

CERTIFIED COPY
DATE ISSUED: 11/1/83MINUTES OF THE FIRE PROTECTION SUBCOMMITTEE MEETING
SEPTEMBER 23, 1983, WASHINGTON, D. C.

A meeting was held by the ACRS Fire Protection Subcommittee on September 23, 1983. The purpose of this meeting was to review the current status of Fire Protection Systems at nuclear power plants and to discuss incidents where actuation of fire protection systems had affected safety systems. Notice of the meeting was published in The Federal Register on August 15, 1983 (Attachment A). The schedule of items covered in the meeting is in Attachment B. The list of attendees is in Attachment C. A list of handouts is included in Attachment D. The handouts are filed with the office copy. H. Alderman was the Designated Federal Employee for this meeting.

Opening Statement

Mr. Ray opened the meeting at 8:30 a.m. He noted that the ACRS member present was Mr. J. Ebersole and remarked that Mr. C. Michelson would be present later in the day. He introduced the consultants as Dr. W. Lipinski and Mr. R. Patton. Mr. Ray noted that the meeting was being conducted in accordance with the Federal Advisory Committee Act and the government in the Sunshine Act. The subcommittee and consultants were polled to see if they had any comments or desired to make a statement. Following a negative response, Mr. Ray introduced Mr. Benaroya, Chief of the Chemical Engineering Branch as the first speaker.

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V. Benaroya, NRC - Chief, Chemical Engineering Branch

Mr. Benaroya remarked that the Browns Ferry Fire was the turning point in fire protection reviews. Prior to the Browns Ferry fire, general design criteria 3 was applied in a general manner and the fire protection review was not very extensive.

Following the Browns Ferry Fire, a committee was organized and its licensing recommendations were incorporated in a branch technical position which was issued in June, 1976.

During the operating plant reviews, there were many cases of disagreement with the guidelines by the licensees. At this point Appendix R to 10 CFR 50 was developed. Appendix R consists of the 15 items which were the major cause of disagreement. Of the 15 items of concern, three items were chosen to be backfitted in all operating plants. These were:

1. Emergency Lighting
2. Shutdown capability
3. Reactor coolant pump oil collection system.

In response to a question, Mr. Benaroya replied that the remaining 12 items of Appendix R were not required to be backfitted because they were not complex and the licensees did not have any problem in meeting them.

Mr. Benaroya concluded his presentation by noting that the Chemical Engineering Group had established a cost estimate for the Appendix R backfits at eight to twelve million dollars per plant. Mr. Benaroya expressed the opinion that this was felt to be a reasonable amount as compared to the overall cost of the plant. He noted that he has not seen anything in writing challenging the guideline estimates.

R. Ferguson, NRC -- Chemical Engineering Branch

Mr. Ferguson noted that following the Browns Ferry Fire, the review group published their recommendations in NUREG-0050 in February 1976. These recommendations fell in four categories. They recommended improvements in NRC fire protection guidelines, improvements in NRC evaluation procedures; the inspection and enforcement procedures related to fire protection; improvement in the fire protection programs at the facilities; and improvements in the local government emergency procedures, and their cooperation with the plants under emergency situations.

Mr. Ebersole raised a concern regarding the shutdown control panels. He noted that he saw nothing in NRC's plans to somehow standardize the concept of the shutdown control panel. His point was that the shutdown panels should be reviewed to take account of the fact that they themselves may present a shutdown hazard when something happens to them.

Mr. Ferguson remarked that a comprehensive fire hazard analysis had never been done at plants. The licensees were requested to perform fire hazard analysis at each plant. This consisted of consideration of the plant as fire areas or fire zones. Each area or fire zone was examined to determine what would happen if you lost everything within the area or zone. Then based upon the safety consequences, a decision had to be made as to what sort of fire protection would be provided. This would be a fire suppression system in that particular area.

Mr. Ferguson noted that guidance on manpower requirements were issued in June of 1978. The guidance prevented people from critical plant positions being taken out and responding to fires. The guidance stated that the personnel in the fire brigade should have experience or training in the safety significance of a fire.

Mr. Ferguson stated that part of the administrative control in the fire brigade training is to establish a fire pre-plan. Each fire area in a plant is surveyed and plans are made to determine how a fire in that particular area would be attacked.

Nick Fioravante, NRC, Auxiliary Systems Branch

Mr. Fioravante stated that there were two requirements in Section III-G of Appendix R which lead to an alternate or dedicated shutdown capability. The first is the separation criteria for Section III.G.2. The inability to meet separation criteria would lead to a requirement for alternative

shutdown capability. The second requirement leading to a requirement for an alternative shutdown system relates to the fire suppression system. This is the case where redundant trains are not separated sufficiently and the use of the fire suppression system in putting out a fire in one train could lead to damage in the other train. Then alternative shutdown capability would be required.

