENHUT: Then let me make sure I understand. You said a couple of times that there were so many million Btu's it is well within the capability of one heat exchanger. Help me again. What is the capability? What number are you thinking?

MR. CONNELL: The manufacturer's rating on the heat exchanger is 258.8 million Btu's per hour.

MR. EISENHUT: And this scenario you're going through now, is this what you considered when you're looking at a couple of different cases here? What was really your design assumption?

MR. CONNELL: Can I put that aside? I've got a couple of more cases and I'm sure you're going to find them both more interesting than these two.

MR. EISENHUT: I just -- I understand. I just want to know the yardstick you're using.

MR. CONNELL: What is the design basis? That is the next case.

MR. EISENHUT: All right, good.

MR. CONNELL: Here comes the design basis. The design basis is a limiting --

(Laughter.)

MR. CONNELL: This is the design basis accident with the worst single failure. This assumes the complete double-ended rupture of the pipe inside containment, concurrent with a loss of offsite power and the worst single active failure in the plant.

MR. MATTSON: Now, worst from what standpoint?

MR. CONNELL: The worst single active failure means the active failure that causes the least amount of containment heat removal capability to be available, the least amount of containment heat removal capability. That is the design basis for the plant.

This, if you will recall --

(Slide.)

MR. MATTSON: The assumptions on which is the worst failure can change depending upon what system you're looking at. You just described the worst single failure from the standpoint of protecting the containment integrity, is that correct?

MR. CONNELL: That is correct.

MR. MATTSON: What is the worst single failure for assuring the continued viability of the component cooling water system, the same failure or another failure?

MR. CONNELL: You're always one case ahead of me.

(Laughter.)

MR. CONNELL: That is the next one or possibly the one after the next one.

MR. EISENHUT: Maybe we ought to go for a cup of coffee and let you continue.

(Laughter.)

MR. CONNELL: For this particular one, the design basis accident with the worst single failure, this is the failure of bus G to energize. And if that happens, you notice that you will lose two fan coolers and you will lose a spray pump.

Notice also that if that is the failure, the G bus failing to energize, that means the other two buses do energize, and that means in particular that bus H energizes. That means that FCV-355, which is a supply side valve on the C header, has power and it will close on the P signal. This is a case that was used for the design basis heat removal capability for Diablo Canyon in response to general design criteria 44.

Let me talk about another case --

(Slide B-16.)

-- the case that I think you were alluding to, Roger. This was recognized by PG&E, that under different postulated conditions it would be possible to reject more heat than for this design case to one heat exchanger and thus raise the heat exchanger outlet temperature above the design value.

For example, if it is assumed that all equipment functions as designed, that is you have this failure of bus G, both containment spray pumps and all coolers will be operating. And if you further assume the same design basis temperature time history inside containment and you assume all of the other parameters that are normally used in a DBA worst case analysis, then you can calculate the temperature of the discharge of a single component cooling water heat exchanger, and that temperature would go up to about 140 degrees or approach 140.

This case, while it is not the design basis case, was calculated by PG&E. The total heat load is approximately 406 million Btu's per hour. For this case, which I think going back to yours exceeds the manufacturer's rating of the heat exchanger, in this case the operator action that is taken is the same as what you would take in the DBA case, which is, as I said, you would cut in a second heat exchanger which is available.

MR. RUBENSTEIN: When in the long agonizing design of Diablo Canyon did you calculate this case?

MR. CONNELL: I haven't been on Diablo Canyon for long, but this is in the files, was in the files in 1974. It is in the '74 time frame.

MR. MATTSON: How long does the operator have to valve in that other heat exchanger?

MR. CONNELL: Jim Tinlin is going to talk about that. Maybe I didn't understand your question. He's going to talk about --

MR. MATTSON: Well, I gather the procedures say if you start to go up to 140 degrees Fahrenheit you better start thinking about putting another heat exchanger in.

MR. CONNELL: It is a low number, but that's what the procedure says.

MR. MATTSON: If you were in this situation how long would it be, days, hours, minutes?

MR. CONNELL: He's going to talk about that.

MR. TINLIN: Do you mean the time it takes to get to that temperature or the time it takes the operator to perform a manual action?

MR. MATTSON: Both. Minutes or hours?

MR. TINLIN: Minutes before the operator action.

MR. MATTSON: And you will explain why that is enough time later?

MR. TINLIN: Yes.

MR. WERMIEL: Can't I compound that scenario even further and make it worse by taking a single failure in one of the containment sprays?

MR. CONNELL: You really are going to get to my next question, which is what about if your failure were to that C loop.

MR. WERMIEL: No. If one of the spray pumps fails, I'm not putting even more heat load on the containment cooler.

MR. CONNELL: That's true.

MR. WERMIEL: So that 140 would actually be somewhat more.

MR. CONNELL: I don't have a number with me today on that.

MR. WERMIEL: Given a different single failure for what Roger was alluding to, it would go even higher than the 140.

MR. MATTSON: The same procedures would apply. You just put a greater time demand on the operator.

MR. WERMIEL: That is what I was leading to. It seems to me the limiting condition is not quite that even yet. It's even more limited time.

MR. MOORE: I would like to reference back to some of Dick Anderson's remarks and what Ed said. There was a very conservative bounding calculation done which indicated this 140 degree situation. We feel, number one, that is not realistic when you look at it in detail, and one of the future actions that is currently going on in the project is to explore these questions in more depth and identify what the temperature is, identify what the rate of temperature is, and judge that against operator actions.

MR. CRAWFORD: Could I say something? The reason that's not really true is the assumption used in this calculation was the design basis profile, which assumed you only had three fan coolers and one spray pump. Therefore, the temperature profile he was using to get to 140 degrees really isn't real. It is assuming you have only three fan coolers and one spray pump in terms of heat in the containment.

MR. MATTSON: That's a case where the single failure criteria has really turned into a double failure criteria, because you started with the failure of a bus.

MR. CRAWFORD: You got it.

MR. CONNELL: I had thought of at least one more case.

(Laughter.)

MR. MATTSON: Quick, think of another one.

(Laughter.)

MR. CONNELL: This case is very similar to the one we just talked about, where you have the same conditions inside containment as you would under a DBA, but you assume all your five fan coolers are running and your two core spray pumps are running. But now your single failure is valve FCV-355 fails to respond on the P signal.

So now you've got the additional heat loads from the C header on there, and if you do that then the total peak heat rejection rate may rise to above 440 million Btu's per hour, a little bit more than the case we just talked about before. Of course the actions are the same.

MR. EISENHUT: On that scenario -- let me make sure I understand. Since you are starting on that scenario from 140 degrees, and you assumed one of the buses failed, and you are postulating FCV 355 fails. That is the scenario you went through.

MR. CONNELL: It was kind of a mixed scenario. This last case was this. The temperature-time profile in the containment corresponds to the case where you have failed bus G. In other words, you have got three fan coolers and one core containment spray. Now, otherwise that is just used for the mathematics to calculate temperature-time. You have now assumed you really don't have any failure, all five fan coolers and one containment spray. Then you calculate some number approaching 140.

MR. EISENHUT: I understand.

MR. LE FAVE: In your FSAR you calculate 215 degrees in your air coolers. Would that be based upon 140 degrees?

MR. CONNELL: No, that is based upon the design basis case which is in that FSAR, which is the three fan coolers and the one containment spray pump. And I think that FSAR is different, the temperature values in different spots on the system.

MR. LE FAVE: Well, as I recall, it was 216 degrees from the fan coolers.

MR. CONNELL: Yes.

MR. LE FAVE: And I noticed the design pressure at the suction end of the pump is 161 degrees. I was really kind of curious as to how did you have to meet that 171 degree value at the suction end of the pump.

MR. NOVAK: I have one more question before we take a break. What parameter of design are you reaching for or coming up with to go to 140. Is it bearing temperatures? What portion of the CCW, I mean, would first be affected?

MR. CONNELL: I don't really know, but for purposes of the design, it looks like it is going to be the bearings on some of the pumps, SI and charger pumps. The safety injection pump.

MR. ANDERSON: Let's be sure we don't get locked into 140 degrees because that is a very preliminary analysis that does not include the real situation inside of containment. That also is based upon a 70 degree ocean temperature, and that has some long background and history as to exactly how 70 degrees was arrived at. That is ultraconservative, I think based upon something like six plants at the site with recirculation. Normally the warmest temperature is 50, 55 or 56 degrees, so we plan in our further action to take a look at these temperature profiles and develop more information on the temperatures and the operation times involved. That is part of what we are going to do.

MR. NOVAK: This is the water temperature leaving the CCW heat exchanger?

MR. CONNELL: That's correct.

MR. MOORE: I would like to go back to your question, the fan cooler. Water side considerations will be looked at as a part of this further analyis that we spoke of earlier. I don't believe that it was considered in this 1974 calculation. The situation was recognized and resolved as not being the case by putting a second heat exchanger into service.

MR. ANDERSON: Okay. Ed, continue.

[Slide B-17]

[Slide A-13]

MR. CONNELL: The next thing I want to look at are the effects of nonseismic Category I equipment on seismic Category I components. The design philosophy employed in Diablo Canyon in meeting the regulatory requirements for this interface and for those requirements given in Reg Guide 1.29 will be discussed later by Chuck Aronson. I want to just talk about two specific equipment interfaces, those for the chemical addition tanks and those for the Sentry post LOCA sample cooler.

The chemical addition tank meets all the requirements for separation of seismic and nonseismic components. This is achieved by the piping from the vital headers, up to and including a normally closed manual isolation valve, being seismic Category I.

[Slide A-14]

Now let me talk about the post-LOCA sample cooler. This was added in 1980 as part of the NUREG 0737 changes. It had a similar arrangement and thus could have met the same separation criteria. However, PG&E believed that it would be valuable to have the operators use the same post-LOCA sample station for normal sampling, and this way they would be sure that the operators were familiar with the equipment and were able to safely take hot samples if required post-LOCA. Thus, the manual isolation valves are shown open on the current version of the P&ID.

With the valves open the arrangement would still meet requirements if the piping and the small sample cooler were designated as design Class I. The piping is, in fact, as we have said earlier, design Class I. The cooler, while specifically designed and built for the nuclear industry, did not employ a full 10

CFR 50 Appendix B quality assurance program. The cooler has recently been fully qualified by analysis for all postulated seismic conditions. Gary Moore is going to show you some pictures of the cooler and you can see how sturdy an installation it is.

Thus, it is assured that the cooler will not fail under accident or seismic conditions and will not jeopardize the safety function of the component cooling water system.

[Slide A-15]

[Slide B-18]

MR. MANEATIS: Would this be a good time to take a break?

MR. NOVAK: Let's take ten minutes.

[Recess]

MR. EISENHUT: Let's get moving again.

MR. CONNELL: I would like to go to the next area of review of the Standard Review Plans, which concerns leakage. There are numerous provisions for collection, isolation and control of leakage to assure compliance with the requirements. Leakage of radioactive fluid into the system would be detected by the radiation monitors in the CCW pump discharge lines. Also, this could be detected by rising surge tank level and alarm. The tank itself and the components in the system are protected by a relief valve with the discharge routed to the auxiliary building sump. The relief valve is sized for the rupture of the reactor coolant pump thermal barrier. Leakage out of the system is detected by falling surge tank level and alarm.

I have described earlier the numerous makeup sources that are available. Mitigation of a leakage from a passive failure, which is defined in Section 3.1 of the FSAR, has 50 gpm for 30 minutes, which is well within the makeup capabilities of the system.

The NRC in FSAR Question 9.26 asked for some further discussions of system features and to assure continuous supply of CCW to equipment required for the safe shutdown until postulated leaks or ruptures could be isolated. As described earlier, any individual user can be valved out using design Class I valves, or an entire loop of the system can be valved out, again using design Class I valves.

In response to the NRC Question 9.26, Table 9.2-8 of the FSAR was amended to discuss a postulated leak or rupture of 200 gpm. This leakage value is a limiting case derived from a balancing of a number of different considerations, such as operator reactor times, detection capabilities, isolation capabilities, and the system makeup provisions. It is a reasonable number for design purposes.

MR. NOVAK: Do you have any flow limiting devices in the system?

MR. CONNELL: Not in general, no.

MR. FRIEND: There are control valves.

MR. CONNELL: I assume you mean automatic?

MR. NOVAK: No, I meant fixed.

MR. CONNELL: I'm sorry, that is what I thought you meant, and the answer is no.

MR. CRAWFORD: We do have some. In general we don't. We do have on certain heat exchangers.

MR. MATTSON: Let's see. There is an 0737 requirement, a TMI requirement that says something to the effect of applicants and licensees go forth into the auxiliary building and think about places that radioactivity could arise following a bad accident and places where you might want to send an auxiliary operator to open and close a valve, or you might have a piece of equipment located near one of those hot places and think about what leakage provision you want to improve or what shielding provision you would want to improve.

Now you have done that, I assume. That has been reviewed separately, not in connection with this matter. But have you looked at -- there are a lot of places where heat is coming up and the operator can go down and close them out.

MR. CONNELL: Yes. Perhaps I didn't state that earlier, but I thought I had. On this basic diagram the valves on the suction side of the pump there are accessible. They are in the component pump rooms, the CCW pump rooms, which is a low radiation area, and the other valves on the discharge size are located in the heat exchanger room, and those valves -- the heat exchanger room is also a low radiation area.

MR. MATTSON: There aren't any other lines that go through there that carry hot stuff?

MR. CONNELL: That's correct.

MR. MATTSON: The makeup system doesn't have a line running through there?

MR. CONNELL: What makeup system? There isn't a hot line.

MR. MATTSON: Like the one at TMI that was full of crud.

MR. TINLIN: Are you talking about the reactor coolant makeup system?

MR. MATTSON: Yes.

MR. TINLIN: No, it doesn't.

MR. CONNELL: That's correct, it doesn't.

MR. MATTSON: There is nothing else in there that connects with the primary coolant system?

MR. CONNELL: That's correct

MR. MATTSON: Fine.

[Slide B-19]

MR. CONNELL: Testing and ISI requirements. The active components of the CCW system are accessible for visual observation and maintenance, and also they are in continuous or intermittent use during normal plant operation. Thus, no additional special provisions are necessary to meet testing and inspection requirements.

[Slide A-16]

[Slide B-20]

Reactor coolant pump seal coolant, NUREG 0737, Section II.K.3.25, requires that cooling water be available to the reactor coolant pump seals given a loss of off-site power or the loss of instrument error. Diablo Canyon meets this requirement. Note that the valves in question on Diablo Canyon have motor operators which are fed from emergency on-site power and the CCW pumps are also fed from emergency on-site power sources, and therefore the requirement is met.

[Slide B-21]

On instrumentation. Tom Crawford is going to talk about that later on.

[Slide B-22]

There is a requirement in the Standard Review Plan to provide a failure modes and effects analysis in the SAR to ensure that essential portions of the system will function following design basis accidents, assuming a concurrent single active component failure.

MR. MATTSON: I'm sorry. Go slow. I have to go back one. Reactor coolant pump seals.

[Slide]

Section II.K.3.25. Diablo Canyon meets this requirement because you say -- didn't we see a slide a couple of hours ago that said makeup for the component cooling water is dependent upon air-operated valves?

MR. CRAWFORD: Only the automatic makeup, not the manual.

MR. MATTSON: That would be an answer to my question. Is that what I misunderstood?

[Slide]

MR. MOORE: These particular valves are air operated. They have a manual bypass system around them.

MR. MATTSON: That is manual local, and again, it is the kind of thing that you look through to see whether other lines potentially carry --

MR. CONNELL: I don't know about those particular valves.

MR. TINLIN: Something you maybe ought to point out, that the CCW system is not the only mode of cooling for reactor coolant pump seals. The normal charging system is the other mode.

MR. MATTSON: The normal cooling water cooling system depends upon component cooling water.

MR. TINLIN: The component cooling water gets the flow from the vital headers.

MR. MATTSON: I was going more to the II.K.3.25 requirement. I didn't want to pass over that too quickly. But I understand you say that is an acceptable answer. I'm happy with that.

[Slide B-22]

MR. CONNELL: Now, on reliability analysis, the FMEA is presented in Section 9.2 of the FSAR.

[Slide B-23]

The next area is flood protection, and also in the FSAR there is an analysis that was done some years ago to assure that the system will operate under postulated flooding conditions, internal missiles --

MR. LE FAVE: Just internal missiles from pipe break, or external flooding?

MR. CONNELL: Well, we have done both. The way I read the Standard Review Plan, this was talking about external, but the answer is yes for both.

MR. MATTSON: Is this a system that you looked at when you did nonseismic/seismic systems interaction study?

MR. CONNELL: Is what? Is the CCW part of, do you mean, what we call the systems interaction program?

MR. MATTSON: Yes.

MR. CONNELL: Yes, but it is for the effects on that system, yes.

MR. MATTSON: The flooding was included in that, wasn't it?

MR. CONNELL: Yes.

MR. HOCH: Let me correct that. The flooding is included in that only if you are coming out of a seismically-induced interaction, which is something that might lead to flooding.

MR. MATTSON: Yes, that is what I meant.

MR. RUBENSTEIN: What you call a target system.

MR. CONNELL: Yes, correct.

Internal missiles. This was presented in Section 3.4 of the FSAR. An analysis was presented which demonstrates acceptable protection of the safety-related systems.

[Slide B-24]

External missiles. The effects on system operation from external missiles is discussed in the

FSAR in Section 3.3. Compliance with the requirements is demonstrated by location within missile-protected structures or by a failure analysis which demonstrates acceptable consequences.

[Slide B-25]

Now, the last section in the FSAR is pipe breaks. An analysis and a field walkdown was conducted to demonstrate that CCW is adequately protected against the effects, that is, jet impingement and pipe whip, of high energy line breaks. About 1977 a heavy metal doghouse was added around the CCW heat exchangers to provide this protection for the system.

MR. BUCKLEY: That is just for outside containment, right? Jet impingement?

MR. CONNELL: That is the way I read your standard review plan, yes; but we, of course, have jet impingement inside.

MR. BUCKLEY: You are looking at that.

MR. CONNELL: That's correct.

This concludes my prepared remarks. Although the CCW system was designed and constructed years before Rev. 1 to the Standard Review Plan was issued, I think each of the 15 broad areas of review was properly considered and implemented.

MR. ANDERSON: Maybe at this point we could show the slides, and I would like to ask Gary Moore to show that, and that would firm up some of the understanding of the system, particularly how it is operated and where some of this equipment is located.

MR. NORTON: Excuse me, Dick, before we go further. One housekeeping detail. One of the reasons I asked this to be prepared in writing, in written detail and presented this way was because of two or three things. One, we knew it was going to be transcribed, and two, because there are allegations that are made and there is some sensitivity about the interpretation, about material representation.

What I would like to ask is that this prepared, which was basically followed by the presenter, be incorporated in the transcript. I followed it along most of the time. The words are precisely the same, but once in a while he would turn his head away from what he was reading and the words would vary a little bit, and I think it is proper to put the prepared thing in the transcript.

MR. EISENHUT: I don't think we have a problem with that. The slides will also be in there as a whole standard package.

I would like to ask you a question about the last sentence of the package that is in the record.

[Laughter]

You said something to the effect in here that each of the 15 broad areas of review was properly considered and implemented. Would you say, then, that you meet the Standard Review Plan, Rev. 1, Section 9.2.2? I am trying to explore, really.

MR. CONNELL: To my knowledge I would say we meet the intent of the Standard Review Plan.

MR. EISENHUT: And you don't know of any significant deviations?

MR. CONNELL: Not that I know of; significant deviation from the way I read the Standard Review Plan, no.

MR. ANDERSON: Okay. I will ask Gary Moore, then, to show the slides. Gary is the project engineer from the PG&E organization. He has been with PG&E since 1969 and has been associated with Diablo Canyon for the last four years.

[Slide]

MR. MOORE: I think for these slides we will need the lights dimmed a little bit.

[Discussion off the record]

I am going to present some pictures taken of the Diablo Canyon plant of the component cooling water system. Specifically these pictures are heat exchangers, valves, pumps and piping and the piping support system, and I will also correlate the pictures with the flow diagram.

The first slide is of the component cooling water heat exchanger.

MR. EISENHUT: Could I suggest you stand on the other side? That might help you out a little bit.

MR. MOORE: Then I interfere with this. All right.

This green heat exchanger is the component cooling water heat exchanger, and Chris is pointing that out on the flow diagram.

[Slide]

This slide is depicting how we have physically separated the two component heat exchangers from each other: namely, this is the 1-1 heat exchanger shown in the last slide, and this is the heat exchanger 1-2.

MR. EISENHUT: That is a concrete wall?

MR. MOORE: Yes. This is a concrete wall that is separating the two heat exchangers inside of this heavy metal doghouse that Ed just mentioned.

[Slide]

This picture is showing the discharge piping leaving the component cooling water heat exchanger on the component cooling water side. This header here happens to be the "B" header. This header here is the "C" header. This is the component cooling water heat exchanger. I wanted to just have you note how the pipe is supported. Both of these are seismic pipe restraints.

MR. MATTSON: Do you see the remote manual valve in that picture?

MR. MOORE: We have a much better picture of it.

MR. EISENHUT: Excuse me. As you go through this, if there were any supports, hangers, braces that were modified as a part of the ongoing seismic redesign effort, if you know of any, would you flag those as you go through?

MR. MOORE: I am personally unaware of any supports that have been modified on the component cooling water system, but there happens to be one slide where a modification is being performed on the fire water system, which is in the same area.

[Slide]

Once again, this is a different view of the same piping, once again showing the seismic supports.

[Slide]

This is where the component cooling water header "C" goes through the wall separating the turbine building from the auxiliary building, and this is a rather massive seismic restraint on that header. And this is the answer to your question one slide later. This is the support modification to the fire system header.

[Slide]

All right. This picture is showing FCV 355, which is the automatic isolation valve on the C header. It is motor operated and is provided with means of manually operating it also.

[Slide]

Another view of the same valve operator showing the platform and the relative position of the platform and the valve operator.

[Slide]

This is a view of the discharge valving associated with the component cooling water heat exchanger discharge. What you are seeing here is FCV 431, which is a motor-operated valve with manual operator. You can see the back side, if you will, of FCV 430. The operator for this valve is on the other side. These two valves -- operator is this here, and you can just see the edge of an operator there -- are the two manual isolation valves in the crosstie to the C header, which is here, and it joins right behind this beam.

MR. EISENHUT: Is that a wall that separates those two?

MR. MOORE: I believe that is just a column.

MR. NOVAK: So there is no actual physical separation between those two operators?

MR. MOORE: That is correct.

MR. ANDERSON: There is distance. One is on one side of the pipe and one is on the other.

MR. MOORE: The first slide, if I can go back to that.

[Slide]

These are the two manual operators that I just referenced, and you will see that there is no wall.

[Slide]

This picture is showing some of the seismic restraints which were added to the component cooling water heat exchanger as a result of the Hosgri evaluation.

[Slide]

This slide is showing a discharge on the component cooling water pump. Here is the centrifugal pump, the discharge piping, and this is showing the split on how it is divided into the two discharge headers leaving the pump. You will also note the two manual isolation valves on the discharge header.

[Slide]

This slide is showing the suction piping associated with one of the component cooling water pumps, and you will note here is a vital header.

George, could you possibly focus that?

MR. ANDERSON: I think it is a little bit out of focus in the picture.

MR. MOORE: This is the vital header here. This is the C header here. Here are some of the manual isolation valves that are shown in the flow diagram.

[Slide]

This is a picture of the component cooling water system piping in the auxiliary building, and you will note that this is header C and this is header B, and you will note how the piping is supported seismically on both the two headers.

[Slide]

This is a slightly different perspective of the same picture. This is Header B and this is Header A. And why you note so many blue pipes is that in this particular area we have both return and supply piping going to the heat exchangers.

[Slide]

Once again, this picture is showing the pipe supports and how the headers are treated in exactly a similar manner. This is Header C.

[Slide]

This slide is showing the post-LOCA sample cooler that has been identified as a nonconformance on the job. This the component cooling water supply and return line. These units right here are the heat exchangers themselves. Please note what I would consider a very substantial support connected to a rather massive concrete wall.

[Slide]

This view is from the opposite side.

[Slide]

This slide is showing how the component cooling water piping is routed back to the headers.

[Slide]

This is showing how this piping is supported seismically.

[Slide]

This is a seismic restraint for the supply and return lines to the sample cooler.

[Slide]

We are now into a series of slides that will show some of the heat exchangers that are connected to Loop C. This particular heat exchanger is a letdown heat exchanger, and this particular heat exchanger happens to be seismically qualified.

[Slide]

This is the component cooling water piping going to this heat exchanger. You can see the seismic restraint.

[Slide]

This is the seal water heat exchanger, which is also seismically qualified.

[Slide]

This is a view of the same heat exchanger from the opposite direction, once again showing the seismic restraint of the piping.

[Slide]

This is the spent fuel pit cooling water system heat exchanger.

MR. MATTSON: Could we interrupt you a moment? I didn't see any isolation valve in that last one.

MR. MOORE: I believe these are on the other side of the wall. I have some pictures. I don't know if I have pictures of the isolation valves with this particular heat exchanger, but you can see how they have been arranged.

MR. MATTSON: I understand the point you were trying to make on that last slide. Could you go back?

[Slide]

Let's say the isolation valve is on the other side of the wall. It is a Seismic Category I isolation valve. Even though this piping and this heat exchanger wouldn't have to be Seismic Category I, you have said that this one happens to be and so is the one that services it. Is that right?

MR. MOORE: That's correct.

MR. NOVAK: That is a letdown heat exchanger?

MR. MOORE: This particular one is. The seal water, I believe. The first two sides of this series where the letdown heat exchanger -- they both happen to be yellow.

MR. ANDERSON: The point that we are trying to make is that even though Loop C is not officially a Seismic Category I loop, a great deal of seismic consideration was built into the design.

MR. MATTSON: That is all very nice, but the key -- and I don't mean that to be a facetious comment, but the key to the Commissions's regulations would be the isolation valve you can see in this picture and then that other one back there, 355. I am still understanding your story, right?

MR. ANDERSON: Right.

MR. MOORE: John, do you have a point?

MR. HOCH: I just wanted to emphasize the piping. You said this particular piping and this particular heat exchanger happen to be qualified. The piping to every heat exchanger on C loop is completely seismically qualified.

MR. MATTSON: Even inside that last isolation?

MR. HOCH: Yes.

MR. FRIEND: Up to the nozzle.

MR. MATTSON: Up to the nozzle.

MR. FRIEND: Yes.

MR. MATTSON: You hadn't made that point.

MR. EISENHUT: That's right, you hadn't. So then let me ask the second piece here. When you relooked at this post-Hosgri, you kept that intact and you kept any modifications you had to make, so now when you are doing the seismic rereview, you are in fact, then, rereviewing and you put Loop C into the program for the seismic review, to the point where if you had to make anything as a result of the present program, you would be making it in Loop C up to the nozzles again.

MR. MOORE: Yes. All Category I piping is being reviewed, and this is Category I piping.

MR. WERMIEL: I guess the whole crux of the problem, if you could call it that, is whether or not the program is considering or reconsidering the 200 gpm supposed leak rate. Did you in any mechanistic way decide that that number was reasonable based upon the failure of those heat exchanger components that are not seismic Class I like this one is, or is the 200 just a number that you rationalized with engineering judgment?

MR. MOORE: Well I think, to answer that question directly, I have a little bit of a problem with your first statement. Part of the program, the design --

MR. WERMIEL: Is the 200 gpm being reconsidered, I guess, at all?

MR. MOORE: Let's kind of separate the pieces here. As part of the internal verification program, the answer to that is no. As part of the ongoing project work concerning the potential nonconformance of the system, the answer is yes. Okay. To answer the second part of your question, there is evidence that there is some basis, okay, of the 200 gpm leak, but we feel -- and that is why I asked for this particular area to be further considered -- I feel that there is not enough objective evidence to satisfy people looking at it today. And I can certainly say that there was engineering judgment used in the development of that 200 gpm leak.

MR. WERMIEL: And the consideration, the reconsideration that you are undertaking is both a mitigative type thing -- in other words, following the seismic event, I must assure I have the time to isolate whatever is broken with my qualified valves, and in a functional consideration, gee, what does that leak do to my component cooling water system while it is occurring?

MR. MOORE: Let me kind of rephrase it. With regard to the 200 gpm and the review of seismic capability of Loop C components in that area, we are presently revisiting that issue to verify the validity and the credibility of the design assumption used, namely, 200 gpm, and in the FSAR we say that that is the maximum credible leak that can occur to the component cooling water system. I guess it is fair to say that that design assumption has been questioned. So to try to put that question to bed, we were reviewing it.

[Slide]

Okay, this is, as I said, the spent fuel pit cooling system heat exchanger. I know I couldn't say that twice. This particular heat exchanger is not seismically qualified.

[Slide]

This slide is of this pipe restraint.

[Slide]

And once again showing the seismic considerations of the piping.

[Slide]

Another view.

[Slide]

All right. Getting to the subject of isolation valves, this slide is showing manual isolation valves associated with this type of equipment.

[Slide]

This is the boric acid evaporator coolers. It happens to be an equipment sked. These heat exchangers are not seismically qualified equipment. This is showing component cooling water going to that piece of equipment.

MR. LE FAVE: Where would the seismic boundary be in something like that?

MR. MOORE: At the nozzle.

MR. WERMIEL: What is the relative distance, I guess, from the spent fuel pool cooler to some of the other nonqualified heat exchangers? They are all in the auxiliary building, I gather, but are we talking --

MR. MOORE: I will let my operating friend give you that answer.

MR. HOCH: Jim, it is not near any of the other heat exchangers. As a matter of fact, it is in its own compartment with a shield in front of it.

MR. WERMIEL: So some of these would require some time for the operators to shake it back and forth.

MR. MOORE: Well, in answer, once again, I don't want to beg off on your question, but the question of response time of the operator was one of your specific questions and we plan to give you the answer in Section 7 now or wait till Section 7 of the presentation.

Once again, another picture showing manual isolation valves.

[Slide]

This is a picture of the positive displacement charging pump. The lube oil cooler happens to be cooled off of component cooling water headers C.

[Slide]

Now this is a picture of the surge tank, which is, as Ed pointed out, located on top of the auxiliary building. This is the tank itself. The question came up this morning about tornado shielding. That is what this is. There is a better view of that, and you will notice seismic restraints on the tank, and I have a better slide but this is the instrumentation we have been discussing.

[Slide]

This is a closeup of the same view. This happens to be the level switch that has been discussed.

[Slide]

This is a shot from the other side of the surge tank, once again showing the tornado initial shielding and the seismic restraints.

[Slide]

This is showing the two surge lines that the makeup system ties to, and this is those lines entering the surge tank through this hole.

I believe that concludes the slides.

MR. ANDERSON: Mr. Eisenhut, what we would like to suggest, I think, is a little change in the agenda. We have been going through this with a number of questions. The exact same thing happened when we were putting this together. We had a hard time getting through it ourselves without getting into discussion, and many of the questions have been answered as we go along.

So I would suggest that over the lunch break we ask people to read Mr. Aronson's remarks. It is all written down. The slides are there and I think maybe after lunch we can discuss any specific questions you have on that, and we will not bother, then, to go through and read that. We would include it with the transcript. You can ask questions on it but we would not have Mr. Aronson read that particular presentation, just to speed things up, and then maybe we could begin after lunch with the questions on the criteria design philosophy and then go on to instrumentation because I think there we get into some specifics that we would like to show you and then finally the operation and try to get through that as quickly as we can so we can open up our discussion.

MR. EISENHUT: Let me make a suggestion. First, I agree we need to figure out how to speed it up. I think you will find in the end a lot of our questions have been answered as we go along, asked and answered. Roger Mattson we lose this afternoon. What I would prefer to do is press on for a while and get another section done if we could.

MR. ANDERSON: Well, let's go to Crawford, then, on instrumentation.

MR. MOORE: Excuse me. I would like to just make one clarification. John Hoch helped me with one of the questions that was asked. The question was asked on the spent fuel pool heat exchanger whether the manual isolation valves were outside the room. I guess I didn't get a very clear answer on that. Yes, and they are accessible. John wrote down accessible without entry, yes, you don't have to go into that room. And Jim Tinlin estimates that it takes something like five minutes to get to those valves.

MR. EISENHUT: From the control room?

MR. TINLIN: Yes.

MR. MOORE: And we will better discuss the basis on how those times are developed.

