NUREG/CR-0910
PNL-3052
R5



# Pattern Recognition Methods for Acoustic Emission Analysis

P. G. Doctor
T. P. Harrington
P. H. Hutton

July 1979

Prepared for
the U.S. Nuclear Regulatory Commission

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute

Battelle

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PNL-3052

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(b) whether, on the basis of such items of noncompliance the Order should be sustained.

FOR THE NUCLEAR REGULATORY COMMISSION

John G. Davis
Acting Director
Office of Inspection
and Enforcement

Dated at Bethesda, Maryland
this 12th day of February, 1979

POOR ORIGINAL

A-205 Sheet 6 of 6

KEWAUNEE

## Fine proposal trimmed; WPS protests again

NUCLEAR NEWS / FEBRUARY 1979

The Nuclear Regulatory Commission reduced its proposed fines against Wisconsin Public Service Corporation's Kewaunee unit from $10 000 to $7000, but the action was not meant to be conciliatory. Similarly, WPS is unwilling to give ground—even as it protested the first proposal, it protested the second on January 2.

Since the fine is still proposed, and not yet imposed, the conflict has not reached the stage where a hearing is required. The NRC's Office of Inspection and Enforcement (OIE) is now studying WPS's protest, which seeks to have the penalty on one proposed citation reduced and the other eliminated entirely. The enforcement action pertains to a radiation overexposure to a worker on May 2, 1978, during a refueling outage. WPS was originally fined $4000 for failing to survey the area under the reactor (where the worker searched for a water leak), $3000 for not following radiation-area work approval procedures, and $3000 for failing to equip the worker with a radiation monitor. The worker's total dose was 2.9 rem.

WPS appealed the fine (*NN*, September 1978, p. 55), and the OIE reduced it—but implied no sympathy for the protest. Combining the first two citations into a single procedure-violation charge, with a $4000 fine, OIE acting director John Davis upbraided utility management for minimizing the significance of the incident that drew the fines, appearing to condone token efforts to follow procedures, and failing to acknowledge management's responsibility for licensed activities. The $7000 fine was proposed December 13.

In its January 2 response to the reduced-fine proposal, WPS president Paul D. Ziemer wrote, "We cannot see that [the] incident was other than that the [health physics] technician did not survey the area completely and our shift supervisor assumed that when he requested the survey, he was receiving adequate information. Certainly when he was told he would be entering a 75 rem field he knew that he was entering a high radiation area and planned to meet *that* condition." (Emphasis Ziemer's.) Further disputing the NRC's interpretation of the incident, Ziemer referred to the recently released NRC plant rating proposals (*NN*, January 1979, p. 41): "As it is evident that your organization uses evaluations of events to comparatively rate plants, we do feel that these investigations should be as complete and accurate as possible."

POOR ORIGINAL

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

December 31, 1974

APPENDIX XX
IMPOSITION OF CIVIL PENALTIES:
PROCEDURES FOR

To: All AEC Licensees

CRITERIA FOR DETERMINING ENFORCEMENT ACTION AND CATEGORIES OF NONCOMPLIANCE WITH AEC REGULATORY REQUIREMENTS - MODIFICATIONS

On November 1, 1972, the Commission issued criteria for enforcement actions to be taken for noncompliance with its rules and with license conditions in accordance with Sections 161, 186, and 234 of the Atomic Energy Act and Subpart B of Part 2, 10 CFR. On June 5, 1973, the Commission notified licensees that categories of violation with AEC regulatory requirements had been established because the Commission and the nuclear industry recognized that the significance of violations varies in the potential for affecting the health and safety of the public, the common defense and security, and the environment.

Based on a review of the experience with the criteria for determining enforcement action and the categories of noncompliance, modifications of the use of these criteria and these categories are being made. Comments explaining the modifications are enclosed as Attachments A and B.

The changes in the criteria and categories are primarily administrative in nature and should result in a higher level of understanding of the enforcement program - and the results of the program - on the part of the public and the industry. The basic purpose of the enforcement program - enhancement of the health and safety of the public, the common defense and security, and the environment - remains the same. The long standing practice of requiring corrective action for each identified item of noncompliance (Violations) is not changed. The enforcement program continues to emphasize corrective action where necessary to assure that regulated activities meet applicable requirements and are conducted with due regard for public health and safety, common defense and security and protection of the environment.

The modifications clarify the enforcement criteria and categories of noncompliance in the areas of safeguards and environmental matters and provide more explicit definitions to aid in a better understanding of the enforcement program. These definitions make clear the applicability of the program in matters of quality assurance, management control, and systems performance. Also, because the Commission relies to a degree on reports from licensees to assure that timely corrective action is taken and to assure that the industry is notified of important matters

APPENDIX A

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which are performed in such a manner as to constitute an immediate or potential threat to employees or the public; or for construction deficiencies which, if not suspended immediately, could eventually result in significant or essentially irreversible construction defects which impact on safety or which increase the potential for or the potential severity of an accident. If, for example, a quality assurance requirement for a specific construction activity is not implemented, this activity may be suspended until full compliance with the requirement is achieved.

Regulatory Operations Bulletins and Immediate Action Letters have been used not only to disseminate information but also as a means of accomplishing voluntary action on the part of licensees to inspect, report and make commitments to correct problems on a timely schedule. These two communications are recognized in these revisions. If these methods are ineffective in achieving the desired action, an order may be promptly issued requiring the action.

The enforcement record of a licensee may be a consideration in selecting the appropriate enforcement sanction in any given case. A licensee's enforcement history is evaluated in terms of distribution of items of noncompliance by importance and by the degree of repetitiveness of noncompliance with the same basic requirement. However, regardless of the history, consideration will be given to the more significant enforcement sanctions as a result of any inspection that reveals items of particular importance to safety and management.

The former system of severity categorization, which was the subject of a letter to licensees dated June 5, 1973, has been revised to place items of noncompliance with regulatory requirements (Violations) more clearly in perspective with regard to their relative significance to the public health, safety and interest and the common defense and security. As shown in Attachment B to this letter, the revised system for categorizing violations (items of noncompliance) has three levels of relative importance which are designated in descending order as (1) "violation," (2) "infraction," and (3) "deficiency," each of which is a legal violation in the statutory sense.

It should be recognized that the enforcement criteria and the categories of noncompliance apply only to situations where there is an apparent failure on the part of a licensee to meet regulatory requirements. The licensee may also be notified of deviations from commitments and appropriate codes, standards, or guides. The significance of these failures generally is judged against the actual or potential consequences resulting from the failures and from the standpoint of licensee awareness and management of his program. From the viewpoint of enforcement, a licensee failure that results in the potential for consequences is

## CRITERIA FOR DETERMINING ENFORCEMENT ACTION

In Connection with Licensing and Regulatory Provisions
of the Atomic Energy Act of 1954, as Amended,
and Regulations and Licenses Issued Thereunder

### INTRODUCTION

The purpose of the AEC enforcement program is the enhancement of the health and safety of the public, the common defense and security, and the environment. The enforcement program emphasizes corrective action, where necessary, to assure that regulated activities meet applicable requirements and are conducted with due regard for public health and safety, common defense and security and protection of the environment. Corrective action is required for each identified item of noncompliance.

Results of AEC inspections and investigations of licensed activities have shown that licensees have not in all cases complied with the regulatory requirements, and it has been necessary to take specific enforcement actions commensurate with the items of noncompliance. This document sets out the criteria for enforcement actions to be taken with respect to future noncompliance with the Atomic Energy Commission's requirements in accordance with Sections 161, 186 and 234 of the Atomic Energy Act and Subpart B of Part 2, 10 CFR.

### LEVELS OF ENFORCEMENT ACTIONS AVAILABLE TO THE COMMISSION

The formal actions available to the Commission in the exercise of its enforcement responsibilities are of three basic types (notices of violation, civil penalties, and orders) which may be applicable to a specific enforcement situation.

1. Written Notices of Violation (10 CFR 2.201)

   Notices of Violations are written notices to licensees, citing the apparent instances of failure to comply with regulatory requirements (Violations) which for purposes of categorization have been classified violations, infractions and deficiencies. Such items of noncompliance are generally observed or identified during investigations, inspections, or inquiries.

   The same letter enclosing a Notice of Violation may also enclose a notification of apparent deviations from licensee commitments and the provisions of appropriate codes, standards or guides.

2. Civil Monetary Penalties (10 CFR 2.205)

   The Commission may levy civil monetary penalties against licensees for violations, infractions or deficiencies with respect to requirements in licensing provisions of the Act or any rule, regulation,



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CIVIL MONETARY PENALTIES - CRITERIA

The Commission may levy civil monetary penalties on licensees who do not comply with the licensing provisions of the Act or any rule, regulation, order, or license issued. Generally, the type of cases that are appropriate for imposing civil penalties are those involving significant items of noncompliance and which represent a threat (but not necessarily immediate) to the health, safety, or interest of the public, or to the common defense or security, or the environment. As a matter of judgment, civil penalties may be used in lieu of license suspension when there is no immediate threat to the health and safety or the common defense and security and license suspension would deprive the licensee or his employees of their means of livelihood, or the public of essential service.

Civil penalties may be the appropriate enforcement action in cases or situations which meet one or more of the following criteria:

a. Those cases of noncompliance with the same basic requirements that were brought to the attention of the licensee in a "notice of violation" following a previous inspection; or

b. Those cases of noncompliance in which the licensee fails to carry out in a timely manner the corrective action the licensee stated would be taken in response to a previous written notice; or

c. Those cases involving the deliberate failure of a person to comply with regulatory requirements;* or

d. Those cases involving items of noncompliance in which (1) the licensee's history is one of chronic noncompliance, or (2) due to the nature and number of items of noncompliance, it is apparent that management, having been afforded an opportunity to correct previous items of noncompliance, is not conducting its licensed activities in conformance with regulatory requirements, or

* NOTE: Section 221(b) of the Atomic Energy Act requires the FBI to investigate all suspected or alleged criminal violations of the Act.



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ORDERS - CRITERIA

The AEC has authority to issue orders to "cease and desist" or to suspend, modify, or revoke licenses. The Commission is empowered to enforce these orders and obtain any other appropriate relief by injunction from Federal district courts, if necessary. Cases involving an immediate threat to the public health and safety, or the common defense and security, require immediate steps to remove the threat and are handled by this type of action. Persons who deliberately violate, attempt to violate, or conspire to violate the Commission's regulations and orders, are, upon conviction of the violations, subject to fine up to $5,000 and imprisonment for not more than two years (Section 223 of the Act).

In the event the licensee fails to respond to a "notice of violation" or to demonstrate that satisfactory corrective action is being taken, an order to show cause may be issued requiring the licensee to show why the particular order (either of revocation, or modification, or suspension) should not be made effective. In those instances where the health, safety, or interest of employees or the public, or the common defense and security so requires, or deliberate noncompliance with the Commission's regulations is involved, the notice provision may be dispensed with and, in addition, the particular order may be made immediately effective pending further order.

a. Orders to Cease and Desist

An order to cease and desist is ordinarily issued when a person is conducting unauthorized activities and has been notified of the need for authorization but fails to terminate the activity and other similar circumstances as appropriate.

b. Orders to Suspend a License

An order is ordinarily issued for immediate suspension of a license, or a portion thereof, as necessary to remove an immediate threat to the health, safety or interest of licensee's employees or the public, or to the common defense and security; or for noncompliance with AEC requirements relating to construction of a facility which, if not corrected immediately, could subsequently result in a significant threat to the health, safety or interest of employees or the public, or the common defense and security.

c. Order to Modify a License

An order for the modification of a license, in whole or in part, is ordinarily issued as an enforcement sanction when it is determined that a licensee's operations or activities must be limited or modified to protect the health, safety, or interest of the licensee's employees or the public, or the common defense and security.



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## REGULATORY OPERATIONS BULLETINS - CRITERIA

A Regulatory Operations Bulletin may be issued to a class of licensees requesting specific actions as a result of safety related equipment design inadequacies, defects, operating inadequacies, malfunctions, or failures of a generic nature that have occurred at a similar facility or operation. The Bulletin will specify that licensees inspect for and/or correct the inadequacies described in the Bulletin, notify Regulatory Operations of the corrective action taken or planned, and the date when action was or will be completed. An order may be issued if the response to a Bulletin is not prompt and effective.

## IMMEDIATE ACTION LETTERS - CRITERIA

A Regulatory Operations Immediate Action Letter is ordinarily issued to solicit or confirm a licensee's commitment to certain actions for investigating, reporting, controlling, and correcting situations involving defects, deviations, failures, or administrative controls, at the licensee's facility. An order may be issued if the response to an Immediate Action Letter is not prompt and effective.

CATEGORIES OF ITEMS OF NONCOMPLIANCE

The Commission and representatives of the nuclear industry have recognized that the significance of items of noncompliance with AEC requirements varies in the potential for affecting the health and safety of the public, the common defense and security, and the environment. The Commission considers that it is desirable to include in Notices of Violation an indication of the significance of each item of noncompliance cited. As a means of categorizing the items of noncompliance into an order of importance which will express their relative significance, the Commission has established three categories of items of noncompliance as follows:

Violation

A violation is an item of noncompliance of the type listed below, or an item of noncompliance (1) which has caused, contributed to or aggravated an incident of the type listed below, or (2) which has a substantial potential for causing, contributing to or aggravating such an incident or occurrence; e.g., a situation where the preventive capability or controls were removed or otherwise not employed and created a substantial potential for an incident or occurrence with actual or potential consequences of the type listed below:

(a) Exposure of an individual in excess of the radiation dose specified in 10 CFR 20.403(b) or exposure of a group of individuals resulting in each individual receiving a radiation dose which exceeds the limits of 10 CFR 20.101 and a total dose for the group exceeding 25 man-rems.