Mr. Fioravante defined alternative shutdown capability as alternative controls. He noted that they are using basically the same plant equipment they would use for other shutdown activities. The difference would be a remote control panel. He remarked that a few facilities have proposed the use of a dedicated shutdown or licensing concept under Appendix R.

Mr. Fioravante noted that the alternative or dedicated shutdown system assumes the loss of offsite power concurrent with the fire.

He mentioned that guidelines have been developed listing instrumentation that is required for safe shutdown. For PWR's it's pressurizer pressure and level, reactor coolant hot leg and cold leg temperatures, steam level, steam generator pressure and level, source range neutron flux.

For BWR's it is, reactor water level and pressure, and suppression pool level and temperature.

Mr. Wermiel noted that the equipment utilized for the alternative shutdown does not need to meet seismic category criteria, single failure criteria, and other design bases accident criteria. For a number of plants this has resulted in the use of non-safety related equipment.

Mr. Fioravante discussed isolation of the remote shutdown panel. He noted that if the remote shutdown panel contains redundant equipment, then there must be appropriate transfer switches and isolation switches so that a fire at the panel will not disable redundant controls in the control room.

T. Waniboch, NRC, Division of Licensing

Mr. Waniboch discussed the status of review of the technical reviews on Appendix R. He noted there were 48 plants involved. The exemption requests for 34 of the plant sites have been completed. The review of the shutdown modification of 36 of the plants have been completed.

He noted that as the plants were inspected, licensees recognized additional areas as not complying with the rule. After the inspection, the utility will usually either make the modifications necessary to conform or will try to justify an exemption request. The result is that additional exemption requests are received after the inspections.

V. Benaroya, Branch Chief, Chemical Engineering Branch

Mr. Benaroya briefly discussed fire protection guidelines for new plants. He mentioned that in January 1984, the Chemical Engineering Branch will ask the Commissioners if they want a rule for new plants. If the Commissioners want a new rule, then one will be developed. If the Commissioners decide the current rule is adequate, then the current rule will be revised to reflect what has been learned in fire protection.

In response to a question from a Committee member asking how a three hour barrier is defined, Mr. Benaroya responded that it is a structure that has passed ASTM 119 tests.

A Committee member questioned as to whether the barrier itself is merely part of a larger system which would have a heat sink on the cool side. He questioned whether performance of the barrier had a direct relationship to the heat sink that is present.

Mr. Benaroya responded that the quality of the barrier is relative. A three hour barrier is superior to a one or two hour barrier.

Mr. E. Berry remarked that when a barrier is tested in a laboratory, it is tested in a large room under natural conditions. However, in the case of cable wrap, it is tested in a wrapped condition to simulate the natural conditions. Thermocouples are installed within the wrap to monitor the temperature inside.

Mr. R. Ferguson, NRC

Mr. Ferguson discussed the PRA studies associated with fire events. Usually the PRA study is done by a utility. The NRC contracts with a subcontracter to review the PRA, then the NRC reviews the contractors report. He pointed out that Indian Point One had a relatively large contribution to core melt risk as shown by the PRA study. The NRC determined the core melt risk would be very low or negligible after the modifications were made.

One of the basic precepts of the fire protection PRA's is reduction of the frequency of fire. Mr. Ferguson cited an EPRI report which considered the number of fires since 1977, and reported a reduction of about one fourth.

A Committee member asked what the requirements were for reporting fires to the NRC. Mr. Ferguson responded that his understanding was that only fires that damaged safety equipment had to be reported. There was a discussion regarding the validity of the PRA numbers if the total number of reported fires might not represent all of the possible fires. The response was that the PRA will demonstrate changes in relative frequency.

Mr. Ferguson noted that Brookhaven is doing a PRA study of the NRC's fire protection requirements. The plan is to gauge the relative benefit of each kind of requirement, i.e., are Administrative controls of more value than retardant coatings etc. This may help to determine future approaches by the NRC.

A Committee member asked how the question of improper application of fire protection with a manual application was handled. The concern was a fire brigade accidentally damaging alternative systems with a hose while fighting a fire.

Mr. Ferguson responded that training of the fire brigade would help to prevent this.

W. Morris, NRC, Office of Research

Mr. Morris presented an overview of the activities that the Office of Research is engaged in to support the division of licensing. He noted that there were two main elements in the research. One is deterministic fire protection measures that are used in the regulations, and the other is more probabilistic used to develop perspectives on fire risk and fire risk analysis. He remarked that the focal areas for the fire research program are: spatial separation, control rooms, and spurious actuation of fire suppression systems.

