



Introduction to WIPP Passive Institutional Controls

WIPP Passive Institutional Controls

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Introduction WIPP Passive Institutional Controls

- **What are Passive Institutional Controls (PICs)?**
- **Why are they needed?**
- **What are the PICs for WIPP?**
- **How were the PICs for WIPP Developed?**

WIPP Passive Institutional Controls

- **What are PICs?**
 - **According to EPA**
 - **Definitions (40 CFR191.12)**

“Passive institutional control means:

 - (1) Permanent markers placed at a disposal site,**
 - (2) public records and archives,**
 - (3) Government ownership and regulations regarding land or resource use, and**
 - (4) other methods of preserving knowledge about the location, design, and contents of a disposal system.”**



WIPP Passive Institutional Controls

- **Why are PICs needed at WIPP?**
 - **Required by the WIPP regulator (EPA) for “Assurance” purposes**
 - **What is “Assurance”?**
 - **EPA defines assurance as a measure that provides additional confidence that the repository will perform as predicted by performance assessment**



WIPP Passive Institutional Controls

- **Assurance Requirements (40 CFR 191.14)**
 - *“Disposal sites shall be designated by the most permanent markers, records, and other passive institutional controls practicable to indicate the dangers of the wastes and their location.”*



WIPP Passive Institutional Controls

- **What are PICs intended to do?**
 - **PICs are intended to communicate to potential intruders information about the existence and location of the repository, the wastes buried there, the nature of the hazard the wastes represent, and the goal of not disturbing the disposal system. A fundamental assumption about nuclear-waste disposal is that if future generations have and understand the appropriate information, they will not intrude into the repository or disturb the remainder of the disposal system.**



WIPP Passive Institutional Controls

- **Why EPA required PICs**

- "In developing the 40 CFR part 191 rule, EPA recognized that the quantification of risk over long periods of time was subject to considerable uncertainty and consequently introduced assurance requirements into the rule to qualitatively address this uncertainty.... *Passive institutional controls are designed to reduce the probability of inadvertent human intrusion into a repository by conveying information about location, design, and hazards of the WIPP.*" (EPA 1996)



WIPP Passive Institutional Controls

- **What are the PICs for WIPP?**
 - Permanent Markers (PM)
 - Government Ownership
 - Records
 - Awareness Triggers
- **How were the WIPP PICs developed?**



How Were PICs Developed

- **History of PICs**
- **Generally understood that a geologic waste disposal site should not be disturbed and that controls should be used to reduce the likelihood of human intrusion**
- **EPA's draft disposal rule had requirements for active and passive controls (1985)**
 - **Active controls are short term (approx. 100 yrs.) – passive controls are long-term (1,000's of yrs.)**



How Were PICs Developed

- **Project identified PICs as a deterrent for human intrusion – How?**
 - **PICs must communicate existence and hazards of WIPP to future generations**
 - **What will the future of mankind be?**
 - **How do you communicate with future generations?**
- **Project studies to address these questions**



How Were PICs Developed

- **The DOE began addressing Passive Institutional Controls by convening two panels**
 - **Futures Panel (Hora et al. 1991)**
 - **Markers Panel (Trauth et al. 1993)**



How Were PICs Developed

- **Futures Panel – (Hora et al. 1991)**
 - 4 expert judgment teams to delineate possible future societies in the next 10,000 years near WIPP
 - Teams included expertise in the physical, social, or political sciences
 - Teams developed detailed qualitative assessments of possible future societies
 - Each team also developed quantitative assessments by providing probabilities of various alternative futures, of inadvertent human intrusion, and in some cases, of particular modes of intrusion

How Were PICs Developed

- **Markers Panel (Trauth et al. 1993)**
 - **The expert panel was tasked to identify the basic principles for marker design efforts. The panel identified these principles:**
 - **the site must be marked**
 - **message(s) must be truthful and informative**
 - **multiple components within a marker system**
 - **multiple means of communication (e.g., language, pictographs, scientific diagrams)**
 - **multiple levels of complexity within individual messages on individual marker system elements**
 - **use of materials with little recycle value**
 - **international effort to maintain knowledge of the locations and contents of nuclear waste repositories**

