

9/13/65  
UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

In the matter of the application by )  
GENERAL ELECTRIC COMPANY )  
and )  
SOUTHWEST ATOMIC ENERGY ASSOCIATES )  
For a Provisional Construction Permit )  
for the Southwest Experimental Fast )  
Oxide Reactor (SEFOR) )

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DOCKET NO. 50-231

Appearances

Jules Pearlman, Esq. 1/  
on behalf of General Electric Company

Mr. J. Robert Welsh, President 1/  
of Southwest Atomic Energy Associates

Troy B. Conner, Jr., Esq. and Howard B. Helman, Esq.  
on behalf of the U. S. Atomic Energy Commission  
Regulatory Staff

Limited Appearance

Mr. Edward L. Wilson by limited appearance presented a  
statement of position as a representative of the  
Arkansas State Board of Health

INITIAL DECISION

A. PRELIMINARY STATEMENT

1. The Applicants propose to construct and operate a 20 mega-  
watt (thermal) plutonia-urania-fueled, fast-spectrum, sodium-cooled,

1/ The Applicant SAEA was not represented by counsel in these pro-  
ceedings. The attorney's notice of appearance as required by  
10 CFR 2.713(a) identified only GE as the person on whose behalf  
he appears. SAEA has delegated to GE responsibility for prose-  
cuting this application. The position of the GE attorney was  
thus stated:

"I am an attorney representing General Electric and there-  
fore will be the sole counsel for the Applicants."

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experimental reactor to be located near Fayetteville, Arkansas. The course of events in the proceedings and the record indicate that the Applicant, General Electric Company (hereinafter GE), has and will continue to have primary responsibility for designing, constructing and operating the proposed facility; the Applicant, Southwest Atomic Energy Associates (hereinafter SAEA) has certain financial obligations in the design and construction program and thereafter will have title to the facility.

2. A hearing upon the application for a provisional construction permit under 10 CFR § 50.35(a) was conducted in Fayetteville by this Board whose members were designated by the Commission in the hearing notice, published on May 28, 1965 at 30 Fed. Reg. 7199. The issues for hearing are declaratively stated in the ultimate findings of this Initial Decision. The oral hearing was concluded on July 2, 1965 and additional written evidence was thereafter furnished and was made a part of the decisional record as shown by the Board order dated August 5, 1965, upon which date the hearing record was closed. Proposed findings of fact and conclusions of law were submitted on behalf of the Applicants by counsel for GE; a response thereto, suggesting some modifications, was submitted by counsel for the AEC Staff. In addition to these pleadings the Applicants have submitted a motion for expedited effectiveness of this Initial Decision in accordance with 10 CFR § 2.764(a), and AEC Staff counsel expressed consent to the granting of that motion. The record demonstrates that at this time the technical plans and design for SEFOR are impressively thorough in most respects. Based

on the findings set out hereinafter, it is the conclusion of the Board that, subject to specified conditions, a provisional construction permit should be issued at this time.

3. The published notice of hearing and announcements made on the hearing record invited public attention to the provisions of the Commission's rules which permit participation by intervention (10 CFR § 2.714) or by statements of position under the limited appearance provisions of 10 CFR § 2.715. No person sought to intervene as a party. However, a limited appearance was made on behalf of the Arkansas State Board of Health by Mr. Edward L. Wilson. Certain matters of possible significance to the issues in this proceeding were touched upon in Mr. Wilson's statement and in supplements<sup>2/</sup> submitted by him after the hearing. The State of Arkansas and the United States Atomic Energy Commission are parties to an agreement, effective July 1, 1963, pursuant to which the State Board of Health is the responsible agency for discharging the State's functions relating to radiation control and surveillance. Mr. Wilson appeared as its representative. Although the general conclusion of the State Board of Health is that the Applicants' description of the proposed facility affords reasonable assurance that it can

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<sup>2/</sup> The dubious evidentiary status of limited participation statements permitted by the cited rule is no impediment to the Board's consideration of the points presented on behalf of the State of Arkansas in view of the special consideration expressed for State representatives in subparagraph (c) of 10 CFR § 2.715. Moreover, counsel for the participants gave assurance that their evidence would respond to the matters stated in Mr. Wilson's presentation which was made at the commencement of the hearing.

be constructed and operated without endangering the health and safety and property of the public, yet additional clarification and assurances in certain areas are desired by the State.

4. The State's position is summarized in this paragraph. The scope of the Applicants' proposed environmental surveillance program for soil, air, and water sampling and analyses needs clarification; the details and results of this program should be made available to the State for its review. More consideration needs to be given to the possible effects of radioactive waste discharges and to the likelihood of reconcentration of radionuclides in relation to the rather substantial dairy and agriculture activities within a 10-mile radius of the facility. Sampling programs probably should include the milk-food chain contamination possibilities. The radioactive liquid waste management proposal, relying significantly on radionuclide retention by ion exchange in the soil, should be supported by confirming investigations of soil properties. Consideration should be given to the possibility of ground water contamination due to earth structure faults in the vicinity. The micrometeorological characteristics at the site need investigation to confirm the assumed validity of application of data collected at relatively remote weather stations; localized observations are needed to show that proposed waste releases and the analysis of the maximum hypothetical accident are properly based. The State Board of Health would like to have reasonable access to the plant site, records, data and analyses relating to the foregoing points of possible impact upon public health and safety considerations.



5. The Applicants have submitted proposed findings of fact and conclusions of law in 62 numbered paragraphs, together with an appended proposed form of provisional construction permit. The AEC Staff has responded with proposed findings and conclusions which state agreement with the Applicants' proposals except for certain modifications suggested in 13 numbered paragraphs; a substitute provisional construction permit form is also proposed. Those pleading documents are part of the decisional record and, as hereinafter shown, they have been accorded the consideration and disposition contemplated and required by §§ 7 and 8 of the Administrative Procedure Act. The numbered paragraphs of those pleadings are referred to from time to time hereinafter. Findings upon procedural matters are proposed in paragraphs 1 through 6 of the Applicants' pleading and paragraphs 1 and 2 of the Staff's responding submittal; the substance of those proposals which has been deemed material has been stated above in this preliminary statement; to the extent that those findings are not here or hereinafter adopted they are rejected as being immaterial.

