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NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

DKT/CASE NO. 50-537

TITLE UNITED STATES DEPARTMENT OF ENERGY
PROJECT MANAGEMENT CORPORATION - TENNESSEE VALLEY AUTHORITY (Clinch River Breeder Reactor)

PLACE Oak Ridge, Tennessee

DATE December 17, 1982

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD

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

Hemlock Room

Executive Seminar Center Building

301 Broadway

Oak Ridge, Tennessee

Friday, December 17, 1982

The hearing in the above-entitled matter was convened pursuant to adjournment, at 8:00 a.m.

BEFORE:

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GUSTAVE E. LINENBERGER, JR., Member

CADET HAND, Member

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- - -

ARGUMENT

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P R O C E E D I N G S

8:00 a.m.

JUDGE MILLER: All right. We will resume our closing arguments.

I think, Dr. Cochran, that you were addressing the Board.

You may resume.

DR. COCHRAN: Yes.

Just to back up so we don't lose any continuity.

Yesterday I demonstrated that if you multiplied the Staff's estimate of the HCDA, a realistic calculation, HCDA thyroid dose of 100 rems at the ORGDGP, Staff's Exhibit 18, Page 7, by the ratio of the worst sector to ORGDP X/Q factors, namely a factor of 12, you would exceed the 10CFR 100 guideline values for thyroid by a wide margin; some 1200 rems, compared to the guideline value of 150 rems at CP.

It's 8 times higher than permitted.

The factor of 12 came from dividing the Applicants thyroid dose for HCDA analysis at the worst sector, 85 rems, Applicant Exhibit 46, Page 34, by Applicants HCDA thyroid dose for the ORGDP, Applicants --

JUDGE MILLER: Just a minute.

I think you're going a little too fast for

the Reporter, Dr. Cochran.

DR. COCHRAN: I understand. I'm trying to prevent from getting cut off at the end.

JUDGE MILLER: You won't get cut off.

No. But take it slowly enough that she can get it accurately in the record.

DR. COCHRAN: Certainly.

The factor of 12 came from dividing Applicants thyroid dose for HCDA analysis at worst sector, 85 rem, Applicants Exhibit 46, at Page 34, by Applicants HCDA thyroid dose for the ORGDP, Applicants Exhibit 47, at Page 13.

Note Staff's HCDA is a Class I, Thadani on cross-examination by Intervenors on his 5(b) testimony and Applicants HCDA is a Case 1 or 2, a non-energetic CDA, Applicants Exhibit 46, at Page 34.

I also note that -- noted yesterday that if Staff's filter efficiences and meteorology were substituted to the Applicants Case 1 thyroid dose calculation of 85 rems in Applicants EXhibit 46 at Page 32, the thyroid dose would increase by a factor of 14 to about 1000 rem.

This factor of 14 is the ratio of Staff to Applicants HCDA thyroid dose at the ORGDP, Staff's Exhibit 18 at 7 and Applicants Exhibit 47 at 13.

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In some the Staff's most benign CDA, Class 1, Appendix J at Page J-5, which has an upper bound probability of 10^{-4} per year in the worst sector direction, which increases the upper bound probability to 10^{-5} per year, has a thyroid dose of about 1000 rems or about 8 times the dose guideline value -- 7 or 8 times the does guideline value.

If one assumes Staff filter efficiencies which were unchallenged by the Applicants, thus the safety goal is not met for non-energetic CDA's, based on the Staff's own analysis.

The Board should note that the highest thyroid doses for the least energetic CDA, Applicants Exhibit 46, Page 34, and therefore Applicants criticism of Staff's groupings of CDA categories does not apply.

The Board should also note the above worst sector thyroid dose estimates that I've made are for "realistic NEPA assumptions" rather than "conservative site suitability source term analysis".

I refer also the Board to the first sentence of the third full paragraph at Appendix J, Page J-11 and the accompanying footnote for a curious statement of what is expected as opposed to what is demonstrated.

Now, I refer the Board back to Appendix J, Table J-2, in the Class 1 CDA upper bound probability of

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10^{-4} per year, based on the Staff's estimates of upper bound frequency of 10^{-4} per year for the reactor shutdown system and loss of heat sink frequences, Appendix J, Page J-3 to J-5.

The Board should take note of the ASLB partial initial decision in the matter of Med-Ed. That's the TMI-I restart, Volume 1, December 14, 1981, Docket 50-289-SP; particularly to the discussion of the St. Lucy ALAB 603 decision, 12 NRC 30, 1980 and referring back to TMI restart decision at Paragraph 1011.

Also refer to the discussion at Paragraph 1050 at Page 242, related to the TMI-I restart.

These decisions demonstrate that the Staff's upper bound estimate of 10^{-4} per year for loss of heat sink and unprotected loss of flow and unprotected transient overpower event are not sufficiently low to justify exclusion of the CDA from the DBA.

I would also call your attention to Dr. Rumble's statement on cross of Staff Exhibit 16, where he said he could draw no distinction between 10^{-4} and 2×10^{-4}.

I turn now to the 10CFR 100 Site Suitability Source Term Analysis, which is the heart of Contention 2.

I draw the Board's attention to Staff Exhibit 1, which Site Suitability Report, particularly at Page 3-11,

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where the Site Suitability Source Term assumptions are set out, as well as the LPZ bone dose, which is given as 9 rems.

And the Intervenors argue that this is the controlling dose in th is calculation and you can -- it will be the one we will focus attention on.

On Page 8 of the Staff's Exhibit 1, the dose guideline value for the bone surface is given as 150 rem at the CP.

I will defer Intervenors challenge to this value until discussion of Contention 2(e) and 11(d).

Mr. Edgar led you to believe there were only two factors in dispute by which this 9 rem value should be increased.

First, contrary to Mr. Edgar's claim, the bone surface dose calculated with the newer ICRP-30 models, that is, using the dose conversion factors from NUREG/CR-0150, is three times the bone dose that one would calculate using ICRP-2 models, as the Staff did in Staff's Exhibit 1.

Both Applicant and Staff now use the newer models as set forth in NUREG/CR-0150 and I don't think there's any difference of opinion between any of the parties on the validity of those dose conversion factors.

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You should take note of the Staff and Applicants use of these dose conversation factors at Tr.2360 to -61, Bell; 2389 to 2390, Branagan, Applicants Exhibit 46 at Page 33 and the Tr. 3128, Dr. Morgan.

The factor of three is demonstrated by comparing Table 1 from Morgan,Tr. 3128 against the site suitability report, Table 4 at Page 3-11.

Mr. Edgar confuses bone surface with body burden and also I take note of the fact that Dr. Thompson's recollection is, with regard to the factor of 2, was, I am sure, Tr. 1904.

The 9 rem bone dose should thus be multiplied by a factor of three to get the 27 rems to the bone surface, which is the number supplied to Intervenors by the Staff.

You cannot use the bone dose to compare to a bone surface dose guideline value,so the 9 rems is irrelevant.

The second factor is isotopic concentration of fuel.

Applicant Witness Yarbro, Tr.4265, admits that high burn-up fuel increases the dose by a factor of 2 to 4. Cochran's estimates are up to a factor of 4.3, Cochran, Tr. 4590.

Mr. Edgar notes that we will revisit this

issue at the fuel cycle.

Mr. Edgar also, in effect, argues that Applicant is free to apply for a license, now, to fuel the CRBR with low-burn-up PU or by implication, even uranium or even bubble-gum and then once the site suitability issue is behind him, apply for a license amendment.

Since we will revisit this issue, for now, I will simply note the following:

10 CFR 100 applies to reactors of the general size and type, not reactors of the general size and type, which use a precisely defined isotopic ratio of plutonium fuel, as represented in the current version of the CRBR fuel Tech Specs. Two, Applicants Witness Yarbro indicated that there is only sufficient low burn-up LWR fuel under 25,000 megawatt days per metric ton to operate CRBR for about one-half of the 30-year lifetime of the reactor.

Intervenors introduced evidence to demonstrate that Applicants isotopic concentrations are actually typical of 12 to 14,000 megawatt days per metric ton; not 25,000.

Applicants have no assurance -- this is Three -- Applicants have no assurance that TVA will want to use low burn-up fuel in the CRBR after the five-year demonstration period.

The fact that the CRBR -- this is Four -- the fact that the CRBR may reduce the isotopic concentration of 238 and 241 as fuel is burned in CRBR, there is actually no evidence to that effect, although it certainly seems like that could go that way to me.

This does not solve Applicants dilemma.

Rather. the issue simply becomes whether the high burn-up LWR plutonium or plutonium having been recycled in LWR's, will simply be put into the CRBR as fresh fuel.

It will have the high concentrations when it's put in the reactor initially, and so the fact that it's going to burn down is irrelevant to the site suitability source term analysis, in that respect.

The third factor is due to -- that would increase the site suitability source term bone surface dose calculation, is due to the contribution to the bone surface from releases after 30 days to cover the entire passage of the cloud, that is required under 10 CFR 100. See Tr. 3127 to -28, Morgan. Tr.2350 to 2351 and-53 and 2356 and 2357, Bell and Hulman, where the Staff admits that the post 30-day releases are not negligible and that the puff release is appropriately conservative.

10 CFR 100 requires consideration during the entire passage of the cloud.

Staff acknowledges this, Tr. 2350 to -51. Staff Witness Bell testified in cross-examination by Intervenors, that the calculation, including the puff release, while very conservative, incorporated the appropriate degree of conservatism with respect to the treatment of post 30-day releases, Tr. 2354, Bell.

Mr. Bell also stated that the calculation which included the puff release was more appropriate and more realistic than calculations which do not consider any emissions after the 30-day period, Tr.2355, Bell.

Mr. Bell later contradicated his own testimony during cross examination by Counsel for Applicants, Tr. 2403 to-04, Bell.

This should not be credited as it was elicited by a leading question by Counsel for a non-adversarial party.

Since the Staff treatment of the puff release was appropriately conservative, the correction factor for the bone surface dose is on the basis of the data provided Intervenors and found in Morgan's testimony. The factor is the ratio of 115 rem to 27 rem.

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DR. COCHRAN: Edgar in his argument failed to note the puff is through the annulus filtration system, Tr. 2356 to 57.

Furthermore, the Strawbridge estimate that 90 percent release in one day and 98 percent in one week is for "realistic or otherwise non-conservative aerosol depletion," aerosol depletion rate that Staff does not adopt in Staff's site suitability source term analysis.

The history of 10 CFR 100 demonstrates that a very high degree of conservatism should be used, Transcript 3057 to 59, Cochran; Transcript 2558 to 79, Attachment A to Staff Exhibit 3.

The fourth correction factor is to correct for the Staff's confinement factor; that is, the fraction of the one percent plutonium source term which is released through the filters.

