

MEMORANDUM FOR: Charles E. Ader, Chief, Advanced Reactors and Generic Issues Branch, Division of Regulatory Applications, RES

THRU: Jerry N. Wilson, Section Leader, Advanced Reactors and Standardization Section, Division of Regulatory Applications, RES

FROM: Edward D. Thom, Senior Reactor Systems Engineer, Advanced Reactors and Generic Issues Branch, Division of Regulatory Applications, RES

SUBJECT: SUMMARY OF MEETINGS WITH GE, DOE, AND ANL ON THE ALMR PRISM DESIGN HELD IN ROCKVILLE, MD, ON OCTOBER 25 AND 26, 1990 NRC PROJECT 674

Three meetings were held with General Electric (GE), DOE, and Argonne National Laboratory (ANL) to discuss three review areas related to the Advanced Liquid Metal Reactor (ALMR) Power Reactor Innovative Small Module (PRISM) design. They are:

- (1) Seismic isolation.
- (2) Control room design, role of the operator, and multi-module control.
- (3) Metal fuel behavior during unprotected transient overpower (UTOP) events.

The agenda and attendees lists for each of these three meetings are attached. Because DOE considers the PRISM design to fall under the umbrella of its Applied Technology provisions, the viewgraphs used during these meetings are not included in this summary.

#### Seismic Isolation

The seismic isolation criteria and design were presented by GE. The isolators provide horizontal damping of ground motion. The reactor vessel and its internals, as well as equipment vaults which contain systems and components important to safety, are located on the seismic island.

A comprehensive research and development (R&D) program is supporting the design of the isolators and will be used in quantifying their performance. The DOE seismic isolation program (SIP) goals are to:

- (1) Reduce overall seismic hazard to facilities
- (2) Simplify design, construction, and equipment qualification
- (3) Reduce costs, and

- (4) Provide a technology base adequate for nuclear facilities.

With respect to PRISM, the SIP objectives also include assessment of issues of reliability, failure modes, and beyond design basis safety margins. The NRC staff has reviewed some of the SIP material and DOE and GE will be providing the staff with additional material.

The seismic isolation program is focused on the development of design tools (analytical model development), design guidelines, and reliable seismic isolation elements with well understood performance characteristics (isolation bearings properties and margin, materials development/environmental effects, etc).

The staff believes that the seismic isolation program will provide the needed information regarding the design and performance of seismic isolators for the PRISM design. The data will allow the NRC to make a final determination when the PRISM design certification is reviewed.

#### Control Room and Role of Operator

The design goal of the control room is to optimize plant operation. It is not safety grade. The remote shutdown facility (RSF) is a Seismic Category I, tornado hardened structure located about 40 feet from the control room building, and the distance traveled by the operator is estimated to be less than 120 feet. The RSF is equipped with Class 1E electronics to perform safety functions. The control room has no Class 1E components.

The NRC discussed reasons why a Class 1E reactor trip system should be added to the control room design, however the staff also indicated that the remainder of the control room need not be fully safety grade. The rationale for the Class 1E trip in the control room is based on uncertainties in the need for, and response time of, operator action to trip the reactor(s) for unforeseen events. At this time the staff is unable to make a determination on whether prompt operator action will be required. One role of the operator is to serve as a backup to the safety systems.

In addition to the RSF, reactor shutdown can be accomplished from the equipment vaults on the seismic isolated nuclear island. This feature appears to meet the intent of GDC 19. However, the habitability of the equipment vaults has not been addressed. GE will perform a habitability study of the equipment vaults.

The operator also provides a backup communications role during post-accident monitoring if the primary data links (telephone and microwave) are lost. The RSF features appear to be adequate for this function. Our review for the ability to perform these functions from the equipment vaults is, at this time, inconclusive.

Multi-module control will be demonstrated in the prototype facility.

#### Metal Fuel Behavior

The ternary metallic fuel (uranium, plutonium, and zirconium--U-Pr-Zr) used in the PRISM design was discussed by ANL. The discussions focused on the fuel conductivity and the characteristic of the unprotected transient overpower (UTOP) event.

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The key factor in understanding or evaluating the fuel is plutonium (Pu) redistribution with burnup. Some preliminary data suggested significant redistribution of the Pu. Newer data developed by ANL suggest that the redistribution is not significant. ANL, through DOE, will provide the staff contractor, BNL, with the new data. Open literature will be provided.

