

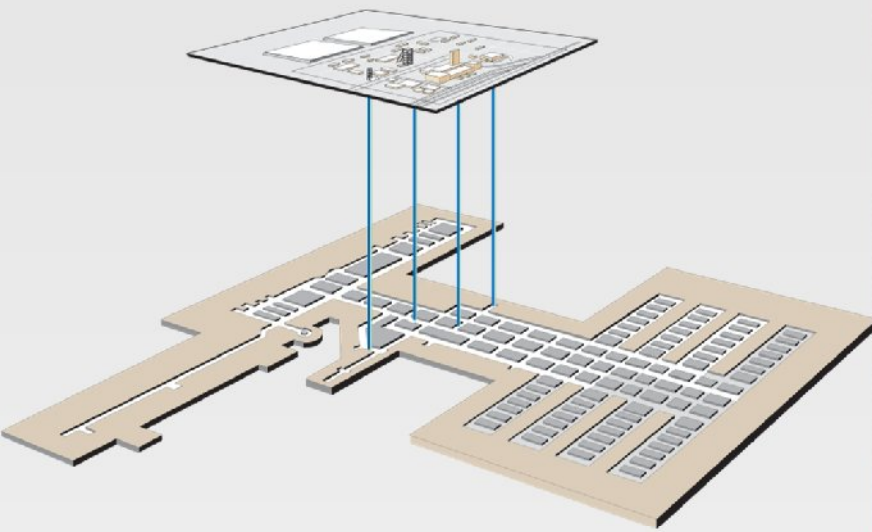


February 26 – March 1, 2012 ♦ Phoenix, Arizona

**Waste Isolation Pilot Plant (WIPP) Markers Program Development  
Panel Presentation**

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with help from Russ Patterson and Thomas Klein,  
and review comments by Roger Nelson**

WIPP: a Department of Energy facility for the permanent disposal of defense-related transuranic wastes



Host rock: bedded salt  
Repository depth:  
2,150 feet/655 meters



12+ years safely operating a deep geologic repository for radioactive waste in America

Waste Isolation Pilot Plant



# Disposal to be followed by decommissioning and markers



When WIPP waste disposal mission is complete, the site will be decommissioned and the underground will be sealed

Permanent markers will be placed on the surface to warn future generations about the presence of radioactive material

## Permanent Markers



# Passive Institutional Controls (PICs)

- PICs are markers and archives designed to warn and inform future generations about the location, purpose and content of a repository
- In the US, the Waste Isolation Pilot Plant (WIPP) is required by the U.S. Environmental Protection Agency to use markers and other PICs to indicate there is danger below

# Advertent and inadvertent intruders

- The inadvertent intruder drills through the repository to get to a suspected resource and needs to be warned there is something below that poses sufficient health and financial (cleanup) risk to merit not drilling here
- The advertent intruder knows there is a repository, understands the health and fiscal risks, but wants to drill into it, or through it, anyway

# How do we warn potential future intruders?

- Symbols suggesting fear and foreboding have been suggested
- Not a practicable design to implement
- Providing information --not arousing fear, ought to be the governing objective



# WIPP Conceptual Marker Design

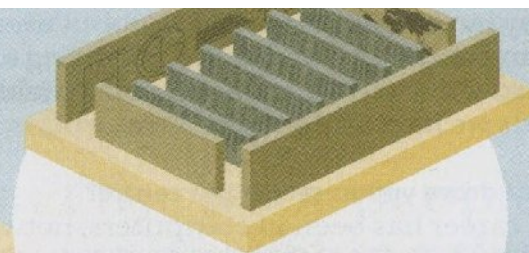
- The design provides layers of information and warnings
- Redundant messages will be carved into perimeter monuments
- There will also be an accessible information center and two less readily accessible information storage rooms
- Multiple national and international archives will also be used to store WIPP information

**BERM:** an earth and rock barrier  
10m high and 30m wide



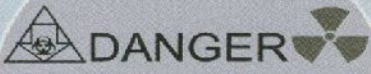
BERM

16 LARGE SURFACE MONOLITHS



**INFORMATION CENTRE:** maps of nuclear sites and warnings in several languages, plus detailed scientific information on radioactivity

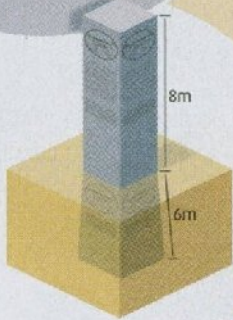
INFORMATION CENTRE



**DANGER**  
POISONOUS RADIOACTIVE  
WASTE HERE  
DO NOT DIG OR DRILL



**MONOLITHS:**  
engraved  
with warning  
messages  
and symbols



Buried and sealed  
information rooms

**HOT CELL**

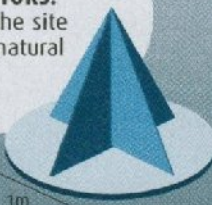
Buried warning plaques

**NUCLEAR WASTE:**  
buried 600m below surface

**HOT CELL:** the sealed  
room used to handle  
the waste will show  
that it used to be  
dangerous to touch



**BURIED RADAR  
REFLECTORS:**  
show the site  
is not natural



1m

32 engraved  
monoliths  
on perimeter  
of site

6.5 km

6.5 km

# A WIPP PIC Concept



# Content of information message

- The warned intruder (no longer inadvertent) can be dissuaded if the warning is believed
  - You cannot force belief, it is an internal emotion
  - The way to encourage intruders to believe and not intrude is to tell the whole story and let them judge
  - Thus warning messages must be complete and detailed, not cryptic
- Finding the right amount of information to inform and hopefully dissuade the intruder is an area ripe for developing international consensus & guidance

# Yucca Mountain markers: WIPP design adapted to mountain environment

- Clusters of three structures and perimeter monuments (redundancy)
- Archives at each of the three clusters
- Messages/warnings carved into monuments
- Messages/symbols also to be buried in coins made of fired clays



WIPP Concept Variant

## Reactions to markers may be complex

- 18,000 casualties from the 2011 tsunami in Japan
- Past generations erected stone tsunami warnings
- New generations understood message, felt sea-wall technology would be protective
- Older generation carried out its ethical obligation to the future



# Current generation has ethical obligation to warn future

- Repositories may attract resource hunters
- The best way to warn against this type of intrusion is to describe:
  - What is in the repository and why it is considered useless, and why it is dangerous
- Once a would-be intruder has been informed, he or she is no longer an “inadvertent” intruder
  - If a future society decides to unearth the waste knowing what is there, it is not this generation’s concern or problem.

# Ethical considerations also apply to present generations

- Present generations face real threats to their environment
- Current populations face real threats to their health and well being
- Resources ought not to be taken from efforts and materials needed to maintain human life quality today for the sake of preventing low hypothetical threats to far-future humans

# WIPP intent

- There is a project addressing Records, Knowledge and Memory (RK&M) preservation under the Nuclear Energy Agency in Paris <http://www.oecd-nea.org/rwm/rkm/documents/rkm-collective-statement-en.pdf>
- It is WIPP's intent to help create an international consensus on marker concepts and message content recommendations with RK&M participants
- WIPP stands ready to lend its experience and expertise to this effort
- We request your interest, and your help

WIPP Intent