The CRBR containment has two filter systems, the annulus filtration system and the vent purge system.

The record will show both of these are relatively novel compared to the containment systems on lightwater reactors.

The annulus filtration system takes activity from outside the containment in the annulus and pumps it back in, while the vent purge system takes activity from within the containment and pumps it out.

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The Staff and Applicants, in performing their site suitability source term analysis, are operating under a novel theory that one should include one of the filters in the analysis and exclude the other, even though both are integral parts of the secondary containment system.

The Board should also take note in this regard 10 CFR 100.2(b) and 100.10(a)(c).

In conducting the Staff's site suitability analysis, they have made a mockery of the site suitability source term analysis, as I will demonstrate. By ignoring the one filter system and including the other, their site suitability source term calculations invariably come out with higher doses to the population than their realistic HCDA calculations. I'll demonstrate that.

Moreover, even though the site suitability source term analysis is supposed to be conservative, they include in their analysis only the vent system that pumps the activity back into the reactor containment, rather than the one that pumps it out.

If you look at Staff Exhibit 18, Answer 10 to 17, Pages 6 through 7, you will see that the Staff and Applicants' so-called conservative site suitability source term doses are always higher than the quoted realistic NEPA CDA analysis, a factor of 22 higher for the thyroid dose and a factor of 9 higher for the whole body dose in

2-3

the Staff's analysis.

Mind you, this is despite the fact that the site suitability source term analysis is more conservative than the realistic HCDA analysis performed by Staff with regard to the following:

One, the X/Q is 95 versus 50 percent.

Two, the filter efficiencies.

Three, the plutonium source term.

Four, the timing of the releases.

And, five, plateout considerations in the containment.

By totally ignoring the vent purge system, the Staff and Applicants have totally offset every single conservative assumption built into the site suitability source term and still project doses 10 to 20 times below the quoted realistic values.

A fifth factor is the plutonium source term. This issue is simple.

If the CDA is within the design basis envelope, Intervenors win and the plutonium source term should be 10 percent.

If the CDA is outside of the design basis accident envelope, Applicants and Staff win and the plutonium source term remains at one percent.

A sixth factor is due to the Staff's failure

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to use 80 years for the dose commitment period for the maximally exposed individual, rather than 50 years which is more -- rather, they used 50 years which is more appropriate for workers who are not exposed until age 20; Morgan, Transcript 3170 to 74.

Now, just to summarize, the Board should start with the 9-rem bone surface dose from the Site Suitability Report and multiply it by the following factors to calculate the actual bone surface dose.

Where the Board disagrees with my analysis, they simply drop that factor.

You take the 9-rem bone dose and multiply it by 3 to correct for bone-to-bone surface dose. Multiply it by a factor of 4.3 to correct for higher burnup fuel.

Multiply it by a factor of 4.3 for the post-30-day release.

Multiply it by a factor much greater than 10 to correct for Staff's failure to include the vent purge contribution to the containment releases.

Multiply it by a factor of 10 if the Board concludes that Intervenors are correct and the CDA is not a design basis accident.

Multiply it by a factor of 1.5 for the lifetime of the maximally exposed individual.

Taken together, the actual bone surface dose

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is something greater than 90,000 rem or 10,000 times that assumed in the Site Suitability Report, and it's more than 600 times the Staff's proposed bone dose guideline value, when all these factors are taken together.

In the first week of the hearings, the Intervenors presented its case that an LMFBR requires a higher standard of protection against CDA's than a lightwater reactor and should include CDA's within the design basis.

See, for example, Transcript 2765 to 2781, Cochran; 2818 to 20, Cochran.

Intervenors also presented testimony that CDA's have occurred or were considered DBA's in other U.S. fast reactors and are not hypothetical, but warrant serious attention to protect the public safety.

Transcript 2822 to 23, Cochran; Transcript 2823 to 25, Cochran.

I don't know whether the Board squirreled away the findings of fact that we submitted.

JUDGE MILLER: You withdrew them, I believe.

DR. COCHRAN: Yes, we withdrew them, but I'm simply reading the highlights of some of those, if that would help you.

JUDGE MILLER: Are you going to re-introduce them? We don't mind, we just --

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DR. COCHRAN: Not in this form.

JUDGE MILLER: Okay.

DR. COCHRAN: But if you miss a word or two, you might reach into your wastebasket is all I'm suggesting.

The NRC Staff originally considered CDA's as DBA's for the CRBR and has demonstrated no rational basis for its change in position.

The Staff has failed to establish and justify any principal design criteria which if met would insure that the probability of a CDA is sufficiently low to exclude CDA's from the design basis.

The Staff's claim that it has established specific criteria that would render CDA's sufficiently improbable is without merit. These criteria are so vague as to be meaningless.

Staff admits these criteria do not have specific detail; Tr. 2206, Morris.

These criteria provide no indication whatsoever that if met they would insure the probability of CDA's as sufficiently lower that they may be excluded from the design basis.

The Staff has failed to demonstrate that the CRBR meets or even approaches the Staff's safety objective.

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Staff Witness Rumble stated that it would be prudent to consider results of specific failure mode effects analysis in its engineering judgment as to the credibility of a CDA if those results of specific analysis were available; Tr. 2185 to 86, Rumble.

The Staff has not considered the results of specific failure mode effects analysis in its engineering judgment regarding the probability of CDA initiation; Tr. 2178, Morris.

Staff's reliance on similarities between LWR and LMFBR systems for assurance that CDA's will be sufficiently improbable is misplaced.

It is impossible to establish the reliability of CRBR shutdown systems relative to those of LWR's without a comprehensive failure mode and effects analysis or a fault tree/event tree analysis; Tr. 2662, 2846, Cochran; 2232 to 33, Morris.

The Staff did not and does not intend to analyze the intent to which previous unrecognized dependencies between various LWR reactor features have been discovered as a basis for their conclusion that such interdependencies are very improbable for CRBR; Tr. 2256 to 57, Morris.

One of the major causes of uncertainty in WASH-1400, a comprehensive probabilistic risk assessment

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for LWR's cited by the NRC's Risk Assessment Review Group was the variation between reactors, since WASH-1400 examined only one BWR and one PWR; Tr. 2847, Cochran; 1705 to 17, Strawbridge.

There's substantially larger differences between the major safety systems, for example, the reactor shutdown systems, in a reactor of the general size and type of CRBR and those in lightwater reactors and between systems in reactors of the same LWR type; Tr. 2847, Cochran; 1705, 1707, Strawbridge.

Staff Witness Morris admits that implementation of a particular safety function could be very different for LMFBR's and for lightwater reactors; Tr. 2206, Morris.

No systematic Staff effort was made to take into account foreign experience with breeder reactors; Tr. 2209, Morris.

Staff Witness Morris admitted that Staff does not have a good understanding of the specific design features of other domestic and foreign breeder reactors or how much features have been implemented; Tr. 2212 to 14, Morris.

Staff admits that human error could cause undetected interdependence between various elements of the reactor, such as two shutdown systems; Tr. 2255, Morris.

Staff admits that human error could be

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responsible for a CDA initiating condition in both LMFBR's and LWR's; Tr. 2263, Morris.

Staff Witness Rumble admits it would be helpful for the Staff to consider systematic fault tree/event tree analyses in determining the effects of human error in a generic fashion; Tr. 2420, Rumble.

Staff has not performed any systematic analysis of how human error could initiate or exacerbate an accident at the CRBR; Tr. 2243, Morris.

Staff has not analyzed the extent to which system interdependencies have been discovered in LWR's for its conclusion that they are highly unlikely or very improbable for the CRBR; Tr. 2256, Morris.

Staff does not intend to perform such an analysis; Tr. 2257, Morris.

The Staff and Applicants failed to justify their categorization of accidents within and outside the CRBR design basis.

Staff and Applicants -- Both Applicants and Staff state that they determine which accidents to include within the CRBR design basis by examining a range of accidents to determine which are credible; Tr. 2003, 2450.

Staff denies it attaches any quantitative or qualitative probability to the word credible; Tr. 2173, Rumble; 2191 to 92, Morris.

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Applicants do not use quantitative probabilities or quantitative threshold criterion for determining whether CDA's or within or outside the DBA envelope; Tr. 2858, 1480 and 1483 to 84, Clare.

When asked to define credible accident, stated, "Credible means that it is of sufficient likelihood that it should be considered in the design basis"; Tr. 1653, O'Block, Deitrich, Clare, Brown and Strawbridge.

When asked to define "credible," the Staff stated that its only definition of credible is that it is synonymous with accidents within the design basis; Tr. 2172, Hulman, and 2453.

Based on circular definitions, therefore, and the failure to use any quantitative or qualitative probabilities, neither Applicants nor Staff have provided an adequate basis for their categorization of accidents within or outside the design basis; Tr. 1653, 2172 and 2453.

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DR. COCHRAN: In making their judgments that the likelihood of CDAs is so low that it can be excluded from the design basis, Applicants did not rely upon (a) their reliability program documented in the PSAR, Appendix C (Tr. 2857, Cochran), the probability of failure of the reactor shutdown systems or any of the general design features (Tr. 2857, Cochran; 1461, Clare), tests of the reactor shutdown or shutdown heat removal or other CDA prevention systems (Tr. 2858, Cochran; 1479, Clare), quantitative reliability threshold criteria (Tr. 2858, Cochran, 1480, 1483, Clare), probabilities risk assessments (Tr. 2858, Cochran; 1484, Clare), analysis of evaluation of designs of plants other than CRBR (Tr. 2858, Cochran; 1684, 1725-28, Brown; 1487, Clare), sufficiency of completeness of the SSR, Appendix A criteria, the Denise Caffey letter criteria or any known set of criteria (Tr. 2856-58, Cochran; 1483, 1487-88, Clare), analysis of CDAs once initiated, including Section 5 of the Applicants' Exhibit 1 (Tr. 2858, Cochran; 1488-89, Clare), any quantification of the failure rates of the reactor shutdown system, the decay heat removal system, the probability of rupture larger than the design basis rupture or the reactor vessel or pipe or the systems designed to maintain the individual subassembly heat generation or removal balance (Tr. 1461-62, Clare).

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Applicants' general design approach does not provide a basis for excluding CDAs from the DBA envelope. The three-level design philosophy in Applicants' Exhibit 8 presents no justification for selection of design basis events (Tr. 2859-62, Cochran).

The Staff admits it does not have a basis for judging the completeness of Applicants' list of CDA initiators (Tr. 2863, Cochran).

Applicants concede that it is impossible to confidently list all important initiators before an event tree and fault tree analysis have been performed. CRBR project PRA Program Plan, June 18, 1982, Page 3 at Tr. 2863, Cochran.

