Examination of the North Experimental Area of WIPP

SAND2013-1823P

Presented by:

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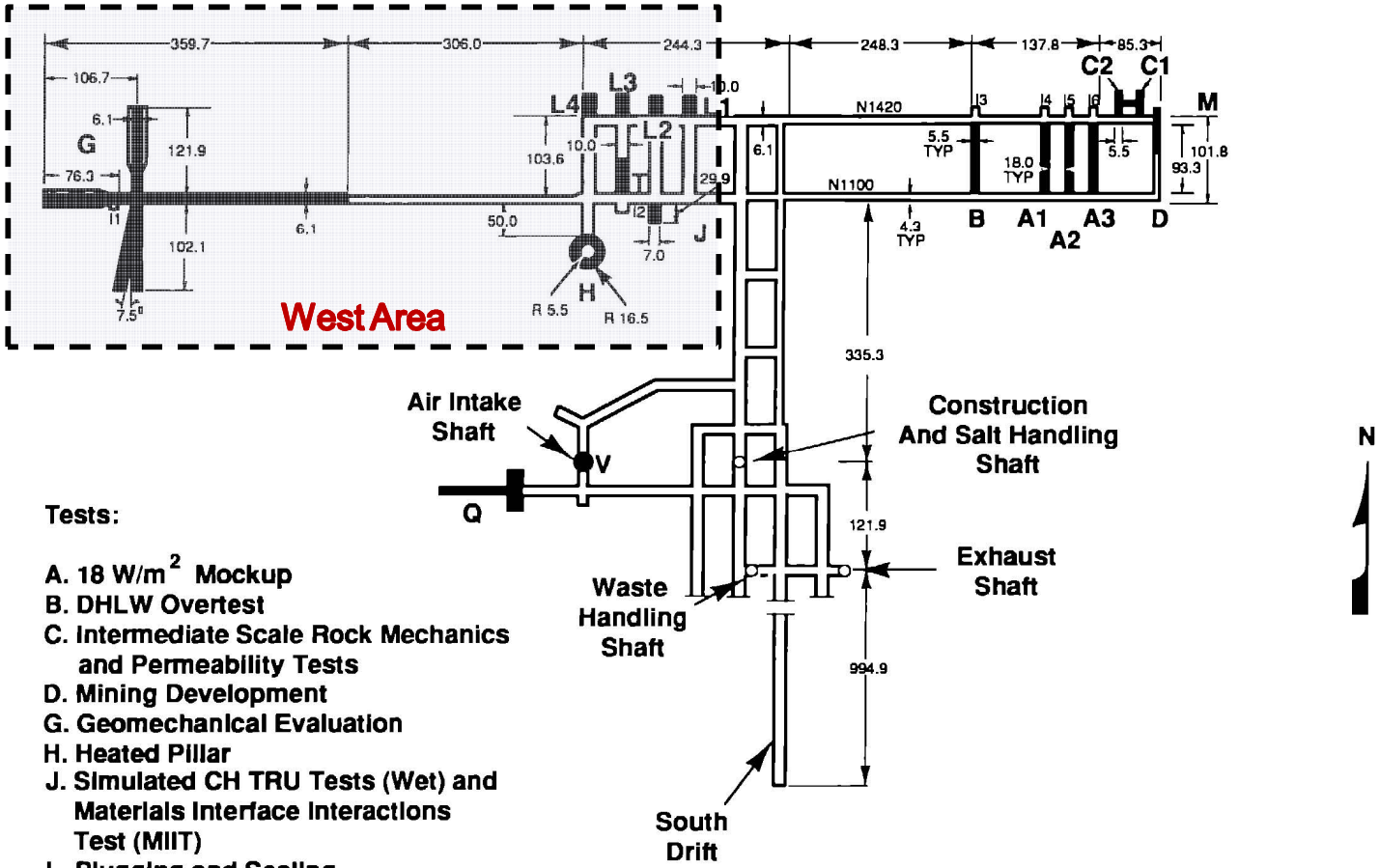
Introduction

- **As presented in the SDI Proposal (2011), an activity was added to the UFD Salt R&D work package to conduct test planning activities necessary for the acquisition of data from the existing north experimental area of WIPP.**
- **LANL, SNL, and WIPP M&O have been provided the resources necessary to develop a plan to examine the north WIPP experimental area that was shut down when heater tests were terminated in the early to mid 1990's. This scope includes:**
  - **the development of initial planning documents that define the information needs and scientific objectives (e.g. sampling plan, coring plan, forensics)**
  - **Planning by the WIPP M&O personnel to perform the physical activities associated with gaining access to the selected north experimental area.**
- **Milestones/Deliverables:**
  - **Forensic Studies of Material Recovered from the WIPP Experimental Area (3/29/2013)**
  - **Test Plan for Forensic Analysis in the North Experimental Area of WIPP (9/27/2013)**
  - **Re-entry Plan for Mining into the North Experimental Area of WIPP (9/27/2013)**

North Experimental Area - West



Tests:

- A. 18 W/m^2 Mockup
- B. DHLW Overtest
- C. Intermediate Scale Rock Mechanics and Permeability Tests
- D. Mining Development
- G. Geomechanical Evaluation
- H. Heated Pillar
- J. Simulated CH TRU Tests (Wet) and Materials Interface Interactions Test (MIIT)
- L. Plugging and Sealing
- M. Small Scale Seal Performance Tests
- T. Simulated CH and RH Tests
- Q. Circular Brine Room Tests
- V. Air Intake Shaft Performance Tests
- WPP. Waste Package Performance, Simulated DHLW (B, A1)

Munson et al. – SAND89-2671

Notes:

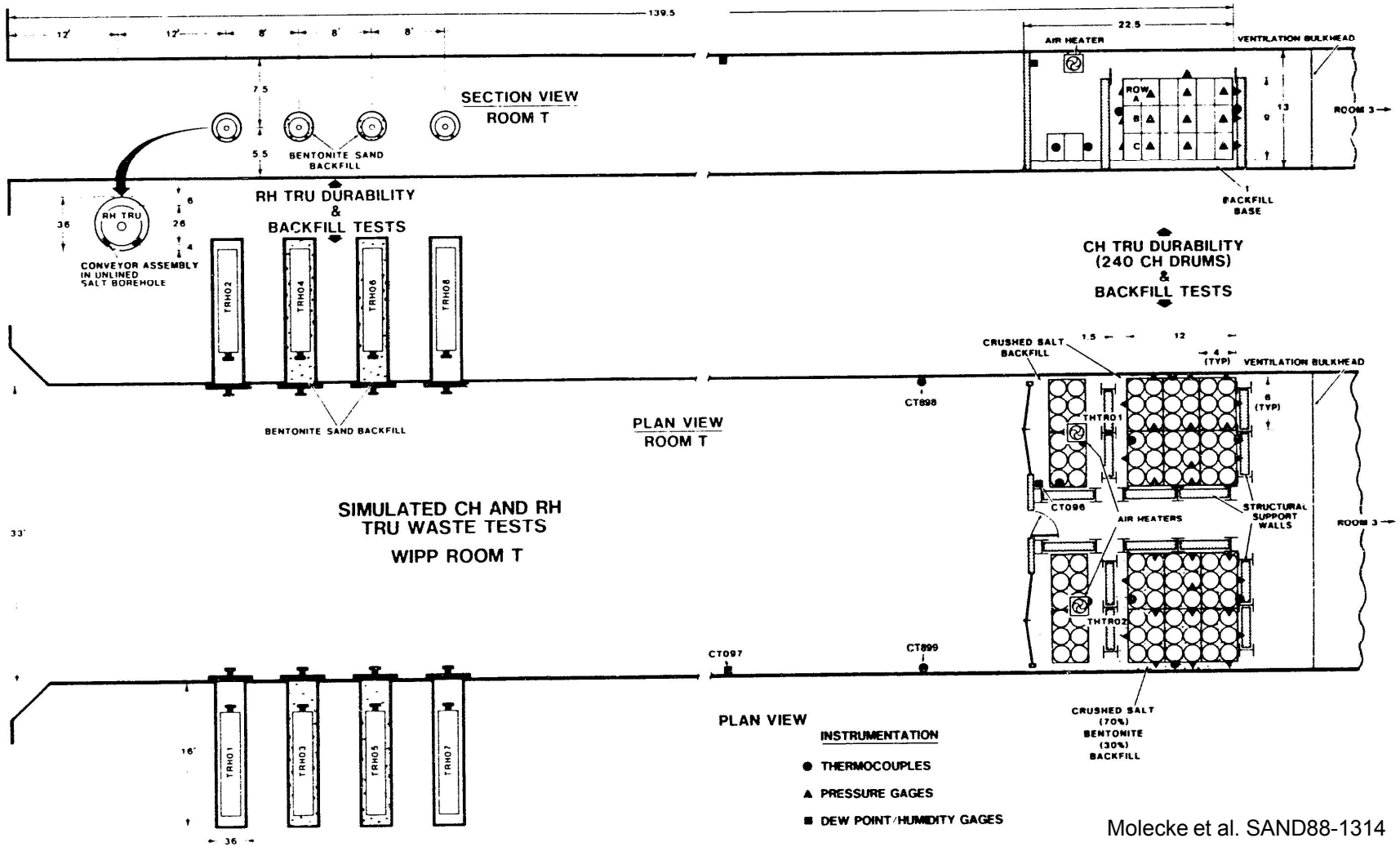
1. All Dimensions in Meters
2. Not to Scale