MR. ANDERSON: Okay. We will ask Tom Crawford to go on here. It is a pleasure to introduce Tom to give this presentation. Tom is one of those rare engineers who has been on Diablo Canyon on one project for a period of nearly 12 years. He started in 1971. He was responsible for writing much of the criteria involved in instrumentation. Today he serves on two ISA committees, and one of them involves seismic or involves the classification of in-line instruments, and so he is very well qualified to talk about instruments, and particularly well qualified to talk about the instrumentation on the Diablo Canyon project.

AGENDA ITEM 5: INSTRUMENTATION

MR. CRAWFORD: I am going to describe the PG&E design philosophy as it applies to Diablo Canyon. I will then describe how we actually classify instruments and how it complies with industry standards, NRC guidance and regulations. Next I will give a short history of our classification system, and finally I will describe how that classification system is implemented in the component cooling water system.

[Slide 1]

In keeping with Criterion 1 of Appendix A to 10 CFR 50, if we were unconstrained by any other standards, we would develop six instrument classifications, from the most important function to the least. They would be: first, those devices which actually perform safety functions themselves; two, those devices which the operator uses to perform manual safety functions; three, those devices that tell the operator the condition of the vital systems; those devices that tell the operator if the safety systems are working; five, those devices which the operator needs to troubleshoot the safety systems; and finally, six, those devices not involved in safety systems.

In actuality our classification systems do directly parallel standards and regulations, so it is impractical to have six classifications. But remember this logic because you will see that the first two levels closely match our Class I.A, the second two closely match our I.B, and the third two are not safety related.

The design classification of instrumentation at Diablo Canyon specified by Design Criteria Memorandum M3 was titled, appropriately, "Design Class I

Instrumentation." The original version was dated March 18, 1971 and the current revision was dated March 5, 1980. The first classification that it identifies is Instrument Class I.A.

[Slide 2]

Instrument Class I.A instruments are those which are required to accomplish the functions of the reactor protection or engineered safety feature systems. Simply stated, any instrument which performs a function which is necessary to complete the safeguards function is classified as Instrument Class I.A.

This parallels the definition of IEEE Class IE electrical equipment. Class IE is defined as "the safety classification of electrical equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling and containment and reactor heat removal or otherwise are essential in preventing significant releases of radioactive material to the environment," and that is from IEEE Standard 308-1974.

Although not specifically stated in the explanation, the instrumentation which performs the safety function can be operator controlled if manual action is an acceptable way of performing the safety function. Instrument Class I.A complies with 10 CFR 50, paragraph 50.55(a)(h), which requires compliance with IEEE 279. Instrument Class I.A totally envelopes IEEE Class IE as defined in IEEE Standard 308-1974. The electrical portions meet IEEE 279, 323 and 344 as appropriate.

There does not appear to be any industry standard with which to compare our requirements from the mechanical and pneumatical portions of I.A. Class I.A instruments are seismically and environmentally qualified to meet single failure criteria and have Class IE power.

[Slide 3]

Instrument Class I.B instruments are those which provide post-accident monitoring functions. This classification meets the requirements of the U.S. NRC Regulatory Guide 1.97, Rev. 2. It is broken down into five types defined in the Regulatory Guide. They are Type A, those instruments that provide information required to take preplanned manual actions. Type A instruments are seismically and environmentally qualified, meet single failure criteria and have Class IE power.

Type B instruments are those instruments that provide information to monitor the process of accomplishing critical safety functions. Type B instruments are seismically qualified, environmentally qualified, meet single failure criteria and have Class IE power.

Type C are those instruments that indicate the potential for breaching or actual breach of barriers to fission product release. Type C instruments are seismically and environmentally qualified, meet single failure criteria and have Class IE power.

Type D are those instruments that indicate the performance of individual safety systems. Type D instruments are seismically and environmentally qualified and have Class IE power. Type E are those instruments that provide information for use in determining the magnitude of the release of radioactive materials.

These classifications were written to meet Draft 2 of Reg Guide 1.97, Revision 2. We are in the process of revising our criteria to precisely comply with the issued reg guide. It will be issued before June 1st, 1983 as required by the reg guide. We, like others, are having delivery problems with qualified state-of-the-art devices, and the physical plant does not yet fully comply with the issued reg guide.

(Slide 4.)

Okay. Instrument Class IC instrumentation is all instrumentation which has no safety function but is attached to a design Class I pressure boundary. It does not parallel any current industry classifications. Class IC instruments are seismically qualified to maintain their pressure boundary.

We are addressing this in ISA's SP-67.07 committee, but we aren't really there yet. The committee is limiting its work to in-line devices, but the PG&E classification also addresses off-line devices.

(Slide 5.)

All instrumentation not covered by these classifications is instrument Class II which performs no safety function.

Before I go on I would like to make a clarification on a point that may be confusing. All valves with actuating devices on them have two classifications. The instrument classification applies only to the actuator. The piping classification applies only to the valve. It is entirely possible to have an instrument Class II, piping Class I valve and vice-versa.

The instrument Class II valves, which you see on the Class I piping in the component cooling water system are indeed piping Class I valves.

I would like to capsulize the minimum requirements for our classifications.

(Slide 6.)

This table is taken directly from our design criteria memo, and not all the information on it is pertinent to the issue at hand. What I want to point out is an instrument Class IA is seismically qualified single failure criteria, environmentally qualified Class IE power. It's actually classified as Class IE.

Instrument Class IB, types A, B and C, are all seismically qualified to meet single failure criteria, have environmental qualifications, have IE power. Type D is also seismically qualified. It doesn't have to meet single failure. It does have environmental qualification, and it has emergency power; and emergency power at Diablo Canyon is indeed IEEEE, Class IE. We don't have a separate kind of emergency power.

Okay. I would like to address an area which I know has caused considerable debate, and this is the area of contingency actions. Our instrument Class IB, type A is the classification which we allot to instruments which the operator uses to perform manual safety functions. The verbiage in our design criteria memo is "preplanned manual actions."

In actual implementation we refer to Reg Guide 1.97, Revision 2, which calls type A variables, and I quote, "Those variables to be monitored that provide the primary information required to permit the control room operator to take specific manually controlled actions for which no automatic control is provided, and that are required for safety systems to accomplish their safety functions for design basis accident events. Primary information is information that is essential for the direct accomplishment of the specified safety functions; it does not include those variables that are associated with contingency actions that may also be identified in written procedures."

As I said earlier, in our revised criteria memo we used this definition precisely. We defined "contingency actions" as actions for which capability is provided to diagnose and correct system problems which are not part of the direct accomplishment of the safety function. We believe this is consistent with the regulatory guidance, and that is consistent with the design philosophy which I described earlier.

I would like to point out that instrument Class II is simply a functional classification. It is not necessarily a measure of the availability of the device. There are many instrument Class II devices in the plant which have been seismically qualified and are wired and powered as IEEE Class IE devices. Some are even redundant. This goes to a very conservative PG&E philosophy that requirements are only minimums. Quality should be commensurate with importance regardless of which box it fits into.

This is important enough for me to restate it. These are classifications which fit into little boxes to comply with NRC requirements. PG&E has many devices under our old classifications which were seismically qualified, wired and powered as IEEE Class IE but which have been reclassified as Class II to conform with NRC definitions.

The component cooling water surge tank level switch which apparently sparked the controversy at hand is just such an instrument. It performs a contingency function, and it's therefore not instrument Class IA or

IB. As you will hear later, it is used in an abnormal condition procedure and not in an emergency procedure. It is, however, provided with Class IE power and inputs into a seismically qualified enunciator.

(Slide 1.)

I would like to share with you the history of our design classification system. The original design criteria memo was written in March of 1981 to drafts of ANSI N-18.2.

MR. NORTON: Excuse me, Tom. You misspoke. That's 1971.

MR. CRAWFORD: I'm sorry. 1971.

Instrument Class IA was reserved for those instruments defined in Section 5.3 and 5.5 of N-18.2. Instrument Class IB was everything else in the safety functions; that is, the next four items on our philosophy list.

Although some specific minimum criteria were given for IB, the unwritten criteria was basically the embodiment of GDC 1, quality commensurate with its function.

In December of 1976 the NRC Region V was auditing us and found inconsistencies in the wiring of IB devices and asked what the criteria were. Since we couldn't provide a single set of criteria, we agreed that an overhaul was in order.

In 1977 we wrote design criteria memo M-3, Revision 1, putting all devices which perform safety functions into IA and parallelled IA to IEEE Class IE. We relabeled Class IB as devices used for "peripheral control and monitoring of safeguards systems," with requirements consistent with the importance to be determined on a case-by-case basis. None of it was called IE, but we wired it, powered it, and qualified it as if it were IE, if we felt it to be appropriate.

After TMI I participated in the staff-industry meetings on Reg Guide 1.97, Revision 2, and when I thought that it was basically firm, the Draft 2 stage, I rewrote our criteria memo M-3 to make IB reflect the draft regulatory guide. The upgrade to the physical plant, which is still in progress, has been minimal.

Our Class IB previousl included peripheral control and some diagnostic monitoring. When we made it match the regulatory guide there was no place for these functions. From a classification point of view they became Class II, but they will still be available when we think the operator needs them. The surge tank level switch is just such a device.

Now I want to discuss the implementation of these classifications in the component cooling water system.

(Slide 7.)

This slide shows the diagram or this is the system diagram which Mr. Connell showed you earlier, and I'm going to go through each classification, one classification at a time, and show you which instruments in the system fit that classification and why they fit it.

(Slide 8.)

Okay. This slide shows the instrument Class IA, automatic functions in the component cooling water system. There are no protection systems signal initiating, in other words IA instruments in the system. There are several system automatic functions which are initiated by devices outside of the system. A safety injection signal is initiated by LOCAs and main steam line breaks. Containment high pressure, that causes all three component cooling water pumps to start. It opens FCV-366 and 360 which are on the containment fan coolers. That is all I get the safety injection does.

Containment isolation signal, which is initiated from a safety injection signal in phase A, closes some of the containment valves on header C of the component cooling water system. A phase B containment isolation signal which is initiated when the pressure in the containment exceeds 22 psi closes the remaining containment isolation valves on header C, and it isolates the entire header C by closing FCV-355.

(Slide 9.)

In addition to the automatic safety functions, there is one manual safety function which this slide shows; that is, the system changeover when one goes on to RHR. Most of this is accomplished locally, but the radiation dose level is such that access to the RHR heat exchanger valves is not feasible. I should point out that is the only place we have analyzed where that is the case. Therefore, these valves, FCV-364 and 365, are remote manual valves and are indeed Class IA.

(Slide 10.)

This slide shows the instrument Class IB devices. Since the only manual safety function is the RHR realignment, the only IB type A instrumentation would be that used for such a realignment. The operator makes this change when he goes into the recirculation mode after a LOCA.

The type A instruments for this function are the refueling water storage tank level and the containment recirc sump level, neither of which is in the component cooling water system. There are not type

B or C variables by definition, and also if you compare it with the table in the reg guide, there are two type D variables. The reg guide defines the flow and the temperature, two vital systems, as being the instruments needed to monitor whether the component cooling water system is doing its job, and therefore they are the type D variables. So we indeed have discharge variables, and we have flow to the vital headers.

In addition, PG&E considered the flow to the nonvital header as a very legitimate way of determining whether the system is performing its function. So we've also classified that indicator as I3, type D.

MR. MATTSON: You've got a temperature indicator and a flow indicator, but one of the things you worry about is whether you have got enough water contained in the component cooling water system.

MR. CRAWFORD: The safety function of the component cooling water system is to provide flow to its vital functions. We know whether we have enough flow.

MR. MATTSON: So if you had a makeup problem, you would see a flow deficiency.

MR. CRAWFORD: Yes. The point you are getting at precisely, which I might as well just hit head on, is there is a concern obviously about how does the guy know that he is going to lose his flow. Right now what we're talking about, well, is a device which specifically issues to alert the operator that if he doesn't do something, he might lose his system.

But the regulatory guide does not talk about what I will call preventitive measures, which is what we're talking about here. The reg guide addresses whether or not the safety system is working. It doesn't say it's going to be working in ten minutes if you don't do something. It says is it working now?

As I said earlier, we feel that it is a good idea for the operator to know if he is going to lose it, and therefore, we provided that level switch, and we've made sure that it has got Class IA power, et cetera. But that doesn't fit the box in the reg guide is what I'm telling you.

MR. MATTSON: Let's see. If we reached down out of the sky and said make the level indicator IB, you could do that?

MR. CRAWFORD: Well, to meet IB you have to meet the reg guide, and the reg guide talks about indication. Okay. It is an irony the reg guide doesn't talk about an alarm, and the alarm does not meet the requirements of a reg guide.

MR. MATTSON: Except for an alarm versus an indicator, you would meet it?

MR. CRAWFORD: One minor thing is these instruments were installed as seismically qualified. As you are well aware, we are going through phase 1 in all of this. We have not upgraded or maintained those seismic qualifications to the current thinking. They have been tested, and there is a response specter available, and we would have to go through and check. There is a possibility, a very real possibility because of that area that they may need to be reshaped. But it is more of a testing thing. It is not a matter of function.

MR. MATTSON: A different kind of question: If there was a makeup deficiency and the surge tank had trouble of some kind and the level didn't serve that function because of a loss of capacity of your seismic event, after a seismic event you would get some indication from the flow meters of the loss of makeup and probably go through some diagnosis to figure out that it wasn't the pump that was causing the trouble, but it was in fact the loss of fluid.

How long would you have for what size leak?

MR. CRAWFORD: It depends upon the leak.

MR. MATTSON: To identify, can you give me some feel?

MR. CRAWFORD: It depends specifically on the leak. The operator action would first be to isolate the leak. As I described earlier, we have flow indicators on every heat exchanger or every significant heat exchanger.

MR. MATTSON: I was trying to get a feel if it was a 10 gpm leaking at 3 nanoseconds or something.

MR. CRAWFORD: Well, the design of the system is assuming 200 gpm leak. He has something like 20 minutes.

MR. MATTSON: How big a leak?

MR. CRAWFORD: Two hundred.

MR. MATTSON: For a 200 gpm leak he has 20 minutes to find it and fix it or else he's going to lose a pump?

MR. CRAWFORD: He has 20 minutes to get to the bottom. He has still got water in the surge tank for 20 minutes.

MR. CONNELL: That assumes no makeup.

MR. CRAWFORD: That assumes the automatic makeup function doesn't work. It assumes that.

MR. MATTSON: That is a little bit different question. After the surge tank runs out, now at X gpm how many minutes has he got before he does what, burns up a pump?

MR. CRAWFORD: Something I haven't indicated here, he also has low pressure switches on the headers, so that is the first thing he will actually see.

MR. MATTSON: Are those Class IB?

MR. CRAWFORD: They are IC. Again, they are enunciators.

MR. MATTSON: They are seismically qualified but?

MR. CRAWFORD: They are IC. They are enunciators and therefore are not within the scope of the reg guide. They will not trip the pump.

MR. MATTSON: But he still gets the indication.

MR. CRAWFORD: Yes.

MR. LE FAVE: The standby pumps do not automatically pick up on low discharge pressure, do they?

MR. CRAWFORD: In an accident all the pumps start automatically.

MR. LE FAVE: In normal operation you would be talking about a pipe break.

MR. CRAWFORD: He would not.

MR. LE FAVE: It would pick up or he wouldn't.

MR. CRAWFORD: I'm sorry. That low switch also starts all pumps.

MR. BUCKLEY: But in response to Roger's question, if you drained the surge tank, you've only got whatever water is in that surge line, so you're talking about minutes.

MR. CRAWFORD: You're talking about however long it takes to drain the surge line basically.

MR. MATTSON: But the pumps will work without the lines being full for a while, won't they?

MR. CRAWFORD: Sure. The first thing he's going to have, he's going to have low pressure alarm, and then he's going to get a low flow.

MR. EISENHUT: I'm not sure I understand the answer, though. Suppose one of these heat exchangers out on loop C has a leak and suppose -- let's stipulate for whatever reason for the moment it's more than 20 gpm. In the normal operating mode how long does he have? You start draining the system. You get indication. How long is it before an operator must be doing something to isolate that?

MR. CRAWFORD: Must be doing something to protect what?

MR. EISENHUT: To ensure that he has an adequate flow for the safe emission of the CCW.

MR. FRIEND: Nothing. As long as the makeup system is functioning, he could go for a long darn time because it's just running on the floor, and it's making up at 250 gpm.

MR. EISENHUT: So it is really, as Roger says, it's a horse race. You've got water going out of the heat exchanger.

MR. CRAWFORD: Could I have Ed Connell's slide of the makeup system?

MR. EISENHUT: So actually the time is a lot more than any 20 minutes, and you really have to look at this in the overall context of what kind of leaks. You've got the whole system full. You've got a surge tank. You might or might not have makeup on. You've really got to put it in a different perspective.

(Slide.)

MR. CRAWFORD: I should explain something. When we put these control valves in, we seismically qualified them. The level of controls are seismically qualified to function. I was talking to John Lasher about it. It's interesting. This level controller was the only instrument we've ever had that actually had a problem. It is a pneumatic controller, and it jumped its seismic shock mills in the test, and it drifted by 10 percent, but it still works.

We have a seismically qualified level control on that tank. Now, it doesn't have backup error. I don't want to mislead you. In other words, if you lose offsite power, you have no error to it. But I'm saying that device is bought as a Class I device. It will work through a seismic event just fine.

We have redundant capability automatic makeup. We fully feel that we're going to have makeup.

MR. MATTSON: I think your point is even stronger than that. I think your basic point is we meet Reg Guide 1.97.

MR. CRAWFORD: That's right.

MR. MATTSON: And that is after all the staff's best, most current thinking of what is required to function after design basis events and beyond design basis events for all PWRs no matter their design vintage, and that is a very strong statement.

MR. CRAWFOI [redacted] That's right. In fact, we go beyond it.

MR. EISENHUT: The point I think you're making, if you go beyond it, if I understand what you're telling us, you go beyond it, and from looking at your Table 1 I don't see really much difference between -- ID, type C is really no different than ID, type A or B. They are all really the same bag. The only difference is item 5, the IEEE classification, between a Class IA.

MR. CRAWFORD: Only IA meets IEEE classification because most of that has to do with system bi-stables. They don't imply two indicators.

MR. EISENHUT: But all of this instrument is

Class IB, I guess.

MR. CRAWFORD: No. B's instruments are level switches. They are not IB at all. They are instrument Class IC.

MR. EISENHUT: I'm sorry. The level switches --

MR. CRAWFORD: The level switches are IC.

MR. EISENHUT: But you say it is seismically qualified.

MR. CRAWFORD: It was seismically qualified when we installed it. Because of the declassification, we have never revisited that qualification.

MR. EISENHUT: I understand.

MR. DUNNING: Did you say the enunciator system was seismically qualified?

MR. CRAWFORD: That is correct, with limitations. The drum isn't. But you will get the alarm on the window.

MR. DUNNING: Your only point was that Reg Guide 1.97 didn't address enunciator systems?

MR. MATTSON: Before you get too far afield, I think where Tom and Daryl are headed is trying to prove that it's even better. I think there must be instruments in more directly applicable safety systems where we have to make the same statement.

Let's take the RHR or the ECCS in the low circulation mode. Let's assume we're asking the same question. It probably has a flow indicator and a temperature indicator to show that it is accomplishing its decay heat removal system and that it has got adequate flow. It probably does not under Reg Guide 1.97 have to have an instrument saying that it is losing suction, right?

MR. CRAWFORD: You've got it.

MR. MATTSON: You would know it by loss of flow eventually, but you don't have to be able to anticipate it under Reg Guide 1.97.

MR. CRAWFORD: That's exactly right. You said it. That level switch is an anticipatory device.

Okay. So all the remaining instrumentation physically on the system is instrument Class IC. There are many devices, none of which have a safety function, so I will not discuss them here.

(Slide 11.)

I would like to discuss other devices which are not Class IA or IB which we feel are important. Most were Class IB under our old definition of "peripheral control and monitoring." They don't, however, fit our current definition of Class I devices except IC as appropriate.

This slide shows some of those devices. First off, we have the ability to automatically make up the surge tank with redundant instrument Class IC controllers and the instrument Class II control valves. We have the instrument Class IC low alarms on the surge tanks, which I discussed earlier. They are functionally redundant and powered as IEEE, Class IE.

We feel the determination of the surge tank level is an important diagnostic tool for leak detection. Although I didn't show them on this slide, we have Class IC flow indicators in every significant heat exchanger on loops -- on headers A and B. We also have a flow indicator on every heat exchanger on the C header which has a line size over two inches, except for one which is isolated by a containment isolation signal. Some of these are local and some are on the main control board basically depending upon how important we felt they are. These allow the operator to quickly locate and isolate leaks.

MR. FRIEND: Read that paragraph again, please.

MR. CRAWFORD: Although I didn't show them on this diagram, we have Class IC flow indicators on every significant heat exchanger on headers A and B. We also have a flow indicator on every heat exchanger on the C header which has a line size over two inches, except for one which is isolated by a containment isolation signal. Some of these are local, and some are on the main control board. These allow the operator to quickly locate and isolate leaks.

MR. MATTSON: Jerry, does that help with your question?

MR. WERMIEL: To some extent.

MR. CRAWFORD: Although our design basis is the ability to operate given a long-term single failure where the operator goes down and manually isolates the system halves, we felt it would be wise to provide immediate capability to cut in or out heat exchangers. Therefore, we have motor operators on the discharge valves for the heat exchangers, FCV-430 and 431. These are instrument Class II simply by definition, but they are seismically qualified, powered and wired as IE devices. They are also environmental devices.

We have Class IC radiation monitors on the system to detect radioactive leaks into the system, and these monitors also isolate the system vent as a precautionary measure.

In summary, the instrument classification system for Diablo Canyon meets all applicable standards, regulations and guidance, and the actual implementation is more conservative than classifications themselves.

MR. ANDERSON: If we could ask you to maybe take a look at Chuck Aronson's written presentation over lunch, we could talk about some of the specifics in that.

MR. FRIEND: Unless you want to keep going.

MR. EISENHUT: I will give you a choice. Since we're going to have to come back, I would suggest go ahead and maybe taking a break at this point. I don't think you can make it all the way through the whole thing.

MR. MOORE: No, we can't.

MR. ANDERSON: But Jim Tinlin on the operation, that might be fairly short if we could get through that.

MR. EISENHUT: Okay. Why don't we go ahead and do that and then break for lunch?

(Discussion off the record.)

MR. ANDERSON: Okay. We have asked Jim Tinlin to give this next part of the presentation.

I mentioned some of his background before. He is a senior reactor operator, and he is also the training coordinator for the Diablo Canyon operations and training section, so he has very good qualifications in talking about plant operations.

Jim.

MR. TINLIN: Basically I'm going to cover the operation of the system. Much of it has been covered already before, but I'm just going to reiterate it from an operations standpoint.

(Slide 1.)

You can see the normal operation of the CCW system in this slide. We will normally have two pumps in operation, one heat exchanger to remove all of the normal heat loads from the system during operation. All the components are normally connected to the system, not isolated, with the exception of a few specific components which we have capability of supplying it from the other unit, and that's the only reason why I included that. They may not or may be connected to the system, but they have no vital function.

The standby heat exchanger will be in service and capable of being used if it is filled, vented, and essentially all the operator has to do is open one valve in the heat exchanger.

MR. EISENHUT: Let me ask a simple question, and really I am not sure I understand the question. Why did you -- when you did the design why did you line it up so that under these normal conditions following these events you really only used one heat exchanger rather than just lining it up in parallel from the start?

I mean what was just really the philosophy of it?

MR. TINLIN: Why one heat exchanger during normal operation rather than two?

MR. CRAWFORD: You have one for standby.

MR. HOCH: During normal operation you have one auxiliary feedwater pump. You don't use all three component cooling water pumps. There is some consideration for other power users, and we are sensitive to from an economical standpoint there's no reason to operate it.

MR. EISENHUT: Then following an event as you go through various phases does the same thing hold? Is that why you hold on one and sort of reserve the second for backup?

MR. TINLIN: According to the design of the system, one heat exchanger is sufficient to remove the design heat load during the design basis accident. The other one there has a standby just in case you need it. At least that's my philosophy.

MR. EISENHUT: Well, I just wanted to make sure that that is the logic, and then in essence you keep a perfectly good heat exchanger in reserve all the time.

MR. TINLIN: In standby.

MR. FRIEND: You have a whole loop, Daryl, so you can take an active failure and another one.

MR. EISENHUT: Earlier it was mentioned when I referred to normally used heat exchanger, one, do you really do that from an operation standpoint, or do you alternate?

MR. TINLIN: That was my next paragraph. Basically, the way we operate the system is like I said, two pumps, one heat exchanger, and normally on a weekly basis we slop off the heat exchanger and pumps to equalize run times.

MR. WERMIEL: Can I ask a question on the pumps? What are your tech specs say for availability. Do you enter an LCO with one pump down or two?

MR. TINLIN: The technical specification for this system specifically states that two vital headers must be available. We interpret that to say one header flow path and one pump.

MR. WERMIEL: And one pump is sufficient to fulfill the design basis?

MR. EISENHUT: Let me see this. Now I have a whole slew of questions.

Is there -- if you took that interpretation it would say that one of the vital loops could be down essentially indefinitely.

MR. TINLIN: No. We have a time period. If you see that LCO, you have 72 hours to repair the header. If you don't, you have to go to hot shutdown in six hours and a cold standby in 30.

MR. EISENHUT: Okay.

(Slide 2.)

MR. TINLIN: During plant cooldown which was previously mentioned, the third CCW pump and second heat exchanger is placed into operation, mostly for convenience because you are using two RHR heat exchangers to cool the reactor coolant system down to cold shutdown conditions. It is not required that both the exchangers be in operation. It is just that having two in it decreases the amount of time it takes to cool down, which is a little bit easier for the operators to do that way.

We can cool the plant down with one heat exchanger if necessary. It has the capability.

MR. EISENHUT: Excuse me. Then let me clarify your presentation, and your writeup said, and it appeared earlier also that you switched and put on the second heat exchanger 1-2 due to the increased heat load.

MR. TINLIN: Right.

MR. EISENHUT: What you're really saying, as I understood what you now say, is mostly for convenience, and in fact you could handle it with one.

MR. TINLIN: Sure. It would take a lot longer to cool down, though, but you can remove sufficient heat with one heat exchanger.

(Slide 3.)

And then it is placed back to its normal configuration once the system has been cooled down.

Abnormal operation I have broken down basically into two contingency actions. One of them would be the event of a high heat exchanger outlet temperature. This alarms the main control board at approximately 120 degrees to indicate to the operator that either excessive heat loads exist on the system or that a flow reduction has occurred.

Per procedure the operator has several immediate actions he can perform. One, he is going to verify the condition exists by looking at the temperature indicator on the main control board. If the heat load is in fact too high, the standby heat exchanger is placed in service using all applicable operating procedures.

In addition to that, he will also check flows on the ASW system as well as the CCW system to verify that that is not the cause of the excessive temperature.

MR. NOVAK: With regard to the component cooling water pumps, do they have any special characteristics to clear air binding problems?

MR. WARD: Do you mean in the sense of being automatically vented?

MR. NOVAK: Yes. If you do get air binding, do you have to bleed them?

MR. TINLIN: Not on the pumps specifically. There is a system on the heat exchangers to fill in there.

MR. MOORE: The answer to your question is -- I believe the correct answer to your question is there are no special features or design features for that purpose. Venting and filling of the system I believe is a manual operation.

MR. FRIEND: But the surge tank is vented, and it is high up in the system, so once you get the system solid, it is not going to --

MR. MOORE: I anticipated his question. I think he was postulating down here.

MR. WERMIEL: Let me just ask another question on the same thing Daryl and I were talking about before. The tech spec allows one CCRB pump to be out indefinitely.

MR. TINLIN: That's the way we interpret it.

MR. WERMIEL: Okay. Now, I have that pump down. I have two pumps available. I now get an event which requires at the P signal to close up CV-366, the

C-loop.

MR. TINLIN: 355.

MR. WERMIEL: 355. Whatever it is. If the C-loop is isolated, do I lose suction to the 1-2 pump? On the suction side I'm talking about. Because the valves are closed there, it appears to me I don't have any suction to that pump -- that is the way it looks -- which means that a single failure in the 1-3 pump now leaves me with no CCW. That is the way it looks.

MR. LE FAVE: That is the condition we want to discuss, though, not the P signal. It is the pipe break in a single failure that takes you out, not the P signal.

MR. WERMIEL: It's anything, I guess, that could cause isolation or failure in the C-loop, which could be a pipe break.

MR. TINLIN: That other condition that was shown was isolating the entire C-header loop which is one of the what I guess you could say the biggest contingency action you could do. Normally you would isolate each individual heat exchanger. In that case you would not be isolating the pump. And this big failure on C-loop, according to the FSAR, is not postulated. We're looking at 200 gpm again.

MR. WERMIEL: With a 200 gpm leak do you know that you won't get an unacceptable suction condition?

MR. TINLIN: Sure, because we can make up for it with the makeup system.

MR. WERMIEL: And you're saying I will have that makeup capability even following some seismic event?

MR. TINLIN: Yes.

MR. MOORE: That was the Class I makeup system.

MR. TINLIN: This can be indicated by several indicators and/or alarms on the control board. One can be a low CCW surge level, as was talked about previously, and/or low header pressure alarms which are on the vital loops. Automatic actions that can occur in this case are the standby CCW pumps start on low pressure, and the automatic makeup system valves will open to raise the surge tank level on low levels.

Immediate operator actions that the operator has to perform are: one, to verify that those previously mentioned automatic actions occurred. If they don't occur, he is directed to specifically perform manual backup actions for those automatic actions, which would include starting additional pumps, open bypasses around those makeup valves if necessary, whatever he has to do.

If level is lost in both halves of the surge tank, the operator is instructed to trip the reactor and trip the reactor coolant pumps, because the reactor coolant pumps will lose cooling, and rather than trip the coolant pumps and trip the reactor, he puts the plant in a safe condition and removes that heat load. If, in fact, only the level 1 half of the surge tank is lost, he can physically separate the systems, run on one good vital header and then place the plant in a safe condition.

(Slide 4.)

As indicated --

MR. BUCKLEY: Can I ask you a question on that? Your makeup through your solenoid valves in the surge tank comes on before you get a low level alarm. You get an indication to make up before you get a low level, right, I would imagine.

MR. CRAWFORD: Yes. It is proportional controllers, not an on/off.

MR. BUCKLEY: So you could have the makeup pumps continuing to make up without ever getting a low level alarm in the surge tank, is that correct?

MR. TINLIN: That's possible.

MR. BUCKLEY: So you could have a leak and not get an indication of a leak.

MR. CRAWFORD: Not true.

MR. TINLIN: The level control valves are equipped with an alarm on them to indicate the fact that they have opened. That will clue the operator into the fact that makeup should be taking place.

MR. BUCKLEY: They would be making up -- I mean they would be alarming every time they make up, right?

MR. TINLIN: That's right.

MR. BUCKLEY: So the operator would not necessarily know it is a leak or just a normal makeup.

MR. TINLIN: Well, that amount of makeup would definitely be an unusual occurrence.

MR. BUCKLEY: The valves will be open for an indefinite period of time, and would you have a continued alarm?

MR. TINLIN: Yes. The alarm stays in.

MR. BUCKLEY: So that would be a kind of indication.

MR. CRAWFORD: Not only an alarm but there's a counter on it. In other words, for a whole lot of reasons we want to know when we are making up, so we have a position switch, and we have a little mechanical device on the valve that counts every time the valve is open. We let the operator know that he is making up.

MR. MOORE: And we use this counter in time to, if you will, allow the operator to determine the rate at which he is having to make up or the rate of the leak that he has.

MR. TINLIN: Or a fairly good estimation of what the leak is. When this procedure is completed, basically the following steps are to determine the source of leakage and some of the indicators, as we pointed out before, flow meters, both locally and remotely, that he can use and then isolate that source of leakage.

This particular slide shows a typical component isolation valve arrangement. Every component on the CCW system has at least one supply and return isolation valve. Some have more than one. Some have automatic valves. So every one of them is capable of being isolated independently or if there needs to be an entire train.

(Slide 5.)

During emergency operation, which would be a LOCA and post-LOCA condition, a safety injection signal starts all three component cooling water pumps to protect against any single active failure. Also, during a safety injection signal, a phase A containment isolation signal is generated which isolates most of the process lines in and out of the containment, which will significantly reduce the normal heat loads in the system.

