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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

UNITED STATES DEPARTMENT OF ENERGY
PROJECT MANAGEMENT CORPORATION
TENNESSEE VALLEY AUTHORITY

Docket No. 50-537 CP

(Clinch River Breeder Reactor Plant)

Location: Oak Ridge, Tennessee

Pages: 8700 - 8884

Date: August 11, 1983

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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In the matter of: :

UNITED STATES DEPARTMENT OF ENERGY :

PROJECT MANAGEMENT CORPORATION : Docket No. 50-537-CP

TENNESSEE VALLEY AUTHORITY :

(Clinch River Breeder Reactor Plant) :

- x

Holiday Inn
420 S. Illinois Avenue
Oak Ridge, Tennessee

Thursday, August 11, 1983

Hearing in the above-entitled matter was reconvened, pursuant to adjournment, at 8:30 a.m.

BEFORE:

MARSHALL E. MILLER, Chairman
Administrative Law Judge

GUSTAVE A. LINENBERGER
Administrative Judge

CADET HAND, JR.
Administrative Judge

APPEARANCES:

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Department of Energy
Washington, D.C.

On behalf of the NRC Regulatory Staff:

SHERWIN E. TURK, Esq.
Senior Litigation Attorney
Office of Executive Legal Director

C O N T E N T S

E X H I B I T S

P R O C E E D I N G S

JUDGE MILLER: Are we ready?

Mr. Edgar, you had certain matters with reference to exhibits you wanted to put on the record; is that correct?

MR. EDGAR: Yes, sir. Because the bulk of the exhibits which we find, in terms of Applicants' exhibits, occupy about 30 cartons, we believe the most convenient thing and manageable process for the Board would be for us to ship the four sets of our exhibits that have been admitted into evidence, the bulky ones. The four sets will consist of Applicants' Exhibits 59 through 86, 88, 90 through 93.

Applicants' Exhibits 87, 88, 94, and 95 have been admitted into evidence and bound into the transcript, and numbered sequentially.

That leaves two additional Applicants' exhibits, Exhibit 96, which is the Marshallese Islands data report, the Brookhaven report.

Four copies have been furnished to the reporter, and we would have that stay with the reporter, and, secondly, Exhibit 97, which is Mr. Bowman's statement of professional qualifications, likewise four copies have been furnished to the reporter so that the four sets furnished to the Board by shipment will be missing six exhibits.

Those are 87, 89, 94, 95, 92, and 97. Those all would be with the reporter either in the transcript or separately.

JUDGE MILLER: Right. I think that sticks with our records, so that will account, then, for all of the Applicants' exhibits, at least so far.

MR. EDGAR: Right. Yes, sir.

JUDGE MILLER: Very well. Anything further now for the record before we go back to the interrogation of witnesses?

MR. TURK: One preliminary matter, and then I'd like to go off the record.

JUDGE MILLER: We are off the record.

(Discussion off the record)

JUDGE MILLER: All right. We'll go back on the record.

Staff counsel, Mr. Turk, has indicated that there was one communication received by myself as Chairman, which I caused to be circulated among all of the parties on the distribution list as an ex parte communication.

I think we will probably have that document appropriately marked and made a part of the record as we do with all written statements, limited appearance statements of that kind, so, Mr. Turk, do you have or can you get a copy that will be furnished to the reporters for that purpose?

MR. TURK: I have one copy I can give to the reporter now, if that's sufficient.

JUDGE MILLER: Yes. That will probably have to be Xeroxed in order to become part of the record.

(The document referred to follows:)

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July 20, 1983

Turk/Mizuno
Karman/Treby
II
FF

318 Summit Ave. #3
Brighton, Mass. 02135

50-537

Marshall E. Miller, Esq.
Administrative Judge
Atomic Safety & Licensing Board
U. S. Nuclear Regulatory Commission
Washington D. C.

SERVED JUL 28 1983

Re: COMMENT UNDER 10 CFR 2.715, CONSTRUCTION PERMIT PROCEEDING, CLINCH RIVER BREEDER REACTOR, DOCKET 50-537.

Gentlemen:

The undertaking of licensing the Clinch River Breeder Reactor is a disquieting one to this private citizen. This reactor system is currently one of a kind. As a citizen Intervenor in the Allens Creek construction permit proceeding (of which I am happy to say Mr. Gustave Linnenberger was a member of that panel) I heard of many problems and many "fixes" that went into a "standard" General Electric boiling water reactor. Allens Creek was to be perhaps the thirtieth boiling water slated for construction, and nature had grudgingly yielded secrets of the design.

Here, the Board and parties will hopefully be able to reach these problems before they occur thus producing a a safe operating record. I personally criticize the Applicant for pursuit of the Clinch River plant when the evidence is scant for its need. But, this aside, there is so little prior experience with the breeder reactor design compared with the boiling water reactor design, that the burden is heavy on those who would have this project go forth.

(Please circulate this statement to those on the project service list, and place a copy in the record of the proceeding. Thank you.)

Sincerely,

John F. Doherty

John F. Doherty

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of PROJECT MANAGEMENT CORPORATION TENNESSEE VALLEY AUTHORITY (Clinch River Breeder Reactor Plant)	)))))))))	Docket No.(s) 50-537

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document(s) upon each person designated on the official service list compiled by the Office of the Secretary of the Commission in this proceeding in accordance with the requirements of Section 2.712 of 10 CFR Part 2 - Rules of Practice, of the Nuclear Regulatory Commission's Rules and Regulations.

Dated at Washington, D.C. this
28th day of July 1983.

Peggy K. Downing
Office of the Secretary of the Commission

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
PROJECT MANAGEMENT CORPORATION	)	
TENNESSEE VALLEY AUTHORITY	)	Docket No. 50-537
USERDA	)	
(Clinch River Breeder Reactor Plant)	)	

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Anything further of a preliminary nature?

All right. If not, we'll resume the questioning of the witness panel.

Cood morning, gentlemen.

MR. EDGAR: Judge Linenberger, before we begin, I wondered if -- the Board's basic question yesterday had to do with whether the systems described in the testimony . .e workable.

I think one thing missing here might be the experience that we have already had. The systems have been in place for nine years, and I wonder if the witnesses might step back a second and give a very short description of some of that experience.

JUDGE LINENBERGER: Well, you're anticipating a line of questioning --

MR. EDGAR: Okay, I'm sorry.

JUDGE LINENBERGER: -- that will come a little later. We're not quite done with these gentlemen; however, Mr. Edgar, you provided us yesterday, I think, with what I think is a very useful backdrop to this discussion by way of your explaining the certain aspects of the quadripartite organization and structure, and some of the details about that that are of interest as a foundation to our understanding of the quality assurance program.

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Let me ask two questions further, one of which you may have answered yesterday, but if you did, forgive me.

If and when the Clinch River Plant is built and goes into operation, at that time who will be the owner or owners of record of the plant?

MR. EDGAR: Under the existing arrangements which are described in Applicants' Exhibit 86, the Department of Energy is the owner. The property, the plant hardware, is owned by the United States, and the Department of Energy is the custodian for the United States.

Likewise, the site is transferred to the Department of Energy from the Tennessee Valley Authority, so it would be owned by the United States in the custody of DOE.

Let me -- I'm speculating here, now, if you'll allow me to draw the line here between -- I'm giving you existing fact now. If the other forms of financing come in, there may, and I can only say may, it's speculative, there may be ownership interests in others than the United States. That would have to be reflected in an amendment to the application; however, there won't be any change in control from the management or safety standpoint.

end 1

JUDGE LINENBERGER: Okay. Now, leaving that speculative aspect aside for the moment, this DOE ownership, would that obtain throughout the entire lifetime of the plant, again leaving aside the speculative nature?

MR. EDGAR: Well, under the existing arrangements, the Department of Energy is the owner of the plant--the United States is the owner of the plant, with custody in the U. S. Department of Energy.

At the end of the five-year demonstration period, TVA has the option to purchase the plant at a mutually agreeable price, so that one could have an ownership transfer at that point.

On the other hand, if that should not come to pass, the Department of Energy would have the option to continue operation or do as it pleases. It would then remain the owner.

JUDGE LINENBERGER: At the initiation of operation of the plant, does the supervisory or managerial role, whichever is a better word, of Project Management Corporation change?

MR. EDGAR: No, sir. The management responsibility for the project is in the United States Department of Energy Clinch River Breeder Reactor project office. Some of the employees of the project office are PMC personnel, but DOE is the lead manager and sole manager of the project.

Pursuant to the project agreements, which are again in Exhibit 36, the Tennessee Valley Authority would operate the plant for the project office.

There is a separate agreement that defines those responsibilities. TVA would provide all of the plant operators and the know-how and the management skill to operate the plant, subject to the management direction of the CRBRP project office, so there is a single-point contact, and there is still the responsibility and control.

JUDGE LINENBERGER: And do those relationships change in any substantive way after the demonstration program is completed, let's say?

MR. EDGAR: That could happen in this sense: Let's suppose that TVA exercises its option to purchase the facility. If that should occur at the end of the five-year life, then TVA would take over ownership and operation of the plant, and at that point the Clinch River project office would not have reason to exist. It would be a TVA reactor, as with any other reactor on the TVA system.

JUDGE LINENBERGER: Fine. That helps with our perspective, what we are talking about now.

Let me say to you gentlemen-- Before I say what I am about to say, one further question. I'm sorry, Mr. Edgar.

Within PMC, who is the senior-most corporate official, by name, currently with day-to-day line authority for this program?

MR. EDGAR: The chief operating officer for day-to-day operations of the Clinch River Breeder Reactor plant is Mr. Percy Brewington, who is a U. S. Department of Energy official, who is the project official. He sits in Oak Ridge and has final authority over project decision making.

Within Project Management Corporation, Mr. Bill Rolf is general manager. He and his personnel report to Mr. Brewington.

JUDGE LINENBERGER: Who does Mr. Brewington report to?

MR. EDGAR: Mr. Brewington reports to Mr. Joseph LaGrone, who is the head of the U. S. Department of Energy, Oak Ridge operations office.

JUDGE LINENBERGER: Is he an officer?

MR. EDGAR: No, sir.

JUDGE LINENBERGER: Well, I guess I should be reading more and talking less, but who is president of PMC?

MR. EDGAR: The president of PMC is Mr. Wallace B. Bankey, who is vice chairman of Commonwealth Edison Company. PMC is a corporation which provides personnel and money to the project. PMC does not have management control of the project in any way, shape or form, other than its personnel who report to Mr. Brewington may have decision-making authority, but there is no decision-making authority there independent of Mr. Brewington.

JUDGE LINENBERGER: All right. Thank you.

It probably need not be said, but I would like there to be no question about the fact that the Board considers that the importance of this project's quality assurance activities during construction and into operation are of, I would say, nearly equal importance to our concern for the health and safety of the public; that is, we in no way take this discussion of quality assurance to--in no way view it to be a matter of window dressing to get you a construction permit, and I hope nobody involved in this project in whatever capacity, in whatever agency, would so view it.

It is an extremely serious matter, and you gentlemen have a heavy responsibility, and the Board hopes that all of you well understand that money spent properly in quality assurance efforts is going to well pay off in money saved later in how well the plant is built and how well it performs.

JOE ANDERSON,

JOEL KARR,

VERNON DALE HEDGES

and

GEORGE CLARE

were called as witnesses on behalf of the Applicants and, having been previously duly sworn, were examined and testified as follows:

BOARD EXAMINATION

BY JUDGE LINENBERGER:

Q Well, we left off yesterday afternoon with I believe some discussion about what you gentlemen have called OPDD and the magic shelfful of material that comprises the OPDD, and I believe you indicated to us that that documentation, while supportive of and an integral part of the so-called management policy and requirements document, is indeed physically a separate set of documents, sets of which are maintained within all of the cooperative and involved functional operations, such as the A-E group, the constructor of the reactor, manufacturer, and so forth.

The management policies and requirements document, as well as the project status and control system documentation, seem to me to be extremely important to the smooth running of the quality assurance effort.

What I am leading up to is to inquire of you gentlemen, whoever wishes to discuss this, what efforts have been taken and are taken to assure that the information contained in these documents and the operational guidelines, communication directives, and so forth, that these things are well known to and indoctrinated into the personnel that have to implement these things.

It doesn't do much good to have it sitting on a shelf if very few people know what's in it and go their own

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way when they have a problem.

How ingrained--do the people that implement quality assurance know that these are their guidelines, these are their fences that constrict them?

A (Witness Hedges) The project has an audit system that is in practice at the project office level and at the participants' level, in which the participants and the project office audit the implementation of the MPR requirements and audit the accuracy of the PS and CS.

Also when changes come out to the MPR, those changes are reviewed with all of the operating organizations at the time they come out.

A (Witness Clare) I could add to that, perhaps.

Q Please.

A From a slightly different perspective, which is that of a contractor organization which is responsible for implementing the requirements of the MPR, we prepare specific procedures by which our organization will implement the requirements of the MPR, and we do have a formal training program by which, through periodic meetings, there is distribution of memoranda, et cetera. The employees of our organization are trained in how they should operate in accordance with those procedures. Then it is their operation in accordance with those procedures which is audited by Mr. Hedges and others to ensure that we in fact comply with the MPR.

End 2

Q All right, sir.

Do I understand correctly that Burns & Rowe is the architect-engineer?

A (WITNESS HEDGES) That's correct.

Q Now, Mr. Clare just contributed something worthwhile, I think, in response to my question, but I'm not sure Mr. Clare speaks for Burns & Rowe.

Do any of you gentlemen -- and Burns & Rowe I just pull out of the air as one part of the activity -- do you gentlemen know firsthand that Burns & Rowe has the equivalent kind of training and familiarization program that Mr. Clare just spoke about?

In other words, I'm trying to get a feeling. Is this familiarity, understanding, and ingrained rigor that is imposed by the MPR, is this really permeating throughout the entire complex of organizations that support this project?

A (WITNESS HEDGES) Burns & Rowe also has a procedure system, as Mr. Clare mentioned. As MPR changes come out, they're implemented in the procedure. Burns & Rowe also has a formal training program which includes listing everyone who should go, and make-up sessions for those who don't happen to be in plant at the time the first session is given.

j-3-2

All people who are involved in the implementation of that MPR change do receive training.

A (WITNESS ANDERSON) Could I add a point to this discussion?

Q Go ahead.

A These points have kind of focused on the taking of the MPR issued and implementing it as an increment of the MPR, but I think very germane to the understanding of how the project participants have, in fact, implemented the MPR as a way of life in the project, one has to recognize that the MPR has been with the project for over ten years, actually, and it actually evolved into this project --

JUDGE MILLER: Pardon me. I think we'll take a recess at this time. I want to find out what this kitchen business is going on here. I'm not going to go all day with this clattering going on.

Let's take a recess.

(Recess)

JUDGE MILLER: All right. We'll resume.

I'm sorry to have interrupted you in mid-response. Do you want to start over with your answer, or can you recall where you were?

WITNESS ANDERSON: Maybe I can pick up about where we were.

JUDGE MILLER: Fine.

WITNESS ANDERSON: The point I was trying to make was the project MPR, the management policies and requirements have really been with the project from its beginning. It even had roots in an earlier project, the FFTF project, and the kind of methodology that was established with the management of the project. So it came into the project and the project participants have in fact been living with it since their entry into the project back in the early '70s. And each of those participants, including the project office, has developed within their own management systems sets of procedures that implement the policies and requirements of the project, and all of those procedures have been reviewed and have been found acceptable as implementing the project's management policies and requirements. And over the years as the design has been accomplished and as the procurement and manufacturing has been accomplished, there has been a rigorous audit surveillance verification practice that's been accomplished by both the project office and the major contractors to verify that those procedures were being implemented and executed in accordance with the project's management policies and requirements.

That's been going on, and it's really been a way of life. The evolving pattern of how those requirements were established and how each of the organizations put them into procedures and executed them, oriented their people to the establishment of them, and then implemented them as an ongoing process.

BY JUDGE MILLER:

Q Let me get to perhaps a peripheral matter. While it's been going on, all this ongoing activity, purchasing and so forth, could somebody give us a brief description of what's gone on, what you've bought and so forth? We don't have much idea although we know there have been substantial appropriations through the years.

Just give us a brief summary, if you will, hardware and software and so on, which will enable us to apply that to the procedures you just described.

A (WITNESS CLARE) A very major portion of the plant design has been completed, on the order of 90 percent. Of course, the remaining 10 percent must be completed, and as we get into the fabrication and construction phase, there will be modifications and adjustments that have to be made to the design as it exists today.

A major portion of the long-lead equipment items have been ordered.

Q What are those, for example, the long-lead?

A The long-lead items are those items which take a number of years to complete the detail design, order materials, machine material, and fabricate the items. A prime example is the reactor vessel.

Q Where is the reactor vessel? Is that on site now?

A The reactor vessel now is in storage at the Mount Vernon, Indiana, facility of Babcock & Wilcox.

Much of the heat transport equipment has been fabricated and is either nearing completion or is completed. The other types of equipment in the plant, for example, the instrumentation and control equipment, is perhaps not quite so far along, since it is not as much of a long-lead type of item, but those system designs are being completed.

Some fabrication has begun, and, in fact, has been completed on those items. Much of it is yet to be done.

JUDGE MILLER: Thank you.

BY JUDGE LINENBERGER:

Q Well, sir, you stressed, and I think properly so, that this quality assurance framework and its functioning and the effective functioning of it are not matters new to the current project organization. It is something the project has been living with for quite some time. Let me inquire in a belated way here with respect to background experience, has -- to what extent, if any, has the experience of DBA over the years in quality assurance, especially with respect to their nuclear plants, been reviewed for lessons to be learned or be adopted or be critiqued as how to or how not to do things?

Can any of you speak to that?

A (WITNESS ANDERSON) I can speak to it briefly. TVA as a partner in the project did make available to the project organization early on, in the early '70s, its technical information in terms of its design and manufacturing specifications for components. It did make available its procedural information with regard to management systems. That was evaluated and was reflected in the development of the project's early on design, particularly in the balance of plant rather than in the nuclear design itself, and that experience of their early years was factored into the planning stages of the project early on.

Since that time, TVA has made available its functioning experience, both in the plants and in the design and construction of its projects, and that has been monitored by the project itself in terms of how that experience has come about, and the lessons that could have been learned from it, and factored into the project's management system as it has evolved.

Q We pretty much have been talking generalities, and generalities that for the most part involve relatively high-level people and relatively responsible positions.

The news outlets, the trade journals, a variety of publications in the last few years have highlighted a number of what I will personally characterize as horror stories--I don't say that in a sense that I know them to be true; I say that in a sense that if they are true, they are horrible--that involved, for instance, the question of whether a welder's qualification really means anything, or did somebody sign off on a test acceptance form for him and say, "Get to work. We need the job done."

Welder inspectors, it is alleged, have been encouraged at times to pass things that may not be quite what middle or upper management would like to see passed.

Cutting of corners at the field job site level has come back to plague the reputation and the pocketbooks of the people that have been building certain other nuclear plants.

Mr. Karr, I believe you're associated with Stone & Webster, and if I understand correctly, they are responsible for construction, is that correct?

A (Witness Karr) That's correct.

Q Can you comment on the kind of thing I'm talking about to indicate why it is that Mr. Brewington, who Mr. Edgar identified earlier this morning, should expect any better performance on site at Clinch River than has occurred or may have occurred as reflected by some of these so-called horror stories that I have alluded to?

A Well, I think by definition Mr. Brewington should expect better performance than some of those other situations; however, during the course of the project, not only Stone & Webster as a constructor, but the overall project has reviewed each of the situations that's come up at the other plants, the other projects that have achieved some notoriety through the press, to determine, to the best of our ability, what the causes, the ultimate causes for their problems were for the situations, to determine for ourselves what kind of actions and activities would be required in order to avoid that situation ever occurring at Clinch River, and then going back and reviewing the management organization, the management systems, the methodology that we have on the project, to assure ourselves that we will avoid getting into the kinds of situations that have occurred on the other projects. That has included not only the construction activities, but also the entire spectrum of designers and manufacturers.

