

**PRESENTATION TO THE NUCLEAR WASTE  
TECHNICAL REVIEW BOARD**



**STAFF TECHNICAL POSITION ON INVESTIGATIONS TO IDENTIFY  
FAULT DISPLACEMENT HAZARDS AND SEISMIC HAZARDS AT A  
GEOLOGIC REPOSITORY**

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January 23, 1992

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**STAFF TECHNICAL POSITION ON INVESTIGATIONS  
TO IDENTIFY FAULT DISPLACEMENT HAZARDS AND SEISMIC  
HAZARDS AT A GEOLOGIC REPOSITORY**

## TOPICS FOR GUIDANCE ON TECTONICS

- Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository
- Analysis of Fault Displacement Hazards and Seismic Hazards at a Geologic Repository
- Use of Tectonic Models

## TOPIC UNDER CONSIDERATION

- Application of Fault Displacement Hazards and Seismic Hazards to Design

## NEED FOR THIS STAFF POSITION

- Staff site characterization analysis identified significant concerns with DOE's plans to investigate fault displacement and seismic hazards (i.e., the ability to fulfill Part 60 requirements)
- Site characterization has begun at Yucca Mountain
- While the staff has no objection to DOE starting site characterization, staff concerns have not been resolved

# CHRONOLOGY OF DEVELOPMENT

PUBLIC COMMENT DRAFT TP ISSUED	AUGUST 1989 (54 FR 35266)
DOE/NRC TECHNICAL EXCHANGE ON DRAFT TP ON METHODS OF EVAL- UATING SEISMIC HAZARD AT A GEOLOGIC REPOSITORY	DECEMBER 1989
DOE/NRC TECHNICAL EXCHANGE ON TECTONICALLY SIGNIFICANT FAULT	JUNE 1990
DOE/NRC TECHNICAL EXCHANGE ON STP	FEBRUARY 20, 1991
PUBLIC COMMENT DRAFT OF STP ISSUED	MAY 13, 1991 (56 FR 22020)
ACNW WORKING GROUP/FULL COM- MITTEE MEETINGS ON FINAL DRAFT STP	DECEMBER 17-18, 1991
ISSUE FINAL STP	EARLY 1992

## OBJECTIVE OF STP

- **PROVIDE AN ACCEPTABLE APPROACH TO THE COLLECTION OF SUFFICIENT DATA RELATED TO FAULT DISPLACEMENT HAZARD AND SEISMIC HAZARD FOR INPUT TO BOTH THE PRECLOSURE AND POSTCLOSURE ASSESSMENTS OF PERFORMANCE**

## PURPOSE OF THIS STAFF POSITION

- Describe an acceptable approach to meet 10 CFR Part 60 requirements for investigation of fault displacement hazard and seismic hazard
- Provide a path to resolution of SCA concerns with respect to fault displacement hazard and seismic hazard

## APPROACH ADOPTED IN THIS STAFF POSITION

- **Benefits from past regulatory experience in using explicit criteria for identifying fault hazards  
(Does not adopt, in any form, Appendix A, 10 CFR Part 100)**
- **Uses deterministic criteria to determine which faults require detailed investigation, but recognizes the utility of probabilistic techniques for faults outside the controlled area**
- **Recognizes the need to perform iterative assessments of performance and that additional investigations to those noted in the STP may be identified by these assessments.**



## KEY PROVISIONS

- Identifies the entire Quaternary (i.e., 2 m.y.) as the period of geologic time that should be considered
- Provides a methodology and criteria for identifying and investigating those faults that are of potential concern to the repository
- Specifies that faults or fault zones previously removed from further consideration may need to be reconsidered based on the results of site characterization
- Recognizes that it is better to err on the side of investigating some faults or fault zones which may be found to be of no concern to repository performance rather than risk overlooking a fault or fault zone that may be significant

