UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
The Cincinnati Gas & Electric Company, et al.	)	Docket No. 50-358
	)	
	)	4/24/81
(Wm. H. Zimmer Nuclear Power Station)	)	
	)	

APPLICANTS' PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW IN THE FORM OF AN INITIAL DECISION

The Cincinnati Gas & Electric Company, et al., Applicants in the captioned proceeding, in accordance with 10 C.F.R. §2.754 and the Atomic Safety and Licensing Board's Schedule for Filing Proposed Findings and Conclusions of March 20, 1981, hereby submit the attached proposed findings of fact and conclusions of law in the form of an initial decision with respect to those issues for which the hearing has been completed.

Respectfully submitted,

CONNER & MOORE

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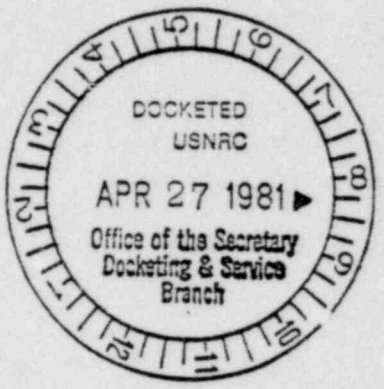

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Charles Bechhoefer, Esq., Chairman
Dr. M. Stanley Livingston, Member
Dr. Frank F. Hooper, Member

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_____ ___, 1981

APPEARANCES

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JAMES H. FELDMAN, JR., Esq., for the Miami Valley Power Project.

ANDREW B. DENNISON, Esq., for Zimmer Area Citizens and Zimmer Area Citizens of Kentucky.

DAVID K. MARTIN, Esq., Assistant Attorney General for the Commonwealth of Kentucky.

GEORGE E. PATTISON, Esq., Prosecuting Attorney and LAWRENCE R. FISSE, Esq., Assistant Prosecuting Attorney for Clermont County, Ohio.

MRS. MARY REDER and MR. DONALD REDER, for the City of Mentor, Kentucky.

TABLE OF CONTENTS

INITIAL DECISION
(OPERATING LICENSE PROCEEDING)

I. INTRODUCTION

1. This initial decision concerns the application filed with the Nuclear Regulatory Commission by The Cincinnati Gas & Electric Company, for itself and as agent for Columbus & Southern Ohio Electric Company and The Dayton Power & Light Company, (hereinafter collectively "Applicants") for a facility operating license which would authorize the operation of the Wm. H. Zimmer Nuclear Power Station (hereinafter "Zimmer Station" or "facility"). The Cincinnati Gas & Electric Company is responsible for operation of the facility which utilizes a boiling water reactor designed to operate at a core power level up to 2436 thermal megawatts with a net electrical output of approximately 800 megawatts. The facility is located on Applicants' site on the eastern shore of the Ohio River, one-half mile north of Moscow and about 24 miles southeast of Cincinnati, in Washington Township, Clermont County, Ohio. Commercial operation of the facility is projected for 1982.

2. On April 6, 1970, the Applicants filed an application with the Atomic Energy Commission, now the Nuclear Regulatory Commission (hereinafter "Commission" or "NRC") for permits to construct and operate the Zimmer facility. Following reviews by the Commission's Staff (hereinafter

"Staff") and the Advisory Committee on Reactor Safeguards, as well as public hearings before an Atomic Safety and Licensing Board, a permit to construct the Zimmer facility was authorized. Pursuant thereto, Construction Permit No. CPPR-88 was issued on October 27, 1972.

3. The application for an operating license was docketed by the NRC on September 10, 1975. On September 28, 1975, the Commission published "Receipt of Application for Facility Operating License; Availability of Applicants' Environmental Report; and Consideration of Issuance of Facility Operating License and Opportunity for Hearing (40 Fed. Reg. 43959). In response to the notice, petitions for leave to intervene were filed by the Miami Valley Power Project ("MVPP"), Dr. David B. Fankhauser, Mrs. Marie B. Leigh and the City of Cincinnati. On November 3, 1975, this Atomic Safety and Licensing Board ("Licensing Board" or "Board") was established to rule on the petitions.[1/] After a prehearing conference held on January 23, 1976,[2/] the Board issued a Notice of Hearing and admitted all of the

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1/ Establishment of Atomic Safety and Licensing Board to Rule on Petitions (November 3, 1975).

2/ Notice of Hearing and Order Concerning Special Prehearing Conference (December 24, 1975).

petitioners as parties to the proceeding[3] and specified the contentions at issue.[4]

4. By letter from the Staff dated September 9, 1977, the Board learned that Mrs. Leigh had died. While the Board considers that under the Commission's Rules and Regulations there is no need to pursue such contentions, they were encompassed within the remaining contentions of the other intervenors in the proceeding. Thus, the topics were given adequate consideration during the course of the proceeding.[5]

5. This Board was reconstituted on three occasions due to the illness of one member, the retirement of another, and a conflict in schedule.[6]

6. Discovery in this proceeding took place over a period of approximately three years, with the Board permitting additional discovery in certain instances when new contentions were admitted or new matters arose.

3/ Order Granting Petitions for Intervention and Providing for Hearing (March 19, 1976). The Board's "Order Granting Petitions to Intervene" (November 28, 1975) had been reversed by the Atomic Safety and Licensing Appeal Board in ALAB-305, 3 NRC 8 (1976).

4/ These contentions were modified in part by Order Granting Motion for Reconsideration of Form of Intervenor Contentions (April 13, 1976) and Order Denying in Part and Granting in Part Applicants' Objections to Order Specifying Contentions (June 17, 1976).

5/ Cf. Public Service Company of Indiana (Marble Hill Nuclear Generating Station, Units 1 and 2), LBP-77-52, 6 NRC 294, 300-01 (1977).

6/ See Notices of Reconstitution of Board dated November 2, 1977 (42 Fed. Reg. 58583), October 2, 1978 (43 Fed. Reg. 46911), and March 5, 1981 (46 Fed. Reg. 16382).

7. The prehearing conference required by 10 C.F.R. §2.752 was held on May 21-23, 1979. During the course of the conference, the Board, accompanied by representatives of the parties, toured the Zimmer facility and the surrounding environs, including the Moscow Elementary School. During that prehearing conference as well as a number of times during the course of the evidentiary hearings, limited appearance statements were heard. The sessions for receipt of limited appearance statements which were held in Moscow, Ohio and in Cincinnati, occurred during the evening, in addition to daytime hours, to accommodate as many people as possible. The Board asked the Staff to respond to a number of the issues raised and the Board is satisfied that the Staff has adequately addressed the identified concerns. 7/

8. During the course of the prehearing and evidentiary phases of the proceeding, resulting in part from the occurrence of the accident at the Three Mile Island Nuclear Station, Unit 2 ("TMI"), the Board admitted a number of new parties and participants. The Board admitted Zimmer Area Citizens/Zimmer Area Citizens of Kentucky, as an intervenor pursuant to 10 C.F.R. §2.714 and the Commonwealth of Kentucky, Clermont County, Ohio and the City of Mentor, Kentucky, as

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7/ The Board is mindful of the burden that such requests place upon the NRC Staff, particularly the Office of Inspection and Enforcement, in investigating such allegations and reporting back to the Board.

participants pursuant to 10 C.F.R. §2.715(c).[8] Additional contentions dealing with cable trays (Contention 14), control rods (Contentions 15 and 16),[9] fire protection of cable trays (Contention 17), monitoring (Contentions 18 and 19),[10] and emergency planning (Contentions 20-32) were admitted and discovery on these issues was permitted.

9. The NRC Staff prepared a draft and a final environmental impact statement pursuant to the requirements of the National Environmental Policy Act and 10 C.F.R. Part 51 (Staff Exh. 2). Pursuant to 10 C.F.R. §51.52(b)(1), the Staff introduced into evidence material which supplemented or amended the FES (Staff Exh. 2-6). This material consisted of an NRC Staff Supplement to the Final Environmental Statement relating to the radiological impact of Radon-222 releases (Staff Exh. 3), a comparison of health effects attributable to coal and nuclear fuel cycle alternatives (Staff Exh. 4) with certain revised information pertinent thereto (Staff Exh. 5) and a statement addressing risk

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8/ Memorandum and Order, LBP-80-14, 11 NRC 570 (April 22, 1980); Memorandum and Order Admitting Kentucky as an "Interested State," (April 1, 1980): Memorandum and Order Admitting Clermont County, Ohio Pursuant to 10 C.F.R. §2.715(c) (June 11, 1980); Memorandum and Order Admitting Mentor, Kentucky, Pursuant to 10 C.F.R. §2.715(c), LBP-80-6, 11 NRC 148 (January 29, 1980).

9/ Order Admitting New Contentions and Establishing Discovery Schedule with Regard Thereto (April 9, 1979).

10/ Memorandum and Order Admitting New Contentions, LBP-79-22, 10 NRC 213 (August 7, 1979); Memorandum and Order Ruling on Contentions of ZAC-ZACK, LBP-80-19, 12 NRC 67 (July 2, 1980).

assessment methodology mandated by a January 19, 1979 Commission statement of policy concerning the Reactor Safety Study and Review Group report (Staff Exh. 6) also modifying Staff Exh. 4.

10. The decisional record in this proceeding consists of the following:

a. The material pleadings filed herein, including the petitions and other pleadings filed by the parties, and the orders issued by the Board during the course of this proceeding;

b. The transcripts of the prehearing conferences on January 23, 1976 (Tr. 1-120) and May 21-23, 1979 (Tr. 121-532), and the transcript of testimony of the evidentiary hearings with pagination from 533 to ____; 11/

c. All of the exhibits received into evidence which are identified in Appendix (A) to this Initial Decision.

11. The Applicants filed three motions for summary disposition 12/ with regard to a number of the contentions. The Board granted the motions with respect to Contentions 1, 5,

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11/ Intersperced in these transcripts are limited appearance statements which of course do not constitute a part of the decisional record. 10 C.F.R. §2.715(a); Iowa Electric Light & Power Company (Duane Arnold Energy Center, ALAB-108, 6 AEC 195, 196 n.4 (1973). Pages 3600-3900 were skipped by the reporter in preparing this transcript.

12/ Applicants' Motion for Summary Disposition (April 6, 1979); Applicants' Supplemental Motion for Summary Disposition (April 23, 1979); and Applicants' Motion for Summary Disposition Relating to Contention 17 (September 21, 1979).

11 and 12.[13] The remainder of the contentions were considered during evidentiary hearings held on June 19-22, 1979, June 26-29, 1979, August 7-10, 1979, November 14-15, 1979 and March 2-4, 1981.

12. During the course of the proceeding, MVPP and Dr. Fankhauser moved to delay delivery of unirradiated fuel to the site of the facility. The Applicants opposed the motions, both on jurisdictional grounds and on the merits. The NRC Staff supported the Licensing Board's jurisdiction to consider the motions, but urged denial on the merits. While the Board found it had jurisdiction to consider the matter, it found that the intervenors provided no information which would warrant granting the requested relief, i.e., the Applicants' actions fail to conform with the requirements of the regulation or the outstanding materials license or that the NRC Staff is failing to exercise properly its authority in this area.[14]

13. In making the findings of fact and conclusions of law which follow, the Board considered the entire record of

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13/ Prehearing Conference Order (June 4, 1979) at 13-18; Applicants' Renewed Motion for Summary Disposition or, in the Alternative, for Certification (July 25, 1979); and Memorandum and Order (granting motion for summary disposition of contention 5), LBP-81-2, 13 NRC ___ (January 23, 1981).

14/ Memorandum and Order Denying Motion to Delay Delivery of Fuel to the Site, LBP-79-24, 10 NRC 226 (August 15, 1979). While the Board deemed such order to be appealable, no review by the Atomic Safety and Licensing Appeal Board was sought.

the proceeding and all of the proposed findings of fact and conclusions of law submitted by the parties. Each of the proposed findings of fact and conclusions of law which is not incorporated directly or inferentially in this Initial Decision is rejected as being unsupported in law or fact or as being unnecessary to the rendering of this Decision.

14. The Board is guided in this operating license proceeding by Appendix A, Section VIII of 10 C.F.R. Part 2, which in subsection (b) provides that the Board will make findings on matters in controversy among the parties.

II. FINDINGS OF FACT

A. Contested Issues

Compliance with 10 C.F.R. Part 50, Appendix I

Contention 6

> The Applicants will not meet the design objectives of Appendix I to 10 C.F.R. Part 50 because the dose levels to the children at the Moscow Elementary School will exceed those which are permissible.

15. Pursuant to the requirements of 10 C.F.R. Part 50, Appendix I, the Applicants and Staff independently demonstrated that the design objectives of Section II.A-C were met for operation of the Zimmer Station (Applicants' Exhibit 1 (hereinafter "Appl. Exh. __") (Environmental Report Operating License Stage (hereinafter "ER") at §5.2; Staff Exh. 2, Final Environmental Statement (hereinafter "FES") at §5.4;

Tr. 767-68). Accepted methodology, including the use of Regulatory Guides 1.109, 1.111 and NUREG-0016, was used in calculating the doses to individuals who are determined to have the highest exposure due to various pathways (Testimony Relating to Contention 6, Calculations of Potential Doses at the Moscow Elementary School Resulting from Releases from the Zimmer Nuclear Power Station, following Tr. 610 (hereinafter "Contention 6 Testimony") at 1-4; Tr. 613-615). None of the critical doses were to individuals at the Moscow Elementary School (Affidavit of Kevin L. Rooney, following Tr. 607 (hereinafter "Rooney") at 4). This contention has no merit inasmuch as the calculated emissions from the facility comply with the design objectives of 10 C.F.R. Part 50, Appendix I and the doses at the school were not "critical," i.e., were less restrictive.

16. Even considering the very low level of the doses calculated at the site of the school (Tr. 829-30), because of the proximity of this school to the facility (approximately 1/2 mile), and because of its use at that time as a school, the Board sought to assure itself that the calculations were conservatively done. The Board has satisfied itself that the assumptions and the calculational methods utilized lead to suitably conservative dose calculations (Contention 6 Testimony at 2-4). In particular, the Board is satisfied that the use of a two year period for meteoro-

logical data collection in accordance with Regulatory Guide 1.23 leads to suitably conservative meteorological values as correlated with data taken at other nearby locations (Tr. 679-82).