With the experience around the country at the present time, we feel that we have done a very in-depth review of potential problem areas, and assured ourselves that we are not going to have those kinds of problems.

Q I was a little interested in the basis for your introductory comment that by definition Mr. Brewington should expect things to go better.

Did you have anything specific in mind there that caused you to say that?

A Only that in Mr. Brewington's position, I think, at least as a personal opinion, I would expect the project to be executed perfectly.

Q Well, those kinds of expectations are certainly laudable. As I'm sure all of you are well aware, they require darn hard work and attention to detail to make them come true, but so be it.

The Board asked about, in a prior communication to the parties, and the testimony here responds to an interest in how various systems and components of the plant are graded with respect to their relevance to safety and what the implication might be of that grading or categorizing of various parts of the facility, what the implication might be to the quality assurance--the level of quality assurance attention or the kind of quality assurance program that is invoked to follow those various categories of systems, components, et cetera.

Now, as I say, the testimony has--I realize has addressed this. I wanted to get specific about something, though.

If I look at the figure on page 23 of your testimony, I see a listing of nine--an indication that there are nine types of programs, and there is a discussion on the following pages that gives some for instance components and what type of program will be used to follow those components.

Can you cite for me a document that lists and defines these Type 1 through 9 programs? Where, if I wanted to go read about them, should I look?

A You would go look in the management policies and requirements document.

Q Boy, that sounds like an awfully important document. Everything is in there. But they are defined there?

A Yes, they are.

Q Where does Westinghouse, for example, look for guidance if it has a question as to which QA program type ought to apply to a particular piece of hardware that's under their scope of work?

A Again, they would look for guidance to the MPR for that.

Q All right. Now, I can envisage a Westinghouse engineer saying, "Gee, it is obvious to me where this component fits in the overall scheme of things, what its duty is, what its relationship is to safety. I decree that it is a Type 2 program, and away we go. I don't need to look at the MPR to know that," and that may be indeed okay.

On the other hand, somebody above him, were he involved, might make the determination, "No, Type 2 isn't good enough. It ought to be Type 1."

What kind of checks does the system impose that assures that these things are properly categorized and assigned a proper type of QA program?

A (Witness Anderson) I might explain just a little bit about how the Westinghouse designer would use this kind of guidance, using Westinghouse as the example.

Q Right.

A The Westinghouse procedural system does pick up and include this in their procedures in which they give their guidance to their designers, their design engineers, so that in the concept of the execution of this, the design engineer would go through the system, and he would pick the program requirements that, in his judgment, were the right requirements.

He would write those into the specification for the equipment. That specification gets reviewed by others in his organization, and one of the others would be the people in the quality assurance organization that have technical expertise in this technology too.

If he had doubts at the time he was actually writing the specification, he would consult with those quality assurance engineering personnel too, and collectively they would come up with the requirements to go in the specification, and ultimately the internal review cycle would include their agreement with those.

Now, if the component was one of the components that had approval at another level, even all the way to the project office, the reviews in that approval circuit at the higher levels of the project would also include the evaluation of those specifications by people within the quality assurance organization.

Q All right. Suppose some of these reviews or audits that are going on--we will assume now a construction permit had issued and fullblown construction is under way.

Suppose some of these reviews or audits turn up a glitch of some kind, and--an anomaly. I don't know whether "glitch" is in the dictionary--that causes real concern about whether there is a proper categorization, proper quality assurance effort being undertaken, and this involves something that's ongoing today when the problem is uncovered.

Now, what I am leading up to is where does stop work authority reside such that if a problem that is thought to be serious turns up, somebody can say, "Hold everything until we figure this out, lest we go too far, spend money needlessly, goof it, or something"?

In other words, getting back to some of these various organizational figures that appeared in the early part of the testimony, where does stop work authority reside?

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A (Witness Hedges) Stop work authority resides with the quality assurance manager in each of the participants' locations, and it resides with me in the project office, as stated in writing and signed by Mr. Brewington.

End 4

Q So if I look at -- back to page 3 and that box diagram of the various elements of the organization; are you telling me, sir, then, that in each of those boxes, as well as the top project office box, there resides stop work authority associated with the quality assurance --

A (WITNESS HEDGES) That's correct.

Q -- responsibility. Okay. At the bottom of page 20, in the answer to question 25, there is a mention of nine levels of program requirements that have been developed to meet the graded approach to quality assurance. Are those nine levels of program requirements, do they uniquely translate or relate to the nine types of quality assurance programs?

A (WITNESS ANDERSON) Yes, that's really what they are.

Q Okay. The accomon and unnerving experience that is encountered frequently when a problem arises relates to the fact that it is someplace in the organization where a decision has got to be made, and people go to blueprints and P&I diagrams, and the like, and start comparing what the paperwork says with what's actually materializing on the job.

There is a realization that things don't match, what's on the paper doesn't match what's going into place on the job. There could be two reasons why that's happening, at least two. One is that what's going into the job is wrong, or the other might be that the paperwork documentation, the diagrams and blueprints, et cetera, are not up to date.

Let's deal with the later situation for the moment and, indeed, this is addressed to some extent in this testimony, but it's obvious that up-to-date documentation is extremely important and especially in the field or in the control room at the site.

I'd like for you gentlemen just to summarize perhaps in a little more detail than the testimony goes into how you will be assuring yourselves that, where needed, the documentation is up to date.

A (WITNESS KARR) Within the project's configuration management program, configuration management system, we have provided a mechanism which will accomplish two things.

First, it will provide to the engineering change process a mechanism whereby we can appropriately keep the documenentation which defines the intended configuration of the plant up to date.

Second, it provides a vehicle through the project status and control system to notify the individuals responsible for the work itself of the current status of that documentation. By doing those two things, and by setting out through plan, policy, and procedure the requirements for accomplishing that, we have a plan which will, at a given time, provide to the users the identification of the body of documents which currently reflects the configuration of the plant.

Q Well, okay.

Let's take it in just a little bit more detail. Suppose the need for a change is identified in some unspecified way, at this point, and that change is approved. Maybe it is a weld specification that, for whatever reason, somebody decided a different heat treat is required.

Now, from the kinds of things you've told me, I guess I feel pretty confident that in some of the -- most of the upper levels of program management, I would find that change after it is approved pretty appropriately documented. I guess what I'm concerned about is, more particularly, how does it get appropriately down to the welder at the site?

A (WITNESS ANDERSON) With that kind of a change, maybe I can go into a little bit more detail of just how that would go through.

Q Please.

A Like all other changes within the project, the beginning of that change is with the engineering change proposal that we discussed yesterday. That particular document is a vehicle for obtaining the approvals through the design organizations, through the requisite approval authorities for that; backing that up is the project status and control system which, from the initiation of that change proposal, carries that as either a pending change, a change which has been approved, or a change which has been reflected in the base line documentation itself.

Within each of the user organizations, procedures have been set up and have been in use for as long as they have been on the project reacting to the MPR requirements; that when those changes occur, procedurally, through records management and document control systems, those changes are distributed to the individual users of the information concerned. So in this case, a specification, each holder of that specification who was holding it for use would receive the change information through a control distribution process.

Procedurally, then, they are required to update their information by appending the new information to the old document, and there is an extensive surveillance and audit program conducted by the quality assurance organization of each of the participants to ensure ourselves that that process is ongoing and operating effectively.

Q Mr. Hedges and Mr. Anderson, do either of you have anything to add to that, not necessarily with respect to welds, but the basic topic? How does the word get down to the working level?

A (WITNESS ANDERSON) I think in most instances it starts with the working level, and then comes back to the working level, or if the working level identifies the need for a change because there is either an error, a mismatch, a vague piece of information, if that were to occur, anyway, the need is identified at the working level.

The working level people then draft the request for a change, and that moves through the system and comes back to that place in the working level, so that the change actually gets identified in their terms of what they need, and goes through the change control system and comes back to that point.

These vehicles that Mr. Karr has mentioned are the way that the controls on the system are then executed.

Q Well, getting back to the weld analogy, the need for a change in, let's say, field pre/post treatment of a weld may well originate with a metallurgist far away in the Westinghouse organization somewhere that maybe has little or no line responsibility for anything on Clinch River.

He just is interested in what makes good welds, and finds out that standard practice can be improved on and it turns out he has a good idea. And he's not at the working level to feed this up, and then have to come back.

I'm nitpicking you, I know, but I'm looking to just see how well you gentlemen think your bets are covered.

A In that context, his working level would be at the point of either writing specifications or reviewing specifications, maybe even reviewing problems which had occurred, and determine root causes and corrections for those problems, back-reviewing specifications then to identify what may have allowed something to occur.

So his working level really may be the specification itself in that context, at which time he then would initiate the change request, which would get processed through the system.

Q There have been many references to the management policies and requirements document or documentation, and it certainly sounds as though it plays an extremely important role. So do red and green traffic signals, but society has found that the signals alone are not enough, there have got to be some laws to make it desirable to respond to the signals.

Does the system have any kind of checks, balances, restraints, rewards, disciplines, sanctions for things getting out of line and away from prescribed procedures?

A (WITNESS HEDGES) The MPR is published by the project office, signed by the director, and it is directive upon all project participants to follow it, implement it by their procedures. It is -- the implementation, then, is audited through the participants' audit program and the project office audit program.

In the event that there is noncompliance found by either, the corrective actions system would require a formal answer as to why and what would be done to prevent that from occurring again.

JUDGE MILLER: Pardon me.

Let me inquire a moment, Judge Linenberger. I think probably all of you have heard about the experiences that various utilities at nuclear plants had with so-called whistle-blowers, people who say that weld construction-- I'm thinking of quality control during construction, but it can apply to other areas--whether there are open lines of communication, whether there is, whether justified or not, fear of reprisals, chilling effect.

Have you given any thought to responsible management handling both the problem and the opportunity of whistle-blowers so that maybe that should be looked into? You may have to weed out those of a subjective nature, but nevertheless, somewhere along the line, useful information can be derived.

Has that been given any thought at this stage? If so, what?

WITNESS ANDERSON: The project has procedures whereby those kinds of people with concerns--investigations of things that are alleged by either Staff members or others within the project, there are methods by which that's handled, and it is given redress.

JUDGE MILLER: I'm not speaking now of the formal aspects. I know very well that there are rules and procedures. But I think experience has shown in some plants, not all, but in some, that it has worked rather imperfectly, let us say, and that it is a problem, we know, because getting -- people, even responsible personnel in the field in authoritative positions, don't like to be bothered by whistle-blowers, obviously. But there has to be some mechanism where you just don't have it in a book or rule somewhere, but an operation that there is a reasonable opportunity, and that it is going to have to cut against, to some extent, your official chain of command.

Now, what thought has been given to that when you get into a construction phase or something remotely approaching it?

A (WITNESS HEDGES) May I respond to that?

The project office has in place, as Mr. Anderson has said, procedures which permit so-called whistle-blowers an opportunity to express their concern and plausible objections. We have recently been re-evaluating that whole procedural concept to be certain that it provides what we want to provide to a whistle-blower, which is careful attention to whatever he or she feels is a problem, and close it out with proper corrective actions.

We are probably going to revise that system somewhat, but the construction -- constructor has in place a system that I think it might help if he described.

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JUDGE MILLER: All right.

WITNESS KARR: We have looked at that overall situation, and in planning for construction where many of these situations occur, we have provided not only the procedural base, but we have instituted a program whereby personnel leaving the quality assurance organization of the constructor, in particular, are provided with an interview as they leave or during their tenure with the project with the project office quality assurance organization as well.

JUDGE MILLER: Exit interviews?

WITNESS KARR: Exactly.

JUDGE MILLER: That's a very good idea. I have heard of that.

WITNESS KARR: We feel that with our own employees, there may be some reluctance on their part or on their supervisor's part to discuss an adverse situation, and that given a third-party opportunity, to hope to utilize that to provide a forum to air any potential grievances or problems which they might not feel willingly to openly discuss with their own supervisors.

We have some experience with that kind of a program elsewhere and feel that it works very well.

JUDGE MILLER: That is certainly a very interesting suggestion and certainly affirmative. Your organization should be commended. Thank you.

WITNESS CLARE: If I could comment briefly from the perspective of another contractor, we also have a mechanism identified for individuals with concerns. I don't think we use the term "whistle blowers."

JUDGE MILLER: I will take the responsibility. It is a vernacular and barely in the vocabulary, but it is there because I had to look it up once.

WITNESS CLARE: The mechanism we have does identify a pathway for individuals who would prefer not to go to their direct line management to bring safety concerns, noncompliance concerns, to a nuclear review committee, which has a broader perspective on such matters and can treat them with appropriate confidence and render judgments and help the individual understand whether his concerns are or are not valid.

We have, of course, postings in our facilities that identify these pathways for the individuals. We have sessions where we help people understand how those work. As recently as last month, here for our employees in Oak Ridge we had such a session. At that time part of the presentation included a videotape of the Westinghouse executive who was responsible for all of our nuclear energy activities, where he reiterated the overall Westinghouse policy that we will provide safe designs, safe equipment that is in compliance with the specifications, and that none of the individuals should be concerned about reprisal for bringing forth instances where corrective action needs to be taken.

JUDGE MILLER: Very well. Thank you.

BY JUDGE LINENBERGER:

Q Mr. Clare, you mentioned an important function served by an organizational unit called a safety review committee.

In the context of what might be going on a year or two from now with Clinch River, there are many aspects of safety that are going to be important, not just nuclear. There are all kinds of things, such as on-the-job safety, proper operation of the plant, et cetera.

To what extent can you gentlemen from your firsthand knowledge tell us about the need for and existence of some sort of safety surveillance review and monitoring or auditing function in each of the segments of this overall program?

Let's start with you, Mr. Karr. Insofar as the constructor is concerned, I doubt that he worries too much about nuclear safety, but I suspect he worries a lot about on-the-job safety and the handling of materials and equipment.

A (Witness Karr) Within the constructor organization, the safety program, on-the-job safety program is handled by one of our organizational units, a standard working safety program in compliance with OSHA regulation and in compliance with the DOE regulations.

I'm not sure what you are getting at. I'm not sure

I quite understand your question.

Q Well, this is indeed part of what I am getting at, and sticking with Stone-Webster for the moment, what kind of-- are there forms of channels of communication between those people at Stone & Webster worried about Clinch River and those people in Stone-Webster worried about construction quality assurance? Is there a formal inter-relationship, inter-communication channels there?

A I think the best way I can answer that is to state that everyone within the Stone & Webster organization associated with the job site is involved, part of and governed by the safety requirements, the safety program for the job itself. This includes communication, information, procedures, requirements, methodology, as well as such things as on-site safety committees to review the safety of the work.

Now, this includes the quality assurance unit personnel, as well as everyone else on the job site.

Q So if you, from the quality assurance side, decide that for the protection of certain pieces of equipment, they must be moved, certain crane-handling operations need modification, is there somebody wearing a safety hat in Stone-Webster who says, "Hey, that may be nice for your QA guys, but it is going to jeopardize our crane operators or our riggers, or something, if we follow that. Let's back up and negotiate or see if we can't work out something better"? Does this kind of thing get formally reviewed?

A Yes, it does. Anything to do with job-site safety goes through our senior site safety officer, who is taxed with the responsibility of safe working conditions on site, regardless of the source

If we in the quality assurance unit were to propose something, for instance an altered rigging procedure for a heavy vessel, that would be reviewed by several groups to ensure that we weren't asking for something that would ultimately endanger a craftsman or the equipment itself.

Q That's the kind of thing I'm looking for. Do you gentlemen have anything to add from within your own areas of responsibility?

A (Witness Hedges) Within the project office there is also a member of the public safety organization who is concerned about safety at the site. That person coordinates very closely with the quality assurance surveillance people who are at the site.

If the quality assurance surveillance notes something that appears to be unsafe, that person, the safety person, would be called and asked to look at it.

Q Mr. Anderson?

A (Witness Anderson) I probably have nothing really to add to what Mr. Hedges has said about the project office and its program.

Q Let's go back now to the figure that appears on page 11, which Mr. Edgar accommodatingly supplied a better copy of.

I would like to hear, perhaps in different words than I have read in the testimony, functionally just what it is that figure is intended to convey. Perhaps, Mr. Hedges, I will start with you on this.

A (Witness Hedges) That figure is intended to convey three levels of control. In the case of procurement of an item, the first level of control being that of the supplier, in which the supplier would have the quality assurance program, which includes quality control.

That quality insurance program would have been reviewed and accepted or approved by the major participant, who is Level 2. The Level 2 major participant has in place also a quality assurance program for surveillance and audit of the activity of the Level 1, which is the supplier, but in addition there is a third level, which is the project office.

The project office has in place an audit and surveillance which will entail auditing and surveillance of the major participant and how he is performing his function and, in addition, the project office will, at their discretion, go into the supplier and conduct audits and surveillance there also.

Q On that last point, is the authority and functional mechanism for accomplishing what you just said, the project office looking within a supplier's organization to see how well certain things are being done, is that kind of thing specified, called out in some document such as the MPR or, in other words, if somebody in the project office wanted to go to, let's say, Hanford, for example, and check on something that's going on in fuels development, does he have to go through any special paperwork to do this, or does he surprise anybody if he shows up at Hanford and starts poking his nose into things and run into hostilities because he is meddling? How does this get accomplished?

A Let's presume that Hanford in this case is under contract to Westinghouse to perform. We would go through the contractual chain, inform Westinghouse that it is our intent to perform an audit or a surveillance at a particular time. Westinghouse would then arrange it with Hanford.

Q Where is something written down that tells Westinghouse they can expect this to happen occasionally?

A It is in the contracts, the original contracts signed by Westinghouse.

A (Witness Anderson) I might clarify that just a bit. In looking at this chart, the interface relationships appearing on the chart generally reflect the contractual relationship that exists, and then those vehicles--there is a specification which provides for access and arrangements and the overview accessibility by the government, by the project office, to

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accomplish inspection, surveillance, audit functions.

JUDGE MILLER: We will take a 15-minute recess.

(Short recess.)

JUDGE MILLER: We'll resume, please.

Judge Linenberger.

BY JUDGE LINENBERGER:

Q Well, let me just ask, is there anything more with respect to the implications of this figure from page 11 that we were recently discussing that any of you gentlemen wish to comment upon?

A (WITNESS CLARE) I might add one comment.

Q Sure.

A This figure is essentially an organizational figure of the project, and it identifies the line responsibility for the hardware, the software, the construction, et cetera. And it is not surprising that the quality assurance program follows that, because, in fact, the -- achieving the real quality is a line function, and it is the line organization that has the responsibility for assuring that that quality is actually achieved during the design process, the fabrication process, et cetera.

The quality assurance organizations which are a part of these overall organizations have the check and balance responsibility to audit and confirm that, in fact, the requirements are being met.

It wasn't clear to me that that had been explicitly stated before.

Q I appreciate those comments, and in that same vein, speaking of line responsibilities, perhaps for just a few moments to probe into the consideration of the extent to which the quality assurance responsibilities that are implicit in everything we have been discussing are adequately insulated from management influence of a nature that might compromise the ability to get the job done, as you gentlemen right here see the need to get that job done.

I know, for example, from the witness qualifications information supplied with this testimony, that you, Mr. Karr, are serving in an acting capacity right now, and I don't want to, in any way, put you on the spot here, but human nature being what it is, that says to me there is a potential for either your working extra hard to make sure that it is obvious to everyone that you're the one who should have the full stick at some later date. The other side of that coin is that, well, since you're in an acting capacity, maybe you shouldn't rock the boat anywhere.

Tell me about that a little bit, if you would, please.

A (WITNESS KARR) Okay.

First, a minor correction I think I should note, in that the word "acting" in that first line needs to be deleted.

Q Very good.

JUDGE MILLER: Congratulations. We just promoted you.

(Laughter)

WITNESS KARR: I don't want to speculate on a cause for that in view of your earlier discussion.

(Laughter)

WITNESS KARR: Within each of the project organizations, the principal contractor organizations, the project office has required that the participating organization provide for their review and acceptance a charted description of the authority and the responsibilities of the quality assurance unit within that organization.

