U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

PRESENTATION TO THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: IN SITU DESIGN VERIFICATION

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IN SITU DESIGN VERIFICATION STUDY (STUDY PLAN 8.3.1.15.1.8)

INTENT: USE THE TEST FACILITY ITSELF AS A PROTOTYPE FOR CONSTRUCTION OF THE REPOSITORY; e.g., TO DEVELOP

- **CRITERIA FOR STABILITY OF OPENINGS**
- **METHODOLOGIES FOR EXCAVATING AND SUPPORTING OPENINGS**
- **A DATA BASE FOR COST AND SCHEDULE ESTIMATES**
- **A TEST CASE FOR VENTILATION CODES**

DESIGN VERIFICATION STUDY

OBJECTIVES

- EVALUATE LONG-TERM PERFORMANCE OF OPENINGS
  - SIMULATED REPOSITORY GEOMETRY
  - RANGE OF GROUND CONDITIONS
- DOCUMENT AND EVALUATE CONSTRUCTION OF ESF
  - EXCAVATION
  - SUPPORTS
- COLLECT INFORMATION FOR REPOSITORY VENTILATION SYSTEM DESIGN

DESIGN VERIFICATION STUDY

(CONTINUED)

SCP APPROACH

- MONITORING DRIFT STABILITY
- EVALUATION OF MINING METHODS
- EVALUATION OF GROUND-SUPPORT SYSTEMS
- AIR QUALITY AND VENTILATION

DESIGN VERIFICATION STUDY

(CONTINUED)

POST-SCP MODIFICATIONS

- REVISE SCOPE OF MINING METHODS EVALUATION
- EXTEND STUDY TO CALICO HILLS

DESIGN VERIFICATION STUDY

(CONTINUED)

MONITORING DRIFT STABILITY EXPERIMENT

GOALS

- DEVELOP CONFIDENCE IN LONG-TERM STABILITY OF REPOSITORY DRIFTS
- VALIDATE ASSUMPTION THAT TIME-DEPENDENT DEFORMATION IS NOT SIGNIFICANT
- DEVELOP CRITERIA FOR ASSESSING STABILITY
- DEVELOP TECHNIQUES THAT CAN BE USED TO MONITOR STABILITY IN THE REPOSITORY
- IDENTIFY IMPENDING INSTABILITIES, IF ANY

