TESTIMONY
of
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NATURAL RESOURCES DEFENSE COUNCIL

Before
SUBCOMMITTEE ON NUCLEAR REGULATION
SENATE COMMITTEE ON PUBLIC WORKS

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Thank you, Mr. Chairman

My name is Anthony Z. Roisman and I am a staff attorney with the Natural Resources Defense Council (NRDC). With me is Dr. Thomas B. Cochran, a staff scientist with NRDC. NRDC is a national non-profit environmental organization with a membership of approximately 35,000. We are particularly interested in these hearings because of our long involvement with the problem of plutonium breeder reactors in general and the Clinch River Breeder Reactor (CRBR) in particular.

Public knowledge of the fact that Burns & Roe had serious misgivings about the wisdom of the CRBR came as a shock to many proponents and opponents of the project. No one was more justifiably shocked than NRDC, which had been involved in probing the wisdom of the CRBR since 1971 and had been actively participating in the NRC proceeding for consideration of a construction permit for the CRBR since 1975. Because the purpose of that proceeding was to uncover all relevant facts and opinions about the CRBR in order to permit the licensing board to determine whether a construction permit should be issued, and because as of April 25,

1977, when the hearing was suspended as a result of President Carter's decision to halt the CRBR project, all prehearing discovery had ended, it would be reasonable to assume that the facts and opinions disclosed in the Burns & Roe document were known to the hearing board and all the participants in that proceeding. In fact, with the possible exception of the NRC Staff and the Applicants, no participant in the proceeding was aware of the facts and opinions disclosed in the Burns & Roe document. The relevance of those facts and opinions to the question of the wisdom of constructing the CRBR is indisputable, and thus it is essential to determine how this adjudicatory process -- criticized by many as overly long -- could have failed to uncover these crucial matters. It is our position that at least the Applicants, and perhaps also the Regulatory Staff, were guilty of seriously misleading the participants and the licensing board by failing to disclose the facts and opinions contained in the Burns & Roe document. It is our further position that the process used by the Regulatory Staff in analyzing the CRBR construction permit application and all other construction permit applications is inherently incapable of discovering such facts and opinions when the Applicants do not voluntarily choose to disclose them.

The NRC hearing is not the only mechanism which was available to discover some of the truth about the CRBR. ERDA held several public hearings on the LMFBR and the CRBR, and Congress also investigated the project. The concerns expressed in the private Burns & Roe memorandum were not expressed publicly in

those proceedings. In fact, Burns & Roe personnel testified to ERDA in 1975 and took positions inconsistent with the private judgments of Burns & Roe. Thus, it is also pertinent to inquire into the mechanisms used by ERDA and Congress to ascertain the truth and see how those mechanisms failed to disclose the private judgment of Burns & Roe.

Before addressing the deficiencies in the conduct of the Applicants and the Regulatory Staff, we would like to emphasize that for the most part the matters contained in the Burns & Roe document are as relevant and valid today as they were when Burns & Roe wrote them in 1973.

The Burns & Roe report states:

> "For example, Westinghouse and Burns and Roe have been told orally by RRD and PMC that we should not comply with the requirements of 10CFR50 Appendix A (General Design Requirements) for LMFBR where such requirements arise from theoretical DRL safety considerations and would not necessarily provide a simple, reliable plant."
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> "This approach is being fostered in full knowledge that it may not result in meeting DRL's licensing requirements and that many issues would have to be taken to the AEC Commissioners for resolution. It is part of a power struggle between parts of the AEC. The LMFBR Demonstration Plant is viewed as a test case in which RRD and PMC can knock out many theoretical safety-oriented design features which complicate commercial plants and make them more expensive, and in which a new approach to safety and licensing can be established. In addition, the Demonstration Plant is viewed as having to be consistent with FFTF in order to justify the approaches on that project. Unfortunately, some safety approaches on FFTF were apparently decided on because of the severe cost bind that project is in."

This attitude on the part of ERDA and the Project are still prevalent today and it is obvious that the CRBR and follow-on LMFBRs will not be demonstrably safe designs.

ERDA and the Project have been quite successful in their goal to knock safety design features out of the CRBR, particuarly with respect to the "potential problem areas" identified in the Burns & Roe Report (p. B-9):

> " . . . present emergency core cooling provisions and natural circulation assumptions; the current assumption that a double-ended pipe break is not a credible accident; the assumptions as to the extent of the Hypothetical Core Disruptive Accident (HCDA) and features needed to contain it; the effects of sodium spills and fires; radioactivity releases above the operating floor; plutonium leakage and levels at the site boundaries; and the ability to design an effective system to contain a core and reactor vessel meltdown."