#### B. FINDINGS OF FACT

##### Applicants' Qualifications

6. Two of the issues specified in the notice for hearing require determinations as to whether the Applicants are technically and financially qualified "to design and construct the proposed facility." These issues do not reach to the operation of the plant. The Board's findings and conclusions under these issues are likewise so limited. Basic findings and conclusions regarding the technical and financial qualifications of GE and SAEA are proposed in paragraphs 8, 9, 10, 14, 15, 16 and 19 of the Applicants' proposed findings and conclusions.

The Board finds that, except for the nature and extent of participation by Gesellschaft (identified later) in the SEFOR project, the evidence supports those findings; accordingly they are approved and adopted, but subject to the minor modification suggested in the AEC Staff pleading that the last two sentences in paragraph 19 be replaced by this conclusionary finding: the evidence shows GE to be technically qualified to design and construct the proposed facility. Only the first sentence of paragraph 18 is deemed material. Paragraph 20 is rejected because it is not material to the Applicants' qualifications to design and construct the facility.

7. The findings and conclusions adopted by reference in the preceding paragraph are herein briefly summarized. GE is a large publicly owned corporation with assets in excess of \$3 billion and with extensive experience and competence in the atomic energy industry. It has the entire technical responsibility for the design and construction of SEFOR, and it has a financial responsibility for the costs thereof in excess of \$10.9 million.<sup>3/</sup> SAEA is a nonprofit and mutual benefit association of utility companies organized under the laws of the State of Arkansas. The agreement among SAEA members to support SEFOR is premised in substantial part upon references to existing and intended contractual arrangements with Gesellschaft (identified later) and GE and AEC. The SAEA contract obligation is to pay a sum not exceeding

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<sup>3/</sup> The Applicants estimated the cost to construct at \$12.35 million; the Staff believes this figure might approach \$15 million. The total cost of the facility, including research and development and fueling, will be much greater. The SEFOR project will also involve substantial Atomic Energy Commission funding, the details of which are neither proved nor material here.

\$5.9 million towards construction costs. Documents relating to the financial status of each of the SAEA members and the testimony of an AEC Staff witness support the finding now made that the Applicant SAEA and its obligated members are financially qualified to fulfill the commitments made by it and them toward defraying the costs of designing and constructing the proposed facility.

8. The design and construction of the proposed facility will fulfill in part a project cooperatively undertaken by the United States Atomic Energy Commission, the Applicants, and Gesellschaft für Kernforschung m.b.H (Gesellschaft) with whom is associated the European Atomic Energy Community (EURATOM) which is an expected supplier of \$2 million toward construction costs. A multitude of statements in the evidence--which includes the application--unsystematically allude to a network of contracts which are said to unite these participants and to define their individual and several responsibilities to the project and to each other. The only contract document in evidence is the basic agreement among 15 utility companies, and two individuals as utility company representatives, who comprise SAEA. The evidence shows that this SEFOR project is the central theme of a series or group of memorandum agreements and contracts between or among: SAEA and Gesellschaft; SAEA and AEC; and SAEA and GE. These contracts are not in the record which thus lacks the best evidence of the relationships among these participants. For the reasons pointed out later the Board is unable to make findings based upon the terms of the narratively

described contracts.<sup>4/</sup> Proposed finding 7 is hence rejected.

9. The Applicants' proposed findings 11, 12, 13, 17, 21 and a previously excepted portion of 14, relate to the respective parties' financial and technical contributions to, and participation in, the design and construction and operation of SEFOR. Those proposed findings are rejected because substantial and probative evidence--the best evidence--of their contractual obligations abides in the documents possessed but not exhibited by SAEA. However, the expected financial participation by Gesellschaft is adequately discernible. A document copy in evidence, under seal and signature by the Federal Minister for Scientific Research for the Federal Republic of Germany, describes Gesellschaft as a limited liability company--with two shareholders who are the Federal Republic of Germany and the State of Baden-Württemberg--entitled to enter into contracts and agreements which are enforceable at law. The document states that Gesellschaft contracted with EURATOM for development of a fast breeder reactor with 40% of the costs to be contributed by EURATOM, and that \$5 million has been provided for SEFOR. Also in the record are copies of letters from Gesellschaft's counsel in Germany, from SAEA's counsel in New York and from the Comptroller

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<sup>4/</sup> The parties were urged--in prehearing, by a Board letter on June 17, 1965, and during the hearing--to assure that the final hearing record be not deficient of probative evidence upon these matters. Repeated inquiries pointed to the possible decisional significance of assessing the mutual and respective obligations of GE, AEC, SAEA, Gesellschaft, and EURATOM under the several agreements referred to in the documents then on file. The Board's direct question, "What are the relevant provisions . . . ?" is unanswered, as is the invitation to explain why the contracts were not exhibited.

<sup>5/</sup> Proposed findings relating to the SEFOR experimental program, including AEC Staff proposal 3, are separately considered hereinafter at paragraphs 29-33.

General of the United States. Therein the private attorneys stated opinions that the SAEA-Gesellschaft contract terms are valid and binding, and the United States official expressed the view that the AEC-SAEA agreement is within the contracting authority granted by statute to AEC. By according probative value to all of the information of record the Board finds and infers that Gesellschaft is obligated to contribute \$5 million towards the cost of constructing the SEFOR facility, that the 40% contribution by EURATOM is likely to be forthcoming, and that the expected \$5 million payment by Gesellschaft may reasonably be relied upon. Upon that finding, and relevant antecedent ones, it is concluded that the Applicants are financially qualified to design and construct the facility proposed herein.<sup>6/</sup> Their technical qualifications to do so, i.e., those of GE, have been found hereinabove.

<sup>7/</sup>  
10. An ultimate issue in this proceeding requires a determination as to whether the issuance of the requested permit would be inimical to the common defense and security. The fact, as found above, that

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<sup>6/</sup> Although the basic SAEA agreement provides that its \$5.9 million limit may be increased only with the unanimous consent of all members, the evidence does not show what recourse might be had in the possible event of Gesellschaft's nonliability or breach or evasion with respect to its ascribed financial commitment. If contractual assurances against such potential fund shortages exist, they are not in this record. It can not be determined whether, in such case, the respective obligations of SAEA, of GE, or of AEC might be significantly altered.

<sup>7/</sup> Issue 4 requires this Board to determine,

"Whether the issuance of a permit for the construction of the facility will be inimical to the common defense and security or to the health and safety of the public."