TRI-6346-30-0

North Experimental Area – West Side

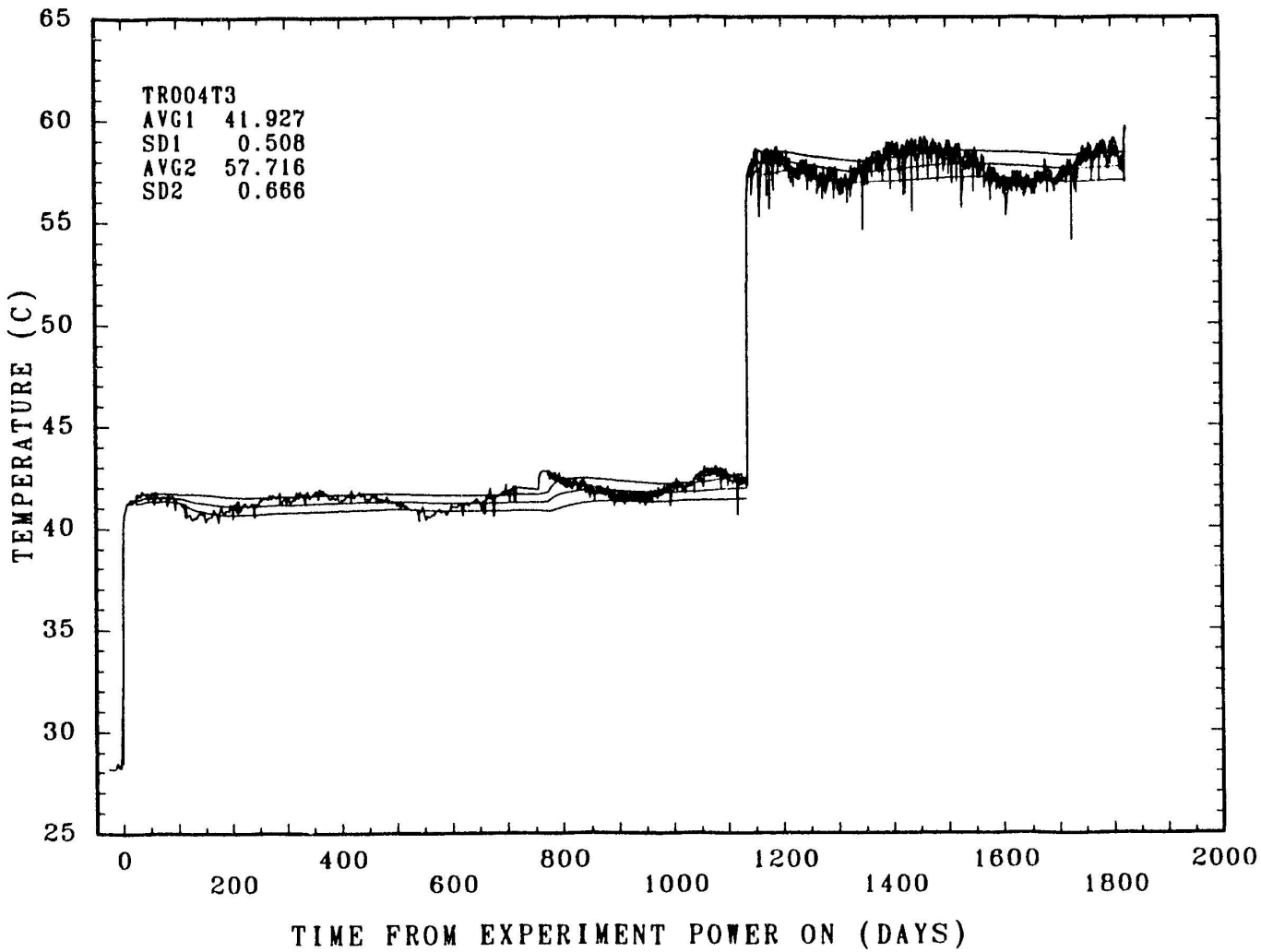
- **Geo-mechanical Experiments in Room G and Room H**
  - **Room G - Never Implemented the Wedge Pillar Test and Access Drift Backfilled**
  - **Room H – No Waste Packages or Heater Canisters and Access Drift Backfilled**
- **Simulated Waste and Corrosion Experiments Room J and Room T**
  - **Room T Remains Intact – Access Drift Backfilled**
  - **Room J Completely Decommissioned**
- **Small Scale Seals & Plugging Program in L Rooms**
  - **Most of the seals were cored during testing and the access drift is backfilled**

Room T Test Layout



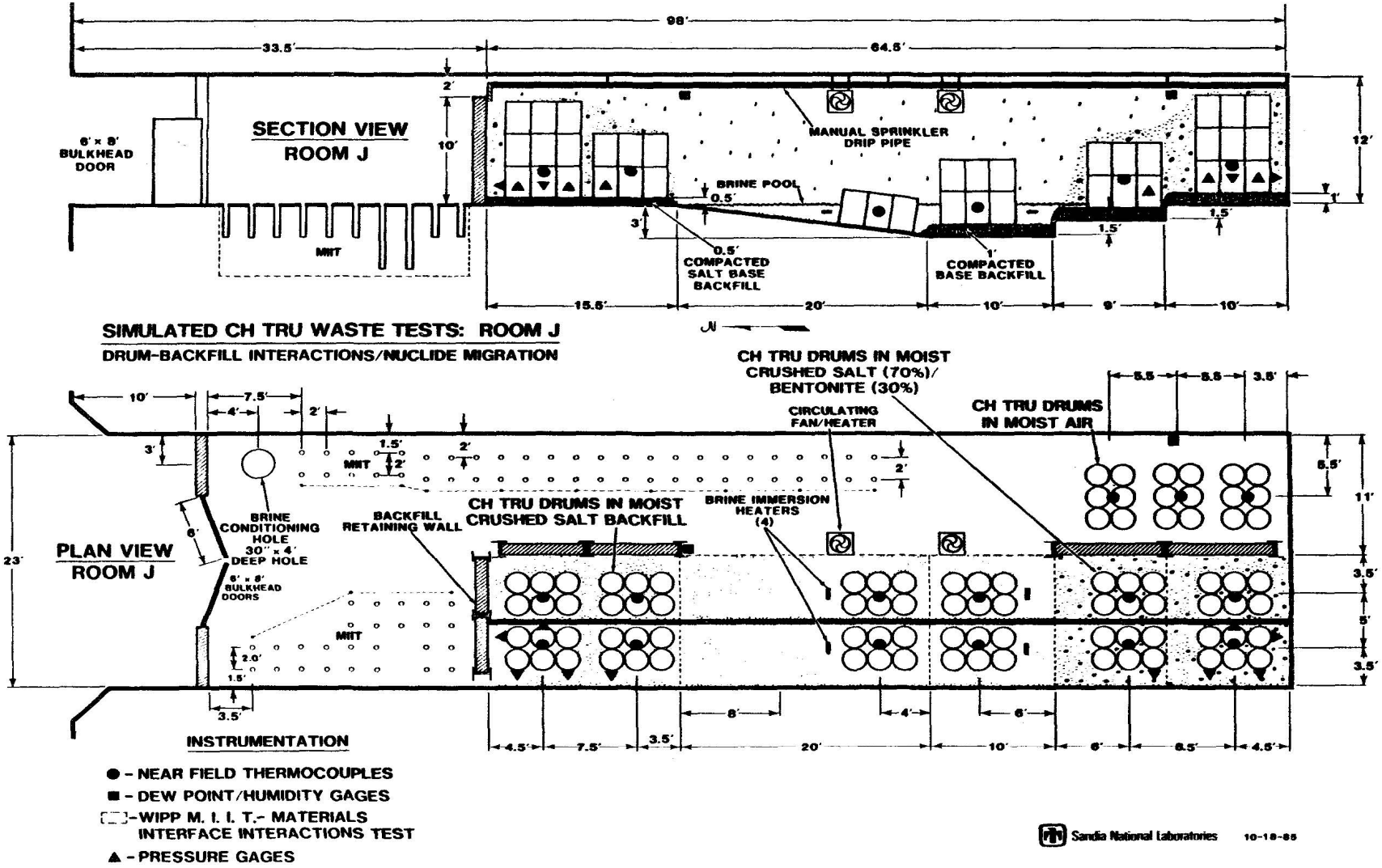
Molecke et al. SAND88-1314

Highest Temperature for Room T WPs at 120 Watt & 300 Watt Outputs



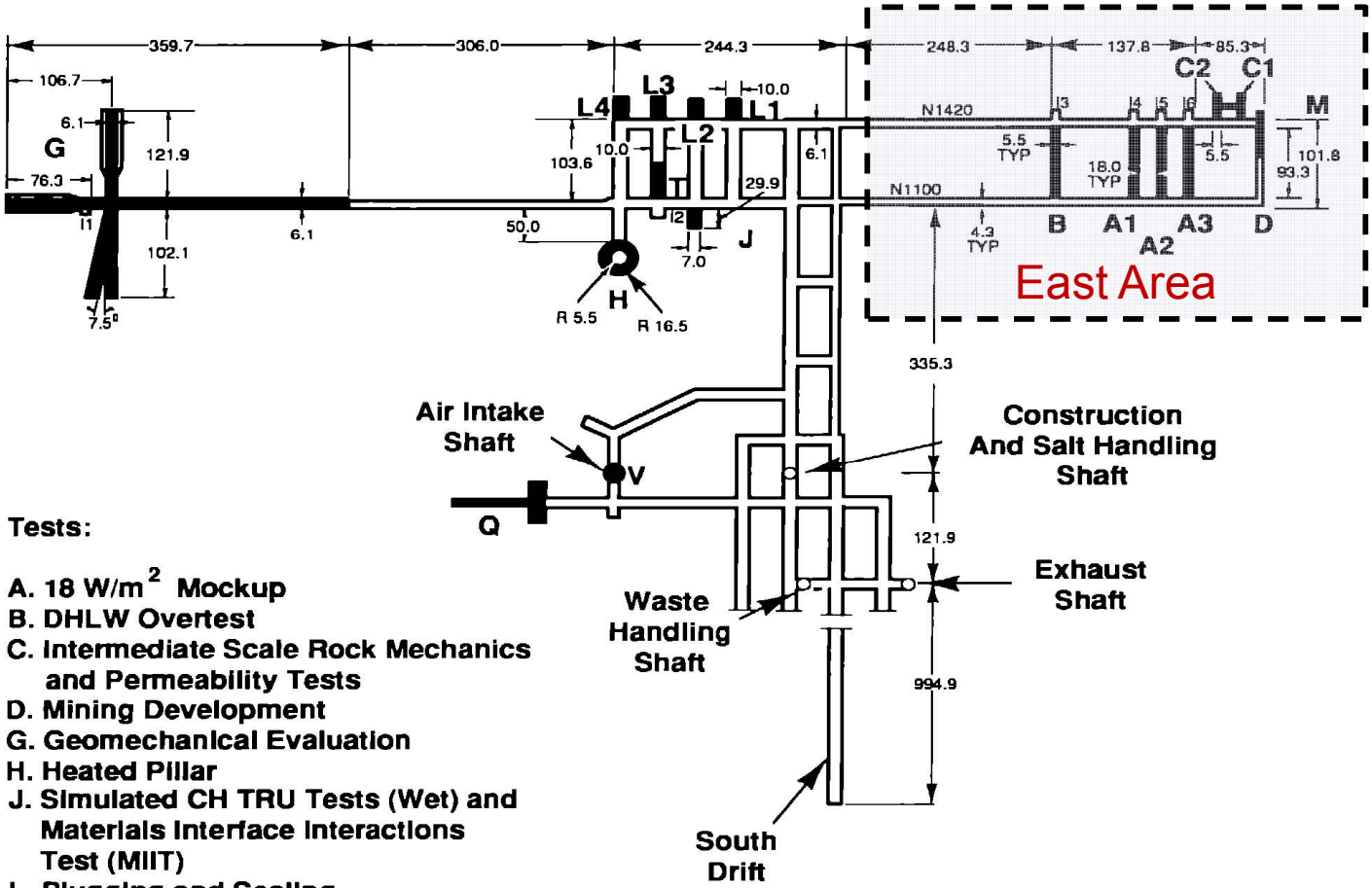
Molecke et al. SAND88-1314

Room J Test Layout



Molecke 1985

North Experimental Area - East



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L. Plugging and Sealing
M. Small Scale Seal Performance Tests
T. Simulated CH and RH Tests
Q. Circular Brine Room Tests
V. Air Intake Shaft Performance Tests
WPP. Waste Package Performance, Simulated DHLW (B, A1)