Consider, for example, the Core Disruptive Accident (CDA), a euphemism for a core meltdown and explosion of the reactor. One of NRDC's contentions in the licensing proceeding was that the core meltdown and explosion should be an accident which the reactor is designed to contain without releasing significant quantities of radioactivity to the public. In early NRC correspondence the Staff indicated that it thought the core meltdown and explosion should be considered in the reactor design. Historically, core meltdown and explosion accidents have been considered in the reactor design in all previous U.S. fast reactors, including EBR-I, EBR-II, Fermi, SEFOR, and FFTF.

The Project argued during the licensing process that the core meltdown and explosion should not be an accident considered

in the CRBR design. Therefore, the Project proposed to eliminate from the CRBR design the core catcher -- a device intended to contain the core debris following a reactor core meltdown. On May 6, 1976, the NRC Staff reversed its earlier position and established a precedent by agreeing with the Project that the "probability of core melt and disruptive accidents can and must be reduced to a sufficiently low level to justify their exclusion from the design basis accident spectrum."

By eliminating the core meltdown and explosion accidents considered in the CRBR design, the Project with NRC's concurrence no longer is required to build a reactor vessel that can withstand the largest core meltdown and explosion considered credible. The Project and Staff simply take the position that all core meltdown and explosion accidents are extremely unlikely to occur, although the Staff admits that it cannot quantify the probability of a core meltdown and explosion accident or prove that the probability of such an accident is sufficiently low to warrant ignoring it.

Both the Project and the Staff agree prudence dictates that some measures should be taken to limit the consequences of core explosions, even though they are judged "incredible." However, by eliminating the core meltdown and explosion accidents from the design basis spectrum, the Project and Staff are able to arbitrarily establish the level of the explosive force that the reactor vessel can withstand. The Project has taken the position that the reactor should be designed to withstand an explosive

force of 660 megawatt-sec.*/ The Staff has arbitrarily set the value at 1200 Mw-sec. It is important to recognize here, however, that even this higher level does not represent the upper bound of the explosive potential of the CRBR. This is admitted by the Staff. In its "Analysis and Evaluation of CRBR CDA Energetics," the Staff concludes:

> "The selected number is 1200 Mw-sec. It is the Staff's opinion that the great majority of accidents should yield work-energetics below this value." (p. 1-4) (Emphasis added.)

The Staff cannot demonstrate even this conclusion due to the myriad of uncertainties in the calculations. The computer codes, for example, are inadequate to mechanistically follow the progression of an LMFBR explosion once the reactor core geometry is lost. Proof that the reactor is safe is replaced by a lot of arm-waving and "engineering judgment."

By eliminating the core meltdown and explosion accident from the spectrum of design accidents, the core catcher is no longer a requirement in the U.S. breeder program -- "core melting is [declared to be] incredible." Without the core catcher, which incidentally is required by the French and German LMFBR development program, in the eventuality of a core meltdown accident (Frank von Hippel, Appendix to the Report of the LMFBR Safety Subgroup, July 2, 1977):

> " . . . the radioactive decay heat will bring the sodium coolant in the reactor cavity to its boiling temperature; the pressure in the reactor cavity will rise to the point where the sodium vapor will have to

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*/ A megawatt-sec is equal to a megajoule, a unit of energy. As a rule of thumb, 2 megawatt-sec is roughly equivalent to the energy released by exploding a pound of TNT.

> be vented into the main containment building where it will burn in the oxygen containing atmosphere; the molten core will eat its way into the concrete floor of the reactor cavity; the decomposition of the concrete will release a great deal of water vapor which will react with the sodium coolant to release hydrogen, and finally the containment atmosphere will have to be vented through a filter system within about a day in order to prevent a buildup of the hydrogen to explosive levels. Thus, according to this scenario, the absence of a core catcher will result in the enormous amounts of chemical energy stored in the sodium coolant being released following a melt-down accident thus posing severe additional challenges to the containment.

Despite this enormius and serious potential consequences from a core meltdown and explosion accident, the NRC has dismissed the accident as "incredible," even though it is incapable of specifying what is the probability that such an accident will occur.

It is abundantly clear that many of the problems with the CRBR identified by Burns & Roe are still problems today. We have attempted to analyze the hearing process to see whether this data was fully disclosed in the hearing and, if not, why not. What we have found is that both the Applicants and the NRC Regulatory Staff essentially had two completely separate analyses of the CRBR. One, a private candid analysis of the weaknesses of the CRBR, and the other a public analysis of the CRBR designed to cover up its weaknesses. Nothing short of severe sanctions when such conduct is disclosed can prevent its recurrence. The following discussion contracts public and private statements of Burns & Roe and the NRC Staff and illustrates the history of deception which has been the mainstay of the support for the CRBR.

The judgments contained in the Burns & Roe memorandum were not only never made public by Burns & Roe, but in fact high officials of Burns & Roe with apparent knowledge of the contents of that memorandum publicly testified to ERDA and Congress and made statements totally inconsistent with Burns & Roe's private judgments.