DESIGN VERIFICATION - MONITORING DRIFT STABILITY

ACTIVITIES

- MONITOR ROCK-MASS DEFORMATION
  - IN LONG DRIFTS
  - AT DRIFT INTERSECTIONS
  - AT IMPORTANT GEOLOGIC FEATURES

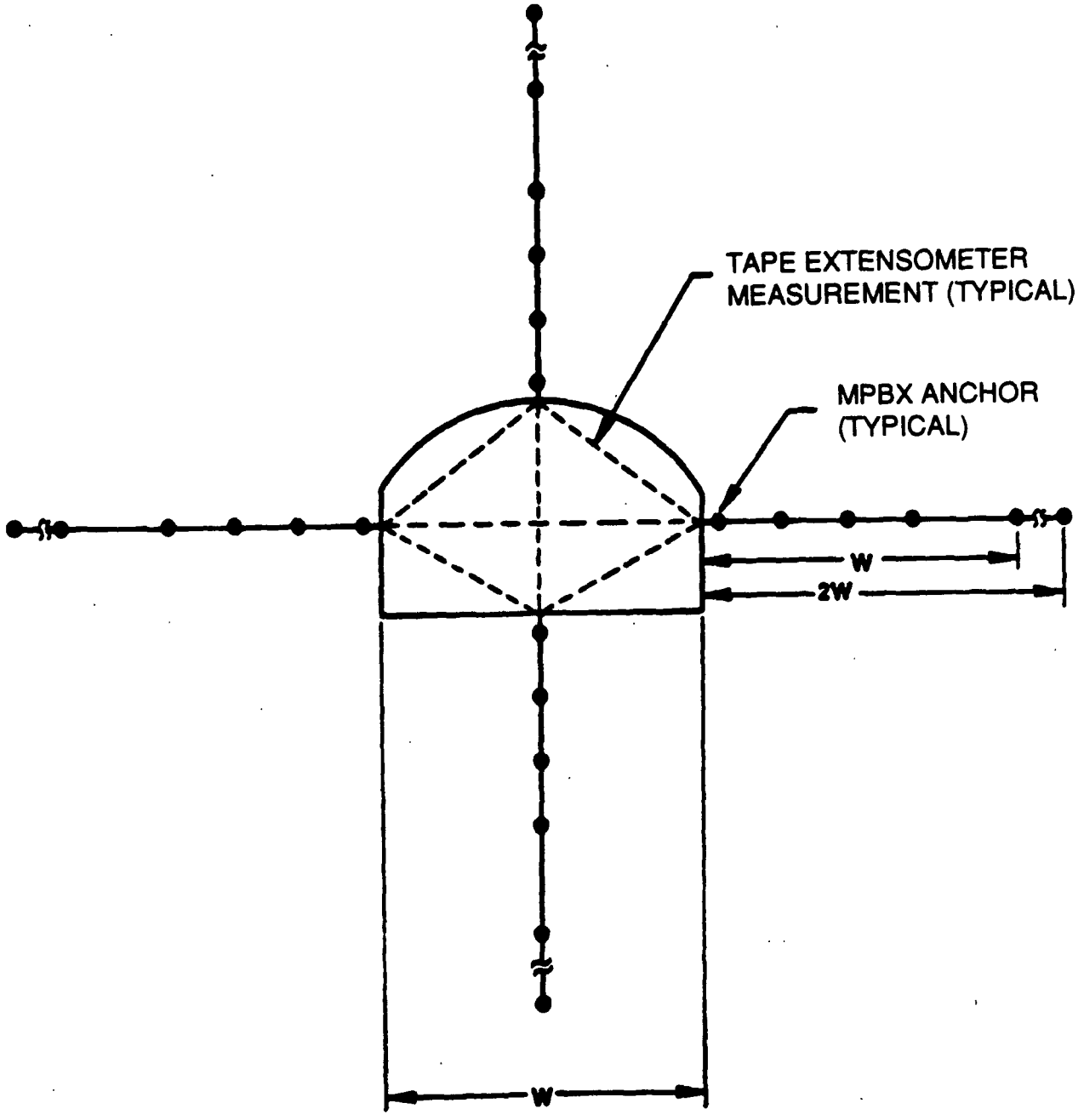
INSTRUMENTATION

- BOREHOLE EXTENSOMETERS
- TAPE EXTENSOMETER

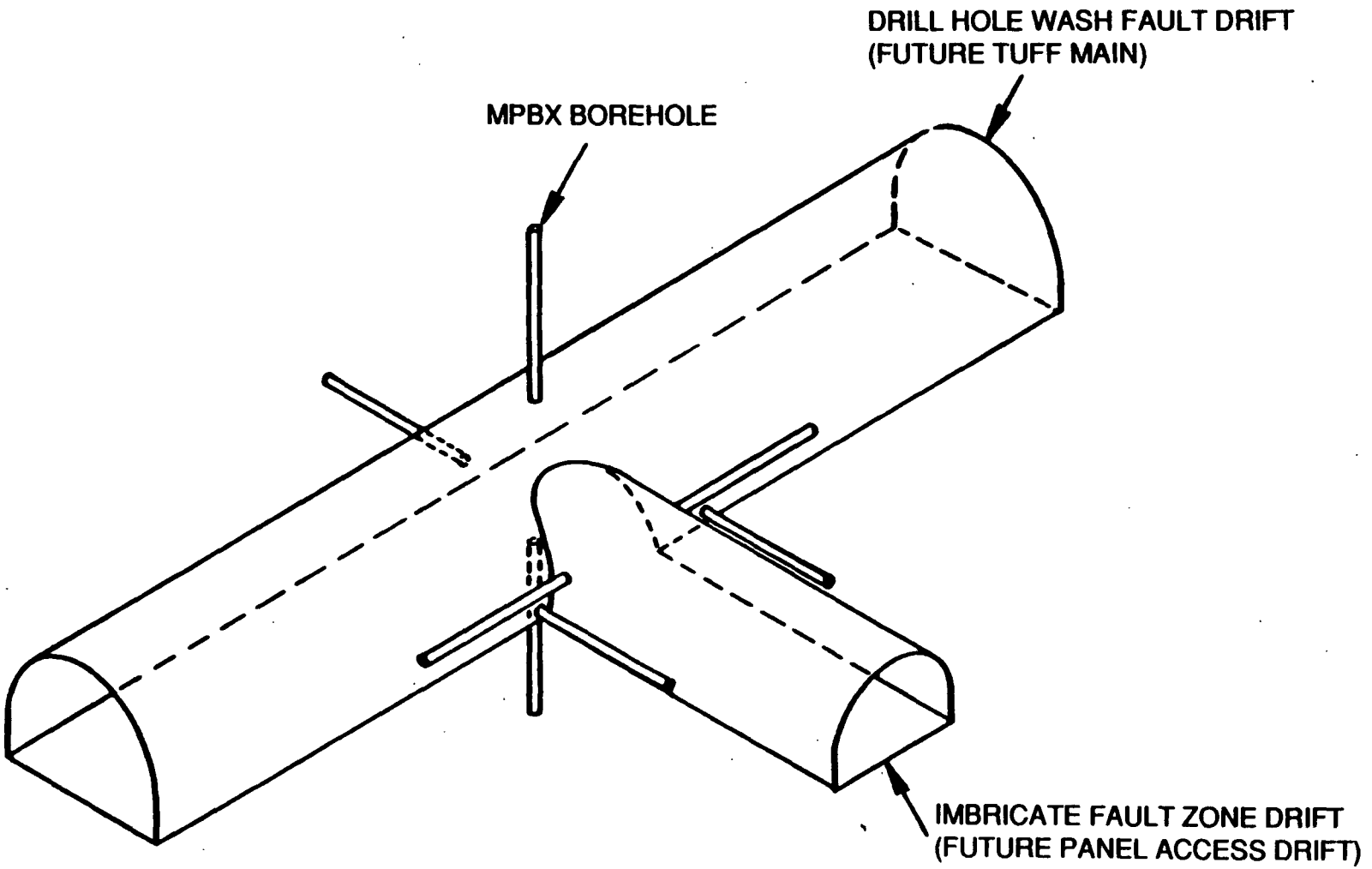
DURATION

- CONTINUE MONITORING THROUGHOUT AND BEYOND SITE CHARACTERIZATION PERIOD

MONITORING DRIFT STABILITY
TYPICAL CROSS SECTION



BOREHOLE EXTENSOMETER PLACEMENT AT INTERSECTION OF TWO DRIFTS



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DESIGN VERIFICATION - EVALUATION OF MINING METHODS

GOALS - DRILL AND BLAST METHODS

- **DEMONSTRATE CONSTRUCTABILITY**
  - REPOSITORY-SIZED OPENINGS
  - LIMITED BLAST DAMAGE
  - RANGE OF GROUND CONDITIONS
- **DEVELOP SITE-SPECIFIC PROCEDURES FOR CONTROLLED BLASTING**
- **DEVELOP CRITERIA FOR ASSESSING CONTROLLED BLASTING; e.g., OVERBREAK, PEAK PARTICLE VELOCITY**

DESIGN VERIFICATION - EVALUATION OF MINING METHODS

(CONTINUED)

GOALS

- MECHANICAL EXCAVATIONS
- DEMONSTRATE CONSTRUCTABILITY
- DOCUMENT EXCAVATOR PERFORMANCE

DESIGN VERIFICATION - EVALUATION OF MINING METHODS

(CONTINUED)

ACTIVITIES

- DOCUMENT EXCAVATION PROCEDURES
- DOCUMENT AND ASSESS QUALITY OF RESULTS
- ASSESS EXCAVATOR PERFORMANCE

SCOPE

- SHAFTS, MAIN TEST FACILITY, LONG DRIFTS
- INCORPORATE FINDINGS FROM EXCAVATION INVESTIGATIONS EXPERIMENTS

DESIGN VERIFICATION - EVALUATION OF GROUND-SUPPORT SYSTEMS EXPERIMENT

GOALS

- DETERMINE EFFECTIVE, EFFICIENT SUPPORT TECHNIQUES FOR THE REPOSITORY
  - RANGE OF GROUND CONDITIONS