Munson et al. SAND89-2671

Notes:
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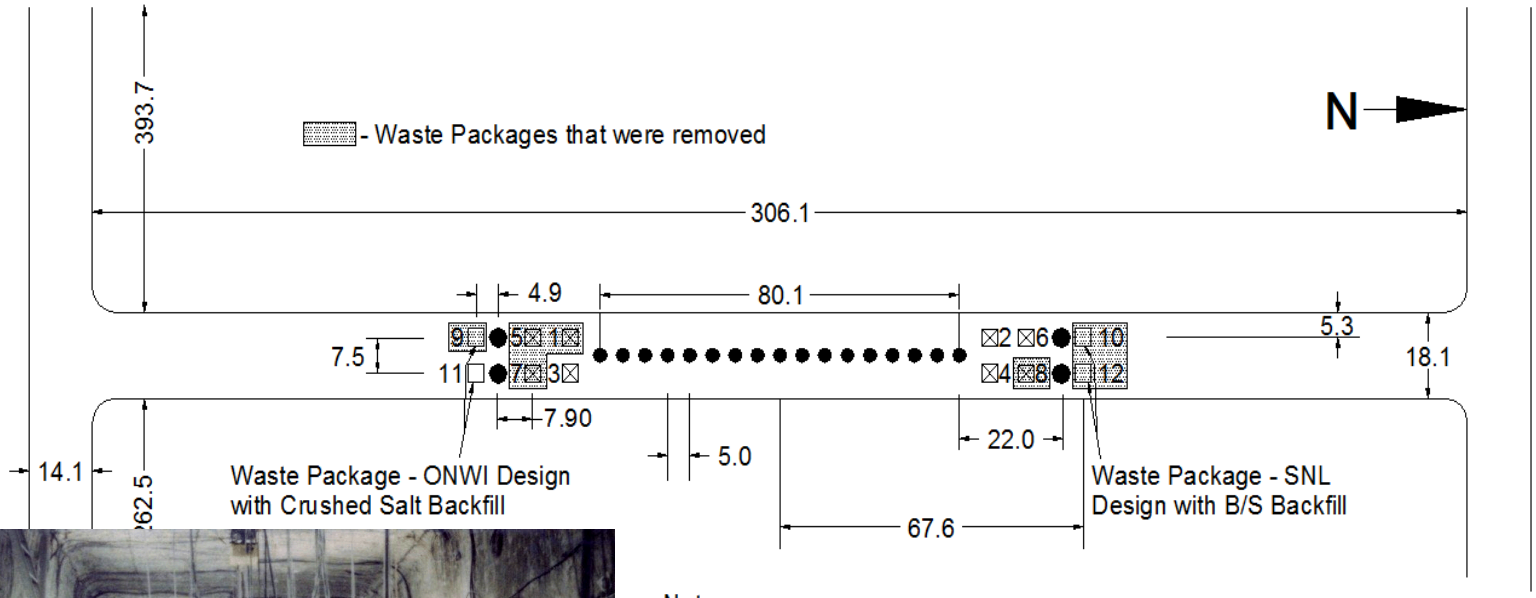
2. Not to Scale

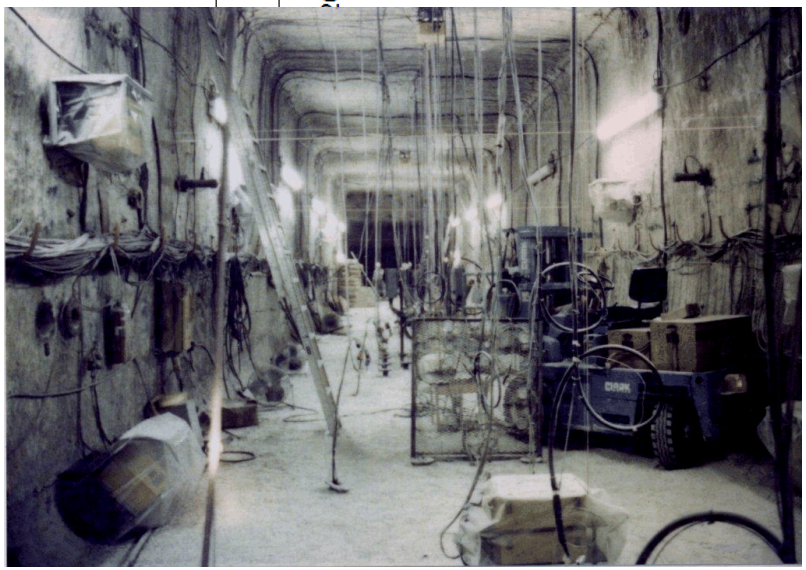
TRI-6346-30-0

North Experimental Area - East Site

- **Thermo/Structural Interaction Tests Rooms A1-A3, Room B and Room D**
  - **TSI heaters and equipment abandoned in place, roof collapsed in test rooms in 1990's**
- **Waste Package Performance Tests in Room B and Room A1**
  - **Room A1 waste packages remain in place, damage from roof collapse to test room**
  - **Room B had 7 waste packages removed in ≈ 1989, 5 waste packages remain**
- **Plugging and Sealing Program in Room M**
  - **Majority of Seals Remain intact, a limited number were cored**

Room B Heater & Waste Package Layout





Note:
- ROOM 18.05 ft. HIGH
- CANISTERS 9.84 ft. LONG
- IN 16.08 ft. DEEP HOLES
- * WASTE PACKAGE CANISTERS 9.84 ft.LONG IN 16.08 ft. DEEP HOLES
- * ALL MEASUREMENTS IN FEET
- * FIGURE DRAWN TO SCALE

- ● 1.07' dia, 1.8 - kw OVERTEST HEATER
- ● 2' dia, 4 - kw GUARD HEATER
- ☒ 1.5 - kw TE DHLW TEST PACKAGE *(1-8)
- ☐ 0.0 - kw TE DHLW TEST PACKAGE (SRL GLASS) (9-12)
- * HEATER & WASTE PACKAGE SYMBOLS NOT TO SCALE