The Burns & Roe memorandum concluded that the CRBR was essentially a bad project:

> "Notwithstanding the above, in spite of the job Burns and Roe does, the issues we raise, and the record we document, most actions on the project are out of our control, and it is already clear that the project results will be extremely poor."
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> "The PMC General Manager has privately advised Burns and Roe to get out of the LMFBR job now, since it does not have a chance of success and could harm us badly."

In a letter to Representative Mike McCormack, Chairman of the Ad Hoc Subcommittee to Review the LMFBR Program of the Joint Committee on Atomic Energy, on April 21, 1975, Kenneth A. Roe (the person to whom the contents of the memorandum were apparently presented in a meeting), stated:

> "We also believe that the CRBRP is a critical link in a well-planned program to achieving commercial breeders."

The Burns & Roe memorandum itself concluded that the data to be gathered from the CRBR would not provide crucial data on the viability of scaled-up commercial size LMFBRs:

"The results of the decisions to date are that there are many aspects of the LMFBR Demonstration Plant design which are not pointed toward scale-up of the plant for commercial use and toward minimizing development costs to the utilities later."

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"It is not clear that the sheer physical size of a future commercial scale LMFBR will not make it unattractive."

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"The Demonstration Plant is based on a non-reheat cycle and 1450 psig steam pressure. Commercial plants will have to operate with a 2400 psi steam pressure which Westinghouse favored for the Demonstration Plant. Considerable development will be involved at utility expense to go to the higher steam pressure."

In his letter to Representament McCormack, Mr. Roe stated:

"The Clinch River Breeder Reactor Plant, at 380 MWe, represents the bridge from the fuels testing facility of FFTF to the 1000-1500 MWe commercial sizes required by utilities. This is a plant that is vitally needed in order to demonstrate to the utility industry that a reasonably sized power plant can operate reliably in a utility system. The design and construction of CRBRP will generate the necessary cost and schedule information to help utilities plan their own breeder reactor needs."

The Burns & Roe memorandum declared that:

"Because of the sensitivity of the information contained herein, you are requested not to discuss its contents with anyone other than those on the distribution list for this memo, nor to leave this paper any place where it might be sighted by others."

* * *

"We will also have to take our positions in documented ways which provide the least chance for adverse information to come into the possession of those who desire to kill the LMFBR program."

In his letter to Representative McCormack, Mr. Roe stated:

> "You are to be commended for the subcommittee's approach to receiving testimony on the LMFBR program from all segments of our country. It is only through such open, public dialogue that we can hope to present the facts, clear up misinformation, and help the members of Congress to make decisions that are vital to our nation's economic health and continued growth."

The Burns & Roe memorandum concluded that the CRBR design was seriously deficient because it used the designs of the Fast Flux Test Facility:

> "The overall approach to LMFBR reactor safety matters has to date been based on FFTF approaches and policies established by Mr. Shaw and RRD which are in many ways contrary to those of the AEC Division of Regulation (DRL). For example, Westinghouse and Burns and Roe have been told orally by RRD and PMC that we should not comply with the requirements of 10CFR50 Appendix A (General Design Requirements) for LMFBR where such requirements arise from theoretical DRL safety considerations and would not necessarily provide a simple, reliable plant."

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> "The LMFBR Demonstration Plant is viewed as a test case in which RRD and PMC can knock out many theoretical safety-oriented design features which complicate commercial plants and make them more expensive, and in which a new approach to safety and licensing can be established. In addition, the Demonstration Plant is viewed as having to be consistent with FFTF in order to justify the approaches on that project. Unfortunately, some safety approaches on FFTF were apparently decided on because of the severe cost bind that project is in."

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> "A number of existing approaches based on FFTF practices are already known as potential problem areas. These include the lack of specific safety criteria for the project; present emergency core cooling provisions and natural circulation assumptions; the current assumption that a double-ended pipe break is not a credible accident; the assumptions as to the extent of the Hypothetical Core Disruptive Accident (HCDA) and features needed to contain it; the effects of sodium spills and fires; radioactivity release above the operating floor; plutonium leakage and levels at the site boundaries; and the ability to design an effective system to contain a core and reactor vessel meltdown."
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> "The AEC has forced the use of FFTF concepts rather than the Westinghouse design over the objections of many in Westinghouse."
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> "We know that some aspects of the FFTF design are abortions due to an AEC decision to make the FFTF containment too small and because of distortions in project efforts because of inadequate estimates and funding problems."

In testimony before ERDA on the LMFBR on May 27, 1975, Dr. Seymour Baron, Senior Vice President of Burns & Roe and the responsible officer for the CRBR program for Burns & Roe (apparently listed as one of the distributees for the Burns & Roe memorandum) stated:

> "The design that has been done on FFTF has served as input for the Clinch River project. The construction experience on Clinch River has been input to our planning -- the FFTF has been input to our planning on Clinch River, and when FFTF starts up it will serve as input to the Clinch River. These have been sequenced in an orderly way so that as data comes out of FFTF it will feed the information to Clinch River, and this is how you sequence it."