(b) Radiation levels in unrestricted areas which exceed 50 times the regulatory limits.

(c) Release of radioactive materials in amounts which exceed specified limits, or concentrations of radioactive materials in effluents which exceed 50 times the regulatory limits.

(d) Fabrication, or construction, testing, or operation of a Seismic Category I system or structure in such a manner that the safety function or integrity is lost.

(e) Failure to function when required to perform the safety function or loss of integrity of a Seismic Category I system, or structure; or other component, system, or structure with a safety or consequences limiting function.

(f) Exceeding a safety limit as defined in technical specifications associated with facility licenses.

(e) Exceeding limiting conditions for operation (LCO).

(f) Inadequate management or procedural controls.

(g) Safety system settings less conservative than limiting safety system settings.

(h) A quantity of SNM unaccounted for which exceeds permissible limits.

(i) Exceeding limits or limiting conditions for operation in licenses, technical specifications, guides, codes, or standards which are imposed for the purpose of minimizing adverse environmental impact.

(j) Other similar items of noncompliance having actual or potential consequences of the same magnitude.

Failure to report the above items as required constitutes an item of noncompliance of the same category.

Deficiency

A deficiency is an item of noncompliance in which the threat to the health, safety, or interest of the public or the common defense and security is remote; and no undue expenditure of time or resources to implement corrective action is required; and deficiencies include such items as noncompliance with records, posting, or labeling requirements which are not serious enough to amount to infractions.

Failure to report deficiencies as required constitutes an item of noncompliance of the same category.

# OFFICE OF
# INSPECTION AND ENFORCEMENT

UNITED STATES NUCLEAR REGULATORY COMMISSION

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# MISSION

TO INSURE (PRIMARILY BY FIELD INSPECTION AND INVESTIGATION AND BY ENFORCEMENT) THAT FACILITIES AND MATERIALS UNDER NRC JURISDICTION ARE CONSTRUCTED AND USED IN A MANNER WHICH PROTECTS THE PUBLIC AND ENVIRONMENT.

A-2/C

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# REGULATED ACTIVITIES

REACTOR ACTIVITIES

- REACTORS UNDER CONSTRUCTION
  COMMERCIAL AND RESEARCH

- REACTORS IN OPERATION
  COMMERCIAL AND RESEARCH

- CONTRACTORS AND VENDORS
  ARCHITECT/ENGINEERS, NUCLEAR STEAM SYSTEM SUPPLIERS
  COMPONENT SUPPLIERS

NUCLEAR MATERIALS ACTIVITIES

- FUEL FABRICATION, PROCESSING AND REPROCESSING PLANTS
- BY-PRODUCT ACTIVITIES
  RADIOGRAPHY, MEDICINE, WASTE DISPOSAL, ETC.
- MATERIAL SHIPMENT ACTIVITIES

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# OFFICE OF INSPECTION & ENFORCEMENT FUNCTIONS

INSPECT AND INVESTIGATE

- APPLICANTS FOR LICENSES
- LICENSEES
- OTHER ORGANIZATIONS (CONTRACTORS, VENDORS, ETC.)

ENFORCE

EVALUATE AND INFORM

- INCIDENTS, INSPECTIONS, INVESTIGATIONS, GENERAL LICENSEE PERFORMANCE
- RECOMMENDATIONS FOR REGULATORY CHANGES

A-218

## INSPECTIONS AND INVESTIGATIONS – FY 1977

OPERATING REACTORS – 1750 INSPECTIONS AND 65,000 HOURS ONSITE

REACTORS UNDER CONSTRUCTION – 1100 INSPECTIONS AND 45,000 HOURS ONSITE

FUEL FACILITIES – 435 INSPECTIONS AND 20,000 HOURS ONSITE

MATERIALS LICENSEES – 2750 INSPECTIONS AT 2600 LICENSEES

LICENSEE CONTRACTORS AND VENDORS – 225 INSPECTIONS AT 165 COMPANIES

EIGHTY INVESTIGATIONS

## ENFORCEMENT ACTIONS – FY 1977

CITED 5448 NONCOMPLIANCES

IMPOSED 16 CIVIL PENALTIES AND 11 ORDERS

A-219

# CURRENT NRC INSPECTION PROGRAM

NRC PHILOSOPHY

- o LICENSEE RESPONSIBLE FOR SAFE CONSTRUCTION AND OPERATION OF FACILITY

- o NRC PROVIDES REASONABLE ASSURANCE THIS RESPONSIBILITY IS DISCHARGED

A.22c

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## ENFORCEMENT AUTHORITY

ATOMIC ENERGY ACT

(SECTION 234, ADDED IN 1969) LIMITS

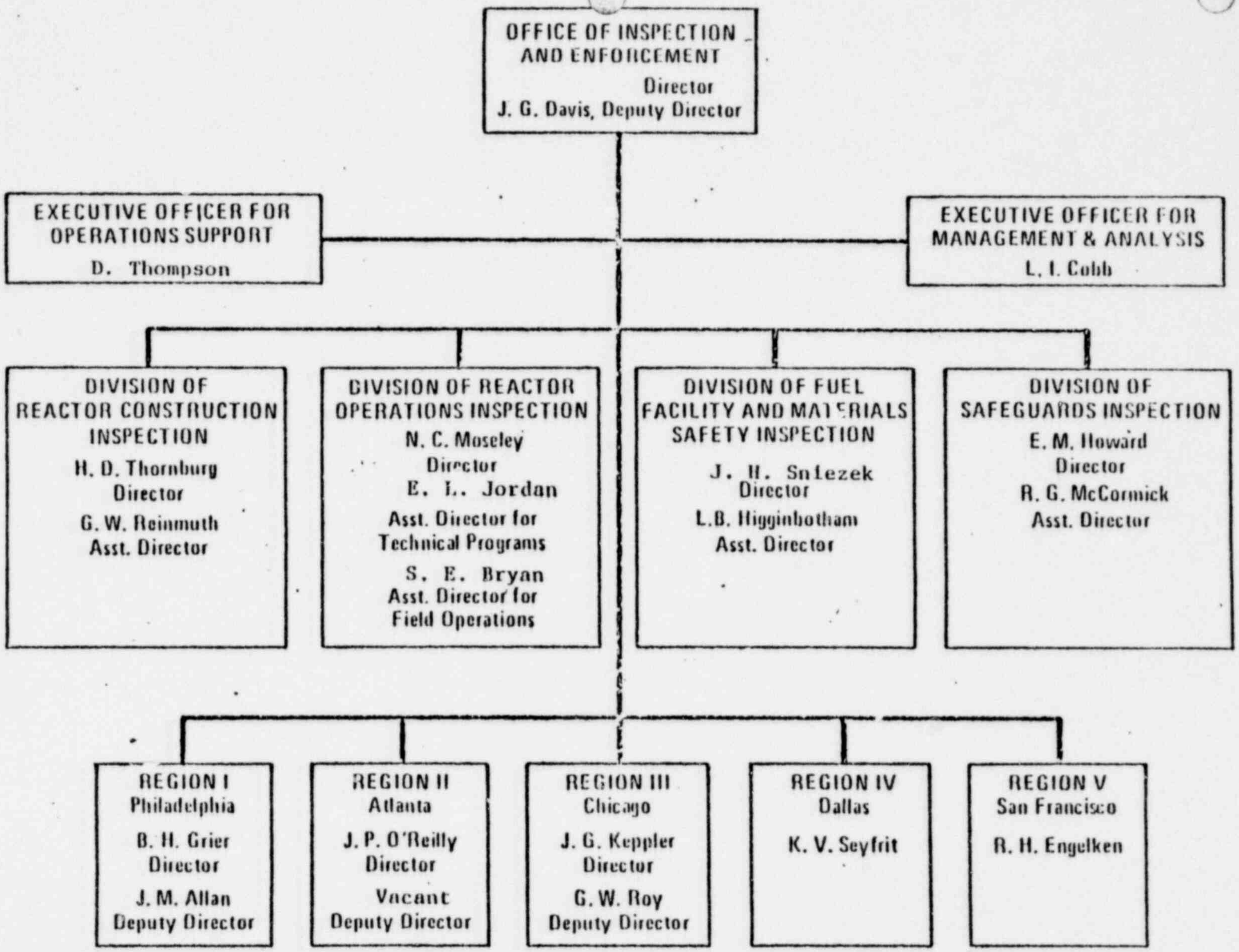
- $ 5,000 PER "VIOLATION"
- $25,000 FOR ALL VIOLATIONS IN 30 DAYS

10 CFR PART 2

REGULATORY REQUIREMENTS

A-221

1030 074




POOR ORIGINAL

7-222

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## ENFORCEMENT POLICY

TAKE ENFORCEMENT ACTION TO ASSURE:

- ANY THREAT REMOVED PROMPTLY
- CORRECTIVE ACTION
- PROPER CONTROLS ESTABLISHED AND MAINTAINED

4-223

1030 076

CLASSIFICATION OF FINDINGS

ACCEPTABLE

NONCOMPLIANCE

DEVIATION

UNRESOLVED

A-227

## CATEGORIES OF NONCOMPLIANCE

| | | |
|---|---|---|
| VIOLATION | - | CAUSED CONTRIBUTED TO OR AGGRAVATED AN INCIDENT OR PREVENTIVE CAPABILITY LOST |
| INFRACTION | - | SUBSTANTIAL POTENTIAL FOR INCIDENT OR REDUCTION OF PREVENTIVE CAPABILITY |
| DEFICIENCY | - | REMOTE THREAT TO HEALTH, SAFETY OR PUBLIC INTEREST |

A-225

1030 078

# ENFORCEMENT SANCTIONS

ENFORCEMENT ACTIONS

- NOTICES OF VIOLATION
- CIVIL MONETARY PENALTIES
- ORDERS
    - CEASE AND DESIST
    - SUSPEND, MODIFY, OR REVOKE LICENSES
    - SHOW CAUSE

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# CIVIL PENALTY CRITERIA

- REPETITIVE - SAME BASIC REQUIREMENT
- FAILURE TO TAKE CORRECTIVE ACTION
- DELIBERATE FAILURE TO COMPLY
- CHRONIC-NATURE AND NUMBER
- FOLLOW A TEMPORARY ORDER
- REPEATED ITEMS AT A CONSTRUCTION FACILITY
- CONTRIBUTED TO CAUSE OR SERIOUSNESS OF INCIDENT
- VIOLATION CATEGORY
- BREAKDOWN OF MANAGEMENT CONTROLS
- USE OF MATERIALS NOT AUTHORIZED
- FAILURE TO REPORT SIGNIFICANT MATTERS

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# ADMINISTRATIVE ACTIONS

- BULLETINS
- CIRCULARS
- IMMEDIATE ACTION LETTERS
- NOTIFICATION OF DEVIATION
- ENFORCEMENT CONFERENCES

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1030 181

# CURRENT CIVIL PENALTY GUIDANCE

CP CONSIDERED IF ACTION POINTS TOTAL 100 OR MORE

- VIOLATION = 100
- INFRACTION = 10
- DEFICIENCY = 2

CIVIL PENALTY SIZE FOR EACH NONCOMPLIANCE

| | VIOLATION | INFRACTION | DEFICIENCY |
|---|---|---|---|
| Power Reactors | $4,000 - 5,000 | 3,000 - 4,000 | 1,000 - 2,000 |
| Fuel Facilities | 3,000 - 4,000 | 2,000 - 3,000 | 500 - 1,000 |
| Research Reactors<br>Large Radiographers<br>Uranium Mills | 2,000 - 3,000 | 1,000 - 2,000 | 300 - 500 |
| Small Radiographers<br>Small Facilities | 1,000 - 2,000 | 500 - 1,000 | 50 - 500 |
| Medical Licensees<br>Academic Licensees | 500 - 1,000 | 300 - 500 | 50 - 100 |