Gesellschaft is to pay \$5 million which is 33-40% of the total capital cost of SEFOR, and the record references to its participation in other respects,<sup>8/</sup> impel a more thorough evaluation of this alien corporation's participation than can be accomplished with the evidence presented. The Board can not be unmindful of this prohibition in § 104 d of the Atomic Energy Act:

"No license under this section may be given to any person for activities which are not under or within the jurisdiction of the United States, . . . . No license may be issued to an alien or any corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. . . ."

Moreover, the Board is unwilling to pass lightly over other possible relevant statutory safeguards of "the paramount objective of making the maximum contribution to the common defense and security" as stated in § 1 a of the Act.

11. The proposed SEFOR project will be a major research and development investigation into the capabilities and characteristics of a

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<sup>8/</sup> Descriptions of the SAFA-Gesellschaft agreement indicate that the latter contributes technical assistance in the design and construction and operation of the facility, that it is assured full access to the information developed in the SEFOR program, and that it will have scientific and technical personnel participating, under GE supervision, at the facility in the conduct of the research program contemplated. The evidence emphasizes that this participation will be under the direct supervision of GE which has sole responsibility for conducting the design, construction and operation as required by the contracts which are said to specify in detail the program for use of SEFOR. Applicants and the AEC Staff say that Gesellschaft will exercise no control over the facility or its use. The AEC Staff has not examined the governing contracts. Noted in passing here, but ignored in the hearing process, is this application's request for "such source, special nuclear, and by-product material licenses as may be necessary . . ."

plutonium-fueled sodium-cooled fast reactor. It has been stated in the evidence that no Restricted Data are involved in the design and construction of the facility, and that GE and the AEC Staff<sup>9/</sup> do not anticipate that the project will involve or lead to the development of information which properly should be so classified. Nonetheless, the public interest considerations encompassed by the noted issue are not put at rest by these assurances; nor are they muted by conclusory declarations that Gesellschaft will not exercise control of SAEA or of GE or of SEFOR. Aloof disregard of contract documents fixing mutual obligations denies to this record basic facts relevant to a necessary judgment concerning "the common defense and security of the United States." (§ 11 g of the Act)

12. The Board's discussion of the Gesellschaft relationship to SEFOR is emphatically not intended to question the sincerity of the purposes or the soundness of the judgments manifested or likely to be manifested by the participants in safeguarding national security. The Board's position has evolved with earnest regard for the Commission's statutory mandates to conduct and assist research and development in the peaceful applications of atomic energy. Likewise abides an awareness that the Commission has an assigned role in programs of international cooperation in expanding technical knowledge of the atom's

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<sup>9/</sup> This is inferred from the first part of Staff proposal 5. The second part of that proposal, which relates to the Gesellschaft control matter, is rejected as being neither supported by the evidence nor explicitly responsive to the statute above quoted.

peaceful uses. Nevertheless, the Board's reluctance to peer into the realm of these possibly high policy matters yields to the inevitable duty of making a determination upon the issues assigned for hearing. The Board must decide the issues on the basis of the record evidence. Each specified issue must be so answered. Issue 4 raised the national security questions and it was notice to the hearing participants that affirmative evidence would be required to answer these questions. The gravamen of that issue forbids that its resolution be derived upon less than substantial probative evidence. This Board believes the solemn charge to it requires more information than has been offered to warrant its finding that "the issuance of a permit for the construction" of SEFOR will not "be inimical to the common defense and security".

13. Precedents forecast that construction permits, even though they are only provisional, ripen to operating authorizations, albeit under Regulatory Staff scrutiny. Here, the Staff's scrutiny does not promise penetration of the serious questions under discussion. <sup>10/</sup> Upon

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<sup>10/</sup> The Regulatory Staff's evaluation of safety matters has been accorded full weight, but it provides less than convincing assurance in some areas. Part of the difficulty here is that the Staff's technical and professional experts--including its accountant witness and its lawyer spokesman--disclaimed direct knowledge of the terms of the SEFOR contractual documents. It may be said that the AEC contractual participation assures that the project is free of doubt on the national security issue. Be that an almost certain inference (AEC contracted only with SAEA, we are told) yet the Commission has stated the issue for determination and that can not be viewed as an inadvertent or meaningless invitation for the Board to accord superficial approval to what the parties would have us to conclude.

a so weighty matter the Board declines to speculate that all is well when available but unoffered evidence that such is the case might have proved it so. The parties will be afforded an opportunity to present such evidence for further consideration and determination by this Board. Alternatively, the parties may offer such authoritative determinations or persuasive legal arguments as they may choose to rely upon to convince the Board that the demands of the national security issue are less exacting than they are herein construed to be.

#### The Facility Site

14. The SEFOR site is located in Cove Creek Township, Washington County, in the State of Arkansas approximately 16 miles S-SW of the City of Fayetteville and 29 miles N-NE of the City of Fort Smith. The site is comprised of 620 acres of rolling-to-hilly terrain, with elevations varying from 1590 feet MSL to 1850 feet MSL. A small, wet-weather creek called Fall Creek flows through the small valley in which the facility will be located. The reactor will be located near the center of the site about 0.4 mile from the nearest site boundary. The population density within a 15-mile radius of the site is about 10 persons per square mile. The largest population centers of significant size in the vicinity are Fayetteville, with a population of approximately 25,000 including the enrollment of the University of Arkansas, and Fort Smith, with a population of about 53,000.

15. The evidence shows that the geology, hydrology and seismology of the site are suitable for the proposed facility. The seismic design criteria provide adequate margins of safety. The United States Geological Survey has concluded that the clay soil would tend to absorb radioactive materials which might be discharged to the tile field or accidentally leak from buried waste storage tanks. However, further response should be made to the request by the State of Arkansas, noted in paragraph 4 above, for confirming investigation of the ion exchange capacity of the local soil. The Applicants' proposed findings 22-25 are not adopted for the reason that many statements therein are not material and the significant facts therein proposed have been found above.

#### Site Meteorology

16. Meteorological data are not available for the site of the reactor. Because of the lack of data for the site, there is some question as to the meteorological parameters and diffusion models which should be applied to obtain limits on radioactive gas routinely released from the facility. There is a more substantial question as to the appropriate diffusion parameters and models to be used in evaluating the effects of accidental releases of radioactivity. The Applicants and the Staff propose that the Board find to be adequate the program for securing and utilizing local meteorological data as it was described in the evidence: the record does not warrant the acquiescence in that position taken by the parties. Instead, the Board



attaches significance to statements made in a basic document in evidence, i.e., comments by the Environmental Meteorological Research Branch Office of Meteorological Research of the United States Weather Bureau. We note there these statements:

"Except for a statement that a meteorological measurement program involving wind speed and direction frequency and wind direction variability is planned for the site, the reports do not give any justification as to the application of Hanford diffusion parameters to the SEFOR site. Experience with ground level smoke plumes . . . has shown that during surface inversions in a narrow valley . . . , the plume trajectory will essentially follow topographic features and be restricted below the ridge level and within the valley walls."