How Were PICs Developed

- **Several design concepts were developed from these panel's conclusions (DOE 1996; Appendix PIC)**
 - **Markers**
 - **Multiple components using durable materials**
 - **Messages**
 - **Multiple formats and levels**
 - **Records**
 - **On and off-site archival, multiple components**
 - **Ownership**
 - **Government**

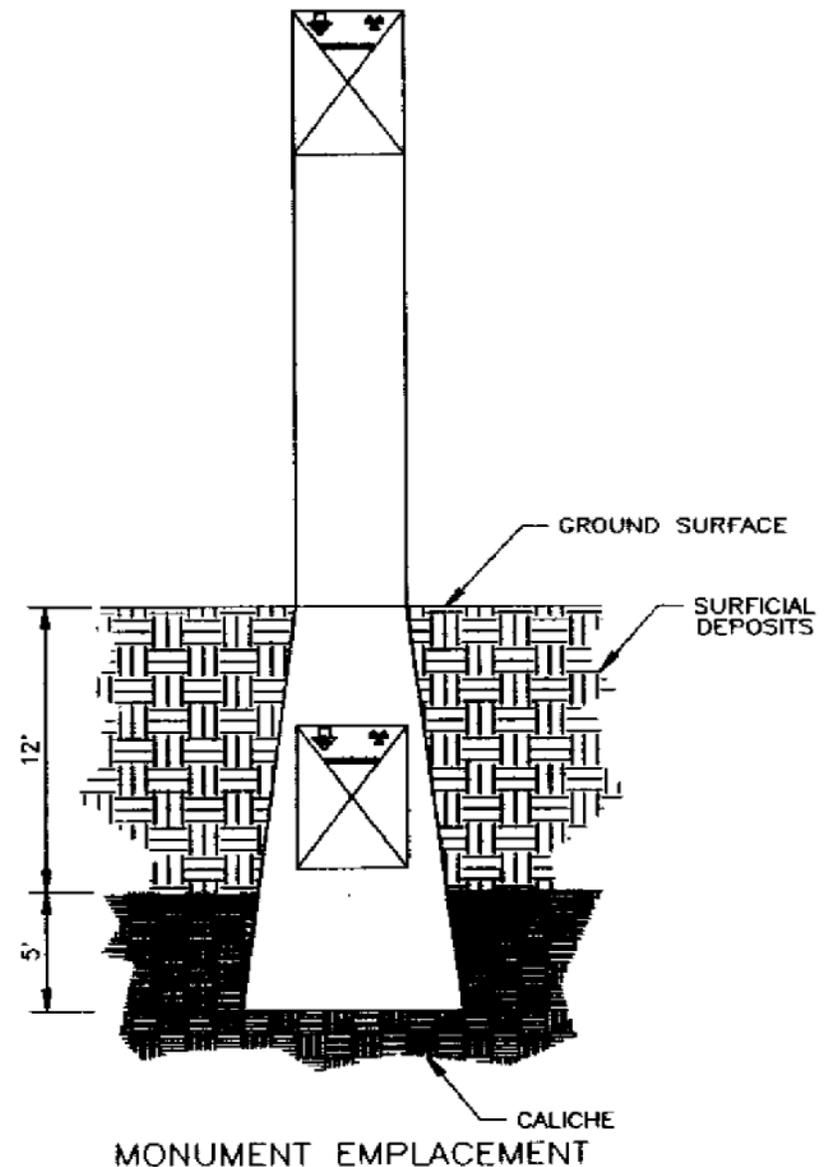


WIPP PICs Design

- **WIPP Site PICs Design**
 - **Monuments for land withdrawal boundary**
 - **Monuments for repository footprint**
 - **Small buried markers**
 - **Large Earthen Berm**
 - **Information rooms (surface and buried)**
 - **Locating devices (magnets and radar reflectors)**