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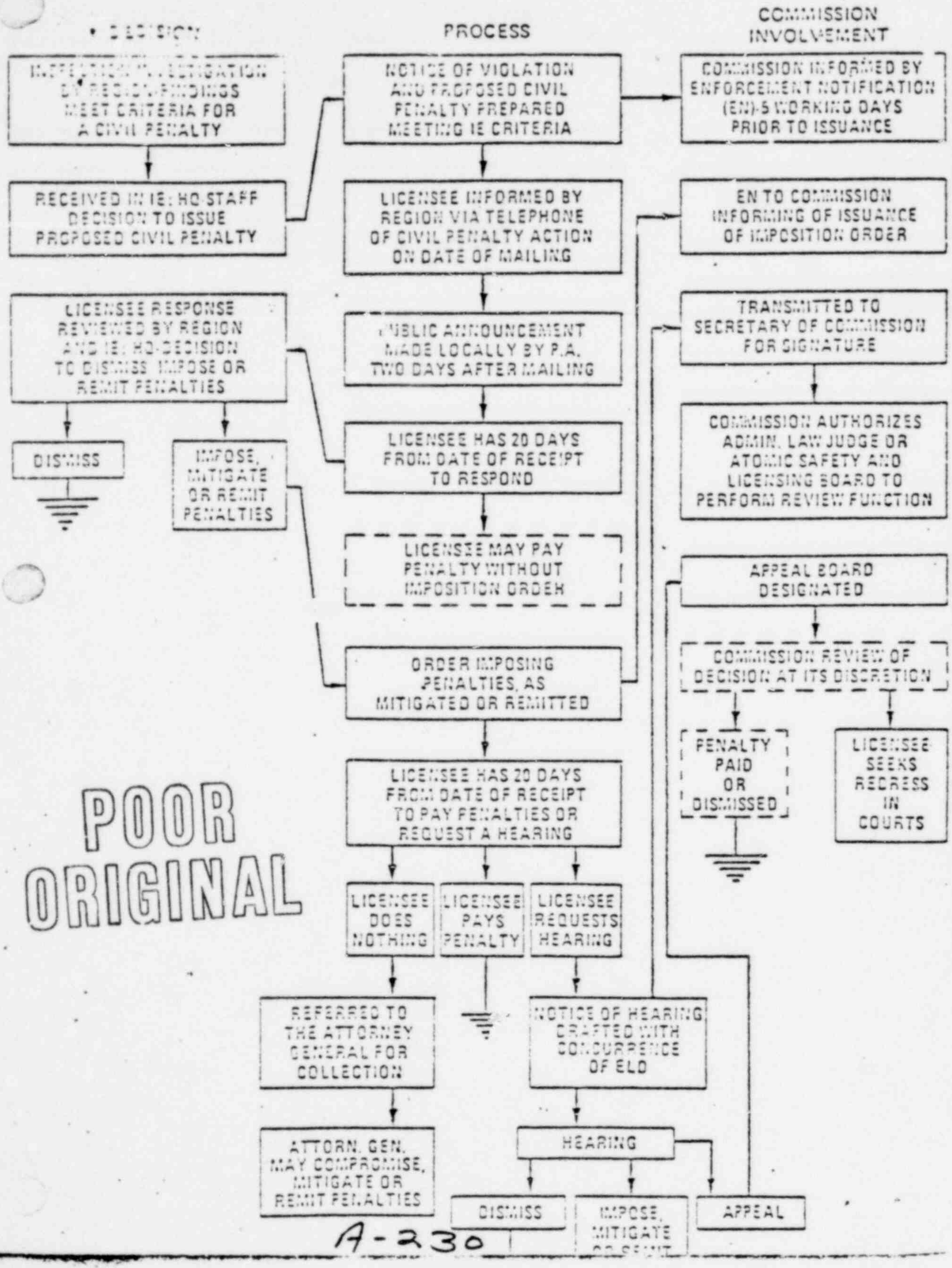


POOR ORIGINAL

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# NRC PARTICIPATION IN
# ALTERNATIVE FUEL CYCLE EVALUATIONS

NASAP

Nonproliferation Alternative System Assessment Program

INFCE

International Fuel Cycle Evaluation

GAO Report Review

Semi-Annual Report to Congress

Total Effort Budgeted as 5 Manyears for FY 79

# INFCE

8 WORKING GROUPS

2 CROSS-CUT GROUPS

NRC PROVIDES TECHNICAL SUPPORT

  REVIEW AND COMMENT ON:

    U.S. PAPERS

    FOREIGN PAPERS

OFFICES INVOLVED:

    NMSS

    NRR

    RES

    OPE

    IP

    MPA

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NASAP

PRELIMINARY DESCRIPTIONS

PSEIDs

SAFEGUARDS BASIS

MEETINGS WITH CONTRACTORS

OFFICES INVOLVED:

- NRR
- NMSS
- RES
- OPE
- MPA



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## NASAP SCHEDULE (1/15/79)

| | |
|---|---|
| DOE REVIEW | 5/1 - 5/31/79 |
| FINAL INTERAGENCY REVIEW | 6/1 - 6/30 |
| OMB-WHITE HOUSE REVIEW | 7/7 - 7/31 |
| PUBLIC RELEASE OF REPORT | 8/15 - 8/31 |
| PUBLIC COMMENT PERIOD | 9/1 - 10/31 |
| REPORT TO PRESIDENT, CONGRESS & PUBLIC | 12/24 |

# INFCE WORKING GROUPS

1. FUEL AVAILABILITY
2. ENRICHMENT AVAILABILITY
3. SUPPLY ASSURANCES
4. REPROCESSING Pu HANDLING, RECYCLE
5. FAST BREEDERS
6. SPENT FUEL MANAGEMENT
7. WASTE MANAGEMENT AND DISPOSAL
8. ADVANCED FUEL CYCLE CONCEPTS

9-2359

## NASAP*

THE NONPROLIFERATION ALTERNATIVE SYSTEMS ASSESSMENT PROGRAM (NASAP) IS DOE's MAJOR EFFORT TO IDENTIFY/ASSESS ALTERNATIVE NUCLEAR REACTOR/FUEL CYCLE SYSTEMS THAT HAVE ACCEPTABLE NON-PROLIFERATION CHARACTERISTICS IN ADDITION TO PROVIDING THE MAJOR BENEFITS OF NUCLEAR ENERGY.

*THE INTERNATIONAL COUNTERPART TO NASAP IS THE INTERNATIONAL FUEL CYCLE EVALUATION (INFCE) PROGRAM; MAJOR INPUT (TECHNICAL SUPPORT) TO THE INFCE IS PROVIDED BY NASAP. NRC STAFF MEMBERS ALSO PROVIDE SUPPORT TO A NUMBER OF INFCE WORKING GROUPS MOSTLY IN THE FORM OF TECHNICAL REVIEW OF POSITION PAPERS AS THEY ARE BEING DEVELOPED.

APPENDIX XXII
NASAP AND INFCE: OFFICE OF NUCLEAR REACTOR REGULATION PARTICIPATION

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1030 089

NASAP

# FACTORS TO BE CONSIDERED IN THE ASSESSMENT AND EVALUATION OF THE MOST PROMISING REACTOR/FUEL CYCLE SYSTEMS

A-237

1. PROLIFERATION CHARACTERISTICS
2. RESOURCE UTILIZATION
3. ECONOMICS
4. TECHNOLOGY STATUS AND DEVELOPMENT NEEDS
5. COMMERCIAL FEASIBILITY AND DEPLOYMENT
6. LICENSING (SAFETY, ENVIRONMENTAL, SAFEGUARDS) ACCEPTABILITY

## NASAP

# NRC'S ROLE: GENERAL

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RECOMMENDATIONS FOR NRC'S ROLE IN NASAP ARE CONTAINED IN A MARCH 7, 1978 LETTER REPORT TO SENATOR LLOYD BENTSEN FROM COMPTROLLER GENERAL STAATS. CHAIRMAN HENDRIE, IN LETTERS DATED JUNE 9, 1978 TO SENATOR RIBICOFF AND OTHERS GAVE NOTICE OF THE POSITIVE ACTION TAKEN ON THIS RECOMMENDATION, IN PARTICULAR, STATING THAT:

> ". . . THE COMMISSION WILL PROVIDE A STAFF REPORT TO THE PRESIDENT AND CONGRESS OF OUR PRELIMINARY FINDINGS OF KNOWN OR SUSPECTED LICENSING ISSUES AND PROBLEMS ASSOCIATED WITH ALTERNATIVE TECHNOLOGIES UNDER SERIOUS CONSIDERATION BY DOE. . . . THE REPORT WILL INCLUDE A COMPARATIVE EVALUATION OF THE ALTERNATIVE TECHNOLOGIES STUDIED FROM THE SAFETY, SAFEGUARDS, ENVIRONMENTAL AND LICENSING POINTS OF VIEW. TO THE EXTENT POSSIBLE, THE ALTERNATIVE REACTOR AND FUEL CYCLES EVALUATED BY NRC WILL BE RANKED FROM A LICENSING STANDPOINT . . ."

NASAP

# TYPE OF NRC REVIEW

- UTILIZE EXISTING FRAME WORK OF RULES AND REGULATIONS TO PROVIDE GUIDANCE IN ASSESSING CANDIDATE ALTERNATIVE FISSION TECHNOLOGIES
- IDENTIFY AND REVIEW UNIQUE FEATURES OF PROPOSED REACTOR TYPES IN RELATION TO ESTABLISHED LWR LICENSING CRITERIA (GDC, REG. GUIDES, ETC.)
- IDENTIFY AREAS OF DISPARITY WITH ESTABLISHED LWR LICENSING CRITERIA
- IDENTIFY MAJOR PROBLEM AREAS REQUIRING RESEARCH/DEVELOPMENT PROGRAMS
- ESTIMATE EFFORT NEEDED (TIME, $'s, ETC.) TO RESOLVE LICENSABILITY ISSUES

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1030 092

NASAP

# LICENSABILITY EVALUATIONS - SOME KEY AREAS

- MULTI-LAYERED DEFENSE-IN-DEPTH CONCEPT (CODES, STANDARDS, EXPERIMENTAL DATA BASE, DESIGN CRITERIA, ETC.)
- SPECTRUM OF ACCIDENTS
- RADIOLOGICAL SITING CRITERIA
- FUEL
- REACTIVITY EFFECTS
- ENGINEERING SAFETY FEATURES (DECAY HEAT REMOVAL SYSTEMS, ECCS, CONTAINMENT, ETC.)
- SAFEGUARDS
- ENVIRONMENTAL

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## NASAP

# "MAINLINE" NASAP REACTORS TO BE REVIEWED

1. LIGHT WATER REACTOR (LWR) (THREE VARIANTS ON CONVENTIONAL PWR)
2. LIGHT WATER BREEDER REACTOR (LWBR) (THREE PREBREEDER/BREEDER PAIRS)
3. LIQUID METAL FAST BREEDER REACTOR (LMFBR) (SIX VARIANTS)
4. HEAVY WATER REACTOR (HWR) (A C.E. VARIATION OF THE CANDU)
5. HIGH TEMPERATURE GAS COOLED REACTOR (HTGR) (LOW ENRICHMENT FUEL)
6. GAS COOLED FAST REACTOR (GCFR)

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# COMPLETED AND ONGOING EFFORTS

- PROVIDED TO GAO A PRELIMINARY ASSESSMENT ON LICENSING ISSUES ASSOCIATED WITH A NUMBER OF FISSION TECHNOLOGIES, NUREG-0364, OCTOBER 1977
- REVIEWED DRAFT INFORMATION SUBMITTED BY DOE ON THE SIX NASAP MAINLINE REACTORS AND PROVIDED PRELIMINARY COMMENTS TO DOE (LETTER N.M. HALLER (NRC) TO E.J. HANRAHAN (DOE), DATED SEPTEMBER 25, 1978)
- HELD MEETING WITH COMBUSTION ENGINEERING (CE), DOE SUBCONTRACTOR, ON CE's DESIGN OF A HWR (MODIFIED CANDU) AND THREE VARIANTS OF THE LWR
- REVIEW UNDERWAY OF CE's MODIFIED CANDU DESIGN
- REVIEW UNDERWAY OF "IMPROVED" LWR: DENATURED URANIUM/THORIUM FUEL CYCLE, URANIUM/PLUTONIUM SPIKED RECYCLE, AND EXTENDED BURNUP
- UPCOMING MEETINGS (END FEBRUARY) WITH GENERAL ATOMICS TO DISCUSS THE HTGR & GCFR AND THE DIVISION OF NAVAL REACTOR TO DISCUSS THE LWBR
- INITIAL TECHNICAL ASSISTANCE NEEDS IDENTIFIED, FOR HWR, LWBR

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# NRC (NRR) RESOURCES APPLIED TO NASAP REVIEW

- NRR's ADVANCED REACTORS BRANCH PERSONNEL PERFORMING PROJECT MANAGEMENT AND BULK OF REVIEW
- OTHER NRR SPECIALISTS UTILIZED AS NEEDED (E.G., LWBR PHYSICS, HWR MATERIALS RELATED PROBLEMS, LWR EXTENDED BURNUP CONSIDERATIONS)
- TECHNICAL ASSISTANCE AT NATIONAL LABS AND UNIVERSITIES
- TECHNICAL SUPPORT FROM OFFICE OF RESEARCH

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# REVIEW SCHEDULE

- ALL MAINLINE REACTOR PRELIMINARY SAFETY AND ENVIRONMENTAL INFORMATION DOCUMENTS (PSEIDs) ARE DUE AT NRC BY 2/9/79 (THE LWR-VARIANT IS IN)
- ROUND ONE COMMENTS (ON DOE DRAFT NASAP REPORT) DUE 4/15/79
- ROUND TWO COMMENTS (ON DOE NASAP REPORT) DUE 6/15/79
- DOE REPORT TO THE PRESIDENT AND TO CONGRESS DUE 12/24/79

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# NASAP H,S&E AND SAFEGUARDS REVIEWS OF ALTERNATIVE FUEL CYCLES

- CONSIDER ALL OPERATIONS FROM RAW MATERIALS SUPPLY TO WASTE DISPOSAL INCLUDING RECYCLE
    - INCLUDE ALL IMPORTANT SUBSIDIARY OPERATIONS AND EFFECTS (I.E., SPIKANT PRODUCTION, $D_2O$ MANUFACTURE)
- IDENTIFY AND EVALUATE IMPACTS RELATIVE TO URANIUM ONCE THROUGH CYCLE
- IDENTIFY POTENTIAL PROBLEM AREAS AND REQUIRED RESEARCH & DEVELOPMENT
- ESTIMATE EFFORT TO RESOLVE LICENSABILITY ISSUES

