

November 28, 1990

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Proprietary Reports	16 copies
Nonproprietary version of Proprietary Reports	8 copies
Nonproprietary Reports	16 copies

However, the staff said it would see if the standard number could be reduced for this approved topical report and it would advise the HCOG of its conclusions.

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Enclosures:  
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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

November 28, 1990

Docket Nos. 50-416, 50-440, 50-458, and 50-461

LICENSEES: Entergy Operations, Inc.  
The Cleveland Electric Illuminating Company  
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Illinois Power Company

FACILITIES: Grand Gulf Nuclear Station, Unit No. 1  
Perry Nuclear Power Plant, Unit No. 1  
River Bend Station, Unit No. 1  
Clinton Power Station

SUBJECT: SUMMARY OF OCTOBER 23, 1990 MEETING WITH MARK III  
CONTAINMENT HYDROGEN CONTROL OWNERS GROUP (HCOG)  
REGARDING THE GENERIC SAFETY EVALUATION REPORT (SER)  
RELATING TO THE MARK III CONTAINMENT HYDROGEN CONTROL

The purpose of the meeting was to hear and discuss HCOG's request for changes to the staff's SER of the HCOG topical report HGN-112-NP, "Generic Hydrogen Control Information for BWR6 Mark III Containments," and for a reduction in the content and number of copies of the approved topical report. Enclosure 1 is a list of meeting attendees. Enclosure 2 is a handout prepared by HCOG.

Two technical areas were discussed in the meeting; severe accident sequences for station blackout with spray cooling available (Sheets 3-12), and the peak containment pressure which is used for equipment survivability (Sheet 14). HCOG comments on the content and schedule of the approved topical report were also discussed (Sheet 15).

HCOG requested that the SER be changed as noted on Sheets 13 and 14 of Enclosure 2. A formal submittal will be made providing the bases for the requested changes. The staff agrees that the clarifications noted on Sheet 13 appeared to be reasonable. However, the requested changes related to the availability of spray coolers and peak containment pressure will require some review. The schedule for submittal of the approved topical report is January 23, 1991, provided the exceptions to the SER can be approved within a month.

Licensees of the four BWR6 plants were present in the meeting. They indicated that it may not be possible to meet their commitment for submitting the final analyses required by 10 CFR Part 44 (within 6 months of issuance of the staff's SER on August 6, 1990). Requests for extensions will be made by each licensee, if needed, after resolution of the requested exceptions.

In response to the HCOG request to reference the HCOG submittals used and referenced by the staff in its SER, the staff said that the topical report HGN-112-NP was a brief description of the hydrogen control program plan and results, but the substantial test and analytical results, bases, and conclusions

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were provided in other submittals. These submittals were made over several years with varying degrees of significance. The significant reports used by the staff in its SER are listed in the Bibliography to the SER, and it is these submittals which should be submitted together with HGN-112-NP as the "approved topical report." The staff suggested that some of the voluminous test reports may not need to be resubmitted. Regarding the number of copies to be submitted, the staff stated the number of copies currently provided to make the standard distribution for topical reports was:

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HCOG/NRC MEETING  
October 23, 1990

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**HCOG/NRC MEETING**

**OCTOBER 23, 1990**

- o **OVERVIEW**
  
- o **SER HYDROGEN GENERATION SCENARIO CONSIDERATIONS**
  
- o **SPRAY/COOLER AVAILABILITY**
  
- o **SER CLARIFICATIONS**
  
- o **CONTENT & SCHEDULE OF ACCEPTED TOPICAL REPORT**

## OVERVIEW

- o SER closes most hydrogen control requirements of 10 CFR 50.44.
  - Identifies remaining issues to be addressed in plant specific reports.
  
- o Better definition of SBO sequence in SER is needed.
  - Assure consistency between HCOG HGE and recoverable TBU sequence
  
- o Equipment survivability analysis using sprays/coolers is justified.
  
- o Potential SER changes:
  - Severe vs. recoverable degraded core accidents
  - Pressure survivability
  
- o SER requirements for Topical Report content should be re-evaluated.
  - Attaching all references results in a document of excessive size.

# HYDROGEN GENERATION SCENARIO CONSIDERATIONS



## SER STATEMENTS

- p.21 "The phenomenology of the TBU sequence is similar to that of the HCOG base case with regard to the SORV."
- p.21 "For purposes of the hydrogen control rule, the TBU sequence as described in NUREG-1150 (which encompasses the SORV as described by the HCOG) is an acceptable sequence leading up to core recovery. In summary, the TBU is acceptable for the time sequence of events and for the hydrogen production rate and total amount."
- p.25 "For code modeling, the TBU sequence for an HGE was considered equivalent to the SORV sequence... with respect to the depressurization and core uncover time, thus similar as far as hydrogen generation is concerned."
- p.29 "The TBU sequence was found to be similar to the SORV, which was initially proposed by HCOG. Thus, for hydrogen generation purposes the TBU sequence satisfies the requirement of 10 CFR 50.44"

## 10 CFF, 50.44 REQUIREMENTS

- o "Each licensee... shall provide its nuclear power reactor with a hydrogen control system justified by a suitable program of experiment and analysis."
  - HCS must handle 75% MWR without loss of containment structural integrity.
  
- o "Each licensee... shall provide its nuclear power reactor with systems and components necessary to establish and maintain safe shutdown and to maintain containment integrity. These systems and components must be capable of performing their functions during and after exposure to the environmental conditions created by the burning of hydrogen."
  