One of the key items that is involved in that review is an identification of the independence of the quality assurance unit from undue influence due to cost and schedule considerations, such that before that is accepted, each of the officers of the individual organizations have, in fact, identified and charted their quality assurance organization to act in an independent manner.

BY JUDGE LINENBERGER:

Q Do you other gentlemen have anything to add here with respect to your own specific bailiwick?

A (WITNESS HEDGES) Well, simply in the project office, the quality assurance organization is charted, and that chart is signed by Percy Brewington, I might add, who -- Percy Brewington is very familiar with the quality assurance program, and a strong supporter of that program. He insists that his entire staff be supportive of the quality assurance program.

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Q Well, this would certainly make the NRC and this Licensing Board happy to learn, and without soliciting any comments from you gentlemen, I will make the editorial comment that the Board hopes Mr. Brewington's dedication stems from his awareness that it is going to save him money and headaches in the future to maintain that dedication, rather than just doing it to please the onlookers.

Mr. Anderson, do you have any comments here?

A (Witness Anderson) I might just add to that concept. I think that is a very important concept to the project and the success of the project's quality assurance program for the last many years. The attitudes of the management in the project organizations have all been dedicated to the achievement of quality assuring activities of the project from its inception.

It was recognized early on that it was a complex organization, it was a complex project, and there must be good management control exercised over the whole functioning of the project, and one of those elements must be the quality assurance project, so that the management was dedicated to that purpose from the beginning, and the support of the previous project director was strong and was directly supportive of the integrity of the quality assurance program.

That has been true of the leaders in all of the project organizations, and it has been very vital to the success of the program that the performing managers--that is, the managers of engineering and procurement and those functions in the project--have all been dedicated to and supportive of the achievement of quality in their work and the performance of the quality assurance program as it has been identified and defined to them, as well as to supporting units of the sister organization.

So the attitude has been good and supportive all along from all of the management in the organization, and their involvement has been direct, and the execution of the functions assigned to them has been very supportive.

Q Anything further?

A (Witness Hedges) No.

JUDGE LINENBERGER: Mr. Edgar, I have not met, nor do I know by sight Mr. Brewington. Has he attended any of these sessions?

MR. EDGAR: He has been in the hearing sessions. He has not appeared as a witness.

JUDGE LINENBERGER: No. I just meant has he--

MR. EDGAR: He is here in Oak Ridge, and we can have Mr. Brewington come over, if you would be interested.

JUDGE LINENBERGER: No. I wasn't looking for any--

MR. EDGAR: He has appeared before the Commissioners earlier on in a proceeding, but I don't believe that he has made himself--or been before the Board in any official capacity.

JUDGE LINENBERGER: Chairman Miller, I think I have gone as far as I feel I need to at this time.

JUDGE MILLER: Any redirect?

MR. EDGAR: One clarifying item directed to Mr. Anderson.

CROSS EXAMINATION ON BOARD QUESTIONS

BY MR. EDGAR:

Q Yesterday, Mr. Anderson, you mentioned that the OPDD 10 had been prepared by Westinghouse for the project office. In regard to that, which entity had final approval authority of initial issuance of the document?

A (Witness Anderson) The project office had authority approval over the overall design description.

Q What entity must approve any changes to that OPDD 10?

A The same organization. The project office has approval authority of all changes.

Q And what entity has the ultimate authority for overall plant design control?

A The project office again has that authority for the overall plant design control.

MR. EDGAR: Thank you. No further questions.

I would just note for the record that I got through the HCDA without once fumbling over SMBDB, and now I tripped on OPDD 10, so you can't win.

JUDGE MILLER: Anything further from the Staff?

MR. TURK: Nothing.

JUDGE MILLER: Very well. 'e will excuse the panel. Thank you very much.

Anything further from Applicants in this regard?

MR. EDGAR: No, sir. We had previously made the offer, and it had been inserted in the transcript, of Exhibit 95. I don't think I need to re-offer it at this time.

JUDGE MILLER: I believe that that is correct. At any rate, Exhibit 95 is in evidence and it is received.

(The document previously marked for identification as Applicants' Exhibit No. 95 was received in evidence.)

MR. EDGAR: I will ask the Board's advice on this. I don't think it is necessary. Mr. Turk asked whether we need to introduce the Xerox of the chart on page 11 of Exhibit 95. That is already in the record in the PSAR. I made a statement to correlate that. It is in Exhibit 73, which has been previously introduced.

If the Board thinks, for convenience or clarity, we should introduce the Xerox, we can introduce that, but I think it is findable in the record.

JUDGE MILLER: Yes. I think the record is clear on it, and we will have the copies for our use. Thank you for reminding us.

Anything further?

MR. EDGAR: No, sir.

JUDGE MILLER: Staff.

MR. TURK: As we see it, the next order of business is for the Staff to put on its panel in response to Board Question No. 6.

JUDGE MILLER: Yes.

MR. TURK: Before doing so, I would like just a moment, please.

JUDGE MILLER: Yes.

(Pause.)

MR. TURK: The Staff would call to the witness stand Mr. John Spraul--S-p-r-a-u-l--and Mr. Algis Ignatonis--I-g-n-a-t-o-n-i-s.

JUDGE MILLER: Will you gentlemen stand, please, and take the oath?

Whereupon,

JOHN G. SPRAUL

and

ALGIS J. IGNATONIS

were called as witnesses on behalf of the NRC Staff and, having been first duly sworn, were examined and testified as follows:

DIRECT EXAMINATION

BY MR. TURK:

Q Gentlemen, starting with the seat closest to the Licensing Board, would you please state your names, titles and by whom you are employed.

A (Witness Spraul) My name is John Spraul. I am a quality assurance engineer in the quality assurance branch of the Office of Inspection and Enforcement of the NRC, Bethesda.

A (Witness Ignatonis) My name is Algis Ignatonis. I am a project engineer for the Region II office, NRC.

Q Have you gentlemen prepared statements of professional qualifications for use in the proceeding?

A (Witness Spraul) I have.

A (Witness Ignatonis) Yes, I have.

MR. TURK: For the record, let me note that I have distributed two copies to the Licensing Board members, one to each, three copies to the reporter and a copy to Applicants' counsel of NRC Staff Exhibit No. 44. That exhibit is entitled, "NRC Staff Testimony of John G. Spraul and Algis J. Ignatonis on Board Question 6 Concerning Quality Assurance."

BY MR. TURK:

Q Gentlemen, I would ask you to turn to NRC Staff Exhibit 44, and indicate whether your statements of professional qualifications are contained therein.

A (Witness Spraul) Yes, it is.

A (Witness Ignatonis) Yes, it is.

Q Is NRC Staff Exhibit No. 44 a copy of your written testimony which was submitted to the Board on July 8, 1983, including your statement of professional qualifications?

A (Witness Spraul) Yes.

A (Witness Ignatonis) Yes.

Q Do you have any corrections or modifications which you wish to make to this exhibit?

A (Witness Spraul) Yes, I do. On page 2, Answer 3, A3, the first word should be "our" testimony instead of "my" testimony.

On my statement of qualifications, the last line, about the middle of the last line where the word is "cofer" it should be "cover."

A (Witness Ignatonis) I would like to make a correction to my professional qualifications also. On the first sheet, third paragraph, it should be stated that I'm responsible for inspection activities at four nuclear plant sites, seven reactors, "not including the Clinch River Breeder Reactor."

Q So you are inserting the word "not" before the word "including"?

A That's correct, yes.

Q To the best of your knowledge and belief, is this exhibit, NRC Staff Exhibit 44, which represents your written testimony and professional qualifications, true and correct?

A (Witness Spraul) Yes, it is.

A (Witness Ignatonis) Yes, it is.

Q Do you adopt it as your sworn testimony in this proceeding?

A (Witness Spraul) Yes, I do.

A (Witness Ignatonis) Yes, I do also.

MR. TURK: At this time, Mr. Chairman, the Staff would request that NRC Staff Exhibit No. 44 be received into evidence and bound into the transcript as if read.

JUDGE MILLER: Any objection?

MR. EDGAR: No objection.

JUDGE MILLER: Staff Exhibit 44 will be admitted into evidence and will be incorporated in the transcript.

(The document previously marked for identification as NRC Staff Exhibit No. 44 was received in evidence.)

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(NRC Staff Exhibit No. 44 follows:)

NRC STAFF EXHIBIT 44 8760

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
UNITED STATES DEPARTMENT OF ENERGY PROJECT MANAGEMENT CORPORATION TENNESSEE VALLEY AUTHORITY	)	Docket No. 50-537
	)	
(Clinch River Breeder Reactor Plant	)	

NRC STAFF TESTIMONY OF JOHN G. SPRAUL AND ALGIS J. IGNATONIS ON BOARD QUESTION 6 CONCERNING QUALITY ASSURANCE

Q1. Please state your names, by whom are you employed and the nature of your responsibilities regarding Clinch River Breeder Reactor ("CRBR")?

A1. My name is John G. Spraul. I am a Quality Assurance Engineer (Nuclear) in the Quality Assurance (QA) Branch of the Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission. I reviewed and evaluated the QA programs of the CRBR Applicants and their principal contractors.

My name is Algis J. Ignatonis. I am a Project Engineer for the Region II office of the U. S. Nuclear Regulatory Commission. I am responsible for inspection activities at CRBR, and have assisted in the development of the inspection program for CRBR.

Q2. Gentlemen, have you prepared a statement of professional qualifications?

A2. Yes. Copies of our professional qualifications statements are attached to this testimony.

Q3. What is the purpose of your testimony?

A3. My testimony addresses the concern raised by the Atomic Safety and Licensing Board ("Board") in Board Question 6, which states as follows:

> The SER discussion of quality seems to emphasize quality assurance and the various separate contractor organizations that will implement it. Does the staff consider that QC responsibilities and activities are separate from QA or an integral part thereof? The staff is requested to discuss its answer to this question and to explain briefly how it will monitor QA and QC efforts for adequacy.

Q4. Please define the terms "quality assurance" and "quality control".

A4. Appendix B provides the following definitions:

> As used in this appendix, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material, structure, component, or system which provide a means to control the quality of the material, structure, component, or system to predetermined requirements.

Q5. Does the Staff consider QC responsibilities and activities to be an integral part of QA?

A5. Yes. This is consistent with the Introduction to Appendix B, quoted above, which states: "Quality assurance includes quality control. . . ."

Q6. Is the QC function treated as an integral part of the QA programs of the CRBR Applicants and their principal subcontractors?

A6. Yes. The QA programs for CRBR are described in Section 17 of the CRBR Preliminary Safety Analysis Report ("PSAR"). As set forth in the PSAR, the Applicants and their principal contractors are either directly responsible for QC functions and activities, or have adequate controls over QC functions and activities, to assure that they are properly performed. The Staff's evaluation of the adequacy of the CRBR QA and QC commitments is set forth in Section 17 of the CRBR Safety Evaluation Report ("SER")(NUREG-0968, March 1983).

Q7. Will the Staff monitor QA and QC activities throughout the construction of CRBR?

A7. Yes. In this regard, it should be noted that QA/QC is the responsibility of the Applicants; the Staff's QA/QC responsibility is to review the Applicants' QA/QC plan and to audit its implementation. In order to monitor QA and QC efforts for adequacy, the Staff is developing a construction inspection program for the CRBR. The program will be based on the Staff's IE Manual for construction inspection of light water reactors, modified as necessary to be appropriate for the CRBR. Staff inspection procedures have been developed for the pre-construction permit ("CP") phase of the work, with inspections starting in the first half of 1983. (The Staff performed a number of CRBR inspections during 1976-1977.) Upcoming Staff inspections will be "after-the-fact" inspections concerning design and manufacturing of completed components and equipment, and the storage of those components and equipment. The Staff expects that these inspections will involve reviews of documentation by Applicants and their contractors as to procedures, inspection and test reports, manufacturing data, "shop travelers", design review reports, specifications, drawings and other such records. Subsequent Staff inspections will focus on site preparation, Applicants' site surveillance program, foundations, environmental protection, and subsequent activities as work progresses. The Staff will also inspect fuel fabrication activities. Further information concerning the Staff's QA/QC inspection program is set forth in Section 17.5 of the CRBR SER.

JOHN G. SPRAUL

PROFESSIONAL QUALIFICATIONS

QUALITY ASSURANCE BRANCH

OFFICE OF INSPECTION AND ENFORCEMENT

I am a Quality Assurance Engineer in the Quality Assurance Branch in the Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission. In this position, I am responsible for the review and evaluation of applicants' descriptions of quality assurance programs proposed for the design, construction, and operation of nuclear power plants as assigned to me.

I received a Bachelor of Chemical Engineering degree from the Georgia Institute of Technology in 1951. In 1971, I completed the requirements for the Professional Designation in Quality Control at the University of California, Los Angeles. My nuclear experience prior to joining the NRC includes 2 years of engineering work in gaseous diffusion with the Goodyear Atomic Corporation and 12 years of nuclear fuel and nuclear power plant component design, manufacture, and testing with the Atomics International Division of Rockwell International. My quality assurance experience prior to joining the NRC includes 2 years as Chief Inspector and 4 years as Director of Quality Assurance at Atomic International, where I was responsible for managing the entire quality assurance program.

I joined the Quality Assurance Branch of the NRC in 1974. Since joining the NRC, I have reviewed the quality assurance program descriptions for design and construction reports on quality assurance submitted by utilities, architect-engineers, NSS suppliers, and constructors.

I am a member of the American Nuclear Society and a senior member of the American Society for Qualitv Control. In 1972, I was certified as a Quality Engineer by the American Society for Quality Control. This certification has been renewed to cofer the 1983-1985 time period.

PROFESSIONAL QUALIFICATIONS

ALGIS J. IGNATONIS

My name is Algis J. Ignatonis. I am employed by the U. S. Nuclear Regulatory Commission, Region II, as a Project Engineer.

My primary assignment as a Project Engineer is to perform inspections of nuclear power reactor facilities during the construction, startup and operational phases. My duties include the review and evaluation of applicant and license management and their organization; implementation of procedures and practices and their effect on the safety of plant operation; and compliance with licensed conditions, rules, orders, and regulations. This responsibility includes the auditing of licensees' and applicants' quality assurance programs for the construction and operation of their nuclear power plants. I coordinate the inspection efforts of resident and region-based inspectors and consultants for assigned and special inspections.

In my present assignment as project engineer, I am responsible for inspection activities at four nuclear power plant sites (7 reactors), including the Clinch River Breeder Reactor (CRBR). Five units are operational and two are under construction (not including the CRBR). I have assisted in the development of the inspection program for CRBR.

Also, during my current assignment I have had dual responsibilities through April 1983 as an Acting Section Chief.

I have been employed with the Nuclear Regulatory Commission since September 1974. My major duties performed during this tenure are as follows:

October 1980 to August 1981	Senior Resident Inspector at Turkey Point.
April 1979 to September 1980	Detailed to the Three Mile Island Technical Support Task Force as a Senior Reactor Engineer following the March 28, 1979 accident. Responsibilities included: (1) analysis of plant conditions and proposed changes in system design or operation mode; (2) review of standard operating procedures, emergency procedures, and Technical Specification Surveillance procedures; and (3) design review of plant modifications for maintaining reactor coolant system pressure and core cooling, containment cleanup, and recovery operations.
March 1978 to April 1979	Performed reactor systems plant reviews for the Grand Gulf, Susquehanna, and WNP-2 OL applications. In addition, I participated in the Systematic Evaluation Program, reviewing older vintage design plants, in particular the Palisades plant and San Onofre Unit 1. Also, I performed primary review and coordinated staff review on the generic safety issue of reactor coolant pump overspeed following a loss-of-coolant accident.
March 1977 to March 1978	Performed similar work as stated above, except plant reviews included the Sundesert Nuclear Plant (CP application) and the Fast Flux Test Facility (OL application). Served on the Power Burst Facility Program (fuel research) review group representing NRR's viewpoint for reactor system licensing needs in research.

September 1974 to March 1977	Reviewed GESSAR and Hartsville PSAR applications and plant reloads. Also, served as the princi pal reviewer for the GE GETAB application to licensed operating plants, and CP and OL applications.

Prior to my employment with the Nuclear Regulatory Commission I was employed by NASA, Marshall Space Flight Center for eight years. My duties included performance of technical investigations in the analysis and support testing of environmental control and life support systems for Skylab, Apollo, and Saturn 1B/V Instrument units. I reviewed contractor work engaged in design, development, manufacture, and testing of environmental control hardware. I was extensively involved in testing of equipment.

I graduated from Illinois Institute of Technology, Chicago, Illinois, in 1965 with the degree of Bachelor of Science in Mechanical Engineering. In 1974 I graduated from University of Alabama in Huntsville, Alabama with the degree of Master of Science. I have also taken graduate courses in reactor safety and nuclear reactor theory at the Catholic University in Washington, D.C., and have successfully completed appropriate NRC inspector training courses.

I am a member of the American Society of Mechnical Engineers.

MR. TURK: At this time the panel is available for Board questioning and cross-examination.

JUDGE MILLER: Any cross-examination, Mr. Edgar?

MR. EDGAR: No questions.

JUDGE HAND: Yes, I have a question.

BOARD EXAMINATION

BY JUDGE HAND:

Q On page 3 at the very bottom of the page, there is a quote around the word "shop travelers," and I don't know what "shop travelers" are.

A (WITNESS SPRAUL) That is a document that is prepared by the organization that is manufacturing an item which says in stepwise order who does what. And then as it goes with the piece of hardware, then it is signed off by the person that does a particular step, so that a manufacturing process is followed through logically, and the documentation is there and it is machined, welded, inspected, whatever, step by step. And the traveler accompanies the hardware through the shop, and we call it a shop traveler.

Q Does that stay with that piece of hardware right to the point of where it is installed in the plant?

A It would stay with the piece of hardware through the manufacturing process, and then it would become

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part of the personal record of the manufacturing process for that piece of hardware.

It would not normally be shipped with the part to the plant, no, sir.

Q When a part gets to the plant and somebody wants to know about its origin, how do they trace it backward, then, to the manufacturer?

A There is normally a certificate of conformance that comes with it, a copy of the purchase order, a copy of the specification that has been met and drawings that have been met accompany the hardware.

Q So, it is possible to go back to the original specifications and the checking and fabrication that were involved?

A Yes, sir.

Q And one other very general question. With a project as large and as complex as the Clinch River Breeder Reactor, how many Staff does NRC presume it will devote to the quality assurance-quality control activity through the construction period?

A (WITNESS IGNATONIS) Speaking for the region involving our inspections, it is hard for me to pinpoint the number, but I would say that we in Region 2, as well as -- we expect some members from Region 4 to participate, and I'd probably be talking about a number of -- I'd say about maybe in the order of 20 inspectors, or so.

Q And these 20 inspectors would probably be on site?

A No, sir. Assuming that the Clinch River Breeder gets a CP and construction starts, we'll have a resident inspector that will be on site -- we would expect to have a resident probably within 70 days of the time construction starts. Other than that, we would have regional and specialist inspectors come in for separate inspections.

Q People would come and go to the site?

A Yes, sir, not only the site, but also the different vendors.

Q For that single resident inspector, if that's what it turns out to be, does he sit in his office all day, or is he in fact out --

A He is supposed to be performing inspections most of the time.

Q He's trying to keep track of what's going on?

A The inspector at the site of construction, he would be a specialist; he may be a metallurgist. He is an experienced inspector. He's qualified in concrete pour and materials, and anytime he would have a question he would contact the region for a specialist's advice as well.

For example, if it has to do with welding, and he's not familiar, he would call one of the specialists that would be knowledgeable in nondestructive examination, as an example.

Q Ordinarily, would there be a single resident inspector, a single person in that position throughout the full construction?

A Yes, sir.

Q So that if he were, in fact, a metallurgist, or something, he would seek advice when they came to electrical matters?

A Yes. We do have region-based inspectors in -- specialists of electrical inspections and instrumentation and control.

Q In its inspections program, does NRC see every piece of paper that relates to the program's quality assurance and quality control activity, or is it a selected picking here and there?

A We selectively examine -- well, I should say at random we would pick a number of procedures of quality assurance to review on a periodic basis, different inspections.

JUDGE MILLER: You're going to have to talk louder.