## NASAP FUEL CYCLE REVIEWS

### Features of Some Proposed Alternative Fuel Cycles

Uranium Fuel Cycles

- Use of Extended Burn-Up LEU Fuels
- Use of $D_2O$
- Use of Spikant in Pu Recycle Fuel or Pu Byproduct
- Use of Two Different Reprocessing Operations -
    - Standard
    - Coprocessing

Thorium Fuel Cycles

- Use of U-233 Make-Up and Recycle
- Use of Thorex Reprocessing
    - Storage of Spiked Pu Byproducts
    - Management of Thorium Wastes

Alternative Institutional Arrangements

- Fuel Cycle "Safe" Centers

## NASAP Fuel Cycle Features and Safeguards-Related Issues

| | Primary Safeguards Issues |
|---|---|
| Heavy Water | • Safeguards for $D_2O$ |
| Spiking | • Material Accountability |
| | • Spikant Levels |
| | • Legal Aspects |
| | • As Low As Reasonably Achievable |
| Coprocessing | • Concentration of Plutonium |
| U-233/Thorium Fuels | • Need for Non-Destructive Analysis Techniques |
| Denaturing | • Threshold Enrichment |
| Fuel Cycle Centers | • Resolution of Safeguards Organizational Roles, Responsibilities, and Procedures |

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# CURRENT ACTIVITIES RELATED TO SPENT FUEL

## STORAGE

- INCREASING STORAGE CAPACITY AT REACTORS
- SEPARATE FACILITIES FOR STORAGE (PART 72)
- GEIS (NUREG-0404)

## TRANSPORTATION

- NRC RULEMAKING (NUREG-0170)
- URBAN STUDY (SAND 77-1927)
- CRITICAL MASS PETITION
- DOT RULEMAKING

# NRC RULEMAKING

- JUNE 1975 GENERAL APPRAISAL
- NUREG-0170 COMPLETE
- FOLLOW-UP ACTIVITY
  - URBAN STUDY
  - PHYSICAL FORM
  - NORMAL EXPOSURES
- POSSIBLE CLOSURE

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## URBAN STUDY

- ALL RADIOACTIVE MATERIALS
- SPECIAL FEATURES OF CITIES
- EVALUATION OF SOCIAL IMPACT
- WORKING DRAFT ASSESSMENT (SAND 77-1927)
  - BASED ON NYC
  - MORE WORK NEEDED
  - NOTABLE CONSEQUENCES FOR SUCCESSFUL SABOTAGE
- COMPLETION SCHEDULE
  - PRELIMINARY DRAFT ASSESSMENT (JULY 79)
  - SOCIAL IMPACT ASSESSMENT (AUGUST 79)
  - DRAFT ENVIRONMENTAL STATEMENT (OCTOBER 79)

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# CRITICAL MASS PETITION

- SEPTEMBER 77 YELLOWCAKE SPILL
- CRITICAL MASS + 2 CONGRESSMEN
  - Routing
  - Emergency Plans and Response
  - Financial Responsibility
- WIRTH STUDY
  - Emergency Response
  - Packaging
  - Routing
  - Responsibility
  - Other

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# DOT RULEMAKING

- HAZARDOUS MATERIALS TRANSPORTATION ACT (1975)
- NEW YORK CITY ORDINANCE (1975)
- DOT CONSIDERATION OF NYC
  - HEARING (NOVEMBER 77)
  - DOT RECODIFICATION EXCEPT ROUTING (FEBRUARY 78)
  - OPINION (APRIL 78)
- DOT HIGHWAY ROUTING OF RADIOACTIVE MATERIALS
  - F. R. INQUIRY (AUGUST 78)
  - PUBLIC MEETING (NOVEMBER 78)
  - PROPOSED RULE (JULY 79)
  - COMMENTS AND MEETINGS
  - EFFECTIVE RULE (MARCH 80)

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 21, 1979

APPENDIX XXV
STATUS OF GENERIC ITEMS RELATING TO
LIGHT-WATER REACTORS

Honorable Joseph M. Hendrie
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: STATUS OF GENERIC ITEMS RELATING TO LIGHT-WATER REACTORS: REPORT NO. 7

Dear Dr. Hendrie:

The Advisory Committee on Reactor Safeguards has previously reported on the "Status of Generic Items Relating to Light-Water Reactors" in its letters of December 18, 1972, February 13, 1974, March 12, 1975, April 16, 1976, February 24, 1977 and November 15, 1977. Since the Committee limits its definition of generic items to those cited specifically in its letters pertaining to projects and related matters, the attached listing is not all-inclusive; the Nuclear Regulatory Commission Staff has additional generic items.

In an effort to simplify referencing, the Committee has revised the numbering system for its generic items. (Attachment 4 cross-references this numbering system with that in Report No. 6.) Items 1 through 48 in Attachment 1 are a reiteration of the generic items considered resolved at the time the Committee issued Report No. 6, on November 15, 1977. Items 49 through 52 are those items resolved since November 1977. Following each resolved item is a brief statement of the specific action that resulted in resolution. Items 53 through 77 listed in Attachment 2 are those items previously listed for which resolution on a generic basis is still pending. The ACRS and the NRC Staff will continue to consider the safety significance of these items on a case-by-case basis until generic resolution is reached. Formal actions, such as issuance of Regulations or Regulatory Guides, are anticipated for many of these items.

Owing to questions raised concerning the scope and intent of various generic issues, the Committee has included, in Attachment 3, a brief description for all unresolved items cited in this report.

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With regard to the status of generic issues, as they apply to each plant, the NRC Staff addresses the status of the pertinent issues in the applicable Safety Evaluation Report. The ACRS identifies those that it believes relevant in its reports on individual projects.

"Resolved" as used in the Generic Items reports refers to the following: In some cases an item has been resolved in an administrative sense, recognizing that technical evaluation and satisfactory implementation are yet to be completed. Anticipated Transients Without Scram represents an example of this category. In other instances, the resolution has been accomplished in a narrow or specific sense, recognizing that further steps are desirable, as practical, or that different aspects of the problem require further investigation. Examples are the possibility of improved methods of locating leaks in the primary system, and of improved methods or augmented scope of in-service inspection of reactor pressure vessels.

The ACRS expects to report to you from time to time on the status of generic items.

Sincerely yours,

Max W. Carbon

Max W. Carbon
Chairman

Attachments:
1. Resolved Generic Items
2. Unresolved Generic Items
3. Descriptions of the Unresolved Generic Items
4. Cross-reference of Numbering System between the Present and Previous Report.

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GENERIC ITEMS

Resolved Generic Items

1. Net Positive Suction Head for ECCS Pumps: Covered by Regulatory Guide 1.1.

2. Emergency Power: Covered by Regulatory Guides 1.6, 1.9, and 1.32 and portions of IEEE-308 (1971).

3. Hydrogen Control After a Loss-of-Coolant Accident (LOCA): ACRS concurred in proposed Staff position, covered by NRC Standard Review Plan for Nuclear Power Plants.

4. Instrument Lines Penetrating Containment: Covered by Regulatory Guide 1.11 and Supplement.

5. Strong Motion Seismic Instrumentation: Covered by Regulatory Guide 1.12.

6. Fuel Storage Pool Design Bases: Covered by Regulatory Guide 1.13.

7. Protection of Primary System and Engineered Safety Features Against Pump Flywheel Missiles: Covered by Regulatory Guide 1.14.

8. Protection Against Industrial Sabotage: Covered by Regulatory Guide 1.17.

9. Vibration Monitoring of Reactor Internals and Primary System: Covered by Regulatory Guide 1.20.

10. In-service Inspection of Reactor Coolant Pressure Boundary: Covered by ASME Boiler and Pressure Vessel (BPV) Code, Section XI and Regulatory Guide 1.65.

11. Quality Assura. .e During Design, Construction and Operation: Covered by 10 CFR 50, Appendix B; ASME BPV Code, Section III; ANSI N-45.2-1971, Regulatory Guides 1.28, 1.33, 1.64, 1.70.6 and Proposed Standard ANS-3.2.

12. Inspection of BWR Steam Lines Beyond Isolation Valves: Covered by ASME BPV Code, Section XI.

13. Independent Check of Primary System Stress Analysis: Covered by ASME BPV Code, Section III.

14. Operational Stability of Jet Pumps: Test and operating experience at Dresden 2 and 3 and other jet pump BWRs have satisfied the ACRS concerns.

Attachment 1

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15. Pressure Vessel Surveillance of Fluence and NDT Shift: Covered by 10 CFR 50, Appendix A and Appendix H; and ASTM Standard E-185.

16. Nil Ductility Properties of Pressure Vessel Materials: Covered by 10 CFR 50, Appendix A and Appendix G; ASME BPV Code, Section III; "Report on the Integrity of Reactor Vessels for Light-Water Power Reactors," (WASH-1285) by the Advisory Committee on Reactor Safeguards dated January 1974.

17. Operation of Reactor With Less Than All Loops In Service: Covered by ACRS-Regulatory Staff position that manual resetting of several set points on the control room instruments under specific conditions and procedures is acceptable in taking one primary loop out of service. This position is based on the expectation that this mode of operation will be infrequent. Cited in Standard Review Plan Appendix 7-A, Branch Technical Position EICSB 12.

18. Criteria for Preoperational Testing: Covered by Regulatory Guide 1.68.

19. Diesel Fuel Capacity: Covered by ACRS-Regulatory Staff position requiring 7 days fuel (Standard Review Plan 9.5.4).

20. Capability of Biological Shield Withstanding Double-Ended Pipe Break at Safe Ends: Covered by ACRS-Regulatory Staff position cited in several letters that such a failure should have no unacceptable consequences.

21. Operating One Plant While Other(s) is/are Under Construction: Specific requirements have been established by ACRS-Regulatory Staff. Covered in Regulatory Guide 1.17, 1.70 Section 13.6.2; 1.101; ANSI N 18.17 and Standard Review Plan 13.3 Appendix A and 13.6.

22. Seismic Design of Steam Lines: Covered by Regulatory Guide 1.29.

23. Quality Group Classifications for Pressure Retaining Components: Covered by Regulatory Guide 1.26.

24. Ultimate Heat Sink: Covered by Regulatory Guide 1.27.

25. Instrumentation to Detect Stresses in Containment Walls: Covered by Regulatory Guide 1.18.

26. Use of Furnace Sensitized Stainless Steel: Covered by Regulatory Guide 1.44.

27. Primary System Detection and Location of Leaks: Covered by Regulatory Guide 1.45.

28. Protection Against Pipe Whip: Covered by Regulatory Guide 1.46.

29. Anticipated Transients Without Scram: Covered by Regulatory Position Document, "Technical Report on Anticipated Transients Without Scram for Water-Cooled Power Reactors," WASH-1270, September 1973.

30. ECCS Capability of Current and Older Plants: Covered by Rulemaking as a general policy decision, although acceptable detailed implementation remains to be developed. Docket RM-50-1, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water-Cooled-Nuclear Power Reactors," December 28, 1973.

31. Positive Moderator Coefficient: PWRs presently have or expect to have zero or negative coefficients. Where some Technical Specifications allow a slightly positive coefficient, the accident and stability analyses take this into account. Burnable poison provisions have been designed into PWRs to reduce otherwise excessive positive coefficients to allowable values.

32. Fixed Incore Detectors on High Power PWRs: Fixed incore detectors are not required for PWRs since reviews of potential power distribution anomalies have not revealed a clear need for continuous incore monitoring.

33. Performance of Critical Components (pumps, cables, etc.) in post-LOCA Environment: Qualification requirements of critical components are now covered by Regulatory Guides 1.40, 1.63, 1.73 and 1.89 and IEEE Standards 382-1972, 383-1974, 317-1972, 323-1974.

34. Vacuum Relief Valves Controlling Bypass Paths on BWR Pressure Suppression Containments: On designs prior to GE Mark III containment, resolution lies in surveillance and testing of vacuum relief valves. For Mark III containments, an additional requirement is that the design be capable of accommodating a bypass equivalent to one square foot for a given flow condition.

35. Emergency Power for Two or More Reactors at the Same Site: Resolved by issue of Regulatory Guide 1.81.

36. Effluents from Light-Water-Cooled-Nuclear Power Reactors: Resolved by issue of Appendix I to 10 CFR 50.

37. Control Rod Ejection Accident: Resolved for PWRs by Regulatory Guide 1.77

38. Main Steam Isolation Valve Leakage of BWR's: Covered by Regulatory Guide 1.96.

39. Fuel Densification: Covered by 10 CFR 50 Appendix K plus case-by-case review of vendor fuel models.

40. Rod Sequence Control Systems: Covered by NRC Staff Review and Approval of NEDO-10527 and Presentation to ACRS.

41. Seismic Category I Requirements for Auxiliary Systems: Covered by Regulatory Guides 1.26 and 1.29.

42. Instruments to Detect (limited) Fuel Failures - NRC document, "Fuel Failure Detection in Operating Reactors," B.L. Siegel and H. H. Hagen, June, 1976 resolves issue for limited fuel failures, but not for severe failures (See Item 56).

43. "Instrumentation to Follow the Course of an Accident" Regulatory Guide 1.97 Revision 1 resolves ACRS concerns.