The double-ended pipe break that causes CDA in the CRBR and there's no basis for excluding it from the DBA envelope. I call the Board's attention to the material and the report by Harris, which we will revisit at the Appendix J section of this argument.

Applicants have no analytical test for selection of DBAs and no basis for excluding CDAs from the DBA envelope.

Applicants and Staff lack the presence of even one substantially similar fast reactor during the licensing of which it was demonstrated that the probability of a CDA is sufficiently low (Tr. 2868, Cochran).

Applicants' testimony demonstrates that their use of terms, such as "low," "very low level," "extremely unlikely," "prevent," and "highly unlikely" are not clearly defined (Tr. 1385-86, 1495-96, 1616, 1637 and 1639, Clare).

Applicants and Staff make a circular argument concerning CDAs which will require CDAs to be low probability; hence, they will be of low probability (Tr. 2868, Cochran; 2225, Morris).

That completes my summary argument.

JUDGE MILLER: All right, Mr. Edgar, I guess it's turned over to the next segment. What are you going into? II?

MR. EDGAR: I wanted to ask the Board whether the Board would want any response at this point on the first set of issues. I have four very finite points of response, that I would think I could cover in ten minutes.

It's up to the Board at this point as to --

JUDGE MILLER: This is closing argument. Normally, the one who bears the burden of proof is entitled to open and close.

Closing, we would expect to be both brief and not to go into matters which could have been gone into because all of them are controverted matters.

MR. EDGAR: I understand. I recognize

there are time constraints, too.

But I suppose what I'm doing is asking the Board's advice as to what's most productive also.

JUDGE MILLER: Well, we think that the Applicants are entitled to a limited period of rebuttal, since they have to go frist and lay out their entire points on each of these segments.

MR. EDGAR: There are four basic points that I'd like to address to the Board.

The first relates to the issue of whether the HCDA should be a DBA. The next three relate to the issue of the site suitability source term calculation.

The HCDA equal to a DBA point strikes us as one that the Board should consider in light of several elemental points of August. You heard yesterday for the first time rather a bewildering path of argument on a set of calculations.

But let's try to focus on what the purpose of that calculation was. What is the argument to be made as a point of logic?

The argument really has three elements of logic. The first is that the Staff -- and this is the assertion -- the Staff and the Applicants have adopted a go/no go criteria of 10^{-6} per reactor year of exceeding Part 100.

The next point is through some rather circuituous manipulation of information, which has not been brought in and sponsored by a witness under oath.

We show that one can arrive at numbers in excess of Part 100. The next element of logic is that Appendix J shows that the probability of an HCDA for all time is less than -- or is greater than 10^{-6}; and, therefore, an HCDA should not be a DBA.

Well, if you go through these points, there's a critical foundation. The first principle is stated as Applicants and Staff have accepted this go/no go criteria of 10^{-6} per year.

Dr. Cochran yesterday cited Mr. Morris at Transcript 2277 through -79, and Mr. Clare at Transcript 1483 for that proposition.

I would like the Board to consider very carefully those citations. Do they show what Dr. Cochran said they show?

First, consider Morris' statement at Transcript 2278. Dr. Morris was asked whether the Staff adopts such a criteria, and Dr. Morris read explicitly and quoted from Staff Exhibit 5, which is the May 6, 1976 letter, and said, "This is a design objective, rather than a fixed number that must be demonstrated."

He then went on to say, "It is a matter of

judgment."

That citation does not prove the point asserted.

Let's then go to Mr. Clare's asserted adoption of the criteria. This one, we believe, is a little more significant.

This appears at Transcript 1483. It is in response to a question by the Intervenors. More significantly in our judgment, it is in response to a follow-up question by the Chairman.

Mr. Clare said the following, if you'll read the transcript: "Such a criterion was set early in the project. The project no longer believes that such a criterion is necessary, nor have we used any conclusion with regard to such a criterion in our testimony and in our conclusion that CDAs need not be DBAs."

Indeed, we regard the use of Mr. Clare's statement, which is directly contrary to the point asserted by Intervenors, a misuse of the citation.

The next point is just as fundamental. Neither Staff nor Applicants hold out Appendix J as a realistic assessment of the probability of CDA. It is not intended to demonstrate that an HCDA should not be a DBA.

The Staff was quite clear. The Staff provided a conservative assessment of the environmental

risks of HCDA. It is a much more limited system level analysis in an attempt to get some definition for the purpose of environmental analysis.

This is clear from Staff Exhibit 17 at 8 and at 14.

Moreover, Applicants' Exhibit 46 at 13, at 21 and at 39, clearly demonstrates the conservatism in the Staff's analysis.

We, therefore, suggest to the Board that the proper perspective on that entire argument is to consider the premise for the argument, the purpose of the analysis; and we believe that the Board should consider the reliable substantive evidence in this record, sponsored by qualified witnesses and reject the assertions to the contrary.

As to the next point, now going beyond that argument, there are three basic points raised on the site suitability source term analysis, that we believe warrant a response.

We have heard them all before, but there are three that stand out at this point. The first one is a rather novel approach to the problem. The argument is made that neither the Staff nor the Applicants used a vent-purge system for the purpose of the site suitability source term analysis.

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This is the most fundamental of misconceptions. The NRC Staff, in calculating site suitability source term analysis, did exactly what one would do for a light water reactor; that is, assume the use of systems which are part of the containment which apply in the case of design basis events.

What Dr. Cochran did not point out to the Board is that the vent-purge system question is an additional design feature that has been put in the plant to accommodate the CDA.

It is not part of the containment design basis accident. Indeed, what it does is provide a means of radioactivity removal in the event of a core melt accident; and it vents from inside the containment -- that is, you've got a primary containment and then you have a secondary concrete shell.

This system pulls air from inside the primary through a radioactivity removal system and direct from the atmosphere -- to the atmosphere. It passes right through the secondary.

The other system, which is the design basis system, takes the air in the annulus of the containment; that is, between primary and secondary, and pumps it back into the containment.

It is a recycling system. So that clearly has

relevance for the site suitability analysis, but the vent-purge system is simply not applicable in that case.

And if you make the argument that it is, then you don't understand what the system is for.

The next point that warrants some comment -- and I'll make this very brief -- is the issue of this puff release.

The Intervenors have gone through again, a torturous attempt to splice together information in the record.

I'll just cite one passage to the Board that's relevant here.

Mr. Strawbridge at Tr. 1830 through 1832 made three basic points. The first is that if you look at the dose from the site suitability source term as a function of time, 90 percent of the dose is incurred in the first day. 98 percent of the dose is incurred in the first week.

The puff release is an effort by the Staff to test the sensitivity of dose beyond 30 days.

Mr. Strawbridge also pointed out, though, that within the 30-day period, aerosol effects will reduce the concentration of radioisotopes in containment by three or four orders of magnitude.

Now this is significant. The Staff did a

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sensitivity analysis and made the worst possible assumption. The puff release assumes that on Day 30 the entire containment inventory is instantaneously released. But the Staff's conservative analysis did not consider the aerosol effects which will reduce that source term in containment by three or four orders of magnitude.

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MR. EDGAR: The burden of the evidence in the record is that the dose from the puff release after 30 days is quite small. It is not a significant incremental addition.

The final point is that of isotopics. Dr. Cochran came back this morning and asserted to the Board that there is a real issue there.

If you go to the most fundamental level on isotopics, the most Intervenors have shown is that U-238 -- excuse me. Strike that. -- that Plutonium-238 and Plutonium-241 are more radiotoxic than other isotopes of plutonium.

We don't regard that as a serious issue for the Board to take up. Indeed, it's unnecessary to the Board's decision.

What they are trying to mask is the fundamental error in their argument.

Dr. Morgan at Tr. 7131 through 32 suggests that Plutonium-238 and Plutonium-241 will build up in relative concentrations on recycle of plutonium in the Clinch River Breeder Reactor.

The facts are these: That's true in a lightwater reactor. A lightwater reactor has a thermal neutron spectrum and the physicist will tell you that the two radioisotopes will build up on recycle.

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Unfortunately, however, for the Intervenors' case, the Clinch River Breeder Reactor is not a lightwater reactor. It's an LMFBR. It has a fast neutron spectrum, and it's clear, and despite Dr. Cochran's rather halting concession this morning, the fact is that he has conceded at Tr. 4539 that under the conditions for the Clinch River Breeder Reactor, Plutonium-238 and 241 will be burned up on subsequent recycle.

That is demonstrated by Applicants' analysis in Exhibit 36, which is Volume 3 of the Environmental Report, Amendment 14.4(a) to Chapter 5.7.

We thus suggest to the Board that the four points to put aside for permanent reference are the following: That the argument presented through the rather torturous calculations do not show that an HCDA should be a DBA; that as to the site suitability source term argument, the vent purge argument to which Dr. Cochran has ascribed a factor of 10 increase in dose is simply a product of failing to understand the purpose of the vent purge system.

The puff release argument is simply, which he attributes a factor of 4 to, is simply a product of ignoring the pertinent evidence in the record.

And the isotopics argument to which Dr. Cochran ascribes a factor of 4 is the product of a failure to

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understand the fundamental physics of a LMFBR.

JUDGE MILLER: All right. Do you wish to go now into the second...

MR. EDGAR: Yes, sir.

JUDGE MILLER: ...aspect of these contentions?

II. CONTENTIONS 2 AND 3
ENVIRONMENTAL RISKS AND EFFECTS OF SEVERE ACCIDENTS

MR. EDGAR: We are turning now to the second issue set that we described yesterday, which is the environmental effects of accidents, which is Contentions 2 and 3.

It is, as the Chairman will recall, as I went through in the introductory argument yesterday, I tried to sort out what portions of the contentions apply.

It is -- Some of them overlap, but the basic subject matter that we are dealing with here is the environmental risks and effects of severe accidents, the Staff's Appendix J analysis on the HCDA.

We think that it's important for some initial perspective to be established concerning the environmental effects of accidents and the analysis of the risks which one should attribute and estimate for the CDA.

I went through an extensive discussion yesterday

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addressing the four basic design features which are important to preclusion of the CDA, and I will not repeat that discussion today.

But at that point of departure, we think it's important to note that Clinch River has a specific set of analyses and design features which have the purpose of dealing with conditions beyond the design basis.

The relevant citation here is Applicants' Exhibit 1 at 53, Tr. 2042. That provides a general description of the features.

Notwithstanding the fact that the HCDA should not be a DBA, the Applicants have gone on to provide a set of features which can deal with, mitigate, and thus limit the risks associated with the HCDA.

Now, two phrases appear repeatedly, and it's perhaps one of the best arguments for handing out a glossary. We have thermal margins beyond design basis. That term appears; and we have structural margin beyond design basis. That term appears.