WITNESS IGNATONIS: I do maintain copies, also, of the project office as well as the different participants in the project, their QA manuals, and it is a control copy where they can reference it in my office as well as when they go out in the field.

Q You use the word "random." Is there any basis for that randomness? Is it a selected randomness?

A It is sort of a select randomness. They'll go out there, for example, in recent inspections that we have been performing, once we come out to the site, we'll have an entrance visit with the Applicant, telling that we want to inspect these particular procedures in our request area, and maybe identify a dozen or so, just pick and go through them.

Q Is there any legal basis for -- perhaps you can't answer this -- but do the NRC regulations require anything specific in the matter of quality assurance and quality control on the part of NRC?

A (WITNESS SPRAUL) That would be in Appendix A, General Design Criteria 1, that require a quality assurance program from the Applicant, and we require basically what has been submitted in the PSAR regarding a description of their quality assurance program, and whether we have the commitments we look for in the PSAR, then it is up to the Applicant and his principal contractors, if you will, to meet those commitments, and the NRC is authorized to inspect and verify whether or not those commitments are being met, and to take appropriate actions if it is found that they are not being met.

Q Does NRC approach its surveillance QA/QC activities for the different parts of a plant quite differently? Is it more interested in certain parts than other parts?

A (WITNESS IGNATONIS) If I can ask, there is another member here who is not on the panel, who would be more qualified to answer this question, Virgil Brownlee.

JUDGE HAND: Well, I'd like some sort of an answer.

JUDGE MILLER: Yes, I think we better call for the gentleman who can assist in answering this line of inquiry.

MR. TURK: May we have a moment's pause, please?

JUDGE MILLER: Yes.

(Discussion off the record)

MR. TURK: Mr. Chairman, the other member of the panel has indicated to me off the record that he is capable of responding to the question.

JUDGE MILLER: Well, since the record reflects that there is some suggestion to the Board that another gentleman who is here and capable of being called forward could shed light, I think the record will look

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better if we have him come forward.

Come forward, sir.

Whereupon,

VIRGIL BROWNLEE

was called as a witness on behalf of the NRC Staff, and being first duly sworn, was examined and testified as follows:

BOARD EXAMINATION

BY JUDGE MILLER:

Q Give us your name and address, and how you fit into the picture in terms of the panel, and we'll proceed.

A (WITNESS BROWNLEE) Virgil L. Brownlee, B-r-o-w-n-l-e-e. I'm employed out of Region 2 with the AEC-NRC since 1969, in the capacity of either principal inspector or section chief.

I work with most of the utilities in the southeast part of the United States primarily in construction -- design, engineering and construction and operation.

Q Fine. And could you just tell us your professional and educational background.

A I basically came through the military nuclear programs. Upon leaving those programs, I came to the Commission in 1969.

Q Very well.

Now, what was the question?

BY JUDGE HAND:

Q Mr. Brownlee, the Clinch River Breeder Reactor Plant has everything from a color scheme, I suppose, and some landscaping, to some pretty vital equipment that's involved in the nuclear steam supply system, and all of the bits and pieces to handle the fuel, and I just wondered, from NRC's position, how it handles its quality assurance-quality control program with that tremendous spectrum of things sitting there in front of it?

Do you just pay a lot of attention to the color of the building? Do you fuss about that?

A The Licensee is required to establish what his safety-related systems, structures, and components are, and over the years, the IE, inspection and enforcement --

JUDGE MILLER: Inspection and enforcement is what is referred to sometimes as IE or I&E.

WITNESS BROWNLEE: -- has developed an extensive inspector program.

Now, that program is primarily directed to the safety-related-type equipment, structures, and components. There are other matters that we get into, though, but primarily that program is for safety-related.

The other area is important to safety aspects. We do look into those matters, but primarily, our concern is going to be on the safety-related systems.

Those are identified in the preliminary safety analysis report. That program that we implemented is primarily started with the Licensee even before he submits his application, and we have our management meetings, establish our contacts, do early design and procurement-type audits against submitted or tendered application.

Much of this was done in our period back in '75, '76.

JUDGE MILLER: On Clinch River?

WITNESS BROWNLEE: Yes.

JUDGE MILLER: Okay.

WITNESS BROWNLEE: From that point, as they get closer towards the construction permit, we have looked at vendor activities, the Licensee's activities relative to the implementation of this overall QA program now. We have this year alone, I think, up to about eight or nine inspections on this particular facility relative to his overall QA program implementation.

JUDGE MILLER: Where did those inspections take place?

WITNESS BROWNLEE: We have been here.

JUDGE MILLER: "Here" meaning?

WITNESS BROWNLEE: Oak Ridge. Both on the site and at the project offices.

We have accompanied them to meetings in San Jose, G.E.

We've been to ETEC test facilities where the pumps, steam generators are being tested.

JUDGE MILLER: Where are they located? You may have mentioned it.

WITNESS BROWNLEE: Los Angeles.

JUDGE MILLER: Okay.

WITNESS BROWNLEE: As late as last week, we had one of our engineers, our quality assurance engineers, accompany Westinghouse to a Babcock & Wilcox facility. Those types of activities are what we are involved in out of Region 2.

As we draw closer now and towards that construction permit, we come from an overall general viewpoint.

Now we are going to get specific, depending on the activities as that project goes on. We'll be looking at the civil area up front, and what I'm about to explain is going to be applicable to mechanical, electrical, instrumentation control.

JUDGE MILLER: Slow down.

WITNESS BROWNLEE: But let me explain how we zero in on those specific construction activities, and let me use this front-end civil work.

Prior to -- before they get that civil construction permit, we will have had some of our geologists out there. They have already been here. We will have our civil engineer. We will have our QA men. They will look at that QA program in the area of the civil work. Then our discipline engineers are going to look at those procedures that are in place for the control network. They're going to look at that plant and its certification.

They're going to look at the materials procurement. They're going to look at the laboratory. They're going to look at the staffing.

JUDGE MILLER: The what?

WITNESS BROWNLEE: The staffing. The quality assurance people, their activities. They're going to look at the quality control people, their certifications, their knowledge. They'll look at engineering for adequate support. And basically, we come to the conclusion that they have got the wherewithal to do that business.

We hope to look at it in-depth up to maybe up to six months, and we do come up with a position from the regional office that they have the wherewithal to do that job, and that is a concession from our quality assurance group, and also from our engineering support group, using our discipline engineers and our quality assurance engineers to arrive at that conclusion.

Those are on site inspections, and those are dealing with the people that are doing the job.

BY JUDGE HAND:

Q What if you decided, in your shop, that the quality of the people was less than you felt desirable?

A (WITNESS BROWNLEE) Mr. Brewington would know that by Friday.

Q Do you have any absolute control over that? Can you stop the project based on such a --

A We have that authority in the region.

Q You provided a very, very useful and helpful answer, as far as my understanding of it.

A That was just the front end, but I never told you how we selected yet.

Q You didn't tell me what?

A You asked before how we select.

Q Yes.

A And the randomness, I think, is what got us into this. Subsequent to this front-end determination that the wherewithal is there between the Licensee and his contractors, we're going to do unannounced inspections.

These can be three weeks apart, four weeks apart, but we will have those discipline engineers up on this site, and they will be in the same areas we just discussed. And if a base mat pour is going on, if that has got six different pours in it, one or two of those pours will probably be examined.

The activities are going on at that time. Undoubtedly, he will also look at some of the past records on a couple of the pours that have already been made. So that is sort of how our sampling physically works.

The same thing would be true if I was later downstream in my piping system erections, same type of program, and --

Q Has -- in your experience, has inspection led to identification of a problem early enough so that it could be rectified in the construction stage, rather than trying to go back and change something later?

A We have a hard time on that one. Usually what I try to do is get that front-end determination that the capability is there, and that the people are there before the work starts, or at the very latest, within 10 percent of that work being done, we would have come to those conclusions. And just recently, we did come to a situation on one of the other plants where a problem was identified, the Licensee vigorously looked into it, and at the front end of the job identified they had problems, yes.

Q Well, the news certainly is at the other end, it's after things are constructed.

A We have been very fortunate in this region. We have not been in that group yet.

Q Is that good fortune or good work?

A We like to look at it one way.

JUDGE MILLER: Since we are going to hold you responsible, we'll give you the credit where the credit is due.

JUDGE HAND: Thank you, Mr. Brownlee.

JUDGE MILLER: I have just a few questions before we turn it over to Judge Linenberger.

I can see from your experience that you have been right down in the firing line when some of these problems have arisen in the various plants, Mr. Brownlee. And you may have heard some questions that I asked previously concerning so-called whistle-blowers, or persons, employees, or inspectors of various types who have problems.

I'm aware that some of those may just simply be disgruntled persons who are unhappy with the way they are being treated for reasons having nothing to do with safety, but then on the other end of the spectrum, there could well be some matters which are certainly worthy of an in-depth investigation, let's say, certain types of things and appropriate remedies being invoked.

Could you just describe to us how NRC, from your point of view, inspection and enforcement, would correlate with the description that we have had from other witnesses as to the procedures to be adopted on complaints of various kinds? And I'm thinking particularly now of those that are at least somewhat substantive in character and having in mind such things as readiness of access by more independent people than immediate superiors, chilling impacts--the nature of these investigations by not only your office, but others.

A If I generally can characterize what I've seen in the past, and how we have tried to work in the regional office with the Licensee on this --

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BY JUDGE MILLER:

Q And how will you do this with Clinch River, drawing upon your experience and focusing upon the Clinch River plant?

A (Witness Brownlee) What we have done-- Of course, there is a regular NRC form that is to be posted by particularly your craft gates, the different entries and on different bulletin boards. We have asked the licensees, and have excellent response, if they would also post a letter that our resident inspector and also our regional office has available on a direct charge basis--

Q What I am interested in are the realities of the situation in the field as we have seen them in other plants, as distinguished from the formalism--and I recognize that all you have said is true and correct, but nonetheless, to somebody in the field with a problem he or she deems to be of significance, how is he or she going to be assured that it is considered on the merits and not just sloughed over by formalisms? We had an example a while ago where I guess it was a Stone & Webster organization who had considered the use of exit interviews by independent persons in order to glean information. That kind of thing, I believe, is what I am really directing your attention to, reality rather than formalism.

A There are other examples I have seen where contractors have actually posted their own notification to the personnel on different bulletin boards and at access points.

Q Posting notification is great, but then what if the guy who says something gets fired? I am trying to get you off of that formalism to reality. I can cite you situations where posting was significant and admirable, but it was not reality.

A Well, I guess I have not dealt with that particular problem.

Q Well, would someone within your organization be prepared to start thinking about it in terms of this particular plant as we proceed along with the licensing?

A Yes, yes.

Q Has there been some effort to do so, that you can identify?

A At this particular time we have not.

Q Is it your belief or understanding that the Nuclear Regulatory arm, which is responsible--or arms. There may be some new ones, the Office of Investigation and that--are considering the matter and will come up with some appropriate procedures? Is that your understanding?

A Yes, we will do that.

Q Okay.

A (Witness Ignatonis) Algis Ignatonis again. I would also like to mention that we also do instruct our inspectors to be sensitive to this issue. We dc have a course that's covered in the region. It is offered to all inspectors, and it is called "Fundamentals of an Inspection." One area that we talk about are allegations, and we ask them to be sensitive. Even if it is a perceived allegation, they should inform their management.

Q Yes. That's the kind of thing that I hope that you will be paying attention to as this program evolves. I take it that steps are being taken, both to consider the problems and to consider also what affirmative things can be done and information gleaned, is that correct?

A Yes.

JUDGE MILLER: Okay. All right.

BY JUDGE LINENBERGER:

Q Mr. Brownlee, you were speaking a moment ago about what you termed an upfront assessment of whether an applicant has at least the threshold wherewithal to step in as construction begins and adequately carry out his responsibilities as the Commission would like to see them carried out.

Now, has such a determination been made with effect to the Clinch River project?

A (Witness Brownlee) Our inspections up to date now have--we have no reason to believe that they do not have the wherewithal to do it. I have planned and made arrangements in the period of October and November to further inspect those civil activities on site, and prior to the issuance of a CP, Region II will have come to a determination. At this time we have none.

Q While we are on the subject, I might as well stay with it with the other two witnesses.

Mr. Spraul, from your point of view, from the vantage point of headquarters, which I believe is where you are located, are you aware of or has NRC made any determination of any deficiencies or reasons why the Applicants' organization needs to make any changes of substance before you would be willing to see them step in and implement their quality assurance program?

A (Witness Spraul) I have perceived none.

Q And you, sir?

A (Witness Ignatonis) Same.

Q Okay. I should like to understand just a little better the relationship between the resident inspector and the regional office to whom he reports, and I assume each resident inspector does report to a specific regional office.

A (Witness Spraul) That's correct.

Q Okay. When we talk about the--or you gentlemen talk about, especially you, Mr. Ignatonis, the staff of inspectors that's available from the region to move to the field on specific areas of construction that require specific disciplines, what I'm interested in is is it the responsibility of the resident inspector to advise the region that next week somebody is going to be doing something on welding, and he wants the help of an inspector with welding background, or how does this work?

A (Witness Ignatonis) Yes, sir. We normally do work in the way you just said.

The resident inspector, when he is on site, follows very closely all the activities that are taking place. If he feels that he needs some assistance with a specialist from the region, like you mentioned--for example, if it is conducting UT examinations --he will call what we call the project engineer. For example, I will be the project engineer. He will tell him that he needs some assistance or talk directly with one of the specialists and tell him that the licensee is ready to perform such an installation. "We need your help out there," and we try to accommodate that.

We have free-flowing information. I talk to the residents almost on a daily basis.

Q Your statement of-- Excuse me.

A I would also like to add that we also routinely, the specialists, work on completing their inspection modules. We have a certain module assigned for all inspectors to perform, and they will call me and ask what the status, where it stands for them to go out to inspect. They will perform a similar inspection.

Q Your statement of qualifications was modified to make the point that your responsibility does not include the Clinch River Breeder Reactor site. Is this something that you anticipate will change with time, or are you filling in for somebody who will have that responsibility?

A I believe it was a clarification that was meant to be made that I'm really responsible for seven--I mean for eight reactors, which includes the Clinch River Breeder. I will continue with that, following the project engineering duties.

Q Oh, I understand that. Okay, fine.

Mr. Spraul, the kinds of things we have heard so far and many of the things we have read in this testimony would indicate to me that with competent and aggressive on-the-toes people in the field, there may not be a continuing day-to-day need for you to get into the act.

Now, perhaps I view life too simply here. Can you speak a little bit about your role, and these kinds of things?

A (Witness Spraul) Yes. Once the CP is issued, my role drops to essentially nothing until the FSAR is submitted, at which time I or one of my colleagues would review the QA program for the operations phase, just as we have done for the design and construction phase.

I am in contact-- If questions come up, I'm available, if questions come up from the region as to specific interpretations of commitments in the SAR. I will be in touch with these people. They will ask questions as to what does this mean, how did you interpret this, and things like that, so that they can then use that as the basis for their inspections as they go out into the field.

Once having reviewed the QA program descriptions against the standard plan, getting those to the point where they are acceptable to the staff, preparing Chapter 17 of the SER, safety evaluation report, then my role drops significantly.

Q Clinch River, if it goes forward, will certainly be a first-of-a-kind plant in many respects, despite its borrowing or taking advantage of technology from many other programs. It certainly is a program that will receive intensive attention, not only by the nuclear power industry of the United States, but a lot of attention worldwide as to how it progresses, so that there certainly is an extremely heavy burden, not only in the context that there is a burden on any LWR system, but an especially heavy burden with respect to Clinch River to assure that things run as smoothly as possible.

I'm interested in whether that kind of consideration has caused NRC to assess whether it should modify in any way, strengthen in any way its approach to auditing, monitoring, following the construction activities of Clinch River as compared with a light water reactor plant that's a little more of a routine undertaking? Whoever wishes to address themselves to that or all of you, fine.

A (Witness Spraul) Let me start by saying that for the normal light water reactor plant, I would be reviewing the quality assurance program description of three or four, at the most, entities. It would be basically the applicant, the NSFS supplier, the architect-engineer, and if it is not the architect-engineer, then the constructor also, so that's a maximum of four.

On the Clinch River project, I have looked at seven different organizations' quality assurance programs, so that due to the organization and the way it is set up and the entities involved, our review has extended beyond that which would normally be done for a light water reactor.

Q Mr. Ignatonis.

A (Witness Ignatonis) Yes, Judge Linenberger. Recognizing your concerns, which I think I recognize correctly, maybe perhaps it would help to identify--if I could tell you some of the inspections we have performed to date, in what areas, where we are going, as well as getting some contract assistance.

We are particularly interested in seeing how the configuration management system works, how effective it is, and maybe I can start off with telling you what we have been inspecting so far to date, at least what was started early this year and to now, just briefly tell you.

We had specifically nine inspections performed. They were primarily in the QA program implementation of design and procurement activities. They were in documentation reviews, such as project office management policies and requirements documentation, which has been talked about for some time.

We also reviewed project office procedures, project office QA manuals, including the participant QA manuals.

We reviewed the quality records and work activities of site preparation. We had a geologist out there at the site.

We reviewed also the audits that were conducted by the project office, as well as the lead reactor manufacturer.

We have accompanied the project office when they were performing their audits, and we looked at how the audit was being performed by the project office as well as the lead reactor manufacturer, and we looked at the equipment storage.

We recently have let a contract out with EG&G to assist us in evaluating the Applicants' overall effectiveness of design controls that are consistent with 10 CFR Part 50, Appendix B, and basically what we are looking for is an evaluation which is going to include the review of the lead reactor manufacturer, or Westinghouse, of design control activities with other--

JUDGE MILLER: You are going a little fast, a little slow, and you are not looking at the microphone.

A (Witness Ignatonis) What we want to look at with the team from EG&G is to help us assist inspect how the design interface works between the lead reactor manufacturer, the reactor manufacturer and the vendor. What we will do is select subsystems or components and follow through all the paperwork and see how effective the configuration management is.

This work has already started, and we expect to complete it by October of this year.

Q You mentioned contracting with EG&G to assist you. Does that action of bringing in contract assistance represent something that's a routine practice with LWR projects, or is this a first-time kind of thing because of the complexities of Clinch River?

A This is a first time, the first time we are doing this. We do not normally do this routinely with light water reactors.

End 10

BY JUDGE LINENBERGER:

Q Can you give us examples of -- any other examples of things that you're doing with and for and about Clinch River that are different from your normal approach to life with light water plants?

A (WITNESS IGNATONIS) I'm trying to think here. I cannot probably give a specific example. We are dealing with Region 4 that specializes in vendor inspections about the complexity as we see it, and we are asking for their assistance, also. But other than that, I cannot comment.

Q Well, let me ask one specific.

Early on, you indicated that you have an available cadre of perhaps as many as 20 inspectors, I assume, not all full time on Clinch River, but available as needed to assist with Clinch River.

Now, is that a larger number on Clinch River than would normally be used on a -- in an LWR effort?

A I've been advised that our resources, since construction is slowing down in other areas of light water reactors, that we could really significantly have quite a few more resources, maybe we can even go to 50 inspectors and concentrate on the Clinch River area.

Q Well, okay. Now, that's something external that makes -- maybe makes your life a little simpler, but I'm looking for examples of things that NRC is consciously, if indeed there are any, I'm not meaning to infer that there must be some -- but looking to see whether there are things that NRC is taking the initiative to do with respect to staffing, nature of inspections, nature of statistical sampling, or whatever, that's different with respect to Clinch River than your routine approach to life with light water reactors. And I guess I'll strike the word "routine," because I'm sure your life isn't routine at all.

A (WITNESS BROWNLEE) I think one major area that's been overlooked, and we're working closely with the NRR project office, and the particular areas of concern they might have, and we are reviewing -- and I just happen to have the document here that was mailed, this is our inspection plan for Clinch River which is apart from the light water reactor program, although it is the light water reactor program. But we are evaluating manual chapter for manual chapter its applicability to life at the Clinch River project.

The concerns that are generated as time goes by, and those that are being identified, are being folded into our light water program to see if we need significant changes. Is that the type of things you're alluding to?

