

Repository Subsurface Design

**Presentation to:
Nuclear Waste Technical Review Board (NWTRB)**

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**Yucca
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Project**

Discussion Topics



- **Ventilation**
- **Preclosure Conditions**
- **Design Basis Events**
- **2nd Tunnel Stability Workshop**
- **Subsurface Performance Confirmation needs and plans**



Ventilation

Ventilation

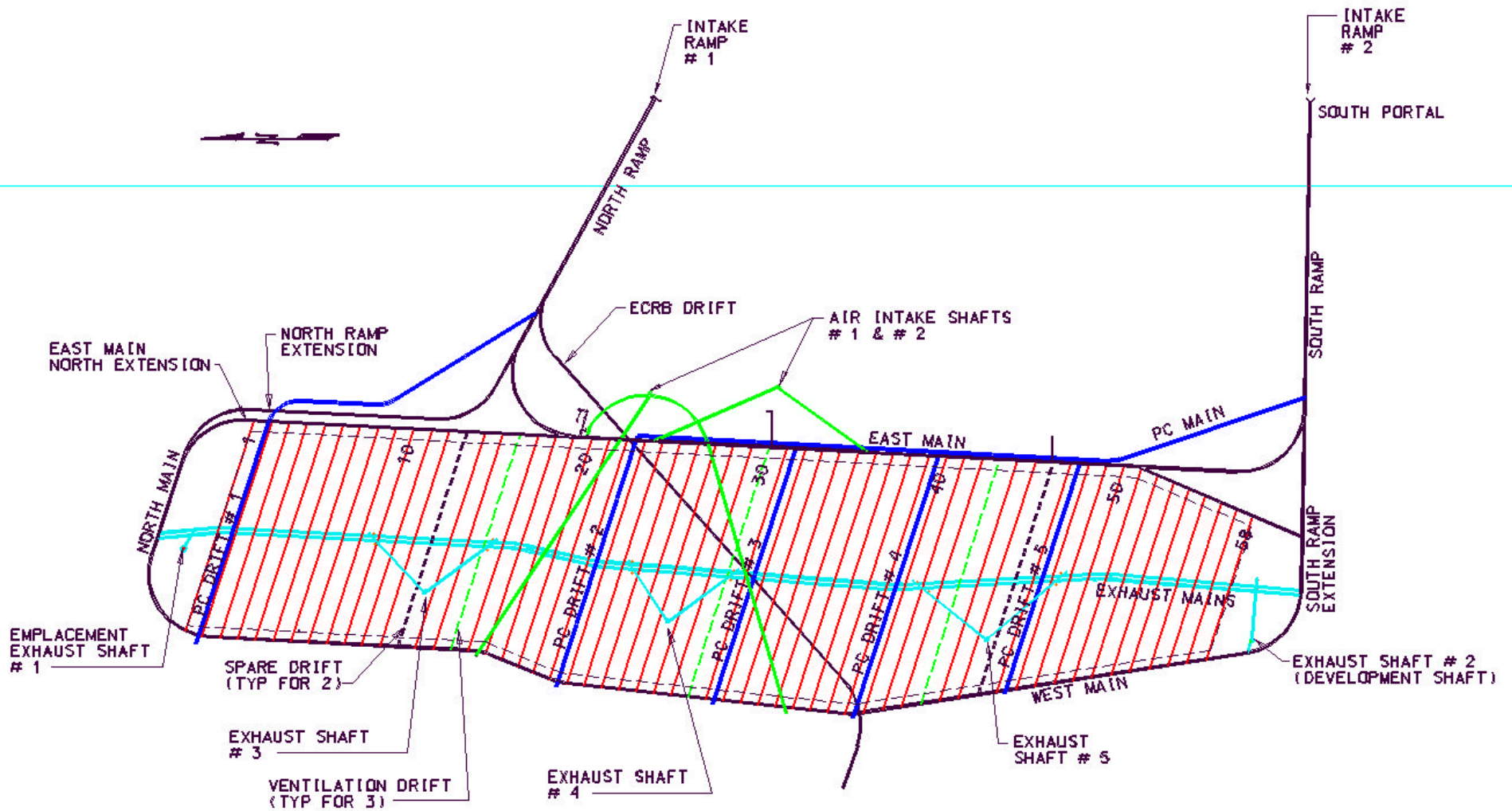


- **Primary difference between VA and EDA II is the air flow rate through the emplacement drifts**
- **VA had very low, leakage-type, flow**
- **EDA II requires a minimum of 2 m³/s**
- **Below-boiling pre-closure conditions can be attained at 10 m³/s**

Ventilation

(continued)

- **Post-closure below-boiling condition requires 10 m³/s for ~200 years**
- **A flow of 10 m³/s per drift requires ~1700 m³/s total flow, and 7 airshafts plus the two ramps**
- **Peak power requirements for Emplacement system estimated at approximately 6,700 kW**



NOTES:

1. 60 MTU/ACRE.
2. SPACING OF EMPLACEMENT DRIFTS = 81 m.
3. NUMBER OF EMPLACEMENT DRIFTS = 53.