If a phase B containment isolation signal is generated, which will come about under most LOCA conditions but definitely during a design basis LOCA, the miscellaneous header C supply, reactor coolant pumps and vessel support pad coolers, which are also on header C, automatically isolate. Operators are required by procedures to specifically verify all these actions have occurred. If they don't occur, he manually backs them up. This is in the immediate operator action section of the procedures which they are required to memorize and know word for word to get a license to isolate the plant.

Post-LOCA conditions require the safeguard system to be separated into redundant trains to prevent loss of a system in the event of a single passive failure. This procedure specifically states the time frame when this must be done and the valve lineups required.

(Slide 6.)

Basically, as you can see by this slide, both heat exchangers will be placed in service, one supplying each vital header, and one pump will be aligned to one vital header, and the other pump or pumps will be aligned to the other vital header and/or header C as necessary.

(Slide 7.)

If a failure happens to occur on header C, the loop can be manually valved out of the system completely to maintain the integrity of the vital loops A and B. All of these manual actions which would have to be performed to valve this out are all located, as was previously mentioned, in low radiation areas, CCW pump rooms and CCW heat exchanger rooms, and can be accomplished in a fairly short period of time.

MR. NOVAK: Do you have any estimates as to the times -- let me call them a break period. If you were say in a post-accident LOCA, for some reason all CCW pumps were secured, do you have any analysis or feeling for the amount of time it would take or the amount of time you would have to perform certain safety functions which would be lost or challenged?

MR. TINLIN: What you're saying is if I completely use the CCW system during a safety injection, how long do I have before I have to get it back before I start losing safeguards components?

MR. NOVAK: Yes.

MR. CONNELL: No CCW at all?

MR. NOVAK: Yes. For some reason. I would expect that there is some lag time, some grace period for which you could restart, for example, the containment, the failure to turn on coolers.

MR. CONNELL: I don't have a quantitative answer to that.

MR. ANDERSON: I guess we can't answer that question. We haven't looked at that, and that is not part of the design basis.

MR. FRIEND: We approach it the other way, Tom, to do our best to ensure that we don't have a loss of CCW system rather than to try to make an evaluation of how long it can survive without it.

MR. NOVAK: There is no specific procedure prepared that would suggest for some reason securing all CCW pumps?

MR. TINLIN: No, never. There is no reason to shut that entire system down. I can't think of any, whether it be normal operations or abnormal.

MR. MOORE: I think that is what the license allows you to do.

MR. NOVAK: I realize that, but I still asked.

MR. ANDERSON: Okay. Are we finished with that section then? And maybe we could ask you maybe to look at Mr. Aronson's prepared remarks during lunch, and we can discuss that further.

And the questions, of course, the NRC questions we received on Tuesday, and then any discussion, that can take place this afternoon.

MR. CREWS: Can I add one more thought? We looked at the procedures within the operating department for assuring the reportability to make sure they are according to the tech specs.

Can you just say when we come back, tell us how you adopt this interface, the internal technical program information? It would give me a great deal of comfort if I knew, for example, that those findings got to the operating department.

MR. MOORE: I can answer that question right now. As I pointed out, when I formed the technical review group when the interim nonconformance was identified, one member, one standing member of the TRG is a member of the operating department. It happened to be Jim Tinlin, I believe, on the second, third and fourth meetings, and it was another member of the operating department on the initial one. And one of their responsibilities is to monitor those activities and make sure that we are in conformance with their reporting requirements.

I don't know. John, would you like me to just briefly discuss how we have been reporting issues like this out of the verification program?

MR. HOCH: I would rather do it, if you don't mind.

MR. MOORE: That answers I think the only other question.

MR. FRIEND: Why don't we break for lunch, and we could get out act together and give you a good discussion after lunch.

MR. EISENHUT: I think that is a good idea. Why don't we come back at 2:00?

(Whereupon, at 12:50 p.m., the meeting was recessed for lunch, to be reconvened at 2:00 p.m., the same day.)

AFTERNOON SESSION

(2:00 p.m.)

MR. ANDERSON: We have been through a number of answers and questions. I guess at this point it is best to just open it up to your questions. We can discuss further questions sent to us this Tuesday, if that would be your wish, or we can deal with any other questions you might have from the morning's presentation or from reading Mr. Aronson's presentation or anything else you want to talk about at this point.

MR. EISENHUT: Well, first of all, let's see. I might suggest the following. Does the Staff have any specific items on Aronson, on the Aronson paper? And if not, why don't we go ahead to the specific questions that were identified, sent out and referred to in the agenda. And a number of those, of course, we already addressed; some we did not.

Maybe we ought to walk through those that have obviously been addressed, and it would be pretty simple just to move on down the line. Would that be a fair way to proceed?

MR. NORTON: I think Jess had a question pending over the lunch hour, and maybe we ought to do that first because that is not in that list.

MR. EISENHUT: Sure.

MR. HOCH: Jess, could you phrase your question once again?

MR. EISENHUT: No. You understand the question, right?

(Laughter.)

MR. HOCH: Well, I will try to pick it up. I would prefer, Daryl, since lunch has come in between that he ask us again.

MR. CREWS: Basically, we have looked in some depth at the procedures you set up internally, focusing primarily on the operating QA program and the operational phase and assuring the recording requirements and the regulations be complied with.

We feel comfortable with the system established there, and what I was asking was what sort of evidence do you have to assure that the IDBP's findings and your technical program findings are fed into that system? And I'm talking now in part about the IDBP reporting.

MR. HOCH: Okay. First of all, we are accomplishing reporting of items that we identify as part of either the internal technical program and either identified to us by the IDBP by means of the semi-monthly report, and that report, of course, was ordered by the Commission as part of the Commission order. We are identifying items in that report.

Unit 1, of course, does have an operating license, and the project works very closely with PG&E's nuclear plant operations department and the people at the site. We have on project an operations coordinator who reports to the project and has his other foot, so to speak, back across the street in nuclear plant operations and reports to Jim Shepard, who is manager of nuclear plant operations.

We have a continuing relationship with plant operations that requires us to keep them informed of items that we identify in the internal program and of items that are identified from the IDPP, and that is done both by means of the semi-monthly report, by periodic meetings with them. The project meets with PG&E management on a bi-weekly basis, every two weeks, and that includes meeting with Jim Scott, our vice president for nuclear power generation, and quite often directly with Jim Shepard, director of nuclear plant operations, to keep them informed about the progress of the project's work.

In addition, all of the IDBP reports that are distributed are provided also to Nuclear Plant Operations and directly to the plant staff. They are reviewed by the plant staff. We have a continuing dialogue with them. We respond to their questions, keep them informed about what is going on, not only internal technical program items but what has been identified by the IDBP. That is the mechanism we are using. That is the agreement we have with Nuclear Plant Operations to make sure that they feel that all of the reporting requirements and the technical specifications continue to be satisfied.

MR. RUBENSTEIN: Those are excellent words, but do you have a system that carries these forward until they're disposed of?

MR. MOORE: Actually, we have two. I kind of appreciate your problem. You haven't had the benefit of all of the various presentations with regard to the verification program. But we have really two systems. If the issue is identified as being under -- an issue under our quality program, then it has a tracking system to close those issues out. But separately from and in addition to that program, all programs identified either by the IDBP or ourselves are put into a computerized tracking system when they are first identified, and that item is not closed until we get either final completion of concurrence from the IDBP or we close the issue on the project ourselves.

MR. RUBENSTEIN: To walk the last mile what is the level for identification? Is that when someone comes to a supervisor or when someone writes a letter to a supervisor, or where does this become officially in the tracking system?

MR. MOORE: Once again, we have two different systems. I think I kind of outlined the system that is a part of our quality program, namely the employee comes to a supervisor, and a determination is made at that point. That doesn't necessarily have to be in writing.

As far as the verification program is concerned, I think there are two different thresholds, and I can have Dr. Cooper address the thresholds that are used in the IDBP. But basically, if they identify an item that seems open to them, they initiate an open item, and depending upon what they determine when we send them further information or they get more involved, they may categorize that in one of the four different classifications as an error, or a deviation, or it may just close upon further investigation if it is not an open issue any more.

With regard to the project, we have a little more specific threshold definition. There is actually three different ways it can be triggered over a threshold: number one, if it has safety significance; if it is generic; or if we can't figure out what it is within 14 days. And I guess in terms of the staff, that is 21 days, but on the project it is 14 days to allow getting it reported.

MR. NORTON: In terms of reportability it is 21 days.

MR. MOORE: Yes. In terms of the staff getting it notified in our semi-monthly report, it is 21 days.

MR. RUBENSTEIN: I understand.

MR. EISENHUT: Okay. Why don't we go on to the questions.

MR. MOORE: I will ask Jim Tinlin to address very quickly the answers to question 1, parts A through F. And I think they will be very quick answers, because I believe he's answered all of them already.

MR. MANEATIS: I thought we were going to allow the staff to ask any questions that they feel we haven't answered rather than plow the ground all over again.

MR. EISENHUT: You can do it either way. I think I agree with you. But I just would like to have you -- if you tell me you've answered which ones of these, and if not, let's just move to those where you have yet to answer some of them, you obviously haven't, and then go on to any other questions.

I think I agree with you. I think you can go through them very, very rapidly. I don't expect to complete reverification information.

MR. MOORE: Okay. Based upon what I think the instructions are, I feel that we have answered really all the questions except for those questions asked under question 4.

MR. EISENHUT: Let me see if the staff -- if you have any more questions, I guess falling under 1, 2 or 3, or follow-on questions. Maybe we ought to dispose of those.

MR. BOSNAK: Really, it's probably under question 3 and also in the Aronson paper on page 10 of that document. Really, the basic question, that is: Have you varied from what we understood your seismic-nonseismic interface criteria was when we went through accessory 8?

At that time we understood that the interface was generally an anchor between seismic and nonseismic portions of piping. And what I'm reading here is what you're saying is most of the nonseismic portions of the branches, the heat exchangers in loop C, if they are not seismically qualified, they are small. That is what I read this paper as saying.

Do you have any that are large? And if you didn't have an anchor say at the interface, would that be a problem if the nonseismic portion were postulated to fail?

Are you still meeting your basic criteria where you have a line that goes from seismic to nonseismic and you have an anchor, and generally, of course, you have the isolation valves.

MR. ARONSON: It's not exactly that situation from the standpoint of the analysis, as I understand it. The nozzle on the heat exchanger is being treated as a point in space which is an anchor; in other words, this is where the piping system terminates.

MR. BOSNAK: If the whole area were considered to be nonseismic where this is postulated to go, what kinds of loads would you have on the piping that is seismic, and have you looked at that?

MR. ANDERSON: I think we have to understand a little bit about the design philosophy as far as the seismic design goes. From my own experience with PG&E back in 1971 when I worked on the Mendocino project, we were really quite surprised at the care that PG&E put into all of their specifications, whether they were safety-related or not, that dealt with earthquake requirements. And this is kind of a unique situation.

Most utilities were dragged into the seismic design arena by their nuclear power program, and PG&E being an area that has earthquakes was very much involved in designing for earthquakes totally apart from the safety aspects of nuclear power. They had sent people up to Fort Richardson, Alaska after the 1964 earthquake to evaluate the damage up there, and as we talked to the original designers, a great deal of judgment and good judgment was applied to the equipment in loop C.

The original designers judged that the equipment in loop C would not fail in a design basis seismic event, even though it was not classified as seismic category 1. And that judgment was based in some cases on some equipment being qualified or being furnished as qualified for seismic 1. In some cases it was based on some simplified analyses they did, and in some cases, particularly in the cases of the smaller heat exchangers, it was based upon just simply judgment that that kind of equipment won't fail, and if it did fail, it was small anyway. So that is the basic judgment that went into the system.

The original designers feel that they are not going to have any failure due to an earthquake. Well, now, what we have offered to do here is we will go back and do some analyses and some evaluations to confirm that original judgment. So they did not think that the nonseismic portions would fail, so really the equipment was assumed to be there, and the piping was classified seismic category 1 right down to the nozzle, even though it would not have to be.

MR. BOSNAK: So even though the item was not seismic, it is supported seismically. Is that what you're saying?

MR. ANDERSON: The piping is designed to put a minimal load on the nozzles so that there will be no failure at that point. The equipment itself would be very unlikely to fail just by the nature of the kind of equipment that is in that loop.

MR. MOORE: Maybe another way to look at it, although I'm not a piping engineer, to try to answer your original question directly, I feel that the criteria is being met because we're carrying one seismic support beyond the Class I isolation valve. And maybe John can help me or help me find an error. And that, I think, was very adequately pointed out in the slides. Which allows you to quantify, if you will, the loads at the heat exchanger nozzle, but that is not to say that there is a seismic anchor at the heat exchanger-piping interface. Hopefully, I haven't given you that impression.

MR. POSNAK: No, you haven't. I was trying to
find out exactly what you did.

MR. MOORE: But in terms of our category 1
piping criteria, I believe, as shown in the picture, it
is consistent, I believe, with the criteria that you
reviewed, too.

MR. HOCH: Let me help a little bit. What
generally happens, to draw from what Dick and Gary just
said, in order to meet manufacturer's requirements for
nozzle loads, what generally happens is that although
this last seismic restraint may not indeed be an anchor,
may not indeed be a complete anchor, it generally is a
bilateral restraint at least. And as Gary showed you in
most of those pictures, I think in the general case
there is one after the valve and before the heat
exchanger. And that is at least some response.

MR. MOORE: And I think it's very safe to say
that when we do do our review of seismic capability of
these particular heat exchangers, small nozzle loads
transferred from the piping most certainly will be
accounted for.

MR. LE FAVE: You will have to do that to
defend that 200 gpm, I believe. On the surge tank the
minimum for a 1000-gallon level, is that the alarm set
point or is that the automatic makeup set point?

MR. CRAWFORD: That is the alarm set point.

MR. LE FAVE: What is the makeup rate from the automatic system?

MR. CRAWFORD: 250 gpm.

MR. LE FAVE: Both systems are 250?

MR. CRAWFORD: Well, it's a minimum 250.

MR. WERMIEL: You've assumed following a seismic event if I had a failure in the air supply and the normal makeup level control valves fail closed, I have 20 minutes to get out there and open up those bypass valves.

MR. CRAWFORD: Yes.

MR. WERMIEL: Assuming the design basis leak.

MR. CONNELL: Which exceeds the passive failure which is 50 gpm.

MR. LE FAVE: That is what he used there.

MR. FRIEND: Doesn't the 20 minutes start up the low-level alarm?

MR. WERMIEL: Yes. At the 4000 gpm level.

MR. FRIEND: But if you're just talking about losing the level control, you are some place up mid-range of the normal level, so you have more than that even.

MR. WERMIEL: It's possible they could have been operating for a while near the level alarm point.

MR. MOORE: We have not taken credit for that. I think Howard is probably referencing the actual situation, but the design basis doesn't take that.

MR. LE FAVE: We use the pipe crack criteria size that we have now for ASME SSS 301.

MR. CONNELL: We haven't calculated that number.

MR. LE FAVE: I think right at the discharge header of the pumps. I think that would be much greater than the 200.

MR. MOORE: Daryl, if there is --

MR. EISENHUT: I have one sort of in item 3. You mentioned earlier the post-TMI, post-accident sampling heat exchanger was an area that you're going to continue to look at. And I think in your very opening comments that was an area that you decided that does not meet the FSAR.

MR. MOORE: Yes, sir.

MR. EISENHUT: Can you tell me what the deficiency was?

MR. HOCH: Unfortunately, Daryl, you and Roger stepped out during that part of the presentation.

MR. CONNELL: The FSAR has a statement that says in there no Class I components attached to the Group A and B except for the leak -- and now you have something that is not designated but is design Class I.

We have subsequently gone back and done an analysis of this so as to get an analysis, a computer model of the cooler, and it passes for the seismic loading. The cooler itself, as I think you know, was specifically designed for the nuclear industry in response to 737. However, the industry did not require that that have the full 10 CFR 50 Appendix B quality program, so it doesn't. So that is the slight inconsistency.

MR. EISENHUT: In normal operation it would be valved out?

MR. CONNELL: No. What PG&E did was when the P&ID shows this valved in, and the reason for that, and I think a very good reason, was that because we want the operators to use that during normal operation so that they are familiar with how to operate it should it ever happen in the LILCO situation.

MR. EISENHUT: And the valves on that heat exchanger are remote?

MR. CONNELL: They are local man [illegible]

MR. EISENHUT: Would you have access to them during an event of radiation levels similar to TMI?

MR. CONNELL: On the pump suction side, yes. On the other side we are investigating it right now.

MR. EISENHUT: Those valves are local, though, to sort of the inlet exhaust, the inlet discharge line?

MR. CONNELL: Yes. On one side the answer is yes. On the other side we are looking.

MR. BUCKLEY: Is that because they're located so far away on another elevation?

MR. CONNELL: What gentleman asked this morning, are there other hot lines in the area, we are looking at that.

MR. BUCKLEY: But you had two valves upstream of the sampler, right, coming off into the suction side of the RHR pump, and presumably the sampler is in a location a fair distance from the 12-inch suction line.

MR. CONNELL: Yes. The sampler itself is.

MR. BUCKLEY: So that would be the reason why it wouldn't be so hot.

MR. CONNELL: Yes.

MR. EISENHUT: How far away are the valves from the actual sampling heat exchanger?

MR. CONNELL: Somewhere 30, 40 feet.

MR. EISENHUT: And you have a shielding between the valve and the heat exchanger then?

MR. CONNELL: The sample cooler is on one side of the wall, and the shielded sample station is on the other side of the wall.

MR. EISENHUT: So you have adequate shielding?

MR. CONNELL: To take a sample, yes, but taking a sample that has been checked, of course, and you do have adequate shielding.

MR. EISENHUT: One other question, which I apologize again might have been asked this morning. When you put in the post-TMI sampling heat exchanger why did the system break down? I mean was this just an oversight that you put it on inconsistent with the FSAR?

MR. CONNELL: I guess I wasn't there, so I don't know firsthand; but as near as I can tell, it was a balancing of whether the system is -- it was a balancing of wanting to make sure that the operators knew how to do it, which I think is another thing that was discussed in relation to 737.

MR. ANDERSON: When it was first put on a vital header it was assumed that the valves would be closed during normal operation, and then this decision came about later that said why leave those valves closed; why don't we use that sample cooler during normal operation. So that is how it happened. It was kind of an evolving thing, and if the valves are left closed during normal operation, then it would meet the requirements of the FSAR even though it is not described. With the valves opened and on that loop, we feel technically it doesn't meet the requirements; however, it certainly isn't any kind of significant problem or safety issue.

MR. MOORE: To answer your question directly, how I can postulate it happening, when the design request, change request came through for the schematic to be changed to show the valves open, it was not appreciated, the impact of that. If you want to label that, I guess that could be labeled as a minor loss of design control is what I would classify it. And I think it is only a loss of design control at this point in time with the fact that we cannot retrofit, if you will, the quality assurance portion of the sample. I think we have demonstrated, at least seismically, that there is not an issue.

MR. EISENHUT: Okay. Don't take our passing on to say we've asked the questions we're going to. I think we will continue to be looking into that area, but why don't we go on to item 4.

MR. MOORE: I will take item 4A. Just for those who don't have a copy of the question, I will read the question and then I will give you the response.

The question has several parts. I will only address part A, and then other members of this panel will address parts B, C and D.

Regarding the interfacing of seismic and nonseismic portions of systems, such as on the component cooling water system, and the operating capability of the seismic portions of systems, what design approach wherein (both piping and both INC) was used throughout the plant, for example, when applied to part A, emergency diesel generator intake/exhaust piping silencers and filters.

I will answer your question regarding the design approach used for interfacing seismic and nonseismic portions of the emergency diesel generator system by outlining the approach uses.

Originally, the diesel generator exhaust and inlet piping was classified as design Class II. However, the supporting system for this piping was designed to design Class I criteria. The exhaust silencers were treated in a similar manner, and its design included failures which would result in significant flow blockage. The air inlet filter and silencer were procured as design Class I. What I have just read is information that is currently in our FSAR, PG&E's FSAR.

The design of the exhaust system was changed in 1974 to accommodate the operating department's request to reroute the piping through the turbine building roof. The original design requirements were maintained for this design change. As part of the phase 1 internal technical program the diesel generator system components were checked to ensure the adequacy of the seismic qualification.

The documentation was assessed to be inadequate to fully support their seismic qualifications. Therefore, on September 28, 1982 the project initiated analyses to objectively demonstrate the seismic adequacy of the inlet and outlet piping support systems. In addition, on January 1, 1983 the project confirmed reanalysis responsibility of the design Class I components in the system.

To date, the piping portions, the piping support portions of the system have been reanalyzed to the latest Hosgri spectra and modification to the support spectrum will be issued to the field shortly.

The design Class I portions of the system will be qualified on a schedule consistent with the precept licensing commitments.

MR. EISENHUT: Let me understand what that means. For, for example, a Hosgri event, today you would not conclude that the intake exhaust piping -- you wouldn't conclude that you have confidence that it would withstand the event and that you are re-evaluating it to ensure that it either does or make modifications in accordance with the ongoing verification program.

MR. MOORE: I think that we believe -- well, let me put it this way. Today we don't know. We feel that the documentation is inadequate and therefore are revisiting the Sequoyah system for that piping to assure that it is seismically adequate.

MR. EISENHUT: But have you proceeded far enough to the point where you have determined that modifications will be required?

MR. MOORE: Yes, I'm sorry. Those analyses are complete with regard to the piping support systems, and there are modifications required as a result of those analyses and are being presently issued to the field.

MR. SCHIERLING: Was that issue raised in any of the semi-monthly reports?

MR. MOORE: No, sir. This came out as part of the normal activity of the piping program. And I don't know if it has been identified in the phase one results of not. I would expect to see it identified in the phase one final report.

MR. FRIEND: It is a timing problem, Hans. It may not have been yet, but all of the modifications as a result will be in our report.

MR. MOORE: Let me clear up maybe a misconception here. We don't know what is causing the changes, because there are current spectra that is different on the job than the original spectra that were used to qualify this. And I do not know whether that is causing the modification or something else is causing the modification.

MR. EISENHUT: But in any event, you have determined there will be modifications. And can I get one other feeling, as to when it was decided that those modifications would have to be made? I mean, it wasn't in the last two weeks, right?

MR. MOORE: Well, let me put it this way. The reanalysis was requested in the end of September of last year. Now, when the analyses were completed that told you you had to do modifications, I don't know.

MR. EISENHUT: That's fine. My real question was the question about the reanalysis.

Now, any other questions on that item?

(No response.)

MR. EISENHUT: Why don't we go to the next item.

MR. MOORE: I will have Ed respond to B. Could you read the question?

MR. CONNELL: Yes. As I understand the question, it is, what is the seismic-nonseismic interface criteria for the lube oil system or the lube oil filter of the safety injection system.

There is no interface.

MR. EISENHUT: Let me help you. I wrote the question, that question, so maybe it is my ignorance.

The safety injection pumps often come from a manufacturer. Sometimes they may come from Westinghouse or they may come from someone else. They may come with a lube oil filter system physically attached on some arrangement or they may leave the lube oil system to the AE, in this case the utility.

My real question is, it is really not the seismic versus nonseismic interface; it is an interface of a seismic design safety injection pump and a seismic design lube oil filter system that come from two different sources.

MR. CONNELL: Okay. Let me talk about how the two different sources meshed up on this. On the Pacific Pumps, through Westinghouse you had a lube oil system on them. They did and still do. They were not delivered with a filter in the lube oil system. PG&E subsequently added a filter from Pacific Pumps.

The pumps and the lube oil system were seismically qualified by Westinghouse. When PG&E put the filter in the lube oil system, they went back and checked the seismic adequacy of their installation.

MR. EISENHUT: Who is "they"?

MR. CONNELL: PG&E. The way they did that was a piping engineer did it by inspecting the design. If the filter weighs less than 20 pounds, there was essentially no nozzle loads because it is tubing, and you look at the support details. And that is the way it stood until September of '82, when as part of the phase one program we went back and reanalyzed, or reexamined rather, all of the seismic qualifications, and when we did that we decided to do an analysis to back up the piping engineer's judgment.

My understanding today is that the analysis has been complete, but it has not yet received the final checking. As of today that analysis confirms the original piping engineer's judgment of that about seismically qualified.

MR. EISENHUT: Let me ask another ignorance question. When it was done sort of by judgment from a piping engineer, was that documented originally in any form?

MR. CONNELL: We have a couple of documents on that. The first is it was, the filter was put in by NPO Nuclear Power Operations. They initiated the DCN, the design change notice. It came to San Francisco and they had a note on there that, engineering to confirm the seismic adequacy of the details And that is when it went to the piping engineer, and it is my understanding that he documented this in two ways: one by signing a DCN or initialing; and two, I believe that he wrote a memo to the file or some such thing saying, this DCN is okay.

MR. BOSNAK: Are there any other units where you add tubing?

MR. CONNELL: On Westinghouse equipment, that is the only piece that I know of. I mean, that is the only piece of mechanical equipment where we added a component.

MR. BOSNAK: Sometimes things are added in the field.

MR. CONNELL: Yes. This was added.

MR. BOSNAK: And the supports for the tubing are oftentimes overlooked as to the amount of supports they might need for seismic input.

MR. CONNELL: My understanding on the supports is this, that NPO did this for Unit 1, Construction did it for Unit 2 or is doing it for Unit 2, and they've gotten together and compared notes on the tubing supports. And I think that eventually the two units are going to look the same on the tube supports.

MR. BOSNAK: So all of the tubing that might have been added on at a later time has been taken care of with regard to supports?

MR. CONNELL: Well, I know for sure with regard to this pump it has been, yes.

MR. EISENHUT: His question was the tubing.

MR. CONNELL: I'm talking about the support for the tubing, yes. Each unit started out with a little bit different tubing support design after the modification and they are comparing notes on it. So it has certainly been considered, yes.

MR. EISENHUT: Well, I recognize the filters are a small physical component. It happens to be a pretty critical component.

MR. CONNELL: It is similar to a filter that was on the charging pump, which came from Westinghouse with a filter on it.

MR. EISENHUT: Go ahead.

MR. MOORE: Okay. I will ask Tom Crawford to read and answer parts C and D to question 4.

MR. CRAWFORD: Part 4 asked: What is the interface between seismic and nonseismic on the reactor protection circuitry? In the seismic qualified class, that means it meets 279. All isolation between Class 1E and non-Class 1E equipment is by IEEE qualified isolators.

It's all redundant as necessary, it's all seismically qualified as necessary. Anything that is not electrically isolated by an isolator, it is treated as an associated circuit. The associated circuits are treated as Class 1E circuits.

MR. EISENHUT: So all signals to the reactor protection circuit come from Class 1E seismic 1, 1A?

MR. CRAWFORD: Not true. That wasn't the question you asked the first time.

MR. EISENHUT: I know. I was just trying to make sure I asked the right question.

(Laughter.)

MR. CRAWFORD: We have specifically -- and the NRC is aware of this, because the NRC asked the question to everyone, the same question, and everyone knows that certain radiation monitors on the inputs to the solid state protection system are not Class 1E. They are wired as 1E and treated as 1E, but the devices themselves are not qualified as Class 1E components.

There is a relatively long explanation, but this is well documented in the file.

MR. EISENHUT: And my question is really except for that item.

MR. CRAWFORD: None others. There are inputs from the turbine, that is all Class 1E equipment. The first stage pressure transmitters are all Class 1E.

MR. LeFAVE: The same from the feed pumps to the feed pump input, loss of feedwater?

MR. CRAWFORD: I would have to look at that. The only one that we know of that is not a Class 1E component is the radiation monitor. That is Class 1E components, treated as Class 1E components.

Now, if the question you're asking is do they -- in other words, a trip signal is not a safety requirement. In other words, it's not part of an accident analysis and it may not have the three out of four logic in it, but it is a Class 1E component.

MR. MOORE: Okay. 4D.

MR. CRAWFORD: Again, 4D is just the seismic-nonseismic interface for instrument controls needed by the operator to respond to DBE's. Okay, basically what we have at this time, all of the Class 1E equipment is as I described in the answer to the last question.

The only place where we have this -- at this very minute aren't totally in compliance with everything, right now the equipment that is type D or the stuff that is under Reg Guide 1.97 doesn't always have the isolators between the indicators on the board and the computer in the plant. Okay, so that they will

-- I mean, everything will met Reg Guide 1.97 on the schedule we're committing to and all of that, but right at this very minute I can't honestly say that the indicators are isolated from the computer.

But the circuitry, all of the circuitry is Class 1E and is wired as 1E, and actually we have done analyses that show there is no failure in the computer circuit. In other words, it is a floating resistor such that a short circuit on the computer side would have no affect on the function of the indicator.

MR. EISENHUT: All right. Let's see, there was an item 5 and I think we probably discussed this before.

MR. MOORE: I believe we have.

MR. EISENHUT: All right, back to your agenda.

MR. ANDERSON: Well, I guess we just have one more item. That is the future action.

AGENDA ITEM 8. FUTURE PROJECT ACTION

MR. ANDERSON: I hope we have been able to demonstrate by what we have said in this meeting that we do meet the licensing commitments for the Diablo Canyon project as far as the component cooling water system goes. And as I say, we have mentioned several times we will be looking further at certain issues.

One issue is this 200 gpm leak design basis that was stated in the FSAR, and we will be confirming the judgment that went into that commitment. And we also will be looking at heat loads beyond the bases given in the FSAR, particularly looking at temperature conditions in the component cooling water system for other conditions of operation, several of which or most of which have been discussed in our meeting today.

And beyond that, I think we will just be answering any questions that come up from the NRC. We hope that this has put any of your concerns to rest and we will be expecting to hear any further questions that you might have on this.

MR. EISENHUT: Well, let's see. When you originally started today you said the TRG still had a couple of issues before it.

MR. ANDERSON: That's correct.

MR. EISENHUT: One was the heat load and one was the surge tank, as I recall.

MR. ANDERSON: One was the classification of the level switch on the surge tank. Now, that issue will be submitted to the higher level review group within the PG&E organization and the project does not plan any further action on that. We plan to just give them the information and they will make their decision based upon that information or gather any further information that they feel necessary. So that really was not included in the project.

MR. EISENHUT: I guess my question then is, what is the vehicle and how will we see that these are resolved? I mean, this issue, you have a couple of issues for the project you mentioned. There's another one.

How does this get closed out and how will we see it?

MR. MOORE: Well, with regard, obviously, I think the only public way that I would see it being closed is you would see us close our open item 34 with regard to this subject. If we found other concerns you would see that being reflected in possibly another open item being identified.

But in terms of what the NRC would see, I think you would have to come in and visit our offices and audit our quality assurance records to see how the problem is being disposed. I think that is accurate.

MR. EISENHUT: And let's see. Well, I guess it is easier to say at some point we would be asking you to think how you could document, as far as we are having this meeting, with a few open issues or a few issues where you've stated that you're going to be following up. I think certainly we will be asking a way to close them out on the project. So that will certainly be one issue we want.

Do you have a schedule for when you're going to hope to wrap up either the issues that came out of the TRG which are now going to management review -- is there any kind of indication of when those will be resolved?

MR. MOORE: I've committed to management to try to have this issue closed by three weeks to a month. The only thing that makes me kind of want to throw a caveat in, if you will, is that I have not to date sat down with the people doing the thermal analysis and scoped what further situations we're going to look at and how long that will actually take.

MR. EISENHUT: So on the order of a month, let's say?

MR. MOORE: That is what our goal is.

MR. EISENHUT: And the other question is on the reevaluation of the 200 gpm that the project is undertaking; the same kind of time?

MR. MOORE: Yes.

MR. EISENHUT: Let's see. Jesse, do you have any other questions?

MR. CREWS: No.

MR. HOCH: Darrell, I do know that as of Wednesday the management level review group that we've been talking about was being formed, was being put together.

MR. MOORE: I believe the nonconformances were written, the new nonconformances were written and directed to that group on Monday of this week.

MR. EISENHUT: Let's see. Any other comments from the Staff?

(No response.)

MR. EISENHUT: If not, let's see, Mr. Cooper is over there in the corner. Any comments, Bill?

MR. COOPER: No, we don't have any comments.

MR. EISENHUT: Mr. Goldenberg is here. Do you have any comments?

MR. GOLDENBERG: I don't have any comments myself. If Joel intends to provide comments he will do it in writing.

MR. EISENHUT: Certainly if he has any comments feel free to send me any.

MR. MANEATIS: I can't say any more than I hope that we have provided you the response that you were looking for, the details on the component cooling water system, and hopefully we have given you another perspective from which to judge some of the concerns raised on this system.