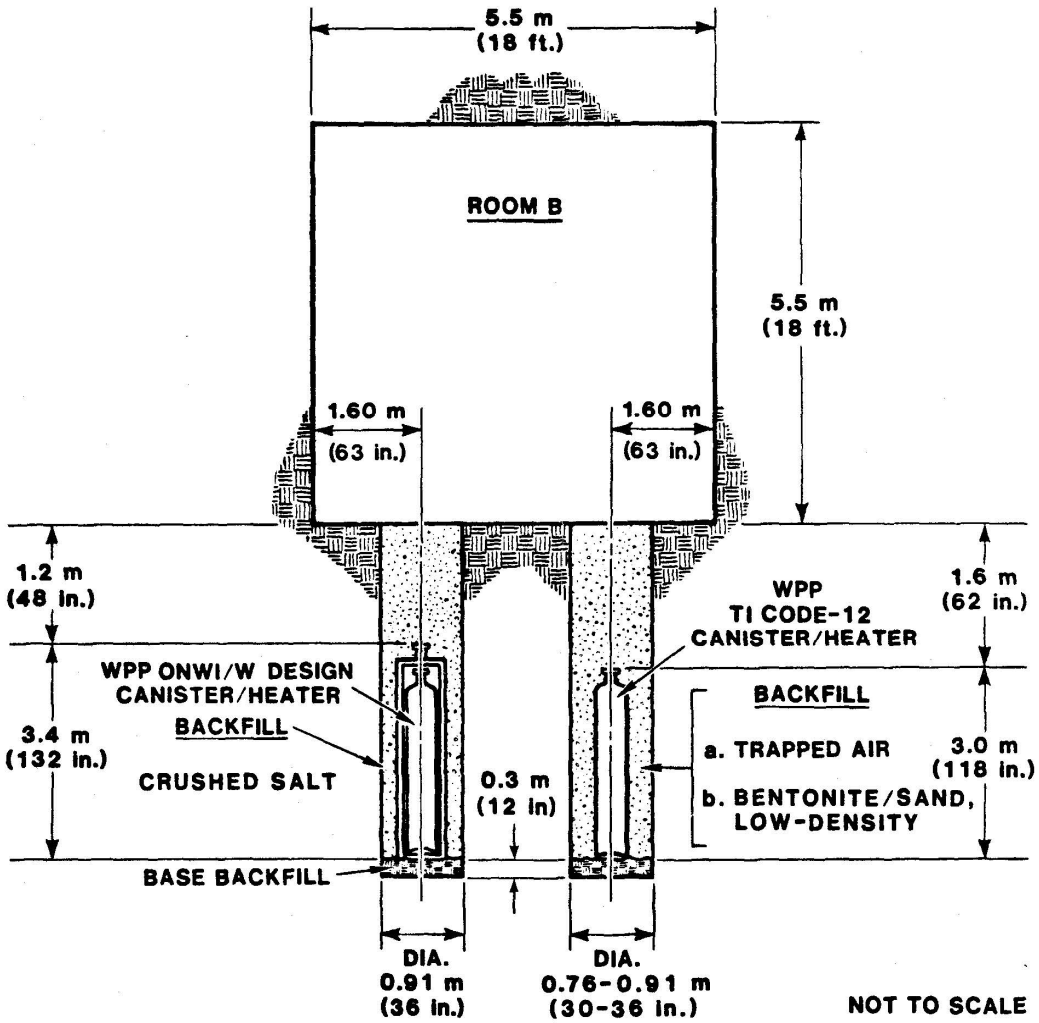
All Dimensions in Feet

Room B Heater Listing

WP/Heater ID	Test	Heater*	Qty	Heat (Watts)	Canister Size (in.)	Description	Backfill Material	Objective
B061-B064	TSI	Guard	4	4,000	24 x 120	Schedule 40 Mild Steel Pipe	Table Salt and Vermiculite	Thermal Load
B020-B027 B030-B038	TSI	Canister	17	1,800	12.8 x 120	Schedule 80 Mild Steel Pipe	Table Salt and Vermiculite	Thermal Load
WB1	WPP	Canister Removed	1	1,500	31.5 x 132	ONWI Mild Steel Overpack	Trapped Air	Nondegraded, Brine Migr., Fluid Vol. Prod.
WB5	WPP	Canister Removed	1	1,500	31.5 x 132	ONWI Mild Steel Overpack	Crushed Salt	Degraded, Long-Term Brine Intrusion
WB9	WPP	Canister	1	None	31.5 x 132	ONWI Mild Steel Overpack	Crushed Salt	Degraded, Long-Term Brine Intrusion
WB11	WPP	Canister	1	None	31.5 x 132	ONWI Mild Steel Overpack	Crushed Salt	Transportation & Handling Effects on SRL Glass
WB3,WB6, WB7,WB8	WPP	Canister Removed	4	1,500	24 x 118	All TiCode-12	Bentonite/Sand Low Density	Degraded & Nondegraded Canisters, Tailored backfill
WB10, WB12	WPP	Canister	2	None	24 x 118	All TiCode-12	Bentonite/Sand Low Density	Handling Effects on SRL Glass, Long-Term Brine
WB2	WPP	Canister Removed	1	1,500	24 x 118	Schedule 60 Steel Pipe,	Trapped Air	Non-degraded, Brine Migration., Fluid Vol. Prod.
WB4	WPP	Canister Removed	1	1,500	24 x 118	Schedule 60 Steel Pipe, TiCode Overpack	Bentonite/Sand Low Density	Non-degraded, Tailored backfill

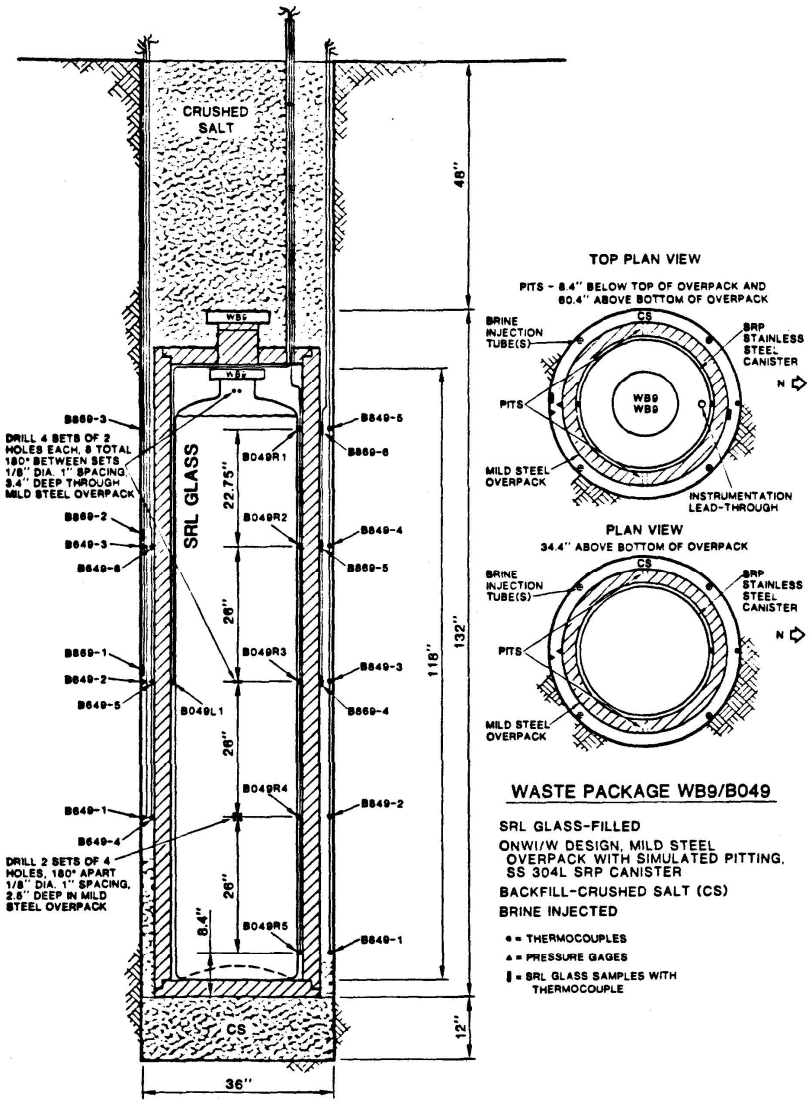
Red Text Represents Waste Packages that Have Been Removed