Monuments

- Granite monuments with multiple levels of messages engraved on surfaces (above and below ground)
- 25 feet tall
- 2 piece
- 16 monuments - inside berm
- 32 monuments - LWB perimeter
- Level II and III messages



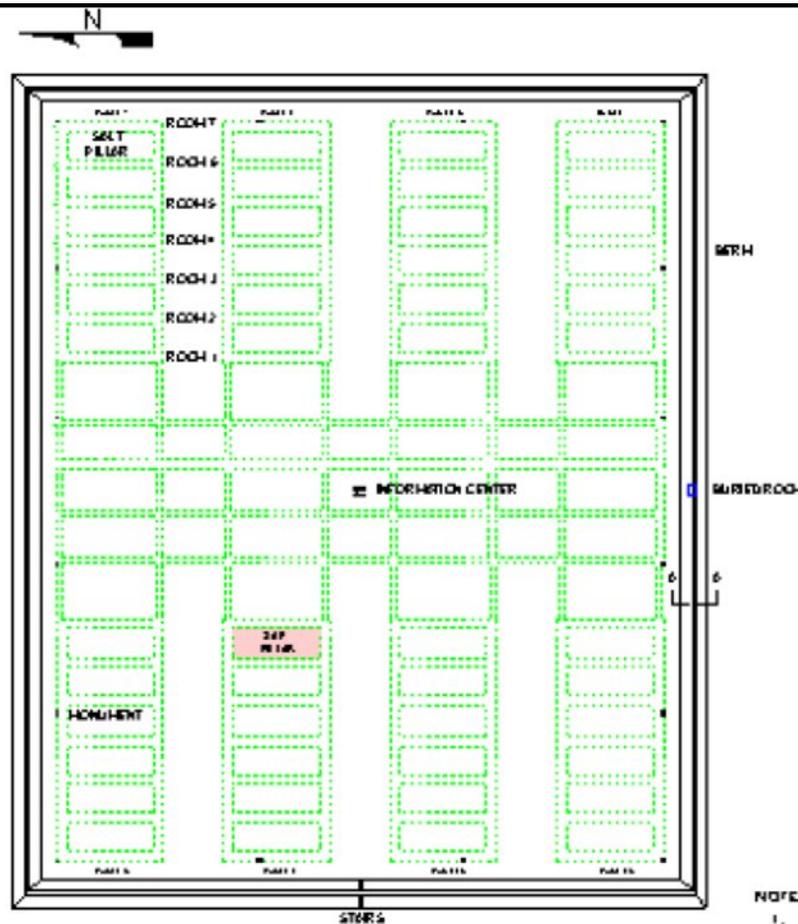
Monuments

- **Subsurface Markers**
- **9 inch diameter**
- **3 materials**
- **Level II messages**
- **Within berm and repository footprint**
- **Random placement**