MR. EISENHUT: Okay. You certainly have. And the only other comment that I have is, we gave you a charge at our meeting in January a couple of weeks ago. I want to personally commend you. I think you all have really put together an effort to go through the component cooling water system, looking at all of the design aspects.

I will tell you, I intended to make the questions as broad as I know how to make the questions. And I will tell you that we tried to make the detailed agenda which we sent out to you earlier this week cover as broad an array of questions to really focus on the issues. And we think you certainly presented some very valuable information.

We will be taking a hard look at it and the Staff will be getting together and sort of seeing where we go from here. But at least for my own personal self, I want to tell you, you've made a very fine presentation. I really appreciate your getting everything together in short order and it was very valuable.

And we want to thank you all for coming back here, and we will be back in touch very shortly on how we want to proceed, if any, and what form that will take to close out these issues. So again, thank you very much and thanks, everyone.

(Whereupon, at 2:55 p.m., the meeting was adjourned.)

* * *

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

NRC Staff with Pacific Gas & Electric Company

in the matter of: COMPONENT COLLING WATER SYSTEM DIABLO CANYON UNIT 1

Date of Proceeding: Bethesda, Maryland

Docket Number:

Place of Proceeding: January 28, 1983

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

Ray Heer

Official Reporter (Typed)

Ray Heer

Official Reporter (Signature)

Diablo Canyon Unit 1

Component Cooling Water System
Phillips Building - Room P-118
Bethesda, Maryland
January 28, 1983

DESCRIPTION OF THE
COMPONENT COOLING WATER SYSTEM

Presented By
E.C. Connell

I would like first to present to you a general description of the DCPP Component Cooling Water (CCW) System and discuss its arrangement, basic components, operating modes, performance requirements, and interfaces with supporting systems.

I will then discuss in detail the principal design considerations for the system.

I. GENERAL DESCRIPTION

(Slide A-1)

A. Purpose

The CCW system is designed to remove waste heat from the primary plant equipment and components during normal plant operation, plant cooldown, and following a loss of coolant accident. The components and equipment served are either engineered safety features or have a potential for leakage of radioactive fluid into the CCW System. The CCW System serves as an intermediate system between the normally radioactive systems and the Auxiliary Saltwater System. This double barrier design reduces the possibility of potentially radioactive coolant from leaking to the ocean through the Auxiliary Saltwater System. Component cooling water flows through components in parallel circuits absorbing heat which is rejected to the Auxiliary Saltwater System via the component cooling water heat exchangers. The ASW system rejects heat to the ultimate heat sink, the Pacific Ocean.

(Slide A-2)

B. System General

1. Overall Arrangement

The CCW System consists of three component cooling water pumps, two component cooling water heat exchangers, a component cooling water surge tank which is internally divided so that in effect it is two tanks, two Chemical Addition Tanks (CATs), valves, and piping. The piping system consists of three parallel loops of two separable redundant vital service loops "A" and "B" and a miscellaneous service loop "C" which serves nonvital equipment. By "vital" it is meant "required to perform a safety function." Except for the components on the "C" loop, the chemical addition tanks and the post-LOCA sample cooler, the CCW system, including all piping and valves, is a Design Class I system. Design Class I means the design, fabrication and construction is in accordance with the requirements of 10 CFR 50 Appendix B and meets the intent of the NRC requirements for safety-related systems.

2. Isolation Capabilities

All users whether vital or non-vital are capable of being individually isolated by Design Class I valves. In general, components inside containment can be isolated from the control room. Other components are isolated by local manual valves.

Each of the three loops can also be isolated using only Design Class I valves. For example, if one wanted to isolate loop C, valve FCV-355 would be closed from the control room and local manual valves on the suction piping to the pumps would be closed. These valves are located in the pump rooms which are accessable at all times.

(Slide B-1)

3. Basic Components

   a. CCW Pumps

      3, Design Class I, horizontal, centrifugal

      Rated capacity 9,200 gpm

      Carbon Steel

      Located in AB

      Each on different 4 KV vital bus

   b. CCW HX

      2, Design Class I, shell-tube

      ASW in tube

      258.8×10^6 BTU/hr - Manufacturer's rating

      Located in TB

      Shell carbon steel, tubes 90-10 CuNi

   c. CATs

      2, one each loop

      Carbon steel

      Manually valved out

      Corrosion inhibitor

d. CCW Surge Tank

1, split internally so each side feeds one vital loop

Design Class I

Volume 10,750 gal.

4,000 gal. minimum during normal operation

Carbon steel

Relief valve to AB sump

e. Valves and Piping

Design Class I

Valves carbon steel - bronze or SS trim

Piping - carbon steel, welded joints, flanged connections to equipment

(Slide B-2)

4. Users

a. Vital Headers

RHR HX

RHR PP Seal Water Cooler

SI PP L.O. & Seal Water Coolers

Containment Fan Coolers

Only inside containment components

3 on B, 2 on A

CCW pump coolers

Post-LOCA sample cooler on A

(Slide B-3)

b. Non-Vital Header

None of the components on this header, the C loop, are required to operate for the CCW system to perform its safety function.

(1) Inside Containment

RCP

Thermal Barrier

Bearing Oil Cooler

Reactor Vessel Support Coolers

Excess Letdown HX

(2) Outside Containment

Waste gas compressor seal water cooler

Sample Panel coolers

PD Charging PP Oil Coolers

Gross Failed Fuel HX

Boric Acid evaporator coolers

Waste concentrator package coolers

Seal Water HX

Letdown HX

Spent Fuel Pit HX

SG Blowdown Sample Coolers

(Slide A-3)

5. Layout

Surge tank on AB roof. CCW HX in TB. CCW PP in AB.

(Slide A-4)

6. Operating Modes

   a. Normal Operation

      2 pumps

      1 HX

      All loops

(Slide A-5)

   b. Plant Cooldown

      All loops

      3 pumps

      2 HXs

      RHR HXs are cut in

      If 1 pump or 1 HX is not available, orderly shutdown is not affected, just takes longer

(Slide A-6)

   c. LOCA

      (1) Short Term

         3 pumps start on S signal

         Any One HX

(Slide A-7)

         Loop C isolated on P signal

(Slide A-8)

      (2) Long Term

         Manual valve system into 2 separate subsystems.

         Capability to valve out loop C or valve it into one of the two separated, isolated redundant vital loops.

C. Support Systems

1. ASW

Picks up heat from CCW HX and rejects heat to the Pacific Ocean.

(Slide A-9)

(Slide B-4)

2. MU

Makeup water is supplied to the Component Cooling Water System through two redundant makeup valves feeding into the two redundant component cooling water surge lines. These air-actuated level control valves open automatically in the event of low level in the component cooling water surge tank, indicating that system makeup is required. They close automatically when the normal operating level in the surge tank is restored.

Makeup water for the CCW System is supplied to the above valves by the Makeup Water System. Makeup water can be provided from various water sources and through various pumps and flow paths in the Makeup Water System.

The makeup water under normal operating conditions is provided automatically on demand from the outlet of the makeup water demineralizers, which receive water from the raw water storage reservoir. The elevation of the reservior provides adequate static head to pressurize the outlet of the demineralizers so makeup is supplied to the Component Cooling Water System without pumping. This makeup source is Design Class II up to the Design Class I check valve.

The Design Class I source for makeup to the CCW System is the Condensate Storage Tank (CST), which contains 425,000 gallons of which a minimum reserve of 170,000 gallons is for auxiliary feed water pump operation, so that 255,000 gallons is available.

The makeup water from the CST is pumped by the fully redundant, Design Class I makeup water transfer pumps. Each pump is energized by a separate vital 480 volt bus. All piping and valves from the CST to the CCW surge lines are Design Class I.

There are many other sources of makeup water available for even further backup. Five of these other sources are described in Section 9.2 of the FSAR. Some are Design Class I, such as a cross connect to the Unit 2 CST, while others are Design Class II.

II PRINCIPAL DESIGN CONSIDERATIONS

I would like to discuss now the major design considerations of the CCW system. In the January 13, 1983 meeting in San Francisco, Darryl Eisenhut stated that you will be comparing the system design against the Standard Review Plan (SRP). It should be kept in mind that Revision 0 to the SRP came out after Diablo Canyon was built and was undergoing hot functional testing. There is of course no requirement in the regulations for a blanket backfit to the SRP. Nonetheless, for your convenience the format of this discussion will follow Revision 1 to NUREG-0800, which is your Standard Review Plan. Each of the topics mentioned by Darryl Eisenhut in the San Francisco meeting is included in the SRP and will be discussed here.

The SRP lists 15 areas of review directly related to CCW design. Notwithstanding, that the system was designed in 1968, 7 years before the first SRP was issued and 13 years before the current revision to the SRP was issued, all 15 of the areas were considered in the design. Naturally, the design philosophy and acceptance criteria used by the designer and by the NRC in their review of the FSAR in 1974 have in some cases changed over the years. Nonetheless, the intent of each review area is met as discussed below.

The NRC has arranged the 15 areas of review into 3 major groups as follows:

(Slide B-5)

a. Provide adequate cooling
   - o Functional performance
   - o Multiple performance functions
   - o Surge tank capability
   - o Provide cooling water
   - o Heat loads

(Slide B-6)

b. Other Systems Aspects
   - o Effects of non-Cat. I Systems on Cat. I systems
   - o Leakage
   - o Testing, ISI
   - o RCP seals
   - o Instrumentation
   - o Reliability analysis

(Slide B-7)

c. Interactions

- o Flood protection
- o Internal missles
- o External missles
- o Pipe breaks

I will now discuss each of the areas of review.

(Slide B-8)

A. Functional Performance

This area assesses the ability to withstand adverse environmental occurences and reviews operability requirements for normal operation and during and subsequent to an accident.

1. Environmental Occurences

Essential electrical components were environmentally qualified fc: peration in the required modes as documented in the FSAR. The qualification program was expanded and updated in response to CLI-80-21 and NUREG-0588. It was reviewed and approved by the NRC in September 1981.

Protection of essential system components from high winds and tornado missiles is described in Chapter 3 of the FSAR.

Electrical and mechanical system components which perform a safety function have previously been seismically qualified.

Because of the new seismic input data currently being generated, the analyses are being reviewed and updated or replaced as appropriate. This fulfills the regulatory requirements.

2. Operability in Normal Operation

There is sufficient redundancy in components so that in normal operation there is always one pump and one HX in standby mode. For cooldown all three pumps are used. However, if one of the pumps or one of the HXs is inoperative, orderly shutdown is not affected, but the time for cooldown is extended.

(Slide A-10)

(Slide B-9)

3. Operation for Accidents

Each of the essential pumps in the CCW system and in the support systems, ASW and MU, are assigned to one of three emergency safeguards buses. The CCW and ASW pumps are automatically started on an "S" signal. The limiting failure would be failure of one bus to energize. In this case there would still remain one MU water transfer pump, 2 CCW pumps and one ASW pump. This meets the requirements for short term post-LOCA operation.

In the long term post-LOCA, the system is manually aligned into two separate loops. The valves used for this alignment are located in the CCW HX and pump rooms, both relatively low radiation areas post-LOCA. Only one loop is required to operate. Thus this system can accomodate a single active or passive failure.

(Slide B-10)

There is a requirement of GDC 44 stated in the SRP that there be "component redundancy so that safety functions can be performed assuming a single active component failure coincident with a loss of off-site power." The system design meets this requirement.

(Slide A-11)

(Slide B-11)

B. Multiple Performance Functions

1. GDC 5

GDC 5 speaks to sharing of system and components between units. There is no required sharing of the CCW system or its support systems except for emergency safeguards diesel F. This is a swing diesel that is assigned to the LOCA unit. As discussed earlier, if this bus fails to energize there is sufficient redundancy to safely shut down the plant.

Although sharing is not required it is part of the design philosophy to provide additional flexibility. With this in mind, the plant has been piped up so that by manually opening valves it is possible to cross connect various systems from the two units. One example is the cross connection for the Condensate Storage Tanks.

2. Normal Operation Users

All of the components that require CCW for normal operation only are located on the "C" headers. None of these components is required to shut down the plant.

3. Radioactivity Control

The double barrier design of the CCW reduces the probability of radioactive water escaping to the environment.

Leaks of radioactive water into the CCW system are detected by radiation monitors located in the two component cooling water pump discharge headers.

Any leaky component can be isolated by Design Class I valves.

(Slide B-12)

C. Surge Tank Capability

The CCW surge tank is internally divided thus providing an entirely independent surge volume with supporting instrumentation feeding one of the redundant vital CCW headers. This meets the SRP requirement that in the event of a header rupture, the loss of the entire contents of the surge tank will not occur.

The many makeup sources to the surge tank, including the safety related path from the CST, were described earlier.

(Slide B-13)

D. Provide Cooling Water

As I discussed earlier, because of the use of redundant Design Class I components backed by emergency power supplies and considering the capability of isolating the system into independent trains, an adequate supply of cooling water is assured for all operating conditions.

(Slide A-12)

(Slide B-14)

E. Heat Loads

1. Normal Operation

During normal operation the heat load is approximately 72 million BTU/hr. This is well within the capability of one CCW HX.

2. SI but Less Than P

The major heat load assuming an accident is from the fan coolers. All other loads amount to about 40 million BTUs, 39 million of which are on the "C" header. It is difficult to estimate the heat load in containment for the case where the pressure is higher than the setpoint for an S signal and lower than the setpoint for a P signal since this does not correspond to any of the postulated DBAs. If the heat load is assumed to be 50% of that for the limiting postulated accident, the resulting heat load on the system will be about 240 million BTUs. Again, this can be handled by 1 CCW HX.

This assumes all five fan coolers are working. With fewer fan coolers available, the rate of heat rejection to the CCW System will be less.

3. Limiting DBA With Worst Single Failure

For the postulated case of the limiting complete double ended rupture of a pipe inside containment concurrent with a loss of offsite power and the worst single active failure in the plant, the heat load on the CCW is approximately 244 million BTUs. The "worst single active failure" means the active failure that causes the least amount of containment heat removal capability to be available.

(Slide B-15)

This is the failure of bus "G" to energize. This causes the loss of two fan coolers and one containment spray pump. Since valve FCV-355 is powered from bus "H", it will close and isolate the C header given the design basis accident with the worst single active failure.

This is the case that was used for the design basis heat removal capability in response to the requirements of GDC 44.

(Slide B-16)

4. PG&E's design recognized that under different postulated conditions it would be possible to reject more heat than this to one heat exchanger and thus raise the HX outlet temperature above the design valve. For example, if it is assumed that all equipment functions as designed, i.e., both containment spray pumps and all five fan coolers operate, and is if the same design basis temperature time history inside containment is assumed and all the other parameters used in a DBA worst case

analysis are used, e.g., 70°F ocean water, the calculated temperature at the discharge of a single CCW HX approaches 140°F.

This case, while not the design basis case, was calculated by PG&E. The total heat load is approximately 406 million BTU. For this case operator procedures require another CCW HX to be cut in.

5. Let us consider one more case. Assume design basis accident conditions inside containment, all fan coolers and containment spray pumps running, design basis accident worst case analysis parameters and the failure of valve FCV-355 to isolate on the P signal. In this case, the total peak heat rejection rate to the CCW system will not exceed 440 million Btu/hr. The effect of all five fan coolers and both containment spray pumps may result in lower heat rejection to CCW. Thus, failure of the valve to close does not effect significantly the heat input to CCW. The operating procedure for this hypothetical case would be identical to that for the case just described above.

(Slide B-17)

(Slide A-13)

F. Effects of Non-Seismic Category I Components on Seismic Category I Components

The design philosophy employed by Diablo Canyon in meeting the regulatory requirements for seismic/non-seismic interfaces including those given in Regulatory Guide 1.29, will be discussed later by Chuck Aronson.

I just want to talk now about two specific equipment interfaces: those for the Chemical Addition Tank and those for the Sentry post-LOCA sample cooler.

The Chemical Addition Tanks meet all requirements for separation of seismic and non-seismic components. The piping from the vital headers up to and including a normally closed manual isolation is seismic category I.

(Slide A-14)

The post-LOCA sample cooler which was added in 1980 as part of the NUREG-737 changes had a similar arrangement and thus could have met the same separation criteria. However, PG&E believed that it would be valuable to have the operators use the same post-LOCA sample station for normal sampling. In this way they would be sure the operators were familiar with the equipment and be able to safely take hot samples if required post-LOCA. Thus the manual isolation valves are shown open on the current P&ID. With the valves open, the arrangement would still meet requirements if the piping and the small sample cooler were designated as Design Class I. The piping is in fact Design Class I. The cooler, while specifically designed and built for the nuclear industry, did not employ a full 10 CFR 50, Appendix B quality program. The cooler has recently been fully qualified by analysis for all postulated seismic conditions. You will see a few pictures later that demonstrate how "sturdy" this installation really is. Thus it is assured that the cooler will not fail under accident or seismic loading and will not jeopardize the safety function of the CCW system.

(Slide A-15)

(Slide B-18)

G. Leakage

Numerous provisions for detection, collection, isolation, and control of leakage assure compliance with requirements.

Leakage of radioactive fluid into the system would be detected by the radiation monitors in the CCW pump discharge lines. Also, this could be detected by rising surge tank level and an alarm. The tank itself and the components in the system are protected by a relief valve with the discharge routed to the AB sump. The relief valve is sized for the rupture of a reactor coolant pump thermal barrier.

Leakage out of the system is detected by falling surge tank level and alarm. The numerous makeup sources have been described earlier. Mitigation of leakage from a passive failure, which is defined in Section 3.1 of the FSAR as 50 gpm for 30 minutes, is well within the capabilities of the system.

The NRC in FSAR question 9.26 asked for further discussions of the system features which assure a continuous supply of CCW to equipment required for safe shutdown until postulated leaks or ruptures could be isolated. As described earlier, any individual user can be valved out using Desing Class I valves or an entire loop of the system can be valved out. In response to the NRC's question, Table 9.2-8 of the FSAR was amended to discuss a postulated leak or rupture of 200 gpm.

This leakage value is a limiting case. It is derived from a balancing of a number of considerations such as, operation action times, detection capabilities, isolation capabilities, and system makeup provisions. It is a reasonable number for design purposes.

(Slide B-19)

H. Testing and ISI

The active components of the CCW system are accessible for visual observation and maintenance as well as in either continuous or intermittent use during normal plant operation. Thus no additional special provisions are necessary to meet testing and inspection requirements.

(Slide A-16)

(Slide B-20)

I. RCP Seals

NUREG-737, Section II.K.3.25 requires that cooling water be available to the RCP seals given a loss of offsite power or the loss of instrument air. Diablo Canyon meets this requirement. Note that the valves in question on Diablo have motor operators fed from emergency onsite power and the CCW pumps are also fed from emergency onsite power sources.

(Slide B-21)

J. Instrumentation

As Tom Crawford will discuss later, the CCW instrumentation meets the applicable regulations.

(Slide B-22)

K. Reliability Analysis

The Commission's Standard Review Plan today requires a "failure-modes and effects analysis (FMEA) in the SAR --- to ensure that essential portions of the system will function following design basis accidents assuming a concurrent single, active, component failure."

The FMEA in Section 9.2 of the FSAR demonstrates this.

(Slide B-23)

L. Flood Protection

A flooding analysis was done some years ago to assure the system will operate under postulated flooding conditions.

M. Internal Missiles

An analysis is presented in Section 3.4 of the FSAR which demonstrates acceptable protection of safety-related systems from the effects of postulated missiles.

(Slide B-24)

N. External Missiles

The effects on system operation from external missiles is discussed in detail in Section 3.3 of the FSAR. Compliance with the regulatory requirements is demonstrated by location within missile protected structures or by a failure analyses which demonstrates acceptable consequences.

O. Pipe Breaks

An analysis and field walkdown was conducted to demonstrate that the CCW is adequately protected against the effects (i.e., jet impingement and whip) of high energy line breaks. A heavy metal dog house was added in 1977 around the CCW HX to provide a high degree of protection.

This concludes my prepared remarks. Although the Component Cooling Water System at Diablo Canyon was designed and constructed years before NUREG-0800 was issued, each of the 15 broad areas of review was properly considered and implemented in the design.

LIST OF SLIDES USED
IN E.C. CONNELL's PRESENTATION

Slide A1: Purpose

Slide A2: CCW System Basic Arrangement

Slide A3: CCW System Basic Layout (Elevation)

Slide A4: CCW System Normal Operation

Slide A5: CCW System Cooldown

Slide A6: CCW System Safety Injection ("S" Signal)

Slide A7: CCW System Safety Injection ("P" Signal)

Slide A8: CCW System Recirculation Post-LOCA (Without "C" Header)

Slide A9: Major Sources of CCW System Make-Up

Slide A10: Vital Power Sources for Major CCW System (and Related) Users

Slide A11: CCW System Basic Arrangement

Slide A12: CCW System Heat Loads Summary

Slide A13: CCW System Basic Arrangement

Slide A14: Post-LOCA Sample Cooler Basic Arrangement

Slide A15: CCW System Basic Arrangement

Slide A16: CCW System Reactor Coolant Pump Isolation

Slide B1: Components All Class I

Slide B2: CCW System Users: Vital Components

Slide B3: CCW System Users: Non-Vital Components

Slide B4: Make-Up Water

Slide B5: A. Provide Adequate Cooling

Slide B6: B. Other System Aspects

Slide B7: C. Interactions

Slide B8: A. Functional Performance

Slide B9: A. Functional Performance (cont'd)

Slide B10: SRP Requirement for GDC 44

Slide B11: B. Multiple Performance Functions

Slide B12: C. Surge Tank Capability

Slide B13: D. Provide Adequate Cooling Water

Slide B14: E. Heat Loads

Slide B15: Vital Power Sources for Major CCW System (and Related) Users

Slide B16: E. Heat Loads (cont'd)

Slide B17: F. Seismic/Non-Seismic Interface

Slide B18: G. Leakage

Slide B19: H. Testing and ISI

Slide B20: I. RCP Seals

Slide B21: J. Instrumentation

Slide B22: K. Reliability Analysis

Slide B23: L. Flood Protection
M. Internal Missiles

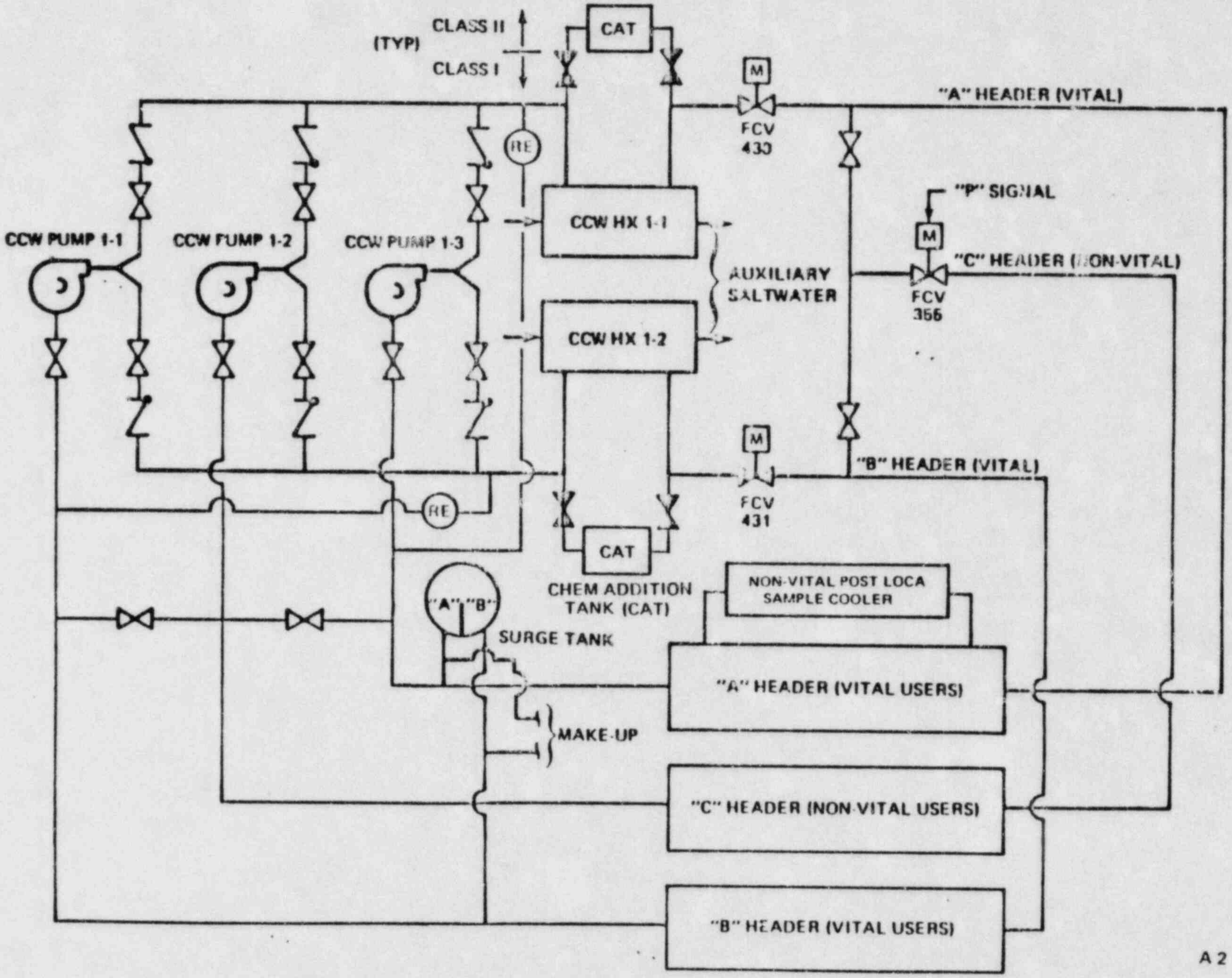
Slide B24: N. External Missiles

Slide B25: O. Pipe Break

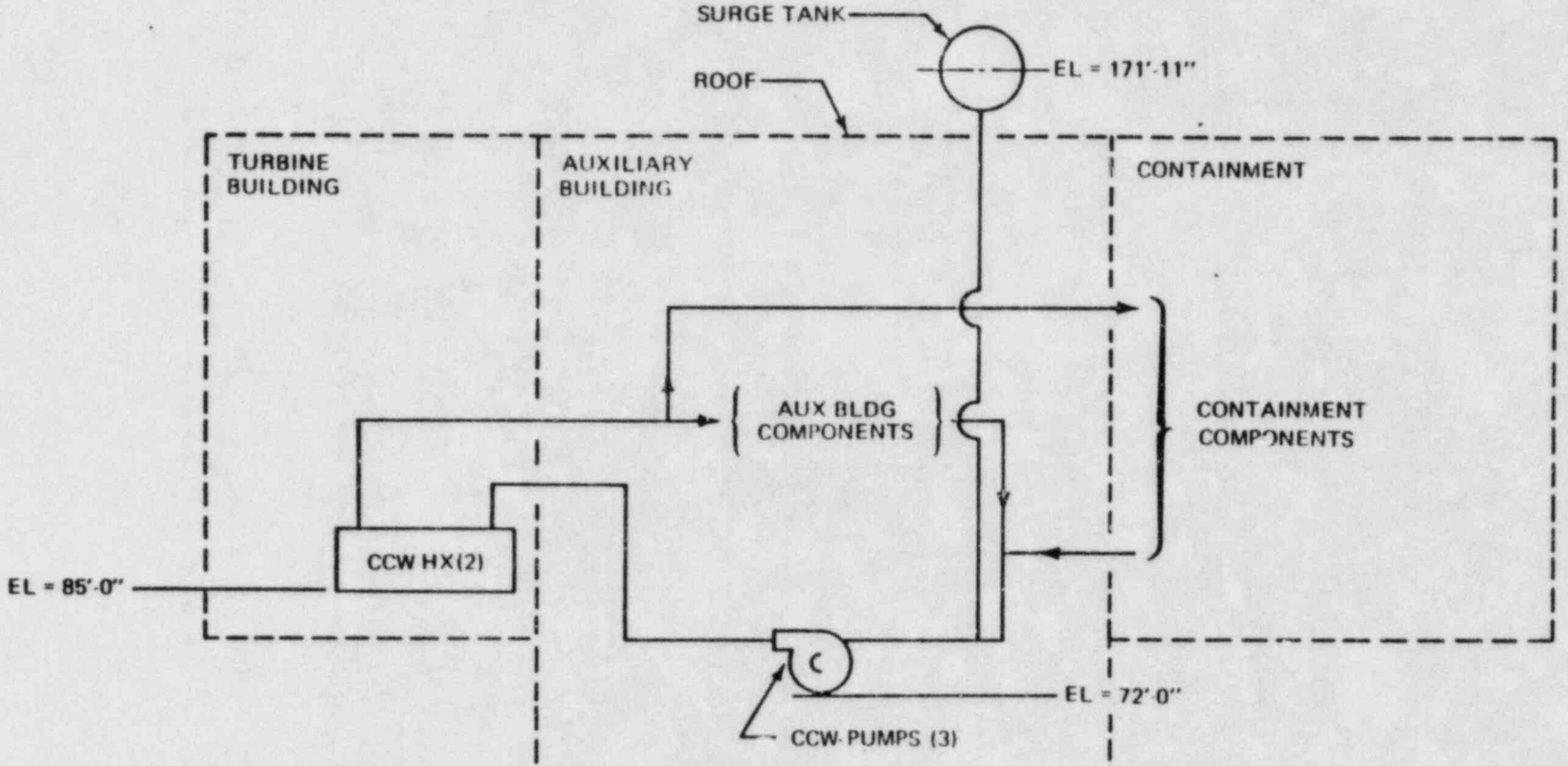
PURPOSE

- REMOVE WASTE HEAT
- ESF OR RADIOACTIVE COMPONENTS
- DOUBLE BARRIER
- REJECT TO ASW

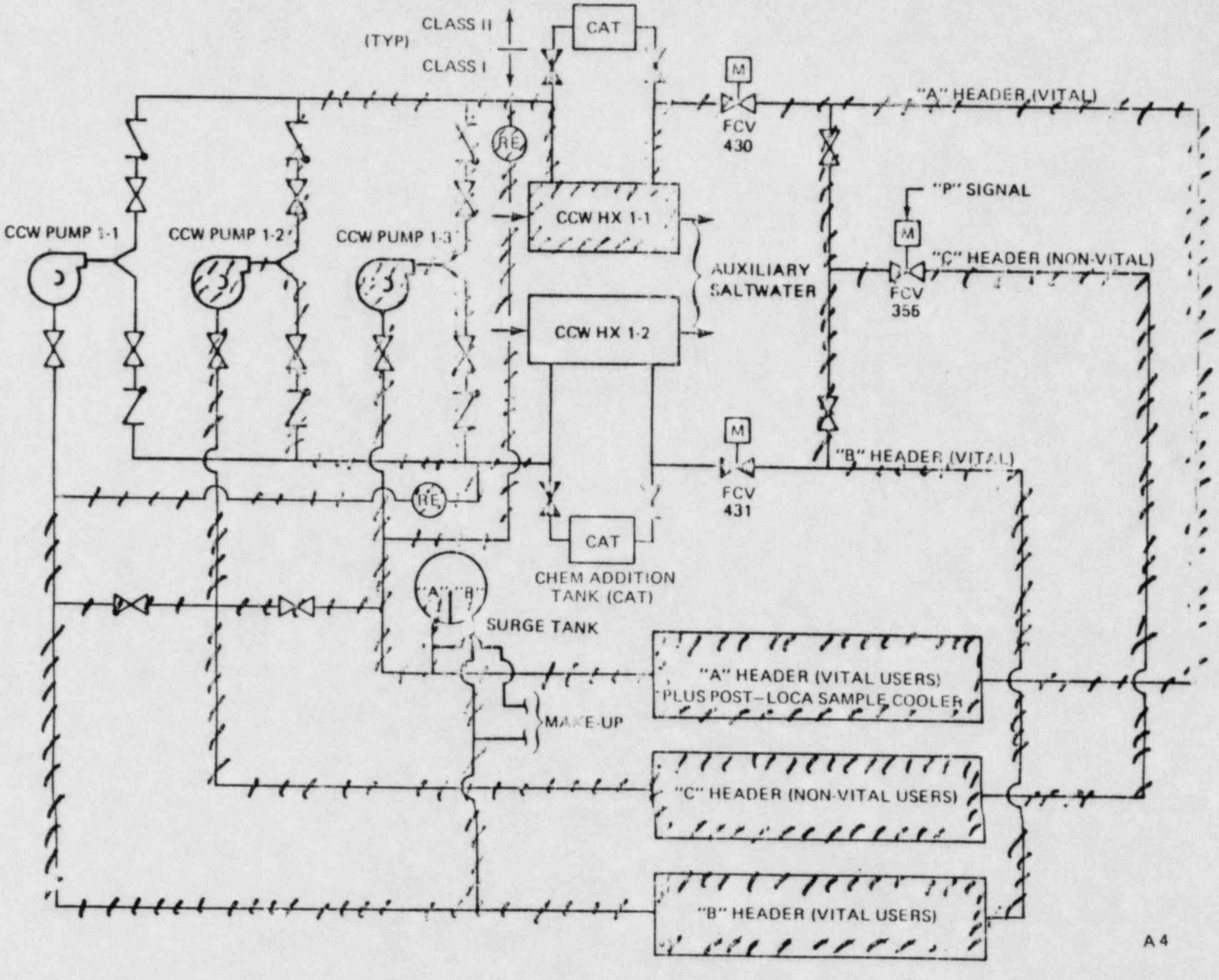
CCW SYSTEM BASIC ARRANGEMENT



CCW SYSTEM BASIC LAYOUT (ELEVATION)