- DEVELOP SITE-SPECIFIC GROUND-SUPPORT SELECTION METHODOLOGY
  - EMPIRICAL ROCK-MASS CLASSIFICATION SYSTEM

DESIGN VERIFICATION - GROUND-SUPPORT SYSTEMS

ACTIVITIES

- EVALUATE GROUND-SUPPORT PERFORMANCE
  - DOCUMENT SUPPORTS USED AND INSTALLATION PROCEDURES
  - ASSESS PERFORMANCE
    * STABILITY AND CLOSURE
    * MEASURED LOAD ON SUPPORTS
    * LOAD CAPACITY MEASUREMENTS
    * GROUND SUPPORT-INTERACTION ANALYSES

- EVALUATE CURRENT DESIGN METHODOLOGY (SAND89-0837)
  - ASSESS SUPPORT SYSTEM USED IN ESF
  - ASSESS DESIGN METHODOLOGY USED TO DETERMINE GROUND SUPPORT

DESIGN VERIFICATION - GROUND-SUPPORT SYSTEMS

(CONTINUED)

SCOPE

- RAMP, MAIN TEST LEVEL AND CALICO HILLS, INCLUDING LONG DRIFTS
- LEVEL OF EFFORT DEPENDS ON NEEDS
- EFFECTS OF HEAT ARE NOT INCLUDED

DESIGN VERIFICATION - AIR QUALITY AND VENTILATION EXPERIMENT

OBJECTIVE

- GATHER INFORMATION IN THE ESF THAT CAN BE USED TO DESIGN THE REPOSITORY VENTILATION SYSTEM

ACTIVITIES

- RADON EMANATION MEASUREMENTS
- CHARACTERIZATION OF OTHER GASES
- SURVEYS OF AIR FLOW AND PRESSURE
- HEAT BALANCE SURVEYS
- FRICTION FACTORS
- DUST GENERATION
- HEAT TRANSFER COEFFICIENT

DESIGN VERIFICATION

PREVIOUS EXPERIENCE

- WELDED TUFF MINING EVALUATIONS (G-TUNNEL DEMONSTRATION DRIFT)
  - LONG-TERM CONVERGENCE MEASUREMENTS
  - CONTROLLED BLASTING DEMONSTRATION
  - EXPERIMENTATION WITH DIFFERENT SUPPORTS
    * ROCK BOLTS: CEMENT GROUTED, FRICTION-TYPE
    * FIBER-REINFORCED SHOTCRETE
- INSTRUMENT DEVELOPMENT
  - DISPLACEMENT MONITORING: BOREHOLE AND SURFACE EXTENSOMETERS
  - ROCK BOLT LOAD MEASUREMENTS