The Burns & Roe memorandum concluded that the CRBR safety was at best questionable:

> "Many safety approaches incorporated in FFTF and planned for the LMFBR Demonstration Plant may not be commercially licensable. These plant features could be addressed and resolved during the Demonstration Plant licensing process."
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> "The Clinch River site selected for the LMFBR Demonstration Plant is one of the worst sites ever selected for a nuclear power plant based on its topography and rock conditions."
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> "In addition, the Demonstration Plant is viewed as having to be consistent with FFTF in order to justify the approaches on that project. Unfortunately, some safety approaches on FFTF were apparently decided on ~~because of the severe~~ cost bind that ~~project~~ is in."

In his testimony before ERDA, Dr. Baron concluded that:

> "As far as the risk, there is nothing that I can see in the design -- and I'm very intimately involved with Clinch River -- as far as accident analysis, as far as safety design, there is nothing I can see in there that represents any risk that is any worse than we are considering on light water reactors.
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> "And my own feeling is there's even less risk on LMFBR than on the light water reactors."

The Burns & Roe document concluded that the CRBR faced severe organizational problems:

> "The PMC organization has lost much of its desire and determination to manage the project and perhaps the ability to do so. It is led by naive individuals who fear and accede to the AEC."
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> "It is not clear that PMC is telling the utility industry its real expectations and fears about the project. The PMC General Manager has privately advised Burns and Roe to get out of the LMFBR job now, since it does not have a chance of success and could harm us badly."

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"The AEC (Division of Reactor Research and Development or RRD, formerly RDT) is trying to run the program. Recent similar programs run by the same group have been failures."

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"There is every indication that the AEC will try to run the LMFBR Project the same way as FFTF, with the added complication of the multi-client/contractor approach. The AEC does not make decisions which are necessarily in the interest of the utility industry; therefore, the ultimate result of the LMFBR Project may not be to the utility industry's liking. The AEC decision-making process is not oriented toward construction needs and on FFTF has been characterized by long delays and indecision because of its slow-moving bureaucratic structure. The AEC is also pre-occupied primarily with component and RM matters."

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"There have been significant recent changes in personnel and matters affecting the AEC. Therefore, its leadership of the project in the foreseeable future is expected to be hesitant and questionable."

In his testimony to ERDA Dr. Baron stated:

"I would just want to make one final comment about the organization. The approach of integrating the PMC organization and ERDA, I think, has been a very good approach. It puts under the one mantle the management of this program. The man who will be running this program will be a highly experienced engineer-constructor manager who knows what it is to get a plant like this designed and built and on the line. There has been, I would say, very healthy relationships among the contractors -- Westinghouse, G.E., A.I., and Burns and Roe -- but I must say these hearings have been a very disruptive and demoralizing thing, because it sets up a sense of insecurity in the people who are trying to get this job done. And anything this Board can do to stop this, I think, will be appreciated."

The existence of contradictions between public and private assessments of the CRBR are not limited to Burns & Roe. The NRC Regulatory Staff also makes markedly different public statements than it privately believes are warranted. For instance, in the CRBR licensing proceeding the NRC Regulatory Staff has concluded that sufficient data now exist to approve construction of the CRBR without designing it to withstand all of the consequences of the core meltdown and explosion accidents (HCDA). Despite this publicly-asserted confidence in its knowledge of the HCDA (core meltdown and explosion accident) phenomena, the Staff privately conceded in two reports prepared in late 1976 and early 1977:

> "Conclusions regarding the extent and type of accommodation for HCDAs, which will be required in commercial LMFBRs, have not been made. Consideration of the consequences of HCDA is, of course, necessary for risk assessment over the entire spectrum of accidents."

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> ". . . about half the issues in the [yet to be resolved safety issues] list would be substantially modified if, by some magic, concerns such as HCDAs could be made to vanish."

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> ". . . the HCDA question must clearly be resolved, clearly requires major test facilities and programs for resolution, and presents a range of conceptual problems qualitatively different from the remaining issues. The remaining problems are technically formidable and require sophisticated research for adequate resolution, but they have, overall, a qualitative resemblance to problems being resolved elsewhere."

Another example of a lack of candor by the Staff relates to the highly explosive sodium to be used as a coolant for the CRBR. In the Site Suitability Report prepared for the CRBR in 1977, the

Regulatory Staff stated that despite a few lingering questions it was satisfied that sodium could be safely used:

> "Although the adequacy of the applicant's measures is under review, the staff believes that there is sufficient experience with handling sodium at experimental and testing facilities to conclude that features can be incorporated in the design to alleviate the above sodium hazards."

In an internal document prepared at about the same time, the Staff was substantially more concerned about the dangers of sodium:

> "The sodium-cooled LMFBR powerplant of commercial size poses design and technical management problems of unprecedented scope. The practical utility of sodium for this service cannot be judged at this juncture, nor can it be in the future without extensive experience with commercial plants. Of the conceivable practicable coolants for powerplants with fission or fusion heat sources, probably none exacts less margin for design, operation and maintenance errors than does sodium."