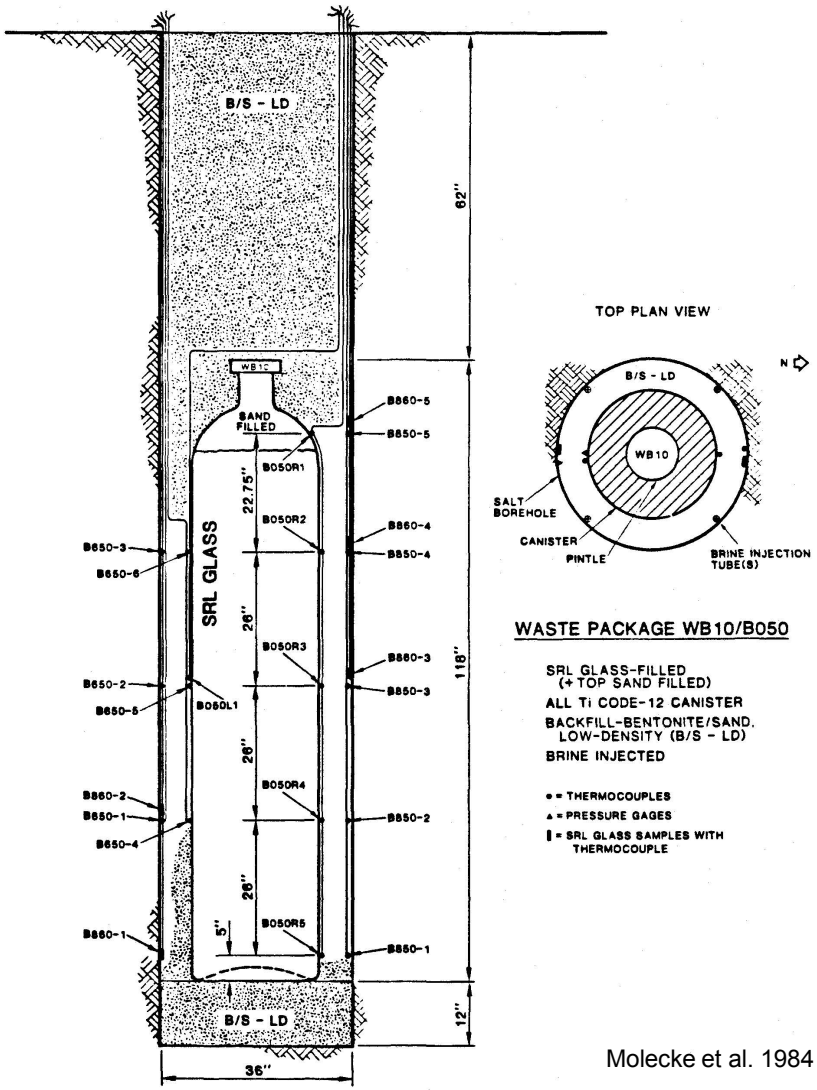
Room B Waste Package Installation



Molecke et al. 1984

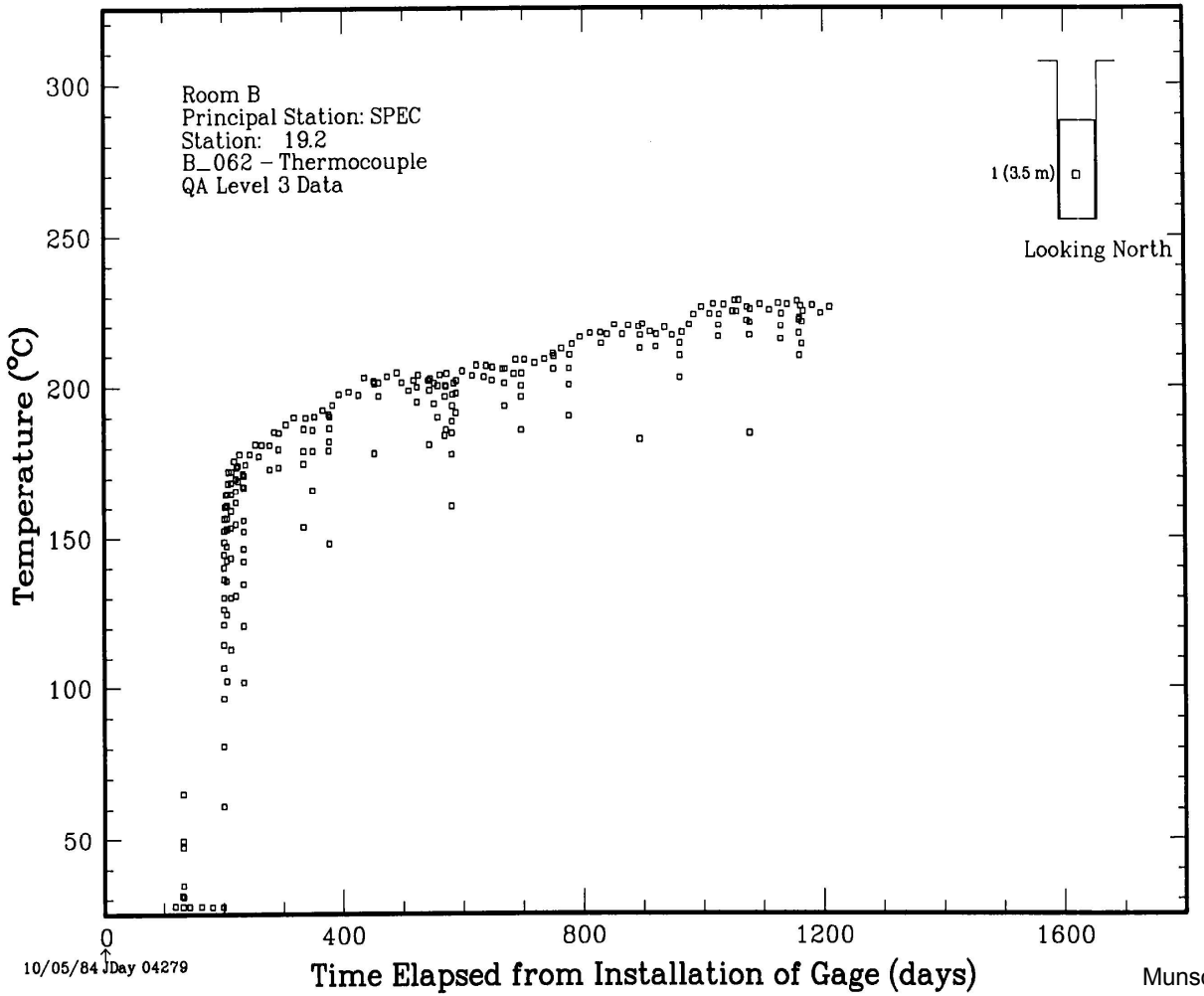
Room B Waste Package Configuration





Molecke et al. 1984

Typical 4 kW Guard Heater Temperature Data



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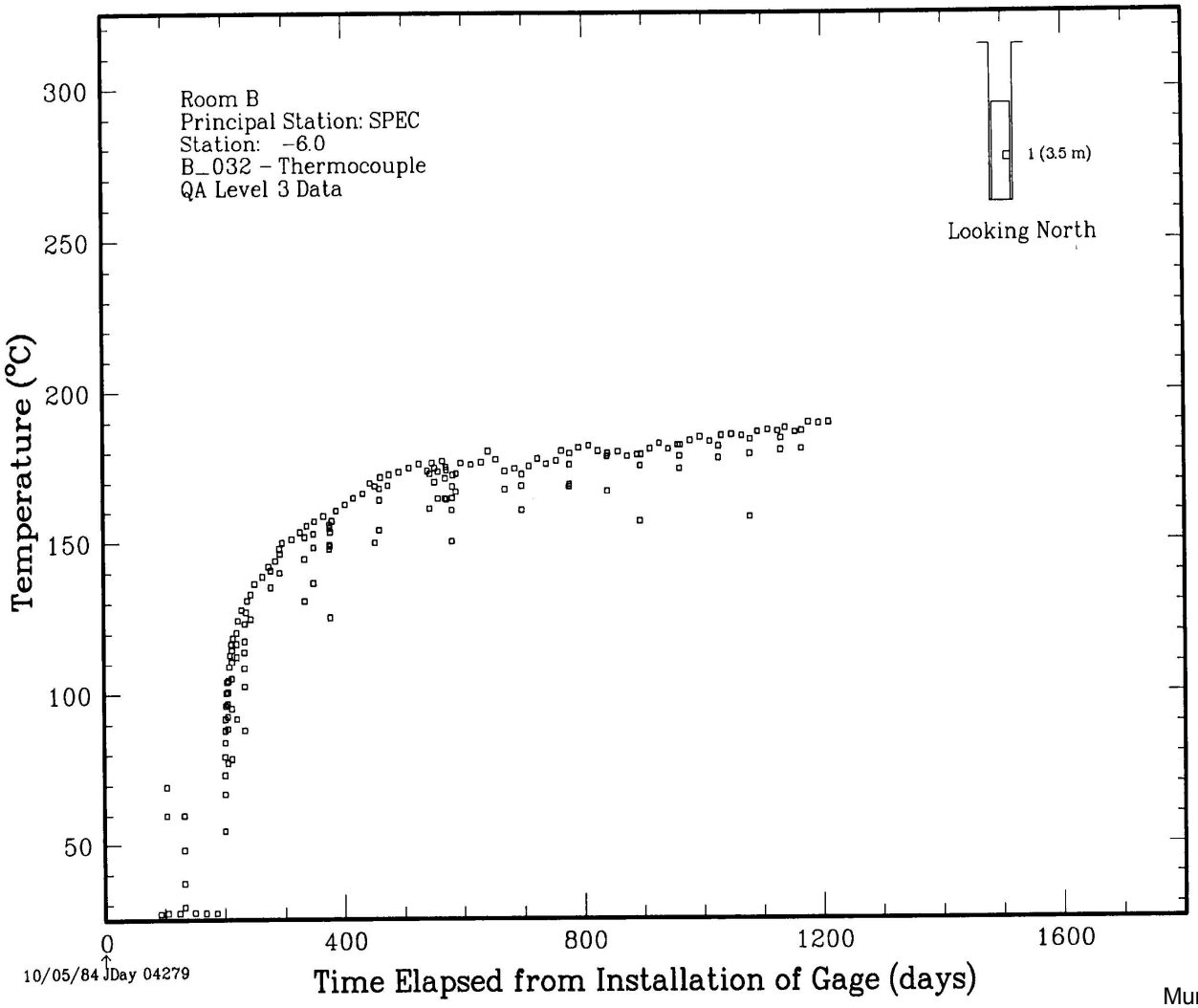
Typical 1.8 kW Heater Temperature Data



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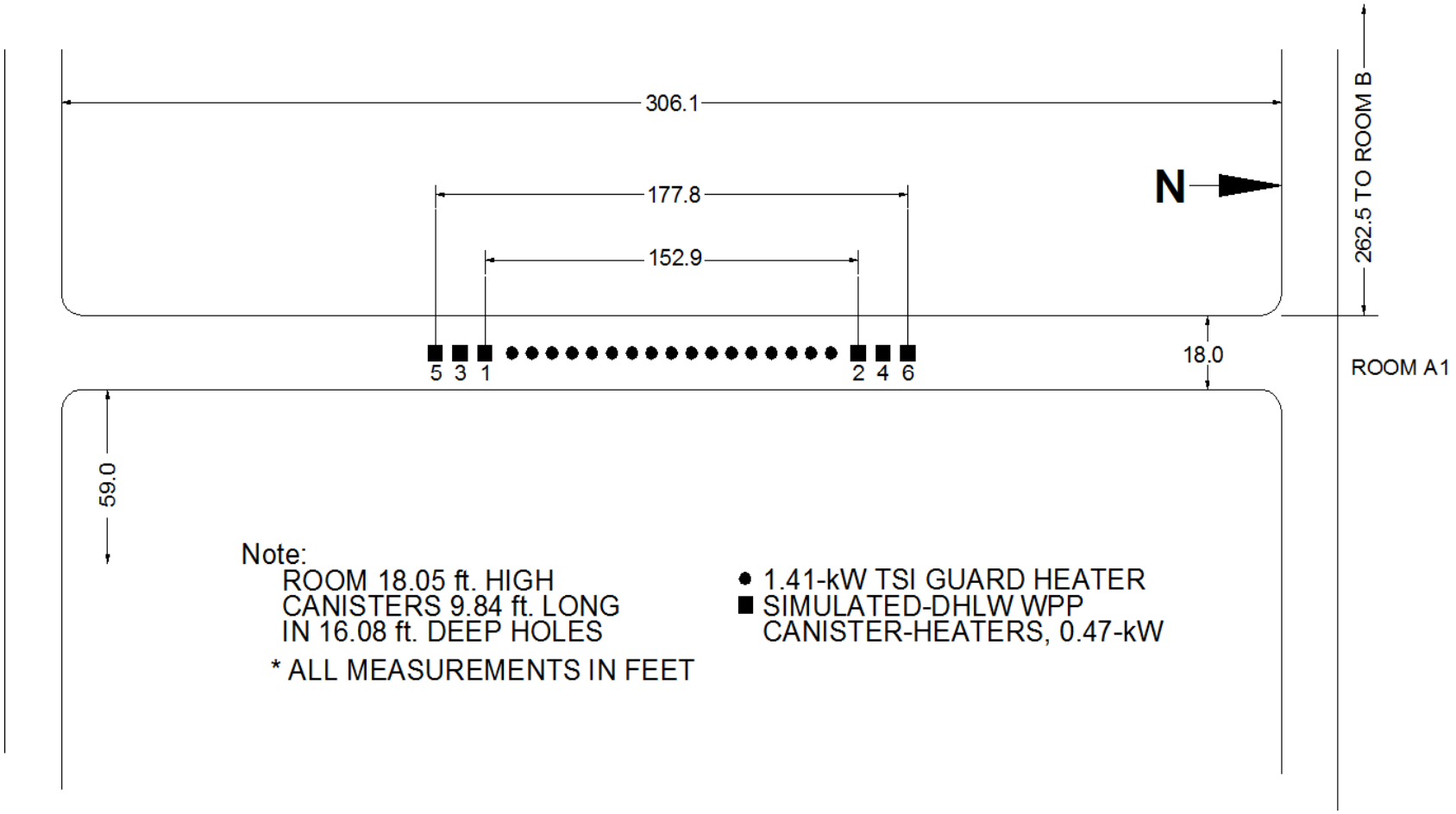
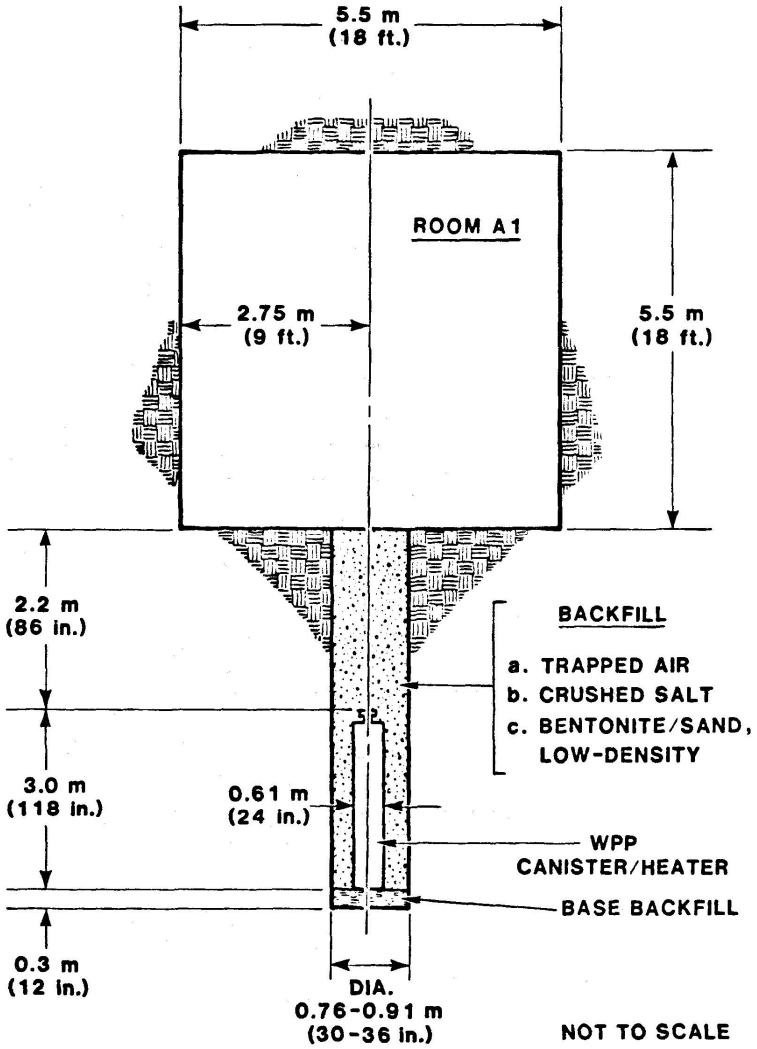
Room A1 Canister & Waste Package Layout