- o Each licensee... shall submit an analysis to the Commission. The analysis must:
  - Provide an evaluation of the consequences of large amounts of hydrogen generated after the start of an accident...
  - "Include the period of recovery from the degraded condition."
  - "Use accident scenarios that are accepted by the NRC staff. These scenarios must be accompanied by sufficient supporting justification to show that they describe the behavior of the reactor system during and following an accident resulting in a degraded core."

## HCOG SCENARIO

- o **HCOG HGE Scenario:**
  - **LOSP initiator**
  - **SRVs cycle; one sticks open**
  - **Fail high pressure systems**
  - **One ESF division available**
  - **Cannot inject with low pressure ECCS**
    - > **Sprays/coolers available**
  - **Core heats up following depressurization**
  - **Have hydrogen generation due to low flow (150 gpm) reflood.**
    - > **Maximizes H<sub>2</sub> production**
  - **Non-mechanistic 'tail' added to achieve 75% MWR.**
  
- o **The HCOG scenario meets the requirements of 10 CFR 50.44.**
  - **Substantiated by large program of testing and analysis**
  - **Includes period of recovery**
  - **Addresses 75% MWR requirement**



## HCOG SCENARIO (cont'd)

- Adheres to the EPGs and the reactor system behavior for the conditions assumed
- Containment structural integrity and equipment survivability have been addressed

## HCOG CONSIDERATION OF STATION BLACKOUT

- HCOG evaluated June 1987 draft of NUREG-1150 to determine impact to hydrogen program.

### CONCLUSIONS (re: HGN-123)

- Some SBO scenarios were inconsistent with Mark III plant design.
- For most sequences, the core was non-recoverable.
- Major aspects of HCOG HGE were consistent with the small percentage of recoverable core SBO sequences.

### RECOMMENDATIONS:

- Close hydrogen issues in SER to address 10 CFR 50.44.
- Address SBO and igniter alternate power supply during IPEs.

## CURRENT UNDERSTANDING OF SBO IN SER

- o The SER identifies TBU as an acceptable sequence for 10 CFR 50.44 compliance up to core recovery.
  
- o Consistent elements of HCOG HGE and recoverable TBU in SER:
  - Recoverable core.
  - Depressurized vessel.
  - Core uncover time.
  - Core is reflooded by low flow system (CRD @ 150 gpm)
    - > "...hydrogen released in the low-rate reflood case is higher than that released in the high-rate reflood case."



## SER ASPECTS REQUIRING CLARIFICATION

- o Must recover AC power for reflood.
- o Power restoration must occur well in advance of reflood.
- o Must reflood at 3100 seconds.
- o Therefore, with the above clarification, the proposed HCOG scenario is acceptable, as it is consistent with the TBU sequence as an initiator for an HGE.

## SPRAY/COOLER AVAILABILITY

- o Sprays/coolers will be available for maximized hydrogen release history
  - Power recovery is necessary before reflood
  - AC power is assumed to be restored in order to be consistent with low volume reflood scenario
  - Sufficient time is available for restoring sprays/coolers before reflood for HCOG hydrogen release history

## SUMMARY

- o Major aspects of recoverable TBU sequence are covered by HCOG HGE.
  
- o HCOG's response to 10 CFR 50.44 maximized the hydrogen production.
  
- o Low volume reflood was used to obtain maximum H<sub>2</sub> generation.
  
- o AC power must be restored early enough to have low volume reflood, which means:
  - Sprays/coolers are available.



## SER CHANGES

· ) **Severe Accidents vs. Recoverable, Degraded Core.**

- 10 CFR 50.44(v) (A) says:

**"Use accident scenarios that are accepted by the NRC staff. These scenarios must be accompanied by sufficient supporting justification to show that they describe the behavior of the reactor system during and following an accident resulting in a degraded core."**

**Each licensee... shall submit an analysis to the Commission. The analysis must... include the period of recovery from the degraded condition.**

- The SER says:

**(p.43) "The plant-specific analysis will use test data... to confirm that the equipment necessary... will be capable of performing their functions during and after exposure to the environmental conditions created by the hydrogen *in all credible severe accident scenarios.*"**

- Therefore, the statement on p. 43 should be clarified.

> ... performing their functions during and after exposure to the environmental conditions created by the burning of hydrogen, in accordance with 10 CFR 50.44.(v) (A).

## SER CHANGES (cont'd.)

### 2) Pressure Survivability Criterion.

(re: SER, p.43)

"In HGN-118-P, the HCOG indicated equipment located inside containment is qualified to a pressure loading of at least 30 psig applied externally. The CLASIX-3 predictions produced the most severe pressure rise of about 23 psig in the Mark III containment. The staff concludes that pressure is not a concern pending confirmation by each licensee of the 30 psig capability."

- 23 psig should be 24 psia for containment, ~28 psia for drywell, neglecting forced burns and diffusion flame portions.
- HCOG acceptance criterion for pressure survivability stipulates that equipment need only survive the maximum pressures defined in the applicable portions of the CLASIX-3 analyses.
  - > Although the generic equipment listed in HGN-118 was all qualified to greater than 30 psig, the generic analysis was not meant to imply that all equipment must withstand 30 psig.
- Plant specific pressure survivability evaluations have conformed to the acceptance criterion above.

## TOPICAL REPORT

### CONTENT

- Inclusion of all references will result in a document of unmanageable size.
- No regulatory basis for inclusion.
- Recommend that a List of References be added to Topical instead.

### SCHEDULE

- As a result of need to meet with NRC and clarify SER, propose generic submittal by 01/23/91.
- Potential for delay of plant specific submittals.