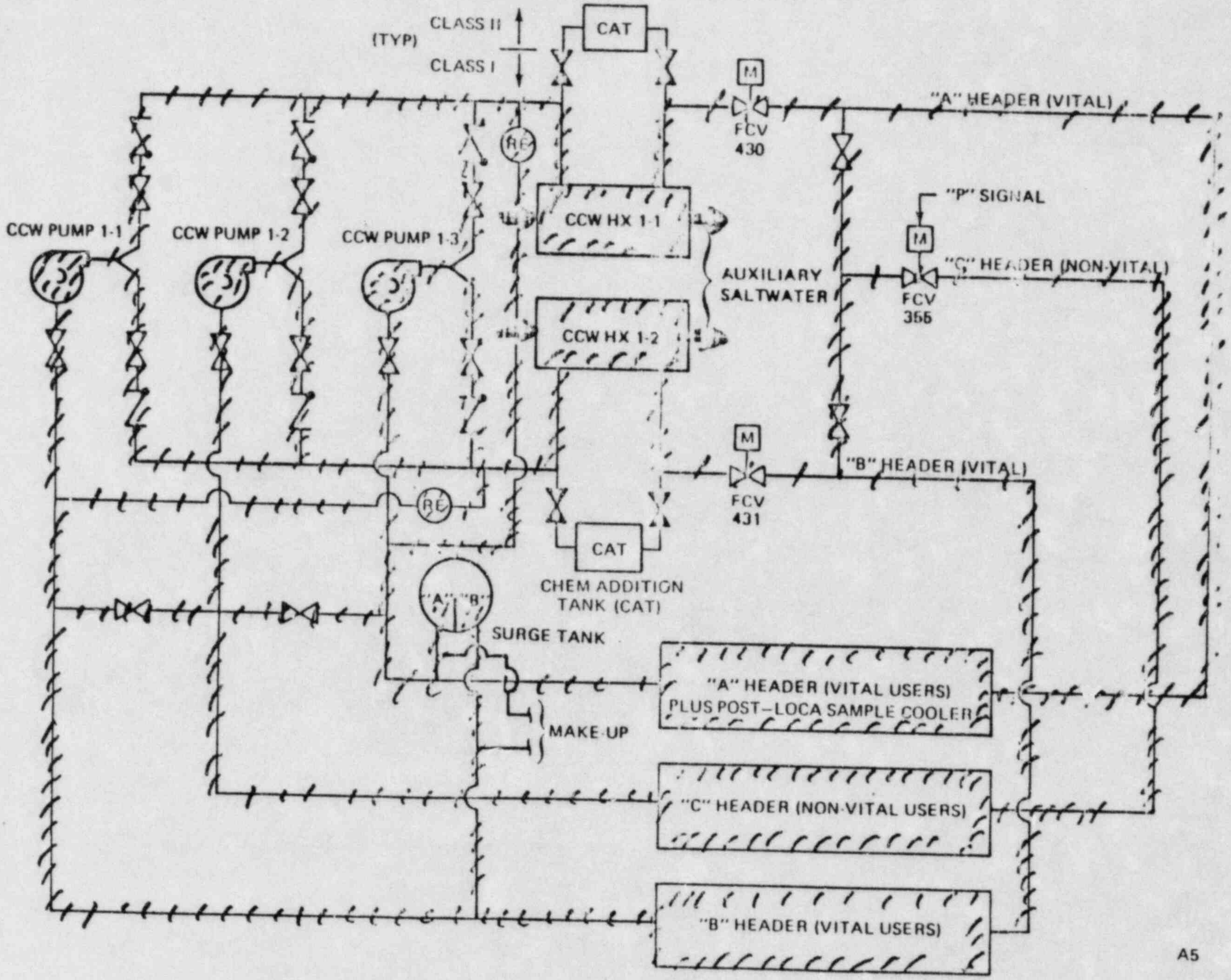


CCW SYSTEM NORMAL OPERATION

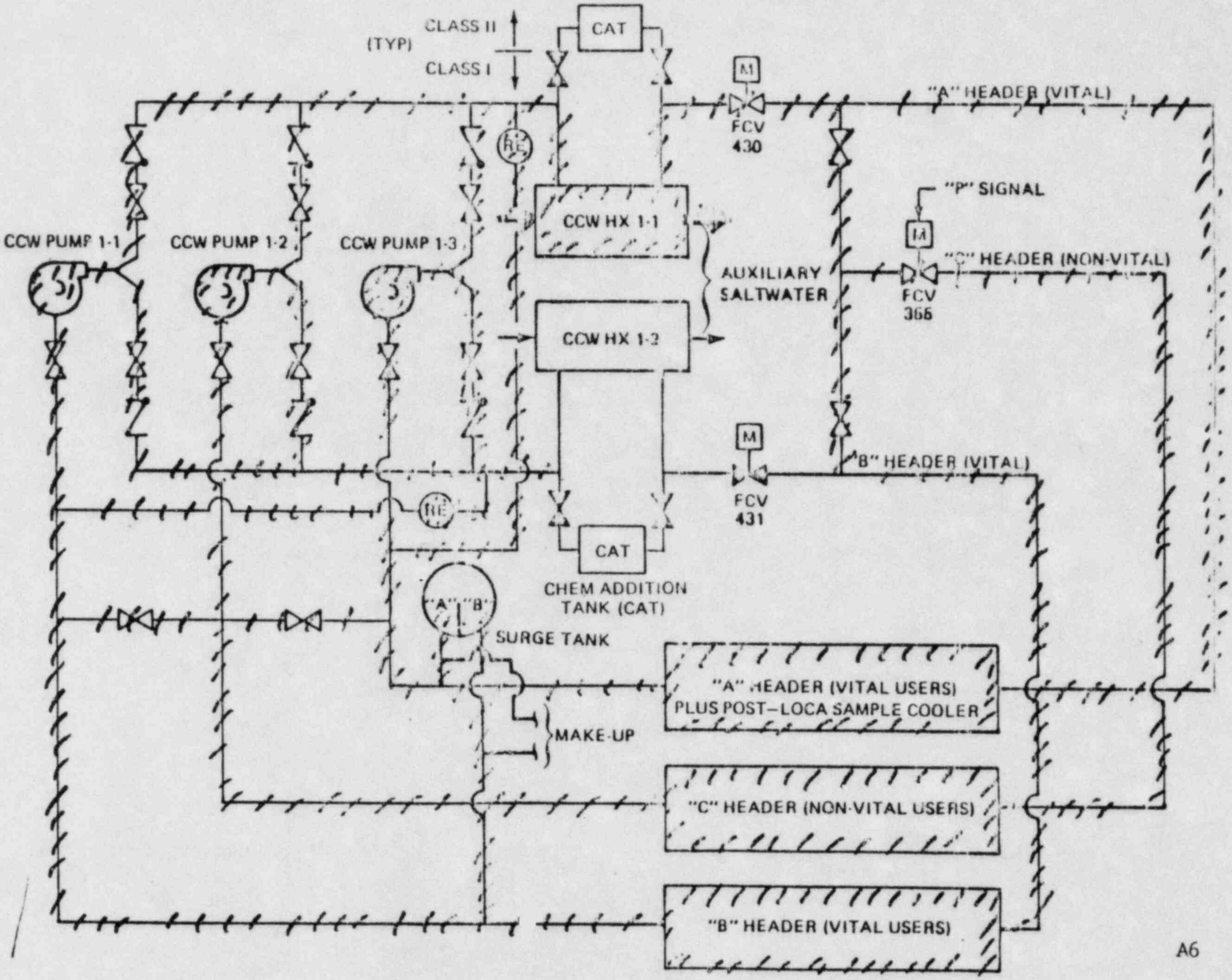


A4

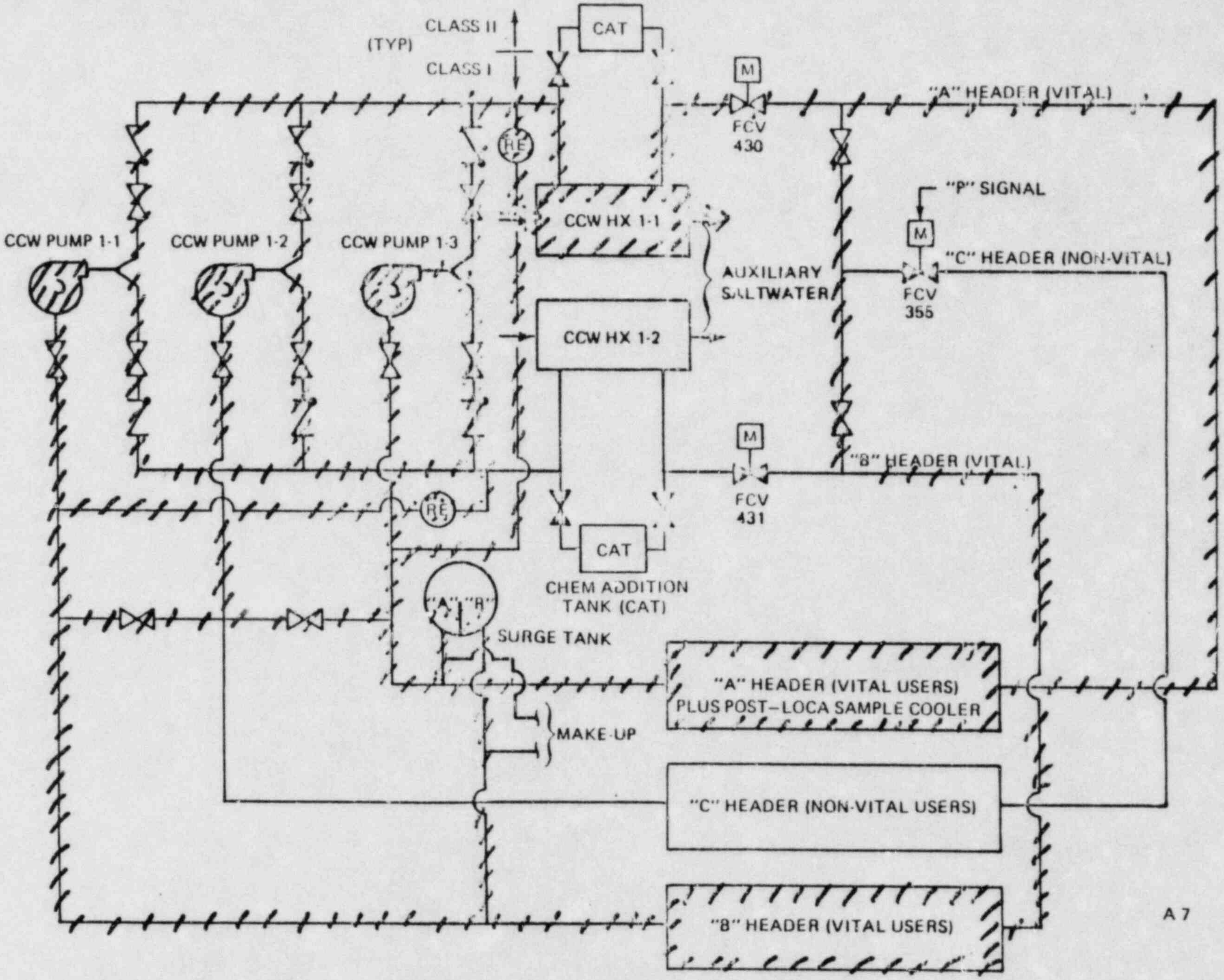
CCW SYSTEM COOLDOWN



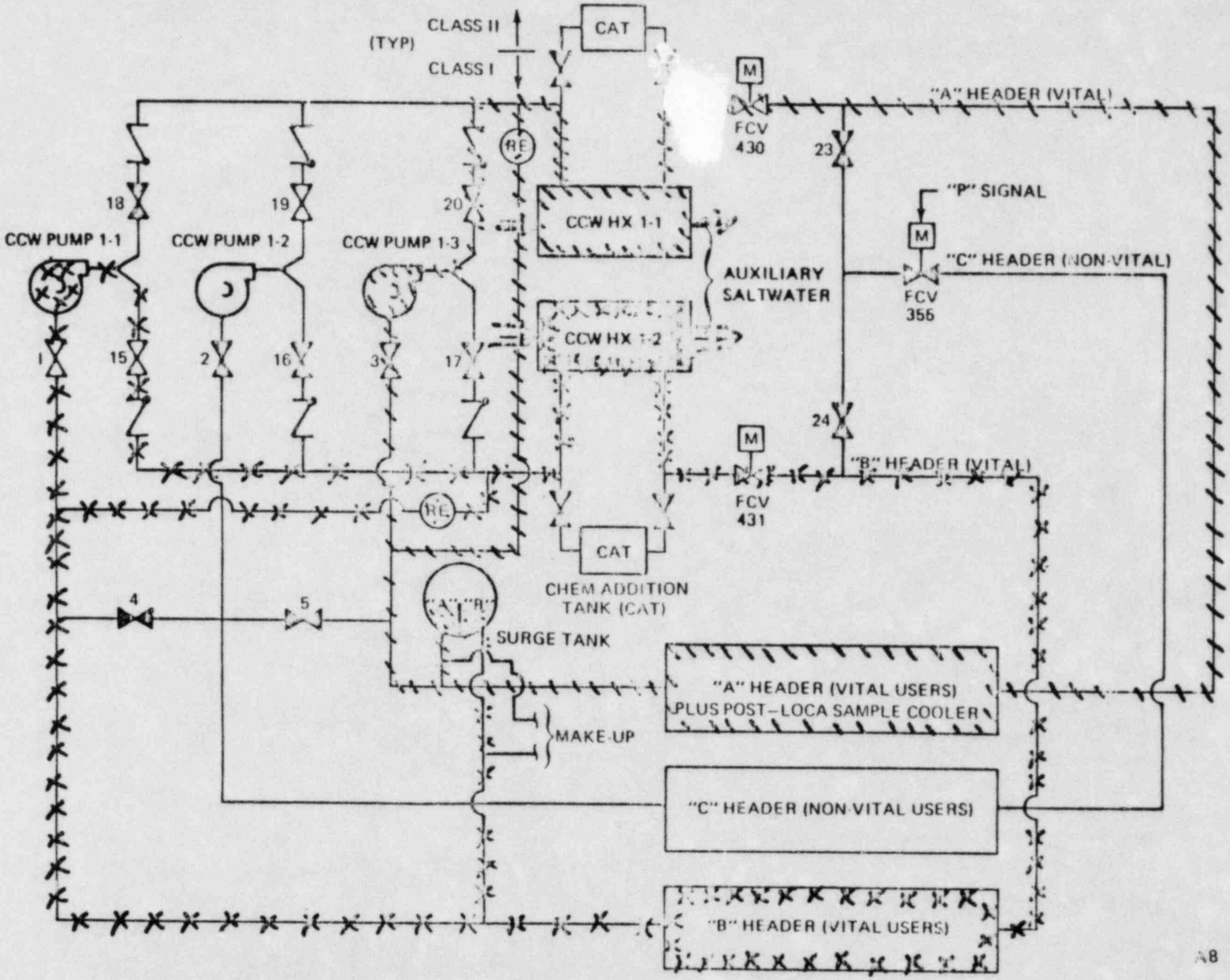
CCW SYSTEM SAFETY INJECTION ("S" SIGNAL)



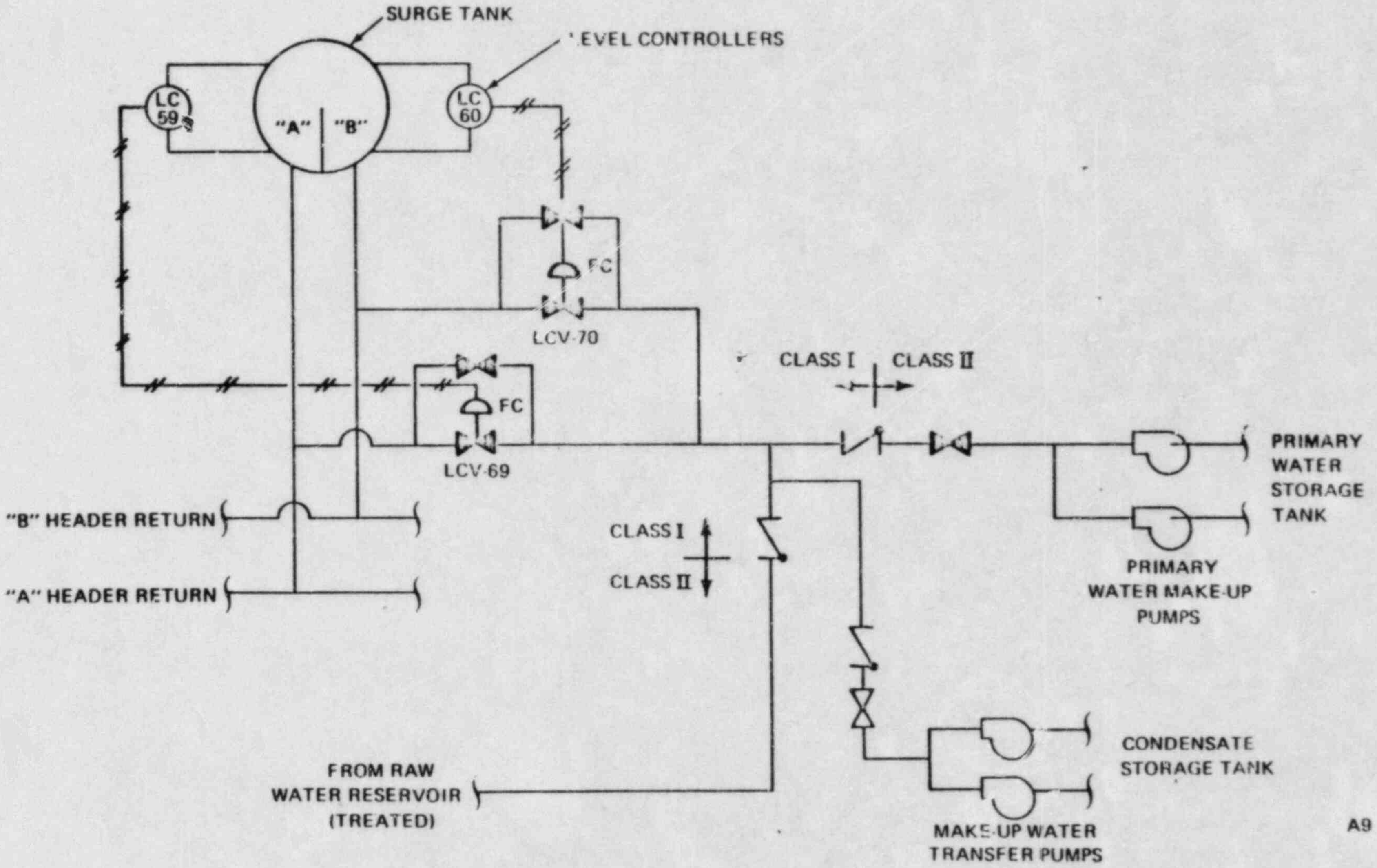
CCW SYSTEM SAFETY INJECTION ("P" SIGNAL)



CCW SYSTEM RECIRCULATION POST-LOCA (WITHOUT "C" HEADER)



MAJOR SOURCES OF CCW SYSTEM MAKE-UP



A9

VITAL POWER SOURCES FOR MAJOR CCW SYSTEM (AND RELATED) USERS

VITAL BUS 1F	VITAL BUS 1G
CONTAINMENT FAN COOLERS (2)	CONTAINMENT FAN COOLERS (2)
CCW PUMP	CCW PUMP
AUXILIARY SALTWATER PUMP	AUXILIARY SALTWATER PUMP
	MAKE-UP WATER TRANSFER PUMP
	CONTAINMENT SPRAY PUMP

VITAL BUS 1H

CONTAINMENT FAN COOLER

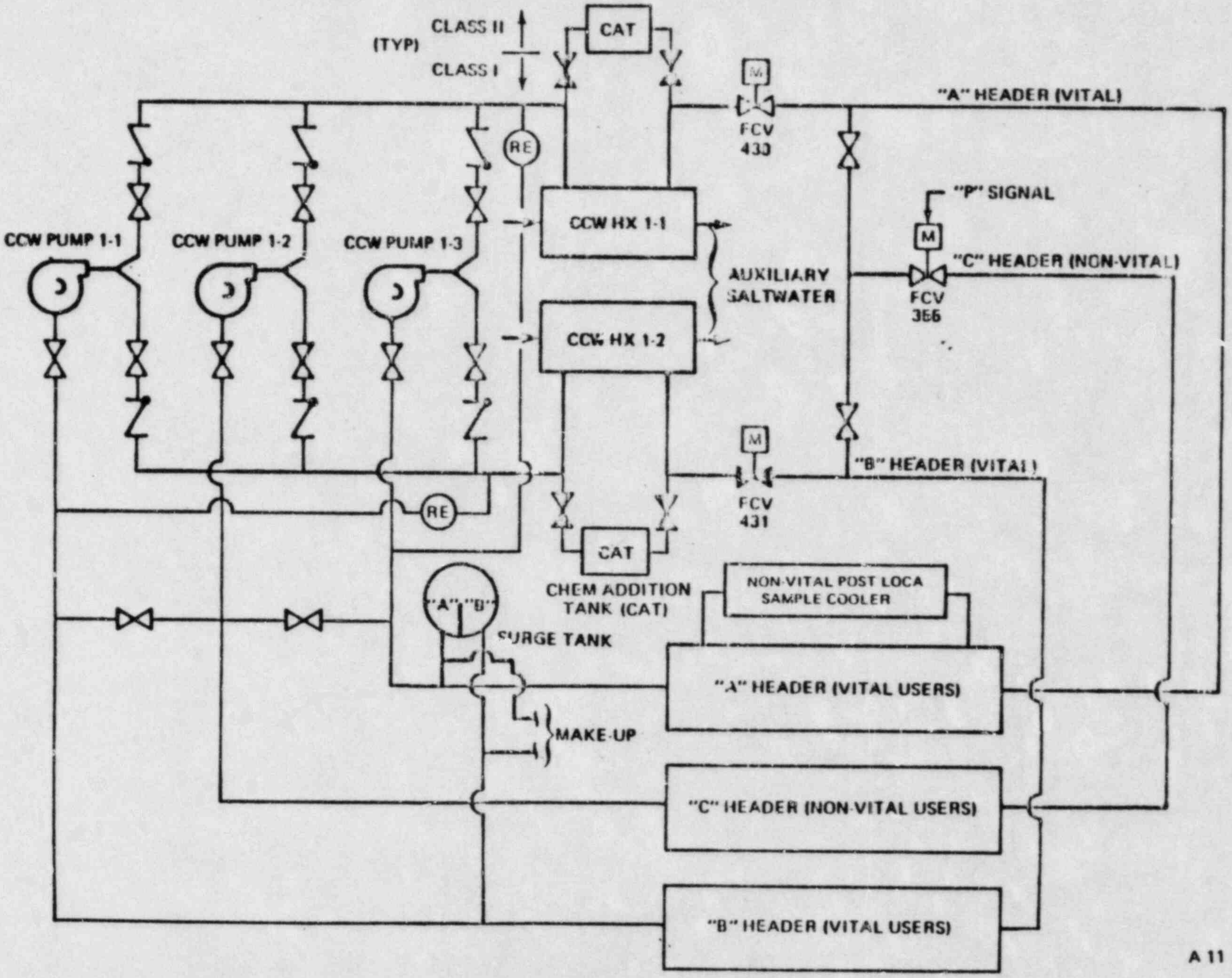
CCW PUMP

"C" HEADER ISOLATION VALVE FCV-355

MAKE-UP WATER TRANSFER PUMP

CONTAINMENT SPRAY PUMP

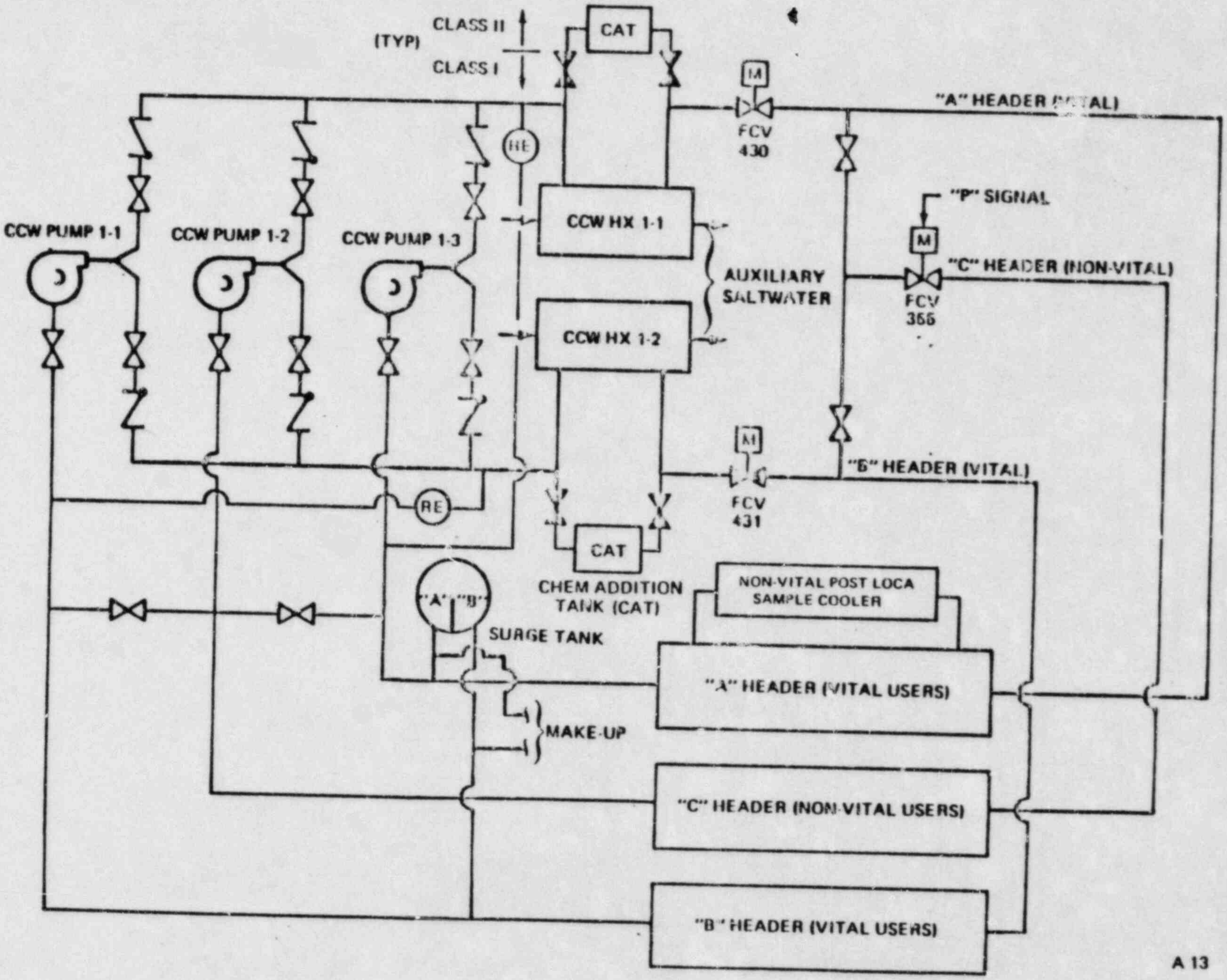
CCW SYSTEM BASIC ARRANGEMENT



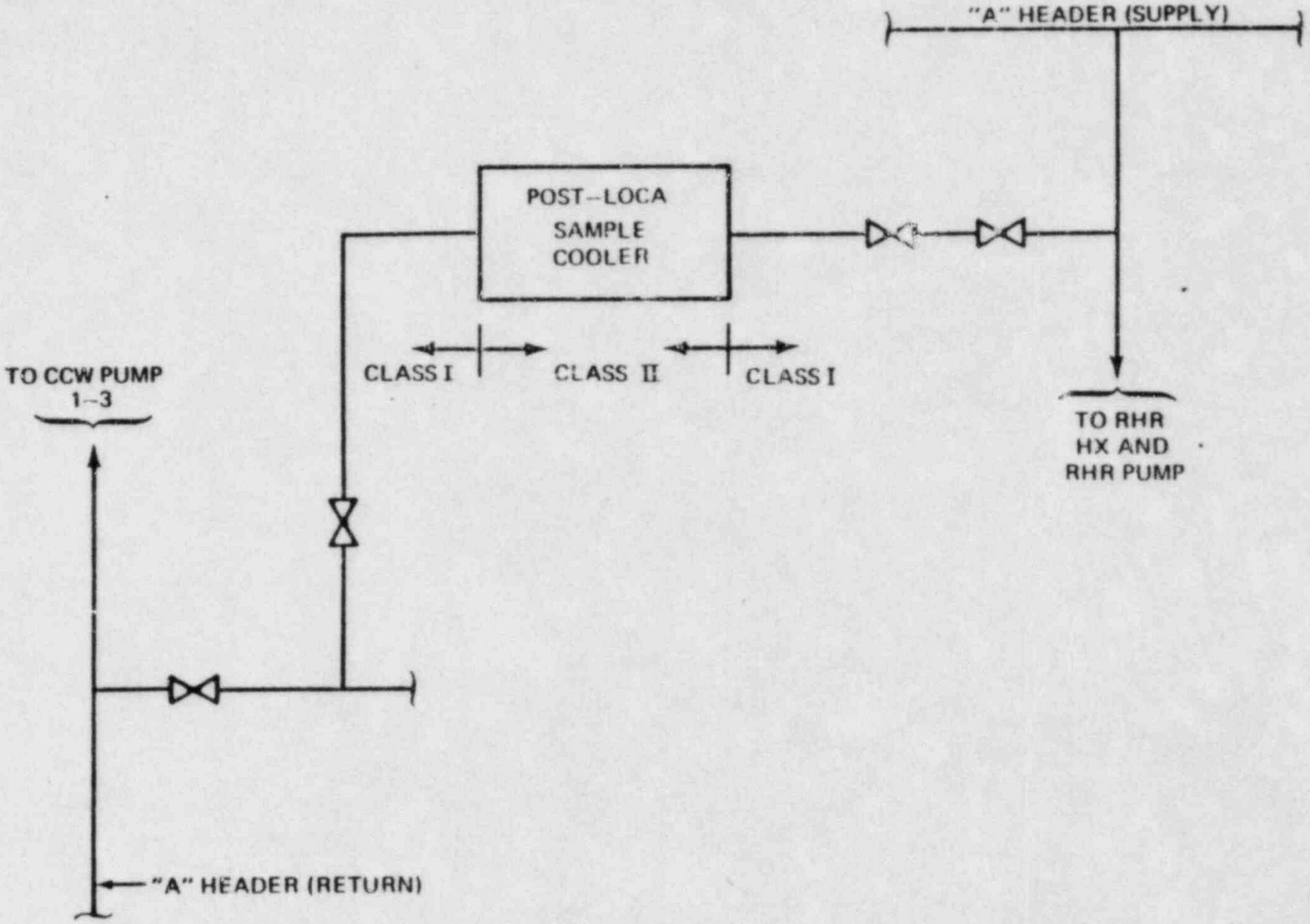
CCW SYSTEM HEAT LOADS SUMMARY

OPERATING CONDITION	TOTAL HEAT LOAD (10^6 BTU/HR)
NORMAL	72
SAFETY INJECTION (“S” SIGNAL-5 FAN COOLERS)	240
SAFETY INJECTION (“P” SIGNAL)	
i) DBA LOCA AND WORST SINGLE FAILURE ANALYSIS	244
ii) NO FAILURES	406
RECIRCULATION (MAXIMUM ON ONE HEAT EXCHANGER)	229