44. Pressure in Containment Following LOCA - NRC document, "Containment Subcompartment Analysis" September 1976.

45. Fire Protection. Resolved by Branch Technical Position 9.5.1, and Regulatory Guide 1.120.

46. Control Rod Drop Accident (BWRs): Resolved through NRC review and documentation establishing such an event as not having severe consequences (memorandum for M. Bender, Chairman ACRS, from Denwood F. Ross, Jr., Assistant Director for Reactor Safety, DSS, dated February 11, 1977.)

47. Rupture of High Pressure Lines Outside Containment: Resolved by positions in Standard Review Plan 3.6.1 and 3.6.2.

48. Isolation of Low Pressure from High Pressure Systems: Resolved by positions in Standard Review Plan 5.4.7.

49. Monitoring For Loose Parts Inside The Reactor Pressure Vessel: Resolved by Staff position to be documented in Regulatory Guide 1.133.

50. Qualification of New Fuel Geometries: Resolved by position in Standard Review Plan 4.2, Revision 1.

51. Maintenance and Inspection of Plants: Resolved by the amount of Staff attention and industry involvement documented in Memorandum for Larry P. Crocker, Technical Assistant to the Director, DPM, from William E. Kreger, Acting Assistant Director for Site Analysis, DSE subject: Resolution of ACRS Generic Item II C-6 dated February 28, 1979.

52. Safety Related Interfaces Between Reactor Island and Balance of Plant: Resolved by position in Standard Review Plan 1.8.

Resolution Pending

53. Turbine Missiles: Turbine failures for past 16 years have been evaluated and a statistical probability analysis has been completed. An ACRS letter (April 18, 1973) discusses the problems. (1)

54. Effective Operation of Containment Sprays in a LOCA: Extensive documentation in topical reports. Review and evaluation required.

55. Possible Failure of Pressure Vessel Post-LOCA By Thermal Shock: Regulatory Guide 1.2 covers current information. Ultimate position as to significance of thermal shock requires input of fracture mechanics data from the Heavy Section Steel Technology Program.

56. Instruments to Detect (Severe) Fuel Failures - NRC document, "Fuel Failure Detection in Operating Reactors," B. L. Siegel and H. H. Hagen. Item 42 covers limited failures. More work is required for the severe failure case to establish instrumentation criteria. (2)

57. Monitoring for Excessive Vibration Inside the Reactor Pressure Vessel: Neutron Noise Analysis has been successful in detecting vibration of some components; however, additional work may be required concerning systems for detecting vibration in other components within the Reactor Pressure Vessel.

58. Non-Random Multiple Failures: This heading covers a multiplicity of diverse components for which requirements should be established. Due to their diversity, the ACRS feels that specific items should be separated into subsets under the general heading of non-random multiple failures;

    58A - Reactor Scram Systems
    58B - Alternating Current Sources onsite and offsite
    58C - Direct Current Sources

The above items are easily identified, other specific items may be added to this listing in the future.

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(1) Regulatory Guide 1.115, "Protection Against Low Trajectory Turbine Missles," will be modified to cover both low and high trajectory missiles.

(2) Identified in the Committee's Report of April 16, 1976 as "Instruments to Detect Fuel Failures."

Attachment 2

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59. Behavior of Reactor Fuel Under Abnormal Conditions: This includes: flow blockage; partial melting of fuel assemblies as it affects reactor safety; and transient effects on fuel integrity. The PBF program will address some of these items.

60. BWR Recirculation Pump and PWR Primary Coolant Pump Overspeed During LOCA: Decision required by ACRS-NRC Staff. (3)

61. The Advisability of Seismic Scram: Further studies required to establish need.

62. Emergency Core Cooling System Capability for Future Plants: Partially resolved by amendments to 10 CFR 50 [50.34(a)(4), 50.34(b)(4), 50.46, and Appendix K]. LOCA evaluation model complete. ACRS feels new cooling approaches should be explored.

63. Ice Condenser Containments: Additional analyses are required to establish response during a LOCA, and to establish design margins.

64. Steam Generator Tube Leakage: Partially resolved by issuance of Regulatory Guide 1.83 which addresses the concern from a preventative point of view.

65. ACRS/NRC Periodic 10-Year Review of all Power Reactors: A more effective, continuous alternative approach to periodic reviews is being proposed. Pending ACRS review, this item is still considered unresolved.

66. Computer Reactor Protection System: Systems should be qualified for reliability, particularly through in situ tests and under various environmental conditions, prior to use in reactor system. (4)

67. Behavior of BWR Mark II Containments: Various aspects, including vent clearing, vent/coolant interaction, pool swell, pool stratification, pressure loads and flow bypass should be resolved. This is an extension of Item 44.

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(3) Item 60 combines two previous items which dealt with PWR and BWR pump overspeed separately.

(4) Identified in the ACRS Report of April 16, 1976 as "Hybrid Reactor Protection System."

68. Stress Corrosion Cracking in BWR Piping: Several failures have occurred in operating BWRs. The ACRS letter of February 8, 1975, discusses possible actions that should lead to generic resolution and extensive programs are underway by industry, ERDA, and NRC.

69. Locking Out of ECCS Power Operated Valves: The Committee suggests that further attention be given to procedures involving locking out electrical sources to specific motor-operated valves required in the engineered safety functions of ECCS.

70. Design Features to Control Sabotage: Attention should be given to aspects of design that could improve plant security.

71. Decontamination of Reactors: As experience is gained in reactor decontamination it should be factored into future plants to optimize control of radioactivity levels.

72. Decommissioning of Reactors: Specific plans should be developed, including definitive codes and standards to cover the ultimate decommissioning of plants.

73. Vessel Support Structures: Questions that have arisen concerning the loads on pressure vessel support structures due to certain postulated loss-of-coolant accidents should be resolved.

74. Water Hammer: Several cases of water slugging or water hammer have occurred in both PWRs and BWRs. Corrective measures should be taken to minimize such events.

75. Behavior of BWR Mark I Containments: Various aspects relevant to the BWR Mark I Containment should be resolved. Included are such items as relief valve restraint, control of local dynamic loads in the torus, vent clearing and establishment of torus water temperature limits during a LOCA. This is an extension of Item 44.

76. Assurance of Continuous Long-term Capability of Hermetic Seals on Instrumentation and Electrical Equipment: The integrity of seals during post-accident conditions may be critical in controlling such an accident. The Committee believes appropriate test and maintenance procedures should be developed to assure long-term reliability.

77. Soil-Structure Interactions: Several matters related to soil-structure interaction and the appropriate seismic response spectrum for use at foundation levels of nuclear plants are under review and reevaluation.

53 Turbine Missiles

Turbine failures for the past 16 years have been evaluated and a statistical probability analysis has been completed. An ACRS letter (April 18, 1973) discuses the problem.

Three issues require answers to resolve the turbine missile problem: (1) The first relates to the appropriate failure probability value; based on historical failures the probability is about $10^{-4}$/turbine-year. Industry predicts a much lower failure probability based on improvements in materials and design. To date the ACRS has accepted the more conservative value; (2) The second issue is strongly dependent on turbine orientation with respect to critical safety structures. Strike probabilities from high angle missiles are acceptably low for single units and may be acceptable for multi-unit plants, dependi . plant layout; however, lower angle missiles with non-optimum (tangential) turbine orientation have unacceptably high strike probabilities; (3) The third issue is one of penetration and damage of structures housed in the containment. The limited experimental data pertaining to penetration of large irregularly shaped missiles are not sufficient to determine structural response to impingement of turbine disc segments. Most missile penetration formulas are not relevant to this case. The EPRI turbine missile impact experiments might resolve this issue, particularly for older plants with non-optimum turbine orientations.

Attachment 3

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54 - Effective Operation of Containment Sprays in a LOCA

Review and evaluation are required of the variety of experiments which have been conducted on the effectiveness of various containment sprays for the removal and retention of airborne radioactive materials anticipated to be present within containment following a LOCA. Such review should consider adequacy of definition of the physical and chemical forms of the anticipated airborne radionuclides, and quality of evaluative tests of the removal efficiencies of various sprays under the conditions of temperature, pressure, and radiation doses expected to exist under LOCA conditions. A desirable extension might be analyses of the use of sprays containing chemicals (such as NaOH) which have the potential for damaging equipment within containment. Studies using other spray additives, such as hydrazine, have been conducted. If compounds, such as this, have distinct advantages, insofar as minimizing equipment damage in the event of inadvertent actuation, action should be taken to encourage their use.

## 55 - Possible Failure of Pressure Vessel Post-LOCA By Thermal Shock

Earlier nuclear reactor pressure vessels subjected to fluences of $1\text{-}4 \times 10^{19}$ nvt, which are anticipated in the last 20 years of a 40-year life, may suffer severe radiation damage denoted by a pronounced shift in impact transition temperature at the inner surface. There will be a damage gradient which decreases sharply, so that the properties halfway through the wall are essentially those of the as-fabricated material. If a LOCA occurs near end-of-life, the injection of cold water on the region of degraded properties may initiate and propagate a crack because of high local stresses near the surface. Analytic procedures indicate the stresses drop rapidly with distance through the wall so the flaw should not propagate beyond some limiting point. The lack of experimental evidence and the relative width of the error band in the analytic results are such that some experiments are required to validate the analytic model. These are under way in the HSST program.

56 - Instruments To Detect (Severe) Fuel Failures

In the event of substantial fuel failure, including the possibility of fuel melt, large amounts of fission products could be rapidly released to the reactor coolant and possibly to the environment. Instrumentation capable of early warning and timely response may avert an incident becoming an accident.

Instrumentation related to such diagnostic purposes for limited fuel failure is being used on most power reactors (see Item 42). Further work is required to establish criteria for similar instrumentation for severe fuel failures.

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57 - Monitoring For Excessive Vibration Inside The Reactor Pressure Vessel

Neutron noise analysis can detect vibration of specific components such as the core barrel. The detection of vibration in other reactor pressure vessel components is less well established.

58 - Non-Random Multiple Failures (Formerly "Common Mode Failure")

The term "common mode failures" has, in many instances, come to mean multiple failures of identical components exposed to identical or nearly identical conditions or environments, and the use of diversity in components has been proposed or required to avoid such failures. The concern of the ACRS is better expressed by the term "non-random multiple failures," which is intended to include not only the type of "common mode failure" discussed above but other types of multiple failures for which the consequences and probabilities cannot be predicted by application of the single-failure criterion. Examples include the use of the same sensors or components for both control and protection systems (a resolved matter); sequential multiple failures due to a "domino effect," and simultaneous multiple failures due to a single fault. Since designs usually do not knowingly incorporate features susceptible to such failures, techniques and criteria need to be developed to detect and avoid them in all systems important to safety. The following is a partial listing of systems whose common mode failure has been cited by the ACRS as a matter of safety concern:

58A - Scram Systems
58B - Alternating Current Sources
58C - Direct Current Sources

Other items may be added to this listing in the future.

59 - Behavior Of Reactor Fuel Under Abnormal Conditions

The behavior of reactor fuel under abnormal conditions is still considered unresolved due to the limited experimental data available. Partial melting of fuel assemblies due to flow blockage might lead to autocatalytic effects leading to more extensive fuel failure, pressure pulses, etc. Similar behavior might occur in the case of reactivity transients. The ACRS encourages analytic modeling but believes appropriate experimental data are necessary. It is anticipated that tests in the Power Burst Facility (PBF) should supply much of the required data.

## 60 - BWR and PWR Pump Overspeed During A LOCA

It is possible for a BWR recirculation pump or a PWR primary coolant pump to overspeed if a large break occurs at the appropriate position in specific piping. Conservative estimates indicate substantial overspeed and possible failure of components, with the generation of missiles. The problem is being approached analytically and experimentally with scaled pumps. The reliability of such protective measures as the use of decouplers between pump and motor is under study for BWRs. In PWRs the reliability of such protective measures as electrical braking of the pump motor is under study.

61 - The Advisability Of Seismic Scram

The ACRS has recommended that studies be made of techniques for seismic scram and of the potential safety advantages and potential disadvantages of prompt reactor scram in the event of strong seismic motion, say more than one-half the safe shutdown earthquake. Various suitable techniques have been identified and exist, but thus far only limited studies have been reported on the pros and cons of seismic scram. The principal potential advantage identified arises from the greatly improved coolability of a core in the unlikely event of a seismically induced LOCA, should scram precede the LOCA by several seconds. A principal reason given in opposition to seismic scram relates to a stated interest in keeping power stations on the line to provide power offsite should a severe earthquake occur.

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62 - ECCS Capability For Future Plants

The ACRS has placed considerable emphasis on ECCS safety R&D so that the extent of the conservatism in the ECCS licensing requirements could be made more precise. With more experimental data a realistic and quantitative appraisal of ECC systems would lead to valid judgments on changes in licensing which could be put on a firm basis.

Parallel approaches that seek to improve the reliability of ECC systems, to improve the monitoring of low power peaking, and to improve those fuel assembly designs by achieving lower peaking factors, are encouraged. Further, changes in plant design which improve the reflooding of the reactor core should be sought and evaluated.

R&D efforts on analysis of core blowdown and reflood should be pursued and combined with the results of the standard problems and the associated experiments. Improved analytical methods would provide a basis for optimized ECCS.

63 - Ice Condenser Containments

The ice condenser containments have substantially smaller volume on the assumption that the ice will condense the steam during a LOCA, thus preventing system overpressurization. The rate of condensation is critical in the initial stages of the blowdown and is influenced by interaction of vapor with the ice. If the current analyses prove that the condensation model is suitably conservative, the problem may be resolved.