Q Yes, indeed.

A Well, we have got an extensive number of manhours already poured into it. This has been reviewed and accepted by NRR. We have some commitment dates like September 30th, and so on, that we have got to have back to them. And I refer to like front-end work, that first six months of work, by September 30th I'll have back to them what manual chapters relative to that civil work going on that require significant changes from the light water program with those special concerns that we know at that time.

Q Who is NRR?

A This is Mr. King, Clinch River Breeder Reactor Project Office, Nuclear Regulatory Regulation Program Office.

Q All right.

A I've got a term problem here.

Q There is an NRC headquarters organization known as NRR, and I wondered to whom you were referring.

A Mr. King's group there.

MR. TURK: For the record, maybe I can clarify.

The NRR acronym stands for the Office of Nuclear Reactor Regulation at the NRC. NRR has set up a distinct suboffice, if I may use that term, which is the Clinch River Breeder Reactor Project Office.

Mr. Thomas King, sitting next to me at the table, is the safety -- I guess, chief of the safety review team at the CRBR project office, within the office of Nuclear Reactor Regulation.

JUDGE LINENBERGER: Thank you very much.

WITNESS BROWNLEE: I think there has been a lot of work already progressed in the process, and will continue throughout construction relative to the special attributes to the Clinch River Breeder Reactor and our inspection and enforcement program.

JUDGE MILLER: Any redirect, Mr. Turk?

MR. TURK: Very briefly.

JUDGE MILLER: Sure.

CROSS-EXAMINATION ON BOARD QUESTIONS

BY MR. TURK:

Q I don't recall if Mr. Brownlee stated his precise title. I'd like to ask him to do that for the record, and also I'd like to ask that following the close of the hearing session, the Staff be permitted to forward as an exhibit to be included in the record a copy of Mr. Brownlee's statement of professional qualifications.

JUDGE MILLER: Yes, you may do so. What will that exhibit number be? 47?

MR. TURK: I believe that will be 47.

JUDGE MILLER: All right. Leave is granted to submit as Staff's Exhibit 47 the qualifications of

Mr. Brownlee, and that may be done by -- do you want to do that by mail?

MR. TURK: Yes.

JUDGE MILLER: That will be done by mail, and it will be regarded as being incorporated into our record.

Proceed.

BY MR. TURK:

Q I'd like to ask Mr. Brownlee for the record at this point to state his precise current title.

A (WITNESS BROWNLEE) I'm the section chief of Project Section 2-A, Region 2, NRC. The section that has been assigned the Clinch River Breeder Reactor Project.

Q Among your duties -- forgive me, I seem to like leading questions.

A The resident inspector will report to me. The project engineer will report to me. We also have out of that region another special application, which is all of the inspection and enforcement activities, and this is different than the normal light water reactor program.

This includes our vendor inspection directions program, so we are treating Clinch River quite differently than we do the normal light water reactor program.

Q So, very quickly, follow-up to a question that was asked previously about unannounced inspections.

Would you explain the reason for having unannounced inspections.

A Typically, we try to operate with about an 80 percent average on unannounced inspections. This means the Licensee is not prepared on who's coming in, what he's going to be looking at. He finds out at the entrance interview, and it is primarily for the purpose of them not second-guessing who it may be.

We talked about the number of engineers that are available. The regional office inspection is a secondary-type inspection over the resident. They have primary responsibility for the approval within our system of the review and approval of those procedures, organizational and our sign-off, and the way our system works.

They are the individuals that make that final determination. Their resident inspector is the first-line contact, day to day, and I know there was some concern about whether he got out of the office. He budgeted for 54 percent of the time in the hole, and I'm supposed to check up on him, if that gives you any confidence.

JUDGE MILLER: We're going to strike that. That was a gratuitously volunteered remark, sir.

WITNESS BROWNLEE: I'm sorry.

JUDGE MILLER: That's all right.

Proceed.

BY MR. TURK:

Q With respect to the inspections plan for the Clinch River Breeder Reactor, which you referred to earlier, can you advise the Board whether the CRBR program office within NRR will be providing any assistance to you in your inspections program?

A (WITNESS BROWNLEE) Yes. I thought we had made that clear.

We are working closely with them, and the attributes that are not necessarily known to our people in light water reactor programs are being provided by those individuals, and those concerns are brought to us.

We review our normal inspections program in light of those concerns and will factor those in. In areas where our present program does not fit, we'll write additional procedures for inspections of those areas.

Q Will the NRBR program office assist in training or educating the Region 2 individuals so that they may perform their functions?

A Yes. We have already got dates scheduled for some of those.

MR. TURK: The Staff has nothing further.

JUDGE MILLER: Cross-examine.

MR. EDGAR: Nothing, Your Honor.

JUDGE MILLER: I believe that's all, then.

Thank you, gentlemen. You're excused.

(Witnesses excused)

Okay. What do we have next?

MR. EDGAR: I think we are at closing argument.

JUDGE MILLER: I know that eventually we'll recess. How much time do you wish? You have the laboring oar, so we'll give you what time you feel is necessary, because we can obviously finish this afternoon with the closing arguments.

MR. EDGAR: I'd like to convene at 1:00 o'clock, if possible.

JUDGE MILLER: We can go anytime you're ready to go.

MR. EDGAR: I will be ready, but I would like to take -- if we could take our lunch break now, that would be good.

JUDGE MILLER: We're recessing now for lunch. We'll reconvene at whatever time you say. You can have more time if you want it.

MR. EDGAR: I think that will be sufficient.

MR. TURK: May we approach the bench for a second?

JUDGE MILLER: Yes.

(Discussion off the record.)

(Whereupon, at 11:30 a.m., the hearing was recessed, to reconvene at 1:00 p.m., this same day.)

(AFTERNOON SESSION)

(1:00 p.m.)

JUDGE MILLER: We will resume, please. Closing arguments, Mr. Edgar.

MR. EDGAR: On behalf of the Applicants, I would like to cover in order, with a few introductory remarks, Issue 1, which is whether a CDA should be a DBA, and Issue 2, which is the adequacy of the HCDA analysis.

Then I will proceed to address each of the 17 specific Board questions identified in the May 24th notice of CP evidentiary hearing.

Finally I will address the limited appearance statement filed by NRDC, et al, which has been marked and entered into the record as Board Exhibit 125.

So with that introduction, in terms of the organization of the presentation, I would begin with several preliminary remarks which have to do with the concept of the CRBRP design safety approach.

Now, the CRBRP design safety approach has followed the Commission's traditional three-level defense-in-depth concept. See here Staff Exhibit 26 at 1 through 2.

The Staff has applied the objective to CRBRP that the level of safety will be comparable to that of other LWR's. See Staff Exhibit 32 at 14.

There has been major emphasis placed on the prevention of accidents in CRBRP. To this end, specific features have been incorporated in the design to assure that the likelihood of conditions that could lead to initiation of HCDA's is extremely unlikely. See here Staff Exhibit 32, TR 8036 through 8101, and Applicants' Exhibit 87, TR 7378 to 7594.

Notwithstanding the fact that Applicants have provided these design features and that the Staff has independently concluded that HCDA's can be excluded from the design basis, the CRBRP design approach is unique inasmuch as and insofar as it provides specific additional features in the design to assure that there is a low likelihood of containment failure and any unacceptable consequences associated with core melt and disruptive accidents beyond the design base. See here Applicants' Exhibit 89, TR 7763 through 7916. Staff Exhibit 41, TR 8270 through 8442.

Now, with that as an introduction to provide the context for consideration of the two first issues which I will address, let's proceed to consider the question and the record evidence concerning whether an HCDA should be a DBA for Clinch River.

It is important to note at the outset that both the Applicants and Staff have grounded their position on whether an HCDA should be a DBA on deterministic engineering judgments, criteria, analyses and applicable experience. See here Staff Exhibit 32 at 7 through 8, TR 8042 through 43. See also Applicants' Exhibit 87, TR 7378 through 7594.

The record clearly shows that this is the most reliable, mature, and valid basis for determining this decision.

See here Staff Exhibit 32 at 13, TR-8048. See Applicants' Witness Clare, TR-7749.

We'll return to the question of the role of probabilistic risk assessment in this decision, but for the moment, it's enough to say that the results of such assessments and analyses have not played a decisive role in either the Applicants' or Staff's position that HDCA should not be DBA's.

See here Staff Exhibit 32 at 13, Staff Exhibit -- or excuse me -- Applicant's Exhibit 87 at 175 to 177. The important thing to establish at the outset with regard to HCDA initiation is that initiation of an HCDA would require multiple failures of mitigating safety systems.

NRC regulatory practice has placed strong emphasis traditionally on deterministic criteria such as redundancy, diversity, and independence,to establish that such multiple failures are highly unlikely.

See here Staff Exhibit 32 at 7 through 8, TR-8042 through 43.

The Applicants developed through FFTF experience, review of other domestic reactors, review of the Staff's standard content of safety analysis reports for LMFBR's, an extensive initial list of design basis events for which detailed review and analysis should be conducted.

See here Applicants' Exhibits 71 through 72, Sections 15-0 through 15-7.

See Staff Exhibit 32 at 8, TR-8043.

The Staff conducted an extensive analysis and review of these design basis accidents. The Staff verified through that review that the design basis accident spectrum for CRBRP was indeed sufficiently comprehensive, and that no initiators or sequences of importance to HCDA initiation have been overlooked.

See here Staff Exhibit 32 at 8 through 9, TR-8043 through 8044.

See Staff Exhibits 26 through 28, and particularly, Staff Exhibit 26, Sections 6 and 15.

The Staff also extended that verification and confirmed that verification through a comparison of CRBRP DBA to those in other domestic and foreign fast reactors, to those in LWR's, and the Staff went on to consider a review of the available failure modes and effects analyses, and initiator studies that have been conducted for CRBRP.

See here in particular Staff Exhibit 32 at 9,

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and at 36 through 42, TR-8044 and TR-8071 to 8077.

See, also, for the domestic -- or LWR and foreign reactor experience, see Staff Exhibits 33 and 34.

The Staff's review of DBA's lent considerable insight into the behavior of the plant to upset conditions, and enabled the Staff to form some judgments as to what safety functions are necessary to prevent CDA's.

The first and foremost conclusion drawn by the Staff here is that the safety functions necessary for prevention of HCDA's are not fundamentally different from those in LWR's, that what we see is that even given technological differences, there is a need to assure that certain systems and certain requirements are in place.

These are specifically, in the Staff judgment, two fast acting, redundant, diversified, and independent reactor shutdown systems, also a requirement for redundancy, diversity, and independence and decay heat removal, means for production or for prevention and timely detection of local imbalance in heat generation and heat removal, and means to assure sufficient sodium flow, and inventory maintenance for heat removal.

Finally, the Staff identified the need for provisions for accommodating sodium leaks, provisions for accommodating sodium fires, and an additional unique requirement which is specific to Clinch River, and that is needed for a formal reliability assurance program, which is to be made part of the engineering process of the project.

See here, in regard to the Staff requirements, Staff Exhibit 32 at 15 through 16, and TR-8050 through 8051.

For their part, the Applicants undertook an extensive mechanistic analyses -- or analysis, to examine the potential for progression to HCDA conditions at a very fundamental physical level.

All initiators and sequences of importance to HCDA conditions, irrespective of their origins or timing, must involve one of two basic core conditions.

They are reduced heat removal or excessive heat generation.

See here Applicants' Exhibit 87 at 4 through 5, TR 7381 to 7382. There are numerous pathways about those conditions which can be defined and which the plant features must be available to mitigate, terminate, and limit.

See here in particular the diagram which shows those pathways in Applicants' Exhibit 87 at 5, TR 7382.

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Without going into great detail here, and I will skip the summary here, but the record contains voluminous detail concerning Applicants' analyses and Staff's independent review and analyses of the design basis sequences for CRBRP and the manner in which the plant features will act to terminate, mitigate, and limit progression of conditions toward HCDA initiation.

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See here Applicants' Exhibit 87 at 4 through 54, TR-7381 to 7431.

See Applicants' Exhibits 71 and 72, Section 15. See Staff Exhibit 26, Section 15, and Staff Exhibit 32 at 36 through 42, TR-8071 through 8077.

We believe--and we believe that these exhibits demonstrate that the analyses provide great insight into the mechanisms and pathways necessary for progression to HCDA conditions, and a high degree of confidence that CRBRP has been thoroughly engineered to preclude the attainment of HCDA initiation conditions.

The other significant implication of the DBA analyses and the Staff's independent review and analyses of these design basis accidents is that there are four basic classes of features in this plant which are necessary for prevention of HCDA conditions.

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These are the reactor shutdown system, the shutdown heat removal system, means to prevent local imbalances between generation and heat removal and means to prevent primary system inlet pipe rupture. Those are the four important features.

The manner in which these features interact with the plant to terminate, limit and mitigate these sequences or pathways which could lead to HCDA conditions are shown diagramatically on Applicants' Exhibit 87 at 54, TR 7431.

We think that that captures the logic and the importance of these features and the role which they play in prevention of HCDA conditions.

Just to go over briefly the evidence of record as to each of these four major classes and features and why each of these features will function reliably to limit HCDA initiation and thus because of these features, HCDA's can be excluded from the CRBRP design base, with respect to the shutdown system first, it is important to recognize that CRBR has proposed a design consisting of two, rather than one as in LWR's, fast-acting reactor shutdown systems, either of which by itself can reduce reactor power level and shut down the reactor when required. See here Applicants' Exhibit 87 at 9 through 53, TR 7387 to 7430, Staff Exhibit 32 at 21 through 24, TR 8056 through 8059.

These reactor shutdown systems are based on proven technology and are redundant, diverse and independent in regard to sensors, logi·, control rod drive mechanisms and control rods.

Both systems function automatically. The only role of the operator in regard to reactor shutdown system action is to confirm that the action has taken place. See here Applicants' Exhibit 87 at 81 through 82, TR 7458 through 7459.

It is also important to emphasize here that the major components and the appropriate integrated systems for the reactor shutdown system have been extensively tested. They have been tested beyond the number of event cycles expected during plant lifetime and, moreoever, both reactor shutdown systems will be subject to periodic on-line functional testing during plant operation. See here Applicants' Exhibit 87 at 71, 81 through 84, TR 7448, 7458 through 61.

Once reactor shutdown is achieved, the shutdown heat removal system proposed for CRBR will act to remove reactor decay heat through, first, any one of three primary heat transport system and intermediate heat transport system and steam generator system loops, with what is called the steam generator auxiliary heat removal system.

Secondly, the CRBR has, in addition to these three heat removal pathways, a diverse direct heat removal service, DHRS. Any one of these four paths is capable of removing reactor decay heat from the reactor core. See here Applicants'

Exhibit 87 at 86 through 111, TR 7463 through 7488. See also Applicants' Exhibit 67, Section 5 through 5.7 and Staff Exhibit 26 at Sections 4, 5, 7 and 15.

These systems are all safety grade systems. They function automatically. One can remove all reactor decay heat with the steam generator auxiliary heat removal system without the need for operator action.

All three paths in the steam generator auxiliary heat removal system have the diverse capability to remove decay heat via natural circulation or convective processes, even in the event of loss of all power; that is, station blackout.

In our judgment, that's a very important capability and one which contributes substantially to the overall reliability of the Clinch River Breeder Reactor decay heat removal reliability.

In regard to that, see Applicants' Exhibit 87 at 97 through 99, TR 7474 through 7476. See Staff Exhibit 32 at 26, TR 8061, and finally see Staff Exhibit 37, TR 8192 8196.

It is also important to recognize that in order to remove decay heat, one must assure sufficient primary heat transport system inventory to assure that decay heat removal is adequate.

This is assured, even in the event of a leak, by a highly reliable passive means, and that means is the use of guard vessels around the major primary system components and elevated piping between those components to assure that even in the event of a leak, inventory is maintained. See here Applicants' Exhibit 87 at 99 through 102, TR 7476 through 79. See also Staff Witness King, TR 8148.

Having covered the reactor shutdown system and the shutdown heat removal system, it is necessary to turn to consider the means available in the design to prevent rupture of primary heat transport system inlet piping.

Here we are talking about a large piping rupture as distinct from a leak.

The sodium coolant in CRBR is pressurized only to the extent necessary to pump the coolant through the primary system. There is no potential for flashing in the vapor due to loss of system pressure as in a LWR. See here Applicants' Exhibit 87 at 112 to 114, TR 7489 through 7491.

The CRB has specifically been engineered to accommodate leaks substantially or many times larger than a design basis leak, without a reduction in heat removal capability of any significant moment. See here Applicants' Exhibit 87 at 27 through 29, TR 7404 through 7406.

In addition, CRBR incorporates highly reliable, redundant leak detection systems, which are capable of detecting a leak which is orders of magnitude below the design basis leak value. See here Applicants' Exhibit 87 at 114 through 117, 119 through 122, TR 7491 through 7494, 7496 through 7499. See also Staff Exhibit 32 at 29, TR 8064.

In addition, there have been extensive fracture mechanics and materials analyses conducted for CRBRP which show four levels of protection to assure that the likelihood of a large pipe rupture is extremely unlikely. Rather than repeat that, I will simply provide the citation, Applicants' Exhibit 87 at 122 through 129, TR 7499 through 7506, also Applicants' Exhibit 88.

The point here is simply that reliance has been placed on reliable, passive understanding of primary system properties so that the likelihood of a large pipe rupture is inherently low.

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In terms of prevention of local imbalance between heat generation and heat removal, CRBR has been providing or has provided two types of features and capabilities.

The first is a set of features and capabilities which will preclude mispositioning of fuel assembly in a location where it might otherwise receive inadequate coolant flow.

The second type or class of feature are those which preclude blockage of flow to an individual subassembly. Now, in terms of features to avoid mispositioning, the CRBRP core design is an integrated mechanical core design which provides lower inlet module discriminator insets, outlet nozzle, identification notches, manual and computerized inventory systems, and a monitoring and detection capability which assures that malpositioning of a fuel assembly is highly unlikely.

See Applicants' Exhibit 87, 131 through 135, TR-7508 through 7512.

That addresses the question of mispositioning of fuel assembly.

Turning now to the question of features to prevent blockage of fuel to an individual subassembly, there are two categories of features here which are important. The first is that the design provides a multiplicity of redundant flow paths in the lower portions of the core, and these flow paths occur in the subassembly inlets, in the inlet modules that hold groups of subassembly, and also in the core support structure that holds and supports the inlet modules.

See Applicants' Exhibit 87 at 136, TR-7513.

These redundant flow paths which have been subjected to extensive scale model testing provide an inherently reliable passive means of assuring that there will not be a flow reduction to a fuel assembly caused by foreign objects or any other means.

See here Applicants' Exhibit 87 at 136 through 137, TR-7513 through 14.

Notwithstanding this, extensive analyses have been performed of blockage at the core inlets and within the core. The fact is that these analyses demonstrate with high confidence that the design will accommodate inlet blockages and in-core blockages without any adverse consequences or significant reduction in heat removal capability.

See here Applicants' Exhibit 87 at 138 through 140, 7515 through 17. It should also be emphasized that there is a large body of experimental and analytical evidence which is based on EBR-2 testing, worldwide LMFBR operating experience, and specific analyses of CRBRP

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design characteristics, which show that rapid propagation of local fuel rod failures beyond their immediate vicinity is highly unlikely.

The cites here are almost too extensive to list, but the major cites that the Board may want to consider here at this juncture are Applicants' Exhibit 87 at 143 through 147, TR-7520 through 24; see Staff Exhibit 26 at Section 15.4, and see Staff Witness King, TR-8149 through 8150.

It should also be emphasized that not only does the experimental data and the worldwide operating experience show that rapid propagation is highly unlikely, but we should remember that each subassembly is housed within a subassembly duct which provides inherent passive protections of any propagation from one subassembly to the next.

See here Applicants' Exhibit 87 at 143, TR-7520.

Even if one were to encounter significant fuel failures, these failures can be detected by fission gas detectors and delayed neutron detectors installed in CRBRP at levels well below those levels which could result in significant imbalance through local heat generation and removal.