"In summary, the atmospheric environmental analysis of the site can only be inferred at this time from general climatic data and from the distinctive topographical features of the site. Reliable and meaningful conclusions will only be possible after pertinent on-site data on local valley wind flows and surface inversion frequency are available."

17. Applicants plan to collect meteorological data at the site for a period of at least one year prior to operation of the reactor. Instruments to measure wind velocity and direction will be installed at a single location on the site at a height of 15 to 20 feet above the ground. The Applicants and Staff conclude that this program should be adequate to assure that the site has no unexpected meteorological characteristics and to obtain a diffusivity factor presumed to be pertinent to the estimate of atmospheric dispersion from an accidental release. The Board does not accept this conclusion for the reason that the Applicants have not demonstrated that the information so obtained can be reliably applied or extrapolated to the estimates of possible

exposure from extreme accidental conditions at various locations at or near the site boundary.

18. The Board believes that a suitable meteorology program should provide that information necessary for meaningful and reliable estimates of the effects of various unfavorable weather conditions, and also the probability that such conditions will occur. On the basis of the information and justification submitted, the Board concludes that the Applicants' proposed program is deficient in that it will provide no information concerning the extent and frequency of inversion conditions. The Applicants have not demonstrated that measurement of wind velocity and direction at a single location will provide sufficient pertinent data on wind conditions at various locations on the site, nor is it shown that other techniques which have been employed in the determination of atmospheric dispersion characteristics of ground level releases over rugged and precipitous terrain are not necessary in this case. The record presents inadequate justification that the proposed data will properly identify and allow for possible effects of channeling of released radioactivity in various directions due to local topographical features. It is not shown that the proposed duration of meteorological studies assures statistical significance for the proper determination of the probability of unfavorable weather conditions pertinent to the safety analyses. The program now described will not provide a meaningful basis for the determination of allowable dilution factors for controlled releases of radioactive material from the stack in the event that the Applicants may find it desirable to utilize such dilutions in normal operation. Therefore the Board rejects the Applicants' proposed findings 26, 27 and 28.

19. In summary concerning the relation of site meteorology to the atmospheric dispersion of radioactivity, the Board expects that the site is likely to be favorable in this respect. However, the information presented is an insufficient basis for an assessment of the possibility and probability that atmospheric dispersion of radioactivity released in extreme accident conditions will be less favorable than that estimated by Applicants and Staff. The Board is not convinced that a sufficient basis for such assessment will result from the very limited meteorological data which the Applicants propose to obtain. The Board does not deem this shortcoming to be of such importance to safety evaluation as to warrant a withholding or a delay of the provisional construction permit, but it is concluded that the granting thereof should be made subject to a further review of additional evidence to be supplied.

20. For the foregoing reasons provisions will be made hereinafter to permit the submission on behalf of the Applicants--and as well on behalf of the Staff--of additional evidence describing a supplemented meteorological survey program plan which will include measurements of atmospheric conditions at a sufficient number of locations on and about the site to warrant inferences of probable meteorological conditions in all pertinent off-site locations. The overall radiation monitoring program, on-site and off-site, warrants further consideration in the context thus to be augmented. Moreover, because a considerable amount of uncertainty was manifested in the extensive record discussions of this local meteorological question, the Board deems it necessary to

its proper evaluation of the question to require as part of the additional submission above indicated, evidence by one or more qualified expert witnesses explaining and justifying the sufficiency of the supplemented weather survey program, the meaningfulness and usefulness of the data thus to be generated, and the reliability of the methods proposed to be employed in translating those data into safety analyses.

#### Reactor Core, Control and Instrumentation

21. The SEFOR reactor together with its control and safety devices and mechanisms, the operational and control instrumentation, and the design criteria intended to provide reliability of operation are described in the record, and summarized in proposed findings 33-43 which are approved. The Applicants propose to evaluate the reactivity value of the control and safety devices, the emergency shutdown margin, and to carry out an instrumentation development program. Provision is made for an alternate control method if the value of the proposed one is shown to be inadequate during the course of the research program. The Applicants' calculated value of the shutdown margin is 7.4 dollars. The Applicants assert that safety requirements will be met if the shutdown margin is 2.0 dollars. The Staff and the ACRS have stated a desire to review the matter if the shutdown margin is shown by experiment to be significantly less than 7.4 dollars. In its report upon SEFOR the ACRS did not agree to the suitability of the lower margin of 2.0 dollars. The Board believes that the record and prudence support the views of the Staff and the ACRS. In other respects the Board finds reasonable assurance of the adequacy of the safety features of the proposed reactor.

Reactor Coolant System

22. Proposed findings 29 and 30--and AEC Staff 7--are adopted in substantial part as shown in this paragraph. The maximum designed thermal power of the SEFOR reactor is 20 megawatts. The reactor and portions of the coolant system which may become radioactive are doubly contained. Reactor heat is removed by two parallel forced-circulation flows of sodium to intermediate heat exchangers and secondary coolants, also forced-circulation sodium, which in turn are cooled by forced circulation of atmospheric air. A constant sodium level will be maintained in the reactor vessel by a make-up system. One coolant system, designated the main one, has a capacity of 20 megawatts; the other, the auxiliary system, has a capacity of 1 megawatt. Operations of the two systems are sufficiently independent so that failure of one will not interrupt operation of the other. Decay heat can be removed by natural convection in the main system. Energy stored in flywheels in the primary system pump drives will protect against thermal damage in the event of electrical power failure. The secondary coolant system is protected against thermal shock resulting from power failure by a high natural circulation rate and by the absence of a high temperature source. All volumes of sodium will be blanketed by purified argon of particularly low oxygen and moisture content. Nitrogen containing no more than 5% oxygen, a composition which will not support combustion of sodium, will be the coolant for the structure, equipment and other items within the containment. The nitrogen will be cooled by refrigeration.