A-Room Canister and Waste Package Listing

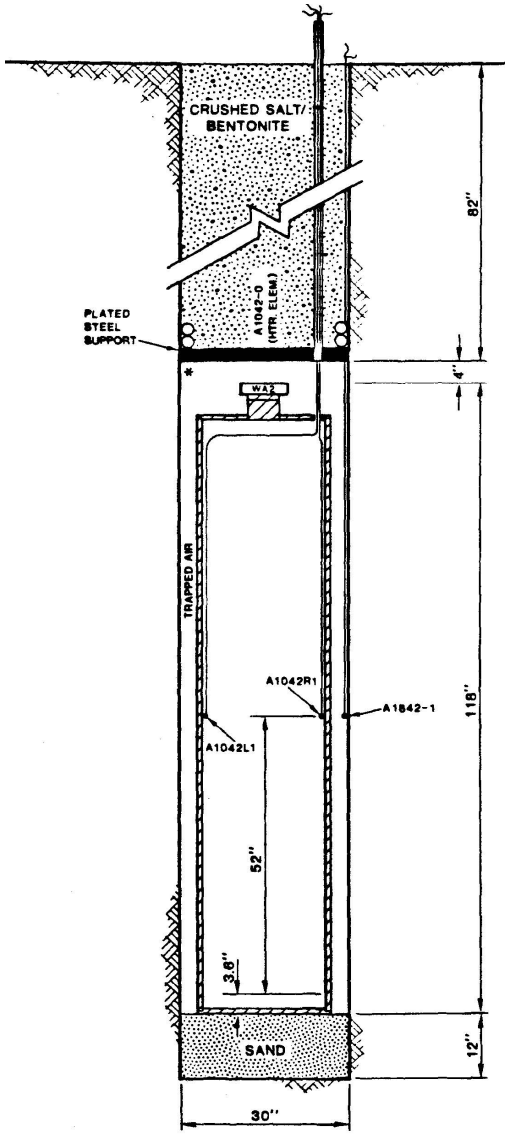
Room	Test	Heater*	Quantity	Heat Load (Watts)	Canister Size	Description	Backfill Material	Objective
A1	TSI	Guard	13	1,410	12.8 in x 118 in.	Mild Steel	Crushed Salt	Thermal Load
A1 WA3, WA4	WPP	Canister	2	470	24 in. x 118 in.	Mild Steel	Crushed Salt	WPP
A1 WA5, WA6	WPP	Canister	2	470	24 in. x 118 in.	Mild Steel With TiCode Overpack	Bentonite/Sand Low Density	WPP, Tailored Backfill
A1 WA1	WPP	Canister	1	470	24 in. x 118 in.	Mild Steel	Trapped Air	Brine Migr., Fluid Vol. Prod.,
A1 WA2	WPP	Canister	1	470	24 in. x 118 in.	Mild Steel With TiCode Overpack	Trapped Air	Brine Migr., Fluid Vol. Prod.,

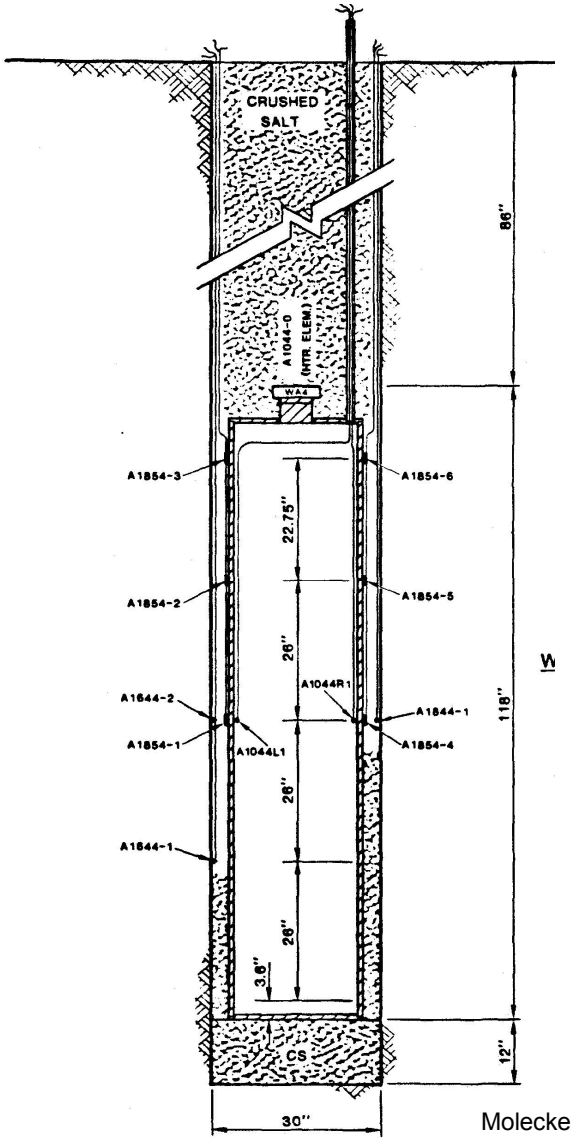
Typical Room A1 Waste Package Installation

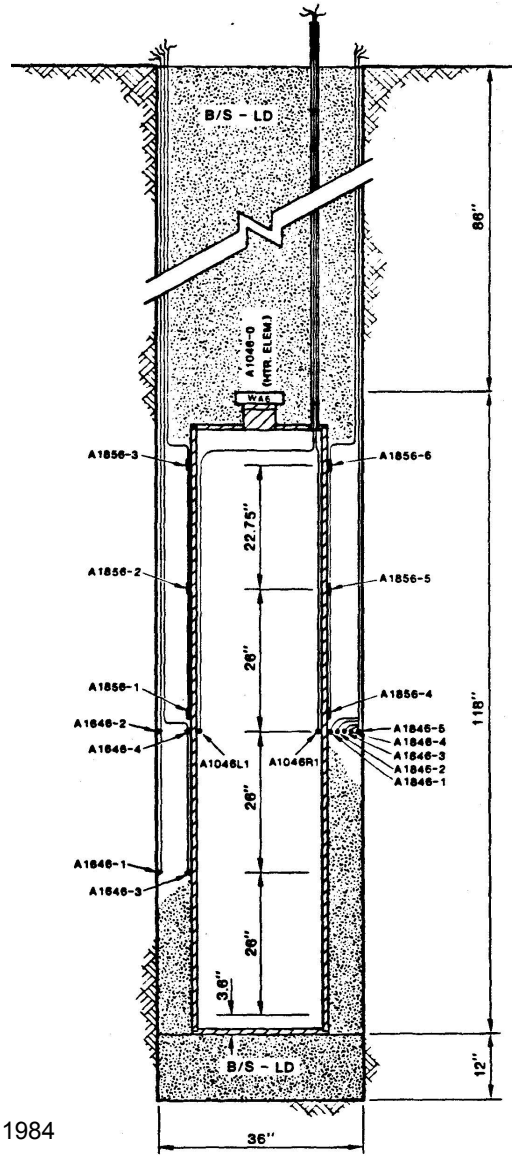


Molecke et al. 1984

Three Types of Room A1 Waste Packages







Molecke et al. 1984

Why Room B and A1

- **DHLW Overtest & DHLW Mockup Test generated the highest heat loads. Temperatures > 200° C measured at some of the heater / salt interface.**
- **Availability of undisturbed heaters and waste packages that had power outputs ranging from 0.47kW to 4kW.**
- **Wide range of backfill materials around the heaters – Crushed Salt, Table Salt, Bentonite/Salt, Air, Vermiculite and Bentonite/Sand.**
- **Accurate and detailed As-Built documentation exists for these test locations.**
- **Proximity to the newly mined SDI/SDDI areas.**