The fuel conductivity and Pu relocation, as well as relocation of the U and Zr in the fuel matrix, can markedly alter the results (or at least the interpretation of the outcome) expected from a transient or accident. The local composition of the fuel (U-Pr-Zr local concentrations) alters the temperatures at which the fuel will change states and ultimately melt and fail.

Other issues concerning modeling of the fuel were discussed. GE will provide BNL with the justification for the peaking factors.

The fuel conductivity issue can be addressed through design changes. GE will identify potential design changes which could reduce the significance of the UTOP event if the fuel R&D program cannot resolve the issue. Examples discussed include (a) reduced the rod stop settings to limit reactivity insertion, (b) lower the Pu content in the design fuel, and (c) lower the overall net thermal power level in the design core.

Edward D. Thom, Senior Reactor Systems  
Engineer  
Advanced Reactors and Generic Issues Branch  
Division of Regulatory Applications  
Office of Nuclear Regulatory Research

Enclosures:

1. Agenda & Attendee List for Seismic Isolation Mtg.
2. Agenda & Attendee List for Control Room Design Mtg.
3. Agenda & Attendee List for Metal Fuel Behavior Mtg.

cc: R. Hardy, GE                      C. Bigelow, DOE  
G. Gyorey, GE                      D. Petersen, ANL  
N. Grossman, DOE                  G. Van Tuyle, BNL  
H. Alter, DOE

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ENCLOSURE 1

Agenda & Attendee List for  
Seismic Isolation Mtg.

MEETING AGENDA  
ALMR SEISMIC ISOLATION  
NRC/DOE/GE  
WHITE FLINT BUILDING - ROOM 10-B13  
OCTOBER 25, 1990

<u>TIME</u>	<u>SUBJECT</u>	<u>PRESENTER</u>
9:00	PURPOSE AND GOAL OF MEETING	R. W. HARDY, GE
9:05	SEISMIC ISOLATION	C. E. BOARDMAN, GE
10:30	BREAK	
10:45	DISCUSSION AND IDENTIFICATION OF ACTION ITEMS	
11:30	ADJOURN	

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October 25, 1990  
 Meeting Attendees  
 Morning Session  
 PRISM Seismic Isolators - Design and R&D

Name	Affiliation	Phone Number
Edward D. Throm	NRC/ARGIB/RES	301-492-3735
Roger Kennelly	NRC/RES/DE/SSES	301 492 3893
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Charles Ader	NRC/RES/ARGIB	301-492-3765
Greg Van Tuyle	BNL	(516)-282-7960 FTS 666-7960





MEETING AGENDA  
ALMR CONTROL ROOM DESIGN  
NRC/DOE/GE  
WHITE FLINT BUILDING - ROOM 10-B13  
OCTOBER 25, 1990

<u>TIME</u>	<u>SUBJECT</u>	<u>PRESENTER</u>
1:00	PURPOSE AND GOAL OF MEETING	R. W. HARDY, GE
1:05	CONTROL ROOM DESIGN	Y. DAYAL, GE
2:30	DISCUSSION AND IDENTIFICATION OF ACTION ITEMS	
3:00	ADJOURN	