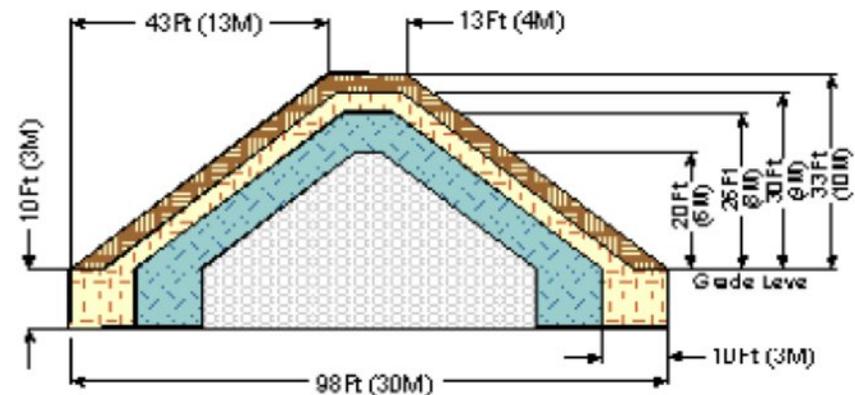


Diameter of Disk is 23 cm. (9 in.)
Not to Scale

Earthen Berm



BERM LOCATION



BERM CROSS SECTION

BERM CONSTRUCTION PROFILE
NOT TO SCALE



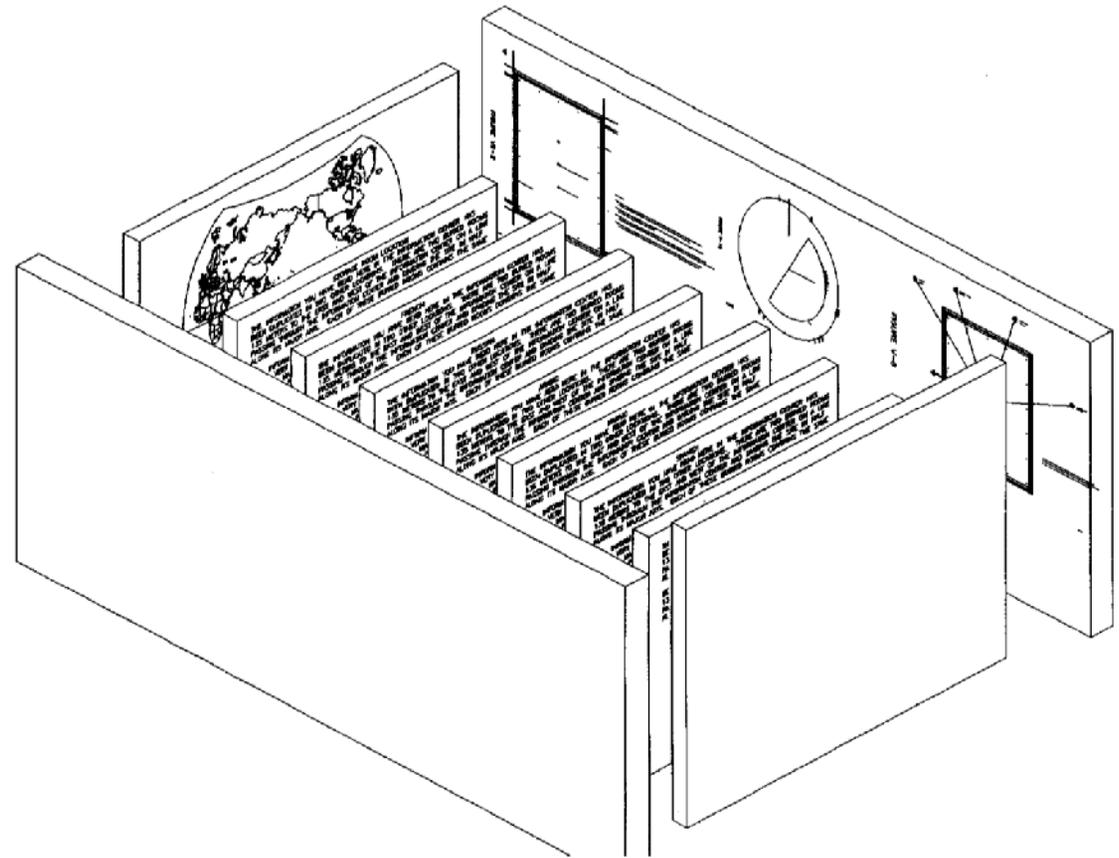
NOTES

1. THE DISPOSAL AREA PER METER MEASURES 62M BY 77M
2. THE INNER PERIMETER OF THE BERM MEASURES 60M BY 314M.
3. THE OUTER PERIMETER OF THE BERM MEASURES 72M BY 374M.
4. PANELS, ROOMS, AND SALT PILLARS REFER TO THE REPOSITORY FOOTPRINT SHOWN AS DOTTED LINES..