What that really is is a description of a set of conditions against which these features are tested.

The features themselves are described in the record. Several relevant citations would be Applicants' Exhibit 1 at 55, Tr. 2044; Applicants' Exhibit 17, Section 2.2.

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The basic elements of these systems are a set of structural reinforcements which preclude premature releast of material through the reactor vessel head on HCDA conditions.

There is also a provision for venting the reactor vessel cavity to preclude overpressurization of the cavity.

There is, as well, an annulus cooling system in the space between the primary containment and the confinement building, the purpose of which is to cool that space and preclude overpressurization of containment as a result of the core melt conditions.

The annulus cooling system is described and discussed at Tr. 5145 and 5342.

Finally, there is a containment vent purge system, which provides for venting through a cleanup system to the atmosphere.

Mr. Strawbridge discussed that at Tr. 5145, in addition to the exhibits which I have previously cited.

The object of that system is that in the event of a core melt sequence the analyses show that in a period of roughly 24 hours, if one assumes failure of all design basis equipment, pressures and buildup of hydrogen in containment may reach levels where structural integrity of the containment may be of concern.

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The vent purge system then gives the ability to manage that accident sequence, and what it does is enable you to relieve pressure in containment and release in a controlled fashion through a cleanup system.

It might be described as something akin to a filtered vent system, although the actual hardware is not a filter, per se. It's a set of Venturi scrubbers, and Mr. Strawbridge described that at the prior citations.

Now, the appropriate perspective on these features is that they provide an additional margin of safety and provide assurance that the risk of events beyond the design basis, even though an HCDA should not be a DBA, is acceptably low.

The citations for that proposition would be Applicants' Exhibit 1 at 6 and Tr. 1995.

Now, given that just as a point of perspective, it's important to recognize that what the Staff has attempted to do in Appendix J is to look at the design characteristics of Clinch River on a system level and to provide an analysis of the risks of these severe accidents.

Now, the Staff given the restriction in time and in the ability, and indeed in recognition that there's no necessity to do a full-blown probabilistic risk assessment, made some extremely conservative judgments in arriving at the probabilities of sequences that could lead

to HCDA's.

In effect, what the Staff did was to select upper bound conditions that they could attach very high confidence to to describe the likelihood of CDA initiation and significant offsite dose.

Staff's Exhibit 8, Appendix J, clearly demonstrates that.

The Applicants' Exhibit 41 indeed provides some very specific analysis to point out the major conservatisms in the Staff's analysis.

Now, given that basic perspective, the question arises as to what really are the arguments raised by Intervenors and what are the disputed issues in this record on the issues of environmental effects of accidents.

We believe that there are five basic issues here. The first involves the Staff's estimated frequency of core degradation due to the loss of heat sink class of events.

Intervenors have raised that in Exhibit 22 at 14 through 16.

The next issue, if you will, involves the Staff estimate that pipe rupture probability is quite low and is not a significant contributor to over-all risk in the context of their analysis.

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That argument is presented by Intervenors at Intervenors' Exhibit 22, 16 through 19.

There is another argument presented concerning the possibility of common mode failures. That appears at Intervenors' Exhibit 22 at 22.

The next point is one that has also been a recurrent theme, and that involves the simultaneous failure of both reactor shutdown systems, what is its probability, based on the Commission's ATWS, A-T-W-S, rule.

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9:00 a.m.

MR. EDGAR: The fifth issue involves containment failure probability estimates by the Staff and that's presented at Intervenors Exhibit 22, at 30.

I have been tempted to go into the nuclear explosion issue but I will answer that with one sentence.

I do not believe it to be a significant issue worthy of the Board's attention in regard to disputed issues of material fact.

It is a plain fact that the kind of events that one might see in Clinch River are not nuclear explosions. The labels don't matter. The physical principles do and you're talking about things that are quite apart from the nuclear explosion.

Let's turn now to the disputed issues and the first one that I've listed involves the frequence of core degradation due to the loss heat sink sequence.

The Staff's Exhibit 17 at 9, displays the rationale for their estimates on this point.

The loss of heat sink is exactly that. The problem described is -- or the sequence described is that events can occur or could occur where the ability to remove heat from the core and reject it to the river through -- basically through the shutdown heat removal system, is lost.

All right.

The Staff went through and examined the redundancy and diversity of the shutdown heat removal system. They also reviewed TWR reliability experience, which indicates that the dominant factor in the loss of heat sink frequence is found, typically, in the auxiliary feedwater system.

Similar systems to the Clinch River Breeder Reactor Plant, and I might note, systems which typically are not safety-grade in all reactors operating, are found to range from 10^{-5} to 10^{-4} per reactor year in probability of failure of the auxiliary feedwater system.

In addition, the Staff noted that because Clinch River has not only the ability to remove decay heat through the primary loops, but has an independent backup direct heat removal system, that the overall reliability should be at least as good as that shown in PWR's.

Notwithstanding that, the Staff did not assign a value of 10^{-5}, which might be typical of modern vintage LWR's. Rather, the Staff purposefully conservatively set the value at 10^{-4}, which is a higher probability of failure than one would see, typically, in LWR's.

The effect of doing that is to increase the probability of failure and thus make auxiliary feedwater

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the dominant conrrtributor to the estimate of failure.

Other factors, the Staff concluded, such as fuel failure propogation or pipe rupture, would be small fractions or fractions of that probability estimate and, therefore, one can ascribe very high confidence to the fact that that estimate is bounding.

I would note specifically in that regard the Staff's Exhibit 17 at 9 through 11 and 14. Also, 12 through 13 and 13 through 14.

Now, let's examine the NRDC argument in regard to loss of heat sink.

Just what have they said here?

The basic point made is that lightwater reactor studies show lower values than those estimated by the Staff.

The citation here is interesting. Intervenors Exhibit 22 at 13 says:

"For example, the Clavert Cliffs Reactor shows a lower probability."

The example, however, is the only LWR which Intervenors' witness was aware of; Tr.6110; other than the Surry Reactor, which is analyzed in WASH-1400.

But if you group the evidence in the record between Calvert Cliffs, Surry and Clinch River, the following comparison emerges:

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The Transcript cite here would be 6110 through -21.

What you see is the Calvert Cliffs is only 4 times worse than Clinch River. That, however, is an old system. It is manually operated. There are only two primary coolant loops at Calvert Cliffs for heat removal of decay heat.

If you compare Surry, what you see is that the value assigned by the Staff for Clinch River is 2 times worse than Surry. Surry is an older reactor. The Clinch River Reactor has a completely redundant, independent and diverse safety-grade automatically actuated auxiliary feedwater system and decay heat removal system.

Moreover, the direct heat removal service is an interesting comparison with the LWR counterpart.

In an LWR you've got a residual heat removal system which is a low-pressure system and typically comes in at 400 pounds; so if you're up around operating pressure, that's not giving you much, but at Clinch River the counterpart, the independent direct heat removal service operates through the complete pressure range.

That's a very significant element of additional reliability and Applicants Exhibit 46 makes that point.

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We believe that if the argument is premised on the fact that LWR studies show lower values, the answer is simple.

The Staff took that into account and conservatively assigned values for Clinch River which are worse than those for LWR's, notwithstanding strong sound arguments to the contrary.

That simply shows that the Staff has taken a highly conservative approach.

The next argument advanced by Intervenors on a related point of auxiliary feedwater reliability and shutdown heat removal system reliability, is the argument that failures of the steam generators could control the loss of heat sink failure frequency. That Clinch River has four independent paths for decay heat removal. Three are through the steam generators. One is through the direct heat removal service.

So, the argument goes -- "Well, the steam generators have problems and you're going to lose your decay heat removal."

This argument ought to be assessed in light of the evidence in the record.

First of all, Dr. Cochran makes two points here in Exhibit 22.

The first is, well, if you had a tube leak in

the steam generator, you could get a sodium water reaction; you could get liberation of hydrogren and the spector of hydrogen concentration in TMI is raised.

The second point is made that the GAO report indicates that there are real problems with the steam generators.

Let's take them one at a time.

As to the first, what Dr. Cochran's testimony totally ignores is the fact that Clinch River has design features to cope with steam generator failure events.

Among them we have an automatic system for water isolation, for draining of sodium from the sodium side of the steam generators, feeding to reaction products separator tanks, to remove the reaction products. There is a system for venting gas from the generators which might evolve during the reaction, to prevent over-pressurization.

Nitrogen will automatically fill the generators to provide an inert atmosphere.

We see no reason why one should assume any extraordinary failure situation with regard to the steam generators.

The problem has been anticipated. See Mr. Clare's testimony at 5262 through -67.

Interestingly, in terms of NRDC's argument,

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when Dr. Cochran wrote his testimony asserting that the steam generators were a big problem, he was not even familiar with the systems that are in place for dealing with that condition. See Tr.6095 through 6100.

The next point involves the GAO report.

What does the evidence show in the record in that respect?

The first is that the GAO report itself was not -- and there is no showing in the record -- that there is any significant technical capability behind that report. The report speaks for itself, as Dr. Cochran said, but then again, he was unable to tell us whether anybody authoring that report had any technical capability, except for one person who was GAO's technical consultant and disagreed with the report.

Now, Dr. Cochran's -- the relevant citation there would be 6129 through -37.

But that's really not so important.

The more significant thing is, "So what?" The problems which are described in the GAO report relate to availability in heat rate and there's no showing in the record that we're talking about a safety problem in connection with that report

See, among other things, Staff Exhibit 21 at 6 through 11 and I'll apologize, I do not have the

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transcript citations for Mr. Becker and Mr. Longenecker's testimony yesterday. We can supplement those for the record but one citation for Mr. Longenecker occurred at roughly 10:01 yesterday and the other at roughly 12:35 yesterday. I apologize for that but we didn't have the transcript.

All right.

That is basically the state of affairs with regard to loss of heat sink.

The argument is made that auxiliary feedwater reliability, or by implication, auxiliary feedwater reliability is overestimated by the Staff.

The record clearly shows that it has not been. In fact, the Staff has very conservatively underestimated the reliability of auxiliary feedwater systems.

Secondly, the steam generator issue is just not a significant issue on this record, that there are ample provisions for dealing with it in design.

The next argument raised involves pipe rupture.

Of course, here again, the argument is made through the Harris Report which is Attachment 3 to Intervenors Exhibit 22, that the probability of pipe rupture in Clinch River could be higher than that of LWR's, and the Intevenors basis for that argument is the

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Harris Report

Now, the Staff looked at pipe rupture probability and examined the data and determined that the estimates of probability for pipe rupture are such that other factors will control the definition of probability.