EDA II



Pre-closure Conditions

Pre-closure Conditions



- **Differences between the VA Design and EDA II Include:**
 - **Higher ventilation rates through the emplacement drifts**
 - **Drift temperatures generally lower than VA (depending on flow rate)**
 - **Significantly fewer emplacement drifts**
 - **Increased moisture removal in near field**
 - **“Line loaded” emplacement drifts**

Some Differences. . .

(continued)

- **Lower Areal Mass Load (60 MTU/ac vs 85 MTU/ac in the VA design)**
- **Higher radiation levels (due to thinner WP barriers)**
- **Larger overall emplacement area**
- **Several additional airshafts**
- **One additional Exhaust Main drift**
- **Placement of dripshields and backfill at closure**



Design Basis Events

DBE Categorization



- **Category 1**
 - Interpreted as those conditions of normal operation which are expected to occur one or more times during preclosure facility lifetime
- **Category 2**
 - Interpreted as DBEs occurring with frequencies ranging from Category 1 to 10^{-6} per year (i.e., $\text{Category 1} > F_i \geq 10^{-6}$)

Subsurface DBE



- **Two Potentially Bounding Category 2 DBEs in the subsurface are:**
 - **Uncontrolled descent of transporter**
 - **Rockfall onto waste package**



Drift Stability Panel

Drift Stability Panel



- **The Drift Stability Panel was convened to provide input on the ground control design efforts of the Repository Sub-Surface Design team**
- **The Panel prefers “rock reinforcement” in the form of grouted rock bolts with heavy wire mesh and channel**

Drift Stability Panel

(continued)

Current and planned analyses that provide a basis for making recommendations for an appropriate permanent ground support system by the end of this calendar year are:

- **Drift stability**
- **Materials longevity**
- **Steel set design and performance**
- **Rock bolt design and performance**



Performance Confirmation

PC Background



- **Performance confirmation tests, experiments, and analyses will focus on evaluating the accuracy and adequacy of the information used to determine that the NRC's postclosure performance objectives will be met**
- **PC is focused on test and evaluation of post-closure performance**

Subsurface PC Testing



- **Possible subsurface repository testing and monitoring**
 - **Underground seal tests for ramps and shafts**
 - **Underground backfill test**
 - **Remotely operated vehicle (ROV) inspection gantry for periodic emplacement drift monitoring**
 - **In-drift instrumentation over limited areas under evaluation for continuous emplacement drift monitoring**

Subsurface PC Testing

(continued)

- **Possible waste package testing and monitoring**
 - Waste package material specimen (coupon) tests
 - Non-destructive inspection monitoring
- **Possible subsurface site testing and monitoring**
 - Geologic mapping, sampling and index testing
 - Age-dating, dissolved solid and microbial testing of water
 - Thermal-effects monitoring around emplacement drifts
 - Seismic Monitoring

PC Plan Status



- **PC Plan (in the subsurface area) is under revision to incorporate EDA II considerations, Repository Safety Strategy and other changes for SR**
 - **EDA II design has different geometry and new/different engineered barriers and materials**
 - **Ventilated drifts are cooler, and no longer representative of post-closure conditions**
 - **PC parameter selection process is being updated and tied to principal factors and process model uncertainties as well as TSPA**
- **Type and extent of PC testing will change**

PC Subsurface Facilities



- **Expected changes in subsurface facilities:**
 - **Observation Drift network will be changed to include Cross-Drift and incorporate other options**
 - **Additional testing of EBS components will be performed**
 - **Consideration of possible special “test area” to assess post-closure conditions**
 - **Extent of rock mass and in-drift monitoring will be reduced from prior plan**



Backup Material

Ventilation Power Estimate



- **3,600,000 cfm (1700 m³/s)**
- **Fan efficiency = 75%**
- ***Fan Pressure = 10 in. H₂O (2.5 kPa)**
 - » 3,600,000 x 10 = 7,550 HP
 - » 6356 x 0.75
- **~20% added to arrive at connected HP of 9,000 BHP**
- *** No credit taken for favorable NVP**