17. The Applicants utilized a conservative occupancy factor of 0.25 in their calculations (Contention 6 Testimony at 3; Rooney at 4). Compared to the number of hours of attendance derived from multiplying the length of the school year (180 days) by the length of the school day (approximately 6 1/3 hours), i.e., 1140 hours, the value of 2200 hours utilized in the analysis is suitably conservative (Tr. 631-32). Even if the students were assumed to spend their entire time at the school, i.e., a 100% occupancy factor, the calculated doses still would be an extremely small fraction of the Appendix I design objectives (Tr. 636-37). The age of the children was also suitably taken into account (Tr. 619-20, 656-57).

18. It has come to the attention of the Licensing Board that subsequent to its consideration of this issue, the Moscow Elementary School was closed (See Tr. 4246-47). While the issue is thus seemingly moot, the Board has presented its findings for completeness of the record. During cross-examination, counsel for Dr. Fankhauser attempted to infer that a higher dose to a critical individual would result if that individual were assumed to attend the school.

There is no basis for such an assumption; in fact, because the school is not a critical location for any pathway, an individual's dose by way of gaseous effluents would be by definition reduced by virtue of his absence from the location of the highest concentration of effluents (Tr. 628). Moreover, on examination by the Board, it became evident that Dr. Fankhauser had taken a statement of an expert upon which he relied out of context. While quoting a statement that children have an increased sensitivity to radiation, Dr. Fankhauser failed to recognize the next sentence which stated that nationally recognized standard setting organizations had already taken this factor into account (Tr. 729-33). Dr. Fankhauser referred to an asserted accumulation of spent fuel as causing doses in excess of the guideline values of Appendix I, but was unable to point to any error in the assumptions used by Applicants in their calculations (Tr. 734-35).[15/]

19. One of the stations for routine environmental monitoring is located near the Moscow Elementary School. During its site visit, the Board examined this station and is satisfied that the appropriate provisions of Appendix I can be met during the life of the facility and that the dose to the children at the Moscow Elementary School, if occupied, will be appropriately taken into account.

15/ The Board had previously granted the Applicants' motion for summary disposition with regard to Dr. Fankhauser's contention regarding doses resulting from the storage of spent fuel. See n.13, supra.

20. The ultimate test of compliance with 10 C.F.R Part 50, Appendix I is not a function of the conservatism of the calculations. In accordance with Section IV of Appendix I, actual environmental measurements will be taken over the lifetime of the facility (Tr. 663). The Technical Specifications for the facility will take into account direct radiation and shine doses even though Appendix I, by its terms, does not take these sources into account (Tr. 725) in order to demonstrate compliance with 40 C.F.R. Part 190 (Tr. 769-71).

21. The question of the necessity to show compliance with Section II.D of Appendix I was raised by the Licensing Board. Based upon its review of 10 C.F.R. Part 50, Appendix I and its underlying decision,[16/] the Board has concluded that it was the Commission's intent that plants in the category of Zimmer be given even more latitude than newer plants in meeting the as-low-as-reasonably-achievable-standard. In fact, plants such as Zimmer, i.e., those for which an application filed prior to January 2, 1971, are not technically bound by the guides on design objectives contained in Section II to Appendix D.[17/] Thus, rather than a limitation on use of the Annex to Appendix I, the January 2,

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16/ Rule Making Hearing - Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Practicable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, CLI-75-5, 1 NRC 277 (1975).

17/ Id. at 292, 328-32.

1971 date is a recognition that the entire section is not a direct requirement to be applied to cases filed before January 2, 1971. However, if a plant can voluntarily meet the design objectives which are intended for newer plants, i.e., Section II.A-C and demonstrate compliance with the Annex to Appendix I which is a more stringent demonstration than would otherwise be required, the Board sees no reason why such standards, being more stringent, should not be applicable to facilities such as Zimmer. Thus, the demonstration of compliance with the Staff Concluding Statement Position as shown in Appl. Exh. 1, Environmental Report, §5.2, and FES §5.4 is an appropriate substitute for a demonstration of compliance with the §II.D cost-benefit provisions. In any event, NUREG-0389, of which the Board has taken official notice (Tr. 835-36), demonstrates that Zimmer, as well as other facilities of its class, could not achieve a favorable cost-benefit ratio by the inclusion in the radwaste system of all items of reasonably demonstrable technology when added to the system sequentially and in order of diminishing cost-benefit return. This showing is itself a demonstration of compliance with the cost-benefit provisions of Section II.D.

22. In spite of the evidence presented with regard to compliance with the Commission's as-low-as reasonably achievable requirements, because of the proximity of the school,

the Board raised the following questions related to whether scheduling of operations could result in a favorable cost-benefit ratio:

> a. With respect to the cost-benefit balance contemplated by 10 C.F.R. Part 50, Appendix I, Section II.D, the Board wishes to be advised whether scheduling of releases from non-continuous sources (i.e., the mechanical vacuum pump and the dry well purge) could effect reductions in man-rem and/or man-thyroid-rem dose to the population reasonably expected to be within 50 miles of the reactor. In this context population includes but is not limited to school children; transients should be included. By scheduling of releases, the Board has in mind:
>
> > 1. time: day/night for the dry well purge and variation of days (e.g., weekends/weekdays/seasons) for both the dry well purge and the operation of the mechanical vacuum pump. In other words, in this analysis the parties should take into account the number of people at various directions and distances from the plant site at night versus the day and on weekends versus week days.

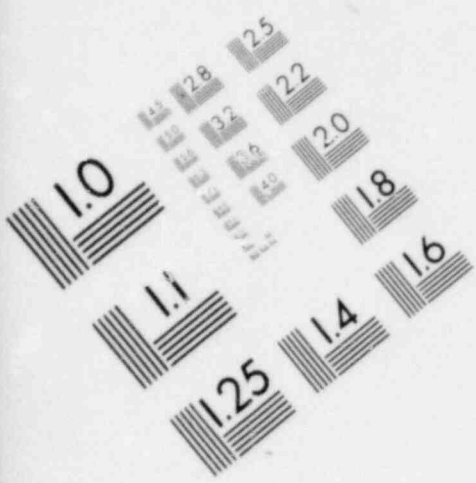
23. Because of the closing of the Moscow Elementary School, this question now has significantly less importance to the Board. However, for completeness of the record, the Board has included its findings here. The Board recognized from the outset the inherent difficulty in responding to its

question. Accurate prediction of wind speed, wind direction and atmospheric stability which may persist during a given release and the prediction of changes in these factors which actually occur away from the plant over the course of time is virtually impossible (Applicants' Response to the Atomic Safety and Licensing Board's Two Questions Relating to 10 C.F.R. Part 50, Appendix I, following Tr. 2937 (hereinafter "Applicants' App. I Response") at 1-2). Thus, it is not really possible to produce a decisional model which could reliably and effectively tell an operator whether to operate the mechanical vacuum pump or drywell purge at some time or to wait for some unspecified additional given time. Thus, even were it theoretically possible that a positive cost-benefit ratio could be achieved, it is extremely unlikely that it would have any real-life utility. Fortunately, the Board was not faced with this question. Both the Applicants and the Staff approached the Board's question in a similar manner by bounding the problem and demonstrating that, with respect to 10 C.F.R. Part 50, Appendix I, it is clearly not cost beneficial to attempt to schedule releases from non-continuous sources under any reasonable set of assumptions (Id. at 3).

24. Inasmuch as the Board requested that the cost-benefit balance as established by the Commission in 10 C.F.R. Part 50, Appendix I, Section II.D be a framework for

evaluating the efficacy of scheduling non-continous releases of gaseous radioactive materials, the values of $1,000 per total body man rem and $1,000 per man thyroid rem were utilized as required by the Commission's rule, and the methodology described in Regulatory Guide 1.109, Revision 1 and population estimates for the year 2010 were used in a conservative manner to calculate the population dose resulting from the non-continuous release of gaseous materials (Id. at 2-5, 5; Tr. 2938-42).

25. The population wheel within 50 miles of the Zimmer Station is highly skewed, with the total population and the calculated population dose dominated by the Cincinnati area (see FES, Fig. 2.1, page 2-3; Applicants' Appendix I Response at 3; Tr. 2939-40). This area lies between twenty and thirty miles from the Station in the NW and NNW sectors. Of a total estimated population of the area for the year 2010 of 2.4 million people, approximately 1.6 million people are estimated to reside in these sectors (Applicants' Appendix I Response at 3). If a significant reduction in population dose could be potentially realized from the scheduling of non-continuous releases, it would be when the wind blows in the NW or NNW sectors immediately before these releases were otherwise scheduled. The maximum potential reduction in population dose would result if one waited for extreme shifts in direction and atmospheric stability from



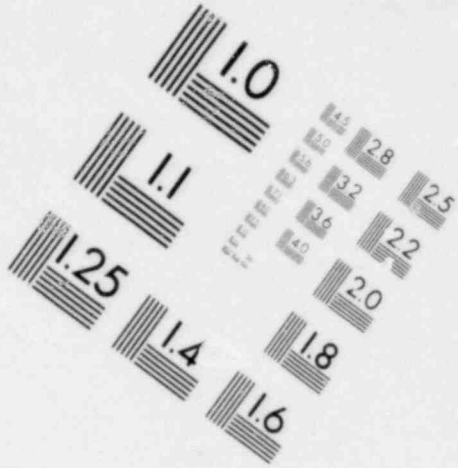
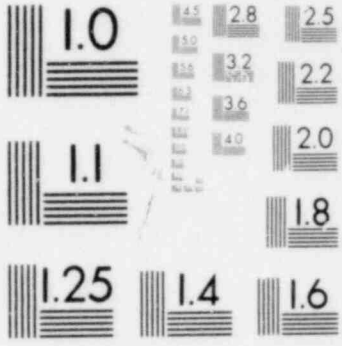
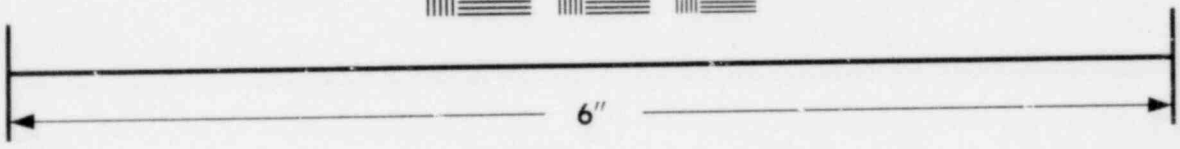
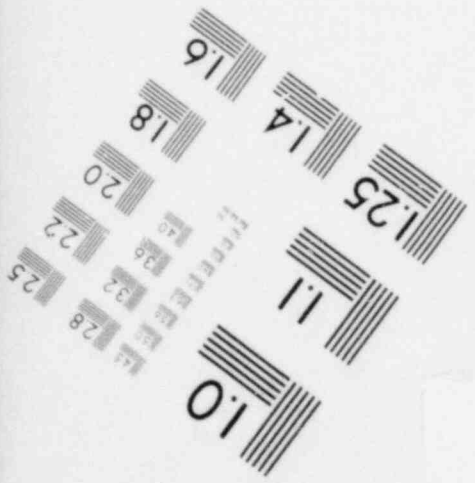
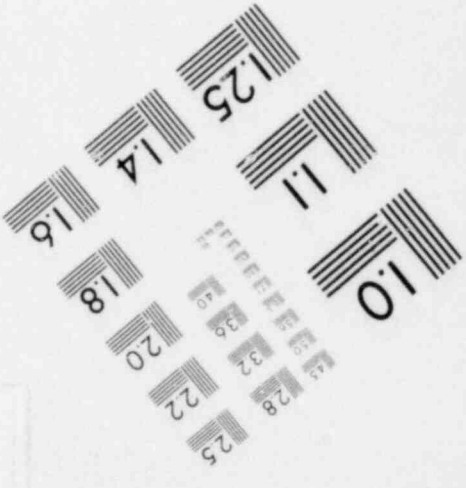


IMAGE EVALUATION TEST TARGET (MT-3)









the NW and NNW so the total calculated man rem dose would be minimized (Id. at 3-4; Tr. 2943-44, 2948). Less significant reductions in population would be calculated for other wind directions regardless of other meteorological conditions because of the skew in population (Applicants' Appendix I Response at 3-4).

26. Man rem and man thyroid rem doses resulting from mechanical vacuum pump and drywell purge releases have been calculated using the most favorable and least favorable meteorological conditions. Under the most unfavorable meteorological conditions, a calculated population dose of 6 man rem by immersion and inhalation dose of 3.0 man thyroid rem would be experienced. This condition would occur 0.46% of the time. Similarly, under most favorable meteorological conditions, the calculated population dose is 0.008 man rem by immersion and 0.004 man thyroid rem by inhalation (Id. at 5-6). Using the guidance of the cost-benefit balance selected by the Commission of $1000 per man rem or man thyroid rem, and as the benefits from scheduled releases are additive, a conceivable (but extremely unlikely) benefit would then be $8,988 if the mechanical vacuum pump operation were delayed until conditions changed from the worst to the best in terms of reducing man-rem (Id.). Similarly, the benefit in dollars for the drywell purge dose is $462 (Id. at 5). In order for these benefits to be realized, an extreme shift in both wind

direction and meteorological stability must take place; the wind direction must shift from a SE wind to a NW wind, and the stability must go from a stability Class G to a stability Class A. Shifts less than these will produce correspondingly smaller benefits (Id. at 6).

> 2. [I]f a reduction in population dose may be achieved by one or more of the scheduling methods referenced above, either alone or in combination, the Board wishes to be further apprised of the cost thereof; in doing an estimate with respect to dry well purge, the parties may wish to segregate purges which may be rescheduled with little or no difficulty or expense from those where greater difficulty or expense is entailed. (Tr. 1429).

27. The mechanical vacuum pump is used during startup to remove noncondensible gases from the main condenser. A delay in mechanical vacuum pump operation to allow for shifts in meteorological conditions would therefore cause a delay in plant operation (Tr. 2972-73). The cost of such a delay would depend primarily on whether the power required to replace the Zimmer output could be supplied by units on the Applicants' generating systems or whether the replacement power would have to be purchased from other utility systems (Applicants' Appendix I Response at 7).

28. The Applicants calculated that if replacement power could be supplied by other units on the Applicants' generating systems, the fuel cost penalty (i.e., the cost of generating replacement electricity utilizing more costly fuel)

associated with a one day delay in plant operation estimated at that time was $169,138. Similarly, the estimated cost of a one day delay in plant operation if all replacement power is purchased from other utility systems was $960,000 (Id.).