In order to attempt to counter that, Dr. Cochran argues that Exhibit 22 at Page 22, that the Harris Report shows frequency which may be 12 times higher than the PWR.

The word "may" is important here. I suppose that means, as the refrain goes, it is possible.

But what does the evidence show? That's the more important consideration.

If you look at Dr. Cochran's Exhibit 22, Attachment 3 at 10, the author who is asserted by Dr. Cochran to be a pipe break expert and, of course, Dr. Cochran is not, concludes that the failure rate for CRBR could be estimated at .1 to 1 times that of an LWR.

Now, all that says is that it's no worse than an LWR and it's probably a factor of 10 better, so Dr. Cochran's own evidence undermines his conclusion.

There is another significant reference here and that involves Staff Exhibit 20 at 4 through 6.

Staff's Exhibit 20 shows that the PWR or the CRBR pipe rupture failure is quite low, in the order of

5-10

10^{-7} to 10^{-8} or lower and, indeed, it shows that it's lower than a PWR.

So we submit that on the basis of the record on pipe rupture, the Staff has adequately taken that into account and conservatively taken into account in their Appendix J analysis and there is no evidence to suggest that that factor would dominate any assessment of risk.

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MR. EDGAR: A very quick point in terms of the state of the record on the third issue, common mode failures.

Common mode failures have been considered by the Staff in Appendix J, and by Applicants throughout their analysis of Clinch River.

The Staff, in estimating frequencies of CDAs, conservatively said or reduced the frequency of failures -- conservatively -- if I said "reduced," what they did was conservatively increased the failure frequency in the analysis, in consideration of, among many other things, a common mode failure.

It has been very carefully considered by the Staff and the Applicants in their analysis. It's important here to recognize that common mode failures are best addressed by providing redundancy, diversity and independence in the systems.

But, in addition, it's important to provide a means of realizing the potential of that redundancy, diversity and independence. There are two key points on that.

The transcript citations that are pertinent here are Clare, Tr. 5270, and Dr. Morris, 5645 to -50.

The Applicants have performed and will continue to perform systems interaction studies and key systems

reviews to be sure that common mode failures will be considered and accounted for.

In addition -- and this is an important point in terms of other arguments raised by the Intervenors in connection with the scope of the Board's rulings which are continuously challenged and in connection with the first issue -- HCDA is not a DBA.

Dr. Morris went on and explained, in response to one of Judge Linenberger's questions really what is the role of a reliability program here.

The reliability program is not the program that's designed to pick out before the fact a proposition and then mindlessly crunch numbers to disprove the fact that a CDA should be a DBA.

It is more hardware-oriented. It is confirmatory in nature and assures that the potential which redundancy, diversity and independence provide, can and will be realized.

Dr. Morris' discussion and dialogue with Judge Linenberger there are quite important.

Thus, we think the record on common mode failures is quite clear. It has been accounted for in the Appendix J estimates and, indeed, there are other additional bases to conclude that that does not in any way affect the Staff's analysis.

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The final point that seems to come up repeatedly -- and we have covered it yesterday in the HCDA argument. It involves the simultaneous failure of both shutdown systems and the reliance upon the ATWS rule to say that the failure rate assigned by the Staff is non-conservative.

The argument goes as follows: The ATWS rule indicates that LWRs should be as high as 10^{-3}; therefore, the Staff's estimated value of 10^{-4} is non-conservative.

Well, that's fine. But I think what the Commission has done -- and the Board is well aware of the FEDERAL REGISTER notice that the Commission issued on ATWS that appears at 46 FED REG 57521, November 24, 1981.

The Commission is noting a concern that failure rates could be as high as 10^{-3}, indicated a need for remedial action.

Well, clearly, the Staff and Applicants are well aware of that. That has been taken into account. But Clinch River has got two independent and diverse and redundant shutdown systems, which is the whole issue that underlies the ATWS rule because light water reactors only have one such system.

Staff Exhibit 17 at 7 through 8 reflects knowledge of that situation and an intentional conservative

estimate of ATWS frequency for Clinch River, and notwithstanding the two systems, assigns a value of 1×10^{-4}.

Again, the Staff can approach that with very high confidence that a conservative estimate has been made.

Let's consider now the next argument which is containment failure probability.

The Staff examined LWR experience, noted that the Clinch River containment design is essentially similar to that of a PWR and assigned a failure frequency, based on experience, of 10^{-2}.

Now, the only evidence to the contrary on that appears -- cited at Intervenors' Exhibit 22 at 31. Dr. Cochran relies on a Nuclear Safety article, which is asserted to demonstrate a higher frequency of failure for LWRs and then, by implication, the Staff's frequency estimated for Clinch River is non-conservative.

Well, you have to look very carefully at this one because if you read the Nuclear Safety article, the kinds of failures that that article is analyzing -- and see Applicants' Exhibit 54 here at Page 619 -- are not design basis leaks in the containment or breaches in the containment, as Dr. Cochran suggests.

But what the author is analyzing is the frequency of leakage at technical specification levels.

The Nuclear Safety article indicates that what they're measuring is tech spec leak rates, which are set below design basis leak rates.

This is normal operational testing, and the failure is defined against a very stringent technical specification.

Thus, when you compute a failure probability based on that article, you're not getting a failure probability of breach of the containment, you're getting a failure probability that the containment will have a pinhole leak.

And we think that on the basis of the record, that argument should not hold water.

Mr. Chairman, Judge Linenberger, Judge Hand, our position is that the analysis of severe accident risk for Clinch River has been based upon several factors which are of vital importance.

The first is that the design itself explicitly takes into consideration severe accidents. This is not a case where one is saying that once one draws the line between the design basis accident and something beyond it, that nothing is done.

There is a careful attempt and a careful systematic disciplined engineering approach taken to providing features which will mitigate those accidents.

Secondly, the Staff has approached the analysis and the estimate of accident risks in Appendix J with a highly conservative approach to assure that with high confidence we will have bounded the risks of severe accidents.

We submit to the Board that on the contested issues; that is, frequency of loss of heat sink, pipe rupture probability, common mode failure, simultaneous failure of shutdown systems and containment failure probability, the Board can and must make affirmative findings.

That is all I have affirmatively.

JUDGE MILLER: All right. We'll take a ten-minute recess.

(A short recess was taken.)

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JUDGE MILLER: Okay. Who goes next? NRDC?

MR. SWANSON: Yes. Pursuant to our discussion we are alternating.

JUDGE MILLER: Okay.

DR. COCHRAN: I would like to begin with some general remarks and then go to some particulars.

First, I think the Board should take note of the admission by Mr. Rumble that this Appendix J was slapped together in a few weeks, which was consistent with his statements to me, as I related in my testimony, that it was a hurried job.

That accounts, I believe, and is consistent with my testimony at Page 7 that it's almost --

JUDGE MILLER: What was your citation? I didn't catch that.

DR. COCHRAN: Excuse me. Intervenors' Exhibit 22 at Page 7, that the Appendix J is almost totally based on conclusory statements and it can at most be -- that can most charitably be characterized as engineering judgment.

The second thing I would like to call to the attention of the Board about Appendix J is that when the Staff has given it their best shot and when you take their data on its face, and they testified to the validity of the analysis, and you apply it to the question of whether the CDA should be a DBA, as I did in the earlier discussion,

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it shows that it's premature for the Board to conclude that the CDA is beyond the design basis.

The third point is this issue of the role of the reliability program.

For my purposes throughout the past year or more, the actual role as stated by the Applicants of the reliability program is not particularly relevant to my interest in it.

I claim that the reliability program contains the best information available to date, or at least some of the best information available to date, on reliability data against which one can test the Staff's assertions about the performance of the various systems as they have analyzed them in Appendix J.

So the issue is not what the role is, but whether the content of that program and the documents behind it and so forth contain any information that would bring to light issues that would either verify or contradict the analysis provided by the Staff in Appendix J and even elsewhere.

As one example of that type of analysis, although I don't assert that it's part of the documentations of Appendix J, is the Harris Report itself, which I think has some relevance to this proceeding.

I'd like to turn to that issue, the pipe

7-3

rupture issue.

Now, on the basis of my knowledge or capabilities related to the pipe rupture issue, which were brought out on voir dire, I have to rely on the assertions of people far more expert than I on that issue, such as Dr. Harris.

Now, that analysis demonstrates, I believe, that the CRBR pipe rupture frequency, at least to the level of analysis that he went, is comparable to that of a PWR within the uncertainty values that were demonstrated by his sensitivity analysis.

The Applicants made a statement that if you read his conclusion, he shrunk the limits of the sensitivity analysis from the table presented in the report, which is my Attachment 3 to Intervenors' Exhibit 22, from the pipe rupture frequency of CRBR to PWR of about .01 to 10, shrunk it down to about .1 to 1.

Well, even if you take that number of .1 to 1, can you ascribe a failure probability of pipe rupture of CRBR markedly different from a PWR? I would submit you cannot say, as Mr. Edgar did, that it demonstrates any -- that it's closer to .1 than 1. I think the data don't show that.

Perhaps a more detailed design specific analysis would show that it's closer to .1. It may even show it

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in the other direction, up around 10; but at this point I don't think there's any demonstration on a level of analysis that's more detailed than that presented by either Staff or Applicants on this issue that the pipe break frequency is markedly different between the CRBR and the PWR.

Now, Staff brought in their -- I believe it was their Exhibit 20, which was the earlier analysis by Mr. Harris, and I think if you read those two that you will see that after Mr. Harris did the earlier analysis, he went to Westinghouse and had some discussions of the data, and Westinghouse suggested some alternative considerations with regard to parameterization in the sensitivity analysis, looking at well volume and well length and well area and so forth.

He went back and did some more work, got a different conclusion, and so I don't think you should attach the -- in terms of the relative frequencies, you should not attach any weight to the earlier work.

Now, the Staff used the earlier work, though for a slightly different purpose, and that was to demonstrate that on the basis of the earlier work, that the probability of pipe rupture frequency in a PWR is very low in any case.

Maybe it is and maybe it isn't. I don't know whether the -- someone like Mr. Harris attaches much

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weight to the absolute probabilities, as opposed to the relative probabilities.

I think that's an important distinction.

In any case, the Staff and Applicants are in sort of a Catch-22 position because even if the pipe break frequency in absolute terms is very low, if the relative probability of the CRBR versus PWR is comparable, then how do you escape the problem imposed by the fact that pipe breaks are design basis events in lightwater reactors.

Now, to get out of that dilemma, it seems you [illegible]. I think, demonstrate that there's something about [illegible]ction systems and recovery systems and so forth that would markedly distinguish propagation of pipe rupture from small leaks to large leaks between a PWR and a CRBR.