During the course of the CRBR hearings, the NRC Regulatory Staff stated under oath that it would be difficult to make a nuclear weapon clandestinely. An NRC Task Force Report on the Allegations of James H. Conran prepared on April 29, 1977, disclosed that this answer "could convey to some people an incorrect impression concerning the actual spectrum of technical opinion on the relative ease and likelihood of success in constructing a bomb." The Regulatory Staff has been made aware of this inaccuracy in its answer for at least four months and has yet to correct the public record.

These illustrations of Burns & Roe and NRC Regulatory Staff conduct highlight a critical flaw in the present NRC licensing system. The Regulatory Staff comes to the proceeding intent upon justifying its preconceived conclusion that the CRBR should be licensed. It shapes and molds its testimony and its answers to discovery to fit that judgment. All the internal misgivings and concerns are smothered by middle and upper management pressure to present a unified front that fully supports the licensing conclusion. Unless the Regulatory Staff can free itself from the compulsion to justify all of its decisions and from the fear of admitting honestly that it does not have universal support for its positions, licensing hearings will continue to be a vehicle for the kind of misinformation and deception which have marked the CRBR proceeding. Because this Committee has jurisdiction over the NRC and its Regulatory Staff, this Committee can and should probe and expose the places where the Regulatory staff is creating a public record which differs from its private record. This year, with the dissolution of the Joint Committee on Atomic Energy, is the first opportunity that has existed for such a probe by a Committee which has legislative jurisdiction over the NRC. In the Burns & Roe memorandum the following statement appears:

> "Further, since nuclear energy is likely to be made a part of overall energy programs, the committee's future role is unclear. If a new Congressional committee were given cognizance over the LMFBR program, project reviews could be extremely different in light of the other information contained in this paper."

We hope that like so much else in the memorandum, that statement will also prove to be prophetic.

The release of the Burns & Roe memorandum is an event which has been widely publicized. The feature which has been most publicized is that it was a hitherto secret report and many of its conclusions were contrary to public statements about the CRBR by its proponents. In this flurry of interest it is important to emphasize that substantively the most significant feature of the Burns & Roe document is not that it was secret but that it was right. The CRBR is a multi-billion dollar turkey, and Burns & Roe and many other proponents have been aware of that fact for years. The NRC Regulatory Staff, although strongly supporting the CRBR licensing, did have the candor to admit that at the present time some of the most crucial information needed to determine whether the CRBR is safe and should be allowed to operate is not available. It nevertheless concluded and emphasized that we should nonetheless proceed rapidly to build the CRBR. The hearing record developed in the CRBR proceeding is persuasive evidence of the folly of now proceeding with the construction of the CRBR.*/

The single most crucial fact which has emerged to date is that substantial areas of analysis of CRBR safety under postulated accident conditions are unresolved at this time. Both Chapter 7 of the Final Environmental Statement (FES) and the entirety of

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*/ Appendix A to this testimony is an analysis of Dr. Arthur R. Tamplin, an NRDC Staff Scientist, that focuses on the fact that even if the United States wanted to built a plutonium breeder facility, the CRBR is the wrong plant.

the Site Suitability Report (SSR) are replete with Staff acknowledgement that the conclusions reached are tentative, based upon preliminary analysis or justified in yet to be released NUREG reports. To itemize all of these areas would require virtually duplicating Chapter 7 of the FES and the entire SSR. Several examples will illustrate our point.

In the FES the Staff concludes (p. 7-2):

> "In the case of CRBRP, the staff has concluded that the design should assure the capability to minimize the risks associated with core meltdown events to an extent comparable to LWR designs. To ensure that the probability of core melt and disruptive accidents is low, emphasis is being placed on the prevention of conditions which could lead to such accidents. To help ensure that this is accomplished, the staff is emphasizing and requiring the achievement of an adequate degree of diversity, redundancy and reliability in key safety features and aspects of the design. */

The Staff then provides "examples" of such measures and lists five "accident prevention requirements" contained in its May 6, 1976, letter to Applicants. The Staff states its "opinion that these requirements can be met" (FES, p. 7-7) and provides "illustrations" of the features which reinforce its opinion that the requirements can be met. FES, pp. 7-7 to 7-8. Missing from the analysis is any definitive statement by the Staff of all the accident prevention requirements needed to meet the safety objectives, any definitive statement of all the bases for the Staff belief that such requirements can be met, and any definitive

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*/ Note the use of such unquantifiable phrases as "minimize the risks," "comparable to LWR designs," and "adequate degree of diversity, redundancy and reliability" at the crucial points in this statement. These qualitative judgments effectively block review of the Staff judgments.

statement that the Applicants intend to meet those requirements. In short, the FES accident analysis is based upon a hypothetical breeder, the design for which does not now exist and the bases for believing that such design will exist are at best incomplete. These uncertainties have a direct bearing on CRBR costs, the timing of the CRBR (redesign can take substantial time), and the ultimate issuance of an operating license for the CRBR (unless adequate designs are identified and implemented in the CRBR there will not be a definitive finding that the safety objective quoted above can be met (Power Reactor Development Co. v. International Union of Elec., Radio and Mach. Workers, AFL-CIO, 367 U.S. 396 (1960)).