### The Reactor Vessel

23. Proposed findings 31 and 32 describe the structure and design criteria of the SEFOR reactor vessel. The evidence supports those findings and they are approved and--for information purposes--are summarized herein. The stainless steel reactor vessel is designed in accordance with § III of the ASME Boiler and Pressure Vessel Code for a pressure of 75 psig and a temperature of 1050° F. In the region of the core the vessel is double-walled. Applicants will carry out a material surveillance program during reactor operation which is expected to provide assurance that any deterioration of the stainless steel properties by reactor operating conditions will not proceed beyond safe limits. The Applicants' design studies of the consequences of a vessel rupture have shown a high improbability of core meltdown and of loss of sodium beyond the reflector structure.

### Reactor Containment

24. The Applicants have presented in the record a description of the reactor containment structures and their capabilities. The salient features are described in proposed findings 49-51 which are approved. The proposed design provides for double containment of the reactor vessel. The inner container is a steel-lined reinforced-concrete structure; the outer container is a conventional welded steel cylindrical vessel. The reactor is to be isolated by the inner container during all reactor operations and by both containers during the transient tests referred to elsewhere.

25. In the design of the containment structures the Applicants have considered, in addition to usual structural requirements, loads arising from seismic and tornadic disturbances and from the pressures and temperatures resulting from the postulated most severe nuclear accident and from other accidents including sodium fires occurring with the normal inert atmosphere in the inner container replaced by air. For example, the inner container is designed to withstand an internal pressure of 10 psig and a temperature of 250° F. Blast protection of the inner container will be provided by the reactor vessel. The design internal pressure of the outer container is 30 psig and the design temperature is 370° F; the peak pressure in the outer container resulting from the most severe postulated accident is expected to be 1 psig. The design leak rates, which can be tested independently, are 1% per day for the inner container and 0.5% per day for the outer container. The "allowable" leak rates, on which estimates of radiological exposures are based, are 20% and 2.5% respectively.

#### Other Plant Features

26. Proposed findings 52-54 are approved in substance and are here summarized. Applicants have recognized the possibility, although remotely probable that a tornado could pass over the SEFOR site and have designed all structures containing facilities important to safety to be capable of withstanding the forces that would be produced by winds up to 370 mph. Reasonable assurance is provided that even if a severe tornado should strike the SEFOR site, no undue radiological hazard to the public would result.

27. Emergency electrical power, to be provided by a diesel generator and batteries, will supply nuclear instrumentation and other critical plant loads to assure an orderly shutdown in the event of a loss of normal power. Used fuel rods will be stored in a sodium-filled, nitrogen-cooled tank. A second double-walled tank provides triple containment of the sodium to guard against an accidental uncovering of the irradiated fuel. Protection against inadvertent criticality is provided by neutron absorbers in the tank. Additional described plant features and plant design criteria include the reactor biological shield, the sodium service systems, and the argon- and nitrogen-atmosphere conditioning systems. It is found that the described designs and criteria for these plant features are adequate from a safety standpoint and that, where necessary, research and development programs have been proposed which will provide information for developing final design details.

#### Design Research and Development

28. Proposed findings 55 and 56 are restated and supplemented in this paragraph. A research and development program was proposed, and will be carried out, by the Applicants to provide information for establishing as yet undefined design features and for preparing procedures for reactor operation which were not or could not be completely specified at the time of filing the application for a construction permit. Structural and operations characteristics questioned by the ACRS will also be investigated. Additional information deemed by this Board

as necessary to support the application and to describe the site will extend the research and development program. Nuclear properties of the core and of the control system will be derived from experiments at the ZPR-III Critical Facility of Argonne National Laboratory. The research and development program supporting the design and operation of the reactor is expected either to investigate and evaluate a number of features of the reactor and auxiliary equipment or to provide information supporting the analyses from which the descriptions and specifications can be inferred. Included in the research and development program are the following items having particular significance to the safety analyses of the project:

- a. An acceptably comprehensive study of the meteorology of the site;
- b. The design, operation, total reactivity value, and rate of reactivity insertion of the Fast Reactivity Excursion Device (FRED);
- c. The value of the Doppler coefficient and other temperature-dependent reactivity effects;
- d. The reactivity value of voids in the sodium coolant and of the control and safety devices;
- e. Comprehensive mechanical, hydraulic and thermal tests to obtain data needed for final design of the core and reactor vessel internals;
- f. Scale model experiments to determine the extent and effects, if any, of gas entrainment in sodium under accident conditions;

- g. Mock-up and engineering tests to provide the basis for a reliable reflector rod and control drive mechanism design; and
- h. Development of required reactor instrumentation, including temperature and flux monitors of fast nuclear transients.

The Board finds reasonable assurance that the information obtained from the research and development programs herein amended will satisfactorily augment current knowledge to sufficiently resolve present questions of safety before the completion of the SEFOR design.

#### Experimental Program

29. The Applicants have stated the objectives of the SEFOR experimental program to be:

- (1) To investigate the operating characteristics of liquid-metal-cooled,  $\text{PuO}_2$ - $\text{UO}_2$  fast reactors;
- (2) To measure and investigate the Doppler effect during normal reactor operating conditions;
- (3) To measure the reactor shutdown capability of the negative power coefficient due to the Doppler effect under transient conditions; and
- (4) To establish engineering design safety criteria for large, economic fast ceramic power reactors.

During the first three years of operation, the SEFOR facility will be used to explore the operating and safety characteristics of ceramic-fueled fast reactors, with particular attention to the role of the Doppler effect. The Applicants have described the characteristics of



the reactor core to be used during the first two years. During the third year tests will be repeated on a core of different nuclear characteristics containing 50% new fuel elements. The characteristics of this new core and these new fuel elements are not now known or described.

30. Evidence is lacking to define a proposed use of the SEFOR facility beyond the three-year experimental program noted in the record, although an operating license for an initial term of ten years is requested in the pending application. The Commission's notice of hearing directed consideration of "the application filed . . . for a provisional construction permit for a . . . reactor designed to operate at 20 megawatts (thermal)." The safety judgments made in this proceeding, except for those based on the analyses of hypothetical accidents hereinafter discussed, necessarily relate only to a facility for use at this site as shown by the record evidence, i.e., a 20 megawatt (thermal) reactor for carrying out a two-year experimental program using the particularly described core. Possibilities of later uses of SEFOR are described only conjecturally by the Applicants, and information concerning these projected uses is insufficient for consideration by this Board.