64 - Steam Generator Tube Leakage

Normally the steam generator is not a critical component during a LOCA-ECCS. However, a special case exists where the steam generator tubes have been degraded due to corrosion, wastage, etc. If the shock loads imposed by the LOCA cause a critical number of tubes to fail, say by a double-ended (guillotine) break, the inflow from the secondary side can cause choking of flow during ECC, preventing adequate cooling of the core. The critical number of tubes is relatively small. A position, such as one specifying a statistically significant level of nondestructive examination (NDE), might resolve this issue. The purpose of NDE would be to confirm that damage is not excessive; such examinations should minimize the possibility of catastrophic failure of a significant number of tubes.

65 - Periodic (10-Year) Review Of All Power Reactors

In its report of June 14, 1966, the ACRS recommended that periodic comprehensive reviews be conducted of operating licensed power reactors by the NRC Staff. These reviews would be preceded by a comprehensive report by the operator which evaluate the past experience and the safety of future operation of the plant.

The NRC Staff has maintained a continuing review of the safety of operating plants. In particular, as generic matters of potential safety significance arise, the appropriate operating reactors are asked to assess the relevance of the matter to each particular reactor. This is a necessary but different aspect of the continuing surveillance and review of the safety of operating reactors than was envisaged by the ACRS in its recommendation of June 1966.

The Committee continues to believe both approaches are desirable and awaits the development of a program of periodic comprehensive reviews.

66 - Computer Reactor Protection Systems*

The proposed systems would contain some types of components and subsystems not previously used for reactor protection. It is necessary that the required system reliability, both during normal operation and under postulated abnormal conditions, be established through an appropriate combination of tests and analyses. While the issue originated with the B&W Hybrid concept it is equally applicable to the proposed CE and W computer reactor protection systems.

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* Identified in the ACRS Report of April 16, 1976 as "Hybrid Reactor Protection System."

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## 67 - Behavior Of BWR Mark III Containments

The BWR Mark III Containment differs in many respects from the Mark I and II designs. Various aspects such as vent clearing, vent/coolant interaction, pool swell, pool stratification, pressure loads, and flow bypass must be evaluated and approved; ongoing experimental tests should develop much of the necessary data to confirm the conservatism in design.

68 - Stress Corrosion Cracking in BWR Piping

Several failures have occurred in operating BWRs. An ACRS letter of February 8, 1975, discusses possible actions that should lead to generic resolution, and extensive programs are underway by Industry, ERDA and NRC.

The austenitic stainless steels are commonly used as piping material in many BWR lines. A combination of weld sensitization, residual stresses, superposed loads, and oxygen equal to or greater than 0.2 ppm in the BWR coolant can lead to cracking, initiating on the inner surface and propagating through the wall. In most cases there will be a leak well before pipe failure so there is adequate warning; however, one can postulate a LOCA caused by a guillotine break with minimal prior warning. Current efforts are to minimize stress corrosion by using other materials.

69 - Locking Out Of ECCS Power Operated Valves

The physical locking out of electrical sources to specific motor-operated valves required in the engineered safety functions of ECCS has been required, based on the assumption that a spurious electrical signal at an inopportune time could activate the valves to the adverse position; e.g., closed rather than open, or open rather than closed. While such an event has a finite probability another probability exists that the valves might be adversely positioned due to operator error.

The ACRS believes the matter should be studied using a systems approach, and considering such items as: (1) the evaluation of the probability of a spurious signal; (2) time required to reactivate the valve operator; (3) status of signal lights when the circuit breaker is open; (4) the possibility of locking out in an improper position due to a faulty indicator; (5) other designs with improved reliability without lock-out; (6) the advantages and disadvantages of corrective action by an alert operator in case of incorrect positioning vis-a-vis a system with power locked out.

## 70 - Design Features To Control Sabotage

Considerable attention has been devoted to control of industrial sabotage of nuclear power plants, particularly with regard to control of unauthorized access, and potential modes of sabotage by individuals or groups external to the operating organization. The ACRS believes that deliberate attention should be given to aspects of design that could improve plant security. With the emphasis being placed on standardized plant designs, it becomes especially important to introduce design measures that could protect against industrial sabotage, or mitigate the consequences thereof.

A-280

## 71 - Decontamination Of Reactors

The Committee believes that well developed plans, confirmed by appropriate experiments when necessary, should be available for the decontamination of primary reactor systems. At this time the information on full scale decontamination is limited. Examples of potential problems include such items as handling of decontamination solutions, potential hideout of radioactive products, enhanced corrosion and crud formation following decontamination, and the possible incompatibility of the different alloys in the pressure boundary with the decontamination solutions.

72 - Decommissioning of Reactors

Experience is limited with regard to decommissioning operations, and particularly with rules for dismantling and for mothballing. Definitive plans and standards should be developed covering such items as adequacy of action, problems in restitution of site, mutual responsibility of State and Federal Government, etc.

## 73 - Vessel Support Structures

A possible consequence of the instantaneous double-ended pipe break postulated to occur in certain large pipes of PWRs is the asymmetric loading of the reactor pressure vessel support structures. The magnitude and effects of such loads on the pressure vessel should be determined to establish if such loads adversely affect the predicted course of a LOCA. If analysis indicates that the results are unacceptable, appropriate corrective action should be taken. A potential effect is pressure vessel movement due to blowdown jet forces at the location of the rupture, transient differential pressures in the annular region between the vessel and the shield, and transient differential pressures across the core barrel within the reactor vessel.

## 74 - Water Hammer

Several instances of water slugging or water hammer have occurred in both BWRs and PWRs due to causes such as the trapping of water between two valves. This slug of water is accelerated by steam or water once the valves are opened. The stored energy is sufficient to damage piping, bend or break pipe restraints, and damage support structures. Water hammer may occur due to flow instabilities in steam generators in conjunction with water flowing into the feedwater inlets, resulting in comparable damage.

Corrective measures should be taken to minimize such occurrences after completion of analytic and experimental studies directed to an understanding of the causes.

A-284

75 - Behavior Of BWR Mark I Containments

Recent tests on the BWR Mark I Containment design revealed phenomena not anticipated on the basis of earlier tests where pressure loads were imposed by insertion of air. Specific problems, somewhat comparable to those under review for the Mark III Containment, include relief valve discharge, pipe restraints in the torus, local dynamic loads on the torus, vent clearing, and influence of torus temperature on the LOCA.

Ongoing experiments are expected to develop the necessary data to confirm the adequacy of the existing design or to permit necessary modifications.

A-285

76 - Assurance of Continuous Long-Term Capability of Hermetic Seals on Instrumentation and Electrical Equipment

Certain classes of instrumentation incorporate hermetic seals. When safety related components within containment must function during post-LOCA accident conditions, their operability is sensitive to the ingress of steam or water if the hermetic seals are either initially defective or should become defective as a result of damage or aging. The damage processes may fall within Item 33, "Performance of Critical Components in Post-LOCA Environment"; however, a special case requiring evaluation has to do with personnel errors in the maintenance of such equipment since such errors could lead to the loss of effective hermetic seals.

77 - Soil-Structure Interactions

Ongoing studies by the NRC and the industry are reviewing and re-evaluating matters related to soil-structure interaction and to the appropriate seismic response spectrum to be used at the foundation level of a nuclear power plant. These reviews may lead to a modification of current criteria used in the seismic design of foundation structures.

Cross-Reference of Numbering System
Between Present Report and the Previous Report*

| Present | Previous | Present | Previous | Present | Previous | Present | Previous |
|---|---|---|---|---|---|---|---|
| 1 | I-1 | 23 | I-23 | 45 | ID-4 | 65 | IIA-4 |
| 2 | I-2 | 24 | I-24 | 46 | IE-1 | 66 | IIB-1 |
| 3 | I-3 | 25 | I-25 | 47 | IE-2 | 50 | IIB-2 |
| 4 | I-4 | 26 | IA-1 | 48 | IE-3 | 67 | IIB-3 |
| 5 | I-5 | 27 | IA-2 | 49 | II-5A | 68 | IIB-4 |
| 6 | I-6 | 28 | IA-3 | 50 | IIB-2 | 69 | IIC-1 |
| 7 | I-7 | 29 | IA-4 | 51 | IIC-6 | 70 | IIC-2 |
| 8 | I-8 | 30 | IA-[illegible] | 52 | IID-1 | 71 | IIC-3A |
| 9 | I-9 | 31 | IB-1 | 53 | II-1 | 72 | IIC-3B |
| 10 | I-10 | 32 | IB-2 | 54 | II-2 | 73 | IIC-4 |
| [illegible] | I-11 | 33 | IB-3 | 55 | II-3 | 74 | IIC-5 |
| 12 | I-12 | 34 | IB-4 | 56 | II-4 | 51 | IIC-6 |
| 13 | I-13 | 35 | IB-5 | 49 | II-5A | 75 | IIC-7 |
| 14 | I-14 | 36 | IB-6 | 57 | II-5B | 52 | IID-1 |
| 15 | I-15 | 37 | IB-7 | 58 | II-6 | 76 | IID-2 |
| 16 | I-16 | 38 | IC-1 | 59 | II-7 | 77 | IIE-1 |
| 17 | I-17 | 39 | IC-2 | 60 | II-8 & IIA-2 | | |
| 18 | I-18 | 40 | IC-3 | 61 | II-9 | | |
| 19 | I-19 | 41 | IC-4 | 62 | II-10 | | |
| 20 | I-20 | 42 | ID-1 | 63 | IIA-1 | | |
| 21 | I-21 | 43 | ID-2 | 60 | IIA-2 | | |
| 22 | I-22 | 44 | ID-3 | 64 | IIA-3 | | |

*Status of Generic Items Relating to Light-Water Reactor Rpt. No. 6, 11/15/77.

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Attachment 4

# DELETION

1

(pgs A-289 - 301)

SUMMARY OF THE MARCH 1-2, 1979
MEETING OF THE AD HOC SUBCOMMITTEE
ON EVALUATION OF LICENSEE EVENTS
REPORTS

The purpose of the meeting was to review the work that some NRC Staff organizations are performing with LERs and to explore with ACRS Consultants their work thus far on the LER study. Attendees at the meeting were Dr. Moeller, Mr. Etherington and Dr. Mark. Consultants peesent were Mr. Arnold, Mr. Epler, Mr. Michelson, Dr. Lipinski, Mr. Cromer, Dr. Seale, Dr. Parker, Dr. Zudans and Mr. Ditto. David Johnson, an ACRS Fellow also participated in the meeting. During the Executive Session, Dr. Moeller reviewed for the Consultants the history, background and objectives of the LER study. He also reviewed with them the memo which he prepared on the proposed plan for the LER Study and discussed the scope of the study with the Consultants.

Dr. Hanauer discussed his experience in studying LERs. He emphasized that he has not done any statistical type studies and that he feels the LER system is important and provides much useful information. He mentioned two things that he has been interested in while studying LERs: 1. Is the reliability of systems and components better or worse than it should be based upon the LER data and 2. Identification of important LERs and the course of corrective action taken.

Mr. Ludwig Benner, Chief of the Hazardous Materials Division of the National Transportation Safety Board discussed his insights as to how the ACRS might use the LER system to improve safety. He said that in his area of responsibility, the process of what happened in one accident is examined to try to prevent others from happening. He feels that the accident process can be related to standards criteria by various reporting methods and he referred the subcommittee to an events modeling process that is used in investigations by the NTSB.

Mr. Eisenhut, DOR, discussed the sequence of events within DOR as LERs come into the reporting system. The LERs are reviewed on a day-to-day basis and on a generic basis. The individual project manager screens LERs pertinent to his reactor on a day-to-day basis and a technical reviewer reviews LERs in his area of knowledge.

Mr. Medeiros, Office of Standards Development briefly reviewed changes that are being planned in reporting requirements for LERs (Reg. Guide 1.16). The revision is aimed partly at removing requirements for reporting insignificant events and removing loop holes in the reporting process. The Reg. Guide revision will probably be complete and ready for ACRS review in the summer of 1979.

Mr. Vesely, Office of Research and Mr. Poloski of INEL reviewed the research going on at INEL in evaluation of LERs. The objectives of the work are to determine failure rates and confidence bounds using the LER file. Part of the work is also designed to develop common cause analysis of LERs and to perform some statistical analysis of LER and NPRDS data. LER data is extracted from the LER and coded into a one line format. The one line format for each LER can then be processed, sorted and with other data, failure rate calculations and confidence bounds are made. This information will then be published in a series of reports for various components. A report on control rods and drive mechanisms has been completed and a report on pumps is nearly completed.

On Friday, an Executive Session was held with the consultants who were still available. Dr. Moeller reviewed the status of the study thus far in terms of the LER reporting system and recommended analyses that should be carried on.

Mr. Michelson suggested that construction deficiencies, their corrective actions, and subsequent effect on LERs during plant operations are important. Mr. Arnold suggested that as a first cut to the study, the NRC Staff be invited to trace the path of a few LERs from their inception through the various NRC organizations from bottom to top and have the Committee judge if the action taken is appropriate. The subcommittee and consultants agreed that this was a good idea and each consultant was asked to pick three possible LERs for this.

Mr. Parker said that it would be useful to sort out the important LERs from the unimportant and trivial ones. He suggested that they might be broken into four categories: those affecting the plant, the public, potentially affecting the plant, and potentially affecting the public. An indication of severity could be given to each. A judgement could be made as to the importance of the four categories in terms of the consequences of an event by itself or the potential consequences of several events.