B. Buchbinder, NRC, Division of Risk Analysis

Mr. Buchbinder described the program in the Division of Risk Analysis to address the development of appropriate methods to assess fire risk. He noted that there is a program underway with the acronym RMIEP which stands for Risk Methodology Integration and Evaluation Program. This program is the development and trial application of an integrated approach to PRA which will encompass all the external events.

Mr. Buchbinder observed that an important function of RMIEP was to develop areas where more research in fire risk assessment needs to be done.

A. Datta, NRC

Mr. Datta remarked that Appendix R requires that fire damage be limited so that hot shutdown capability is always maintained regardless of anything else. At least one of the redundant trains must be functional.

He noted that fire protection is designed to protect against a credible fire. Incredible fires can be postulated that would be beyond any fire suppression system.

Much of the ongoing work concerns fire characteristics. This concerns the type of material that is burning and the heat output in terms of BTU's per unit time.

He spoke of equipment response. The fire environment might cause a failure of the material or a degradation of the material. A key concern is equipment operability. The equipment must operate despite the fire.

Presently there isn't any accurate way to determine the environment surrounding equipment during the course of a fire. The current method is to rely on the engineering judgement of the inspecting engineers. Research is underway to develop computer codes to predict the surrounding environment of enclosures so that the environment surrounding equipment can be predicted during the course of a fire. When the code is developed, the effects of varying the room or enclosure size with the same size fire can be simulated.

Mr. D. Berry, Sandia

Mr. Berry discussed Sandia Research. He noted that there has been tests of cable ignitability, tests of fire among cables, tests of suppression effectiveness, tests of fire barriers and cable coatings, tests of barrier penetration seals, and tests of the damage susceptibility of cable. These tests have helped Sandia to make deterministic assessments of when things seem to be adequate. Mr. Berry remarked that tests have been performed on cables qualified to the IEEE 383 standard and on unqualified cabling. It was found that the unqualified cabling tends to fail as low as 300F-350F, whereas the qualified cabling tends to fail as a result of shorts at about 550F. The qualified cabling has some advantage over the unqualified cabling but both of the failure temperatures are below the auto ignition temperatures of the cabling.

Mr. Berry mentioned the probabilistic aspect of fires. He observed that barriers have doors that could be opened at the wrong time, dampers and penetration seals have failure rates. He noted that in an inspection of a Region III plant 14 out of 20 dampers were inoperable for one reason or another.

Mr. Berry noted that the adequacy of testing methods should be evaluated. He cited the testing of barriers and penetration seals at negative pressure. The cool air flow due to the negative pressure helps to prevent damage. When the same tests were performed under positive pressure, the failure rate was much higher. Mr. Berry remarked that fire induced damage can vary considerably in

its effects. If ignition occurs, the damage is apparent. However, the effects of high temperature, high humidity or corrosive effects might take longer to be apparent and to be observed. Damage to equipment that is not normally in operation or is used for very short time periods might not be immediately detectable.

Regarding the damageability and functional requirements, Mr. Berry listed some of the ongoing work. There is a test program to determine damage thresholds. Some work is going on regarding characterization of energy and mass release rates of fire to get some idea of how severe fires can be. A study is being done to determine how much reliance can be placed upon operators being able to do things under the severe conditions of a fire, and looking at the kinds of systems that may be most vulnerable to these kinds of spurious actuations in uncontrolled situations.

J. Boccio, Brookhaven National Laboratory

Mr. Boccio stated that he would talk about a research program called "Fire Protection Through Physical Separation". He noted that the program was not devised to advance the state of the art in fire science. The program was developed to gather information that is available and then use this information to the best of their ability. As an example, he noted that information was available regarding the energy release of a cable tray fire as a function of time within an enclosure. He remarked that they would like to utilize this information, couple it with an analytical model to determine how this energy redistributes in space and time, and from that make assessments on the heat related stresses as a function of space and time.

P. McKee, NRC, Office of Inspection and Enforcement

Mr. McKee presented an overview of the Appendix R inspections. He noted that they had found areas in some plants where separate redundant trains to the safe shutdown equipment or cables were not provided with alternate means of safe shutdown. He mentioned cases of cabling, charging pump cables, pressurizer heater cables, load center breakers and auxiliary feedwater pumps that were not adequately separated.

Mr. McKee observed that what the inspection findings so far appear to be telling us is that the licensees did not recognize or fully get into all the additional requirements that were required by Appendix R that were over and above those that were required by the branch technical position.