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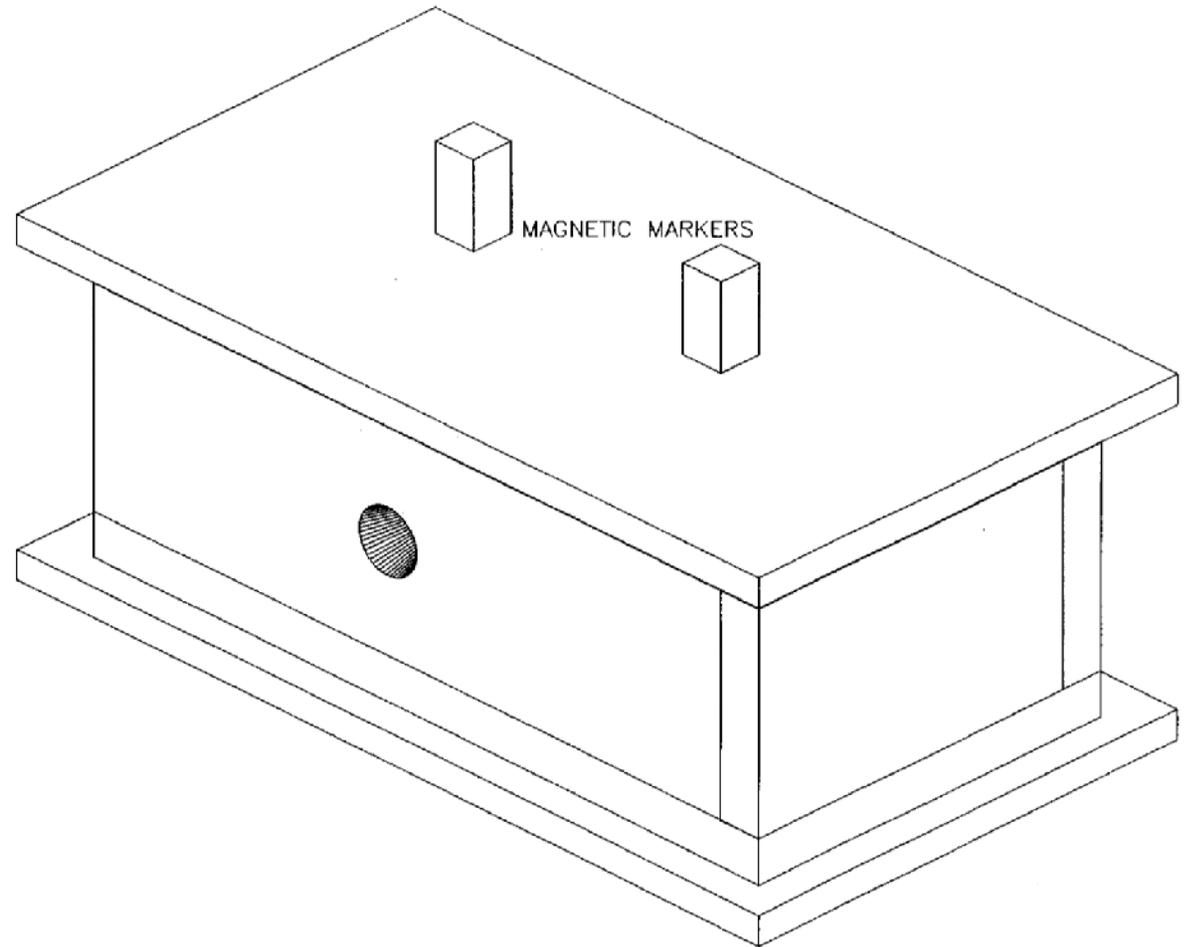
Information Room

- Granite
- 29X40 ft with 15 ft walls (5 ft buried)
- Extensive information engraved on walls – Level IV messages
- Located in center area of berm