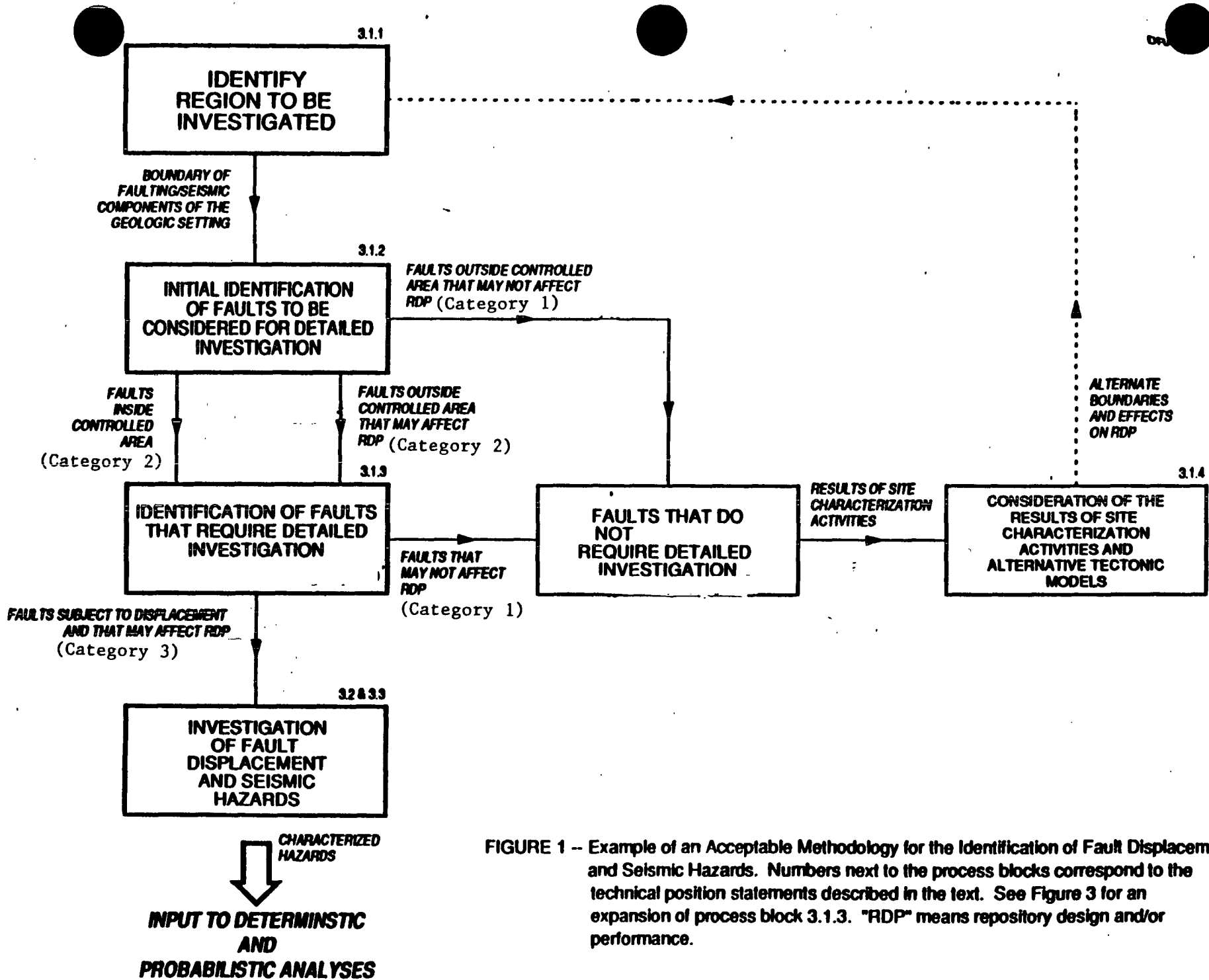


FIGURE 1 -- Example of an Acceptable Methodology for the Identification of Fault Displacement and Seismic Hazards. Numbers next to the process blocks correspond to the technical position statements described in the text. See Figure 3 for an expansion of process block 3.1.3. "RDP" means repository design and/or performance.

## FAULT CATEGORIES DESCRIBED IN STAFF POSITION

- The process described in the staff position describes three categories of faults:
  - Category 1 Faults: Faults that do not need to be investigated in detail
  - Category 2 Faults: Faults that are candidates for detailed investigation
  - Category 3 Faults: Faults that should be investigated in detail

## FAULT CATEGORY 1

- **Fault Category 1: Faults that do not need to be investigated in detail**

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1) Faults that are not subject to displacement; or  
2) are located such that, or of a size (length) such that, they will not affect repository performance or will not provide significant input into models that will be used to assess repository performance

## FAULT CATEGORY 2

- **Fault Category 2: Faults that are candidates for detailed investigation**

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Faults inside the controlled area and those faults outside the controlled area that are determined to be located such that, and are of sufficient size (length) such that, they may potentially have an effect on repository performance or will provide significant input into models used to assess repository performance

## FAULT CATEGORY 3

- **Fault Category 3: Faults that should be investigated in detail**

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Faults that are subject to displacement (as defined by specific criteria) and have the potential to affect repository performance or provide significant input into models used to assess performance

## CRITERIA DEFINING FAULT CATEGORY 3

- A category 3 fault:
  - 1) is subject to displacement; and
  - 2) may affect the design or performance of structures, systems, and components important to safety, containment, or waste isolation; and/or
  - 3) may provide significant input to models used in assessments of design or performance of structures, systems, and components important to safety, containment, or waste isolation