29. If the one day delay cost of $169,138 associated with utilizing other units on the Applicants' system is used together with the methodology of Section II.D of Appendix I, the cost of each minute of delay in startup would be $118. If the 9 man rem reduction was converted to dollars by multiplying by $1,000/man rem, it can be seen that even in the extreme case presented, the Applicants could possibly delay only 76 minutes if it could be assured that the extreme change discussed above would occur. If the power was purchased, a wait of only 14 minutes or less would be cost beneficial in the extreme case discussed (Id. at 7-8).

30. The Staff pointed out utilizing similar methodology that the most favorable conditions to lower the man thyroid rem dose would be to wait until the wind direction was in the direction of the Moscow Elementary School (Staff Response to Appendix I Question, following Tr. 2967, at 4). However, the cumulative frequency of occurrence of wind blowing in such general direction is 2.2% or 8 days per year for Stability Class A (Id. at 5). In addition, the Applicants' study revealed that it would take 152 hours for the wind to go from the northeast to the southeast and from G stability to A (Tr. 2963).

31. Thus the scheduling of releases according to time and wind direction is not practical because of the small cost-benefit time frame, because of the small frequency during which very favorable wind conditions occur to benefit from the scheduling and because of the small magnitude of the reduction of the population dose to be achieved by such scheduling and the comparative small magnitude of the reduction to natural background (Staff Response to Appendix I Question at 5; Tr. 2964). Considering these facts and recognizing that there does not appear to be any benefit of scheduling releases either on a day or night basis (Tr. 2970-71), and recognizing the flexibility of operation contemplated by 10 C.F.R. Part 50, Appendix I, and considering the extreme difficulty in formulating an enforceable license condition, the Board finds that no limitation in operation beyond that presently contemplated by Appendix I for inclusion in the Technical Specifications[18/] is necessary in this case.

Contention 14

> Cable trays containing electrical wires have been inadequately welded by improperly qualified welders, contrary to NRC regulations. More specifically, three piece verticals and two piece channels were welded by people not fully ASME certified. These welders were not consistently able to produce a quality weld with good fusion, a situation aggravated by Husky Product's incentive system which

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18/ The Board also notes that as a legal matter it is doubtful whether any reasonable interpretation of Appendix I contemplates that startup of a facility be delayed even were the result otherwise cost beneficial under Section II.D of Appendix I.

> induced quick blasting techniques to be employed. Further disregarding standard procedures production welding techniques and test welding techniques were not identical. Any meaningful inspection of the crucial three piece vertical welds is impossible because the trays have been galvanized. Therefore, the existing system of cable trays must be dismantled and a new set, welded by fully certified welders, installed.

32. Cable trays used in the Zimmer facility were manufactured by Burndy-Husky Incorporated of Florence, Kentucky and consist of three types of trays: (1) three piece straight tray used horizontally, having two side channels and a corrugated bottom plate (solid) welded together by resistance spots welds by an automatic resistance spot weld machine, (2) three piece vertical tray utilized in straight vertical runs also having two side channels but with a flat plate for the back of the tray. These trays are also welded with the same automatic resistance spot weld machine, and (3) fittings that provide the transition trays from horizontal to vertical, changes in direction horizontally or vertically or T-sections. These transition trays may have either single piece side channels or three piece side channels fabricated from three separate pieces by welding, this welding being done by a manual Tungsten Inert Gas (TIG) process by a qualified welder. The fillet welds are approximately one inch long and are spaced every two to three inches along the welded joint. These side channels are then

spot welded to a corrugated solid bottom plate. This welding is done by either a resistance spot weld machine or by semiautomatic metal inert gas (MIG) process as necessary (Direct Testimony of Thomas Vandel and Harvey Wescott Regarding Contention 14, Cable Tray Welding, Tr. following 1643 (hereinafter "Staff Cable Tray Testimony) at 7-8).

33. These trays, when installed in the Zimmer facility, are supported by seismically designed hangers with support spacing of straight runs not to exceed 9 feet in length. Fittings are supported on both ends by seismically designed hangers (Id. at 8). The designer, Sargent and Lundy Engineers, ("S&L") specified that the cable raceway system for Zimmer (both conduits as well as cable trays) will be designed adequately to sustain a seismic event by reliance on the support hanger system, not the trays themselves. The basic purpose of the trays is to separate and direct the wires. The support for the wires comes from the seismically designed hangers anchored in the structures themselves. The electrical cables would therefore remain in place on the supports even in the unlikely event that the cable trays disappeared (Id.). Considering these factors, the quality of welds in fittings would have no established relation to the safety of the facility. Indeed, MVPP has provided no probative evidence which would indicate that these trays have safety significance.

As such, there is no warrant whatsoever for the assertion that these cable trays must be dismantled and a new set welded. This alone is sufficient to decide the issue in favor of the Applicants.

34. The cable trays were manufactured in accordance with design specifications requiring steel having a minimum yield of 30,000 pounds per square inch. When this material is received at Husky, the receiver documentation is inspected to verify that the shipment meets these specifications (Applicants' Testimony Relating to Contention 14 Cable Trays, following Tr. 985 (hereinafter "Applicants' Cable Tray Testimony") at 1). Design specifications further required the cable trays to sustain a working load of 40 lbs. per square foot plus a load equivalent to 200 lbs. at the mid-point of a 10 foot span with a minimum load (safety factor of 2.0) when treated in accordance with NEMA Standard VE-1-3.01 (Applicants' Cable Tray Testimony at 1; Tr. 1807). The safety factor was determined by means of structural tests at Husky (Tr. 1090).

35. Cable trays for the Zimmer Station were manufactured by the Burndy-Husky Corporation in accordance with a quality assurance program approved by the Applicants (Tr. 990, 1104-05). However, cable trays at Zimmer are not ASME Class 1 (Applicants' Cable Tray Testimony at 1; Tr. 1097). Accordingly, there is no requirement for "certification" of

welders as is required by the ASME Code Section III for pressure vessels, for example. However, each Husky welder was required to have a qualification test to establish his competence for the type of welds made on Zimmer cable trays (Applicants' Cable Tray Testimony at 1; Tr. 987). Each welder underwent a qualification test required for each position and process (Tr. 988, 1035). If necessary, training was provided to enable welders to pass qualification tests (Tr. 1027). During an internal audit by Burndy-Husky, it was determined that due to an oversight, one procedure had not been qualified. From all evidence, this situation was rectified by the Company (Tr. 1045). There is no indication that this deficiency led to any reduction in the quality of the welding of cable trays for Zimmer. Even Mr. Hofstadter, the witness for MVPP, agreed that there was no difference in weld quality between a certified and a non-certified welder (Tr. 1458-59).

36. Mr. Hofstadter claimed that some welders were falsely certified (Testimony of Edwin P. Hofstadter Concerning Contention 14, following Tr. 1153, Response to Question 7 at 2). He first claimed that a welder had to pass eight tests before he would be "fully certified" to perform any work in any of the eight positions (Id.). He could not present any justification for such view (Tr. 1302-06; See also Tr. 1825). During the hearing, he attempted to

change his testimony of what he meant by "falsely certified" (Tr. 1179). He claimed, that as the result of a technicality, because the procedure qualification and welder qualification tests were done at the same time, the welder could not be qualified. The Board had expert testimony by a disinterested outside expert that this interpretation is not necessarily correct (Tr. 2173-76). In any event, inasmuch as the uncontradicted testimony is that the correct procedures were followed by welders taking the test, the Board sees no violation. The Board can see no diminuation in safety even had such technical violation been established.

Any cable tray which did not meet specifications was rejected following quality assurance visual inspections at Husky such that only trays meeting specifications were shipped to Zimmer (Applicants' Cable Tray Testimony at 1; Tr. 1032-33, 1086, 1092). Even Mr. Hofstadter acknowledged the existence of inspection records (Tr. 1445). Additional inspection was made upon receipt at the Zimmer plant to assure that there was no damage in shipment (Applicants' Cable Tray Testimony at 1; Tr. 1098-99).

38. Mr. Hofstadter, the witness for the MVPP who had been laid off by Burndy-Husky, stated that he was motivated to report the alleged "deficiencies" four years after they occurred because he perceived that the cable trays were "overloaded" on the basis of the area the cable occupied

(Tr. 1182, 1186-87). This was based on at best a tour lasting not more than an hour and a half of the facility (Tr. 1325). However, even after his visit to the plant, he made no effort to tell anyone at the NRC or at CG&E of his concerns until four months later, after he was laid off by the Company (Tr. 1245-47).

39. With regard to cable tray loading, what Mr. Hofstadter failed to appreciate was that the design loading was based upon weight and not on how high the cable was piled (Tr. 1187, 1227-28, 1722-23, 1728, 1806). The heaviest loading at the facility is approximately 36 lbs. per foot (Tr. 1073, 1857) as compared to the design allowable of 40 lbs. per foot (Tr. 1857). See also Paragraphs 146-149, infra.

40. The bias and prejudice of Mr. Hofstadter is readily apparent to the Board. He was laid off involuntarily and he has filed suit alleging that such action was taken because of his age (Tr. 1375-76). According to his own testimony, he made no allegations with regard to the cable trays (Tr. 1180-82) either anonymously or otherwise to anyone outside Burndy-Husky before he was laid off. This, in the collective opinion of the Board, is alone significant evidence of bias and accordingly his allegations and testimony have been given correspondingly less weight. Moreover, from a review of Mr. Hofstadter's training and work experience (See for example, Tr. 1196-97), there is no reason to believe that he

has the education or experience to understand the design or use of cable trays at nuclear stations (Tr. 1185-87; 1914-15). We have thus discounted his testimony accordingly.

41. As an example of his lack of qualification to testify, Mr. Hofstadter speculated that a cable contained in a cable tray could "kick" or "jump" when energized somehow putting an additional load on the trays (Tr. 1248-50). However, Mr. Hofstadter is certainly not qualified to discuss design requirements of cables or cable trays at the Zimmer Station. In any event, at Zimmer, power cables are three phase cables bound together in a common sheath so the magnetic forces are in balance. Thus, there would be no physical movement of cables when they are energized or de-energized (Tr. 1809).

42. The MVPP contention alleges that production welding techniques and test welding techniques were not identical in disregard of standard procedures. MVPP has still not clarified what a welding "technique" is in the context of this contention. However, the welding procedures used in the qualification for Husky welders are identical to the welding procedures used in production of the cable trays for Zimmer. The weld procedures refers to the physical steps that are taken to complete a weld. The type of weld refers to the physical configuration of an actual weld. The qualification tests administered to Husky welders required completion of

horizontal or vertical groove welds. ASME Boiler and Pressure Vessel Code, Section IX, which was followed for the Zimmer Station, specifically provides that successful qualification to perform horizontal or vertical groove welds automatically qualifies a welder to perform horizontal or vert[illegible] fillet welds, respectively, as well as flat groove and fillet welds. The welds employed in production of the cable trays provided to the Zimmer project are flat fillet welds (Tr. 1024-25; Applicants' Cable Tray Testimony at 1-2). There is no requirement that the welding parameters such as gas flow be the same for qualification as for the actual work. In fact, because of the difference in thickness between the test piece and the work piece, the parameters must change, even though the test piece qualifies the welder in the procedure.

43. The MVPP contention alleged that the Husky Products incentive system aggravated the ability to produce good welds. Husky Products has an incentive program which rewards welders for increased production without sacrificing quality. In fact, welders were penalized for rejected pieces (Tr. 1081-84, 1091-93, 1107). After welding, the pieces were inspected and trays failing to meet quality requirements were rejected (Tr. 1099, 1381, 1383). Thus the Board finds that there is no basis for concluding that the incentive program had any adverse effect on the quality of the cable trays for Zimmer.

44. For corrosion protection, the trays were galvanized by hot dipping in accordance with ASME standards (Tr. 1100-01). MVPP alleges that "meaningful" inspections of certain welds were made impossible because the trays were galvanized. In fact, visual inspection at Husky as to acceptability of welds was made prior to galvanizing (Tr. 1102). In addition, receipt inspection was done at Zimmer to assure that there was no damage during shipment (Tr. 1106).

45. Following Mr. Hofstadter's complaint to the NRC and others, the NRC conducted an exhaustive inspection at the site as well as destructive testing to verify tensile strength and weld acceptability. The investigation of the cable tray allegation was performed by two NRC inspectors and one investigator with a total of 143 inspector hours being devoted to inspections at the Zimmer site and at the Burndy-Husky plant, excluding the time to write the report (Staff Cable Tray Testimony at 8; Applicants' Cable Tray Testimony at 2; Tr. 1676). The NRC inspectors reviewed Husky Products welding procedure specifications, welding procedures, procedure qualification records, welder performance qualifications along with other welding procedures related records. No concerns were identified as a result of this programmatic review (Staff Cable Tray Testimony at 10).

46. During the investigation, randomly selected samples of cable tray and fittings from the Zimmer site were destruc-

tively tested at the F&S Machining Company, Moscow, Ohio, on September 28, 1978 (Staff Cable Tray Testimony at 11; Tr. 1695-96). These tests were designed to pull resistance spot welds and Metal Inert Gas spot welds on straight tray and fittings apart to determine the quality of the welding. All of the welds so tested were determined to be acceptable (Staff Cable Tray Testimony at 11-12 and Appendix A thereto at 21; Applicants' Cable Tray Testimony at 2-3). The manner in which the spot welds were destructively tested also tested the TIG welds for the fittings. The TIG welds did not fail (Tr. 1762-63, 1774-75, 1787). Additionally, visual inspections were performed by NRC inspectors of TIG welds on three-piece siderails of fittings installed at the site. This visual inspection by the NRC inspectors indicated that these welds appeared sound and suitable for their function (Tr. 1799). Documents reviewed at the vendor plant verified that vendor QC personnel visually inspected such welds prior to the galvanizing of fittings installed at the site (Staff Cable Tray Testimony at 11-12; Tr. 1102, 1110-12).

47. It is important to emphasize that the trays were all manufactured to the same specifications. Therefore, contrary to intervenors' argument, it would not matter whether the specimen trays happened to be vertical or horizontal in use (Applicants' Cable Tray Testimony at 2-3).

48. Mr. Hofstadter stated his principal concern was the overload in vertical trays, particularly in the fittings where a run changed from horizontal to vertical. Mr. Hofstadter stated that his concern would be alleviated if these vertical cables were supported by a Kellum grip, a device which takes the weight of the cables and transfers it to the structure and not the cable trays (Tr. 1452-53, 1668, 1731). Both the NRC and the Applicants testified that such Kellum grips were utilized at Zimmer in accordance with specifications (Tr. 1666, 1804-05). Furthermore, the Staff witnesses testified that, carrying the matter to an extreme, even if a transition piece broke because of a hypothetical "bad weld," even if the break were hypothesized to have a jagged edge, and were such jagged edge to penetrate a cable, no fire would result (Tr. 1675). The NRC witness also stated that if the side of a transition piece fell completely off, nothing adverse to the facility would occur (Tr. 1775). Thus, the Board finds no merit in the suggestion that even a bad weld could result in a safety problem.