See here Applicants' Exhibit 87 at 147 to 52, TR-7520 through 7529.

The Applicants have committed to and have commenced a program which is the cladding run beyond breach program, which will be conducted at a BR-2 to establish the capability and the limits of CRB operation with local fuel failures.

Pending completion of that program, the NRC Staff has imposed operating limits on CRBRP operation which will preclude any significant local imbalance.

/// See here Staff Exhibit 32 at 33, TR-8068,

// and see also Applicants' Exhibit 87 at 132 through 56, TR-7509 through 7533.

That covers the four features. We submit that the record evidence is extensive that first CRBRP analyses have identified the initiators, sequences, and pathways of importance to HCDA initiation.

Secondly, the CRBRP design has the right features and the reliable features to prevent that progression. We submit that on the basis of reliable engineering analysis, that the likelihood of a CDA in CRBRP is sufficiently low that it should not be a design basis accident.

As a footnote to those conclusions, we should emphasize the state of the record regarding the reliability assurance program and the probabilistic risk assessment for CRBRP. Even though it is not an existing regulatory requirement, the Staff has imposed an additional requirement on CRBRP for a formal reliability assurance program.

The purpose of this program is not to disprove that an HCDA should be a DBA; it is an engineering tool which is designed to enhance the safety-related reliability inherent in the major CRBRP safety features.

This program, which is described at Staff Exhibit 32 at 57 through 59, TR-8092 through 8094, and further described at Applicants' Exhibit 87 at 159 through 169, TR-7536 through 7546, will be conducted throughout the entire CRBRP plant lifetime.

It is not a one-time study. It is an ongoing engineering activity, and its results and implementation will be reviewed by the NRC Staff.

See Staff Exhibit 32 at 62 to 64, and TR-8097 through 8099.

The Staff properly considers the reliability program to be a valuable means of assuring safety of CRBRP, but it has not been used as a present basis for a decision on exclusion of HCDA's from the CRBRP design base.

See Staff Exhibit 32 at 52 through 60, TR-8087 through 8095.

Turning now to the PRA, it is a fact that the PRA -- or that the Clinch River Project will perform a comprehensive probabilistic risk assessment which is comparable in scope to WASH 1500.

See here Applicants' Exhibit 87 at 170 through 178, TR-7547 through 7555. It is important to emphasize the objective of that program. It is not to rule out HCDA's. It is to provide an engineering tool within and recognizing its limitations to define the relative importance of systems and components to reliability and safety, and to identify system weaknesses, if any, and to further identify specific preventive or mitigative actions to reduce risk.

See Applicants' Exhibit 87 at 170, TR-7547 and Staff Exhibit 32 at 46 through 47, TR-8081 through 8082.

While the record shows that the experts believe that the PRA is a useful tool or adjunct to assuring the safety of CRBRP, the record also shows that the state of the art is not sufficiently mature to use or to require a PRA as a decisive basis for determining the CRBRP design basis.

See here Staff Exhibit 32 at 13, at 44 through 46, TR-8048 and 8079 through 8081.

See Staff Witness King, TR-8168 through 8169, and Applicants' Witness Clare, TR-7749.

To recapitulate, the CRBRP has placed major emphasis on the design to prevent HCDA initiating conditions. The behavior of this plant in the face of potential HCDA initiating conditions is well understood, and it has been exhaustively analyzed.

The key features which are necessary to prevent an HCDA are well identified, and have been designed using proven methodology, technology, and analyses.

These features are inherent, reliable, and provide a high degree of assurance that CRBRP accidents will be erased well short of HCDA initiation -- initiating conditions. We submit that from a broader perspective, that the evidence here is exhaustive in its level of detail; that the Applicants' attention to the design and the Staff's extensive review are matters which are fully supported in the record, and we believe, buttressed by the Board's personal observation of the people who have conducted that design, and who have performed that review.

We submit, then, that the record calls for a finding that HCDA's should not be DBA's in CRBRP. This concludes issue 1, and we wll now turn to issue 2. I will pick up the pace, but I honestly believe that's an important issue, and it warrants that level of detailed attention.

That's not to say that others are not important, but simply that that is the first and, in our judgment, the most important.

Now, as we had previously pointed out, although CRBRP has been designed so that HCDA's are beyond the design basis, specific features have been provided in the design to provide margin to mitigate beyond design basis accidents, and thus, limit the risk -- residual risk of beyond design basis accidents to acceptable levels.

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The basic purpose of these features is to provide a means of assuring, first, containment integrity and, secondly, control of releases of radioactivity in the unlikely event that an HCDA could occur.

Now, from a physical standpoint, it should be emphasized that there are two basic types or classes of challenges to containment integrity that are important here.

The first type is a challenge from internal missiles, and the second type is a challenge from internal pressure. See here Applicants' Exhibit 89 at 3, TR 7765.

The analyses of these containment challenges and the related phenomenology can be conveniently broken down into two basic categories.

The first is labeled structural margin beyond design basis, and the second is labeled thermal margin beyond design basis.

From a physical standpoint, the first, the structural margin, addresses short-term--that is, minutes or less--challenges to containment integrity, while the thermal portion of the analysis addresses long-term--that is, hours to months--challenges to containment integrity.

In the short term we find what has been called, for convenience, the energetics issue.

One might challenge containment in the short term through a large prompt sodium release through the reactor vessel head into the containment, with sodium burning and resultant over-pressurization of the containment or, alternatively, with a challenge to the reactor vessel head one might generate internal missiles and thereby raise the potential for missiles with sufficient energy to penetrate the containment. See here Applicants' Exhibit 89 at 4, TR 7766.

Now, either of these challenges could occur only if an HCDA occurred which imparted sufficient energy to the reactor coolant boundary to exceed its structural capability. In other words, if one contains the energy within the reactor coolant boundary, one can in turn limit short-term challenges to containment integrity.

With these points in view, the objectives of the Applicants' analysis and the Staff's extensive independent review and analysis were to consider, first, the likelihood of energetic behavior within the core and, secondly, the capability of the CRBRP design to absorb or accommodate those energetics without a challenge to the reactor coolant boundary. See here Applicants' Exhibit 89 at 4 through 5, TR 7766 through 7767, Staff Exhibit 41 at 11 through 12, TR 8282 through 8283.

Now, to review these analyses very briefly, the basic thrust or message of the Applicants' analyses were that the likely outcome of any HCDA energetic sequence would be well within the structural capability of the reactor coolant boundary.

The Staff conducted an independent analysis and review which concluded that HCDA's with sufficient energetics to fail the reactor vessel head are physically unreasonable and not a significant safety concern for CRBRP. See Staff Exhibit 41 at 6, TR 8275.

It is important here to place in perspective what the margin is within Clinch River to accommodate energetics, and I think the best point in the record to gain a grasp of that can be found in the Staff's testimony and, of course, there are related back-up pieces of information in NUREG 3224 and in Appendix A of Staff Exhibit 26, but it is worth looking at some of the numbers and judgments that the Staff developed as a result of their independent review.

Now, recognizing that the values given are reference values for purposes of perspective, the first thing that the Staff determined was that the accident energetics values which would correspond to 1130 megajoules--that is, an isentropic expansion to one atmosphere--would produce minimal dynamic loadings on the reactor coolant system boundary because of attenuating or mitigating effects due to the core barrel upper internal structure and core support structure.

The fact is that the concept of isentropic expansion assumes some ideal process, but as the Staff analyzed it, taking into account the physical attenuating mechanisms within the reactor vessel, the analysis disclosed the ability to accommodate at least 1130 megajoules.

The Staff then looked at it further, taking into account additional mitigating mechanisms, and determined that accident energetics characterized by 2550 megajoules done in isentropic expansion to one atmosphere would be necessary to approach the structural capability of the reactor vessel head.

These levels of energetics, 1130 megajoules and 2550 megajoules, correspond to reactivity ramp rates on dis-assembly of $100 per second and $200 per second, respectively, and both values are far beyond the ramp rates which the Staff expects or calculates for any HCDA event.

See here Staff Exhibit 41 at 28 through 49. See the same exhibit at TR 8300 through 8323.

The Staff's bottom line conclusion was that HCDA introduced reactor vessel failure is physically unreasonable. See Staff Witness Theofanous, TR 8446. That term--"feasibly unreasonable"--is the equivalent to "extremely unlikely."

The Staff has concluded, based on their independent review, that the Applicants' SMBDB energetics level--that is, the 75 megajoules slug impact kinetic energy--is adequate. See Staff Exhibit 27, Appendix A at A.2-11. Excuse me. That should be Staff Exhibit 26. No. I'm sorry. It is 27. I lost it mentally.

The Applicants' own analyses which analyze substantial range of initiating events, accident phenomenology and accident regimes determine that the likely outcome of HCDA sequences was in fact nonenergetic. See Applicants' Exhibit 89 at 61 through 128, TR 7823 through 7890.

Notwithstanding that conclusion, the Applicants have imposed and the Staff has reviewed dynamic load requirements which are based on an assumed HCDA energetic level of 660 megajoules, corresponding--or which result from isentropic expansion to one atmosphere.

The structural analyses, which conservatively calculate loads, neglecting attentuating effects of the reactor internals, show that there is substantial margin in the reactor coolant boundary to accommodate HCDA energetics. See here Applicants' Exhibit 89 at 129 through 130, TR 7891 through 7892,

The energetics analysis included consideration of two specific issues that came up in the course of the Staff review.

The first was plenum fission gas induced compaction.

With regard to that, the Applicants are committed to conduct further analyses to resolve the concern or to implement a simple feasible design modification to limit the energetics potential of this phenomenon. See here Staff Exhibit 41 at 38 through 40, TR 8312 through 14, Applicants' Witness Fauske, TR 7968, and Staff Witness Theofanous, TR 8457.

Further, the Staff's review disclosed a potential kinematic failure mode involving an interference phenomenon with the rotating slugs in the reactor head, which has the potential for challenging the structural integrity of the reactor head.

The Applicants have committed to further analysis and testing, scale model testing, and have developed a feasible design modification to resolve that term--or that particular issue. See in this regard Staff Exhibit 41 at 34 through 36, TR 8307 through 8309, and Applicants' Exhibit 89 at 142 through 143, TR 7904 through 7905.

We submit then that the record shows that there is in fact for CRBR no short-term threat to containment integrity by virtue of energetic HCDA's. For that reason the focus then must shift to the longer term and the phenomena involving longer term thermal penetration of the reactor vessel, guard vessel and the phenomena which influence core debris in the reactor cavity.

Here we are talking about a long-term challenge to containment integrity of two basic types, either over-pressurization by sodium burning or hydrogen burning and decay heat or over-pressurization by the buildup of non-condensable gases; hydrogen, for example, if that does not burn. See here Applicants' Exhibit 89 at 10, TR 7772.

The objectives of the Applicants' analyses and the

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Staff's independent review and analyses here are to assess the capability of the specific CRBRP design features to avoid challenges from over-pressurization and, secondly, to control radioactive releases.

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The specific design features of CRBRP include a reactor cavity vent system, a containment annulus cooling system, a containment vent system, a containment purge system, and a containment cleanup system, and associated instrumentation.

The Applicants' analyses and the Staff's independent review and analyses show that containment integrity would not be challenged by over-pressurization until about 24 hours after initiation of an HCDA event.

Even then, by venting the containment through the cleanup system, one can control radioactive releases so that one maintains the capability for containment integrity, and just as important, limits doses to values which do not exceed the 10 CFR Part 100 dose guidelines.

See here Applicants' Exhibit 87 at 10 through 60, TR-7772 through 7822, Staff Exhibit 41 at 61 through 115, TR-8035 through 8090.

We will return in connection with a Board question involving the containment confinement system to further consideration of this issue, but to recapitulate, the record clearly shows the following: First, either containment failure caused by energetic HCDA's is highly unlikely.

Secondly, any challenge to containment integrity will occur, if at all, at about a day after initiation of an HCDA, and even then, dose consequences will be within the 10 CFR Part 100 guidelines.

In our judgment, this leads to three basic conclusions or implications. First, there is ample margin in the design to accommodate beyond design basis events.

Secondly, there is a substantial amount of time in which operator interdictive actions in the form of repair or recovery of systems, for example, and emergency actions can be effectively implemented.

And, third, in light of the features in the design to prevent HCDA's, the residual risk of HCDA's is acceptably low.

In a broader context, when one examines issues 1 and 2 together in their totality, we would urge the Board to consider several basic points.

First, this design has implemented the best engineering means at our disposal to prevent HCDA's.

Secondly, the design has incorporated additional features that go beyond any conventional sense of three levels of safety or defense in depth to assure that the risk beyond the design basis is acceptably low.

We believe that this adds up, on the basis of this record, to a high degree of confidence that the risks associated with CRBRP operation will be acceptably low.

JUDGE MILLER: Do you want to have a recess?

You've been going for about an hour. You're welcome to suit your own sense of timing.

MR. EDGAR: I will plunge on, if I may.

JUDGE MILLER: Sure.

MR. EDGAR: I would like to get into some of the Board questions, if I could, and I may grind down a little bit in about 20 minutes, but --

JUDGE MILLER: We'll recess anytime you want. You just say the word.

MR. EDGAR: All right.

Thank you.

The first question is Board Question 1, involving the question of the source term activities that are now ongoing with NRC -- within NRC.

At the present time, the NRC accident source term program office plans to address the severe accident source term for LWR's, but not for LMFBR's, since the latter involve different coolant fuel and design.

See here Staff Exhibit 41 at 115, TR-8393. There are two source terms used to evaluate the CRBRP design from a safety perspective.

The first is the source term used for site suitability, the so-called site suitability source term, and the second is the source term used for HCDA's in which beyond design basis mitigating features are operating.

The record clearly shows that a change in the site suitability source term in a more conservative direction is not likely to result from the efforts of the accident source term program office.

It is unlikely that any Staff conclusion would change with respect to the suitability of the Clinch River site; however, should that occur, and the record shows it is highly unlikely, the Staff has evaluated that prospect and considers that changes could be easily incorporated in or accommodated by the CRBRP design.

See here Staff Exhibit 41 at 116 through 117, TR-8394 through 95.

See Staff Witness Hulman, TR-8510 through 8514.

The source term used by the Staff for evaluation of HCDA doses in contrast to the SSST source term has no real parallel in LWR's.

That is, the CRBRP source term accounts for the specific fuel configuration, aerosol behavior, et cetera, which apply to CRBRP. These considerations have already been evaluated for CRBRP and a re-evaluation of similar or analogous conditions for an LWR should not be expected to produce larger source term estimates for the CRBRP.

The record, therefore, shows that it is unlikely that the accident source term program office findings would appreciably alter the Staff's HCDA source term, or more importantly, their conclusion that HCDA doses are below the 10 CFR Part 100 guidelines.

See here Staff Exhibit 41 at 117, TR-8395.

In all events, the Staff has committed to ensure that the conclusion reached by the source term program office will be specifically considered during the OL stage of the review. See here Staff Exhibit 41 at 117 through 118, TR-8395 through 96.

The second Board question relates to the definitions and modes associated with the term "failed fuel." I will attempt to truncate this discussion somewhat, put more emphasis on the citations and less on the characterization of the evidence, but starting with a fundamental principle as used by the Applicants, failed fuel means any loss of cladding integrity resulting from either unpredictable conditions such as fabrication fault, or mechanistic failures resulting from excessive strains caused by internal gas pressure or fuel cladding mechanical interactions.

See here Applicant's Exhibit 82 at 182, TR-7559.

The Applicants' overall design requirements on the fuel deal with all four relevant levels of reactor conditions.

That is, normal operation, anticipated transients, unlikely transients, and extremely unlikely transients.

See here Applicants' Exhibit 87 at 185, TR-7562.

The applications and the specifications of fuel performance limits by the Applicants and detailed analyses of those limits and fuel performance under those conditions assure that the CRBRP fuel over the range of transient conditions will be maintained in a coolable condition.

See Applicant's Exhibit 87 at 183 through 185, TR-7560 through 7562.

It should be emphasized that there is a large experimental data base available from tests conducted at DBR-2 and TREAT,and foreign experience which demonstrate that the overall design requirements are likely to be met by the CRBRP fuel.

Additional data will be available from FFTF and instrumentation is provided on the reactor to monitor fuel performance during operation and predict the capability of the fuel.

See here Applicants' Exhibit 87 at 186, TR-7563.

Turning now to the question of Board inquiry 3, this deals with the question of primary coolant pipe rupture, and the situation of the operating condition in the reactor to the likelihood of pipe rupture.

The primary cause of a burst-type pipe failure would be primary stresses on the piping walls, and within the category of primary stresses one has membrane and bending stresses.

Piping internal pressure is the principal contributor to piping primary membrane stress, and because the operation of Clinch River is near atmospheric pressure, the primary membrane stress is only one-third of the allowable stress under normal CRBRP operating conditions, and approximately one-sixth of the allowable stress under accident conditions.

See here Applicants' Exhibit 87 at 113, TR-7490, and Witness Clare, TR-7622 through 7625.

The Applicants have presented analyses which show the relationship between primary stresses and the potential for primary pipe rupture based on experimental data using the concept of critical crack length.

The critical crack length is the length of a through-wall crack which could or will rapidly open or grow as the result of an applied load.

The critical crack length in Clinch River under normal operating pressure is 30 inches.

This crack length is very large compared to the length at which a developing crack would be detected.

See here Applicants' Exhibit 187 at 114, TR-7491.

See also Applicants' Exhibit 87 at 119, TR-7496.

So to summarize, there is substantial margin in the CRBRP piping by virtue of its operating conditions, and, furthermore, the available experimental evidence concerning critical crack length indicates that the critical crack length is extremely large compared to the crack length at which any developing crack would be easily detected.

The Board now referred to question -- or Board area of interest 4, which is the question of natural circulation or natural convective cooling.

As indicated previously in the discussion regarding shutdown heat removal system, there are three heat transport system flow paths in CRBRP, which are designed to transfer decay heat from the reactor to the steam generator auxiliary heat removal system by natural circulation, if that should be necessary as a result of a loss of both off-site and on-site power.

This is an inherent capability of the design that results from the arrangement of the thermal centers of the heat exchange equipment at successively increasing heights or elevations in the plant, thereby providing the thermal or convective driving head for adequate loop flows.

Removal of decay heat will be initiated in the event of loss of off-site and on-site power without any operator actions. Because of this natural circulation capability, decay heat removal can be maintained in the event of station blackout.

See here Applicants' Exhibit 87 at 99, TR-7476; See Staff Exhibit 37 at 3 through 4, TR-8194 through 95.

The Board also inquired as to the basis for the conclusion that the natural circulation capability of Clinch River has been verified. This verification has been the subject of extensive analyses by both the Staff and the Applicants.

See here Applicants' Exhibit 87 at 98, TR-7475. See Staff Exhibit 37 at 5, TR-8196.

In addition, data from EBR-2 and data from

FFTF support the Staff's and Applicants' analyses.

See 8198 through 8201.

This is not the end point. Additional verification is planned to support further refinement of these analyses, and indeed, natural circulation will be demonstrated in CRBRP during initial staff uptesting.

See here Staff Exhibit 37 at 5, TR-8196.

Board question 5 dealt with quality assurance. As the Board indicated, this is one of the more important subjects with which the Staff, the Applicants, and, indeed, this Board, are faced.

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We believe--and I am short on cites, not having a transcript. I can give you a citation to the prepared testimony, but we would like to emphasize certain points here.

The Board has observed the witnesses from the Applicants and from the Staff.

We believe that the Applicants have established a comprehensive quality assurance/quality control program which incorporates the full range of management checks and balances.

The Clinch River Breeder Reactor plant project office, which has central control and management over all project activities, has properly assigned responsibilities among contractors and has put in place the systems which can assure interface control and avoidance of errors due to the complex organizational structure.

The basic point that we think should be made here is that although the organization is complex, it is bound together by a highly disciplined systematic management system.

These systems--and as the Board properly pointed out--must be workable if the quality assurance program is to be effective.

We are not here dealing on a blank slate, nor are we in a situation where these systems have yet to be developed.

They have been operating. They have in fact been workable for the past nine years. The people are dedicated to making those systems work, and every possible effort will be made to make those systems work.