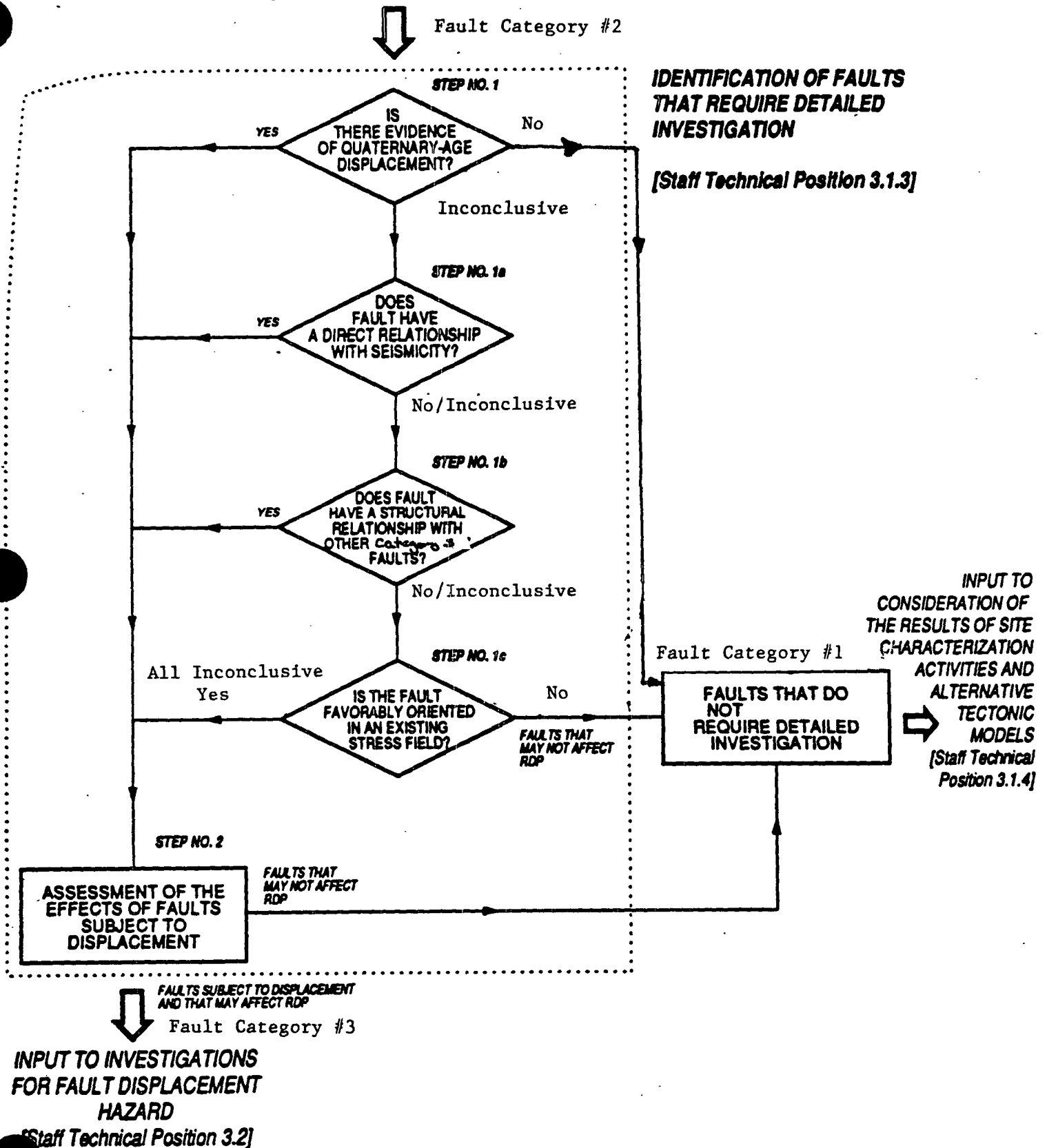
## DEFINITION OF "SUBJECT TO DISPLACEMENT"

- A fault is subject to displacement if:
  - there is evidence of displacement during the Quaternary Period;
  - In those cases where the Quaternary record is incomplete or unclear, the following secondary criteria should be considered:
    - a) has seismicity that suggests a direct relationship with a candidate fault;
    - b) has a structural relationship to a fault that meets one or more of the other criteria;
    - c) is oriented such that it is subject to displacement in the existing stress field.
- If there is documented evidence that no Quaternary displacement has occurred, consideration of the secondary criteria is not required



**OUTPUT FROM INITIAL IDENTIFICATION  
OF FAULTS TO BE CONSIDERED FOR  
DETAILED INVESTIGATION  
[Staff Technical Position 3.1.2]**

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**FIGURE 3 -- Staff Technical Position 3.1.3: Detail to the "Approach to the Identification of Faults that Require Detailed Investigation"** Refer to the text for the discussion of this two-step process. Also see Figure 1. "RDP" means repository design and/or performance.

## CONSIDERATION OF FAULT DISPLACEMENT IN REPOSITORY DESIGN AND PERFORMANCE

- Sites containing Category 3 faults would be acceptable so long as it can be demonstrated, with reasonable assurance, that siting criteria, design criteria, and performance objectives in 10 CFR Part 60 could be met
- Prudence suggests caution regarding design to accommodate fault displacement
- Design for fault displacement must provide reasonable assurance of meeting performance objectives

## CONSIDERATION OF FAULT DISPLACEMENT IN REPOSITORY DESIGN AND PERFORMANCE

- 10 CFR Part 60 contains no requirement for a specific setback distance
- Early resolution of fault-related design and performance issues is needed if DOE contemplates designing for fault displacement