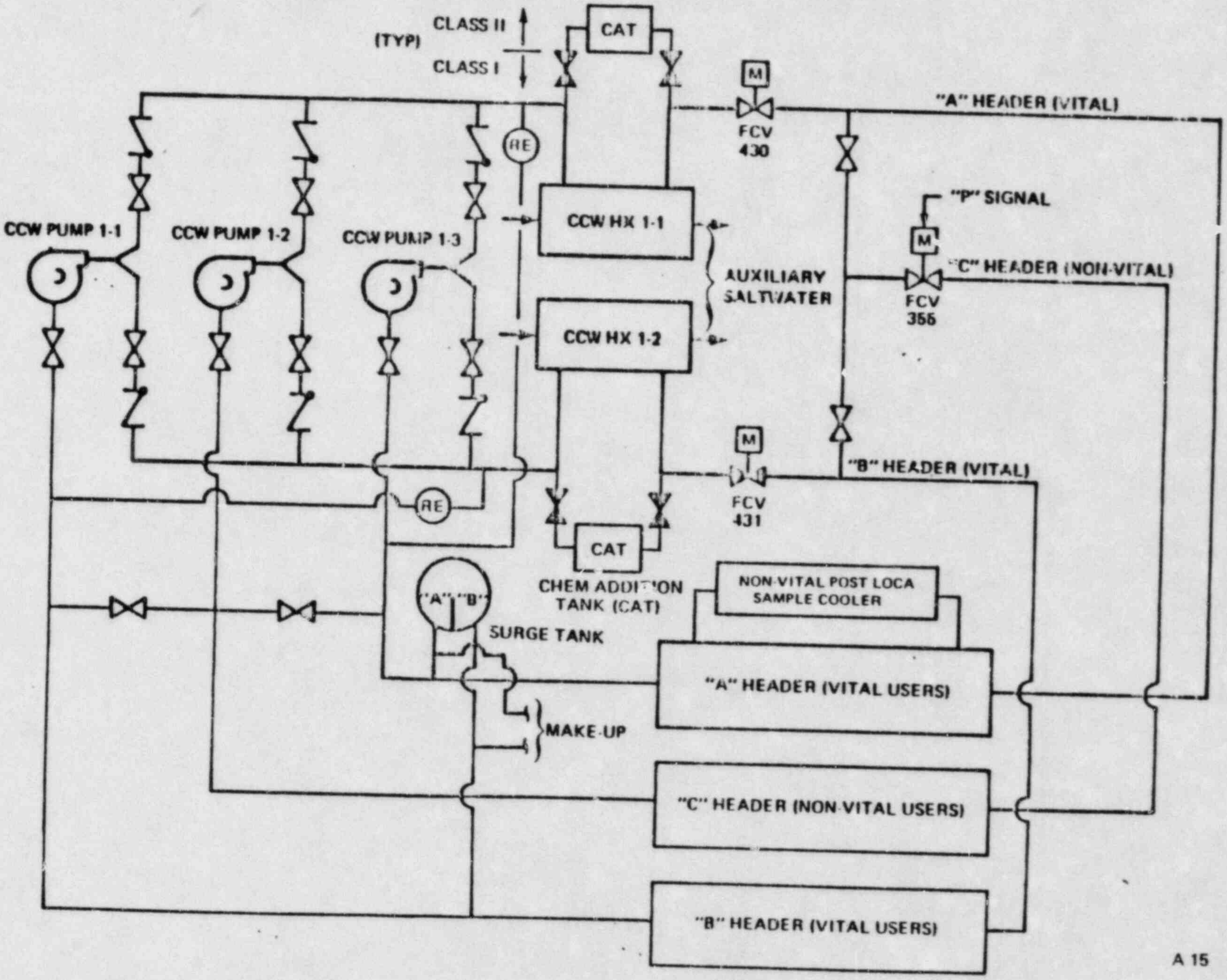
CCW SYSTEM BASIC ARRANGEMENT



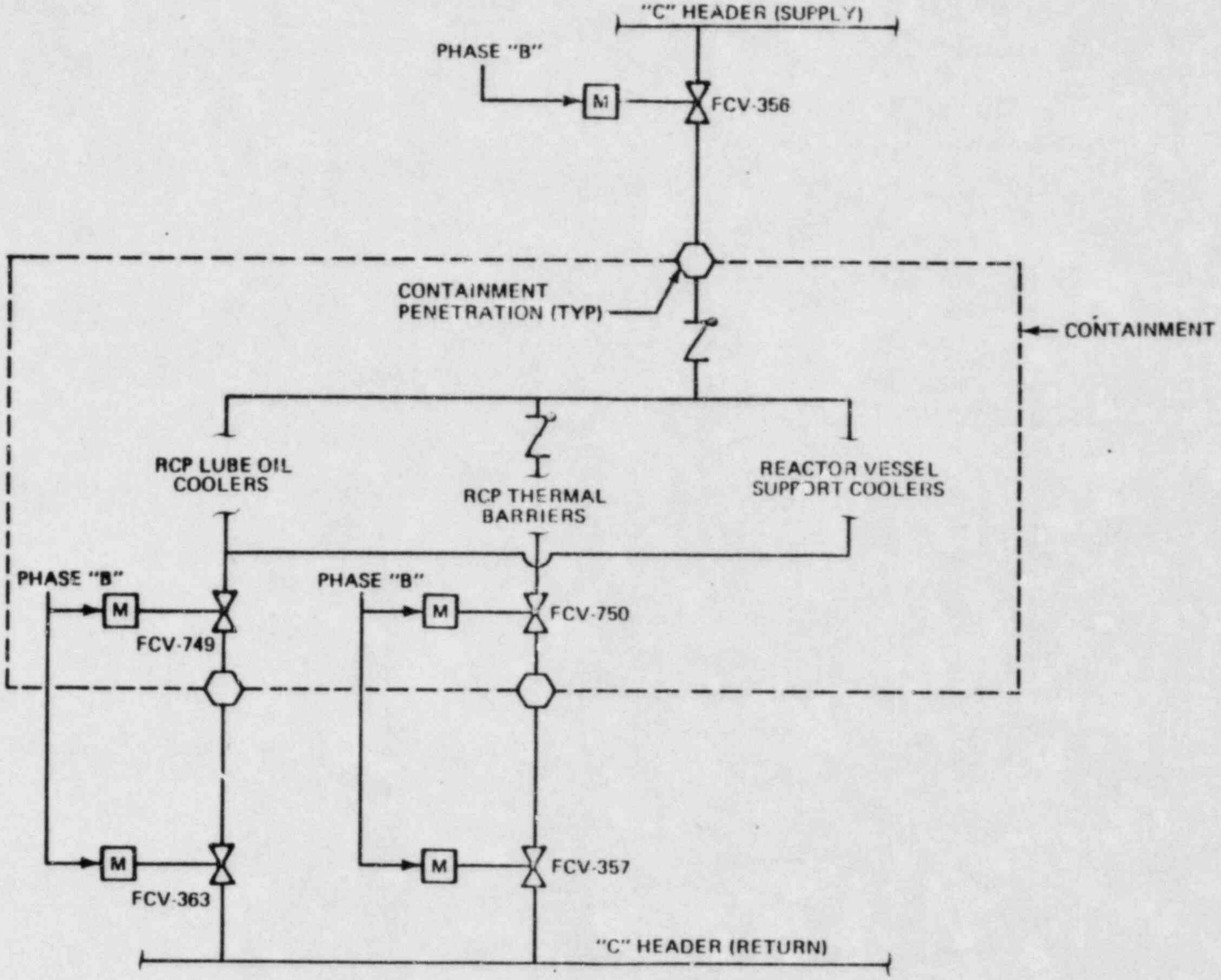
POST-LOCA SAMPLE COOLER BASIC ARRANGEMENT



CCW SYSTEM BASIC ARRANGEMENT



CCW SYSTEM REACTOR COOLANT PUMP ISOLATION



COMPONENTS
ALL DESIGN CLASS I

PUMPS

3, HORIZONTAL, CENTRIFUGAL
9200 gpm
CARBON STEEL
AB
4kV VITAL BUS

CAT

2
CARBON STEEL
VALVED OUT
CORROSION INHIBITOR

VALVES

CARBON STEEL
BRONZE OR SS TRIM

HX

2
ASW TUBE SIDE
258.8 x 10^6 BTU/HR
TB
CARBON STEEL/CuNi

SURGE TANK

1, INTERNALLY SPLIT
10,750 GAL
4000 GAL MINIMUM
CARBON STEEL
RELIEF TO AB SUMP

PIPING

WELDED
FLANGE CONNECTIONS

CCW SYSTEM USERS: VITAL COMPONENTS

"A" LOOP

RHR HEAT EXCHANGER

RHR PUMP

CENTRIFUGAL CHARGING PUMP

SAFETY INJECTION PUMP

CONTAINMENT FAN COOLERS (2)

POST-LOCA SAMPLE COOLERS

CCW PUMP(S)

"B" LOOP

RHR HEAT EXCHANGER

RHR PUMP

CENTRIFUGAL CHARGING PUMP

SAFETY INJECTION PUMP

CONTAINMENT FAN COOLERS (3)

CCW PUMP(S)

CCW SYSTEM USERS: NON-VITAL COMPONENTS

"C" LOOP

WASTE GAS COMPRESSORS (2)
CENTRAL SAMPLE PANEL COOLERS
RECIPROCATING CHARGING PUMP
REACTOR COOLANT PUMPS (4)
GROSS FAILED FUEL DETECTOR HX
REACTOR VESSEL SUPPORT COOLERS (4)
BORIC ACID EVAPORATOR PACKAGE
AUXILIARY STEAM DRAIN RECEIVER VENT CONDENSER
WASTE CONCENTRATOR PACKAGE
NSSS SAMPLE HEAT EXCHANGER
SEAL WATER HEAT EXCHANGER
LETDOWN HEAT EXCHANGER
STEAM GENERATOR BLOWDOWN SAMPLE COOLERS
BLOWDOWN TANK VENT CONDENSER
SPENT FUEL PIT HEAT EXCHANGER
EXCESS LETDOWN HEAT EXCHANGER

MAKE-UP WATER

- AIR-ACTUATED LEVEL CONTROL VALVES
  - REDUNDANT
  - SURGE TANK LEVEL
    - LOW NORMAL OPERATING
- MAKE-UP PATHS
  - MU WATER DEMINERALIZERS
    - CLASS II FROM CHECK VALVE
  - CST
    - CLASS I — PIPE, VALVES, PUMPS
    - MU WATER X-FER PP, REDUNDANT
    - VITAL BUS
    - 425,000 GAL, 255,000 GAL
  - MANY OTHER PATHS
    - DESIGN CLASS I AND II
    - UNIT 2 CST

A. PROVIDE ADEQUATE COOLING

- FUNCTIONAL PERFORMANCE
- MULTIPLE PERFORMANCE FUNCTIONS
- SURGE TANK CAPABILITY
- PROVIDE COOLING WATER
- HEAT LOADS

B. OTHER SYSTEMS' ASPECTS

- EFFECTS OF NON-CATEGORY I
- LEAKAGE
- TESTING, ISI
- RCP SEALS
- INSTRUMENTATION
- RELIABILITY ANALYSIS

C. INTERACTIONS

- FLOOD PROTECTION
- INTERNAL MISSILES
- EXTERNAL MISSILES
- PIPE BREAKS

A. FUNCTIONAL PERFORMANCE

- ENVIRONMENTAL OCCURRENCES

  CLI-80-21, NUREG 0588
  NRC REVIEW 9/81
  SEISMIC ANALYSES

- NORMAL OPERATION

  1 PP, 1 HX IN STANDBY NORMALLY
  COOLDOWN WITHOUT 1 HX OR 1 PP

A. FUNCTIONAL PERFORMANCE
(Cont'd)

- OPERATION AFTER ACCIDENT

  ESSENTIAL SAFEGUARDS BUS — CCW, ASW, MU
  S SIGNAL CCW, ASW
  LIMITING FAILURE LEAVES
    1 MU, 2 CCW, 1 ASW
    REDUNDANT USERS
    STILL FEEDS BOTH PAIRS
  LONG TERM
    MANUALLY ALIGNED
    ONE LOOP REQUIRED
    ACTIVE OR PASSIVE FAILURE

SRP REQUIREMENT FOR GDC 44

REQUIRES "COMPONENT REDUNDANCY SO THAT SAFETY FUNCTIONS CAN BE PERFORMED ASSUMING A SINGLE ACTIVE COMPONENT FAILURE COINCIDENT WITH A LOSS OF OFFSITE POWER."

B. MULTIPLE PERFORMANCE FUNCTIONS

- GDC 5

SHARING BETWEEN UNITS
SWING DIESEL
ADDITIONAL REDUNDANCY
    CST CROSSTIE

- NORMAL USERS

C HEADER HAS NORMAL USERS ONLY
ISOLATION NOT AFFECT SAFETY

- RADIOACTIVITY CONTROL

DOUBLE BARRIER DESIGN
RADIATION MONITORS
DESIGN CLASS I ISOLATION VALVES

C. SURGE TANK CAPABILITY

- INTERNALLY DIVIDED
- FEEDS REDUNDANT SURGE LINES
- SRP REQUIRES POSTULATED RUPTURE OF VITAL HEADER NOT DRAIN TANK
- MANY MAKE-UP PATHS

D. PROVIDE ADEQUATE COOLING WATER

- REDUNDANT
- DESIGN CLASS I
- EMERGENCY POWER
- ISOLATION INTO TRAINS

E. HEAT LOADS

- NORMAL OPERATION
  72M BTU
  HX — 258M BTU

- SI BUT NO P
  MAJOR LOAD F.C.
  ALL OTHERS 40M
      C HEADER 39M
  SAY 50% HEAT LOAD

- DBA, WORST FAILURE
  DOUBLE-ENDED RUPTURE, LOOP, WORST FAILURE
  BUS G
  WORST — LEAST CONT. COOLING
  LOSS — 1 CS, 2 F.C., C HEADER
  244M BTU
  DESIGN CASE FOR GDC 44 AND FSAR

VITAL POWER SOURCES FOR MAJOR CCW SYSTEM (AND RELATED) USERS

VITAL BUS 1F

CONTAINMENT FAN COOLERS (2)

CCW PUMP

AUXILIARY SALTWATER PUMP

VITAL BUS 1G

CONTAINMENT FAN COOLERS (2)

CCW PUMP

AUXILIARY SALTWATER PUMP

MAKE-UP WATER TRANSFER PUMP

CONTAINMENT SPRAY PUMP

VITAL BUS 1H

CONTAINMENT FAN COOLER

CCW PUMP

"C" HEADER ISOLATION VALVE FCV-355

MAKE-UP WATER TRANSFER PUMP

CONTAINMENT SPRAY PUMP

E. HEAT LOADS (Cont'd)

- LESS THAN WORST FAILURE

  CONSIDERED IN EARLY DESIGN
  POSSIBLE INCREASED TEMPERATURE
  E.G. - 5 F.C., 2 CS, DBA ASSUMPTIONS
  YIELDS 140°F, 406M BTU
  OPERATOR ACTION
  SECOND HX

F. SEISMIC/NON-SEISMIC INTERFACE

- REG GUIDE 1.29
- CAT
  MANUAL CLOSED VALVES
- SENTRY COOLER
  1980, NUREG 588
  OPERATOR FAMILIARITY
    VALVES OPEN
  PIPING DESIGN CLASS I
  SEISMICALLY ANALYZED
  SPECIFICALLY DESIGNED FOR NUREG 588
  NO APPROVED NUCLEAR QA PROGRAM

G. LEAKAGE

- INTO SYSTEM
  - REs
  - TANK LI AND LA
  - RELIEF VALVE
- OUT OF SYSTEM
  - TANK LI AND LA
  - NUMEROUS MAKE-UP PATHS
  - DESIGN CLASS I VALVES

H. TESTING AND ISI

- ACCESSIBLE
- VISUAL OBSERVATION
- CONTINUOUS, INTERMITTENT OPERATION

I. RCP SEALS

- II.K.3.25
- LOOP
- LOSS OF AIR
- MOTOR OPERATORS FROM EMERGENCY BUS
- PUMPS ON EMERGENCY BUS

J. INSTRUMENTATION

K. RELIABILITY ANALYSIS

- SRP — "FMEA IN THE FSAR -- TO ENSURE THAT ESSENTIAL PORTIONS OF THE SYSTEM WILL FUNCTION FOLLOWING DESIGN BASIS ACCIDENTS ASSUMING A CONCURRENT SINGLE, ACTIVE COMPONENT FAILURE."

L. FLOOD PROTECTION

M. INTERNAL MISSILES

N. EXTERNAL MISSILES

- INSIDE BUILDINGS
- FAILURE ANALYSIS FOR SURGE TANK

O. PIPE BREAK

- JET IMPINGEMENT
- PIPE WHIP
- DOG HOUSE

Diablo Canyon Unit 1

Component Cooling Water System

Phillips Building - Room P-118

Bethesda, Maryland

January 28, 1983

CRITERIA AND DESIGN BASES

Presented By

C. Aronson

INTRODUCTION

I would like to begin with a brief overview of my presentation.

First, I will establish a point of reference for the Diablo Canyon design and licensing process, in relation to the contemporaneous development of AEC and NRC basic licensing requirements, as well as to other specific nuclear plants of interest.

Second, I will discuss PGandE's basic safety design criteria for Diablo Canyon, and how those criteria developed.

Third, I plan to outline the specific history of Diablo Canyon licensing as related to major NRC requirements bearing on the issues raised.

Fourth, I will discuss the specific licensing commitments for the Diablo Canyon Plant Component Cooling Water System.

Finally, I will address in detail certain of the specific areas of interest identified by the NRC as as they relate to the CCW System. These areas include safety and seismic classification interfaces, application of the single failure criterion and considerations related to CCW system heat loads. Mr. Crawford will then follow with a presentation on the other basic issue of interest, the Instrumentation design philosophy.

EARLY DIABLO CANYON LICENSING AND DESIGN ACTIVITIES

In order to place the Diablo Canyon original design and licensing schedule in perspective, I have prepared a simple slide noting the relationship between the early Diablo Canyon licensing history and the development of the AEC General Design Criteria. I won't read this information but you will note the close parallel between these activities, indicating that a significant portion of Diablo Canyon design effort took place prior to the formal issuance of the GDC.

I would also like to point out that the Diablo Canyon early design effort took place during the transition from "turnkey" plants, in which the reactor supplier was prime contractor, to the current arrangement of Nuclear Steam Supply System vendor/utility coordination of the project. During this transition period, Westinghouse, as the NSSS vendor for Diablo Canyon maintained a close liaison with the designers of interfacing systems, such as CCW. Other plants which were designed in the general time frame of Diablo Canyon include Indian Point Unit 2, Ginna and San Onofre Unit 1.

BASIC DESIGN CRITERIA

Next I will discuss the subject of basic design criteria for Diablo Canyon.

During Mr. Eisenhut's remarks at the status meeting of January 13th, he stressed the Staff's need for a clear statement of PGandE's design criteria in a number of areas. PGandE's basic design approach is to meet the NRC's stated requirements, as discussed to in the licensing documents for the Diablo Canyon Plant. In addition, it is PGandE's design approach to employ sound engineering practices, consistent with the licensing basis for the plant, in interpreting NRC requirements which are not explicitly stated.

Basic safety design criteria for nuclear power plants, are, of course, found in NRC regulations and various guidance documents. The main source for NRC requirements concerning design is in the General Design Criteria, Appendix A to 10 CFR Part 50. Some of these criteria are reasonably specific in nature, requiring a minimum of interpretation. There are certain design areas, however, in which NRC criteria are less clear, even after considering the related NRC guidance material. In these cases some measure of engineering judgment must necessarily be applied. This is often difficult in these areas in that the designer must convert partially non-mechanistic event scenarios into mechanistic events and event combinations. It appears that virtually all of the areas of interest raised by Mr. Eisenhut are in areas where such judgment must be applied. For example, General Design Criterion 2 requires consideration of appropriate combinations of natural phenomena and in plant events in the design process. However, the scope of application of seismic design requirements enumerated in Appendix A to 10 CFR Part 100 simply provide a listing of basic safety functions for the purpose of determining which plant features must be designed to Seismic Category I requirements. It is left to the designer to decide exactly which aspects of the plant must be designed for simultaneous occurrence of a Loss of Coolant Accident and a large earthquake and what assumptions he must make concerning failure of items not fully designed to these seismic requirements.

With these thoughts in mind, I would emphasize our position that the design of the Diablo Canyon Plant Component Cooling Water System is consistent with NRC requirements.

DIABLO CANYON LICENSING HISTORY

I have noted that the early Diablo Canyon design and licensing process closely paralleled the development of the AEC's General Design Criteria (GDC). PGandE adhered to the 1967 draft GDC and, as indicated in the FSAR, reviewed its compliance with the formally issued GDC of 1971. One of the most significant GDC related to the issues of interest is GDC number 2. This criterion concerns design bases for protection against natural phenomena. While this criterion changed significantly between 1967 and 1971, PGandE committed to meet the intent of the 1971 version. I have a <u>slide</u> of GDC 2 for reference. The Diablo Canyon FSAR specifically states that the plant conforms with the important requirement that it be designed for the most severe natural phenomena, with appropriate combinations of postulated accidents and those natural phenomena.

Another GDC of significance is that for design of cooling water systems, GDC 44, for which I also have a <u>slide</u>. This particular GDC had no counterpart in the 1967 draft but the Diablo Canyon FSAR states that the CCW System design conforms to the intent of GDC 44. Note the use of the application of the single failure criterion in this GDC, clearly relates to the safety function of the system being maintained.

Another important portion of 10 CFR 50 Appendix A is the single failure definition included in this <u>slide</u>. The Diablo Canyon FSAR adopts a similar definition of single failure and commits to its application for all safety-related systems including the CCW system. The Diablo Canyon

FSAR amplifies this definition by applying the active failure to the "short term" or an active or passive failure to the "long term". The "short term" is defined as 24 hours. The passive failure is defined as 50 gpm.

I would also note, at this point, that the dominant event upon which the General Design Criteria are structured is the large LOCA, together with worst case single failures in required response systems. Similar emphasis is clearly shown in a review of the licensing documents for Diablo Canyon. Thus the Diablo Canyon licensing approach is consistent with the NRC's oft-stated philosophy of establishing non-mechanistic worst case accident scenarios in order to provide bounding values of parameters for design of plant features. It should be noted that there are no additional specific NRC requirements to evaluate all intermediate combinations of events on a worst-case parameters basis. The Diablo Canyon FSAR includes only the worst case scenario for the CCW System.

In addition to the GDC, another AEC guidance document of particular significance during that time frame is Safety Guide 29 which covers Seismic Design Classification. The Diablo Canyon FSAR states that the design complies with the intent of this Guide. This <u>slide</u> shows one item included in the listing of items which must be designed seismically and which involves interfaces. This is one of the few areas in which regulatory guidance specifically addresses interfaces. However, there is little further guidance in this particular area.

LICENSING BASIS OF THE DIABLO CANYON

CCW SYSTEM

The FSAR describes the CCW System as "Design Class 1" with specific exceptions as noted. A Design Class 1 system is defined in the FSAR as one which is "vital to safe shutdown and isolation of the reactor, or whose failure might cause or increase the severity of a loss of coolant accident, or result in an uncontrolled release of excessive amounts of radioactivity". The CCW safety function under this definition as described in the FSAR consists of cooling of the safety-related equipment following LOCA, as described in an earlier presentation. This slide shows the exceptions to Design Class 1 for the CCW system mentioned earlier. Please note that these exceptions are prominently mentioned at the beginning of the section.

SAFETY/NON-SAFETY-RELATED INTERFACES

I will now discuss the first specific issue, that of interfaces between safety and non-safety related portions of the CCW System. As indicated in the (same) slide, and indicated in the previous presentation, the major safety/non-safety interface concerns CCW Loop "C". No exact point of demarcation is identified between these portions of the system, as the distinction is in reference to portions of the system required, or not required, post LOCA, and does not indicate that items served by loop "C" have no importance. For example the reactor coolant pumps, as discussed in the previous presentation, are served by Loop "C". The significance of this is that, although in the context of Diablo Canyon licensing only loops A and B of the CCW are safety-related, we believe it important that loop C not be subjected to unnecessary inadvertent isolation. The important requirement for the interface is that its design be such as to prevent unacceptable effects of the non-safety related portions on the safety-related portions of the system. Individual interface subjects discussed previously, and to be discussed later, cover individual issues related to potentially unacceptable effects. However, we have determined that the interfaces between safety and non-safety related portions of the CCW system have been adequately designed.

SEISMIC/NON-SEISMIC INTERFACES

As noted at several points earlier in these presentations not all components in the CCW system are Design Class 1. The non-Design Class 1 components attached to loops A and B were discussed in Mr. Connell's presentation. This discussion is confined to loop C components, and, more specifically, to their seismic capability relative to that required for Design Calss 1 components. First, let me reiterate that all loop C piping and valves meet Design Class 1 seismic requirements. Therefore, the seismic interfaces are located at certain loop C heat exchanger nozzles connecting to CCW piping. The loop C heat exchangers vary over a rather wide range with regard to meeting Design Class 1 seismic requirements. In several cases they fully meet these requirements. In other cases they were purchased with various seismic design requirements specified, but there is inadequate documentation to assure that these requirements have been met. Still others were purchased with no seismic design requirements specified. The latter are tabulated on this slide which indicates that they are all small components, for which the leakage potential is very limited.

In our investigations relative to this aspect of the potential non-conformance we have found the following:

1. There is a general trend of increasingly conservative requirements for seismic design with increasing size among these heat exchangers.

2. The heat exchangers were purchased to the same ANSI code requirements as the safety-related equipment in loops A and B.

3. Only ductile materials were allowed to be used in the pressure boundaries of the heat exchangers.

4. The design of the C loop piping supports was intended to limit nozzle reactions on the equipment, as indicated in the slides of the actual system that you have just seen.

The importance of maintaining pressure integrity in loop C was recognized by the designers. Also, as discussed in an earlier presentation, in the event of leakage, each heat exchanger may be isolated with manual valves which are in accessible locations.

Although we are continuing to examine certain of the C loop heat exchangers to provide additional confirmation of their seismic capability we believe that adequate provisions have been made to assure meeting NRC guidance in this area. Specifically, no degradation of safety-related equipment to an "unacceptable safety level," as specified in Safety Guide 2, for such interfaces, will occur.

SINGLE CRITERIA FAILURE

The issue of adequate design for required single failure assumptions apparently originates from the fact that only one automatic isolation valve exists on CCW loop "C" serving non-vital equipment in the system. This issue arises from an incorrect assumption that each individual active component in a system is required to have a redundant counterpart. Single failure analyses can only be made in the context of performance of system safety functions as they contribute to plant safety. Furthermore single failure analyses must be considered in the context of support functions required at all levels to perform the safety function. Note that the slide for GDC 44 does not state that the single failure applies only to the CCW system, that is, any single failure must be considered. As mentioned earlier the worst case single failure assumed in the FSAR for the CCW System is one which has the maximum impact on the most important safety function for the CCW System, removal of heat from the containment fan coolers post-LOCA.

The FSAR clearly states that this case is one involving the loss of two containment coolers, leaving only 3 of 5 available. The only single failures that could cause this condition would be loss of one of the two diesels generators which supply power to two containment coolers. However, the power to the loop "C" isolation valve is not supplied by either of these two diesel generators, so no failure of the isolation valve need be assumed. Therefore the single active failure of this valve is not relevant to the case tabulated in the licensing basis, that is Chapter 9 of the FSAR. There are additional single failures that require examination but they are more closely related to the next issue on heat loads, which I will discuss shortly.

Once again, after thorough review and analysis we have concluded that there is no error in the single failure analysis stated in the FSAR.

HEAT LOADS

The issue involved here concerns possible failure to account properly for heat loads which might result from consideration of single failures other than those covered in the FSAR, or in the absence of single failures. As I indicated earlier, consistent with NRC licensing requirements the FSAR single failure analysis is limited to a single worst case scenario. It does not appear necessary to analyze all other permutations and combinations of failures or non failures in the exact same manner and to the exact same acceptance criteria. There are cases of single failure other than diesel generator failures, as well as non-failures, in combination with non-loss of offsite power, which would result in fairly rapid increase in the CCW system temperature. If 5 containment coolers were operating post LOCA and if an unrealistic Pacific Ocean temperature of 70°F is assumed, the limiting CCW heat exchanger outlet temperature could be reached in a short period of time. This situation has been recognized for Diablo Canyon for many years, and the plant operating procedures specifically include provision for coping with such a situation. In those cases where the number of operating containment coolers require reduction and/or where an additional CCW heat exchanger must be placed in service, such actions can be accomplished from the main control room.

However, you should be aware that this issue is currently being evaluated to assure that adequate provisions and procedures exist to accommodate all credible situations which could occur.

This issue is one which is not specifically covered in the licensing basis, which requires evaluation of operator action times only for those cases where credit for operator action is taken in the FSAR Chapter 15 analysis. This does not apply in the cases under evaluation.

LIST OF SLIDES USED
IN C. ARONSON'S PRESENTATION

Slide 1: Diablo Canyon Schedule Relative to NRC Requirements

Slide 2: 10CFR50 Appendix A (GDC) - Criterion 2

Slide 3: 10CFR50 Appendix A (GDC) - Criterion 44

Slide 4: 10CFR50 Appendix A (GDC) - Single Failure Definition

Slide 5: Safety Guide 29

Slide 6: DCP FSAR Chapter 9

Slide 7: CCW Loop C Components

DIABLO CANYON PLANT SCHEDULE RELATIVE TO NRC REQUIREMENTS

AEC/NRC REQUIREMENTS	YEAR	DIABLO CANYON SCHEDULE
	EARLY 1967	PSAR SUBMITTAL
AEC DRAFT GENERAL DESIGN CRITERIA ISSUED	1967	
	1969	CONSTRUCTION PERMIT
GENERAL DESIGN CRITERIA FORMALLY ISSUED	1971	

TAKEN FROM 10CFR50, APPENDIX A (GDC)

CRITERION 2—DESIGN BASES FOR PROTECTION AGAINST NATURAL PHENOMENA. STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED TO WITHSTAND THE EFFECTS OF NATURAL PHENOMENA SUCH AS EARTHQUAKES,... WITHOUT LOSS OF CAPABILITY TO PERFORM THEIR SAFETY FUNCTIONS. THE DESIGN BASES...SHALL REFLECT:

(1) APPROPRIATE CONSIDERATION OF THE MOST SEVERE OF THE NATURAL PHENOMENA THAT HAVE BEEN HISTORICALLY REPORTED FOR THE SITE AND SURROUNDING AREA,...

(2) APPROPRIATE COMBINATIONS OF THE EFFECTS OF NORMAL AND ACCIDENT CONDITIONS WITH THE EFFECTS OF THE NATURAL PHENOMENA...

TAKEN FROM 10CFR50, APPENDIX A (GDC)

CRITERION 44

SUITABLE REDUNDANCY IN COMPONENTS AND FEATURES, AND SUITABLE INTERCONNECTIONS, LEAK DETECTION, AND ISOLATION CAPABILITIES SHALL BE PROVIDED TO ASSURE THAT FOR ONSITE ELECTRIC POWER SYSTEM OPERATION (ASSUMING OFFSITE POWER IS NOT AVAILABLE) AND FOR OFFSITE ELECTRIC POWER SYSTEM OPERATION (ASSUMING ONSITE POWER IS NOT AVAILABLE) THE SYSTEM SAFETY FUNCTION CAN BE ACCOMPLISHED, ASSUMING A SINGLE FAILURE.

TAKEN FROM PREAMBLE OF 10CFR50, APPENDIX A

SINGLE FAILURE. A SINGLE FAILURE MEANS AN OCCURRENCE WHICH RESULTS IN THE LOSS OF CAPABILITY OF A COMPONENT TO PERFORM ITS INTENDED SAFETY FUNCTIONS... FLUID AND ELECTRIC SYSTEMS ARE CONSIDERED TO BE DESIGNED AGAINST AN ASSUMED SINGLE FAILURE IF NEITHER A SINGLE FAILURE OF ANY ACTIVE COMPONENT... RESULTS IN A LOSS OF THE CAPABILITY OF THE SYSTEM TO PERFORM ITS SAFETY FUNCTIONS.