Mr. R. Ferguson, NRC

Mr. Ferguson remarked that he was going to talk about systems interactions, effective fire suppression, safety systems and systems interaction associated with that.

General Design Criteria - three recognized that fire protection should be consistent with other safety requirements. The Branch Technical position had statements about looking at the effects of fires and fire suppression systems.

During reviews systems interaction are considered. As an example, Mr. Ferguson noted looking at the loss of a component cooling water pump and seeing if the charging pump will still function. During the reviews the flow of water from the fire suppression system was considered. Attempts were made to determine where fire suppression system water would flow after its use on a fire.

There was a discussion of two incidents at plants of the actuation of CO₂ systems had pressurized the compartments in which they were actuated. In response to a question regarding who would be responsible for checking against over-pressurization, Mr. Ferguson replied that it was the responsibility of the fire protection system design.

Mr. Ferguson observed that the Staff had considered protecting safety equipment from inadvertent operation of the fire suppression system. One proposed solution was to locate safety equipment in an area where the potential for fire was so low a automatic suppression system is not necessary. In response to a question regarding seismic actuation of the fire suppression system, the reply was that by use of closed head sprinklers this problem can be avoided.

Minutes/Fire Protection
Sept. 23, 1983

- 15 -

Subcommittee Discussion

Mr. Michelson expressed his concern regarding the ability of equipment to withstand the fire mitigating function. Mr. Datta stated that a test program is planned for this very purpose. Mr. Michelson expressed interest in hearing about this in the future.

Mr. Ebersole desired to know how the fire inspection results are documented. The response was that the inspection results are issued in a summary report. The meeting was adjourned at 3:10 p.m.

NOTE: A complete transcript of the meeting is on file at the NRC Public Document Room at 1717 H St., NW., Washington, D. C. or can be obtained from Tayloe Associates, 1625 I St., NW, Suite 1004 Washington, D.C. 20006 (292) 293-3950

**Advisory Committee on Reactor
Safeguards, Subcommittee on Fire
Protection; Meeting**

The ACRS Subcommittee on Fire Protection will hold a meeting on September 23, 1983, Room 1167, at 1717 H Street, NW., Washington, D.C. The Subcommittee will review the current status of fire protection, and the effects of fire systems actuation on safety systems. Notice of this meeting was published August 15.

In accordance with the procedures outlined in the Federal Register on October 1, 1982 (47 FR 43474), oral or written statements may be presented by members of the public; recording will be permitted only during those portions of the meeting when a transcript is being

kept, and questions may be asked only by members of the Subcommittee and its Staff. Persons desiring to make oral statements should notify the cognizant Designated Federal Employee as far in advance as practicable so that appropriate arrangements can be made to allow the necessary time during the meeting for such statements.

The entire meeting will be open to public attendance.

The agenda for subject meeting will be as follows:

Friday, September 23, 1983 - 8:30 a.m. until the conclusion of business

During the initial portion of the meeting, the Subcommittee, along with any of its consultants who may be present, may exchange preliminary views regarding matters to be considered during the balance of the meeting.

The Subcommittee will then hear presentations by and hold discussions with representatives of the NRC Staff, its consultants, and other interested persons regarding this review.

Further information regarding topics to be discussed, whether the meeting has been cancelled or rescheduled, the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefor can be obtained by a prepaid telephone call to the cognizant Designated Federal Employee, Mr. Herman Alderman (telephone 202/634-1414) between 8:15 a.m. and 5:00 p.m., EDT.

Dated: August 30, 1983

Samuel J. Chalk,

Acting Assistant Committee Management Officer

PR Doc 83-27460-02 9-4-83 8:52 am

DELLING CLERK 7880-01-26

TENTATIVE SCHEDULE
ACRS FIRE PROTECTION SUBCOMMITTEE
ROOM 1167, 8:30 a.m. SEPTEMBER 23, 1983

<u>Time</u>		<u>Speaker</u>
8:30 a.m.	1. Introduction Statement	J. Ray, ACRS
	2. Summary of Fire Protection Activities	
8:35 a.m.	A. Introduction	V. Benaroya, NRC
8:40 a.m.	B. Fire Protection	R. Ferguson
	1. Browns Ferry Fire Guidelines (Branch Technical position)	
	2. Regulatory Guide 1.120	
	3. Appendix R	
9:10 a.m.	3. Alternate Shutdown	N. Fioravante, NRC
9:25 a.m.	4. Status of Appendix R	R. Waniboch, NRC
9:35 a.m.	5. Revision of SEP 9.5-1 and/or Fire Protection Rule for new plants	V. Benaroya, NRC
9:45 a.m.	6. PRA for Fire Protection	R. Ferguson, NRC
10:00 p.m.	7. Fire Protection Research	
	A. Introduction: Rationale for for Fire Protection Research Program	W. Morris/A. Datta, NRC
	***** BREAK *****	
10:45 a.m.	8. Past Sandia Research & Present Safety Issues	D. Berry, SNL
11:05 a.m.	9. Plans for Fire characteristics, equipment and control room vulnerabilities studies	D. Berry, SNL
11:30 a.m.	10. Computer Code Development	J. Boccio, ENL