49. Mr. Hofstadter consistently confused the use of higher amperage by welders with poor welding. However, he admitted that a welder possessing greater skills could successfully use higher amperages in welding. He also acknowledged that the quality of a weld could not be assessed without examining it, i.e., by merely looking at the amerage setting

of the welding machine (Tr. 1454-57, 1512). He seemed to believe that the production amperage setting had to bear some relation to the amperage of the qualification tests but could give no basis for this assertion (Tr. 1456-57). As previously noted, because of different thicknesses of material and other factors, it appears that this basic assumption of Mr. Hofstadter is entirely incorrect. Finally, Mr. Hofstadter admitted to this Board that he was making a general criticism of his employer rather than making any specific statement regarding the quality of welding at Zimmer (Tr. 1461).

50. Based upon all the evidence of record, the Board concludes that the cable trays and fittings installed at the Zimmer facility are adequately fabricated and installed to perform their intended function in the Zimmer facility.

Contention 15

> Control rods which must be easily inserted into and removed from the reactor core have been inadequately manufactured so that they do not meet the size specifications for such control rods.

51. The control rods perform the dual function of power shaping and reactivity control. Power distribution in the core is controlled during operation of the reactor by manipulating selected patterns of control rods. Control rod displacement tends to counterbalance steam void effects at the top of the core and results in significant power flattening. The control rod consists of a sheathed cruciform

array of stainless steel tubes filled with boron-carbide powder. The control rods are 9.75 inches in total span and are separated uniformly throughout the core on a 12-inch pitch. Each control rod is surrounded by four fuel assemblies. The main structural member of a control rod is made of Type 304 stainless steel and consists of a top handle, a bottom casting with a velocity limiter and control rod drive coupling, a vertical cruciform center post, and four U-shaped absorber tube sheaths. The top handle, bottom casting, and center post are welded into a single skeletal structure. The U-shaped sheaths are resistance-welded to the center post, handle, and castings to form a rigid housing to contain the boron-carbide-filled absorber rods. Rollers at the top and bottom of the control guide the control rod as it is inserted and withdrawn from the core. The control rods are cooled by the core bypass flow. The U-shaped sheaths are perforated to allow the coolant to circulate freely about the absorber tubes (Appl. Exh. 1, Final Safety Analysis Report hereinafter "FSAR") at §4.2). See also Figures 4.2-11 and 12 for specific dimensions).

52. The control rod drive system controls gross changes in core reactivity by incrementally positioning the control rods within the reactor core in response to manual control signals. It is also required to quickly shut down the reactor (scram) in emergency situations by rapidly inserting

withdrawn control rods into the core in response to a manual or automatic signal (FSAR §4.2.3.2.2 at 4.2-33 through 39).

53. The control rods were manufactured at General Electric Company's plant in Wilmington, North Carolina. All quality assurance procedures at the manufacturing facility were satisfied. Control rods were inspected pursuant to General Electric's quality assurance procedures to assure that design specification requirements are met before being released for shipment to the Zimmer site (Applicants' Testimony Relating to Contention 15 Manufacture of Control Rods, following Tr. 2209 (hereinafter "Applicants' Control Rod Testimony") at 1). Such inspections included the measurement of the thickness of the control rod to determine if there are spots that are out of tolerance (Tr. 2214-76). The control rods were also examined for straightness and freedom from twisting (Tr. 2733). Periodic audits of the procedures were conducted to assure that quality requirements were being met (Tr. 2210-12).

54. Control rods were packed and shipped according to special requirements which were established to maintain the integrity and configuration of the rods and thus assure delivery to the site in the same condition as when they were packed at Wilmington (Applicants' Control Rod Testimony at 1; Tr. 2234-35).

55. After the control rods were uncrated at the reactor site, and before installation into the reactor, they were inspected for possible shipping and handling damage prior to installation in the reactor vessel. This site inspection was performed during the period July through October 1978 by Reactor Controls, Incorporated ("RCI") and consisted of several visual observations as well as a number of measurements. (Direct Testimony of Federico A. Maura Regarding Contentions No. 15 and 16, Control Rods Thickness and Seals, following Tr. 1643 (hereinafter "Staff Control Rod Testimony") at 3 and Attachment C thereto; Tr. 2237). The actual inspections were done by quality assurance personnel from RCI. Millrights manipulated the control rods to assist these personnel in their inspections (Tr. 2257, 2292-93). Prior to engaging in these inspections, the RCI personnel received training in the steps necessary to conduct the inspections (Tr. 2265).

56. The use of the two envelope gauges and the determination of whether to accept or reject a control rod was controlled by General Electric Company procedures. The 0.280-inch envelope gauge was used to determine if the control rod blade thickness, at any one point in the length of one of the four blades of any control rod, exceeds 0.280-inches. The gauge looks like a tuning fork approximately 1-inch wide. It is passed over the length of the cruciform

shaped blades to determine whether there are any points of interference (Tr. 2215-16). The 0.320-inch envelope gauge is similar to the 0.280-inch gauge except it is approximately 1-foot long and is used to determine if bowing exists over a wider area (Staff Control Rod Testimony at 3-4). The 0.280 dimension did not represent any maximum design requirement for sheath thickness, but a check point at which the design engineer wished to be consulted (Staff Control Rod Testimony at 7; Tr. 2651-53).

57. During the initial site inspection, conducted by RCI for the Applicants, of the 137 control rods, 86 did not pass the initial screening with the 0.280-inch thickness envelope gauge (Staff Control Rod Testimony at 4; Tr. 2247). Of those 86 that did not pass, 4 also did not pass the 0.320-inch gauge used to locate undesirable bowing and the four were rejected (Staff Control Rod Testimony at 4; Tr. 2279). In accordance with the GE inspection procedure a 40-pound force clamp was placed against the blade sheath, adjacent to the high area of the remaining 82 control rods (Tr. 2409-10). The purpose of the clamp was to determine if the local sheath bulge was flexible, and to ensure the absence of foreign matter between the sheath and the poison rods which form the blade. The forty pound load removed waviness of the sheath without permanently deforming the sheath (Tr. 2325, 2381-82).

58. While certain damage such as significant dents or bent rods could be a reason for rejection, normal waviness which is overcome by the clamp, is acceptable (Tr. 2253-54; 2416-17). This procedure is used uniformly at the place of manufacture of the rods as well as in the field (Tr. 2337).

59. The control rod is designed to operate with rubbing friction between the control rod and the fuel bundles which is substantially in excess of forty pounds (Tr. 2324, 2346-47, 2386-89). Therefore, the forty pound inspection clamp load has no effect on safety or normal operation (Tr. 2345-47, 2368-72, 2381-82, 2437). The design of the control rods has been confirmed by qualification tests performed by General Electric Company during which control rods were cycled for the expected life of the blade and the wear of the blade and fuel channel were measured (Staff Control Rod Testimony at 6; Tr. 2381, 2423-25). Because of elasticity of the control rod blade and fuel channels, the blade thickness acceptance criteria could be increased above the maximum thickness measured before the first operational difficulty would be experienced (Staff Control Rod Testimony at 7; Tr. 2385-87, 2436-37). In any event, any abnormal friction would be found during the pre-operational and operational testing of the control rod and control rod drive (FSAR §§4.2.3.2.4.3, 4.2.3.2.4.4, 4.2.3.2.4.5 at 4.2-59 through 61; Tr. 2349, 2390-94). Even Mr. Martin, the witness for

MVPP on this matter, stated if such preoperational testing were performed, this would address his concern (Tr. 2585-86). Even in the hypothetical event that a control rod with the highest worth failed to function for any reason, there would be no effect on safety inasmuch as this is a design condition for the reactivity control system (Tr. 2351-52).

60. Of the seven control rods which did not pass the 0.280-inch gauge with the 40-pound force clamp applied, one was rejected and not placed in the reactor. The remaining six control rods were accepted by the licensee after the General Electric Inspection Procedure was clarified to indicate that the clamp could be placed over the high point in question, and the surface area of interest on a control blade was redefined (Staff Control Rod Testimony at 4-5; Tr. 2414-18, Tr. 2281-82, 2286). An NRC inspector witnessed a successful reinspection of those six control rods on April 10, 1979 (Staff Control Rod Testimony at 5).

61. During the course of handling of the control rod drives, flecks or particles of materials were discovered in the connection between the sheath and the tie rod, the center structural member of the control rod (Tr. 2308-09, 2312-13, 2419). A cleaning process was initiated utilizing compressed air, vacuum cleaners, probes and other methods to dislodge the flecks (Tr. 2309, 2326). The rods were wiped down with a degreasing agent (Tr. 2309). The flecks which

had a maximum size of 1/16 inch wide by 1/8 inch wide and which were extremely thin were determined to be the result of a spot welding process (Tr. 2309-12, 2438). A safety analysis was conducted which concluded that were some flecks left in the rods, there would be no effect on safety (Tr. 2328). Even if the flecks were not removed prior to operation, filters on individual pieces of equipment and the cleanup system would remove them should they escape from the sheath (Tr. 2358-59, 2420-21). The Board finds that there is no safety problem associated with these small particles.

62. In January 1979, during initial fuel loading at the Fukushima 6 reactor, it was noticed that several fuel channels hit the small ledge that exists in the corner of the control rod wings at the top of the velocity limiter just before the fuel bundle seated on the orficed fuel support. Under maximum material tolerance conditions, this ledge could nick the corner of a fuel channel. While nicking does not affect fuel channel or control rod life or reactor safety for the Zimmer control rods, the ledge was chamfered to eliminate the possibilities of nicking (Tr. 2315-16, 2318). This chamfering was done with a handheld high speed air motor containing a small milling tool (burr).

63. A gauge was utilized which duplicated the fuel channel corner. If the gauge hit the ledge, the ledge was

chamfered. If the gauge did not hit the ledge, no action was taken. The result was that all corners of all control rods had to pass the gauge before the control rod was accepted (Applicants' Control Rod Testimony at 2-3). The control rods were wiped clean and put back in storage (Tr. 2318). It was not necessary to go through the detailed cleaning previously done because of the procedure used to assure that particles could not get into the control rod (Tr. 2318, 2421). However, at that time the rods were visually inspected and no defects were found (Tr. 2658, 2676). Moreover, random checks with a micrometer and gauges revealed no rejectable control rod blades (Tr. 2658-59). As the result of this operation, all control rods which have been installed in the Zimmer reactor meet all requirements for operation. See also Paragraphs 150-156, infra.

64. Mr. Martin, a millright who was employed by RCI, testified for the intervenor, MVPP. While he testified that he conducted certain "inspections" such as the manipulation of the testing fixture and a micrometer, it was clear that he was being directly supervised by qualified quality control personnel from RCI who were responsible for the inspection. His testimony regarding inspection of the blades did not differ in any substantial way from that presented by the Applicants or Staff.

65. Mr. Martin testified that, while he had no proof, he suspected that the crew he was working on was laid off because they reported the discovery of specks in the control rods. From the facts in this record this accusation has no support. Millrights are hired from the union hall on a daily, "as needed" basis. They are not regularly assigned workers at the Zimmer Station. The work the crew which Mr. Martin was a part had performed had come to a logical stopping point and further inspections were not scheduled for some time (Tr. 2664-65, 2677-80). Mr. Martin admitted that he was not in the union hiring hall when the second crew was hired to do the reinspections and that, were he there, he could have been selected in accordance with union procedures (Tr. 2471-72). On the other hand, the responsible corporate officer stated that it was the Applicants' policy to encourage openness on the Zimmer project and no workers or other individuals bringing problems to the attention of the Company have been suppressed nor has any contractor or subcontractor been instructed to the contrary. He stated that it is not only good safety and construction practice, but also good business practice to attack problems at their source (Tr. 2659-61). A representative of RCI specifically testified that no employees were laid off from the Zimmer job as the result of comments they had made (Tr. 2661). The Board finds no basis for Mr. Martin's charge that he was "fired" for reporting the flecks in the control rods.

66. A witness for the Applicants testified that while an attempt was made to explain in some detail the operation of the control rods to the millrights, the process became too involved and complicated (Tr. 2405-06). It is the conclusion of the Board, based upon Mr. Martin's testimony and his demeanor as a witness, that he had an insufficient understanding of the design, manufacture and operation of the systems or components on which he was working to come to any valid conclusions concerning safety matters. He appeared to be generally resentful of authority, apparently thought he knew more than his supervisors and did not think any training was necessary for him. His testimony was discounted appropriately.

67. The Board has considered all the evidence of record, including the testimony of Mr. Martin. The Board is satisfied that the control rods were designed, constructed, inspected, and will be tested in a manner which assures that they can perform their intended function over their useful life. There has been no competent testimony to the contrary. The most that can be said is that Mr. Martin did not understand the nature of the design of these control rods, was unaware of the prototypical testing of this design and the pre- and post-operational testing to be conducted at the Zimmer facility. Thus the Board finds that Contention 15 has no merit.

Contention 16

> Almost all of the seals on the control rods, which when properly set prevent radioactive water from leaking out when the reactor is shut down for maintenance, do not meet minimum specifications for smoothness. Rough seals cannot set properly, making servicing more difficult and unnecessarily endangering workers and the general public by causing leakage of radioactive water.

68. Under normal conditions, the primary seal which retains water in the reactor is that created by the mating surfaces of the control rod drive and control rod drive housing flanges. The seal noted in MVPP Contention 16 is the velocity limiter to guide tube backseat. These seals are shown in Applicant's Exhibit 1, FSAR, Section 4.2 in Figures 4.2-12, 13 and 14. The only function that these control rod seals in question serve is to limit the leakage of water from the reactor vessel during the time when the drive mechanism is disassembled for maintenance (Applicants' Testimony Relating to Contention 16 Control Rod Seals, following Tr. 2209 (hereinafter "Applicants' Control Rod Seal Testimony") at 1; Staff Control Rod Testimony at 8; Tr. 2745-46, 2766-67). Therefore, these seals would only see the pressure caused by the head of water in the vessel and are not subject to operating pressure. They serve no other function (Applicants' Control Rod Seal Testimony at 1).

69. The specifications for the seals, which are AISI Type 304 stainless steel, are a 63 RMS finish and dimen-

sional constraints in size and shape (Applicants' Control Rod Seal Testimony at 1).