THE CONDITIONS UNDER WHICH A SINGLE FAILURE OF A PASSIVE COMPONENT SHOULD BE CONSIDERED...ARE UNDER DEVELOPMENT.

TAKEN FROM SAFETY GUIDE 29

r. STRUCTURES, SYSTEMS, OR COMPONENTS WHOSE FAILURE COULD REDUCE THE FUNCTIONING OF ANY PLANT FEATURE INCLUDED IN ITEMS 1.a. THROUGH 1.q. ABOVE TO AN UNACCEPTABLE SAFETY LEVEL.

TAKEN FROM D.C.P. FSAR, CH. 9

EXCEPT FOR NON-VITAL COMPONENTS IN LOOP “C” AND THE CHEMICAL ADDITION TANKS, THE COMPONENT COOLING WATER SYSTEM IS A DESIGN CLASS I SYSTEM AND IS SHOWN IN FIGURE 9.2-4. THE SYSTEM IS DESIGNED TO REMOVE WASTE HEAT FROM THE NUCLEAR (PRIMARY) PLANT EQUIPMENT AND COMPONENTS DURING NORMAL PLANT OPERATION, PLANT COOLDOWN, AND FOLLOWING A LOSS OF COOLANT ACCIDENT.

PRELIMINARY

CCW LOOP "C" COMPONENTS FOR WHICH NO SEISMIC REQUIREMENTS WERE SPECIFIED

HEAT EXCHANGER	INLET NOZZLE SIZE
CENTRAL SAMPLE PANEL COOLERS PACKAGE	2"
BORIC ACID EVAPORATOR PACKAGE SAMPLE COOLER	1"
WASTE CONCENTRATOR PACKAGE SAMPLE COOLER	1"
STEAM GENERATOR BLOWDOWN SAMPLE COOLER	3/4"
STEAM GENERATOR BLOWDOWN VENT CONDENSER (NORMALLY ISOLATED)	3/4"

Diablo Canyon Unit 1

Component Cooling Water System
Phillips Building Room P-118
Bethesda, Maryland
January 28, 1983

INSTRUMENT CLASSIFICATIONS AT DIABLO CANYON POWER PLANT AND THEIR APPLICATION TO THE COMPONENT COOLING WATER SYSTEM

Presented By
T.N. Crawford

INTRODUCTION

I am going to describe the PGandE Design Philosophy for Instrumentation as it applies to Diablo Canyon. I will then describe how we actually classify instrumentation, and how it complies with industry standards and NRC regulations and guidance. Next, I will give a short history of our Classification System. Finally, I will describe how that Classification System is implemented in the Component Cooling Water System.

DESIGN PHILOSOPHY

(Slide 1)

In keeping with Criterion 1 of Appendix A to 10CFR50, if we were unconstrained by any other standards, we would develop six instrument classifications from the most important function to the least. They would be:

(1) Those devices which actually perform safety functions themselves;

(2) Those devices which the operator uses to perform manual safety functions;

(3) Those devices that tell the operator the condition of the vital systems;

(4) Those devices that tell the operator if the safety systems are working:

(5) Those devices which the operator needs to troubleshoot the safety systems:

and finally

(6) Those devices not involved in safety systems.

In actuality, our classification systems do directly parallel standards and regulations, so it is impractical to have 6 classifications. But remember this logic, because you will see that the first two levels closely match our Class 1A; the second two closely match our Class 1B; and the third two are not safety related.

Classification

The design classification of instrumentation at Diablo Canyon is specified by Design Criteria Memorandum M-3 titled "Design Class I Instrumentation". The original version was dated March 18, 1971, and the current revision was dated March 5, 1980. The first classification that it identifies is Instrument Class IA.

Instrument Class 1A

(Slide 2)

Instrument Class IA instruments are those which are required to accomplish the functions of the Reactor Protection or Engineered Safety Features Systems.

Simply stated, any instrument which performs a function which is necessary to complete a safeguards action is classified as Instrument Class IA.

This parallels the definition of IEEE Class IE electrical equipment. Class IE is defined as "The safety classification of electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment." (IEEE Standard 308-1974).

Although not specifically stated in the explanation, the instrumentation which performs a safety function can be an operator controlled device if manual action is an acceptable way of performing the safety function.

Instrument Class IA complies with 10CFR50 Paragraph 50.55 a (h), which requires compliance with IEEE 279.

Instrument Class IA totally envelopes IEEE Class IE as defined in IEEE Standard 308-1974. The electrical portions meet IEEE 279, 323, and 344 as appropriate. There does not appear to be any industry standard with which to compare our requirements for the mechanical and pneumatic portions of IA.

Class IA instruments are seismically and environmentally qualified, meet single failure criteria, and have Class IE power.

Instrument Class 1B

(Slide 3)

Instrument Class IB instruments are those which provide Post Accident Monitoring functions. This classification meets the requirements of USNRC Regulatory Guide 1.97, Revision 2. It is broken down into the types defined in the Regulatory Guide. They are:

Type A - Those instruments that provide information required to take preplanned manual actions. Type A instrument are seismically and environmentally qualified, meet single failure criteria and have Class IE power.

Type B - Those instruments that provide information to monitor the process of accomplishing critical safety functions. Type B instruments are seismically and environmentally qualified, meet single failure criteria, and have Class IE power.

Type C- Those instrument that indicate the potential for breaching or actual breach of barriers to fission product release. Type C instruments are seismically and environmentally qualified, meet single failure criteria, and have Class IE power.

Type D - Those instruments that indicate the performance of individual safety systems. Type D instruments are seismically and environmentally qualified, and have Class IE power.

Type E - Those instruments that provide information for use in determining the magnitude of the release of radioactive materials.

These classifications were written to meet Draft 2 of Reg. Guide 1.97, Rev. 2. We are in the process of revising our criteria to precisely comply with the issued Reg. Guide. It will be issued before June 1, 1983, as required by the Reg. Guide. We, like others, are having delivery problems with qualified state-of-the art devices, and the physical plant does not yet fully comply with the issued Reg. Guide.

Instrument Class IC

(Slide 4)

Instrument Class IC instrumentation is all instrumentation which has no safety function, but is attached to a Design Class I pressure boundary. It does not parallel any current industry classifications. Class IC instruments are seismically qualified to maintain their pressure boundary.

We are addressing this in the ISA SP67.07 committee, which I am a member of, but we aren't really there yet. The committee is limiting its work to in-line devices, but PGandE also addresses offline devices.

(Slide 5)

All instrumentation not covered by these classifications is Instrument Class II, which perform no safety function.

Before I go on, I would like to make a clarification on a point that may be confusing. All valves with actuating devices on them have two classifications. The instrument classification applies only to the actuator. The piping classification applies only to the valve. It is entirely possible to have an Instrument Class II, Piping Class I valve, and vice-versa. The Instrument Class II valves which you see on the Class I piping in the Component Cooling Water System are indeed Piping Class I valves.

I would like to capsulize the minimum requirements for our classifications.

(Slide 6)

(This slide is a copy of the matrix from our design criteria memo and not all the information here is germane to the discussion at hand.)

Instrument Class IA and IB, Type A, B, C, and D instruments are seismically and environmentally qualified, and have Class IE power. This diagram shows the criteria for Type D to be emergency power. Our emergency power is Class IE. Class IA and IB Types A, B, and C meet single failure criteria.

I would like to address an area which I know has caused considerable debate. That is the area of contingency actions.

Our Instrument Class IB Type A is the classification which we allot to instruments which the operator uses to perform manual safety functions. The verbiage in our Design Criteria Memorandum is "preplanned manual actions". In actual implementation, we refer to Regulatory Guide 1.97 Revision 2, which calls Type A variables:

> "those variables to be monitored that provide the primary information required to permit the control room operator to take specific manually controlled actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for design basis accident events. Primary information is information that is essential for the direct accomplishment of the specified safety functions; it does not include those variables that are associated with contingency actions that may also be identified in written procedures."

As I said earlier, our revised criteria memo will use this definition precisely.

We define contingency actions as actions for which capability is provided to diagnose and correct system problems, but which are not part of the direct accomplishment of the safety function. We believe this is consistent with the regulatory guidance, and it is consistent with the design philosophy I described earlier.

I would like to point out that Instrument Class II is simply a functional classification. It is not necessarily a measure of the availability of the device. There are many Instrument Class II devices in the plant which have been seismically qualified, and are wired and powered as IEEE Class IE devices. Some are even redundant. This goes to a very conservative PGandE philosophy that requirements are only minimums; quality should be commensurate with importance regardless of which box it fits into. This is important enough for me to restate it. These are classifications which fit into little boxes to comply with NRC requirements. PGandE has many devices which under our old classification were seismically qualified, wired and powered as IEEE Class IE, but which have been reclassified as Class II to conform with NRC definitions. The Component Cooling Water Surge Tank Level Switch, which apparently sparked the controversy at hand, is just such an instrument. It performs a contingency function and is therefore not Instrument Class IA or IB. As you will hear later, it is used in an abnormal condition procedure, and not in an emergency procedure. It is, however, provided with IEEE Class IE power, and inputs into a seismically qualified annunciator.

HISTORY

(Slide 1 Repeat)

I would like to share with you the history of our design classification system.

The original design criteria memo was written in March of 1971 to drafts of ANSI N18.2. Instrument Class IA was reserved for those instruments defined in Sections 5.3 and 5.5 of N18.2.

Instrument Class IB was everything else involved in safety functions; that is, the next 4 items on our philosophy list. Although some specific minimum criteria were given, the unwritten criteria was the embodiment of GDC 1: "Quality commensurate with its function."

In December of 1976, the NRC, Region V, was auditing us and found inconsistencies in the wiring of IB instruments, and asked what the criteria were. Since we couldn't provide a single set of criteria, we agreed that an overhaul was in order.

In 1977, we wrote Design Criteria Memo M-3,. Revision 1, putting all devices which performed safety functions into IA, and paralleled Class IA to IEEE Class IE. We relabeled Class IB as devices used for "Peripheral Control and Monitoring of Safeguards Systems" with requirements consistent with the importance, to be determined on a case by case basis. None of it was called IE, but we wired it, powered it and qualified it as if IE if we felt it to be appropriate.

After TMI, I participated in the Staff-Industry Meetings on Reg. Guide 1.97, Revision 2, and when I thought that it was basically firm (Draft 2), I rewrote our Criteria Memo M-3 to make IB reflect the Draft Regulatory Guide. The upgrade to the physical plant (which is still in progress) has been minimal.

Our Class IB previously included peripheral control and some diagnostic monitoring. When we made it match the Reg. Guide, there was no place for these functions. From a classification point of view, they became

Class II. But they will still be available when we think the operator needs them. The surge tank level switch is just such a device.

IMPLEMENTATION IN THE CCW SYSTEM

I would now like to describe how we implement these classifications in the Component Cooling Water System.

(Slide 7)

This slide shows the system diagram which Mr. Connell showed you previously. I will go through each classification, and show you which instruments in the system fit that classification and why.

(Slide 8)

This slide shows the Instrument Class IA automatic functions in the Component Cooling Water System.

There are no Protection System signal initiating (IA) instruments in the system. There are several system automatic functions which are initiated by devices outside of the system.

A Safety Injection Signal is initiated by LOCAs and Main Steam Line Breaks or High Containment Pressure (3 PSIG). It starts all of the component cooling water pumps and opens the containment fan cooler valves, FCV 360 and FCV 366.

The Phase A containment isolation signal is initiated by the Safety Injection Signal, and it isolates various containment isolation valves on the C header.

The Phase B containment isolation signal is initiated when Containment Pressure exceeds 22 PSIG. It closes the remaining containment isolation valves, and isolates Header C itself by closing FCV 355.

(Slide 9)

In addition to the automatic safety functions, there is one manual safety function which this slide shows. That is the system changeover when one goes onto RHR. Most of this is accomplished locally, but the radiation dose level is such that access to the RHR heat exchanger valves is not feasible. Therefore, those valves, FCV 364 and 365, are remote manual valves, and are Class IA.

(Slide 10)

This slide shows the Instrument Class IB devices.

Since the only manual safety function is the RHR realignment, the only IB Type A instrumentation would be that used for such a realignment. The operator makes this change when he goes into the recirculation mode after a LOCA. The IB Type A instruments for this function are Refueling Water Storage Tank Level and Containment Recirc. Sump Level, neither of which is in the CCW System.

There are no Type B or C variables, by definition, and by comparison with Table 2 of Reg. Guide 1.97, Rev. 2.

There are two Type D variables. Reg. Guide 1.97, Table 2, lists temperature and flow to vital components. These are used to determine if there is adequate flow to vital components, and to insure that the heat exchangers are doing their job properly. Diablo Canyon has added the C header flow just to be on the safe side. All of these devices are seismically and environmentally qualified, and have Class IE power

There are no Type E variables on the system.

All of the remaining instrumentation physically on the system is Class IC. There are many devices, none of which have a safety function, so I'll not discuss them here.

(Slide 11)

I would like to discuss other devices which are not Class IA or IB which we feel are important. Most were Class IB under our old definition of "Peripheral Control and Monitoring." They don't, however, fit our current definitions of Class I devices (except IC as appropriate). This slide shows some of those devices.

We have the ability to automatically makeup the surge tank with redundant Instrument Class IC controllers and the Instrument Class II control valves.

We have the Class IC low alarms on the surge tank which I discussed earlier. They are functionally redundant, and are powered as Class IE. We feel that the determination of the surge tank level is an important diagnostic tool for leak detection.

Although I didn't show them on this diagram, we have Class IC flow indicators on every significant heat exchanger on headers A and B. We also have a flow indicator on every heat exchanger on the C header which has a line size over 2", except for one which is isolated by a containment isolation signal. Some of these are local, and some are on the Main Control Board. These allow the operator to quickly locate and isolate leaks.

Although our design basis is the ability to operate given a long term single failure where the operator goes down and manually isolates the system halves, we felt that it would be wise to provide immediate capability to cut in or out heat exchangers. Therefore, we have motor operators on the discharge valves for the heat exchangers (FCV 430 and 431). They are Instrument Class II, but are seismically qualified, and powered and wired as Class IE devices.

We have Class IC radiation monitors on the system to detect radioactive leaks into the system. These monitors also isolate the system vent as a precaution.

In summary, the Instrument Classification System for Diablo Canyon meets all applicable standards, regulations, and guidance, and the actual implementation is more conservative than the classifications themselves.

LIST OF SLIDES USED IN T.N. CRAWFORD's PRESENTATION

Slide 1:	Diablo Canyon Instrumentation Philosophy
Slide 2:	Instrument Class IA
Slide 3:	Instrument Class IB
Slide 4:	Instrument Class IC
Slide 5:	Diablo Canyon Instrument Classifications
Slide 6:	"Table 1"
Repeat of Slide 1	Diablo Canyon Instrumentation Philosophy
Slide 7:	CCW System Basic Arrangement
Slide 8:	Class IA Automatic Functions
Slide 9:	Class IA Manual Functions
Slide 10:	Class IB Functions (All Type D)
Slide 11:	Contingency or Convenience Devices

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DIABLO CANYON
INSTRUMENTATION PHILOSOPHY

MOST IMPORTANT

- DEVICES WHICH PERFORM SAFETY FUNCTIONS THEMSELVES
- DEVICES WHICH THE OPERATOR USES TO PERFORM MANUAL SAFETY FUNCTIONS
- DEVICES TO MONITOR CRITICAL CONDITIONS
- DEVICES TO DETERMINE IF THE SAFETY SYSTEMS ARE WORKING
- DEVICES TO TROUBLESHOOT SAFETY SYSTEMS
- DEVICES NOT INVOLVED IN SAFETY SYSTEMS

LEAST IMPORTANT

INSTRUMENT CLASS IA

- DEVICES WHICH ACTUALLY PERFORM SAFETY FUNCTIONS
  1) INPUTS
  2) OUTPUTS
  3) MANUAL
- NRC
  - MEETS 10CFR50, PARA. 50.55 a(h)
  - MEETS SRP CHAPTER 7.1, 7.2, 7.3, AND 7.4
- INDUSTRY
  - MEETS IEEE 308 - 1974
  - MEETS IEEE 279, 323, AND 344
  - NO STANDARDS FOR MECHANICAL/PNEUMATIC PORTIONS

INSTRUMENT CLASS IB

- INSTRUMENTS TO ASSESS PLANT CONDITIONS

TYPE A	PREPLANNED MANUAL ACTIONS
TYPE B	SAFETY FUNCTION ACCOMPLISHMENT
TYPE C	BREACH OR POTENTIAL BREACH
TYPE D	SAFETY SYSTEM PERFORMANCE
TYPE E	RADIOACTIVE RELEASES

- NRC
  - MEETS REGULATORY GUIDE 1.97, REV. 2, DRAFT 2
  - WILL MEET R.G.1.97, REV. 2, FINAL VERSION, BY JUNE 1, 1983
- INDUSTRY
  - ENVELOPES ANSI/ANS 4.5 - 1980 AS MODIFIED BY R.G.1.97, REV. 2

INSTRUMENT CLASS IC

- INSTRUMENTS WHICH MUST MAINTAIN A SYSTEM PRESSURE BOUNDARY
- NOT SPECIFICALLY ADDRESSED BY NRC OR INDUSTRY STANDARDS OTHER THAN REFERENCES IN THE APPLICABLE PIPING CODES
- ISA's SP67.07 WILL ADDRESS INLINE DEVICES

DIABLO CANYON
INSTRUMENT CLASSIFICATIONS

IA ○ DEVICES WHICH ACTUALLY PERFORM SAFETY FUNCTIONS

1) INPUTS
2) OUTPUTS
3) MANUAL

IB ○ INSTRUMENTS TO ASSESS PLANT CONDITIONS

TYPE A	PREPLANNED MANUAL ACTIONS
TYPE B	SAFETY FUNCTION ACCOMPLISHMENT
TYPE C	BREACH OR POTENTIAL BREACH
TYPE D	SAFETY SYSTEM PERFORMANCE
TYPE E	RADIOACTIVE RELEASES

IC ○ INSTRUMENT WHICH MUST MAINTAIN A SYSTEM PRESSURE BOUNDARY

II ○ NOT REQUIRED TO PERFORM A SAFETY FUNCTION

TABLE 1

	Classification						
	IA	IB					IC
		Type					
Criteria		A	B	C	D	E	
1. Seismic[1]	Yes	Yes[2]	Yes[2]	Yes[2]	Yes[2]	No	No
2. Single Failure Criteria	Yes	Yes	Yes	Yes	No	No	No
3. Environmental Qualification	Yes	Yes	Yes	Yes	Yes	No	No
4. Power Source	IE	IE	IE	IE	EMR[3]	EMR[3]	-
5. IEEE Classification	IE	-	-	-	-	-	-
6. Display Type	-	Con[4]	Con[4]	Con[4]	OD[5]	OD[5]	-
7. Display Method	-	Rec[6]	Rec[6]	Rec[6]	Ind[7]	Ind[7,8]	-
8. Unique Identification	-	Yes	Yes	Yes	No	No	No
9. Periodic Testing	Yes	Yes	Yes	Yes	Yes	No[9]	No

Notes:

1) Applies to function. All devices must have qualified pressure boundaries if applicable to Class I Piping.

2) Seismic qualification for after seismic event.

3) EMR - Emergency Power, need not be battery backed.

4) Con - Continuous Display. Intermittent displays such as data loggers and scanning recorders may be used for multi-point parameters if no significant transient response can occur inside the recording interval.

5) OD - On Demand.

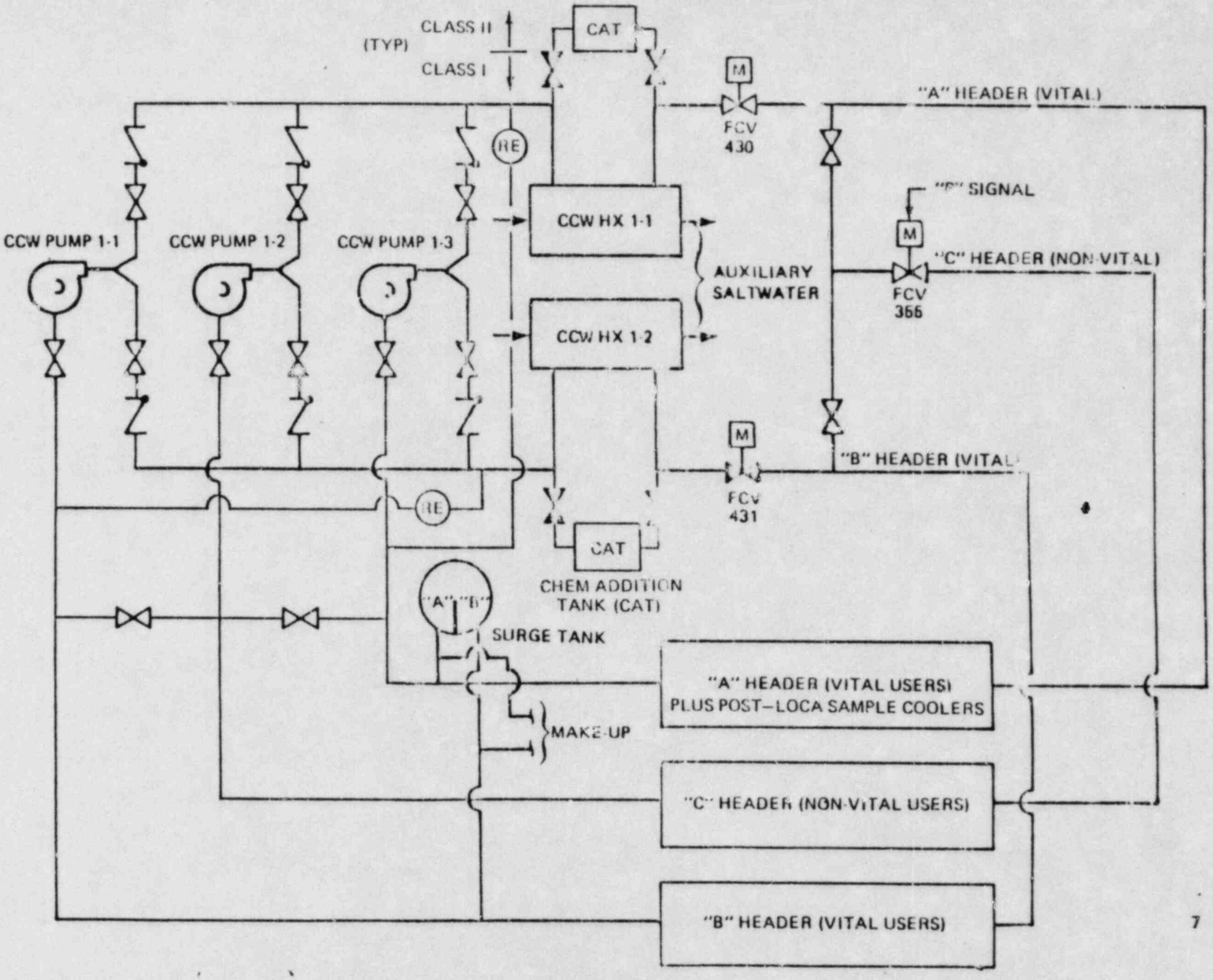
6) Rec - Recording for those parameters where trend or historical information is required to monitor the function.

7) Ind - Dial or digital indication.

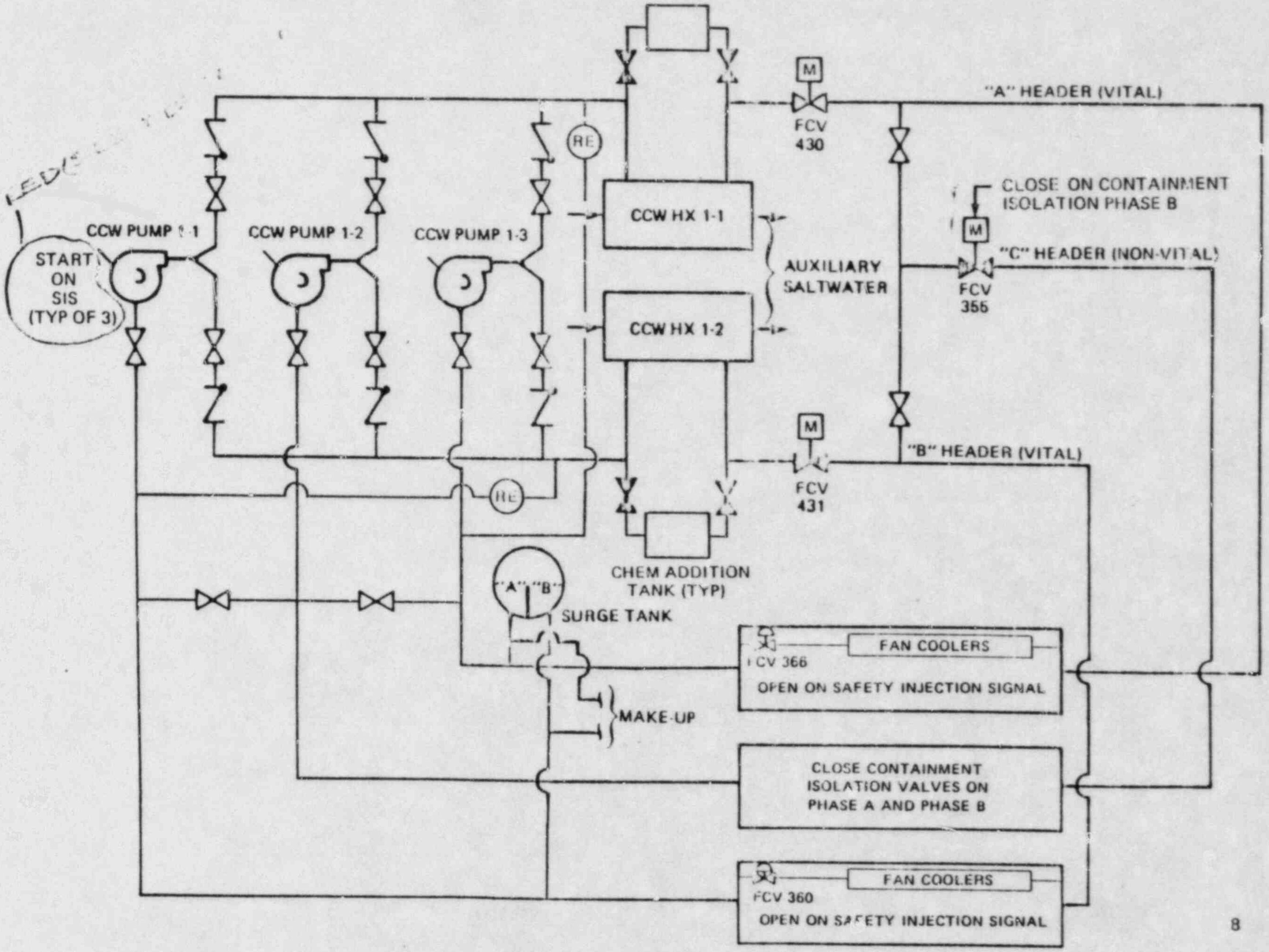
8) Effluent release monitors require recording. including effluent radioactivity monitors, environs exposure rate monitors, and meteorology monitors.

9) Radiation monitors shall be periodically tested.