Now, Applicants and Staff have offered evidence that there are certain features to mitigate against that concern, but I don't believe, as evidenced by our cross-examination in the first week of the hearings, that there is any basis for assuming at this time in the proceeding, at least, that there's any basis for assuming that those differences, whatever they are, are significant enough to markedly distinguish the conditional frequency that if a pipe leak occurs you will catch it in the CRBR more readily than you would in a lightwater reactor in terms

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of prevention of a break beyond the design basis.

Now, a separate or fifth issue that I want to raise is that of common cause failure and it has some relationship to the earlier discussion of the reliability program and what value it would have on these proceedings.

Intervenors have introduced in cross-examination this week the statement that appeared at Page 3-2 of the RSS MAP of Calvert Cliffs, and we read into the record the sentences it included:

> "For purposes of comparing safety, then, the appropriate place for comparison is the accident sequence, since it is at this point where all systems interdependencies are considered."

Now, the Staff's Witness Rumble said he didn't agree with that statement, and fair enough; but opinion is divided on that issue, as evidenced by the Staff's own consultants who prepared this document for the Staff who are at Sandia and Battelle, Columbus, Laboratories.

If in fact this statement is true, and I think the statement has validity, then I think one should probe the systems interaction issue and the failure sequencies when one does an analysis such as that conducted in Appendix J, to determine the relative roles of common mode failure, if, for example, one is going to compare PWR's

7-7

to CRBR in an attempt to estimate failure probabilities.

The sixth point is the ATWS issue, and Applicants introduced evidence to demonstrate that the shutdown systems, the operating range of the shutdown systems for a Clinch River type reactor and a lightwater reactor were comparable in terms of the period of the reactor versus reactivity below something less than a dollar.

I think that demonstrates that the reactors behave similarly in terms of control or can be designed to behave similarly in terms of control by the operators in operating the reactor under routine conditions.

I believe it's an open question, or at least it hasn't been demonstrated by the Applicants or Staff that the reactivities that would be introduced in a CRBR type reactor versus a PWR or BWR are not markedly different with respect to at least some accident scenarios and, therefore, the response times of the two shutdown systems have to be different.

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DR. COCHRAN: The last point I wish to make is that the Applicants have made no independent analysis of the probabilities, and have only cited selectively the conservatisms that they wish to point out in the Staff's analysis.

On cross-examination it was brought out that there were at least some areas where, in comparing an LWR versus a breeder reactor, the breeder reactor looks worse, in terms of certain conditions. These would be on the side of offsetting the conservatisms identified by the Applicant.

That concludes my sort of principal overview.

I believe Judge Linenberger, in his last question to me in my testimony on Exhibit 22, established what I believe is the important conclusion to draw from my testimony; and that is, the assertions made by the Staff in the FSFES, Section J.1.3 at J-25 are not substantiated by this Appendix J analysis.

In my testimony I made the point in Exhibit 22, Page 15 that there's no discussion whatsoever in Appendix J of the contribution of steam generator failure to the overall risk of LOHS.

Mr. Edgar points out that the steam generators have mitigating systems. But on cross-examination, it

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was shown that the Applicants don't have any probabilities by which they could attach some estimates of the overall failure rates associated with those mitigating systems or the steam generators in toto.

With regard to the Harris analysis -- I'd just back up -- I would suggest that the Board might wish to compare Harris' analysis and conclusions in Intervenors' Exhibit 22, Attachment 3, against the Staff's statements at Page 2-8, namely, the last paragraph carrying over to Page 2-9 of the site suitability report and see for yourself if the statements by the Staff are supported by the analysis by Harris.

At Page 22 of Intervenors' Exhibit 22, I would point out that the Staff's one sentence devoted to common cause failure hardly qualifies as analysis, particularly in light of the conclusions by the Staff cited at Page 23 of Intervenors' Exhibit 22, that the state-of-the-art review concluded that no single method presently exists in a form that can be used to perform an adequate review for adverse systems interaction.

At Page 24 of Intervenors' Exhibit 22, I would point out that there's no substantive basis for the Staff' broad-brush assertion that the foregoing estimates of frequencies and risks associated with the CRBR have included allowances for uncertainties.

Mr. Edgar and I don't agree on all matters, but we agree on the depth to which the Board should probe the issue of nuclear explosions. Applicants can call it what they wish. Intervenors will call it what we wish, and we'll march on, knowing that we're talking about the same events.

Some of the main points from the Applicants' testimony on Appendix J that I would like to bring to your attention is that Applicants have done an independent PRA -- or at least they're not relying on one.

As noted earlier, they haven't shown reactivities and insertion rates one obtains from the spectrum of potential breeder accidents or comparable to those of light water reactors.

With regard to nonconservatisms, they admit sodium fires could reduce the capability of the SHRS. They admit exothermic chemical reactions could result from steam generator water to sodium leaks, which would reduce the capability of the SHRS.

They admit there's less operating experience with LMFBR SHRS than with LWRs. It's more difficult to visually inspect the SHRS piping because of the guard vessels which aren't present in light water reactors, and so forth.

I don't think there's any dispute that you

can't test the natural circulation issue until you've built the reactor.

I believe they admit that the containment features, such as the annulus filtration and vent-purge systems are unique to the CRBR. The Applicants had one part of their testimony which really overlaps into 5(b) at the very end, where Mr. Hibbitts said that Y-12 was vital to national security, and long-term evacuation of Y-12 would be unacceptable, and a particular dose -- the EPA PAGs, if reached, would require evacuation should have a threshold of consequences for Y-12 evacuation didn't have a good understanding of what long-term impacts would be for six months.

Applicants also admitted that there are other ways to cut the risk diversion issue, aside from signing consequences to the power of one as opposed to, say, 1.2, as done in the Commission's -- as evidenced by the Commission's safety goals report.

With regard to the Staff, the Staff's analysis is no better than that in WASH-1400. Actually it's more crude and done hurriedly, and, therefore, has greater uncertainties than WASH-1400.

The Staff's estimates of -- Strike that.

I believe that the Staff's analysis is so cursory that they can't prove that it is conservative.

The Staff is supposed to reference background material, according to the Commission's 9 statement, but it didn't; and it refused to mention the documents in discovery, only -- and these documents only show up for the first time in testimony.

The Staff couldn't back up its estimate of the conditional frequency of highly energetic CDA of .1 except that Dr. Rumble looked at CRBRP-1.

I think we brought out -- Finally, I think we brought out in cross of Applicants that their criticism of this Staff with regard to the conservatisms introduced by combining the various CDAs into the classes that show up in Table J-2, that their analysis -- that the Applicants were incorrect in that regard, that it was shown that the combination of the CDA categories in Class 1 were not sensitive to head release, and the criticism doesn't apply at all to Class 4, and the Applicants didn't attempt to analyze the implications with regard to Classes 2 and 3.

That concludes my remarks.

JUDGE MILLER: Thank you.

Staff.

* * *

MR. SWANSON: Again, I don't want to repeat the points that Mr. Edgar has made. Much of the information, I think, that is relevant on this point was stated yesterday and is contained in the Staff's testimony, Exhibit 2 particularly, which was filed last summer.

However, addressing specifically the Environmental Review, it's most instructive, I believe, to refer to Staff Exhibit 17, which starts at Transcript Page 5748 and the Staff's Final Environmental Statement Supplement, and particularly Appendix J of that Supplement. That's Staff Exhibit 8.

Again, without repeating many of the points that Mr. Edgar stated, I think it's of critical importance that this Board understand the extreme conservatism that's contained in the Staff's estimate of probability contained in Appendix J for CDA initiation.

The CDA frequencies determined by the Staff were based on judging the feasibility of achieving specific level performance. The specific points discussed are referenced on Pages 6 and 7 of Staff Exhibit 17; that is the testimony that was introduced this week.

The CDA initiation frequency attributed to ATWS -- that is, 10^{-4} per year -- is conservative based on a number of factors. It is based on a frequency of operating experience of LWRs of 10^{-4} failure per year for

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a single shutdown system.

As I discussed in greater detail yesterday, however -- and as Mr. Edger pointed out -- there is redundancy, independence and diversity of the CRBR shutdown systems.

There are two independent, diverse and redundant shutdown systems, each of which will have to meet the single failure criterion. This is discussed at Pages 7 and 8 of Staff Exhibit 17.

I went into greater detail yesterday describing some of the aspects of those features and why, indeed, it is conservative to assume a 10^{-4} failure probability for the CRBR system when, in fact, that number is based on a single shutdown system when, in fact, here, of course, we have, as I mentioned, independent, diverse and redundant systems.

The LOHS -- loss of heat sink frequency -- is on the same order as discussed in Staff Exhibit 17, Page 9.

The primary Clinch River steam generator auxiliary heat removal system, we would expect to have a failure frequency in the range of 10^{-5} to 10^{-4} per year is, in turn, backed up by direct heat removal service.

Again, this is discussed on Page 9 of that

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testimony.

There are inherent safety features in the Clinch River cooling system which are discussed on Pages 9 through 11 of Staff Exhibit 17, which support the conclusionary that fuel failure propagation at Clinch River will be very unlikely.

That means it will be bounded by the ATWS and the LOHS frequencies.

Even if they do occur, however, they will be detected early enough to prevent propagation into a core disruptive accident. That point is made at Page 11 of that testimony.

Specific requirements, such as inspection and a systems discussion, are discussed in greater detail in that same testimony, starting on Page 12. They support the Staff's analysis and conclusion that the core disruptive accident initiation frequency from a loss of coolant accident would be bounded by the LOHS frequency.

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Design features such as guard vessel and leak detection systems are passive and they do not require complex active systems.

The basis for the conclusion that a core disruptive accident initiation frequency from flow blockage is discussed on Pages 13 and 14 of that testimony and the Staff concluded that that frequency is bounded by the LOHS frequency.

The Staff, on Page 15 of that document, described the basis for selecting the conditional frequencies of containment isolation failure and containment annulus cooling and vent-purge system failure.

The reactor vessel head release fractions were conservatively selected by the Staff on the basis of its judgment from a consideration of general LMFBR research on energetic CDA's.

The Staff took account of relative volatilities of the different radionuclides species and materials.

This is discussed on Page 17 of that document.

In the Staff analysis for all core disruptive accidents, it was assumed that the total noble gas inventory would be released from the containment building. That's discussed on Page 16.

The Staff also analyzed releases from other modes; such as from drainage into the reactor cavity

where material could be boiled off and discussion of residue from boil-off of the reactor cavity. This is discussed on Page 17 and also 17-a of Staff Exhibit 17.

The releases to the outside environment are also analyzed, based on fallout rates and that is discussed on Pages 17-a and also 20 of the Staff exhibit.

The Staff bases assumptions on sodium aerosols of amounts specified on Page 23 of that testimony, which are based on experimental data with sodium fires.