The Staff uncertainties in these areas is underscored by the long-awaited answers to Interrogatories to Staff Set 11 (1/27/77), pp. 8-10. See also NRDC Interrogatories to Staff Set 19 (3/7/77), Q. 18 - Q. 21.*/ In the interrogatory answers Mr. Denise concedes that the present status of the Staff review is such that it "does not permit us to conclude now that large tolerances exist in the [CRBR] design," although such large tolerance to accommodate operator errors, off-normal operation and

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*/ The May 6 letter, the answers to Set 11 interrogatories and Q. 17 - Q. 49 of Set 19 interrogatories provide additional illustrations of the inherently tentative nature of the Staff review and its impact on the FES conclusions.

component malfunctions is a design objective for the CRBR. Without the ability to now confirm that the large tolerances exist, what is the reasonable basis for the Staff analysis of the adequacy of the CRBR design in Chapter 7 of the FES? We submit there is none.

The magnitude of the uncertainties in the present CRBR analysis as compared to the status of usual LWR review at the time of issuance of the FES is apparent in the Staff conclusion of its accident analysis in the FES (p. 7-11):

> "The design information and evaluations available at this time have been reviewed. Based on this review, our conclusion is that the accident risks can be made acceptably low with the incorporation of the features and requirements in the design as discussed above. The staff's safety evaluation will provide the basis for determining what plant features and R&D programs are acceptable in this regard. The staff believes it is within the state-of-the-art to design, construct and operate the CRBRP in such a manner that the consequences of accidents will not be significantly different from those already assessed for LWRs. Should our further reviews indicate that residual risks are not sufficiently low or that substantial modifications to the plant are required to meet our safety requirements, the staff will require such changes as deemed necessary." (Emphasis added.)

The SSR is a substantially more detailed discussion of the CRBR safety features than the FES and as such more clearly discloses the tentative and preliminary nature of the Staff review. For instance, in several critical areas the Staff does not evaluate the specific design of the CRBR but in effect approves design criteria which if met would make the CRBR minimally acceptable (SSR, p. I-7):

> "Although the NRC staff's radiological safety review is continuing, and the staff is unable at this time to state a final position on whether the CRBR design properly implements all the staff's design criteria, the staff believes sufficient information is available to identify: (1) a facility of the general size and type proposed; and (2) those design parameters that impact upon the question of site suitability. The identification of such a facility and design parameters is based on information submitted by the applicants and independently generated by the staff. In some cases the applicants present design may not meet staff design criteria. Where this has occurred, in order to determine site suitability the staff has determined whether the state of technology would allow the staff's design criteria to be met. The staff finds that it is able to identify an adequate range of reasonable plant design parameters to conclude that the CRBRP site is suitable for a facility of the general size and type proposed from the standpoint of radiological health and safety considerations."

In effect the Staff has spent months of review time essentially concluding that the design criteria it developed (none has been adopted by the Commission) for the CRBR are adequate. See SSR, App. A.

The Staff acknowledges that even its "review of the seismic design criteria applicable to the CRBRP is not complete" (emphasis added). SSR, p. II-5.

In evaluating the reactor shutdown system for which a dual system is proposed, the Staff notes that the adequacy of that system is still under review and that "it appears to have the potential to comply with" the Staff requirement that the probability of core meltdown and explosion accidents be reduced to a level consistent with excluding them from the CRBR design. SSR, p. II-17. The Staff excludes the break in the primary cold-leg piping (an event which could lead to a core meltdown and explosion

accident) as a design accident merely on the basis of the following amorphous conditions (SSR, p. II-19):

> ". . . an acceptable preservice and inservice inspection program, a material surveillance program, continued research and development verifying material degradation processes, and verification of leak detection system performance."

Significantly, similar requirements are imposed for light-water reactors but do not form the basis for excluding the cold-leg break from the design accident. See 10 CFR Part 50, Appendix A, Definitions and Explanations and Criteria 1, 14, 15, 30, 31, 32.

The Staff is not yet convinced that its requirements regarding sub-assembly propagation have been satisfied. SSR, p. II-24. The possible options to cope with this problem make for markedly different results. One includes operating restrictions which would affect the demonstration results of the CRBR and another contemplates use of in-core detection equipment which has not yet been developed. SSR, p. II-25.

Residual heat removal system adequacy is now based upon use of the Primary Heat Transport System loop and pony motor, the safety review for which has not been completed. SSR, p. II-29.