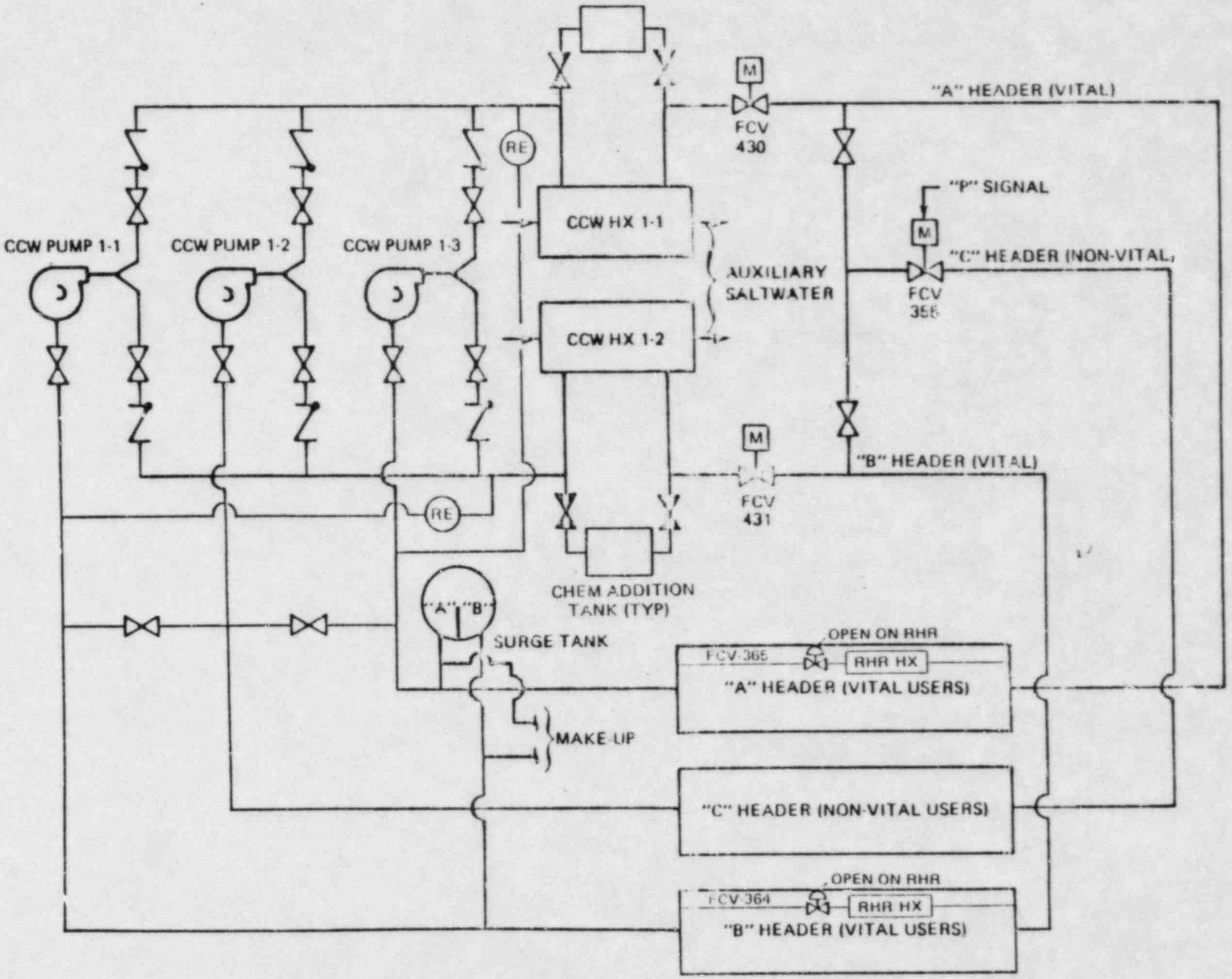
CCW SYSTEM BASIC ARRANGEMENT



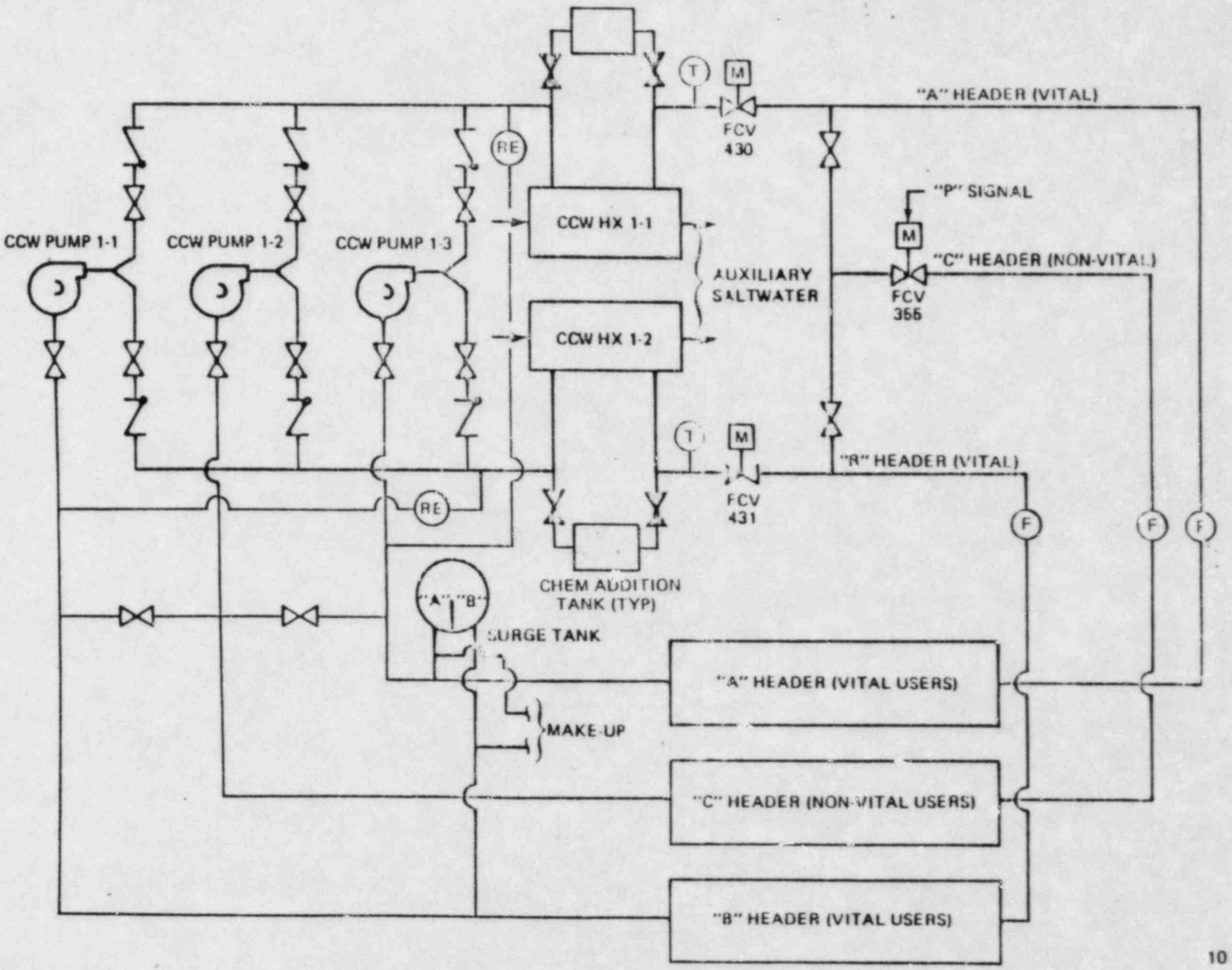
CLASS IA AUTOMATIC FUNCTIONS



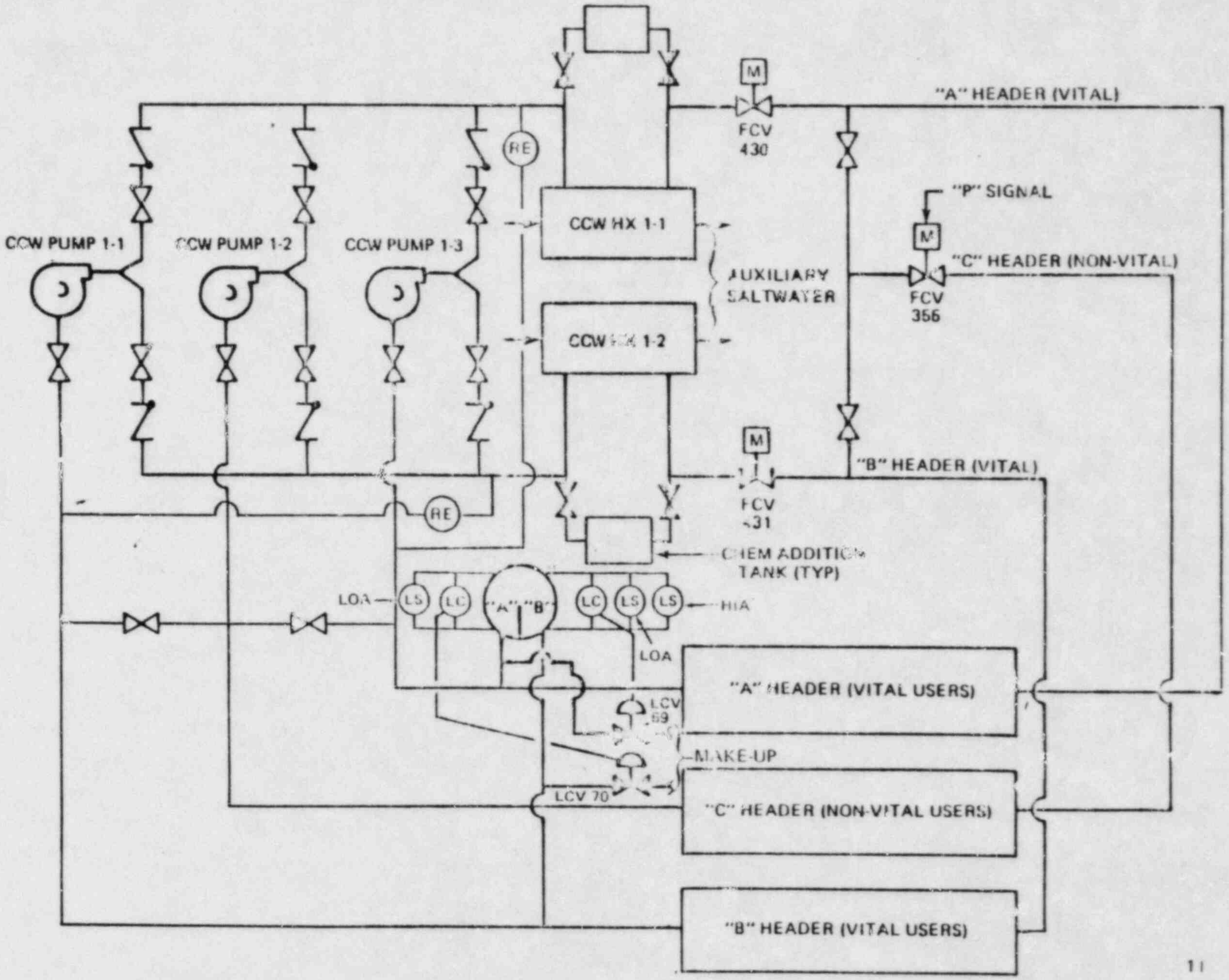
CLASS IA MANUAL FUNCTIONS



CLASS IB FUNCTIONS (ALL TYPE D)



CONTINGENCY OR CONVENIENCE DEVICES



Diablo Canyon unit 1

Component Cooling Water System
Phillips Building - Room P-118
Bethesda, Maryland
January 28, 1983

BASIC OPERATION
OF THE
COMPONENT COOLING WATER SYSTEM
INCLUDING CONTINGENCY MODES OF OPERATION

Presented By
Jim Tinlin

Introduction

Jim Tinlin holds a current Senior Operator License on DCPP Unit 1, and has had previous experience as a simulator instructor at Westinghouse Nuclear Training Center, Zion plant.

He is currently acting in the Capacity of Training Coordinator in the Operations Training Section.

This presentation will cover basic operation of the system, including contingency actions during abnormal operation, and emergency operations.

I. PRESENTATION

A. Normal Operation of the CCW system is broken into two basic catagories: At power and plant cooldown.

1. At power operation (Slide 1): During normal operation, the system heat load is removed by operating two CCW pumps and one CCW heat exchanger. All heat loads may be supplied by cooling water, although not all will be. Components which are not used during normal operation are those such as RHR heat exchangers, safety injection pump seal water coolers, etc.

   The standby heat exhanger will be available for immediate use by being filled/vented and pressurized up to the outlet valve. All pump suction valves, crosstie valves (both suction and discharge, and heat exchanger crosstie valves) will be open.

   Normally, to equalize run times, the pumps and/or heat exchangers are changed over weekly. This ensures operability of the system and enhances overall reliability and equipment availability.

2. During plant cooldown (Slide 2) the idle heat exhanger and standby CCW pump is placed in service due to the increased heat load on the system by the RHR heat exchangers.

   Once the Reactor Coolant has been cooled down to less than 140°F the CCW system can be returned to its original configuration.

B. Abnormal Operation of the system is broken down into two basic contingency actions:

1. (Slide 3) High heat exchanger outlet temperature will alarm at the control board (120°F) to clue the operator into the fact that either excessive heat load has been placed on the system or a flow reduction has occured.

   The operator has several immediate actions he will perform:

   a. Check the temperature indication on the control board to verify the condition.

   b. If the heat load is too high, the standby heat exchanger will be placed in service.

   c. ASW flows will be checked to ensure sufficient flows.

2. CCW leakage out of the system will be indicated by either low CCW surge tank level alarms or CCW low header pressure alarms.

   Automatic actions that will occur on the above are: Standby CCW pump starts and/or makeup valves open to raise CCW surge tank level.

Immediate operator actions include:

a. Verify automatic actions take place, if they don't the operator will manually perform them.

b. Start an additional makeup water transfer pump if required (one normally running).

c. If level is lost in both halves of the surge tank, trip the reactor and reactor coolant pumps.

Subsequent actions include:

a. If level is lost in only only half of the surge tank, separate the system and run the system on one "train".

b. (Slide 4) determine the source of leakage and isolate.

C. Emergency Operation is considered to be during a LOCA and Post LOCA conditions.

1. During a LOCA (Slide 5) a safety injection signal starts all three CCW pumps to protect against a single active failure. Also, during a safety injection signal a Phase A containment isolation signal is generated which isolates most process lines in and out of containment which will significantly reduce the normal heat loads.

If a Phase B containment isolation signal is generated (as during most large LOCA's and certainly during the design basis LOCA) the miscellaneous header 'C' supply, Reactor Coolant Pumps, and vessel support pad coolers are isolated.

Operators are required, during a LOCA condition (EP OP-0), to verify the above conditions occur and manually back them up if necessary.

2. Post LOCA conditions (<u>Slide 6</u>) require the safeguards systems to be separated into redundant trains to prevent loss of the entire system in the event of a single passive failure. This procedure specifically states when this must be done and the valve lineups required.

   Basically, both heat exchangers are in service (one supplying each vital header), one pump is aligned to one vital header and the other pump(s) are aligned to the other vital header (and/or header C as necessary).

   If a failure has occurred on header C (<u>Slide 7</u>) the loop will be manually valved out of the system to maintain the integrity of the vital loops A and B.

REFERENCE

1. Plant Manual, Volume 2 (Operating Procedures), OP-F2 CCW System.

2. Plant Manual, Volume 3 (Emergency Operating Procedures) EP-OP-11 Loss of Component Cooling Water.

3. Plant Manual, Volume 3 (Emergency Operating Procedures) EP-OP-0 and EP-OP-1 Safety Injection and LOCA.

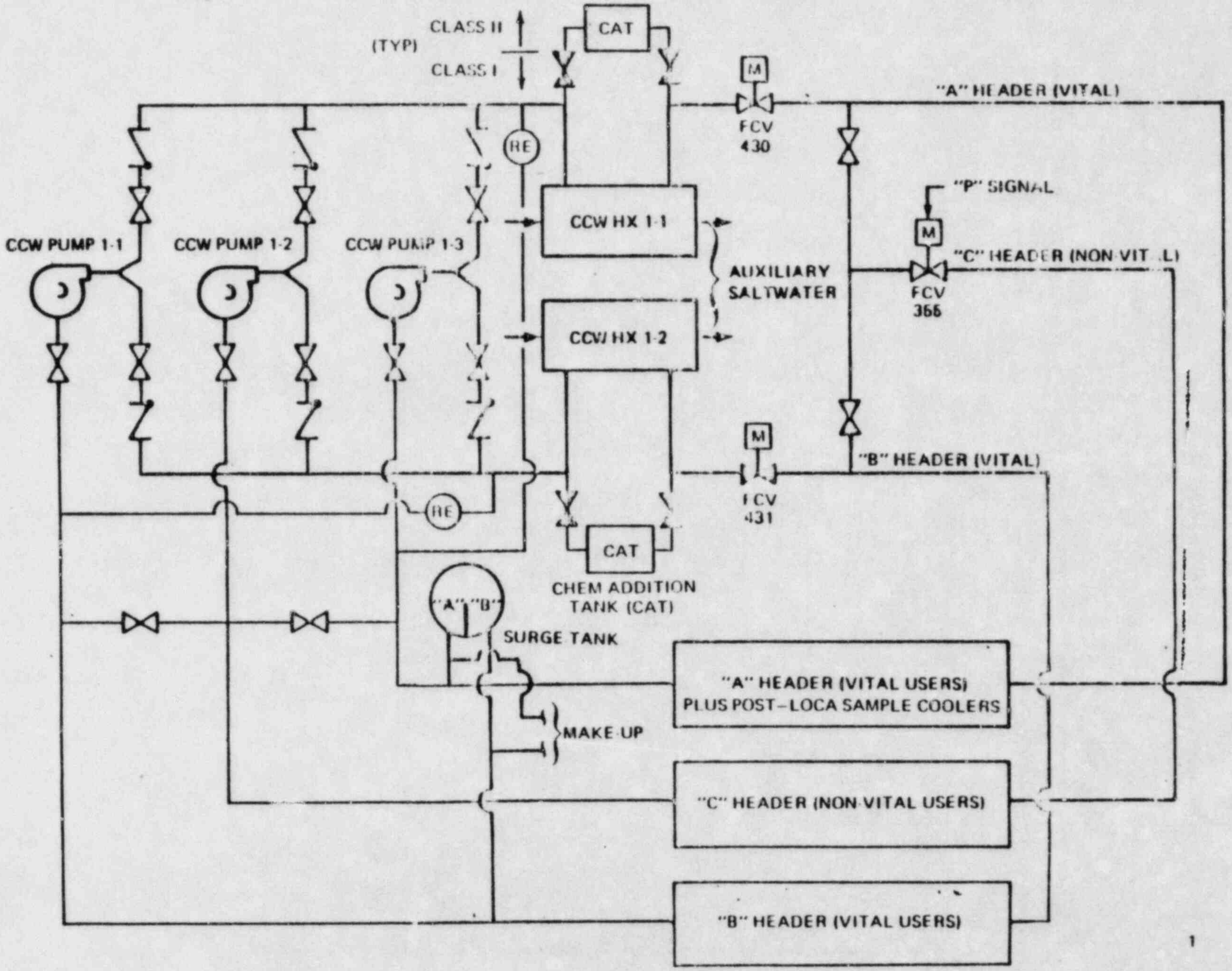
4. Plant Manual, Volume 11 (Annunciator Response Manual), Annunciator windows PK 01-06, -07, -08, -09 (Various alarms associated with CCW system).

5. Diablo Canyon Power Plant Piping and Instrumentation Drawings 102014: CCW System.

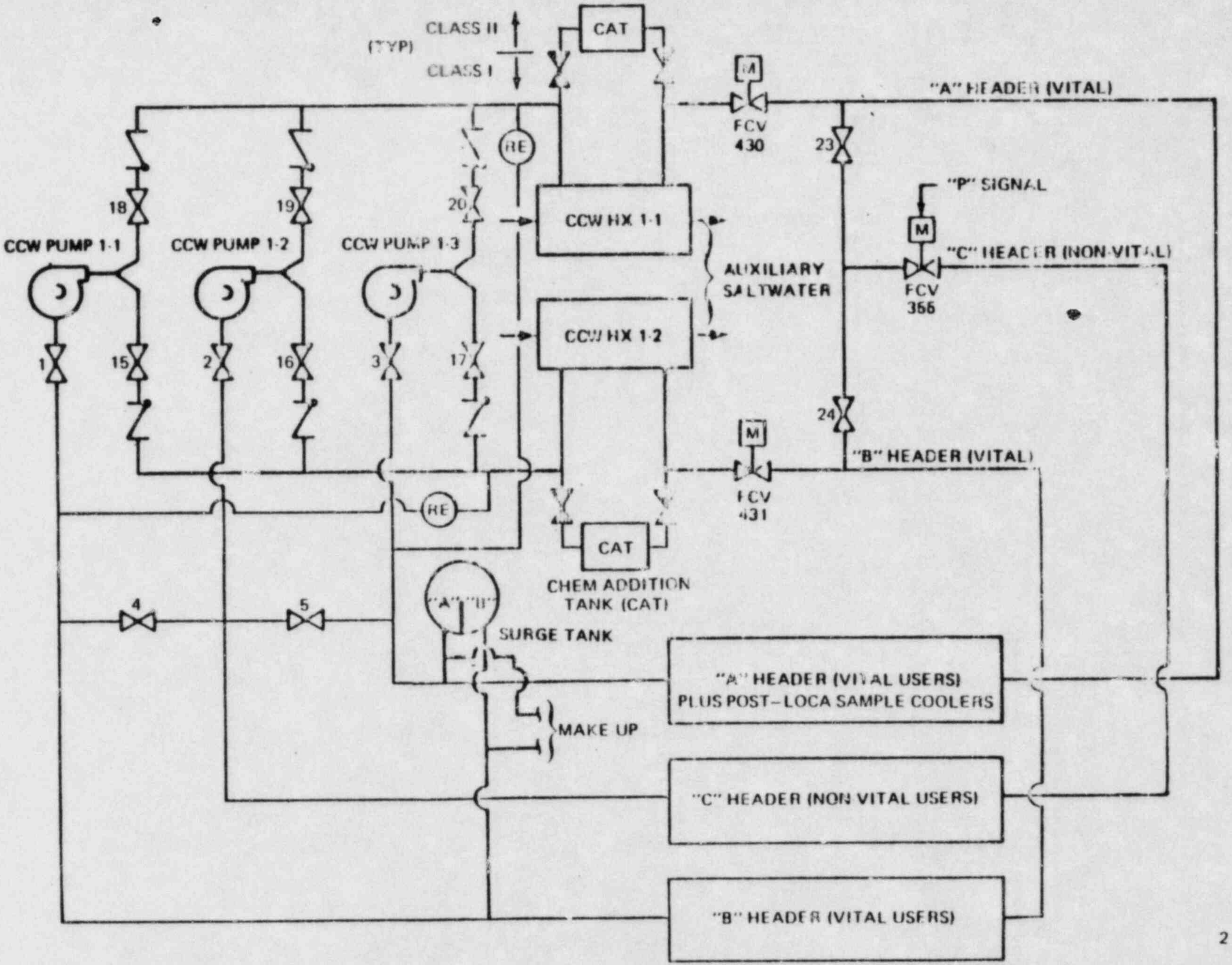
LIST OF SLIDES USED
IN JIM TINLIN'S PRESENTATION

Slide 1:	CCW System Normal Operation
Slide 2:	CCW System Normal Operation During Cooldown
Slide 3:	CCW System Abnormal Operation
Slide 4:	Typical Component Isolation Arrangement
Slide 5:	CCW System Safety Injection ("S" Signal)
Slide 6:	CCW System Recirculation Post-LOCA (with "C" Header)
Slide 7:	CCW System Recirculation Post-LOCA (without "C" Header)

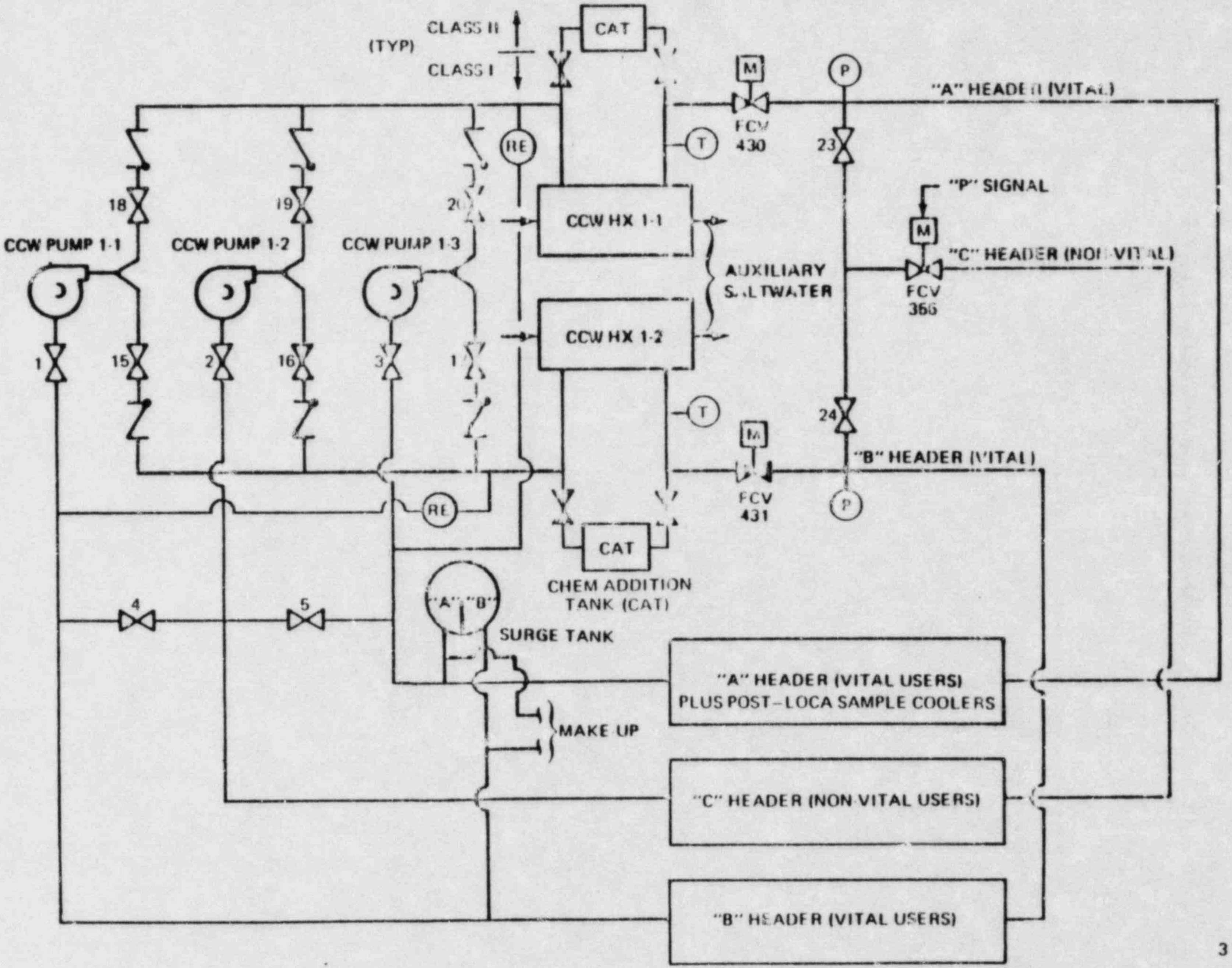
CCW SYSTEM NORMAL OPERATION



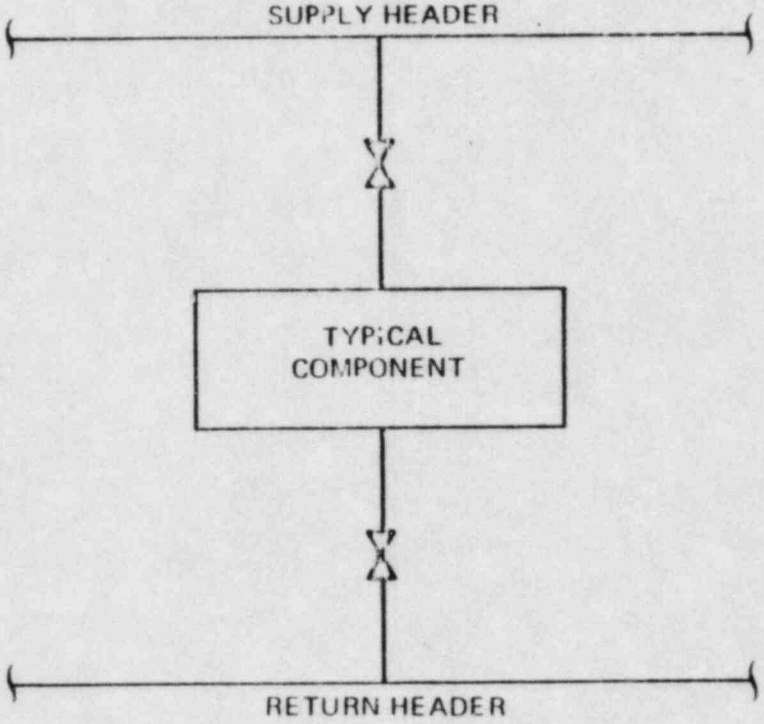
CCW SYSTEM NORMAL OPERATION DURING COOLDOWN



CCW SYSTEM ABNORMAL OPERATION

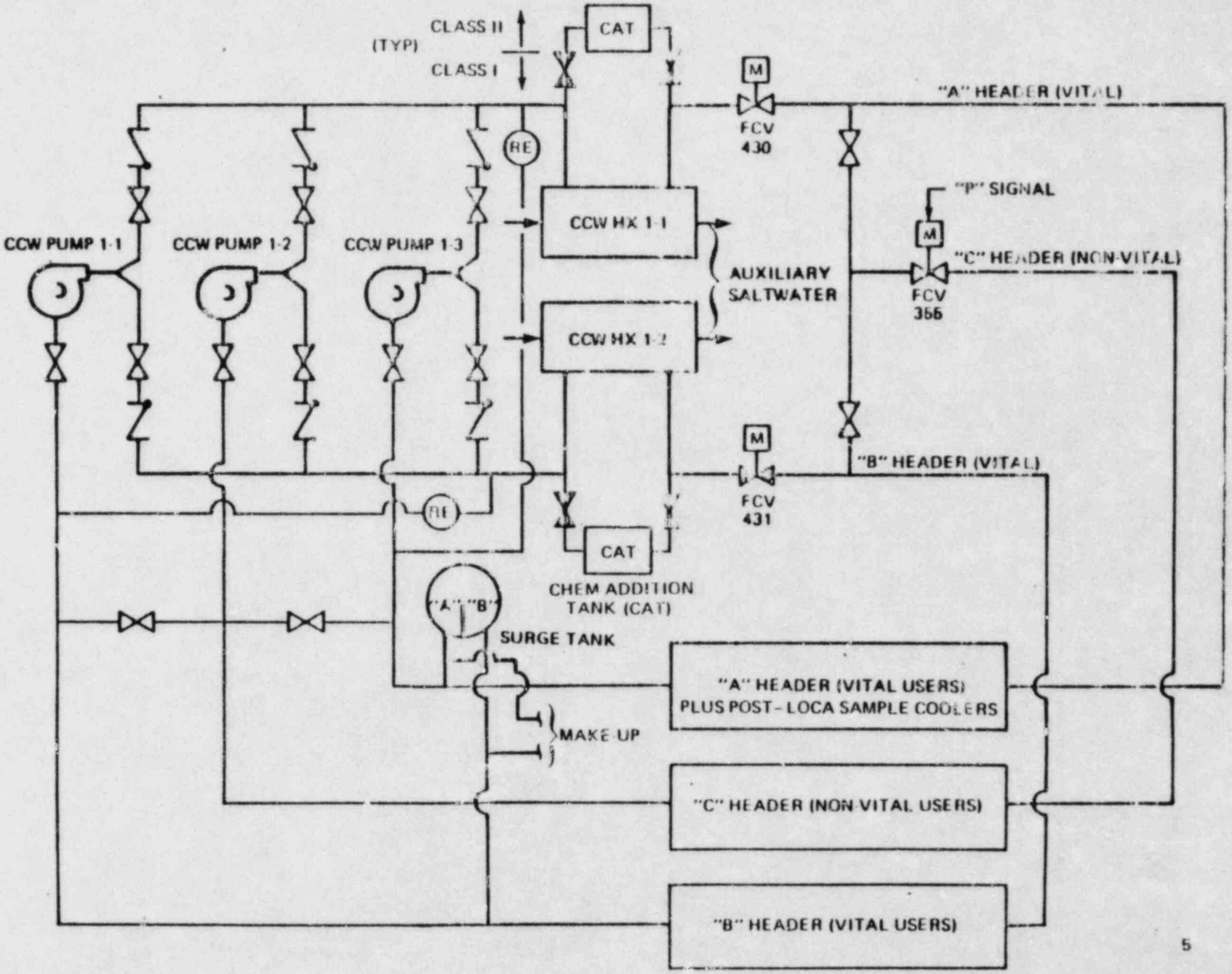


TYPICAL COMPONENT ISOLATION ARRANGEMENT

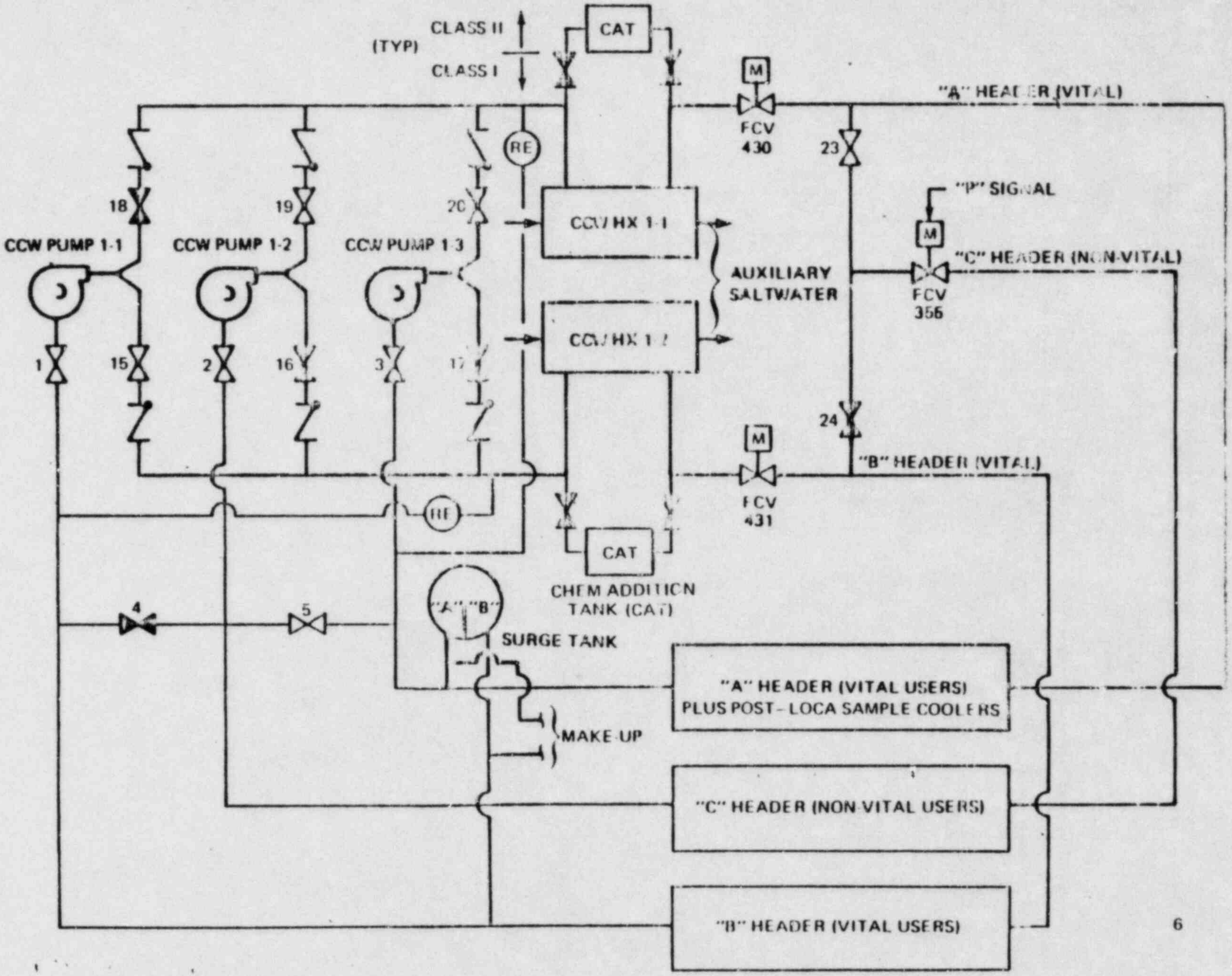


ALL PIPING AND ISOLATION VALVES ARE CLASS I

CCW SYSTEM SAFETY INJECTION ("S" SIGNAL)



CCW SYSTEM RECIRCULATION POST-LOCA (WITH "C" HEADER)



CCW SYSTEM RECIRCULATION POST-LOCA (WITHOUT "C" HEADER)