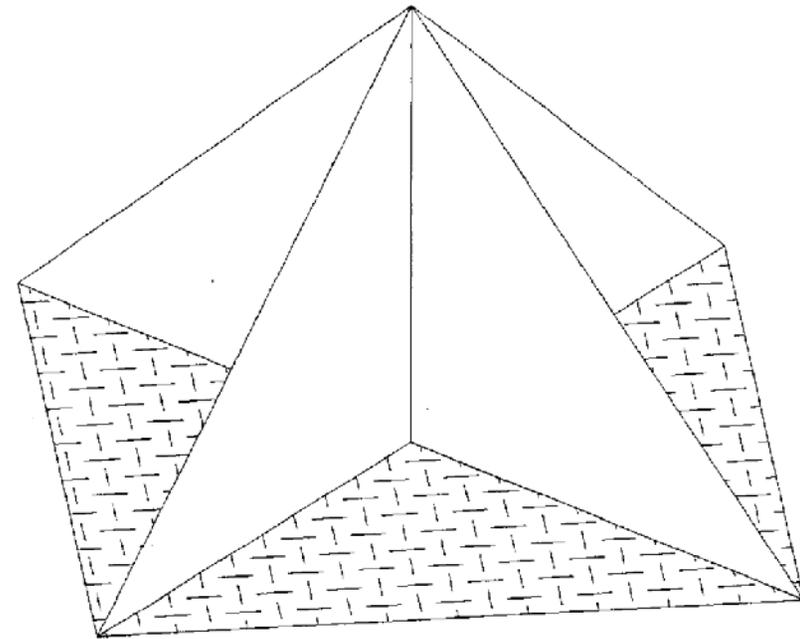
Buried Information Room

- **Granite construction**
- **39X22X16 ft**
- **Same information as Information Center**
- **Sealed**
- **2 locations**
 - **One located within the berm and one north of the berm, within LWB – 20 ft deep**