The consultants also discussed specific things they have learned from their preliminary studies of the LERs sent to them. Dr. Moeller concluded the meeting by informing the subcommittee and consultants that within a short time a suggested scope of the final report would be drafted, a schedule for future meetings established and a format for the individual consultants' reports would be made.

1

A-305

D.W.Moeller: 3/8/79

COMMENTS ON CURRENT LER REPORTING SYSTEM
OBSERVATIONS BASED ON LER SUBCOMMITTEE MEETING ON
MARCH 1 AND 2, 1979

1. Overall Recommendations

   a. The NRC should clearly define the goal of the LER reporting system.

   b. Care should be taken not to permit the reporting form to hamper full disclosure of the event.

   c. Every effort should be made to arrange the reporting system so as to enhance the discovery of the safety implications of each event.

   d. The NRC might consider developing procedures for greater public input into the LER reporting system and its evaluation.

2. Adequacy of Reporting

   a. The NRC should evaluate the possibility of over-reporting for some events and under-reporting for others. For example, an apparent over-abundance of LERs relative to set point drift (actually, errors in calibration) may be due to the set points being specified on too restrictive a basis in the Technical Specifications for certain power plants.

   b. The proposed revisions in Regulatory Guide 1.16 regarding removing loopholes and deficiencies should be carefully removed and evaluated prior to implementation.

   c. The NRC should seek to attain greater uniformity in the LER reporting system. This should include revisions to reduce potential biases of licensees in reporting, and possible differences in the depth of reviews of LERs by NRC inspectors. It should also include any revisions in the system necessary to reduce differences due to variations in the Technical Specifications for plants of different ages.

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d. The NRC should emphasize the need to seek out the cause of each LER (particularly to reduce the number of reported events of unknown origin) and to cite the true cause versus simply naming the specific component in which the failure was observed.

e. There is also a need for the NRC to review the LER reporting system with a view toward:

(1) Increased reporting of information relative to systems interaction

(2) Changes in reporting and logging LERs so as to enhance data retrievability and analyses

(3) Better coordination and interchange between the LER and NPRDS reporting systems

(4) Improved centralization of LER handling and analyses within NRC

f. Lastly, the NRC might consider a detailed study of the reporting mechanisms of the NTSB relative to possible improvement in the LER system.

3. Recommended Analyses

Subcommittee members and consultants suggested a variety of studies and analyses that might be undertaken or expanded with existing LER data. These suggestions included:

a. A study should be made of construction deficiencies, corrective actions, and subsequent LERs to determine their impact at the plant operating stage. In essence, there appears to be a need for better communication during the CP and OL stages. In this regard, it was suggested that Subcommittee members be provided with a plant-by-plant printout of Construction Deficiencies as reported under Parts 21 and 50.55e. These, in turn, would be compared to subsequent LERs occurring at the same plant.

b. The Subcommittee recommended that NRC studies on failure rates, and subsequent analyses of their implications relative to associated risks, should be continued.

c. One Subcommittee consultant suggested that the NRC consider placing counters on key components within operating plants to record the number of times they are called upon for response.

d. Consideration should be given to conducting an analysis to determine whether the frequency of LERs that occur as a result of design errors or defective procedures decreases with plant operating lifetime. Presumably, if proper corrective measures are applied, this should be the case.

e. To gain further insight into systems interactions, an analysis might be conducted of all LERs occurring at multi-unit stations.

f. Limited studies should be conducted of "clusters" and "groupings" of LERs as well as their time of occurrence and sequence. This could provide useful information on possible precursors and on cause-effect relationships.

g. An analysis might also be conducted to determine if the occurrence of certain classes of LERs occur more frequently at one plant versus another where the several plants are comparable in design. Such an analysis might provide data on the accuracy of the reported system, biases or self-interests of the originators, or influencing factors of I&E personnel.

h. The ACRS staff (perhaps ACRS fellows) should consider conducting a comparison study of the same LERs as entered on the computer tapes at NSIC versus NRC Headquarters (NIH). This is to determine if the same care is used in entering and recording the data and whether different interpretations result from different personnel handling the basic raw data as submitted by licensees.

4. Other Considerations

a. Several Subcommittee members and consultants suggested that EPRI be contacted to determine what they are doing and to stimulate cooperative industrial efforts in solving some of the problems evidenced by LERs.

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b. The Subcommittee has been told that the Southwest Research Institute (which operates the NPRDS system) is collecting data on failure rates of given components within commercial nuclear power plants. Subcommittee members and consultants indicated they would like to have officials of SRI meet with us at a future meeting so as to provide further details on the NPRDS system.

c. The Subcommittee suggested that printouts be requested of LERs involving aluminum conductors and leakage of hydraulic fluids. Another suggestion was that a printout be obtained of all LERs that occurred as a result of lightning or thunderstorms. These, in turn, should be submitted to an ACRS consultant knowledgeable in the field of electrical systems for review and evaluation relative to their safety implications.

d. Mr. Herbert Parker suggested that the LERs on air cleaning, monitoring, and ventilating systems be provided to Mr. Ronald L. Kathren of Battelle-Northwest Laboratories for review and evaluation. Mr. Kathren should also be provided with a copy of Dr. Moeller's paper on this subject.

e. Subcommittee members expressed considerable interest in the analyses of human errors and requested that personnel from Iowa State University be requested to review their work at a forthcoming Subcommittee meeting. It was also suggested that the Subcommitte obtain the comments and suggestions of Mr. Hugh Warren, ACRS consultant, on the role of human errors as a contributing factor to LERs.

5. <u>Future Work</u>

Following review of the LERs provided to them, each consultant to the Subcommittee was asked to provide a list of up to 5 specific sequences of events that should be considered for follow-up action. On the basis of the suggestions received (which are to be provided no later than the time of the Subcommittee meeting scheduled for March 23 and 24), the Subcommittee will select three to five LERs for detailed indepth review.

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The selected LERs will include those that were apparent successes as well as failures (in terms of corrective action) and the indepth review will include reports to the Subcommittee by plant personnel reporting the LER, I&E personnel involved, the associated vendor, and the NRC personnel responsible for logging the LER into the system, analyzing its implications, and determining the adequacy of corrective actions. In short, the Subcommittee wants to conduct a complete case history review on several key LERs.

Lastly, it was suggested that Subcommittee members be provided a schedule for future meetings, plus an outline of the proposed scope of the final report. These items have been developed and are attached.

Attachments:
1. Schedule
2. Proposed Scope of Report

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## SCHEDULE

MARCH 23 & 24 — SUBCOMMITTEE MEETING

- select LERs for indepth review
- discussions with field personnel (I&E) involved in evaluations of LERs
- discussions with Dr. Harold Lewis
- initial review of consultant-prepared writeups of key classes or categories of LERs

APRIL 26 & 27 — SUBCOMMITTEE MEETING

- review of case histories of selected LERs (including discussions with people involved)
- further selection of LERs of significance (to be included in the report with details)
- continued review of writeups on key classes or categories of LERs
- discussions with representatives of reactor vendors and EPRI

MAY 24 & 25 — SUBCOMMITTEE MEETING

- review of writeups on key classes or categories of LERs (continued)
- begin to formulate Subcommittee conclusions

JUNE 28 &29 — SUBCOMMITTEE MEETING

- review 1st draft of Subcommittee report

JULY 19 — SUBCOMMITTEE MEETING

- review and approve final Subcommittee report

AUGUST 9-11 — FULL COMMITTEE MEETING

- full Committee review and approval of report

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ATTACHMENT 2
D. W. Moeller - 3/8/79

# SCOPE OF REPORT

I. Introduction

Origins and Purposes of the Study

II. General Review of Findings

III. Review of Specific Categories or Classes of LERs

A. General Description of Failures (including review of generic implications)

B. Frequencies of Occurrence

C. Implications Regarding Safety

D. Corrective Action

1. Was cause of failure clearly determined?

2. Was the fix adequate? Did it address the basic source of the problem?

3. What are the implications of the events relative to research needs?

IV. Recommendations for Future Action

V. Summary and Conclusions

Appendices:

1. This will consist of an enumeration of specific classes of LERs with comments on the specific items and questions cited under Item III above. Preliminary examples of reports on several classes of LERs are attached.

2. Special Studies

   a. Statistical Summary on Air Cleaning
   b. Studies of Clusters on Groups
   c. Other special studies

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## Class of Event

Isolation of high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) systems. This appears to be a problem generic to BWRs.

## General Description

In the events reported, isolation of the two systems occurred as a result of inadequacies in the air ventilating systems. The basis of the problem is that the areas through which the piping for the HPCI and RCIC systems passes are equipped with temperature sensors that are designed to isolate the systems in cases there is a steam leak in the lines. If there is a malfunction in the ventilating systems for these areas, or a sudden change in the outdoor temperature which leads to the sensor indicating a steam leak, the two systems are automatically isolated.

## Frequency of Occurrence

Nine events reported in 1976; eleven in 1977; several in 1978.

## Implications regarding Safety

With the systems isolated, coolant injection is not available for small breaks in the primary system piping.

## Corrective Action

a. The cause of the failure was clearly determined.

b. The fix was to increase the flow in the ventilation systems for the affected areas. However, this does not appear to address the basic cause of the event nor does it offer a permanent solution to the problem.

c. Research and/or additional evaluation appears to be needed if a permanent solution to the problem is to be implemented.

Class of Event

Failure of containment monitors

General Description

Several instances have recently been reported in which monitors within containment (including those designed to monitor post-accident conditions) have failed due to high ambient temperatures.

Frequency of Occurrence

Two such events involving radiation monitors were reported at the Davis-Besse Power Plant Unit 1 in late 1978. One of these involved a post-accident radiation monitor. A similar failure of a post-accident hydrogen analyzer occurred in the Joseph M. Farley Unit 1 in June, 1978. Other events may have occurred; a search is being made.

Implications Regarding Safety

Certain monitors within containment are the sources of alarm for containment isolation. In recent years, the ACRS has repeatedly called for instrumentation of this type (which is necessary to determine the nature and to follow the course of an accident) to be designed to withstand the environmental conditions accompanying an accident. Such requirements have supposedly been implemented through Regulatory Guide 1.97. The performance of an instrument that fails due to high ambient temperatures would be suspect in a post-accident environment. Without adequate post-accident monitoring, the actuation of isolation systems may not occur. In addition, in the case of the hydrogen analyzer an explosive mixture could develop without the knowledge of plant personnel.

Corrective Action

a. The cause of the failure appears to have clearly been determined. Basically, it was attributed (in addition to the heat) to a design error.

b. The fix called for better cooling and a reevaluation of the systems. This appears to be a generic problem that should never have occurred. Research may be necessary to determine a positive solution to the problem.

Class of Event

Bypassing of monitors that actuate containment isolation.

General Description

To maintain the pressure below the Technical Specification Limit, a number of licensees vent the containment through the purge valves. In certain instances, such venting has occurred when the containment particulate monitor isolation signal to the purge valves was bypassed. As a result of this procedure, the purge valves would not have closed in the event of a loss-of-coolant accident.

Frequency of Occurrence

At least two events, one at Salem Unit 1 and one at Millstone Unit 2, occurred in 1978.

Implications Regarding Safety

This situation could result, in case of a LOCA in an excessive release of airborne radioactive materials into the atmosphere.

Corrective Action

a. The NRC Staff is fully aware of these events and the licensees have modified their procedures to preclude venting of the containment through the purge valves if a containment high particulate alarm occurs. The fix, however, appears to be administrative rather than technical.

b. The situation appears to call for an indepth review to determine how the possible occurrence of such a sequence of events could have been overlooked. The reported occurrences appear to be a violation of basic safety precautions.

Class of Event

Containment purging and airborne releases.

General Description

There has been a number of LERs in recent years that relate to containment purging and its relationship to containment integrity and excessive airborne releases for PWR installations. For example, excessive airborne releases at one plant in 1977 led to a decision to reduce the frequency of containment purging. A factor entering into this decision was that the plant had 910 mm-diameter purge lines, and the NRC prefers not to permit continuous purging unless smaller 200 mm-diameter lines have been installed. As a result of the reduction in the frequency of purging, airborne releases from the plant were reduced. At the same time, however, this led to a reduction in the frequency with which the containment could be entered for visual inspection of safety-related equipment, such as piping, snubbers, etc.

In a similar situation at another PWR in 1978, minimizing the frequency of purging led to a buildup of radioactive materials within the primary containment to the point where both the gaseous and particulate monitors were at or near full-scale indication. As a result, the monitors became incapable of detecting further increases in airborne activity that could have occurred as a result of a significant increase in reactor coolant leakage.

Frequency of Occurrence

Although only a few LERs are reported annually in this category, the problem appears to be generic in nature and the number of events involved may be greater than those revealed by the LERs.

Implications Regarding Safety

In the first case, the reduction in the ability and frequency with which inspections can be conducted within containment could lead to a reduction in overall safe plant operation. In the second case, the fact that personnel would purge containment to prevent gaseous and particulate monitoring devices from going off scale appears to reveal a deficiency in the ranges of such monitoring equipment. Although presumably higher range units are available for post-accident monitoring, this is not clear.