Tentative Schedule
Septe. 23, 1983

- 2 -

<u>Time</u>		<u>Speaker</u>
12:00	***** LUNCH *****	
1:00 p.m.	11. Summary of Appendix R Inspection to date	C. Whitney, NRC
1:15 p.m.	12. Effects of Fire Protection on Safety Equipment	R. Ferguson/R. Dromerick, NRC
2:15 p.m.	13. Committee Discussion	
2:30 p.m.	ADJOURN	

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS MEETING
ON
FIRE PROTECTION

1717 H St. NW. Washington, D. C. 20555

ATTENDEES PLEASE SIGN BELOW

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NAME	BADGE NO.	AFFILIATION
Leon E. Whitney	A-2838	NRC
John L. Boccio	E-0174	BNL
ASHOK SINGHAL	E-0229	CHAM
Rocco Huson		EPM ✓
Larry V. Porcile	E-0114	AP&L
DAVID L. LOVE	E-0146	ARKANSAS PWR & LIGHT ✓
Lynn Canale	E-0176	The NRC Calendar ✓
JOHN F. GABRIELLI	E-0111	EBERCO SERVICES INC. ✓
L. Toth	E-0136	GASER ASSOCIATES ✓
V. Dubrowski	E-0135	EBERCO SERVICES INC. ✓
D. KUBICKI	B-1542	NRC
Russell L. Ebersole	E-0121	Toledo Edison Company ✓
Dennis L. Berry	E-0156	Sandia National Laboratories
Randall Eberly	B-155B	NRC
Burch Cassidy	E-0223	Westinghouse ✓
STEVEN KRISTEN	A-0511	NRC
WALTER MAYBEE		DOE ✓
Bill Morris	E-0479	NRC
Wm. V. Johnston	E-0473	NRC
Wm. V. Johnston	E-0314	DEFEND & LIBERMAN ✓
Wm. V. Johnston	A-0473	NRC

MEETING ROOM:

1167

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS MEETING
ON
FIRE PROTECTION

1717 H St. NW. Washington, D. C. 20555

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS MEETING
ON
FIRE PROTECTION

9-23-83

1717 H St. NW. Washington, D. C. 20555

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NAME	BADGE NO.	AFFILIATION
Larry K. Perscale	E-0114	Arkansas Power & Light
DAVID L. LONE	E-0146	ARKANSAS POWER & LIGHT CO.
John Boccia	E-0174	Brookhaven Nat'l Lab
ASHOK SINGHAL	E-0229	CHAM INC.
Dennis Berry	E-0106	Sandia Labs
J. M. P. H. F. P.	E-0101	Taylor Group ✓
Russ Elberole	E-0121	Toledo Edison Co.
D. F. STENCER	E-0219	DEBEVOISE & LIBERMAN
Roger Huston	E-0178	ERM
RICHARD PATTON	E-0215	Butterfield & Sons in London &
L. TATH	E-0136	GASSER ASSOCIATES
U. D. B. B. B.	E-0138	Gasser Associates
3. [illegible]	[illegible]	[illegible]
4. B. Cassidy	E-0223	Westinghouse
5. Cannon	E-0176	NRC Calendar
16. M. K. P.	E-0171	M. K. P. ✓
17. J. F. G. [illegible]	E-0111	EBASCO Services ✓
18. Robert W. Saindy	E-0217	EPRI - Boston
19. Michael P. Cass	E-0240	NORTHEAST UTILITIES
20. E. EVANS	E-0231	EDISON ELECTRIC INST.
21. K. P. Elliott	E-0249	NUS Corporation
23. E. Hansen	E-0144	Taylor Ass.

9-23-83

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LIST OF HANDOUTS

1. Fire Protection by Separation Research Program.
2. Alternative as Dedicated Shutdown Capability.
3. Numerical Modeling of Thermal Environment due to cable fire in power plants.
4. Fire Protection Research Objectives.
5. Safe Shutdown Inspection Site Selection Methodology.
6. Chemical Engineering Branch Presentation.
7. Status of Technical Review
8. Sandia Presentation.