70. Since these are not perfect metal-to-metal seals, a small amount of leakage must be expected until the drive is removed at which time a blind flange can be installed on the control rod drive housing, if needed. This small leakage may create an inconvenience to maintenance personnel during removal and subsequent reinstallation of control rod drives but, in no case, does it create a safety problem (Staff Control Rod Testimony at 8-9; Tr. 2746, 2763-64, 2765-66).

71. To determine that the specifications were met, all control rod seals were subjected to visual inspection with a comparator and a dimensional check in a special inspection fixture. These inspections are performed at Wilmington as a planned part of General Electric's Quality Assurance program (Applicants' Control Rod Seal Testimony at 2).

72. After the control rods were shipped to the site, the seals were inspected for possible damage in shipment (Tr. 2742). The visual inspection was conducted with a comparator (Id.). One control rod was returned to General Electric and replaced because of a scratch across the seal surface. All control rod seals installed at the Zimmer reactor meet design specifications for operation (Applicants' Control Rod Seal Testimony at 2; Staff Control Rod Testimony at 8). There was no requirement imposed by the

General Electric Company, the supplier of the seals, that they be inspected at all at the site, let alone with a comparator (Tr. 2923). The RCI inspection form did not require checking the seals with a comparator (Attachment B to Staff Control Rod Testimony). Thus, inspection of the seals was not specified as a safety requirement (Tr. 2923). In any event, it would require a gross deformity in the seals to create any sort of problem (Tr. 2925). Even in that case, other elements of the control rods would prevent a maximum outflow of water (Id.).

73. Mr. Martin testified on behalf of the intervenors, MVPP. Boiled down to the essentials, Mr. Martin thought the specified roughness of the seal was too great to permit it to meet its design function (Tr. 2798, 2851). Apparently, he thought that the seal had to be "polished" to work adequately (Tr. 2798, 2841, 2851). However, Mr. Martin had no basis for his conclusion; there is nothing in his background which would indicate that he was an expert with regard to control rod seal design such that the Board could give this unsupported assertion any weight. Mr. Martin testified that none of the seals that he inspected met specifications (Tr. 2803). It is stretching credulity beyond any reasonable limit to say that none of the seals met specifications when they had been independently checked at the factory and at

the site because it would imply that all had been falsely or erroneously passed. There is no reason to suspect that the roughness changed from after manufacture to field inspection (Tr. 2841-42). The Board's view of this matter is reinforced by the fact that NRC inspectors looked at the seals on the six control blades inspected on April 10, 1979, and found them to be satisfactory (Staff Control Rod Testimony at 8).

74. From the Board's perspective, Mr. Martin had a predetermined misconception that the seal had to be polished, and, while he admitted he did not have the credentials to know the purpose or operation of the seal (Tr. 2798, 2841), he continued to cling to his position that the design of the seal, i.e., surface finish, was inadequate. Furthermore, Mr. Martin could not even identify the seal when a drawing was presented to him at the hearing (Tr. 2827, 2829). Mr. Martin admitted that he did not know that the seal was designed to leak until the NRC inspector told him (Tr. 2871).

75. In fact, Mr. Martin admitted that his instructions were consistent during the entire inspection process were to check for scratches, nicks, etc. and at no time was he told to use a comparator as a roughness check (Tr. 2838-39, 2856, 2858). The Board's observations regarding Mr. Martin stated in ¶66, supra are relevant here. The Board is totally unimpressed with his testimony and has discounted it completely.

76. Considering all the evidence, the Board finds that the control rod seals in question have been designed and manufactured to perform their intended function. The Board finds MVPP Contention 16 to be without merit.

Contention 17

> Fire insulation material which is being used to protect the cables in the cable trays from fire is inadequate to protect the cables in light of the cable tray installation design and cable tray load. The tests of the fire insulation material were improperly performed in that conditions which will exist during operation were not adequately simulated.

77. The Applicants' witness presenting testimony with regard to MVPP Contention 17 was Mr. Melvin S. Abrams, an acknowledged expert in the testing of fire resistant materials (Affidavit of Melvin S. Abrams, following Tr. 3414 at 1-2, Direct Testimony of Gregory A. Harrison, Bert M. Cohn, and Robert D. Barnes Regarding Contention No. 17, Kaowool As A Fire Barrier for Cable Trays following Tr. 3244 (hereinafter "Staff Fire Protection Testimony") at 7-8). Messrs. Cotta and Borgmann, the Applicants' other two witnesses, were also well qualified. (Statement of Professional Qualifications, Robert E. Cotta, following Tr. 3414). The Board also found the Staff's panel to be well qualified (Staff Fire Protection Testimony at 1-7). MVPP, on the other hand, presented no witnesses with regard to Contention 17.

78. With regard to assuring that an adequate level of fire protection is provided, the principal concern is in areas where wiring and equipment serve safety equipment and could be subject to damage from a single fire incident. In assuring that an adequate level of fire protection is achieved, the NRC uses the defense in depth concept which recognizes that no single echelon of fire safety in and of itself may be adequate to protect nuclear plants and therefore a number of different measures regarding fire prevention, fire detection, fire protection and fire supression are taken. In the situation of cable trays, the location of each tray to the other, the location of trays within the space, the separation between redundant divisions, the presence of materials and equipment creating a fire exposure, the accessibility of the space for firefighting, the presence of fire detection and fire suppression equipment, and other factors are considered in determining whether additional protective measures, such as fire barriers or insulation are required, and if so, what those additional protective measures should be. These determinations are made by the NRC experts who review and inspect the facility in detail utilizing recognized standards and guidance (Staff Fire Protection Testimony at 1-5, 6-8; Tr. 3369-71).

79. Based upon NRC review, the Applicants have agreed to the installation of fire barriers, protective insulation,

automatic sprinklers, or combinations thereof in those places recommended by the Staff for additional protection. The Applicants proposed to use a ceramic fiber blanket thermal insulation material manufactured by the Babcock and Wilcox Company under the trademark name "Kaowool" as a protective insulation material to be wrapped in a specified manner around selected cable trays and conducted tests to show its adequacy for the purpose (Staff Fire Protection Testimony at 8; Appl. Exh. 7A at 4 and Appendix A.2).

80. Although time periods required by the NRC for fire protection of cable trays vary from 30 to 60 to 90 minutes based on location, nearby combustibles, ceiling heights, room dimensions, etc., Applicants will cocoon all cable trays requiring protection with three one-inch layers of Kaowool, giving each tray a 90 minute rating (Affidavit of Robert E. Cotta, following Tr. 3414 at 2-3; Tr. 3245-46, 3377-78, 3425). The 90 minute fire rating was provided for extreme conservatism inasmuch as the Staff has concluded that it would not take more than 15 minutes to detect and extinguish a fire at Zimmer (Tr. 3278, 3378).

81. To qualify Kaowool wrapped trays, the Applicants rely on a test conducted by the Portland Cement Association at Construction Technology Laboratories ("CTL") on June 6, 1979. Four cable tray specimens consisting of 16 foot-long sections with 40% fill of EPR-insulated, Hypalon jacketed

IEEE-383 grade seven conductor control cables similar in type to those used at Zimmer were placed randomly in the trays (Applicants' Exh. 7A at 1; Tr. 3420-22; Affidavit of Robert E. Cotta following Tr. 3414 at 2). The particular cable configuration was chosen as the most susceptible to an outside fire, with the result that other cables at Zimmer would be expected to achieve even better results (Tr. 3421).

82. Cable tray specimens were exposed to the standard time-temperature fire exposure of ASTM E119 (Applicants' Exh. 7A at 2). Eight shielded thermocouples protected in accordance with the requirements of ASTM were used to measure and control furnace atmosphere temperatures (Id. at 13). Average furnace atmosphere temperature was controlled with only a 1.5% variation from the standard time-temperature curve throughout the test (Id. at 14). The particular time temperature standard of E-119 is more severe than conditions possible during a fire at Zimmer (Tr. 3280-81, 3301). The severity is to bound any and all reasonable errors that could be implicit in the model (Tr. 3281).

83. The CTL test was also more severe than a spot fire at Zimmer since it involved continued complete engulfment and possible impingement of the flame on the bottom of the lower two cable trays (Tr. 3316, 3315-16). The test cable trays were wrapped in a manner identical to the installation procedure at the Station (App. Exh. 7A at 8, Appendix A and

Figures 1-14; Tr. 3316, Affidavit of Robert E. Cotta at 2). The position of the trays was to simulate to the extent possible in the limited space available in the furnace, the configuration of trays at Zimmer (Tr. 3451-57). A change in spacing of the trays would not have had any significant changes in the results of the test (Tr. 3456). If only two trays were tested, the test would still be valid but would be less severe because of the positioning of the trays in relation to the burners (Tr. 3449-51).

84. The testing of horizontal cable trays is also sufficient to qualify a vertical cable tray since a vertical tray would actually be less exposed than a horizontal tray suspended above the fire (Tr. 3314-16).

85. Electrical continuity of 15 cables at the bottom sides, top and middle of each tray was monitored by observing lamps in a panel connected to 120 volts that were wired to conductors in each cable. The circuit was designed to indicate short circuits from the outer conductors to the center conductor within each cable (Appl. Exh. 7A at 1, 8, 12).

86. Prior to the start of the fire test, all 60 circuits were meggered and no short circuits were found. The light panel also indicated a lack of short circuits at the start of the tests (Id. at 14). The cables which were monitored were those in positions known to fail first (Tr. 3301-04).

87. The test proceeded without incident for 90 minutes. During that time no short circuits occurred (Appl. Exh. 7A at 15). After the test period had been completed, at 94 minutes, a short circuit was indicated for one cable (Id.). As a result of the test, Kaowool was qualified as a fire thermal barrier between the enclosed cable tray system and external area of exposure fire for the arrangement used during the testing program and the 90 minutes required by the Staff (Staff Fire Protection Testimony at 8-9; SER Supp. No. 1-Zimmer Facility; Letter to Greg Harrison, Division of Systems Safety, NRC, from Bert M. Cohn, Gage-Babcock & Associates, both following Tr. 3244; Tr. 3250-53, 3579).

88. MVPP asserted that because the cables in the trays were not energized, this somehow invalidated the test. However, the Applicants testified that were the cables energized there would be no significant effect on the results. The Applicants have imposed a heat generation limitation on cable trays wrapped in Kaowool of 13 watts per foot irrespective of whether there is power or control cable present (Tr. 3422, 3424-25, 3560-62, 3599). Thus, calculating the internal heat generation assuming this maximum value and comparing it to the heat conducted from the external fire through the Kaowool during the test, it was conservatively determined that the test period would be at the most changed by approximately 1 minute 20 seconds

(Tr. 3422-23). Since the first cable failure occurred at 94 minutes, the results of the tests would not be affected.

89. MVPP alleged that the fill of the cable tray would make some difference in the results. However, the uncontradicted testimony is that the effect of the amount of fill would be negligible (Tr. 3374-76, 3424, 3602-06). In fact, additional fill may be somewhat advantageous (Tr. 3424). In addition, both the Applicants and Staff witnesses testified that the test run by CTL need not be repeated because variance among tests would be small and not significant from a fire protection engineering standpoint (Tr. 3384-85, 3486-88). Looking at the matter from a somewhat different perspective, the conservatism in these tests is based upon the extreme heat input into the test furnace compared to any fire at the plant in the protected areas and the fact that the test period of 90 minutes is significantly greater than the length of time a real fire could burn in these areas at Zimmer (Tr. 3280, 3301, 3316).

90. With regard to another issue related to fire protection of cable trays, the Applicants testified that the design of the Station utilizes concrete curbs around penetrations of floors through which cable trays are routed such that any flammable or other liquids spilled on a floor cannot contact a vertical cable tray or penetrate into the Kaowool cocoon. In addition, when Kaowool butts to a floor

ceiling or wall, a qualified fire retardant sealant will be used to further prevent penetration of any flammable liquid (Affidavit of Robert E. Cotta at 3).

91. The impetus for such a design was the test conducted under the auspices of Sandia Laboratories at Underwriters Laboratories on September 15, 1978, reported in NUREG/CR-0596, A Preliminary Report on Fire Protection. This test was to demonstrate the effectiveness of Kaowool and automatic sprinklers in protecting cables in vertical cable trays. The fuel, 2 gal. of a flammable liquid (heptane), was poured on the floor, and some of it seeped under and through the Kaowool which was wrapped around the vertical cable tray. Because of this, some of the heptane burned within and inside the Kaowool blanket and damaged some of the electrical cables. The Kaowool is totally noncombustible (composed primarily of silica and alumina compounds [SiO_2 and Al_2O_3]), cannot burn, and did not contribute to the fire. The effectiveness of this material as a fire protective insulation was not challenged by this test, and it did not fail. The Staff has determined that the Applicants' measures to preclude an occurrence of this type are adequate (Staff Fire Protection Testimony at 9-10; Tr. 3345-46). The Board concurs.

92. Based upon the evidence of record, the Board finds that Kaowool, the fire insulation material used to protect

cables in cable trays in the configuration proposed is adequate, considering the cable and cable tray design and the other fire protection features of the facility. The Board finds the test which the Applicants rely upon to qualify Kaowool to have been properly performed and the results to be acceptable. The Board therefore finds no merit in MVPP Contention 17.

Contention 13

> The equipment used in the construction and operation of the plant will be excessively costly and, in effect, beyond the financial capability of Applicants. Applicants are financially unqualified to operate the plant because of escalating costs.

93. This contention has been broken into its constituent parts and each part treated separately. The Board will first consider the portion of the contention dealing with the costs related to completion of the construction of the facility and the question which it raised sua sponte regarding additional capital costs resulting from the TMI accident. It will then consider the qualification of the Applicants to operate and decommission the Zimmer facility.

Construction Costs

94. The question of the financial qualifications of an applicant to construct a nuclear power station is a matter for determination at the construction permit stage, 10 C.F.R. §50.33(f) and Public Service Company of New Hampshire

(Seabrook Station, Units 1 and 2), CLI-78-1, 7 NRC 1, 8 (January 6, 1978). Such finding has already been made in this docket (LBP-72-27, 5 AEC 133, 136 (1972)). The finding to be made by this Licensing Board at the operating license stage is set forth in 50.33(f), to wit:

> If the application is for an operating license, such information shall show that the applicant possesses of has reasonable assurance of obtaining the funds necessary to cover the estimated costs of operation . . . plus the estimated costs of permanently shutting the facility down and maintaining it in a safe condition.