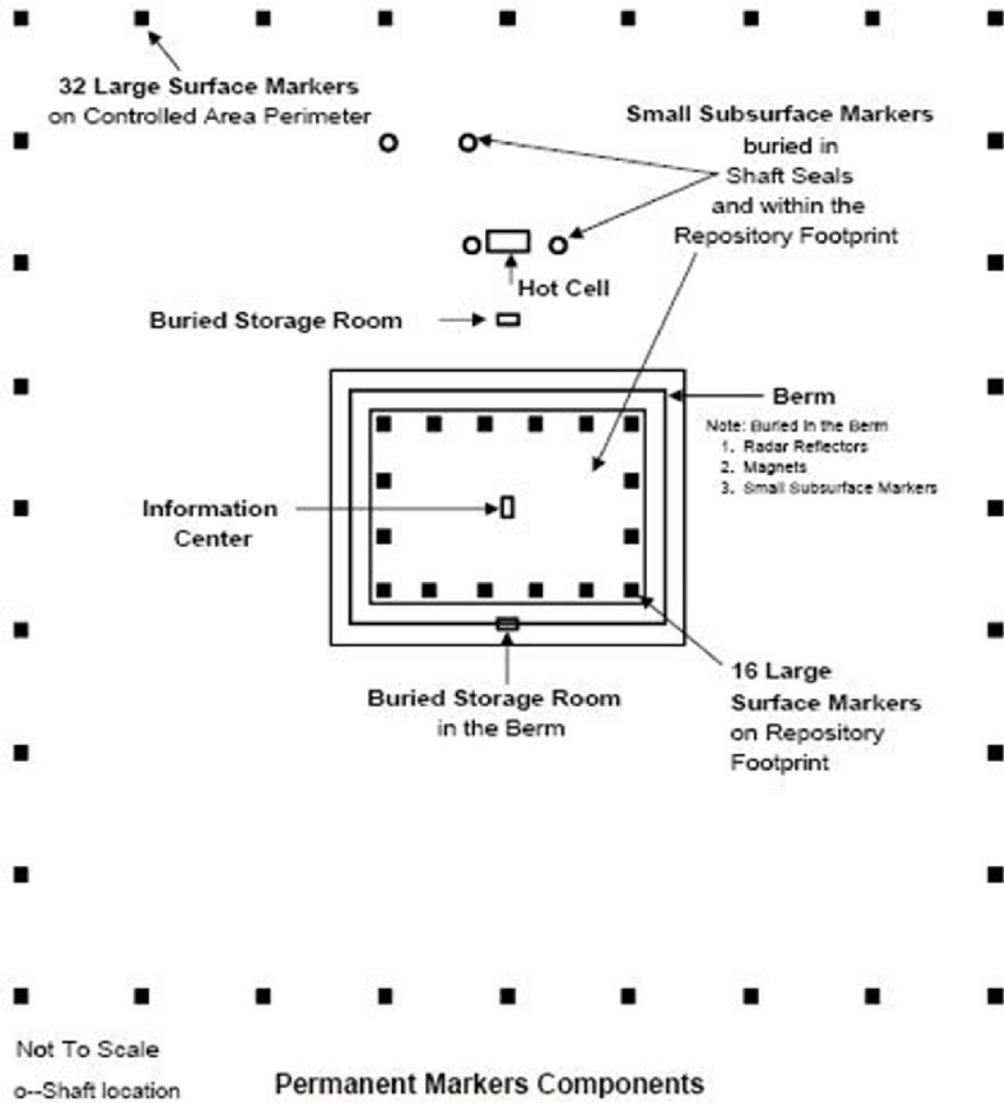
Locating Devices

- **Two systems were proposed to enhance detection of the site and markers**
 - **Magnetic Materials**
 - **A variety of permanent magnet materials and protective coating for the magnets should be buried at the bottom of the berm**
 - **Magnets placed on top of buried information room**
 - **Radar Reflector**





PICs Plan View



Conceptual Design

Messages

- **Communication using different levels of messages**

Level I - Conveys site is manmade

Level II - Conveys danger - Cautionary

Level III - Conveys basic information, what, why, when, where, who and how

Level IV - Conveys complex information in seven languages, includes written record of WIPP, tables, figures, maps and diagrams

Level V - Archival Information

- **Complete rulemaking record of WIPP**
- **Not located at site**

Messages

- **Types of Messages**
 - **Unnatural – not man made**
 - Berm, monuments
 - **Pictographs**
 - **Examples – orientation of constellations, stick figures, current warning graphics**
 - **Language**
 - **Six written languages (UN + 1)**
 - English
 - French
 - Spanish
 - Chinese
 - Russian
 - Arabic
 - Navaho





Records Archival

- **Records are used to communicate the existence and history of WIPP**
- **Record centers should include various Federal and State libraries/agencies and commercial mapping agencies to ensure that the WIPP location and drilling or mining restrictions are identified on widely distributed maps used by almost all public and private organizations**



PIC Summary

- **Passive Institutional Controls are part of the overall WIPP design**
- **PICs intended to endure and communicate the existence and hazards of the buried waste and reduce the likelihood of human intrusion into the repository**
- **PICs include**
 - **Permanent Markers**
 - **Messages**
 - **Government Ownership**
 - **Records**
- **PICs activities are ongoing**



Future PICs Activities – What's Next?

- **Currently a final PICs design must be included in the last EPA Certification Application (about 2035)**
 - **At the latest- PICs must be in place by the end of Active Institutional Controls period – 100 years after site closure (about 2135)**



Future PICs Activities – What's Next?

- **Drivers for PICs Design Changes**
 - **No credit for PICs in PA to reduce the likelihood of human intrusion – since PA shows compliance without PICs a simpler more cost effective design will likely be proposed**
 - **Technological advancement along with societal, political, economic and regulatory priority changes will occur before PICs implementation**
 - **New concepts and advancements from International repository programs**



Future PICs Activities – What’s Next?

- **Ongoing Program to Develop Final PIC Design**
 - **Current activities include participating with global community to develop international guidance on PICs**
 - **Progress of ongoing PICs activities are documented in WIPP Recertification Applications at 5-year cycles**