This result is conservative for the purpose of characterizing the upper limit of aerosol concentrations from large sodium fires.

At Page 32 the Staff describes its analysis of core disruptive accidents sequences in terms of the assumptions made.

The Staff, for example, did not include early containment failures from extremely energetic CDA's, since they are so unlikely that their contribution to the risk to public is not significant.

The conclusion on that point is that there is less than 1 in 10 chance that CDA's, assuming they are already occurring, will become energetic enough to cause a primary coolant system seal failures. That's discussed on Page 35 of the testimony.

And the reasons for that are set forth on that page and, also on Page 36.

Other conservatisms are mentioned in those pages. For example, on Page 38, the Staff points out that no credit was given for the benefit of Clinch River having or allowing more time for operator reaction than would be the case for a comparable LWR's in the case of loss of heat sink accident.

What I have given you is really a summary sketch. Many of the details and arguments I have purposely left out because they have been previously made, either by Mr. Edgar this morning or by myself or Mr. Edgar yesterday and I think to have a complete picture of the basis and to get a clear picture, that extreme conservatism in choosing the 10^{-4} figure, one can simply refer to the pages I noted, as well as testimony cited by Mr. Edgar, which, indeed,supports the conclusion that we have an extremely conservative figure for consideration of the likelihood of a CDA initiation caused by ATWS.

The Staff concluded, if the analyses of CDA's and their consequences, as described in the FES supplement, that is Staff Exhibit 8, meet all the requirements for environmental impact considerations under NRC Regulations and policy and under the National Environmental Policy Act for the description of such impacts and performing

the NEPA cost?benefit analysis, they are totally adequate for such purposes.

The radiological source term analysis was adequately considered -- excuse me.

The radiological source term analysis did adequately consider possible releases for fission products and core materials and also the potential environmental conditions in the reactor containment building created by possible release of substantial quantities of sodium.

The Staff adequately considered the potential release of sodium following a CDA, including the possible range of quantities released and has considered the environmental conditions caused by such a release in its analysis of radiological consequences.

The Staff position is that Appendix J adequately considered the probability aspects of an accident analysis, as is required at this stage of review. As stated by Mr. Hulman, Tr. Page 5644.

A full probability risk assessment, as argued by Intervenors, is simply not required nor is it necessary at this stage of the review.

The Staff's conclusion set forth in Appendix J, Exhibit 17, are adequately supported by the material contained in that document and establish that the risk assessment performed by the Staff was adequate.

If we turn to the arguments raised by Intervenors today, we note some of the arguments raised, and I would like to address them briefly.

The first one was that Dr. Rumble hurriedly slapped together his analysis.

The Staff position is that that is an absurd conclusion, supported only by the self-serving statement by Dr. Cochran in his testimony. The professional qualifications of Dr. Rumble established the years of experience he has performing these kinds -- this kind of review.

The only evidence by Dr. Rumble as to the adequacy of his review is contained in his pre-filed testimony and, of course, the cross-examination of Dr. Rumble.

In that respect, I think it's instructive to note the conclusions that Dr. Rumble and the rest of the Staff panel reached regarding the review and if you look at Page -- by that, I mean the testimony filed by Dr. Rumble, not only filed in Staff Exhibit 17 but also Staff Exhibit 2, which also is Dr. Rumble's analysis regarding the Staff review and when you look at the conclusions of those documents, such as the conclusions stated on Pages 47 through 50 of Staff Exhibit 17, as well as the conclusions in Staff Exhibit 2, you see, for

example, on Page 50, that Dr. Rumble and others concluded that in the Staff's evaluation of the full range of accidents possible at CRBR, including the initiation control and mitigation of accidents, the Staff has, for the purpose of environmental review, adequately identified and analyzed and given due consideration to the ways in which various CDA contributors or accident sequences can lead to accidents and that they have fully analyzed and concluded that the risk to the public is acceptably low, and were adequately considered.

There simply is not a basis in the record for supporting the conclusion that in any way that the Staff's review was hindered by its time constraints.

The point raised by Intervenors that core disruptive accident is a design basis accident, I think was discussed in greater detail previously, both by myself and Mr. Edgar yesterday, as well as early this morning and I won't repeat it again.

As I indicated, the Staff's bases are set forth in its testimony, including Appendix J analysis and the site suitability report, Staff Exhibit 1, and in those documents, the Staff adequately sets forth its basis for excluding core disruptive accidents from the design basis.

Dr. Cochran then went on and discussed the role of the reliability program and, specifically, the

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role that pipe breaks play in the contribution of accident sequences.

He claims in his testimony that the Staff has failed to consider that pipe breaks should perhaps be a more dominant mode in CDA initiation, and he relies on the Harris memo, attachment -- it's Attachment 3, I believe, to his testimony.

However, when you come to the bottom line, in his own attachment and, as Dr. Cochran conceded and Mr. Harris is an expert in pipe break analysis, we find that even if a pipe break occurred the likelihood of pipe break occurrence is no greater at CRBR than it is for an LWR's.

If you go to the reference cited by Mr. Harris in Intervenors own attachment, in their own exhibit, that is Attachment No. 1, which was cited earlier, which is the Staff Exhibit 20, you find the absolute probability of a pipe break which was concluded by Mr. Harris and that number was in the range of 10^{-7} for a hot leg and 10^{-8} for the cold leg.

That conclusion has not been refuted by Dr. Cochran and there's absolutely no basis for concluding, as Dr. Cochran did, that Mr. Harris somehow has changed his conclusion.

You'll note when Dr. Cochran made that

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assertion, he could not cite anything in the record to support that conclusion and, in fact, you won't find that. There is nothing to indiate that the numbers supported by Mr. Harris, for the absolute likelihood of pipe break probability for CRBR is anything other than what is stated in his Reference 1, which Intervenors failed to mention when they cited the Harris Report, which is attachment to their testimony.

As the Staff discussed yesterday in reference -- if you look at Page 17 of Staff Exhibit 2, the Staff points out that even if a pipe break did occur, it is not likely to lead to a core disruptive accident.

I won't repeat the detailed discussion, some of which I mentioned yesterday, but I would simply refer you to Page 17 of Staff Exhibit 2, where the Staff indicates that it is not appropriate to consider a pipe break accident at an LWR with that of the Clinch River because of vastly different characteristics. Pressures are different. It is below the boiling point. The coolant of sodium is below its saturation or boiling point in the CRBR and there are systems to mitigate a pipe break from leading to a CDA at Clinch River, such as the guard vessels and the positioning of piping above the top of the core.

Again, that's all referenced on Page 17 of

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Staff Exhibit 2.

I won't go into a discussion of the Calvert Cliffs comparison. Mr. Edgar already did that but I do know that Dr. Cochran, in his argument, used that as a starting point for arguing that the interdependency is likely to make a difference Clinch River, interdependencies of systems, in that that will somehow cause the Staff's analysis to be flawed because the Staff hasn't considered that.

That simply isn't true. The record supports the conclusion that the Staff has adequately considered the likelihood of interdependence.

If you look at Transcript Page 2256, I think that's Dr. Morris, that testified that the likelihood of interdependency causing an accident, is very low at Clinch River.

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MR. SWANSON: Dr. Cochran admitted that Dr. Rumble disagreed with the statement that Dr. Cochran was trying to advance regarding interdependencies in connection with Calvert Cliffs.

Further, the Staff's Exhibit 2 at Pages 23 and 24 regarding human error indicate that one cannot draw a conclusion, as Dr. Cochran did, that system interdependence is likely to cause a greater likelihood of human error in contribution of accidents at Clinch River.

On the pages I references, Pages 23 and 24 of Staff Exhibit 2, the Staff points out that rapid operator action in responding to accidents will not be necessary at Clinch River.

The Staff goes into greater discussion there that the likelihood of human error, operator misaction, because of various items, including systems interaction, is not a significant problem at Clinch River, that it has adequately been considered by the Staff, and that the argument that somehow the systems at Clinch River place a greater burden on the operator in the response time, that argument by Intervenors simply does not hold weight.

In terms of the systems interaction review, the Staff would simply point out that in Exhibit 2, in response to Question 13, particularly at Pages 15 and 16, the Staff points out the basis for its reliance that systems

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interaction will be adequately considered in detail at the CP review, the assurance that systems interaction will be adequately considered, and thus that it need not play a greater role in accident analysis at this time are the IEEE Standard 279 and various Reg. Guides enumerated in the Standard Review Plan that assure that common cause problems are adequately considered.

I also would refer you to examination of Applicants' Witness Clare at pages Transcript 5270 through 71, and also 5247 through 49, where that witness indicated that key systems review had been performed and that the common cause matter was adequately considered in performing the analysis which led to conclusions regarding likelihood of systems interaction and common mode failures leading to an accident.

I also would point out that the Staff's Exhibit 8, the Final Environmental Statement Supplement, in response to NRDC comments -- you can find that at Pages 12-77 and 78 in response to NRDC Comments 114(e) and 115.

The Staff discussed its assessment of systems interaction, common mode failures, and the reliability program that the Staff will require to assure that -- when we get to the details level of review at the construction permit stage and beyond, that these matters are considered.

The Staff, particularly in response to NRDC

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Comment 115 -- and that discussion is on Page 12-78 of the FES Supplement -- details four points that the Staff will require as part of the reliability program, which help assure that common mode failures, systems interactions problems will be adequately considered.

The four points I will not go into in detail, but simply state that these four points provide assurance to the Staff that common cause failure modes will be eliminated, and it's based on the assurance that an adequate reliability program will be in place.

The reliance on IEEE-279 is a measure of review and the Reg. Guides and other aspects discussed on Pages 15 and 16 of Staff Exhibit 2.

These items help to assure the Staff that systems interaction, common mode failures will be adequately assessed at the level of review at the CP stage and beyond, so that we do have adequate assurance that these items need not be given undue weight at this stage when assessing the likelihood of accidents.

I mentioned before the probability and consideration of probability by the Staff of the likelihood that a CDA energetic accident would cause -- would lead to a more severe accident than that considered by Staff.

Dr. Cochran raised that argument again in his argument later on, and I would simply refer you to the

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Staff's testimony. That's Exhibit 17, in Answer 43. That's on Page 35, where the Staff gave its reasoning behind its choice of the one in ten probability, it's conditional probability, that given a CDA, that it will lead to an energetic situation for which Intervenors claim we have not given adequate consideration.

I think that covers the Intervenors' points. I would simply conclude that the Staff did give adequate consideration in its environmental analysis to the risk of accident sequences.