95. Inasmuch as the Board derives its authority from the Commission Notice of Hearing, a convincing argument can be made that this Board is precluded from reexamining the Commission's findings at the construction permit stage. The fact that the construction costs may have risen does not change this result. It is common knowledge that costs of construction of nuclear power plants have risen rapidly for a number of reasons and nothing has been shown to make the Board believe that the Zimmer facility is atypical. In any event, the Board, for completeness of the record, has set forth herein its findings regarding the financial qualifications to complete construction of the facility.

96. The total estimated, unexpended costs (including unexpended capital costs associated with NRC requirements arising from the TMI accident exclusive of AFUDC) to com-

plete the construction of the Zimmer Station is $204 million. Of these costs, $81.4 million represents CG&E's share. Of this amount, additional AFUDC will amount to $32.1 million and the balance of $49.3 million represents additional money that will have to be raised by CG&E (Appl. Exh. 8, Response to Question 3).

97. C&SOE's share of these costs represents $57.1 million. Additional AFUDC will amount to $22 million and the balance of $35.1 million represents additonal money that will have to be raised (Id.).

98. DP&L's share of these costs is $65.5 million. Approximately $46 million of the $65.5 million will have to be raised with the remainder being non-cash AFUDC (Id.).

99. Construction costs for Zimmer Station are included in the overall requirements for capital and have been or will be financed as a part of the Applicants' overall needs. In 1980, CG&E issued 500,000 shares of 10.20% series $100 par value preferred stock, an additional 3.4 million shares of common stock at a price of $16.125 per share, and $100 million of 12% first mortgage bonds to finance part of its construction program including Zimmer Station. The issuance of additional common stock through the Employee Incentive Thrift Plan, Employee Stock Ownership Plan and Dividend Reinvestment and Stock Purchase Plan raised approximately $14 million in 1980 and is expected to raise $16 million in

1981. In January, 1981, CG&E issued 300,000 shares of 12.52% series $100 par value preferred stock. Presently, CG&E is raising capital through the issuance of short-term debt obligations at interest rates ranging from 17 7/8% to 20 1/2% (Id.).

100. In 1980, C&SOE issued $80 million of 13 5/8% first mortgage bonds, $30 million of which was new capital, and received a $30 million capital contribution from its parent company, American Electric Power Company, Inc. ("AEP") to finance part of its construction program including Zimmer Station (Id.).

101. For DP&L, construction costs for Zimmer Station are included in the overall requirements for capital and have been financed as a part of that company's overall needs (Id.).

102. Determination of future financings for the three companies are subject to several factors, including the amount and timing of rate increases, internal generation of funds, and the course of construction program of each company. Present estimates indicate that CG&E will sell approximately 2,500,000 shares of common stock in the first half of 1981 and will sell debt securities later in the year. It is presently expected that any additional capital which may be required in 1981 by CG&E would be provided from short-term bank loans or the issuance of commercial paper.

Prices and terms of these securities would be determined by the financial market at the time of the sale (Id.).

103. The record indicates that C&SOE will sell approximately $60 million of first mortgage bonds in the first half of 1981 and will receive a $40 million capital contribution from AEP sometime during the year. It presently is expected that any additional capital which may be required in 1981 would be provided from short-term bank loans. Prices and terms of these securities would be determined by the financial market at the time of the sale (Id.).

104. DP&L's future needs will be fulfilled by the issuance of varying types and amounts of securities, including debt, common and preferred equity, leasing arrangements, and, in the interim, short-term borrowings. The timing, amount, and type of specific financings has not been determined and is subject to several factors, including the amount and timing of rate increases, the amount of internally generated funds, market conditions and the amount of the total construction program (Id.).

105. The unexpended costs to complete construction of Zimmer will be incurred during 1981 and 1982. CG&E's share of these costs, $81.4 million compares to the Company's total estimated construction costs of $411 million for 1981 and 1982. For these years, costs to complete Zimmer Station will represent approximately 19.8% of total estimated construction costs (Id.).

106. C&SOE's share of remaining construction costs during 1981 and 1982 is $57.1 million which compares to the Company's total estimated construction costs of $302 million for 1981 and 1982. For these years, costs to complete Zimmer Station will represent approximately 18.9% of total estimated construction costs (Id.).

107. During 1981 and 1982, DP&L's total estimated construction costs are $521 million. Therefore, the unexpended costs will represent about 12.6% of the overall construction budget for the period involved (Id.).

108. Considering the Applicants' ability to finance the capital costs of the Zimmer Station, their bond ratings, their record of obtaining rate relief, and in view of the lack of any evidence to the contrary, the Board finds that the Applicants have the financial qualifications to complete construction of the Station.

TMI Capital Costs

109. As a result of the TMI accident, the NRC imposed requirements with regard to additional training, equipment, systems, structures and facilities, including those relating to emergency planning, for facilities such as Zimmer. The Board asked that it be informed of the specific capital costs to be expended by these Applicants to fulfill NRC requirements. This information is provided in Applicants' Exhibit 8, Response to Question 1. A further breakdown of

these costs were given during the proceeding (Tr. 4124-4133, 4200-03, 4237-41, 4287-88). Included in the $30 million total TMI capital costs was an approximate 5% contingency fee. Since certain equipment has not been procured and total agreement has not been reached with all government agencies regarding emergency planning, certain of these figures represent best estimates. As an example, witnesses for the Applicants stated that costs associated with development of the emergency plan could increase as an upper limit by $2 million. On the other hand, construction of the Technical Support Center was proceeding on the basis of detailed estimates and drawings (Tr. 4249). Approximately half of the items are proceeding on a similar basis (Tr. 4132).

110. Inasmuch as the estimates appear reasonable, considering the contingency added, and giving due allowance for possible added costs and viewing the TMI costs against the total capital costs of the facility and the construction budgets of the three companies, and their proven ability to finance the project, the Board concludes that there is reasonable assurance that from a financial viewpoint the TMI items can be constructed (Appl. Exh. 8, Response to Question 2).

Costs of Operation

111. The Applicants have provided costs of operating the facility in accordance with 10 C.F.R. Part 50, Appendix C in

Appl. Exh. 7, Response to Question 1.A. The figures include nuclear fuel expense, operating and maintenance expense, taxes and return on investment. A return on investment of 10.52% was used which represents a weighted average of the present return of the three owners (Tr. 4270-71). The rate of return would be expected to rise in the future (Tr. 4271). Included in the fuel expense is an allowance, based upon the latest Department of Energy estimates for disposal of the spent fuel (Tr. 4034-35). The depreciation expense category includes an allowance for decommissioning costs (Tr. 3679). The cost of servicing the debt associated with the financing of the construction of the Station is included in the return figures (Tr. 3679-81).

112. The costs of operation of the facility would be recovered from the ratepayers of the three companies (Tr. 4219-20). That portion of the costs of Zimmer not already included in the rate base would be included in the rate base of the three companies by ratemaking proceedings, probably in 1983 (Tr. 4220, 4233). With regard to these three utilities, the Public Utility Commission of Ohio ("PUCO") has acted favorably in each of the ratemaking proceedings brought before them (See, e.g., Tr. 4231 and Appl. Exh. 7, Response to Question 5.b.). When a request for emergency rate relief was requested, PUCO has acted on an expedited basis (Tr. 4231). The three companies have in the past demonstrated an improved and improving financial

picture, due in part to the actions of PUCO (Tr. 4062; 4065-66; 4075-76; 4085; 4159-60; 4221-22; 4276). Based upon these factors and the evaluation of the Staff, the Board finds that the standard of reasonable assurance set forth in the Commission's rules and regulations has been met.

Decommissioning

113. The Applicants' plans for decommissioning are based upon the Atomic Industrial Forum ("AIF") report published in November, 1976, entitled, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives." This study provided cost estimates in 1975 dollars for several decommissioning alternatives for BWR plants of both 1160 MWe and 550 MWe sizes. This study utilized previous decommissioning experience in developing the modes and costs of decommissioning (Appl. Exh. 7, Response to Questions 2 and 3 at 1; Tr. 4009). In planning for decommissioning of the Zimmer Station, the Applicants selected the "entombment" mode which consists of temporarily entombing the facility for a cooling period of about 104 years, followed by dismantling and removal of the structures which were radioactive at the end of life of the facility. It was assumed that a security force will be required to guard the entombed facility for the 104 year cooling period (Appl. Exh. 7, Response to Questions 2 and 3 at 1). The methodology utilized in the AIF study was found to be still valid today (Tr. 4003). Temporary entombment has already been utilized in decom-

missioning nuclear reactors (Tr. 4008). The selected mode minimizes occupational exposure and the environmental impact (Tr. 4026).

114. There are four components of total decommissioning cost: (1) cost of prompt dismantling and removing non-radioactive structures at the end of the 33 year life; and (2) initial entombment cost; (3) annual surveillance and maintenance costs for the next 104 years; and (4) cost of dismantling and removing remaining structures at the end of the 104 year cooling period. This final step includes the final disposal of structures as well as their dismantling and removal (Tr. 4022-23). No further expenses are incurred after this final dismantling/removal. The AIF estimates for these four components for an 1160 MWe BWR and for a 550 MWe BWR were interpolated between to obtain the estimates for the 800 MWe Zimmer plant (Appl. Exh. 7, Response to Questions 2 and 3 at 1; Tr. 3638). Credit for the value of the land after the decommissioning project is complete was also taken into account. The estimate for decommissioning the Zimmer Station is $35.88 million in 1983 dollars (App. Exh. 7, Response to Questions 2 and 3, Table I). A 6% annual inflation rate was utilized from 1975 through 1979. A 6.5% annual inflation rate has been used after 1979 in calculating the cost in 1983 dollars (Id. at 2).

115. During the course of the hearing it was noted that Battelle Memorial Institute had prepared for the NRC a study regarding the decommissioning of a boiling water reactor (NUREG/CR-0672)(Testimony of Michael L. Karlowicz, Jr. Addressing the Financial Qualifications of The Cincinnati Gas and Electric Company, Columbus & Southern Ohio Electric Company and The Dayton Power & Light Company to Operate the Zimmer Facility, following Tr. 4428-4429 (hereinafter "Karlowicz Testimony") at 11).

116. The Staff utilized costs derived from the Battelle study in evaluating decommissioning costs (Karlowicz Testimony at 10-11, 18-20). The study utilized a 100 year period between initial entombment and the starting of dismantlement. For the initial entombment and deferred dismantlement decommissioning method, which approaches the Applicants' proposed method most closely, the cost used by the Staff was $64.5 million (Id. at 11). According to the Staff, this would, utilizing its methodology, translate into an annual total sinking fund payment of $4.5 million to be split among the three owners (Id. at 19-20).

117. The Applicants have compared cost estimates and other aspects of the AIF and Battelle studies and have concluded that the AIF study is still the best basis for analysis (Tr. 4616, 4632-33). For example, the Battelle study allowed six years for the initial entombment while the

AIF study allows a 34 month period. The difference is based upon more decontamination work, including cutting, packaging and shipment of radioactive material offsite associated with the Battelle study, leading to additional administrative and rental costs as well as direct costs, as well as a number of other factors (Tr. 4617-18). The Applicants testified that the AIF Study methodology is also better environmentally because it reduces the occupational dose (Tr. 4626-29, 4630-31). The AIF approach is based upon the physical fact that if left in place, the radiation on certain systems will decay down to a point, after 104 years, that conventional techniques may be used for demolition and the occupational exposures would be reduced (Tr. 4583-84). The Board finds that the estimates utilized by the Applicants in analyzing decommissioning costs to be reasonable.

118. On cross-examination, counsel for ZAC-ZACK attempted to demonstrate some inconsistency between estimates of decommissioning costs appearing in the present testimony and those previously found in the Staff's Safety Evaluation (Appl. Exh. 9, for identification). However, Applicants' witnesses were able to reconcile these figures. The scope of the original estimate was limited to the dismantlement of structures and systems over and above those found at an equivalent fossil plant. This basis has now been changed to allow the sinking fund estimate to be based upon the

entire costs of decommissioning the plant (Tr. 4600-02). Considering this and utilizing the same base year, there does not appear to be a discrepancy (Id.).

119. The 6.5% inflation rate projection utilized by the Applicants is conservative considering past experience and projections utilized by the NRC itself (Tr. 4013). Between 1965 and 1980, the Consumer Price Index rose at a compounded average rate of 6.3% a year. In comparison, the NRC utilized an inflation rate of 6.2% per year between 1980 and 1990, and 5.6% per year between 1990 and 2017 (Id.). The Applicants' expert witness termed the rate utilized as ultraconservative, tending to increase the projected annual fund payment (Id.). The Applicants' expert witnesses also testified it was not proper to project short term current inflation rates into the future inasmuch as, based upon historical data, they appeared to be an aberration (Tr. 4017).

120. Intervenors would apply the same rate of escalation of costs of construction of nuclear power plants to costs of decommissioning. However, such approach is invalid. The increased costs of construction of a nuclear plant are associated not only with escalation, but with interest on investment, changes in scope and increased design requirements (Tr. 4004). Such experience has no relevance to decommissioning which is better defined and more limited in scope (Tr. 4012). In fact, even if an examination of the cost studies for construction of the Zimmer Station is made,

considering the time frames for operation and the original scope of the estimates, they were not far in error (Tr. 4010, 4583-84). Thus, the Board finds no valid basis for attempting to correlate the rise in original construction costs with decommissioning costs (Tr. 4583-84). In fact, inasmuch as other plants would be scheduled to be decommissioned prior to Zimmer, the efficiency of the operation would be expected to improve and the costs thereby reduced (Tr. 4005). Such credit was not taken in estimating costs.

121. The Applicants' witnesses freely agreed that it is not possible to predict the inflation rate in the future and it may rise or fall (Tr. 4021-22). Based upon historical data and the fact that investors would not continue to invest on a rate lower than the inflation rate, the inflation rate may not be looked at in isolation. It must be reviewed in conjunction with the assumed earning rate on the fund (Tr. 4017-18, 4573-75). For example, the Applicants used a tax free rate of return of 6.0% associated with the 6.5% inflation rate. Similarly, the Applicants testified an inflation rate of 8% should be correlated with a tax free rate of return of 7.1%. Changing these two assumptions only, the calculated annual payment was $4,766,005 (Tr. 4047-48). For a 10% inflation rate and a correlated 9.2% tax free earning rate, the annual contribution is $8,886,100 (Tr. 4049). These figures were not advanced by the Applicants as realistic

inflation rates or return rates upon which to determine the sinking fund payment, but merely to illustrate the error in Dr. Estes' testimony. The Board views such values as an indication of the gross overstatement of sinking fund payments proposed by the witness for MVPP, Dr. Estes (up to $123 million per year) who ignored this correlation completely.