Several specific points that flow from that discussion are that the project does have effective systems for coordination of interfacing systems through a formal review and approval system which provides the necessary safeguards for proper system integration and maintenance of adequate documentation. See here Applicants' Exhibit 95 at 12 through 13, TR 8636 through 8637, Applicants' Witness Hedges, TR 8673 through 8674, and 8679, and Applicants' Witness Anderson, TR 8675 through 8677.

Furthermore, Applicants have developed a quality assurance matrix which is applied to all plant components, irrespective of their safety function.

There are no plant components in Clinch River that are not subject to some form of quality assurance.

The quality assurance, though, is graded to suit the safety functions and nature of the equipment which will be installed.

There are nine levels of program requirements which have been developed to apply based on the importance of the items to plant function.

The selection of the appropriate level is made by coordinating the efforts of the design engineer and the quality assurance disciplines and a system of formal reviews and approvals to assure that the specifications incorporate the correct levels of quality assurance. See here Applicants' Exhibit 95 at 20 through 26, TR 8644 through 8650.

A final point is one that received considerable attention through Board questioning and discussion, and that is the configuration management system.

The configuration management system, which is a mandatory requirement imposed by the project on all project participants and which is the subject of procedures which are audited and enforced by the project on all project participants, assures that there will be formal approval and control of the referenced plant design.

The word "baseline" was used. What that means is that the design is frozen and cannot be changed without formal approval in accordance with the configuration management system. See here Applicants' Exhibit 95 at 17, at 27, TR 8641, 8651, Applicants' Witness Clare, TR 8684 through 8688, and Applicants' Witness Karr, TR 8688 to 8689.

The configuration management control system will assure that not only is the status of equipment known and visible at all times to those who need it, but that it is maintained up to date and retrievable so that the as-built condition of the plant will be reflected in project documentation in a timely manner. See here Applicants' Exhibit 95 at 27, TR 8651.

With respect to Board Question 6, there are several basic points which have emerged from the record thus far.

Clearly both Applicants and Staff have treated quality control as an integral part and vital part of quality assurance. See here Staff Exhibit 44 at 2 through 3 and Applicants' Witness Karr, TR 8689.

The Board heard extensive testimony by Staff witnesses this morning concerning the fact that the NRC Staff will monitor Applicants' quality assurance and quality control activities, both before and during construction of CRBRP.

The Staff clearly has an inspection program which gives proper attention to the special attributes of Clinch River and which assures that the right level of attention will be brought to bear on assuring an effective quality assurance and quality control program for Clinch River. See here Staff Exhibit 44 at 3 through 4 and Staff Exhibit 26 at Section 17.5.

We agree with the Board as to the importance of this issue. We also submit that the Board has had the opportunity to observe the people who will be responsible for these programs. They have had the opportunity to observe the Staff.

The record clearly shows that vigorous attention will be given to assuring that quality control and quality assurance will achieve a strong performance in the Clinch River Breeder Reactor.

Now, with the Board's permission, I would like to skip over Board Question 7 and merely provide the citations there. I believe that the issue is fully addressed in Applicants' Exhibit 94 at 19 through 22, TR 7997 through 8000.

Let's turn likewise to a set of matters within Board Question 7, which we believe received greater prominence in the consideration during the hearings.

There are three basic components to Board Question 7. The first is the steam generators. The second is the containment confinement system under design basis conditions, and the third is the containment confinement system under beyond design basis conditions.

As to the steam generators, the record clearly shows that the CRBRP steam generators are properly designed and indeed will be tested to absorb and accommodate the worst thermal transients that can be reasonably imposed on the components during operation. See here Applicants' Exhibit 87 at 188 through 189, TR 7565, and Applicants' Witness Clare, TR 7733, 7737.

Several points in relation to the steam generators:

The first is that the steam generators, or rather the intermediate heat transport system sodium--neither the intermediate heat transport system sodium nor the steam generator water steam is significantly radioactive, and so that accidents in the steam generator involving a release of those materials are not a significant nuclear safety concern.

The primary nuclear safety concern related to the steam generator modules is the mitigation of the effects on the intermediate heat exchange from a sodium water reaction exchanger. See here Applicants' Exhibit 87 at 190, TR 7576.

The steam generator--

JUDGE LINENBERGER: Applicants' Exhibit what?

MR. EDGAR: 87 at 190, TR 7576.

Three levels of protection have been provided to mitigate steam generator tube leaks and assure the integrity of the intermediate heat exchanger.

The first is a leak detection system. See Applicants' Exhibit 87 at 193, TR 7570.

The second is that a rupture disk is provided on the cover gas face of the intermediate heat transport system expansion tank to relieve any pressure associated with a postulated intermediate size tube leak.

If this rupture disk should bust or burst, the plant will automatically shut down, and water side isolation of the steam generator will be effected. See here Applicants' Exhibit 87 at 193, TR 7570.

Finally, the CRBRP has an engineered safety feature, the sodium water reaction pressure relief system, which will actuate to limit loadings on the intermediate heat exchanger to an acceptable level in the event of a postulated large size tube leak. See here Applicants' Exhibit 87 at 193 through 194, TR 7570 through 7571.

The burden of the record or the focus in the record has shifted somewhat from the design basis elements of the containment system to the beyond design basis elements.

The fact is that under bounding design basis accident conditions, the containment vessel will clearly accommodate maximum temperatures and pressures which can be predicted. See Applicants' Exhibit 87 at 203 through 204, TR 7580 through 7581.

The containment system is effective and does show that all site suitability doses are well below the 10 CFR Part 100 dose guideline values. See Applicants' Exhibit 87 at 208, TR 7585. See Staff Witness Hulman, TR 8524.

The maximum dose resulting from a release to containment for any design basis accident is many times less that the corresponding SSST dose, and well below the 10 CFR Part 100 guidelines. See here Applicants' Exhibit 87 at 208 through 209, TR 7585 through 7586, Staff Witness Hulman, TR 8525.

In terms of beyond design basis features, as I had previously indicated, the containment confinement system includes a vent purge system, a cleanup system, an annulus cooling system, a reactor cavity vent system and associated instrumentation for accommodation of beyond design basis events.

The systems are effective in assuring that the CRBRP has a substantial margin in its pressure capability to accommodate beyond design basis events.

The maximum pressure calculated for any HCDA case by the Applicants was 30 psi gauge as compared with a design pressure of about 40 psi gauge.

Now, some of the questioning during the hearings considered the question of what does the 40 psi gauge pressure mean.

The 10 psi gauge pressure allowed or specified for design basis accidents corresponds to a loading condition which couples the safe shutdown earthquake with the maximum design basis accident for CRBRP.

For a beyond design basis accident, the combination of failures and the combination of events which one might see is sufficiently unlikely that it is not appropriate for evaluation of beyond design basis events in CRBRP to impose both the SSE, safe shutdown earthquake, and the pressure conditions caused by HCDA loadings. See here Staff Witness Long, TR 8486.

As a final note, the Staff's detailed review of

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the CRBRP containment confinement system in fact substantially advanced the state of knowledge and confidence about that design relative to that at the LWA stage.

There are at least five major conclusions which can be drawn here.

The first is that energetically induced early containment failure is physically unreasonable or highly unlikely.

See here Staff Witness Theofanous, TR-8520 through 21.

Secondly, the 40 psi pressure capability has been independently verified by analysis and tests.

See here Staff Witness Butler, TR-8522 through 23.

The Staff's review at the CP stage confirmed the Staff's site suitability conclusion, and the fact that the site suitabiltiy source term doses will meet Part 100.

See here Staff Witness Hulman, TR-8524.

Further, the Staff concluded that the consequences of releases from design basis accidents to containment are many times less than those associated with the site suitability source term.

See here Staff Witness Hulman, TR-8525.

Finally, the Staff's review shows that the consequences of HCDA's will meet Part 100. All Staff witnesses questioned agreed that their review yielded a significant increase in confidence concerning the

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containment design and the fact that the containment design is adequate for issuance of a CP.

See here TR-8528 through 8530.

If we could take a short break. We are now on Board question 9.

JUDGE MILLER: 9 coming up?

MR. EDGAR: Sir?

JUDGE MILLER: Board question 9?

MR. EDGAR: We just stopped on 8. We'll resume on 9.

JUDGE MILLER: Very good.

Yes, we'll recess.

(Recess)

JUDGE MILLER: Ready to resume?

MR. EDGAR: Yes.

The Board question 9 inquired as to whether a specific protective action guideline should be developed and implemented for CRBRP. The protective action guidelines are established by EPA for nuclear incident energy response, or emergency response planning. For the plume expansion pathway emergency planning zone, the EPA has established a range of protective action guidelines, or PAG's, as one to five rem for whole-body exposure, and five to 25 rem for thyroid exposure.

See here Staff Exhibit 43 at 3 through 4, TR-8577 through 8578.

The specific analyses done for a range of CRBRP accidents, both design basis and beyond design basis, showed that the controlling or most limiting doses are whole body in thyroid and not other organs.

See here Applicants' Exhibit 94 at 6 through 11, TR-7984 through 7989. Staff Exhibit 43 at 11 through 14; TR-8585 through 8588.

Although one might derive PAG's for other organs by scaling from the existing whole-body or thyroid PAG's using ICRP 26 weight factors, or other appropriate values, because the whole body in thyroid doses are controlling, it is unlikely that any specific PAG's for other organs would be either necessary or useful in CRBRP emergency planning.

See here Applicants' Exhibit 94 at 8 through 11, TR-7986 through 89. Staff Exhibit 43 at 6 through 14, TR-8580 through 8588.

Also, Applicants' Witness Strawbridge, TR-8023, and Staff Witness Hulman, TR-8598.

In the event, however, that EPA should issue revised PAG's in any form, their applicability to CRBRP will be reviewed at the OL stage.

See here Staff Exhibit 43 at 15, TR-8589,

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Staff Witness Branagan, TR-8599, and Staff Witness Perrotti, TR-8601.

In regard to Board area of interest 10, which deals with advanced techniques for material control and accounting at the developmental reprocessing plant, the record shows that research and development activities on measurement capabilities for material control and accounting are not necessary for the effectiveness of safeguards at DRP.

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MR. EDGAR: The primary reliance against theft of nuclear material at DRP is placed on physical protection.

The role of material control and accounting is to provide assurance that the protective systems, the physical protective systems, are working properly, and although rapid material accounting may augment safeguard measures at DRP, the DOE commitments for DRP safeguards, without that rapid material accounting capability, will still conform or be equivalent to NRC regulations. See here Staff Exhibit 36 at 3 through 4, TR 8177 through 8178.

The Board inquired as to a question of convention, and that is the isentropic expansion yield to one atmosphere, what is its meaning and what, if any, contribution does it make to the conservatives in the analysis.

The concept of isentropic expansion yield to one atmosphere is used by the people within that community as a reference point to indicate the relative potential severity resulting from disruptive core conditions.

It has been widely used because it is an unambiguous and easily defined quantity, but it is only a reference value, and it is not used directly in analyzing the capability of the system to accommodate loads. See here Staff Exhibit 41 at 50, TR 8324.

It should be recognized, however, that there are implications of the isentropic expansion assumption itself which was used in the Applicants' analysis of structural margin capability.

No credit in that analysis was taken for attenuating effects in the upper head area and in the so-called cage, as Dr. Theofanous described it. Indeed, the Staff has determined, through a detailed analysis of realistic expansion processes, that approximately 2550 megajoules would be required to produce a slug impact kinetic energy which approaches the structural capability of the reactor coolant boundary--or reactor head boundary. See in this regard Staff Exhibit 41 at 30 through 33 and 51, TR 8302 through 8306 and 8325.

The Board inquired concerning a series of items identified in the SER under Question 12 as requiring a review at the OL stage, and inquired as to the potential that those changes might result in substantial changes to the design of a costly or time-consuming nature.

The Staff has identified and the Applicants have identified a finite set of areas which will require further experimental and analytical work to resolve the issue prior to the OL.

The major areas here involve fuel design limits, methodologies and bases, high temperature mechanical design limits, reactor vessel head structural capability, PRA and reliability analysis and natural circulation.

The record clearly shows that it is highly unlikely that any of these items will result in a significant impact on cost or schedule. See here Staff Exhibit 38 at 4 through 5, TR 8211 through 8212, Staff Exhibit 26, Sections 3.9.9, 4.2.1, 5.2, 5.6.3. See Staff Witness King, TR 8219. See Staff Exhibit 27, Appendix D. See Applicants' Exhibit 87 at 24 through 25, at 97 through 99, and at 170 through 177. The respective TR's here are 7401 through 02, 7474 through 76, and 7547 through 7554.

In all events, confirmation or resolution of these issues will not result in any compromise of safety. See here Staff Exhibit 38 at 5, TR 8212.

The Applicants and Staff have agreed on a course of completion for each item, and programs are in place which are reasonably designed to address those issues and create a resolution in a timely manner. See here Staff Exhibit 38 at 5 through 6, TR 8212 through 13, Staff Witness Stark, TR 8216 through 17.

We believe that it is important to focus on two elements of this issue.

Granted, the advanced stage of design work could carry with it the implication of cost and schedule impacts; however, there is another side to the coin, and that is the advanced stage of design completion also carries with it greater knowledge of the plant and greater knowledge of the issues which might affect the plant.

We have here for Clinch River an SER which, in my experience, is unprecedented in scope, depth, duration and level of detail.

The issues which require resolution are well known. The programs for resolution are well defined, and because of the advanced state of knowledge and because of the detailed information available, the payoff of those programs and the resolution, without significant cost or schedule impact and without any compromise of safety, is highly likely.

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Turning now to Board question 13, which deals with fuel system fallback positions, the Staff has identified fallback positions with respect to fuel performance, which can be easily implemented, and which can restrict operation in such a way that no issue is created in terms of a Staff concern.

See here Staff Exhibit 26 at 4 through 47 -- excuse me, strike that cite. Staff Exhibit 26 at 4-48 through 4048; Staff Exhibit 39 at 3, TR-8225.

The Applicants have committed to address the Staff's concerns with detailed experimental and analytical programs.

See here Staff Exhibit, or Staff Witness King, TR-8553, 8562, and 8564 through 8565.

Operations to date at FFTF and results from similar experience at EBR-2 confirm the fact that it is highly likely that the CRBRP design performance predictions will be realized.

See here Applicants' Exhibit 87 at 212 through 213, TR-7589 through 7590.

Even if a fallback position were implemented, it is highly unlikely that the CRBRP programmatic objectives would be in any way compromised.

One of the fundamental purposes of the demonstration plan is to identify problem areas and

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develop the information from existing data for extrapolation to future plants.

Design modifications can be effected and, indeed, in the area of fuel performance, lessons learned can be factored into reload designs and will provide the technological data base to be used for follow-on plant designs.

We also believe that given the evidence of record that the fallback positions at the moment seem highly unlikely, but even so, there is flexibility to assure that the programmatic objectives are, indeed, satisfied.

See here Applicants' Exhibit 87 at 212 through 214, TR-7589 through 91; Staff Exhibit 39 at 3 through 5; TR-8225 through 27; and Applicants' Witness Schwallie, TR-7607.

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Board question 14 deals with the question of operating with leaking fuel pins, and the implications of such operation. Both Applicants and Staff have given extensive consideration to this subject. Sodium in contact with fuel inside of pin could result in increased gap conductance, but there is no reason to believe that that would adversely affect either performance under steady state or transient conditions.

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See here Staff Exhibit 40 at 2 through 3, TR-8249 through 50. Applicants' Exhibit 87 at 215 through 216. TR-7592 through 93; Applicant's Witness Schwallie, TR-7612 through 14, and Staff Witness King, 8258 through 60.

The Staff is concerned that continued operation of failed fuel rods might cause local swelling with a potential for flow restrictions and reduced heat removal.

The Staff and Applicants, however, have agreed to operational restrictions on CRBR which would require removal of fuel assembly -- a fuel assembly containing fuel pins and a reactor shutdown or upon exceeding a predetermined delayed neutron signal.

See here Staff Exhibit 40 at 3, TR-8250.

Those restrictions, however, will be reviewed upon completion of the cladding run beyond breach tests at EBR-2, which will establish the information necessary to place firm limits on steady state and transient operation with failed fuel rods.

See Staff Exhibit 40 at 3, TR-8250. Staff Witness King, TR-8261.

The Board area of interest 15 deals with the relationship of the reliability program, and the QA program. Rather than go through that matter in any detail at this juncture, I believe we have covered the QA program matters of importance already. The Applicants' response to this question in specific terms is at Applicants' Exhibit 87, at 168 through 169; TR-7545 through 7546, and this coupled with the record directly relating to QA and management systems, which is Board questions 5 and 6, resolve that matter.

Board question 16 deals with the effect or the situation of variations in the composition of concrete aggregates, calcitic versus dolomitic limestone concretes.

Extensive testing and experiments have been undertaken which demonstrate no detectable difference in rates of penetration as a function of concrete composition.

See here Applicants' Exhibit 89 at 41 through 42, TR-7803 through 7804; Staff Exhibit 41 at 86, TR-8364.

Also, see Applicants' Witness Strawbridge, TR-7951, and Staff Witness Swanson, 8543.

Similarly, there will be no appreciable effect on aerosol parameters or the rates of aerosol or aerosol behavior in the containment as a result of concrete composition variations.

See here Applicants' Exhibit 89 at 40 through 42, 7802 through 7804. Staff Exhibit 41, at 85 through 87; TR-8363 through 65; and Applicants' Exhibit -- or Applicants'

Witness Strawbridge, TR-7952 through 53.

With respect to the Board areas of interest in number -- Board area of interest 17, rather than summarize each one, I would prefer to provide the citations on each subject area completely, and then put some emphasis on one or two that are of greatest significance.

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The Board area of interest 17 requested an explanation of the status of the eight areas of concern listed in Section 1, Table 2 of NUREG CR-3224.

At the present time, each area of Staff concern there listed has been resolved to the Staff's satisfaction.

See here Staff Exhibit 41 at 51; TR-8325.

The relevant citations for area 1 are Staff Exhibit 41 at 52 to 53; TR-8626 through -- strike that -- that is incorrect. TR-8326 through 8327; Applicants' Exhibit 89 at 145 through 146; TR-7907 through 7908.

Area 2, Staff Exhibit 41 at 53 to 54; TR-8327 through 28; Applicants' Exhibit 89 at 146 through 147; TR-7908 through 09.

Area 3: The significant point here involves the plenum fission gas induced fuel column compaction and the effect that that might have on HCDA energetics.

Further analyses will be undertaken to more deeply examine this concern. Pending completion of those analyses, or if the analyses confirm this concern, the Applicants have committed to make a feasible design change to prevent the fission gas from rapidly acting on the fuel in a compacted manner.

See here Staff Exhibit 41 at 39 through 40; TR-8313 through 8314; Staff Witness Theofanous, TR-8457; Applicants' Witness Fauske, TR-7968; Applicants' Exhibit 89 at 107 through 108, 148 through 149, and TR-7869 through 70; and 7910 through 11.

Area 4, the cites are Staff Exhibit 41 at 55 to 56; TR-8329 through 30; Applicants' Exhibit 89 at 149 through 50; TR-7911 through 7912.

Area 5, Staff Exhibit 41 at 56 to 57. TR-8330 through 31; Applicants' Exhibit 89 at 150 through 52; TR-7912 through 14.

Area 6, Staff Exhibit 41 at 57 to 58; TR-8331 to 32; Applicants' Exhibit 89 at 150 to 52; TR-7912, 14.

Area 7, Staff Exhibit 41 at 59; TR-8333; Applicants' Exhibit 89 at 150 to 52; TR-7912 to 14.

Area 8, Applicants' Exhibit 89 at 153 to 54; 7915 to 16; Staff Exhibit 41 at 60; TR-8334; Staff Witness Butler; TR-8460; and Staff Witness C. Bell, Charles Bell, TR-8461 to 62.

Turning now to the question of the limited appearance statement filed by NRDC, et al, which has been introduced in the record as Board Exhibit 125.