The conclusions of the Staff in its analysis are set forth, again, in Staff Exhibit 17, and the conclusions that are contained in Pages 47 through 50 of that document, and are discussed in greater detail in Appendix J of the Staff's Final Environmental Statement Supplement, that is, Staff Exhibit 8; the conclusion being that an adequate analysis was performed and that the environmental risks are acceptably small and are comparable to those of LWR's.

That concludes what I have.

JUDGE MILLER: Rebuttal?

MR. EDGAR: Just one point for the record.

In Dr. Cochran's discussion on pipe rupture, he urges that the problem is basically that there's been no demonstration by the Applicants or Staff on a, quote,

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detailed level of analysis.

We find that curious. Applicants' Exhibit 24 was objected to by Intervenors and a motion to strike was filed on the grounds that it was too detailed, and it deals with that subject.

Indeed, that's the fundamental source of information concerning the characteristics of the primary heat transport system piping.

There are two additional references, aside from Applicants' Exhibit 24 that are important here.

The argument is made by Intervenors that even if the Staff's probability estimate is valid, nevertheless, one must go on and show something to the effect that cracks in pipes won't propagate to large leaks.

In that respect, I would cite the Board to two sources. First, Exhibit 1 of Applicants, Tr. 2029 through 2032; Applicants' Exhibit 24.

In addition, however, I should note the guard vessels and elevated piping to maintain inventory are described at Applicants' Exhibit 46, Page 16.

That would conclude my rebuttal. The one item I would note for the record in addition is I gave a citation to Applicants' Exhibit 36, which is an analysis of the issue of buildup or burnup, Plutonium-238 and 241 concentrations.

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The burden of this analysis is that recycle of PU-238 and 241 in Clinch River will reduce their relative concentrations.

The citation I gave should be stated a little more accurately, because the ER is five volumes, and I would rather have a unique clearer identification, if I may.

The full citation would be Applicants' Exhibit 36. That is Volume 3 of the Environmental Report.

In order to find the appropriate section within Volume 3, which is Exhibit 36, one should look under the tab labeled, "Appendices," and within that tab one will find a write-up entitled, "14.4A" -- that's a large "A" -- "Appendix to ER Chapter 5.7."

That is Amendment XVI (October, 1982). I think that will assist in finding it. It can be confusing to go through the ER at times.

I note that the time is becoming rather finite. The Board had indicated to us a spirit that the Board would like to have discussion focused on what we regard at the contested issues.

In our judgment there was no testimony filed on 5(b). We don't regard 5(b) as involving serious dispute, and therefore, we prefer to rely on our proposed findings; and given valuable trial time before the Board,

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I am going to skip that and go to 2(e), the dose guidelines, where we feel there are some clear disputes, and I will proceed with that at this time.

JUDGE MILLER: Well, let me take a reading while we are at it.

It would not be fair to go partly into a certain argument and not have complete responses, or have it addressed by all parties.

I am, therefore, wondering really, we have about 30 to 35 minutes.

I am wondering, really, if there is anything that can be completely covered in that time in any meaningful way.

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MR. EDGAR: I doubt it, Your Honor, if by all parties. I think it would be --

JUDGE MILLER: Yes, by all parties because it wouldn't be fair to have some arguments heard and others not.

We're considering the possibility of continuing these arguments. They are arguments of counsel -- in Bethesda, since it does give the Board a preview -- and we've had some requests before to have some of our proceedings in the Washington area anyway.

Since the formal proposed findings of fact and conclusions of law of record will be those written ones which you were requested to have in the Board's hands by January 24, 1983, you will have the opportunity to have your record of proposed findings in the spirit in which our regulations contemplate them.

We are actually trying this method of extended closing arguments in order to give the Board a preview of the essential issues, to give us an advance shot at starting to study the record and the transcripts and exhibits in a meaningful way instead of a confused mass until we receive your written findings.

Therefore, that being the nature of our experiment, we don't think anybody would be put at a disadvantage if we were to resume these closing arguments in our

courtroom in Bethesda, Maryland, which we're inclined to do.

Does anyone have any comments on that?

DR. COCHRAN: That's one of the best suggestions I've heard in a long time.

JUDGE MILLER: Well, at the time of our suspension of proceedings here today, we're certainly in agreement, Dr. Cochran, on that one.

Next week is Christmas week. What about the period between Christmas and New Year's? The sooner we do this, while it's fresh in our minds, the more helpful it is to all of us.

MR. EDGAR: Mr. Chairman, I'll be very candid on the record.

I was planning to take four days off, for the first time in two years. I'll be there if you want us, but --

JUDGE MILLER: Where were you planning to go?

(Laughter.)

MR. EDGAR: Well, it's very important to me personally --

MR. SWANSON: I also am going to be out of town that week.

JUDGE MILLER: All right. You're talking now about the week of December 27 through 30 or 31; is that

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it?

MR. SWANSON: That's correct.

JUDGE MILLER: How do you feel about next week, the 20th or 21st, 22nd?

(Laughter.)

JUDGE MILLER: You breathe too heavily!

Well, then I take it that what we had better do is get on the ball the first week in January. And since the first working day is Monday, the 3rd, how does that grab you?

MR. SWANSON: Are we talking about a one-day argument?

JUDGE MILLER: You'll notice we put no time limits on it. We think counsel -- By the way, on this you've all done an excellent job, and we commend all of counsel.

You're making an analysis in depth and in focusing.

We think that the -- The Board is preferring not to impose time limits. We think that your own sense of the adequacy of your addressing these subjects be your guide.

If it gets out of hand, we might have to, but so far we've certainly been pleased with the results. And if someone feels that another party or counsel is

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taking too much time, talk to each other, too. We encourage that -- at recess and off the record.

All right. Then does anyone have any objection to resuming, say, 9:00 on Monday, January 3rd?

DR. COCHRAN: Would the 4th be just as good?

JUDGE MILLER: Yes, probably, because we have a whole week there. We're going to keep rolling once we've started.

MR. EDGAR: The 4th would be fine with us.

DR. COCHRAN: It wouldn't kill an otherwise attractive weekend.

JUDGE MILLER: All right.

MR. EDGAR: Judge Miller, that will be in the hearing room at East/West --

JUDGE MILLER: Yes, we have the courtroom there shared by the Appeal Board and the Panel, the Fifth Floor, East/West Towers, East/West Highway, Bethesda, Maryland, commencing at 9:00 a.m., Tuesday, January 4, and continuing until the conclusion of the closing arguments.

Anything else?

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MR. EDGAR: Mr. Chairman, there was some discussion in the conference call of counsel prior to coming down for the hearings -- I think it was the Wednesday or Tuesday before -- the week before; and I'd just like to get some initial, informal discussion.

I have a proposal to make on future schedules. I mean, we're projecting now -- getting the findings before the Board -- projecting a continuation of the oral argument.

But looking beyond that, the Staff contemplates issuing the Safety Evaluation Report in early March.

JUDGE MILLER: Does the Staff still?

MR. SWANSON: Yes.

MR. EDGAR: Right now the Applicants and Staff have -- The Applicants have applied for an LWA-2, and the Staff and Applicants have been discussing the scope of that review and the timing of that review by the Staff.

What I would like to propose to take the matter off the Board's hands is that the parties confer. We will propose a schedule sometime in the next several weeks to the Intervenors and to the Staff and get together to see what we can accommodate.

Our initial thinking is that with an early March Safety Evaluation Report and with an LWA-2 involving

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the plant foundations below grade, that it would be possible to get into hearing by mid- to late May on those issues.

But rather than go through that in great detail at this point, I think it would be well for the parties to sit down and come up with a proposal or an approach and see if those general objectives which would be an SER in early March, hearings in late May, are feasible, and then bring it to the Board to see what can be done.

I guess my thought would be that we might be able to tailgate some discussion of that issue in the oral argument that we'd have out in the Board's -- you know -- devote a little bit of time for just a prehearing meeting of counsel on that.

JUDGE MILLER: Yes. I'm certain we could. And while we're all together there, it would be agreeable with the Board. And we do encourage the parties and their counsel to confer in advance, agree so far as they can upon both issues, a proposed schedule for discovery, motions, if any, pretrial briefs, if required by the issues, and anything else that would be leading up to an agreed commencement of trial.

MR. EDGAR: All right. We'll confer and try to see what makes sense in that area.

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JUDGE MILLER: Judge Linenberger.

JUDGE LINENBERGER: I just wanted to make one brief comment -- this is a long way ahead of time. But when we get into LWA-2 matters, I just want to observe that the Board does not stand in awe of blue prints or construction drawings or whatever, so to the extent anybody feels they might augment that case, feel free.

MR. EDGAR: In that regard, I would like to consider again sometime in the spring the possibility of making the opportunity available to the Board and the parties -- no problem either -- but for the Board to tour that model up at Burns and Rowe.

As we get into LWA-2, we're --

JUDGE MILLER: Where is that?

MR. EDGAR: That's in Oreville, New Jersey, Your Honor. That's not too far from the Newark Airport. I think you've got to rent a car.

But the thing is as large as this room. And as we get toward the design issues, it is a good physical thing to take a look at.

JUDGE MILLER: We might arrange that.

Dr. Cochran, have you had a chance to avail yourself of that view -- that preview. I'm inquiring: Do you wish to participate in the event that we decide at some point --

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DR. COCHRAN: I haven't given it any consideration. I see no objection to scheduling such a viewing.

JUDGE MILLER: Okay. Dr. Hand has indicated to me that possibly one week in late May might be available, but he's going to have problems with his own professional scheduling until approximately what? The first week of June?

JUDGE MILLER: No, my class will finish the 10th of June.

JUDGE MILLER: After June 10. So you might bear that in mind in arranging your schedules.

It is probable that Judge Hand will not be with us January 4th, although we certainly would like to have him, but we understand -- well, he lives 3000 miles away, in the first place.

Since we are proceeding without any participation by the Board, you'll note there have been no questions, although there are some questions that the Board might have had, but we preferred to let counsel handle this as though it were an oral phase of their proposed findings, which is entirely in their hands: time, what they want to talk about and the like -- so without any Board participation other than listening, and then certainly reading the transcript because the transcript will contain the references which will be very helpful to us.

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If there be no objection, it's likely that we will go by quorum on the conclusion of the final arguments, so that we don't -- we're able to schedule them and not impose upon Judge Hand's own requirements.

All right.

(Whereupon, at 11:00 a.m. the hearing was recessed, to reconvene on Tuesday, January 4, 1983, at 9:00 a.m.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

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in the matter of: TENNESSEE VALLEY AUTHORITY (CLINCH RIVER BREEDER REACTOR)

Date of Proceeding: December 17, 1982

Docket Number: 50-537

Place of Proceeding: Oak Ridge, Tennessee

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

Mary L. Bagby

Official Reporter (Typed)

Mary L Bagby

Official Reporter (Signature)