31. The Applicants plan to initiate the experimental program with a general system check-out, dry and wet critical tests, and determination of the static nuclear behavior of the system. This will be followed by investigations of the reactor transfer functions at various power levels using rod oscillation techniques. The static and oscillator tests will proceed from low power to 20 megawatt (thermal) operation. Following analysis of the results of these tests, sub-prompt critical

transient testing will be initiated. Super-prompt critical transient testing is expected to proceed following analysis of, and within the limits established by, the results of the sub-prompt critical transient tests. Reactivity inputs for these transient experiments will be specified and limited so that predicted power and temperature excursions will not be so severe as to cause fuel cladding failure. The transient testing program will accordingly be carried out in steps of graduated severity with frequent inspections of fuel for incipient damage.

32. To carry out these transient tests the Applicants plan to design and develop a Fast Reactivity Excursion Device (FRED) capable of inserting reactivity up to approximately 1.5 dollars, by removal of neutron absorbers from the core, at a maximum rate of 50 dollars per second. The record clearly shows that a major purpose for constructing the SEFOR facility is to carry out the FRED transient testing, and the worst of the extreme accident conditions hypothesized by the Applicants and discussed elsewhere in this finding involve, in part, a hypothesized malfunction of the FRED. Hence, a careful review of the FRED design and performance potential is of great importance in making safety judgments concerning utilization of the SEFOR facility.

33. It is noted that the ACRS explicitly pointed out that it had not reviewed the transient test program "mentioned by the Applicants", and the AEC Staff safety evaluation has considered the FRED only in relation to its possible contribution to the maximum hypothetical accident which was postulated and analyzed. Specific review of the design criteria and details of the FRED will be made by both ACRS and the AEC Staff prior to the issuance of authorization for its operation. Whether

or not a program of transient testing will be authorized by AEC will depend upon satisfactory demonstration that the reactor has characteristics which will permit transient testing with little or no chance of damage. This Board likewise emphasizes that its consideration of the FRED is accorded only in the context of site-facility determinations committed at this time to its judgment in relation to the provisional construction permit application. In doing so the Board has relied upon the operating inviolability of the design criterion of the FRED that its maximum rate of reactivity insertion will be 50 dollars per second and that its possible malfunctions can in no other way increase the severity of the Applicants' postulated maximum hypothetical accident for this facility. Applicants' proposed findings 57 and 58 are rejected to the extent that they are not set out in this and the preceding four paragraphs.

#### Radioactive Waste Management

34. The Applicants proposed a radioactive waste management and disposal program which is described in their proposed findings and conclusions. The record supports the findings substantially as proposed and, subject to a specific modification and to the supplemental findings stated in the ensuing paragraph, findings 45-47 are adopted with this change: the penultimate sentence of paragraph 45 is stricken and the sentence proposed in Staff finding 9 is substituted therefor.

35. The State of Arkansas has a legitimate concern about radioactive waste plans as noted in paragraphs 3 and 4 hereinabove. Although the record includes a generally stated intention on the part of the Applicants to be a cooperatively good neighbor with the State authority,

there are no direct commitments by the Applicants to extend the measures of cooperation which were suggested in Mr. Wilson's statement. The findings and conclusions as proposed by the parties accord no explicit recognition to the requests stated by Mr. Wilson. The findings approved in the preceding paragraph fall short of responding fully to the State's contentions. Hence the Board declines to approve conclusion 48 proposed by the Applicants for the reason that the evidence which would provide adequate and reasonable assurance of protection to the health and safety of the public should include, but does not now detail: (1) a description of the sampling procedures and analytical approach to be followed in the environmental surveillance program; (2) a showing of the extent to which plans in this respect and the results thereof will be made available and acceptable to the Arkansas State Board of Health; (3) the adequacy of the milk-food chain sampling program; (4) a program for confirming by tests the asserted ion exchange capacity of the local soil; (5) the nature and extent of further investigations, if any, to confirm that water table contamination is not probable; and (6) details concerning the extent to which the foregoing and similar health-related matters will be accessible to and coordinated with the State Board of Health. An additional item here is the local meteorological program discussed in paragraphs 16-20 above.

36. Upon the matters noted immediately above, the Board is unable to conclude that sufficient evidence is available to afford the reasonable assurance of safety which could have been, and yet can be, provided in the record. Those areas are within the compass of reasonably foresighted plans which require administrative attention and evaluation

of their possible impact upon facility design and engineering. The failure of the Applicants to respond adequately to these points, most of which were advanced in Mr. Wilson's statement at the commencement of the hearing, is persuasive that this record needs supplemental evidence and proposed findings and conclusions for further consideration by the Board. Without delaying the issuance of a provisional construction permit, the Board will retain jurisdiction in this proceeding to afford to the Applicants an opportunity to tender for further review additional evidence and pleadings upon these matters.

#### Safety Evaluation

37. Considerations of the safety features of SEFOR are divided between those related to normal and expected operation of the facility and those related to accidental occurrences. The Board's review of the proposed design of the facility and of its normal and expected operations as now described discloses no cause for concern about safety of the public. A wide spectrum of potential accidents and of abnormal operating conditions of varying severity has been analyzed to assess their importance and to test the effectiveness of various safeguards. The Applicants' safety analyses of those accidents, with which the AEC Staff concurs in substance, conclude that the consequences within the realm of reasonable credibility would not be so severe as to constitute a threat to the health and safety of the public.

38. In order to evaluate the proposed containment system and site suitability, Applicants have hypothesized accident situations involving a large number of operator errors and equipment malfunctions,



including the accidental malfunction of the FRED. The accidents so considered are based upon postulated chains of events whose sequential and coincidental occurrences are highly improbable. The Applicants' calculations predict that none of these accidents will result in the violation of the integrity of the inner and outer containment structures and that released radioactivity will leave the facility confines only by leakage through these containment structures at a rate commensurate with the design criteria of these structures. The evidence shows that the most severe of these hypothesized accidents indicates reasonably foreseeable outer limits of adverse consequences of a major accident at the proposed SEFOR facility. This conclusion is based upon the Board's reliance on the premise that the possible malfunctions of the FRED will not result in reactivity insertion at a rate greater than 50 dollars per second and that such malfunctions will not in any other way increase the severity of the postulated hypothetical accidents. The parties estimated off-site radiological doses that could result from the worst of these hypothetical accidents, assuming an inventory of fission products which could reasonably accumulate during the described experimental program; these doses are within the guidelines stated in 10 CFR Part 100.