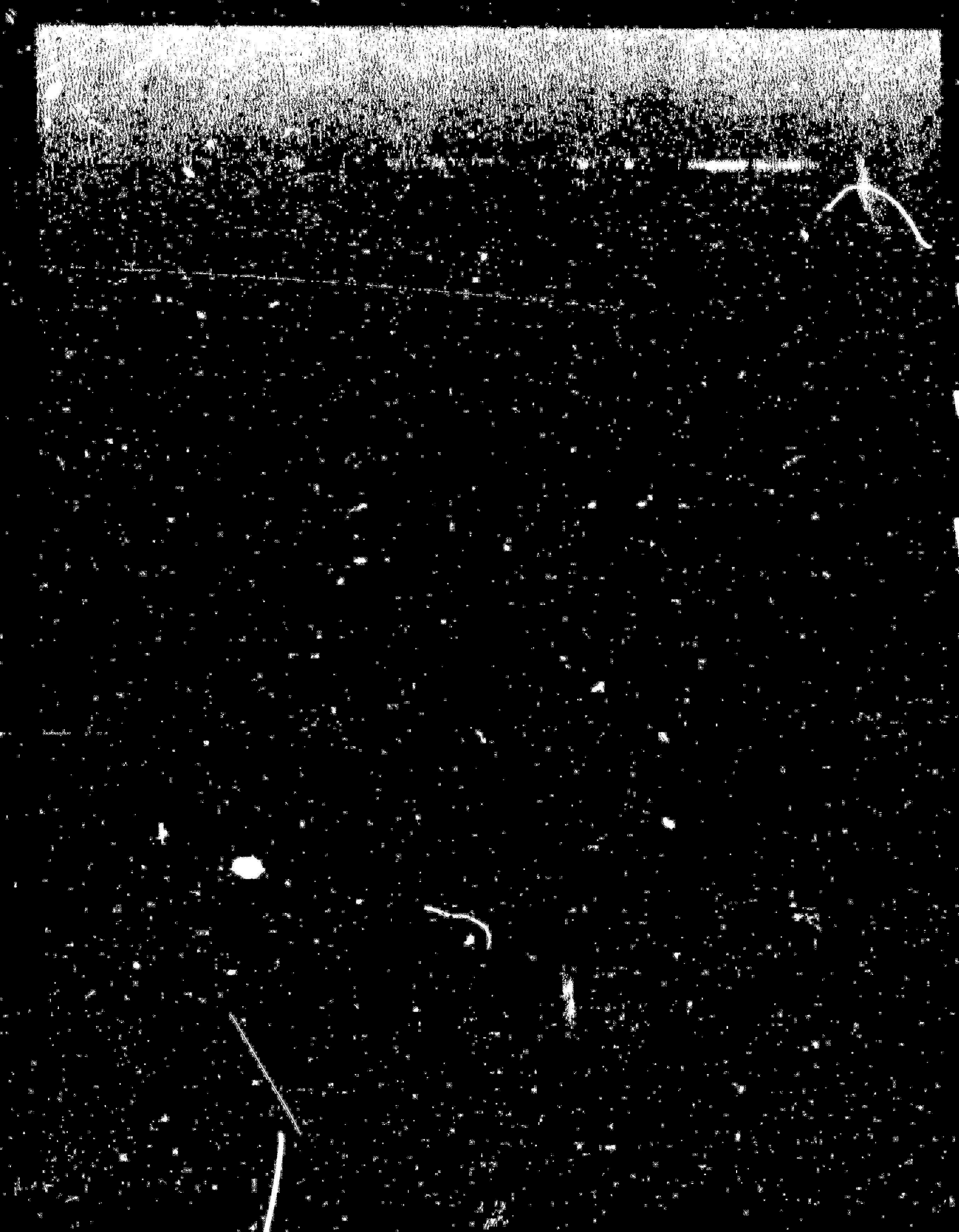
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October 25, 1990  
Meeting Attendees  
Afternoon Session  
PRISM Control Room Design

Name	Affiliation	Phone Number
Edward D. Thom	NRC/AN313/RSS	301-492-5735
<i>Orin Harley</i>	<i>GE</i>	<i>301-492-6177</i>
<i>Tom Dwyer</i>	<i>GE</i>	<i>301-492-6177</i>

ENCLOSURE 3

Agenda & Attendee List for  
Metal Fuel Behavior Mtg.



October 26, 1990  
 Meeting Attendees  
 Morning Session  
 PRISM - Metal Fuel Behavior During UTOP Events

Name	Affiliation	Phone Number
Edward D. Thom	NRC/ARGIB/RES	301-492-3735
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Gregory C. Slovik	BNL	(516)-282-7983 FTS-666-7983
HARRY Alter	DOE/NIE	(301) 353-3745 FTS 233-3745
Dean R Pedersen	ANL	708-972-3335 FTS 972-3335
Dave Yannitell	GE	202-637-4567
H. Pete Planchon	ANL	708-972-9792
Gerard Hofman	ANL	708-972-6683
Pete Williams	NRC/ARGIB/RES	301-492-3736
Chuck Boardman	GE	(408) 365-6522
Dick Hardy	GE	408-365-6557
MIKE BILLONK	ANL	708-972-7146

October 26, 1990  
Meeting Attendees  
Morning Session  
PRISM - Metal Fuel Behavior During UTOP Events

Name	Affiliation	Phone Number
James W. Kline	AEC	701-476-4101
Bob Moore	AEC	407-365-6170
E. Moore	AEC	407-365-6170