Corrective Action

a. Presumably problems of this type were corrected on a generic basis through the development of Regulatory Guide 1.97. Supporting the development of this Guide, the ACRS has consistently urged that more attention be directed to the provisions of instruments capable of determining the nature and following the course of an accident. This has included emphasis on providing instruments with ranges sufficient to assess accident conditions.

b. It is evident that this matter needs further study and that a generic approach to its solution is required. Although there may be an administrative solution to the problem, it is not obvious that it has been found.

Footnote

The events reported above, and those related to failures of minitors within containment (due to high ambient temperatures) and to the isolation of the monitors that actuate the closing of containment purge valves in case of a LOCA, are all inter-related. It is quite possible that all three of these classes of events could be discussed under one heading or category of LER.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 14, 1979

APPENDIX XXVIII
COMBINATION OF DYNAMIC LOADS AS A
REGULATORY DESIGN BASIS

Honorable Joseph M. Hendrie
Chairman
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: COMBINATION OF DYNAMIC LOADS AS A REGULATORY DESIGN BASIS

Dear Dr. Hendrie:

This letter is in response to Commissioner Kennedy's question at the November 2, 1978 meeting between the Commissioners and the ACRS, concerning the combination of dynamic loads as a design basis for nuclear facilities.

The NRC Staff is considering the use of "Square Root of the Sum of the Squares" methodology when combining LOCA and seismic loadings for the primary coolant system boundary. This may eliminate some possibly undesirable conservatism in load combination methodology; however, it addresses only a small portion of the issues in question. The treatment of structural supports for example, is not, at present, considered similarly.

The ACRS is aware of a number of technical programs addressing load-combinations which have been initiated by the Office of Nuclear Reactor Regulation under technical assistance contracts and through requests to the Office of Nuclear Regulatory Research. These may ultimately alter the Staff position on combined loads. However, their presently incomplete status makes a full commentary premature at this time.

The ACRS has established a Subcommittee to continue review of this question and will report to you at an appropriate time.

Sincerely,

Max W. Carbon

Max W. Carbon
Chairman

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 12, 1979

Mr. Lee V. Gossick
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: ACRS ACTION ON PROPOSED REVISIONS OF REGULATORY GUIDES

Dear Mr. Gossick:

During its 227th meeting, March 8-10, 1979, the ACRS concurred in the regulatory position of the following Regulatory Guides:

Regulatory Guide 1.137, Revision 1, "Fuel Oil Systems for Standby Diesel-Generators," and

Regulatory Guide 1.143, Revision 1, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants."

Sincerely,

Max W. Carbon
Chairman

cc: H. Denton, NRR
R. Minogue, OSD
G. Arlotto, OSD
S. J. Chilk, SECY

bcc: ACRS Members
J. Jacobs
H. Voress

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 14, 1979

MEMO FOR: L. V. Gossick
Executive Director for Operations

FROM: R. F. Fraley *R F Fraley*
Executive Director

SUBJECT: REQUIREMENTS FOR SHUTDOWN AND DECAY HEAT REMOVAL USING SAFETY GRADE EQUIPMENT

During the 226th ACRS meeting, February 8-10, 1979, the NRC Staff made a detailed presentation to the Committee concerning the matter of safety grade cold shutdown requirements.

One portion of the presentation and ensuing discussion related to differences of opinion between the NRC Staff and some representatives of industry concerning the relative safety merits of hot-standby versus cold-shutdown conditions and to the maximum desirable time interval before decay heat removal could be accomplished by the low pressure residual heat removal system. Various possible situations, including fire, earthquake, flooding of non-safety grade equipment, and limited supplies of cooling water with acceptable chemistry control, were identified as representing potentially significant factors in a decision on whether safety grade equipment is needed to make the transition from hot-standby to cold-shutdown. However, the NRC Staff did not have the benefit of a systematic probabilistic analysis.

The ACRS believes that the application of fault-tree/event-tree methodology, quantified as possible with particular attention to identification and estimation of uncertainties, could provide considerable insight into the merits of the various current arguments, pro and con, concerning this general matter. Such studies are also likely to identify specific situations for operating plants where special attention may be needed.

The ACRS recommends that a limited probabilistic study, involving members of the Probabilistic Assessment Staff and the licensing staff, be undertaken. Following evaluation of the results of this study, a decision can be made concerning the merits of further work along these lines.

cc: H. Denton, NRR
S. Levine, RES
R. L. Minogue, SD
A. R. Buhl, PAS/NRR
S. Chilk, SEC

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 13, 1979

Mr. Lee V. Gossick
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: TRANSPORTATION OF RADIOACTIVE MATERIALS

Dear Mr. Gossick:

During its 227th meeting, March 8-10, 1979, the Advisory Committee on Reactor Safeguards was briefed by the NRC Staff concerning possible courses of action being considered in relation to the regulation of highway routing of radioactive materials.

The Committee wishes to observe that there are very large quantities of nonradioactive, hazardous materials shipped by highway, and that many of these materials are equally or more hazardous than spent nuclear fuel under conditions of accident or postulated sabotage. The Committee believes that regulations concerning the transportation of radioactive material by highway should be evaluated and adopted with full cognizance of the risks for nonradioactive material, and recommends that the NRC Staff assure that information concerning risks from both radioactive and nonradioactive shipments be made available to the Nuclear Regulatory Commission and the Department of Transportation.

Sincerely,

Max W. Carbon

Max W. Carbon
Chairman

cc: Joseph M. Hendrie, CCM
R. Bernero, SD
S. Chilk, SECY

bcc: ACRS Members
J. Jacobs
H. Voress

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

MAR 13 1979

R. Bernero, Assistant Director, Material Safety Standards, SD

SUBJECT: TRANSPORTATION OF RADIOACTIVE MATERIALS, ACRS PARTICIPATION

The review by the ACRS of the NRC Staff's assessment of the risks associated with the transportation of radioactive materials was undertaken at the request of the Commission and is related specifically to the contemplated NRC rule-making proceedings regarding alternate methods of shipment, including the NRC Urban Area Study.

The Committee has decided that it sees no need for it to review the other possible actions related to transportation and to relations between the NRC and the DOT, unless the Commission sees compelling reasons for further involvement.

R. F. Fraley
R. F. Fraley
Executive Director
ACRS

cc: L. V. Gossick, EDO
R. Minogue, SD
G. Arlotto, DES

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

March 13, 1979

APPENDIX XXXIII
ACRS REPORT ON WM H. ZIMMER NUCLEAR POWER PLANT UNIT 1

Honorable Joseph M. Hendrie
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: REPORT ON WILLIAM H. ZIMMER NUCLEAR POWER STATION, UNIT 1

Dear Dr. Hendrie:

During its 227th meeting, March 8-10, 1979, the Advisory Committee on Reactor Safeguards completed its review of the application of the Cincinnati Gas and Electric Company (CG&E), the Columbus and Southern Ohio Electric Company, and the Dayton Power and Light Company (hereinafter referred to collectively as the Applicants) for authorization to operate the William H. Zimmer Nuclear Power Station, Unit 1. CG&E will be responsible for operating the plant. A tour of the facility was made by members of the Subcommittee on November 16, 1978 and the application was considered at Subcommittee meetings on November 17, 1978 and February 27, 1979. During its review, the Committee had the benefit of discussions with representatives and consultants of the Applicants, the General Electric Company, Sargent and Lundy Company, Kaiser Engineers Incorporated and the Nuclear Regulatory Commission (NRC) Staff. The Committee also had the benefit of the documents listed. The Committee reported on the application for a construction permit for this plant on September 17, 1971.

The Zimmer Nuclear Power Station is located in Ohio on the Ohio River approximately 24 miles southeast of Cincinnati and one-half mile north of Moscow, Ohio. The plant will utilize a 2436 MWt BWR/5 boiling water reactor which is similar to the BWR/4 used in the Edwin I. Hatch Nuclear Plant, Unit No. 2. A principal difference is the use of recirculation flow control valves to regulate power rather than pump speed control which has been used on plants of the BWR/4 type.

The Zimmer Nuclear Power Station has a Mark II pressure suppression containment and is designated as one of the lead plants for this type containment. The NRC Staff has reviewed the generic aspects of the Mark II containment system and has reported its findings in NUREG-0487. The generic aspects of Mark II load evaluation and acceptance criteria were considered at Subcommittee meetings on July 7-8, 1977, November 30, 1977, May 23, 1978, and November 28-30, 1978. The Committee believes that the acceptance criteria are suitable for the lead Mark II plants.

The Applicants have taken exception to some of the acceptance criteria developed by the NRC Staff. The Staff and the Applicants are continuing to work together to resolve this matter. The Committee wishes to be kept informed.

The Mark II Owners Group and the NRC Staff are continuing to develop information relating to the method of combining loads on the containment structure. However, the Applicants have indicated that they will accept the NRC Staff's current, perhaps overly conservative, methodology, to expedite the licensing action. The Committee considers this acceptable.

The NRC Staff has determined that the present Emergency Core Cooling System analysis contains adequate margins for assessing the performance of the Zimmer Plant. It should be noted that recent tests in the Two Loop Test Apparatus (TLTA) have produced new data on the rate of vaporization of emergency core cooling water. The NRC Staff believes that further analysis of the TLTA test results may require changes in the General Electric model for calculation of this vaporization rate in order to reflect more accurately the observed physical phenomena. The Committee wishes to be kept informed.

In view of the important role of the Operational Review Committee in providing continuing reviews, and in updating and implementing safety measures, the ACRS recommends that the Operational Review Committee include additional experienced personnel from outside the corporate structure as voting members for the first few years of operation.

With regard to the generic items cited in the Committee's report, "Status of Generic Items Relating to Light Water Reactors: Report No. 6," dated November 15, 1977, those items considered relevant to Zimmer are: II-4, 5b, 6, 7, 8, 10; IIA-4; IIB-4; IIC-1, 3A, 3B, 5; IID-2. These items should be dealt with by the NRC Staff and the Applicants as solutions are found.

The Advisory Committee on Reactor Safeguards believes that, if due consideration is given to the items mentioned above, and subject to satisfactory completion of construction and preoperational testing, the William H. Zimmer Nuclear Power Station, Unit 1 can be operated without undue risk to the health and safety of the public.

Sincerely,

Max W. Carbon

Max W. Carbon
Chairman

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References:

1. Cincinnati Gas and Electric Company, "Final Safety Analysis Report, William H. Zimmer Nuclear Power Station, Unit 1," with Amendments 23 through 32.

2. U. S. Nuclear Regulatory Commission (USNRC), "Safety Evaluation Report Related to the Operation of William H. Zimmer Nuclear Power Station, Unit 1, Docket No. 50-358," USNRC Report NUREG-0528, dated January 31, 1979.

3. U. S. Nuclear Regulatory Commission, "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," USNRC Report NUREG-0487, dated October, 1978.

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Additional Documents Provided for ACRS' Use

1. Letters, J. M. Hendrie to T. P. O'Niell, Speaker of the House of Representatives and W. Mondale, Vice President of the United States on "Proposed Changes in NRC Civil Penalty Authority", and attachment, n.d.

2. Memorandum, C. R. Storber, Ass't General Coursel, NRC to Commissioner Kennedy, "Response to Questions about Revised Civil Penalties Proposal", dtd March 8, 1979.

3. Letter, T. G. McCreless, ACRS Staff to W. Kerr, Chmn. ACRS Subcommit ee on ATWS, "Summary of NRC Staff Meeting of March 1, 1979" [on ATWS], dtd. March 7, 1979.

4. Memorandum, T. L. Kelley, Dep. Gen. Counsel, NRC to NRC Commissioners, "Draft Federal Register Notice Concerning Subpoenas to ACRS Consultants, dtd. Feb. 12, 1979.

5. Letter, H. R. Denton, ONRR to S. Lawroski, Chmn. ACRS, on "Status of Generic Items Related to Light-Water Reactors: Report No. 6" and attachments, Dtd. Dec. 4, 1978.

6. Letter, ACRS Consultant to ACRS Staff, on reliability of Scram System, Feb. 12, 1979.

7. Letter, ACRS Consultant to ACRS Staff on Reliability of RESAR-414 Scram System, dtd. Aug. 18, 1978 and July 31, 1978.

8. Information Report SECY-78-611, "DOT Inquiry on Highway Routing of Radioactive Materials", R. B. Minogue, dtd. Nov. 24, 1978.

9. Letter, L. D. Santman, Acting Director, Materials Transportation Bureau, DOT, to Chmn. J. M. Hendrie, NRC, on rulemaking regarding routing of highway shipments of radioactive materials, dtd. Aug. 18, 1978.

10. Letter, L. V. Gossick, Executive Director for Operations, NRC to L. D. Santman, DOT, on rulemaking regarding routing of highway shipments of radioactive materials, [illegible]. Sep. 10, 1978 and Nov. 20, 1978.

11. Letters, F. von Hippel, Pr[illegible] Univ. to Rep. M. K. Udall on NRC response to the critic[illegible]ed by the Risk Assessment Review Group.

12. Letter, H. J. C. Konts, Brookhaven National Lab. to NRC Commissioners on NRC response to the criticism provided by the Risk Assessment Review Group.

Additional Documents Provided for ACRS' Use

13. Letter, F. H. Rowsome to H. W. Lewis, Chmn. Risk Assessement Group, on the Report of the Risk Assessment Review Group, and Attach.

14. Memo., S. J. Chilk, Secy. of NRC to L. V. Gossick, Executive Director for Operations, NRC, "Staff Actions Regarding Risk Assessment Review Group Report" and Attach., dtd. Jan. 18, 1979.

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