Well, the fact is that the argument that is presented in Board Exhibit 125 is not new. The central thrust of the argument is the same argument that was presented the first time during the LWA proceedings, not by a well qualified expert witness, but rather by way of closing argument by NRDC's technical representative, Dr. Cochran.

The argument is not different today. There are several attempts at extending that argument, and indeed one might find that the argument can be conveniently categorized into three basic issues.

The first issue has to do with thyroid doses.

The second issue has to do with the probability of HCDA initiation.

The third issue has to do with the Fort St. Vrain and Savannah River reactors.

Let's take the thyroid dose issue first.

Board Exhibit 125 at TR 7654 to 7656 argues that for the purpose of judging the radiological consequences of the HCDA's, that first the thyroid dose calculations should be based on infants rather than adults.

Secondly, that the 300 rem thyroid dose guideline value of 10 CFR Part 100 should be reduced to account for exposure to infants and recent data from the Marshall Islands, and further reduced by a factor of two at the CP stage to account for uncertainty.

Now, changing the 300 rem dose guideline value to account for infant exposure or Marshall Islands data would constitute a clear challenge to the Commission's regulations. See here NRDC's own statement at TR 7656, which is a tacit admission of that point. See also 10 CFR 2.758 and see Staff Witness Hulman at TR 8505.

As to basing those calculations on infants, 10 CFR Part 100 refers explicitly to TID 14844 for guidance concerning the manner in which those calculations have been carried out.

That guidance, which the Staff has consistently followed through longstanding practice, bases those calculations on the adult, standard man. See here Applicants' Witness Strawbridge, TR 7715, and Staff Witness Hulman, TR 8504.

As for the Marshall Islands data, Board Exhibit 125 stated that the data speak for themselves.

The fact is that Board Exhibit 125 submitted one table from a one-inch-thick report and said, "These data speak for themselves."

The record, however, shows that that is not the case at all.

The record shows that the thyroid dose estimates are subject to considerable uncertainty and may, at least in some cases, be considerably higher than estimated.

Secondly, none of the exposed groups is a completely valid control group.

Thirdly, because of the small number of people involved and uncertainties in the doses received, the data do not lend themselves to dose response analysis, which is the very purpose for which NRDC submitted the information.

Finally, the absorbed dose estimates in the report are approximate, and the uncertainties in many of their parameters involved in obtaining the dose estimates make it impossible to state their statistical reliability. See here Applicants' Witness Strawbridge, TR 7717 through 7719. See also the report itself, Applicants' Ehibit 96.

The fact is, Your Honors, you were given one page of data. You were told it speaks for itself. Examination of the underlying data indicates that that is totally and absolutely false.

As an additional point, NRDC's basic argument about the dose guideline values and the application of infant thyroid as the basis for HCDA doses completely mistakes the purpose of these guideline values.

The regulations clearly state that these dose guideline values are not acceptable limits for emergency doses. They are reference values for use in the evaluation of reactor sites. See 10 CFR Part 100, Section 100.11A, Footnote 2;

Staff Witness Hulman, TR 8502 through 8504.

Further, as to the argument that the dose guideline values ought to be reduced by a factor of two to account for uncertainties similar to that done for site suitability source term, it should be emphasized that the 10 CFR Part 100 guidelines were not developed for accidents beyond the design basis, and they were applied by the NRC staff to HCDA calculations with the express stipulation that they would be used for a realistic assessment of HCDA's. See here Staff Exhibit 27, Appendix A at A.8-5 and Staff Witness Hulman, TR 8505 through 06.

Notwithstanding that, though, it is the opinion of the responsible Staff reviewer and official that the uncertainties which reside today in the CRBRP meteorological data and design are now sufficiently low that even accepting the argument presented in Board Exhibit 125, the Staff sees no need to apply a reduction factor to the dose guidelines to account for uncertainty. See Staff Witness Hulman, TR 8501 through 02.

We submit that in light of the foregoing and the fact that the does guideline values are not used for assessing site suitability under design basis conditions, there is no basis whatsoever for crediting NRDC's argument.

As for the use in Board Exhibit 125 of the probability of 10 to the minus 4 for each HCDA initiation based on the Applicants' so-called Phase 1 PRA study, the record shows that that information, as submitted and as used by NRDC, is not reliable.

The record in fact shows that the Phase 1 report contains a caveat that it is a preliminary report and it should only be used as a starting point for further refined investigation. See here Board Exhibit 125, Attachment 1, TR 7674, and Applicants' Witness Clare, TR 7743 to 7745.

The more significant factor, though, is that the 10 to the minus 4 value advanced by Dr. Cochran in Board Exhibit 125 does not constitute a realistic or final evaluation of the probability of HCDA initiation, even if one accepts the accuracy of the methodology involved.

Indeed, the record shows, based on Mr. Clare's testimony, the following: that the 10 to the minus 4 HCDA initiation probability for loss of power was based on average nuclear power plant offsite power failure data rather than the actual experience on the grid and switch yard feeding CRBRP.

Moreover, it was based upon the CRBRP design before the emergency power systems were upgraded.

Moreover, it was based on conservative success criteria for safety systems, and finally it did not consider or include consideration of recovery. See Applicants' Witness Clare, TR 7745 through 7748.

The record thus shows that the probability value advanced by NRDC's statement is not reliable information, and it should have no effect on the Board's conclusion.

Now, turning finally to the Savannah River and Fort St. Vrain reactors.

You were told in Board Exhibit 125 at pages 9 through 17 that releases from the beyond design basis vent purge system must be included in the site suitability dose calculations.

You have heard that before many times and, of course, the basic problem with the argument is that Dr. Cochran does not understand how the vent purge system works; but beyond that, the vent purge system plays no meaningful physical role in the context of design basis accidents and site suitability evaluation. See here Applicants' Witness Strawbridge, TR 7722 through 23.

Now they come up with a new slice on the argument, and here it is: the Savannah River production reactor does include and the Fort St. Vrain reactor may include releases from a vent purge system in their site suitability calculations. See here Board Exhibit 125, TR 7661 tnrough 7665.

The record shows the contrary. In fact, the record shows that, A, neither the Savannah River nor the Fort St. Vrain reactor has installed the functional counterpart of the CRBRP beyond design basis vent purge system.

Secondly, it shows that both reactors have installed, as part of their confinement system, filtration systems which are actually the functional counterpart of the CRBRP design basis annulus filtration system.

Finally, the record shows that the CRBRP site suitability source term analysis does include releases from the annulus filtration system. See here Applicants' Witness Strawbridge, TR 7723 through 7725.

Thus, the record shows plainly, clearly that there is no merit to the argument.

End 22

In closing, having -- and I very much appreciate your patience, but I would like to emphasize several things which we believe that the record clearly shows; that this design, we believe, reflects an extraordinary level of attention to detail.

We think that the NRC Staff review is unparalleled in its scope, duration, and depth. We think the people involved have been to a man dedicated to assuring a safe design.

As I indicated previously, this design is in an advanced stage, and although it could mean impacts and pressures on cost and schedule, and we take the Board's admonitions very seriously there, we do believe that there is a positive side to that equation, and that is, the level of design detail here is extensive.

The issues remaining for resolution are well defined, and there is a great deal of knowledge about this design. We know more and, thus, there is less chance of surprise.

There is, indeed, high confidence that programs are in place that will pay off and result in timely resolution of issues.

We do not believe that there is any potential for compromise of safety. We believe that the record convincingly supports issuance of a CP. We think further that this Board's review coupled with that of the Staff, coupled with the attention to detail of that of the Applicants, can and will assure safe design operation and construction of CRBRP.

As a personal note, as my last words, I would thank all three of you very much for your attention, for your fine management of the process, which has been difficult at times.

You have been tough task masters, but we think that the record clearly supports the issuance of the CP, and we urge you to write an affirmative decision on all counts.

JUDGE MILLER: Thank you, Mr. Edgar.

Mr. Turk.

MR. TURK: Mr. Edgar hasn't left too many stones unturned, which I suppose I appreciate.

At the same time, it would be nice to find a few stones for myself.

MR. EDGAR: Just don't throw them.

JUDGE MILLER: What are you going to do with them?

(Laughter)

MR. TURK: What I'd like to do is avoid having to go through a repetitive summary of the same evidentiary materials which Mr. Edgar has now presented, but instead, present an overview from the Staff's perspective of where we have been and where we are at this point in the proceeding.

And as a preliminary matter, let me indicate that my comments will address our primary conclusion with respect to the DBA spectrum as well as the core disruptive accident analyses, which have been conducted.

I will not address most of the Board questions, because I believe Mr. Edgar has done so sufficiently for our purposes.

On May 9, 1976, a letter was sent from the NRC to the Department of Energy, which established a framework which then was useful and used in regulating the course of the CP application, and which has continued until this day to provide a major framework for the Staff's view and analysis as to whether or not a CP may be issued.

Contained within that letter were the essentials of the Staff's design safety approach, as well as the Staff's approach to our analysis for core disruptive accidents. The letter I refer to is contained in Staff Exhibit 24-B at page I-2 through I-5. And I would like to read a few key passages from that letter which was sent by Mr. Richard P. Denise, Division of Project Management at the NRC, to

Mr. Lochlin Caffey, Director at that time of the Clinch River Breeder Reactor Project Office in Oak Ridge, Tennessee.

Contained within this letter is the following statement with respect to the Staff's perception of the proper design safety approach, which needs to be followed in the CP application for this plant, and I quote, "Our basic position is that the CRBR should achieve a level of safety comparable to current generation light water reactor, LWR, plants according to all current criteria for evaluation and that the design approaches to accomplish the required level of safety be similar or analogous to LWR practice.

"We recognize, however, that there are reactor concept and experience differences which prevent adherence to precise analogies. We have taken some of these differences into account by specifying requirements which are intended to provide assurance that the level of safety achieved for the CRBR will be comparable to that for LWR's."

The letter then goes on to discuss the design in depth concept and the three levels of safety and indicates that a set of design basis accidents must be established, and that systems and features designed to control these accidents should be accomplished, "so that the consequences of accidents within the design basis envelope are within the radiological dose guidelines of the Commission's citing regulations, 10 CFR 100."

The letter also states, "Major attention should be placed on the prevention of accidents leading to core melt and disruption and loss of containment system integrity for all identified initiators."

In this letter, the Staff continues to lay out some basic goals which the Staff hoped could be achieved and which the Staff required to be achieved prior to issuance of a construction permit.

Mr. Denise in his letter states, "We believe that the minimum features and characteristics identified below are necessary for CRBR to accomplish the safety objectives." He then goes on to list in particular five items, and I'm going to paraphrase here.

The first is that at least two independent, diverse and functional redundant reactor shutdown systems should be provided.

The second is that at least two independent, diverse, and functional redundant decay heat removal systems should be provided.

The third is that means to detect subassembly faults to cope with these faults and to protect against progressive subassembly fault propagation should be provided.

The fourth is that the heat transport system integrity should be very high and assured on a continuing basis. And the fifth item here is that the containment system should be protected from the effects of sodium releases in the equipment cells, particularly those cells containing the main heat transport system equipment.

Those have been, throughout, the primary safety functions which the Staff identified as necessary to be performed in order to assure that the level of safety for the CRBRS comparable to that for LWR's, and the Board may wish to note that these same functions are referred to again in NRC Staff testimony presented in this proceeding, and that is the NRC Staff testimony with respect to design basis accidents, NRC Staff Exhibit No. 32.

With respect to core disruptive accidents, the letter from Mr. Denise to Mr. Caffey states as follows: "It is our current position that the probability of core melt and disruptive accidents can and must be reduced to a sufficiently low level to justify their exclusion from the design basis accident spectrum. We will, therefore, not consider CDA's as design basis accidents. Nevertheless, because of the difference in the state of technology and experience between LFBR's and LWR's, the consequent inability to evaluate the safety of the CRBR design as precisely as can be done for LWR's in the absence of a quantitative risk assessment based on experience and data such as the reactor safety study for LWR's, prudence dictates that additional measures be taken to limit consequences and reduce residual risks from potential CRBR accidents having a lower probability than design basis accidents, to ensure that the public health and safety is adequately protected."

The letter goes on to provide more detail with respect to this goal concerning core disruptive accidents, but I think the portions I have read fairly summarize Staff's position early in the proceeding, back in 1976, as to the primary goals which the Staff would look for to see if they have been achieved prior to issuance of a construction permit.

What I would like to do now is turn to the present, and see where we are in 1973 [sic], following issuance of the Staff's safety evaluation report and supplements to that report, and following the conclusion of all principal Staff analyses, to see whether the Staff's position now accepts that these primary safety goals can and will be achieved upon issuance of a construction permit for the CRBR. And I won't take very much time, and I'll proceed first with respect to the DBA spectrum and then to the core disruptive accident analyses.

The Staff has concluded that the design basis accident spectrum is sufficiently comprehensive so as to envelope all credible accidents for CRBR, and this conclusion may be found in Staff Exhibit 32 commencing at transcript 8036, in particular, page 8077.

The basis for this conclusion rests upon five elements: a thorough review of systems proposed to perform necessary safety functions; a thorough review of engineered safety features which mitigate the resulting accident should the primary system fail; a thorough review of the design basis accidents proposed by Applicants; an independent comparison of the CRBR design basis accidents to those of light water reactors, and of domestic LMFBR's and foreign LMFBR's; and, in addition, the fifth element is an examination of failure modes and effects analyses and initiator studies.

These reviews and analyses give the Staff confidence that the design accident -- excuse me -- the design basis accident envelope is sufficient.

This conclusion may be found at transcript 8043 to 8044. And, finally, at page 8077 of the transcript, Staff Witness Becker states that based upon, one, a careful evaluation of the CRBR design basis accident spectrum; two, a comparison of CRBR DBA's with the DBA's of LWR's, domestic LMFR and LMFBR's and foreign LFMBR's and, three, an examination of available FMEA's and accident-initiator studies, the Staff has concluded that the CRBR DBA spectrum is complete and that the entire spectrum of credible accident initiators has been enveloped.

The exclusion of core disruptive accidents from the DBA spectrum has been based upon the deterministic approach which is normally used for light water reactors, and which has been modified appropriately to account for the salient differences between the Clinch River Breeder Reactor and light water reactors, transcript 8048.

Included in the Staff's deterministic safety review approach have been the following elements: The development of principal design criteria based wherever possible on light water reactor design criteria and modified to account for the differences between the LWR's and the CRBR; a review of the proposed CRBR design for feasibility of compliance or for an assessment of compliance with these criteria; and, in addition, close analysis has been given to the features proposed in the design for the performance of the fundamental safety functions, which have earlier been referred to by Applicants, and transcript cite may be found in this regard to transcript -- at transcript 8055.

As part of the Staff's review, the Staff has determined that certain requirements should be imposed upon the CRBR, which are different from requirements imposed on LWR's in order to achieve the safety goal imposed by the Staff early in the proceeding in the 1976 Denise-Caffey letter, and these have been implemented in the principal design criteria.

Attention has also been given to ancillary functions such as the ability of the plant to protect against damage due to chemical reactions involving sodium.

With respect to the fundamental safety functions which the Staff identified early in the proceeding as needing to be accomplished, the Staff has concluded that the proposed CRBR design is capable of achieving the appropriate principal design criteria, TR-8058, 8065, and 8068 through 70.

Mr. Edgar has referred to reliability assurance program, and while this is also a requirement imposed by the Staff, I'll let the record reflect Mr. Edgar's comments in this regard as being correct.

With respect to the core disruptive accident analyses, the Staff has engaged a team of top-notch independent consultants, many of whom have appeared personally before this Board. These individuals performed an extensive independent analysis of the energetics issue.

The results of their work is published in

Staff Exhibit 42, and has been reviewed by a sizable setting of the specific community as reflected in Staff Exhibit 46.

The results of the independent review on the energetics issue are conclusive and indeed, traumatic. The Staff consultants have concluded that a vessel head failure induced by core disruptive accident energetics is physically unreasonable, i.e., extremely unlikely, transcript 8275.

In addition, each of the initial eight areas of concern which appeared to the Staff in its initial review have now been resolved to the Staff's satisfaction, TR-8295. Also, with regard to energetics, the Staff has concluded that the ramp rates associated with a loss of flow accident should not be expected to prevent a challenge to the reactor head, and there are numerous references here, in particular, transcript 8306 and 8312, Staff Exhibit 41.

We would note, of course, that there are two areas where we are looking for further developments. One of them involves the Applicants' commitment to produce a reactor vessel head design capable of withstanding the sodium slug impact kinetic energy of 75 megajoules, which the Staff is confident can be accomplished, transcript 8308 through 09, and, secondly, this conclusion is based upon a resolution of the potential for plenum fission gas compaction to be resolved, which, again, the Staff is satisfied can be resolved.

With respect to the longer term thermal aspects of core disruptive accidents, particular systems have been included in the design of the CRBR in order to accommodate the thermal aspects of a CDA. These include the annulus cooling system, the containment cleanup systems, reactor cavity vent system, and certain containment instrumentation systems. Transcript 8287.

Here, too, independent assessments were performed in such areas as sodium-concrete interactions, the response of containment structure and cooling and cleanup systems, and, in addition, the Staff looked closely at the response of the containment to atmospheric conditions as well as dose consequences.

And I'd like to read a conclusion reached by the Staff with respect to these matters.

end 23

Let me paraphrase. I am having a little trouble finding it.

The Staff witnesses on the core disruptive accident panel stated that they are satisfied that there has been a significant advancement in the Staff's confidence with respect to the appropriateness and general adequacy of the CRBR confinement containment design since the LWA-1 phase, Transcript 8528 through 8530.

In addition, the Staff's CDA panel stated that they are satisfied that at this point in time a construction permit may be issued for the CRBR. Transcript 8529 to 8530.

With respect to radiological considerations, the Staff has considered what might happen in the event of a core disruptive accident involving either energetics or a non-energetic accident, and the Staff has concluded that the radiological doses which may be expected in the aftermath of a core disruptive accident are such that the dose guidelines of 10 CFR Part 100 would not be exceeded.

Based upon these conclusions, the Staff has indeed accepted the proposed design concept for the CRBR of the containment confinement design.

Lastly, with respect to radiological consequences, Board Question 9 asked whether protective action guides need to be developed for the CRBR which would be different from those in use for light water reactors.

In this respect the Staff performed an independent assessment and performed numerous dose calculations referred to by Staff Witness Hulman in his testimony on Board Question 9, and the Staff concluded that the EPA's existing protective action guidelines should be adequate for emergency planning purposes, and that no further protective action guidelines for any other particular organs need to be devised in order to protect the public health and safety in the vicinity of the Clinch River Breeder Reactor.

With those brief remarks, I would like to conclude by stating again where we have been and where we are from the Staff's perspective.

In 1976 we were at an early stage in our review of the CRBR project.

It is now seven years later. We have learned much, and we have performed numerous analyses which lead us to have confidence that a construction permit can be issued at this time while protecting the public health and safety.

In conclusion, then, the Staff would request an affirmative finding by the Licensing Board and the issuance of a construction permit for the CRBR.

JUDGE MILLER: Thank you.

Let me indicate for the record that tomorrow, Friday, August 12, at 12:30, Judge Hand, at the request of the Board and as its representative, will inspect the site.

Counsel and parties, of course, are welcome to attend, if you desire. As you know, this is not an evidentiary matter, and there will be no discourse, but the site will be inspected at that time, arrangements previously having been made.

Is there anything else before we adjourn?

MR. EDGAR: No, sir.

JUDGE MILLER: All right. The evidentiary hearing stands adjourned.

We have our schedule already for the submission of the proposed findings of fact and conclusions of law.

I want to thank all of your for your attendance. We certainly want to thank our reporters for their very able work. Everyone travel safely.

(Whereupon, at 4:05 p.m., the hearing was adjourned.)

CERTIFICATE OF PROCEEDINGS

This is to certify that the attached proceedings before the NRC COMMISSION

In the matter of: Clinch River Breeder Reactor Plant

Date of Proceeding: August 11, 1983

Place of Proceeding: Oak Ridge, Tennessee

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

Edie Spriggs Daniels
Official Reporter - Typed

____
Official Reporter - Signature

Susan E. Young
Official Reporter - Typed

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Official Reporter - Signature