122. The companies presently plan on obtaining the funds required for decommissioning the plant by collecting from their customers through annual depreciation charges during the service life of the facility amounts which will be deposited with a trustee (Tr. 3679-80). The sum of the amounts so deposited plus earnings thereon would be adequate to pay the decommissioning costs. Based on a 6.5% annual inflation rate from 1983 through the final dismantling/ removal of remaining structures in the year 2120, and a 6% tax-free interest rate on funds deposited with the decommissioning trustee, the annual payments to the decommissioning trustee over the 33 year plant life required to provide the necessary funds for each of the four components of decommissioning is $3.55 million dollars (Appl. Exh. 7 Response to Questions 2 and 3, Table II).

123. The $3.55 million payment is determined by looking at the four cost components of decommissioning as determined in 1983 dollars (Exh. 7, Response to Questions 2 and 3, Table I) and utilizing basic, well accepted, financial and

engineering economics methods to determine the annual payments. The first two components, prompt dismantling and entombment, will be accomplished at the end of useful life assumed to be 33 years. Thus the 1983 costs have to be escalated into 2016 dollar costs utilizing an inflation rate of 6.5%. Then utilizing a sinking fund equation, the annual contribution invested at 6% which would produce these amounts is calculated (See Table II, components (a) and (b)). The third component, the annual cost for surveillance and maintenance (Table I, component (C) divided by 104) is first escalated to the end of the useful life of the facility. Next the fund at the end of useful life which will fund these annual payments considering a 6.5% inflation and an investment rate of 6% is determined. The annual payments to accumulate this fund at the end of the 33 year life is determined as for the first two elements. The fourth element, dismantling costs, are escalated for 137 years (33 year useful life plus 104 years of cooling) at 6.5%. Then the fund which when invested at the end of useful life at 6% to produce this amount is determined. The annual payments which would produce this fund is determined. The land value is determined in a similar manner, but it is a credit. The four components are summed to produce the $3.55 million annual payment (Exh. 7, Response to Questions 2 and 3; Tr. 4019-21). Dr. Estes, a witness for MVPP used the same

methodology and the basic algorithm does not appear to be in dispute.

124. Dr. Estes, an accountant, testified on behalf of the MVPP with regard to decommissioning costs. He candidly admitted that he was not an expert with regard to nuclear power decommissioning (Tr. 4403, 4350), the design of the Zimmer Station (Tr. 4393-94) and economic cycles (Tr. 4317). While, as noted above, his computations were arithmetically correct, the Board substantially discounted his testimony because of his admitted lack of expertise, his inability to justify in terms of economic reality his assumptions and because of his seeming bias and prejudice as demonstrated by his attempt to exaggerate the costs of decommissioning to the residential customers of the Applicants. If not intentional, it indicated his complete lack of understanding of utility operation, financing practices, and economics.

125. The calculations presented by Dr. Estes with regard to the effect of Zimmer decommissioning costs on residential customers are simply in error. He assumed that residential customers of the three companies utilized 7000 Kw hrs annually, not based upon actual experience of the Applicants, but upon statistics from other distant utilities and in some part upon his own electrical usage in Wichita, Kansas (Tr. 4419-21). He then determined a per kilowatt hour cost for decom-

missioning and multiplied this by 7000 Kw hr per residential customer and deemed this to be the cost to customers.

126. The error in this calculation can be viewed in a number of ways. If the number of residential customers of the Applicants were multiplied by Dr. Estes' calculated annual charge, it would far exceed the sinking fund payment of $3.588 million. The effect of the calculation would be to assume that Zimmer's output is many times its rated capacity. Looked at another way, inasmuch as Zimmer supplies approximately 8% of the Applicants' capacity, and it is not possible to identify where consumed electricity has been generated, the charges calculated by Zimmer should be multiplied by that factor (Tr. 4329-30). Viewed from still a different perspective, Dr. Estes has artificially attributed a severe penalty to Zimmer without recognizing the lower operating costs associated with it. Viewed in any light, Dr. Estes' work is simply erroneous. He himself admitted the error during the hearing (Tr. 4332-33, 4421).

127. During the hearing, Dr. Estes admitted that there was a correlation between the inflation rate and the rate of return on earnings although his prefiled testimony increased the interest rate while keeping the earnings rate constant (Tr. 4318-20), thereby shedding doubt on his entire testimony. While he tried to rehabilitate himself by stating that the values in his testimony represented after tax yields based

upon a pretax yield of 2% above the inflation rate with an effective tax rate of 40%, this does not represent a realistic case (Tr. 4322, 4338, 4575). Dr. Estes stated he was not aware of returns on municipal bonds and therefore it was not possible for him to come to a valid conclusion regarding investment choices for the sinking fund (Tr. 4339).

128. The Applicants' expert witnesses demonstrated why Dr. Estes' calculations showing a gross deficiency in the Applicants' accumulated decommissioning fund was in error. They showed that for a variety of realistic assumptions there would be a surplus above that predicted by Dr. Estes (Tr. 4578). The first example was with the investment rate equaling the inflation rate. Such assumptions are justified based upon the investment experience that investors will not accept too low a return for any sustained period (Tr. 4575). The witnesses testified that no trustee would invest in taxable securities when tax free bonds will have a greater yield (Id.). Thus the Applicants examined the fund built up using a 9.61% rate for tax free bonds available in November 1980 (Tr. 4576). A further example yielded an after-tax yield of 11.77% when preferred stocks were invested (Tr. 4576-78). As a final example, if the IRS gave tax free status to such funds, presently available investments at 15% would accumulate a large surplus (Tr. 4578).

129. While inflation and earnings rates cannot be predicted into the future, the Board finds that the approach utilized by the Applicants for developing the sinking fund payments to be a reasonable one. The fund trust will be an institutional fiduciary who will be constantly monitoring the investments to assure the greatest return (Tr. 4606, 4613-14), a goal in which even Dr. Estes concurs (Tr. 4395, 4397). Meanwhile, the Company would be reviewing the fund payments and adjusting them periodically to take into account changes in a number of areas, e.g., to reflect new or different technology and changes in service life and to assure that the necessary fund is being accumulated (Tr. 4022, 4014, 4257-58, 4579, 4619). Inasmuch as the funds for decommissioning would be part of the ratemaking proceedings, the PUCO would monitor and regulate contributions to the decommissioning fund (Tr. 4258, 4613-15).

130. In any event, the NRC has no requirement that the sinking fund method could be used (Tr. 4515). The Applicants could provide for the entire amount of decommissioning or any shortfall of the sinking fund at the time the money would be needed from the current operations (Tr. 4515-16, 4586, 4598). Approximately half the funds would be spent after 33 years and the remaining balance used to fund the remaining steps. It should be pointed out that toward the end of the 104 year entombment period, the radioactivity

will have decayed to levels which would permit unlimited access.

131. The Board thus finds that the Applicants have taken a reasonable approach to decommissioning. The Board is satisfied that PUCO will monitor the fund to assure that it is responsive to changing conditions. In addition, the NRC will continue in its monitoring function to assure that necessary steps for funding decommissioning are being taken.

132. As a final matter, the Board will take official notice of the pendency of an NRC rulemaking proceeding with regard to decommissioning to determine, inter alia, whether to consider developing more definitive decommissioning criteria for utilization facility licenses and to consider whether funding or other surety arrangments should be required before the issuance of licenses (Decommissioning Criteria for Nuclear Facilities, Advance Notice of Proposed Rulemaking, 43 Fed. Reg. 10370, 10371 (March 13, 1978)). Thus, considering the steps taken by the Applicants, the regulatory climate, and the fact that definitive Commission guidelines on decommissioning methods and financing should be coming out in the near future, the Board finds it inappropriate to condition the license to require any specific method of funding decommissioning or require any specific amount be set aside. Such action would be generic in

nature and should await the completion of the Commission's rulemaking proceeding. Pennsylvania Power & Light Company (Susquehanna Steam Electric Station, Units 1 and 2), LBP-79-6, 9 NRC 291, 314 (March 6, 1979). The Board finds the actions taken by Applicants to be appropriate.

The Costs of An Accident

133. The Licensing Board asked that the question of the ability of the Applicants to withstand the costs of various contingencies, including extended shutdowns of the reactor caused by problems arising at the Zimmer reactor (up to a maximum of a TMI-type accident) or by generic problems similar to those which have arisen at existing reactors and which have caused shutdowns at other reactors potentially subject to those problems, be addressed (Tr. 3653).

134. The Applicants emphasized the difficulty in addressing the question in specific terms, but discussed a number of generic considerations in detail which were responsive to the Board's question. The Applicants stated that as a result of operating experience and the TMI accident there have been significant improvements to minimize extended outages and reduce the risk of accidents (Tr. 3654). The fundamental point is that any accident or long term outage would have unique characteristics and would have to be dealt with as it developed. The companies would have to resolve financial considerations associated with an accident or outage to the satisfaction of PUCO (Id.).

135. It was emphasized that since the Zimmer Station is a BWR, a TMI type accident could not occur. Nevertheless, improvements are being incorporated into the facility to aid the operators in general accident prevention and mitigation (Tr. 3655).

136. If nonetheless the TMI-type accident is hypothesized to occur, the Applicants calculated that it would cost approximately $835 million to decontaminate and decommission the Zimmer Station reactor (Tr. 3655, 4042-43). Of that amount, $300 million would be paid for by insurance proceeds (Tr. 3662). Next the accumulated decommissioning fund would be used to offset the remainder. This money would have to be raised over a period of 4-5 years (Tr. 4080, 4095). The remainder would be borne by the three owners in proportion to their ownership of the facility (Tr. 3656, 4041-42, 4060). Such costs when distributed among the three companies would not have a substantial effect on rates or on the companies' financial picture (Tr. 4056, 4072, 4304).

137. With regard to replacement power costs, the Zimmer Station is a single unit facility. In contrast, the accident at TMI-2 caused the sister unit to be shutdown and taken out of the ratebase (Tr. 4507-08). Zimmer represents a smaller portion of the CCD system installed capacity (approximately 7.4%) than TMI Units 1 and 2 did of the GPU system (approximately 21.5%)(Tr. 3656). Thus the owners should be in a better financial position to respond to a TMI-type accident (Id.).

138. The Applicants testified that under Ohio law the PUCO includes property considered "used and useful" in rendering electric service in the electric utility's rate-base. There are no laws or regulations in Ohio that specify the period of time that a plant may be taken out of service and still qualify for inclusion in the utility's ratebase. The Applicants stated that they assumed that the PUCO would act responsibly under the circumstances existing at the time of its decision (Tr. 3659).

139. In similar situations where a unit has been out of service for a long time for maintenance or other repairs, the PUCO has not removed the generating unit from plant in-service when it is anticipated that the unit will be returned to service following maintenance or repairs (Tr. 3659, 4266-67). There is also precedent for PUCO allowing costs to be amortized over a period of time (Tr. 4076). Thus if the Zimmer Station were permanently shutdown, the Applicants would look toward amortizing the undepreciated value of the plant (Tr. 4076-77).

140. The Applicants testified that replacement power were Zimmer shutdown would come from their own units and their systems would still have reliable reserve capacity (Tr. 3683, 4046, 4223-24, 4294-95).

141. Considering all the testimony at the hearing, the Board believes its questions have been adequately addressed.

The Board recognizes that it is not possible to give a precise answer to its somewhat speculative questions. The Board recognizes that it must presume a rational regulatory environment in viewing the response to its questions. The Board has not identified any significant deficiency in the response which would demonstrate that the owners of the Zimmer Station could not respond following a hypothetical shutdown or accident.

142. Based upon the evidence before it, the Board finds that there is reasonable assurance that the Applicants are financially qualified to complete construction, operate and decommission the Zimmer Station. We therefore decide that Contention 13 advanced by MVPP has no merit.

B. Uncontested Matters

Pressure Testing of Doors

143. During the prehearing conference, an affidavit executed by Robert Anderson, an ironworker who was employed to install and pressure check watertight doors at the Zimmer site, was submitted to the Board. The affidavit stated that during the course of a pressure test conducted by the contractor, 10 watertight doors leaked between the concrete and the steel angle which was imbedded into the concrete so that the door frame could be hung (Affidavit of Robert Anderson attached to the Direct Testimony of Thomas Vandel Regarding the Pressure Testing of Doors, following Tr. 1643 (hereinafter "Vandel Pressure Testing Testimony")).

144. The Office of Inspection and Enforcement ("I&E"), at the request of the Board, investigated this matter. Based upon this investigation, it was determined that the pressure test witnessed by Mr. Anderson was only a contractor proof test and not a license quality acceptance test. Subsequently the door frames were successfully repaired utilizing an epoxy plastic material. At the time of the initial inspection, some but not all of the quality acceptance tests had been successfully performed (Vandel Pressure Testing Testimony at 1-2; Tr. 2198-2200). Subsequently, I&E conducted a followup inspection, whereby it witnessed the final testing of the doors. Three of four doors tested passed the leak rate test. Necessary repairs will be made to the fourth door to correct two pinhole leaks and the necessary followup leak testing will verify adequate repairs undertaken (Direct Testimony of Thomas Vandel Regarding Pressure Testing of Doors and the Use of Improper Bolts for the Traveling Screen, following Tr. 3140 (hereinafter "Vandel Door and Bolt Testimony") at 1 and Inspection Report 50-358/79-23 appended thereto at 5-6). The Board has concluded that no safety problem exists or ever existed. The Board considers this matter to have been adequately resolved.

Bolts for the Traveling Screen

145. During the hearings held in June 1979, an affidavit was submitted to the Licensing Board alleging that stainless

steel nuts and bolts were not used in the installation of the "drag line" as was required. This item was reviewed by the NRC I&E during a site visit on July 17-20, 1979. It was established that the "drag line" is the terminology used by the affiant for the set of traveling screens installed in the water intake structure at the site, a non-safety related piece of equipment. This classification of equipment is usually not inspected by the NRC. Nonetheless, the stainless bolt and nuts concern was reviewed by the NRC inspector who determined that stainless steel cap screws and lock washers were used in the installation as specified by the manufacturer and that no installation errors regarding substitution of material occurred (Vandel Door and Bolt Testimony at 2 and Inspection Report 50-358/79-23 appended thereto at 4-5). The Board considers that this matter has been adequately resolved.