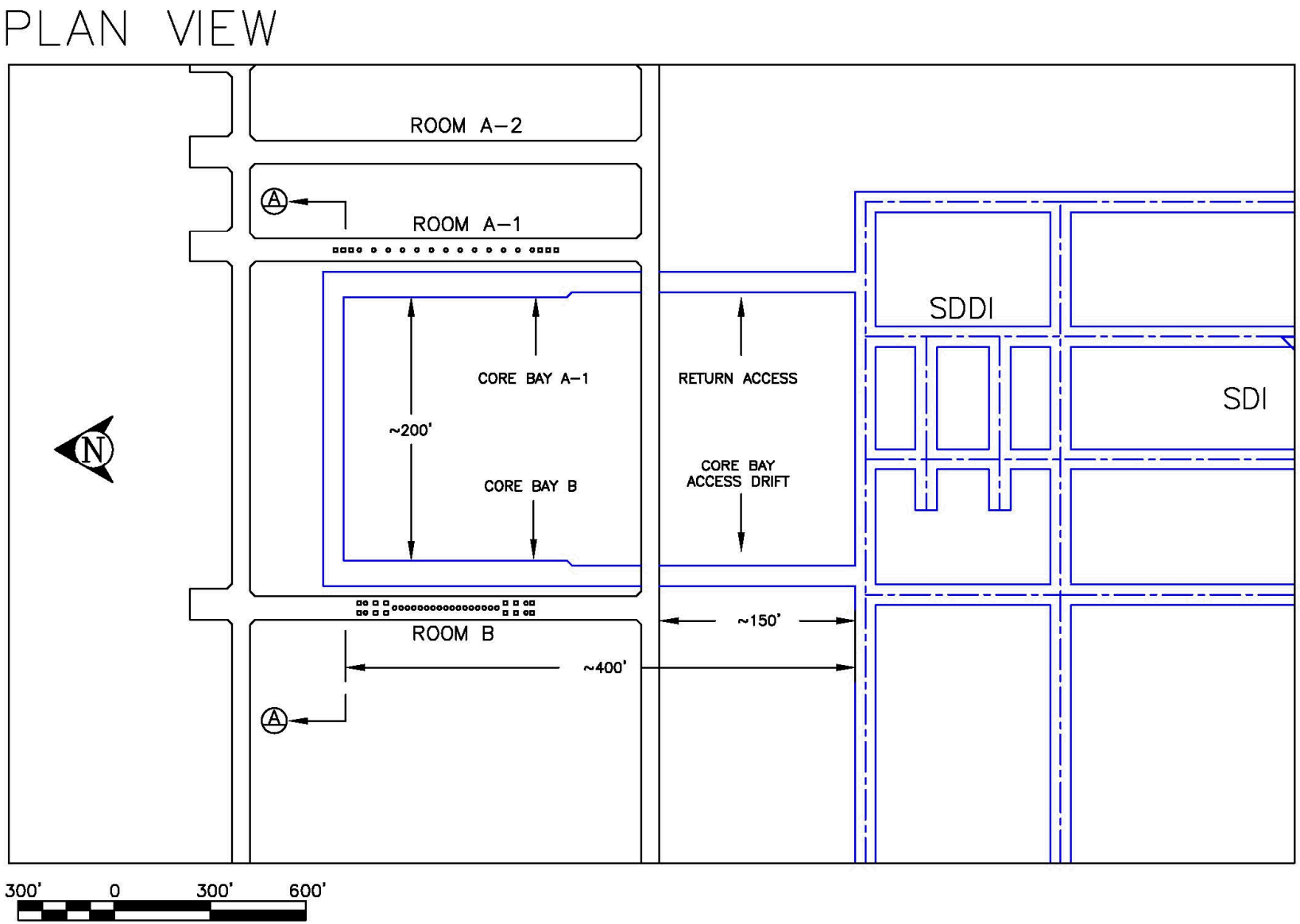
Proposed Forensic Activities

- **Investigate the Brine and Formation Permeability through laboratory testing of core and in-situ testing of boreholes drilled up to the heaters**
- **Evaluate the performance of Waste Package and Heater Materials in place for > 30 years (Ticode & Steel)**
- **Assess performance of crushed salt and crushed salt/bentonite backfill materials through laboratory testing of core samples**
- **Perform in-situ tests to assess the Disturbed Rock Zone (DRZ) surrounding the heaters and test rooms**

Access to A-1 and B Room Heaters

- **Safe access to areas of interest will be planned and engineered by the M&O.**
- **Planning is in process and will culminate in a plan to be delivered in September, 2013.**
- **Access will allow for core collection, sampling, and in-situ testing of the properties outlined previously.**
- **The following are flat file and 3-D conceptual illustrations of access drifts that will meet the program objectives.**