The design basis accident for the containment is one which is the subject of continuing Staff/Applicants controversy. In crucial areas the Staff has no commitments from the Applicants to use particular systems deemed essential by the Staff. SSR, p. II-40. Thus, analyses using 81 psig require

consideration of new design options because "the Applicants' proposed design approach is not consistent with such high cell pressures." SSR, p. II-41. Possible core meltdown and explosion accident consequences for which the Staff is requiring design protection are identified (SSR, pp. II-43 to II-45) but designs to cope with these consequences have not been committed to by the Applicants. SSR, II-45. Other designs proposed by the Applicants in this area are still under Staff review and the analyses are still only preliminary. SSR, pp. II-45 to II-46. The present reactor head design had not been approved. SSR, p. II-48.

Finally, in answer to a question by NRDC, the Staff expert conceded that the crucial finding required to be made before the CRBR could begin operation cannot be made until the plant is built (Answers to NRDC Interrogatories, Set 11, p. 14):

> "The staff cannot now state that the CRBR is designed to conservative standards and engineering practices. A conclusion on this subject will be made at the Operating License stage.

The Congress and the American people are being asked by CRBR proponents to spend over $2 billion to build a demonstration breeder which will demonstrate nothing new, which is located at one of the worst sites ever selected for a nuclear reactor, and which may never be allowed to operate because of inherent safety defects. Surely that is the quintessence of an engineering boondoggle.

APPENDIX A

An Analysis of Why the Clinch River Breeder Reactor is a "Poor Buy"

by

Arthur R. Tamplin

A POOR BUY -- Clinch River Breeder Reactor

Aside from the considerations associated with nuclear weapons proliferation, there are three other important considerations which indicate that the CRBR should be terminated. These are:

1. Its design is primitive, duplicative and even obsolete. It is in essence a duplication of the FFTF which has been called an abortion by the architectural firm for the CRBR.
2. Its design is inadequate from the standpoint of health and safety. There is a great deal of uncertainty relative to the force associated with a so-called core disruptive accident (CDA). The possibility exists that the energy of a CDA could blow the reactor apart and breach its containment structure and thus cause a catastrophic accident.
3. The site selected for the CRBR is recognized to be one of the worst possible choices. As a consequence, it will compromise safety considerations and be more expensive to construct.

A fact sheet for each of the above is attached (also included are appropriate portions of the references). These facts demonstrate that the CRBR should not be constructed along its present design and should not be constructed at its present site. If it is constructed as planned, it will represent an unnecessarily expensive and duplicative project that could compromise the public health and safety and will demonstrate nothing significant beyond that which could be accomplished with the FFTF that is now being completed at considerable expense.

Fact Sheet

CRBR Design Problems

1. Wrong Design

There are three basic designs for an LMFBR -- pool, loop and hybrid. The CRBR is a loop design. However, an extensive and detailed study, funded by both ERDA and EPRI, concluded that the pool design was much better:

> "In summary, from the present study, the pool concept appears to have potential advantages in most of the aspects considered. Furthermore, an overall technical evaluation of the three design concepts by Atomics International and Burns & Roe project personnel, functional managers, and other independent reviewers with extensive liquid metal reactor design and nuclear plant design, construction, and development experience, resulted in highest overall ratings for the pool concept."

2. Duplicative Design

The loop design was chosen for the CRBR because that is the design of the FFTF. The design was selected for economic and schedule reasons so that it could use FFTF features. Hence, it is essentially a duplicative project. A confidential company-controlled memo of Burns and Roe, Inc. (the architect-engineer firm for the CRBR) states:

> "FFTF concepts are being utilized partly to justify that program and to increase AEC ability to spread FFTF costs into the LMFBR Project. The FFTF program is experiencing severe cost and schedule overruns which are likely to get worse and become more of a scandal. The possible use of LMFBR funds for FFTF could be a significant part of the scandal.
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> * * *
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> "The NSSS design has been modified to use FFTF design concepts. Although Westinghouse is the prime contractor for FFTF, it did not recommend FFTF concepts after three years of PDP studies. The AEC has forced the use of FFTF concepts rather than the Westinghouse design over the objections of many in Westinghouse."

3. Poor Design

But not only is the CRBR a duplicate of the wrong design (loop as opposed to pool), it is also a poor design as it is based on the FFTF. It will not represent an important step toward the demonstration of a viable, commercial-sized breeder reactor. The confidential

Burns and Roe memo states:

> "Notwithstanding the above, in spite of the job Burns and Roe does, the issues we raise, and the record we document, most actions on the project are out of our control, and it is already clear that the project results will be extremely poor."
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> "The PMC General Manager has privately advised Burns and Roe to get out of the LMFBR job now, since it does not have a chance of success and could harm us badly."
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> "The AEC believes that the use of previously approved FFTF concepts and components will lead to early, reliable operation of the Demonstration Plant and will minimize technical development work which could hang up the Demonstration Plant.
>
> "When the utility industry comes to develop a second Demonstration Plant or commercial designs, the above will come to light. The utilities will find their development costs high to develop follow on LMFBR's."
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> * * *
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> "As long as AEC and Westinghouse continue to make the design decisions, they are likely not to be in the overall utility industry interest. We know that some aspects of the FFTF design are abortions due to an AEC decision to make the FFTF containment too small and because of distortions in project efforts because of inadequate estimates and funding problems. There are indicators that utility representatives are starting to question why they should contribute $250M to add a balance of plant and steam generator to an FFTF."
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> * * *
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> "Many safety approaches incorporated in FFTF and planned for the LMFBR Demonstration Plant may not be commercially licensable."