39. The Board concludes that the foregoing estimates of potential off-site exposures represent a conservative upper limit to the public hazard incident to operation of the SEFOR facility and that the radiological hazard is acceptable. However, as elsewhere pointed out, our

examination of this conclusion is to be made in the light of the supplemented evidence concerning local meteorological conditions; this is necessary because the analyses otherwise approved herein rest on an assumption of local meteorological conditions which are not yet adequately substantiated. The Applicants' proposed findings 59-61 and paragraphs 10-11 in the Staff pleading are not adopted for the reason that many statements therein are not material and the significant facts therein proposed, subject to the Board's reservations as noted above, have been found here.

40. Although the foregoing conclusions on safety are necessarily limited to the facility and described reactor core to be used during the first two years, the Board feels an obligation to extend its considerations of safety to a period of operation more nearly commensurate with the probable useful life of this facility. The Applicants have indicated that after the completion of the third year of their experimental program, the facility will probably be used as a fuel test reactor if there is need for fuel irradiation tests at that time. No transient tests involving rapid reactivity insertion are contemplated for that fuel irradiation test program. The reactor will be designed to operate initially at a steady power up to 20 megawatts (thermal) with provision for subsequent installation of additional equipment to operate at 50 megawatts (thermal). The Applicants' declarations and speculations about what may be done with SEFOR after the initial three-year period were made in expressed recognition of the proposition that

they will have to secure separate or additional authorization from the <sup>11/</sup>Commission.

41. The Board has confidence in the Applicants' ability to exercise responsibility in establishing design criteria and operating procedures whereby utilization of SEFOR can be extended beyond the initial two-year period with reasonable assurance that it will not impose undue risk to the health and safety of the public. The Board believes the Applicants recognize those features of SEFOR, important to safety, which are unique and/or untried and will consider their initial function as though they too were part of a research and development program. Similarly, the Board does not entertain or imply doubts as to the competence or thoroughness of the AEC Regulatory Staff's technical reviews of possible uses of SEFOR. Nevertheless, because the Board's present review horizon is limited by the evidence and issues as above pointed out, and because this SEFOR facility embodies both an experimental reactor and reactor-use techniques of unproved possibilities, the Board expresses its belief that a hearing upon proposals for other or future uses of SEFOR would enhance the public's assurance that health and safety and common defense and security considerations are being diligently safeguarded.

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11/ The application includes these statements:

" . . . In the event that it is decided to uprate the power level of SEFOR to 50 MW, and [sic] application for a new construction permit will be filed. It is, therefore, requested that the present application be evaluated on the basis of the 20 MW operation and the three-year experimental program which form the only present commitments for operation of SEFOR."

## C. CONCLUSIONS

42. In the conclusions above indicated reservations have been expressed about the sufficiency of the evidentiary showing concerning: (1) the environmental surveillance program and coordination with the Arkansas State Board of Health, (paragraphs 4 and 35-36); (2) the national security issue and alien control implications, (paragraphs 8-13); and (3) the local meteorological survey and analyses, (paragraphs 16-20). Upon weighing carefully the specified issue determinations and safety judgments required to be made by the Board at this time, it is concluded that the foregoing shortcomings are not of such immediate significance as to warrant either denying a conditional authorization for construction or delaying the issuance thereof to await the outcome of a further hearing. Instead, it is deemed appropriate to permit further submissions by the parties upon these questions and provisions therefor are described in the paragraph below.

43. This Initial Decision is based on a consideration of the entire record which has heretofore been closed. The needs for additional information identified above make it necessary to the Board's full and final action that the proceeding continue within the Board's jurisdiction for the limited time and purposes herein specified. The hearing record will be reopened for the reception of additional evidence by way of verified written statements of or on behalf of the participants. Such statements shall include supplemental information upon items (1), (2) and (3) as categorized and referenced in the preceding paragraph. They shall be filed with the Secretary of the Commission on or before October 15, 1965. Copies thereof shall be served on all participants,

including the Arkansas State Board of Health. Each and any of the participants may file, on or before November 1, 1965, supplemental proposed findings and conclusions or comments upon the additional evidence. Thereafter this Board will reconsider the matters reserved and its ultimate conclusions in the light of the complete record as supplemented and will issue an appropriate decision or order. The presently stated determination that the requested provisional construction permit should be conditionally authorized is expressly subject to such reconsideration. Alternatively to the foregoing procedural steps and schedule, the Board will give prompt consideration to such substantiated request for an expedited further hearing and order as the parties or any of them may deem appropriate to this Board's final disposition of all pending matters.

44. The Applicants' motion for expedited effectiveness of this Initial Decision is considered in the light of the terms of 10 CFR § 2.764. It is there provided in pertinent part that such a motion may be granted upon finding that:

" . . . (1) no significant question of fact, law, or discretion has been presented; (2) that the record clearly warrants such action and shows that denial of the motion will result in substantial economic injury or be detrimental to the public interest."

The record supports the requisite findings notwithstanding the reservations hereinabove noted because those matters for this Board's future evaluation are not deemed to involve fact, law or discretion questions of such significant uncertainty as to warrant delaying for administrative reasons the construction to be conditionally authorized by this

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12 / The Board will soon issue an order ruling on proposed transcript corrections.



decision. The Board finds reasonable assurance that subsequent procedures probably will lead to a satisfactory resolution of all safety-related questions which need to be answered in the provisional construction permit stage of the licensing process; however, the Applicants may elect to proceed with construction at the risk attendant upon Board reconsideration. Substantial economic injury and detrimental delay to the Applicants' interests in the SEFOR project can be avoided by granting the motion under discussion upon the conditions stated, and the order herein so provides.

45. Upon the basis of all of the findings and discussions hereinabove set out, and subject to such modifications, if any, as may be ordered by this Board upon its further consideration as herein provided for, this Board concludes, in conformity with the premise of the applicable regulation and responsively to the issues stated in the notice of hearing that:

(1) In accordance with the provisions of § 50.35(a),  
Title 10, Part 50 of the Code of Federal Regulations,

(a) The Applicants have not supplied initially all of the technical information required to complete the application and support the issuance of a construction permit which approves all proposed design features;

(b) The Applicants have described the proposed design of the facility, including, but not limited to, the principal architectural and engineering criteria for the design, and have identified the major features or components on which further technical information is required;

(c) The omitted technical information will be supplied;

(d) The Applicants have proposed, and there will be conducted a research and development program reasonably designed to resolve safety questions with respect to those features or components which require research and development; and

(e) On the basis of the foregoing, there is reasonable assurance that:

(i) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of construction of the proposed facility, and,

(ii) taking into consideration the site criteria contained in 10 CFR Part 100, the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public;

(2) The Applicants collectively are technically qualified to design and construct the proposed facility.