Alleged Electrical Deficiencies

146. MVPP submitted to the hearing board on June 29, 1979 an affidavit of an electrician who alleged that during the course of his employment at the Zimmer site he had observed problems and/or possible problems in seven areas. Pursuant to a request of the Licensing Board, the worker was interviewed by I&E and a site visit arranged. As a result of its investigation I&E determined that while some of the worker's allegations related to safety components, they had

been previously identified and analyzed by the NRC or by the Applicants or by both. The NRC concluded that the identified concerns were being adequately resolved by the Applicants (Direct Testimony of Jack Hughes and Thomas E. Vandel Regarding Electrical Deficiencies, following Tr. 3116 (hereinafter "Staff Testimony Regarding Electrical Deficiencies") at 1-7 and Inspection Report No. 50-358/ 79-19 (hereinafter "Report 79-19")) appended thereto.

147. The Board admitted the Staff Testimony Regarding Electrical Deficiencies only as it related to Contention 14. While the Board admitted the remainder of the document for the purpose of showing that the Staff performed the investigation as requested by the Licensing Board, it has perused the document and believes the Staff has done more than an adequate job in following up the Board's request (Tr. 3117).

148. With regard to those portions of the affidavit relevant to Contention 14, it was established that contrary to the affidavit's allegations, the National Electrical Code does not apply to the Zimmer facility. The applicable limitations regarding cable tray loading are (1) FSAR commitment (Section 8) that tray fill will not exceed 60% of cross sectional area, (2) Sargent & Lundy specified limitations of volume fill, forty pounds of cable per square foot (Applicants' Exh. 1, FSAR, Section 3) of cable tray maximum and allowable thermal heat (ampacity). S&L selected 33

computer selected cable routing points known to be the worst loading cases for designer review. In addition the NRC inspector observed and randomly selected 20 other points for review, i.e., both safety and nonsafety related, cable trays which appeared to be heavily loaded (Tr. 3118). The NRC inspector reviewed the results of the designers' calculations regarding the above stated limitations and verified the designer's determination that in one instance the percent cross sectional area fill for a non-safety related tray exceeded 60%; however, no other instance of the limitations being exceeded (Staff Testimony Regarding Electrical Deficiences at 5; Tr. 3127-30). The single instance of overfill in a non-safety related tray was being corrected. It was determined that the worst condition for volume fill (identified by the S&L review) is one tray that is loaded to 36 lbs/sq ft, the worst condition found of the NRC inspector's random sample was 29 lbs/sq ft, with the overall average in the neighborhood of 1/2 the 40 lbs/sq ft. The worst case ampacity was found to be 48 watts/ft, well below the allowable limitation. The results of the Staff's seismic hanger loading review was essentially the same as for the cable trays and no problems were found (Staff Testimony Regarding Electrical Deficiencies at 5-6 and Report 79-19 at 6-8).

149. The question of the addition of side rails was raised during the cross examination of the Staff witnesses

as well as the practice of laying in the cables on a random basis rather than laying the cables down in neat rows (Tr. 3125). Even if side rails are added to cable trays, the 60% fill limitation for cross sectional area is still based upon the original cross sectional area (Tr. 3124-25). By randomly laying the cables there is additional void space which permits a better dissipation of heat buildup (Tr. 3133-34). The random placement has no adverse effects on safety (Tr. 3136-37). Moreover, this type of fill does not affect the use of Kellum grips discussed previously (Tr. 3129-31, 3135). The Board finds that the additional evidence raised nothing to affect its conclusions regarding Contention 14.

Grinding of Control Rod Velocity Limiter

150. As a result of an affidavit given to the Licensing Board, an inspection was conducted by the Staff regarding the grinding of a chamfer in the upper corner of the control rod velocity limiter at the Zimmer Station. The modification was required to eliminate potential interference between the control rod and the fuel channel during the end of its insert travel. The workman executing the affidavit was interviewed to assure that his concerns were fully understood. The workman's concern related to metal chips allegedly left inside the control rods. These chips had been generated during grinding done in late February 1979 to

remove an oversized weld in the control rods. The affiant informed the Staff investigation that he was satisfied with the pregrinding cleaning job done to remove metal shavings left by the manufacturer (Direct Testimony of Federico A. Maura Regarding Metal Chips in Control Rods following Tr. 3497 (hereinafter "Maura Testimony) at 1-2).

151. The records of the modification, which was performed during the period of February 21-23, 1979, were reviewed by the NRC inspector who also interviewed Reactor Controls Inc., General Electric Co. and licensee personnel involved in the performance of the modification. Based upon the records and interviews, the Staff inspector determined that 80 control rods required grinding of a chamfer in one or more corners of the velocity limiter; all such modification work was done with the control rods in the vertical position; during the work, the corner holes and lower holes in the sheath were covered with tape or shim stock; polyethylene was used to cover approximately the lower 3 to 4 feet of the blades (Id. at 2-3).

152. The NRC inspector reported that Reactor Controls, Inc. and licensee personnel at the job claim no one informed them that metal chips had entered the sheath holes during the modification. They also stated the chips traveled away from the blade due to the position of the blade and grinder, and they personally did not see any chips in the blades

after the modification was completed and prior to reinstalling the blades in the reactor (Id. at 3).

153. At the request of the NRC inspector, a mockup of the grinding was made using a stainless steel 3 x 3 inch channel, half inch thick. Using the same grinder, burring tools and techniques used during the actual modification the inspector determined the direction of travel of the metal particles. In addition, the metal being removed was collected to determine the size of the particles (Maura Testimony at 3; Tr. 3501-02). Based upon such test the inspector concluded that most particles traveled at an angle away from the blade with a few particles traveling in the near vertical direction and no particles traveled in the direction of the blade (Maura Testimony at 3; Tr. 3518-20); and the largest particle found was approximately 1/4 inch long x 3/64 inch wide. The thickness was a few mils. Most particles were the size of sugar grain particles (Id. at 3-4).

154. Based upon analysis of this matter, it was determined that there is no heat transfer problem even if enough metal chips succeed in blocking the flow path between the absorber rods and sheath (Tr. 3502-05). However, relatively large chips trapped between absorber rods and the sheath, in the area where the control rod experiences the highest neutron flux exposure, could possibly generate small cracks after the absorber rod becomes less ductile (Maura Testimony at 4-

5, Tr. 3508-09, 3513-14, 3521-22, 3524-25). No safety problem exists because leaching of B_4C through wall cracks does not occur until after 50% local B^{10} burnup exists (Maura Testimony at 4-5 and attachments B and C thereto, Tr. 3510-12, 3526).

155. The design life of a control blade is defined as the time when its calculated reactivity worth has decreased by 10% of its original value. This value, which takes into account boron leaching, is equivalent to an average B^{10} depletion over the upper one fourth of the blade, of 34%. The safety significance of the boron loss with regard to shutdown capability and scram reactivity was evaluated and has been determined to be negligible (Maura Testimony, Id. at 5; Tr. 3528).

156. Based on review of the modification records, interviews with personnel who performed the modification, the results of the mockup of the grinding done on the blades, the results of up-to-date studies regarding B_4C leaching through cracks in the stainless steel tubing of the control blades, the conservative specification of the design life of the control rods (Tr. 3530-31), and the steps being taken by the NRC to continue monitoring this situation (Tr. 3531-33), it was the NRC Staff conclusion that any chips which may be left in the control rod blades at Zimmer Station do not represent a safety concern. The Board concurs.

III. CONCLUSIONS OF LAW

157. In an operating license proceeding, the Board is called upon to decide only the issues in controversy among the parties (10 C.F.R. §2.760a and Appendix A to 10 C.F.R. Part 2, Section VIII). In this case, the contentions and evidence have placed in issue the general subjects of compliance with 10 C.F.R. Part 50, Appendix I, cable tray manufacture, control rod design and manufacture, fire protection of cable trays, financial qualifications, emergency planning and environmental monitoring.

150. Based upon the foregoing Findings of Fact which are supported by reliable, probative, and substantial evidence as required by the Administrative Procedure Act and the Commission's Rules of Practice, and upon consideration of the entire evidentiary record in this proceeding, the Board makes the following Conclusions of Law:

(1) The requirements of 10 C.F.R. Part 51 have been met;

(2) The requirements of Section 102(2)(A), (C) and (E) of the National Policy Act have been met;

(3) The Board has thoroughly considered the foregoing Findings of Fact concerning the issues in controversy in this operating license proceeding and other matters which have been addressed in this Initial Decision and has concluded that the operating license should be issued as proposed.

(4) Control rods as manufactured and installed are capable of adequately performing their intended function.

(5) Cable trays as manufactured and installed are capable of adequately performing their intended function.

(6) Cable trays for which additional fire protection is required have been wrapped in a material which was qualified to perform its intended function.

(7) Even were the Moscow Elementary School to be in use, the requirements of 10 C.F.R. Part 50, Appendix I would still be met.

(8) The Applicants are financially qualified to engage in the activities to be authorized by the operating license in accordance with the Commission's regulations.

(9) Having considered and decided all matters in controversy among the parties related to operation, the Director of Nuclear Reactor Regulation should be authorized to make such additional findings on uncontested issues as may be necessary to determine whether or not to issue a full-term operating license for the Wm. H. Zimmer Nuclear Power Station.

(10) This decision shall not become effective until the requirements of Appendix B, 10 C.F.R. Part 2 have been fulfilled.

IV. ORDER

159. WHEREFORE, IT IS ORDERED that the Director, Office of Nuclear Regulation, is authorized upon making requisite findings with respect to matters not embraced in this Initial Decision in accordance with the Commission's regulations, to issue to Applicants an operating license for a term of not more than forty (40) years, authorizing operation of the Wm. H. Zimmer Nuclear Power Station at steady state power

levels not to exceed 2436 megawatts thermal; such license may be in such form and content as is appropriate in light of such findings, provided that such license is consistent with the conclusions of the Board herein.

160. In view of the Commission's Rules of Practice limiting the Board's jurisdiction in a contested operating license proceeding, the Board has made Findings of Fact and Conclusions of Law on matters actually put into controversy by the parties to the proceeding. As required by the Commission's Regulations, the NRC Staff will inspect the Zimmer facility prior to issuance of any operating license to determine whether it has been construed in accordance with the application, as amended, and the provisions of the construction permit. In addition, the license will not be issued until the NRC Staff has made the findings reflecting its review of the application under the Atomic Energy Act, which will be set forth in the proposed license, and has concluded that the issuance of the license will not be inimical to the common defense and security and to the health and safety of the public. Upon issuance of the license, the Applicants will be required to execute an indemnity agreement as required by Section 170 of the Act and 10 C.F.R. 140 of the Commisson's Regulations.

161. Exceptions to this Initial Decision may be filed within ten (10) days after service of this Initial Decision.

A brief in support of the exceptions shall be filed within thirty (30) days thereafter [forty (40) days in the case of the NRC Staff]. Within thirty (30) days of the filing and service of the brief of the Appellant [forty (40) days in the case of the Staff] any other party may file a brief in support of, or in opposition to, the exceptions.

IT IS SO ORDERED.

FOR THE ATOMIC SAFETY AND
LICENSING BOARD

Charles Bechhoefer, Chairman

Dr. M. Stanley Livingston, Member

Dr. Frank F. Hooper, Member

Dated at Bethesda, Maryland,
this ___ day of ____, 1981

APPENDIX A

Exhibits

Applicants' Exhibits

No.	Identified	Received	Description
1	597	605	Application, including FSAR, ER and FPER (with amendments)
2	1123	1125	Letter to R.F. Heishman from Earl Borgmann re IE Inspection Report 50-358/78-21
3A-3L	1532		Welding Procedure and Performance Qualifications Test Sheets
4	2007		Page 9-1, Husky Products, Inc. Quality Control Manual
5	2559		List of Individuals Receiving Quality Assurance Training from RCI dated June 27, 1978
6	2560		List of Individuals Receiving Quality Assurance Training from RCI dated July 26, 1978
7A*	3411	3417	Rev. 13 to Fire Protection Evaluation Report
8A*	3411	3419	Rev. 14 to Fire Protection Evaluation Report
7	3618	3652	Additional Financial Information and Page Changes to the Formal Application, submitted November 14 1981
8	3618	3652	Letter to Harold Denton from Earl Borgmann Responding to Three Staff Financial Questions
9	4483	4483	Chapter 20 - Staff Safety Evaluation Report - Financial Qualifications

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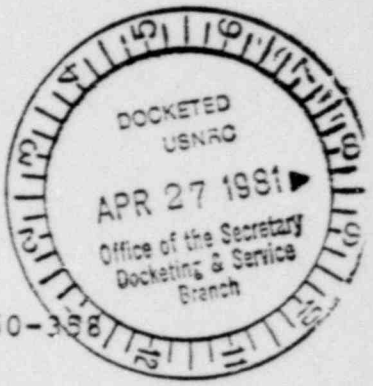
*/ Inasmuch as two exhibits were given the same designation, these exhibits have been designated 7A and 8A and have been referred to as such in this Initial Decision.

No.	Identified	Received	Description
10A-10C	4498	4609	Summary of Rate Increases for Applicants
11A-11D	4570		Decommissioning Costs for Zimmer Unit 1 - Four Tables Prepared at the Request of the Licensing Board
12	4572		Decommissioning FUNP Balances for Various Earned Investment Rates
		Staff's Exhibits	
1	745	745	Professional Qualifications of Richard S. Cleveland
2	754	754	Final Environmental Statement
3	754	754	Staff Supplement to Final Environmental Statement Regarding Radon
4	754	754	NUREG-0332, Health Effects Attributable to Coal and Nuclear Fuel Cycle Alternatives
5	754	754	Revised Tables, Summary and Conclusion to Draft NUREG-0332
6	754	754	Update of NUREG-0332
7	762	762	Letter to Earl Borgmann from Ronald Ballard enclosing revised draft Environmental Technical Specifications
		Dr. Fankhauser's Exhibits	
1	854	861	Enrollment Figures for Moscow Elementary School

Miami Valley Power Project's Exhibits

No.	Identified	Received	Description
1	1057	1119	List of Certified Welders Employed by Husky Products
2	1842	1849	Welder Qualification Program
3	1947	1950	Memo to E. McClung from Randy Pratt re Welding Qualification for J. Allen and M. Brock
4	1956	1970	Field Complaint of Crater Cracks in TIG Welding
5	2043		Affidavit of Donald Blanch



UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of	)	
	)	
The Cincinnati Gas & Electric Company, et al.	)	Docket No. 50-358
	)	
(Wm. H. Zimmer Nuclear Power Station)	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Applicants' Proposed Findings of Fact and Conclusions of Law in the Form of An Initial Decision," dated April 24, 1981, in the captioned matter, have been served upon the following by deposit in the United States mail this 24th day of April, 1981:

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