It is significant to contrast these statements on the CRBR loop design with the conclusion of the ERDA/EPRI study relative to the pool design:

> "Risk Assessment -- Evaluation of risks associated with design complexity, safety margins, and the ease of accommodating design fixes resulted in the conclusion that the pool has the lowest overall technical risk in achieving successful development."

Clearly it is sheer folly to proceed with the CRBR, particularly when the above facts are considered together with the health and safety implications of CDA energetics and the unsuitability of the site.

Fact Sheet

Energetics of a (CDA) Core Disruptive Accident: CRBR Design Inadequate

A catastrophic accident associated with an LMFBR can result from the loss of coolant flow leading to a CDA. It is possible for a CDA to release sufficient energy (in the form of an explosion) to blow the reactor apart and breach its containment structure. In a letter to Dr. Moeller, Chairman of the ACRS, the NRC Staff stated:

> "Based on the information presented in the CRBRP PSAR to date, the Staff does not agree with the applicant that his design has positive margins for the 661 MJ case."

More significant here is the fact that the NRC Staff does not consider 661 MJ of energy release as appropriate. In a letter to ERDA, it suggests that the value should be two times larger:

> "Our current evaluations of the CRBR design indicate that the following CDA consequences should be included in the specification of functional requirements for features to protect containment integrity: A core mechanical work energy release of 1200 MW-sec based on fuel vapor as the working fluid and expansion to 1 atmosphere."

In its letter to the ACRS, the NRC Staff explained the significance of its conclusions:

> "The results discussed so far indicated that the shear ring design as currently specified was incapable of containing the head under the specified CDA level. In order to verify this conclusion, the analysis for the 661 MJ case was rerun using room temperature material properties recently supplied by W-ARD to NRC (Table 2). These properties represent the optimum capability of the shear ring to contain the head although they are not an accurate representation of the true structural system. The results of this analysis were very similar to the results previously discussed with the exception that failure now occurred at a later time.

It is important to recognize that the present estimates of the energetics are only tentative and could subsequently be larger. Nevertheless, they demonstrate that the present design is inadequate. As a consequence, completion of the CRBR will require a redesign. In this respect, it is important to note that the present head, shear rings, and reactor vessel are being fabricated.

A redesign will thus be costly. Since the design is duplicative, inadequate and wrong, it is more economical and clearly prudent to cancel the project rather than to confound its errors.

Here is what the NRC has to say in a draft report on LMFBR safety in March 1977:

> "We realize that other safety issues are also significant and deserve adequate treatment. About half the issues in the preceding list would be substantially modified if, by some magic, concerns such as HCDAs could be made to vanish."
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> "But the HCDA question must clearly be resolved, clearly requires major safety test facilities and programs for resolution, and presents a range of conceptual problems qualitatively different from the remaining issues. The remaining problems are technically formidable and require sophisticated research for adequate resolution, but they have, overall, a qualitative resemblance to problems being resolved elsewhere."

Fact Sheet

CRBR Site Unsuitable

The CRBR site at Clinch River is among the worst (if not the worst) sites that could have been selected. An adequate discussion of alternative sites had to await some years after site selection.

1. Meteorology

In October, 1976, ERDA supplied the following information on alternative sites:

> "These comparisons show that the atmospheric dispersion is approximately an order of magnitude better at each of the alternate sites."
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> * * *
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> "This implies that, on a relative basis, the man-rem commitment at either Hanford or Savannah River would be approximately a factor of 50 less than at Clinch River. A similar conclusion would be expected for Idaho."

2. Geology

In addition to its adverse meteorology, its geology is called into question by a confidential, company-controlled memo of Burns and Roe, the architect-engineer for the CRBR:

> "The site selected is likely to be very costly to prepare and could even be unsuitable."
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> * * *
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> "The Clinch River site selected for the LMFBR Demonstration Plant is one of the worst sites ever selected for a nuclear power plant based on its topography and rock conditions. The suitability of the site will not be confirmed until after an extensive soil boring program. There is a possibility that the site may not be acceptable. As a minimum, site development costs will be high."

Both the unfavorable meteorology and geology will cause the CRBR to be more expensive than necessary. Considering that it is the wrong design, an inadequate and duplicative design, and is to be constructed in the worst location, the CRBR makes no sense and should be terminated.