(3) The Applicants are financially qualified to design and construct the proposed facility.

(4) The issuance of a provisional permit for the construction of the facility upon the conditions stated in this Initial Decision will not be inimical to the common defense and security or to the health and safety of the public.

46. In ultimate summary, it is concluded that pursuant to 10 CFR § 50.35, the Applicants should be conditionally granted a provisional construction permit which authorizes them to proceed with construction of the facility as proposed, but which will be subject to such affirmation or modification as may be deemed appropriate by the Board upon its further consideration of the record, including the supplemental information that is to be supplied by the Applicants as provided hereinabove. WHEREFORE, subject to this condition, and pursuant to the Atomic Energy Act of 1954, as amended, particularly §§ 101, 104, 181, 183, 185, 189 and 191 thereof, and the Rules and Regulations of the Atomic Energy Commission, including § 50.35 and Part 2 thereof,

IT IS ORDERED this 10th day of September 1965 that the hearing record in this proceeding is reopened and the parties are authorized to submit additional information and pleadings upon the matters and within the limits specified in paragraph 43 hereinabove, and

IT IS FURTHER ORDERED, subject to further order of this Board upon the reconsideration provided for above, and subject to review by the Commission upon its own motion or upon a petition for review if any is filed, that General Electric Company and Southwest Atomic Energy Associates be and hereby are authorized to construct the nuclear facility described in their application and amendments thereto and in accordance with the evidence and representations presented and made on the record at the hearing, all in accordance with the architectural and engineering criteria set forth therein; and

IT IS FURTHER ORDERED, that the Director, Division of Reactor Licensing (or the duly authorized Commission official) is directed to issue to General Electric Company and Southwest Atomic Energy Associates a conditional and provisional construction permit in accordance with

§ 104 of the Act, as amended, and the regulations of the Commission issued in conformity thereto, substantially in the form and content and subject to the stated conditions set out in Attachment A which is made a part hereof, and

IT IS FURTHER ORDERED, in accordance with § 2.761 of the Commission's Rules of Practice that this Initial Decision shall become effective ten days after the date of issuance hereof and that, subject to the Board reconsideration provided for above and in the absence of any further order from the Commission, it shall constitute the final decision of the Commission forty-five days after the date of issuance hereof subject to:

(a) Such order as the Board may issue upon reconsideration as hereinabove provided;


(b) The filing and consideration of a petition for review, if any is filed within twenty days pursuant to § 2.762 of the Commission's Rules of Practice; and

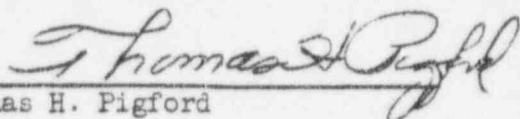
(c) Such order as the Commission may enter upon such petition, if any, or upon its own motion within forty-five days from the issuance of this Initial Decision.

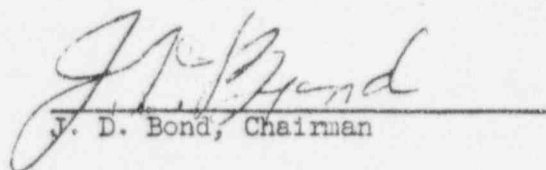
ATOMIC SAFETY AND LICENSING BOARD

Attachment A

Issued:  
September 10, 1965  
Germantown, Maryland

  
A. Dixon Callihan

  
Thomas H. Pigford

  
J. D. Bond, Chairman

ATTACHMENT A

GENERAL ELECTRIC COMPANY  
and  
SOUTHWEST ATOMIC ENERGY ASSOCIATES

DOCKET NO. 50-231

PROVISIONAL CONSTRUCTION PERMIT

Construction Permit No. \_\_\_\_\_

1. Pursuant to § 104 of the Atomic Energy Act of 1954, as amended, (the Act), and Title 10, Chapter 1, Code of Federal Regulations, Part 50, "Licensing of Production and Utilization Facilities," and as authorized and limited by the order of the Atomic Safety and Licensing Board (the Board) dated September 10, 1965, the Atomic Energy Commission (the Commission) hereby issues a provisional construction permit to General Electric Company and Southwest Atomic Energy Associates (the Applicants) for a utilization facility (the facility) as described in the application and amendments thereto filed in this matter by the Applicants and as more fully described in the evidence received at the public hearing upon the application. The utilization facility is a 20 megawatt (thermal) plutonia-urania-fueled, fast-spectrum, sodium-cooled, experimental reactor which is to be located in Cove Creek Township, Washington County, Arkansas.
2. This permit shall be deemed to contain and be subject to the conditions specified in §§ 50.54 and 50.55 of said regulations; is subject to all applicable provisions of the Act, the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the conditions specified or incorporated below:



- A. The earliest date for the completion of the facility is September 1, 1967, and the latest date for completion of the facility is March 1, 1968.
  - B. The facility shall be constructed and located at the site as described in the application, as amended, in Cove Creek Township, Washington County, Arkansas.
  - C. This construction permit authorizes the Applicants to construct the facility described in the application and in the hearing record in accordance with the architectural and engineering criteria, set forth therein.
  - D. This construction permit is subject to the condition that it may be either affirmed or modified by further order of the Board which will be issued after its review of supplemental information to be supplied by the Applicants in conformity with the Board's order pursuant to which this permit is issued.
3. This permit is provisional to the extent that a license authorizing operation of the facility will not be issued by the Commission unless (a) the Applicants submit to the Commission, by amendment to the application, the complete final hazards summary report, portions of which may be submitted and evaluated from time to time, and (b) the Commission finds that the final design provides reasonable assurance that the health and safety of the public will not be endangered by the operation of the facility in accordance with procedures approved by the Commission in connection with the issuance of said license,

and (c) the Applicants submit proof of financial protection and the execution of an indemnity agreement as required by § 170 of the Act.

FOR THE ATOMIC ENERGY COMMISSION

Director  
Division of Reactor Licensing

Date of Issuance: \_\_\_\_\_