Access to A-1 and B Room Heaters



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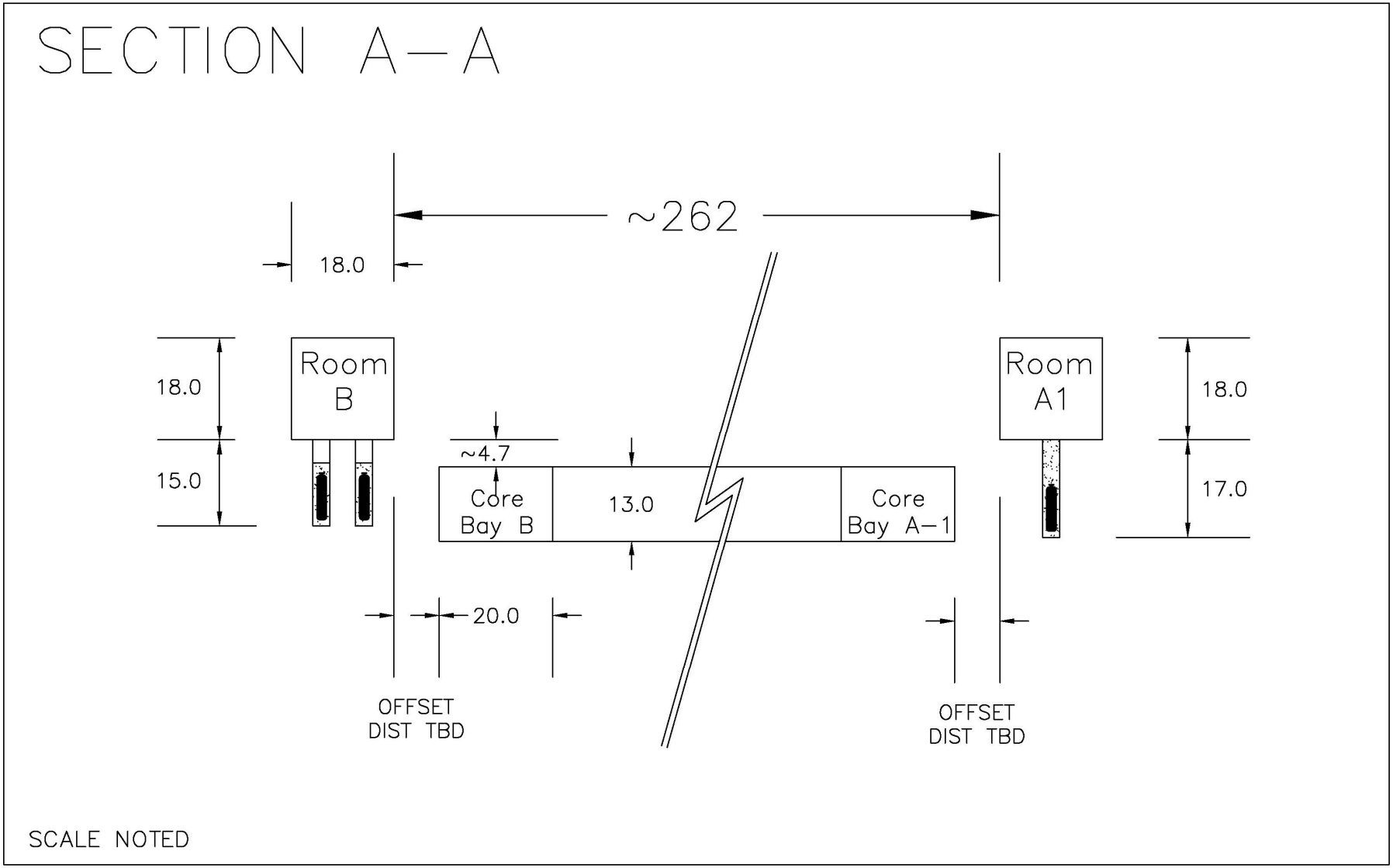
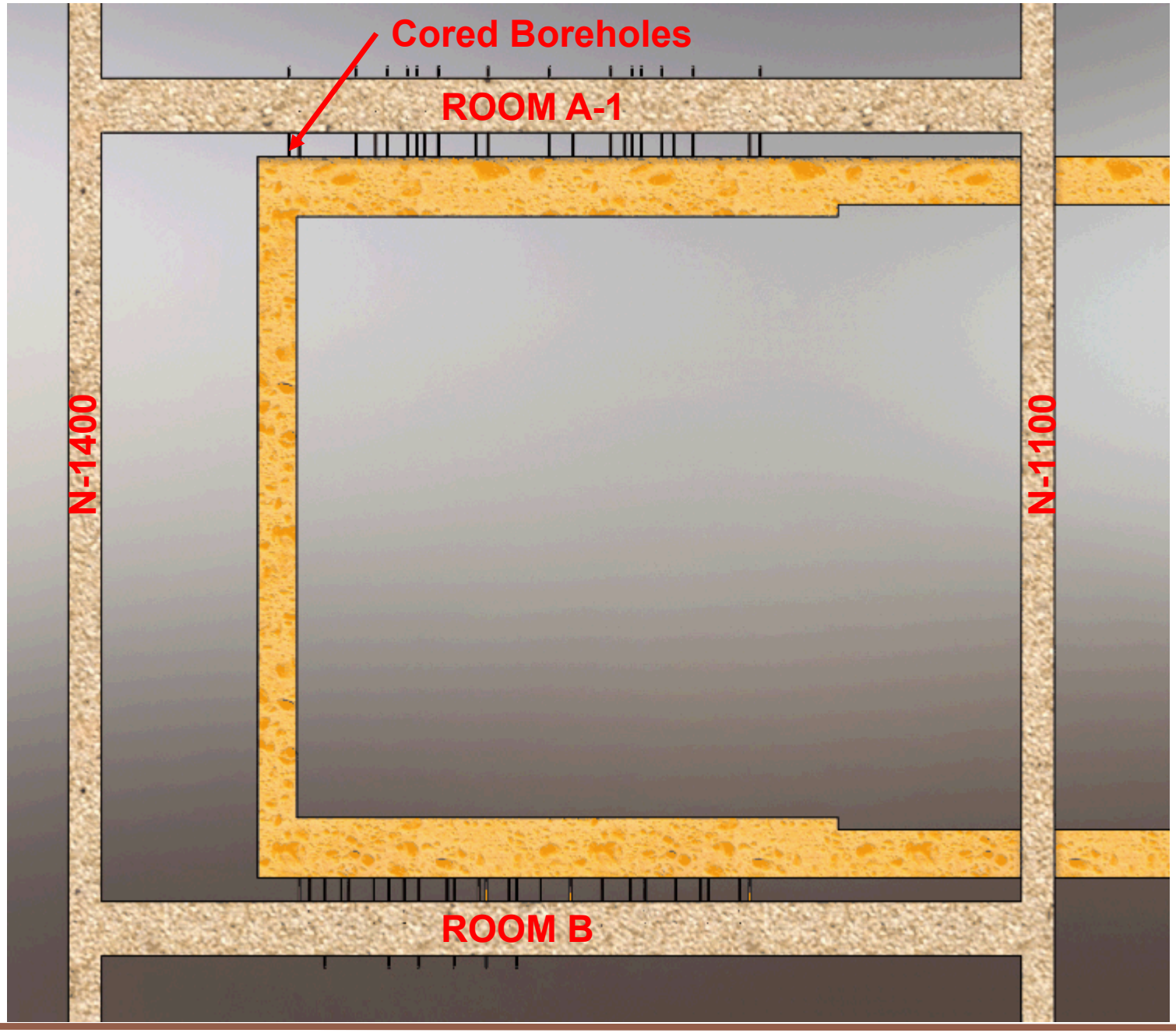
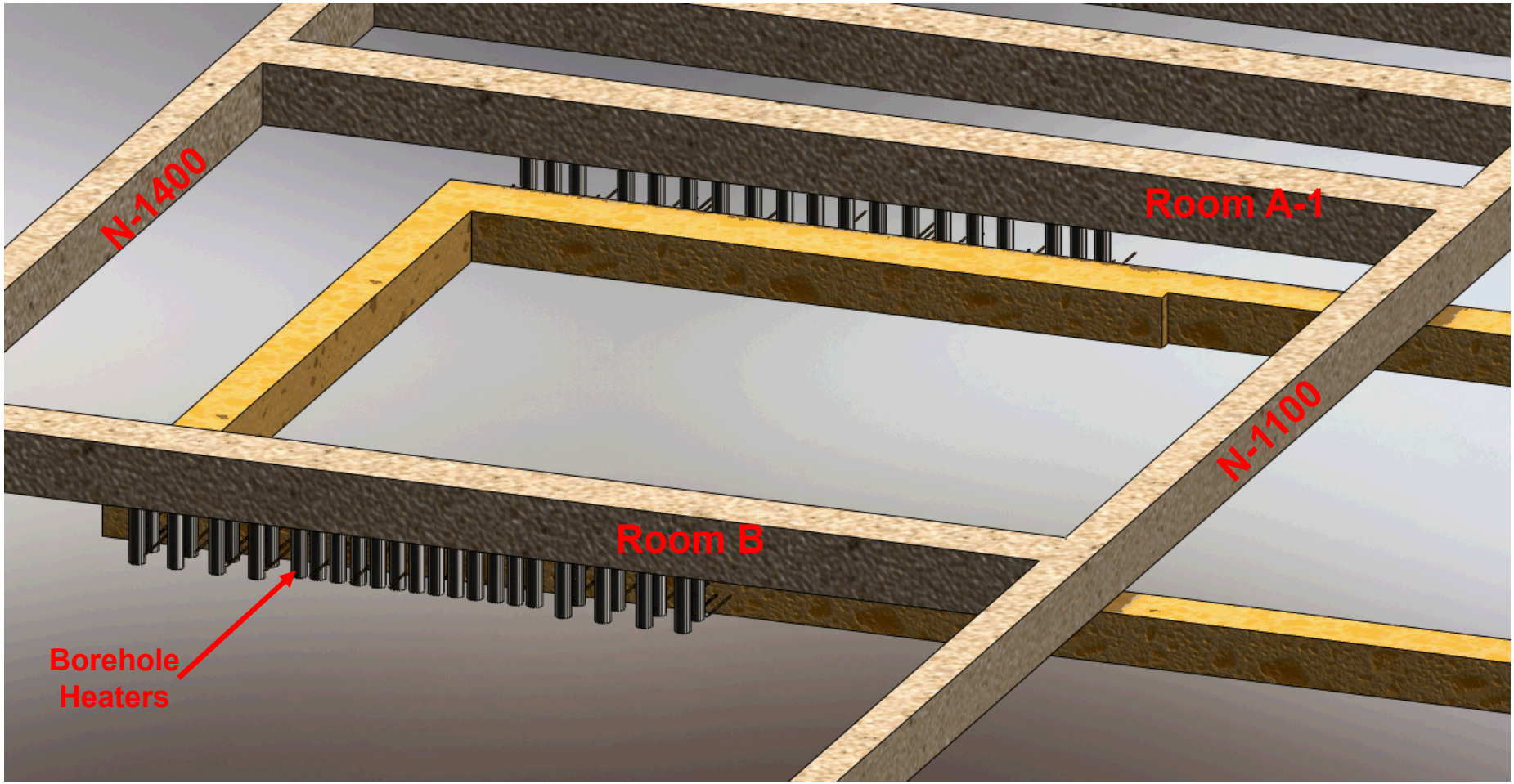
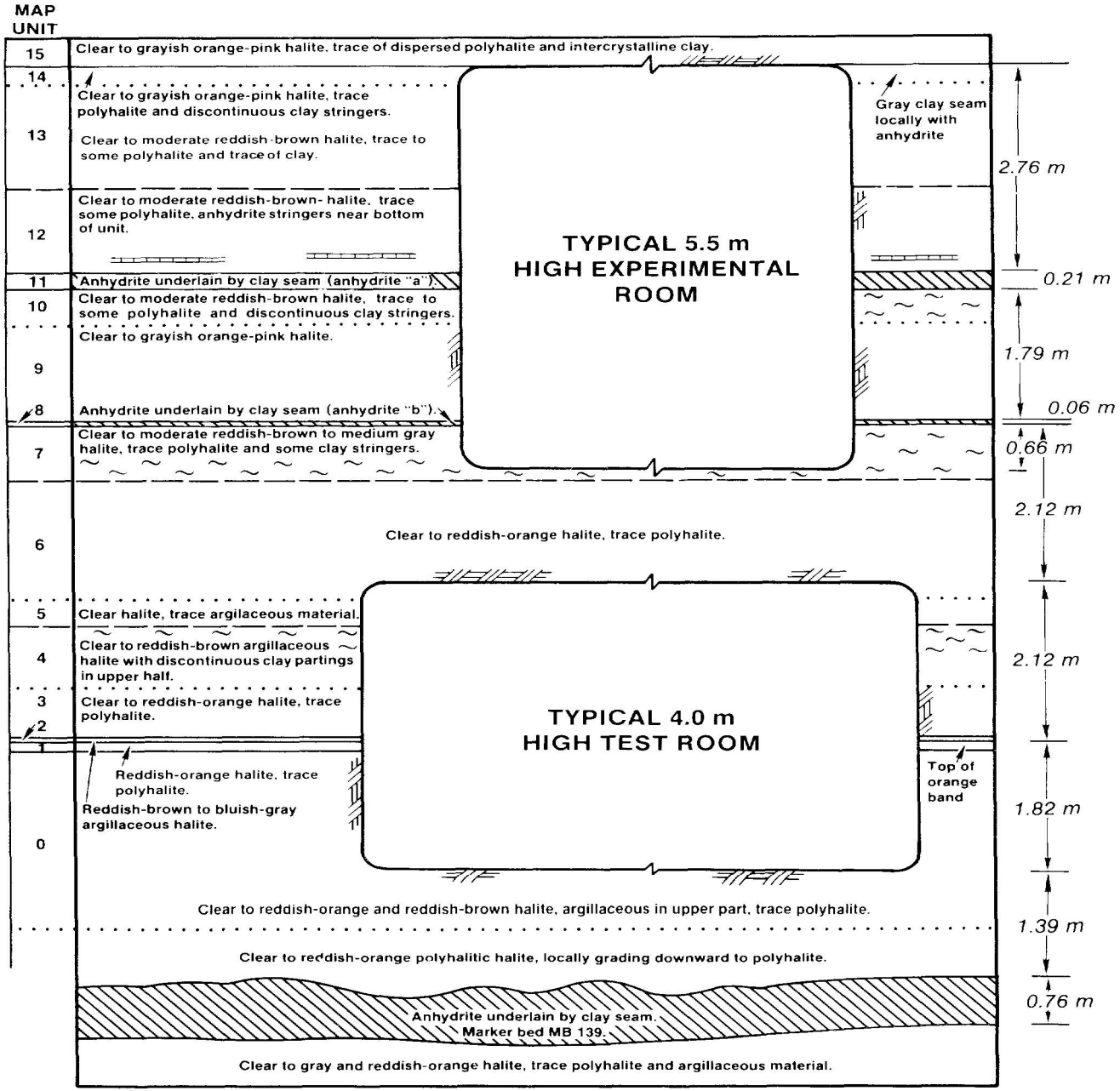



Cored Boreholes
ROOM A-1
N-1400
N-1100
ROOM B


N-1400
Room A-1
N-1100
Room B
Borehole
Heaters

Summary

- As an extension of the URL this area will provide opportunity for a wide range of additional forensic type investigations by multiple organizations.
- ROM cost of initial construction and testing is ≈ $2.25 million.
- Initial phase will take 2-3 years to construct and perform testing.
- Excellent opportunity to gather insight into long term conditions for areas that have been heated and cooled and remain undisturbed for ≈ 30 plus years.
- Other Potential Benefits?


MAP UNIT
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Clear to grayish orange-pink halite, trace of dispersed polyhalite and intercrystalline clay.
Clear to grayish orange-pink halite, trace polyhalite and discontinuous clay stringers.
Clear to moderate reddish-brown halite, trace to some polyhalite and trace of clay.
Clear to moderate reddish-brown- halite, trace some polyhalite, anhydrite stringers near bottom of unit.
Anhydrite underlain by clay seam (anhydrite "a").
Clear to moderate reddish-brown halite, trace to some polyhalite and discontinuous clay stringers.
Clear to grayish orange-pink halite.
Anhydrite underlain by clay seam (anhydrite "b").
Clear to moderate reddish-brown to medium gray halite, trace polyhalite and some clay stringers.
Clear to reddish-orange halite, trace polyhalite.
Clear halite, trace argilaceous material.
Clear to reddish-brown argillaceous halite with discontinuous clay partings in upper half.
Clear to reddish-orange halite, trace polyhalite.
Reddish-orange halite, trace polyhalite.
Reddish-brown to bluish-gray argillaceous halite.
Clear to reddish-orange and reddish-brown halite, argillaceous in upper part, trace polyhalite.
Clear to reddish-orange polyhalitic halite, locally grading downward to polyhalite.
Anhydrite underlain by clay seam.
Marker bed MB 139.
Clear to gray and reddish-orange halite, trace polyhalite and argillaceous material.
TYPICAL 5.5 m HIGH EXPERIMENTAL ROOM
TYPICAL 4.0 m HIGH TEST ROOM
Gray clay seam locally with anhydrite
Top of orange band
2.76 m
0.21 m
1.79 m
0.06 m
0.66 m
2.12 m
2.12 m
1.82 m
1.39 m
0.76 m