

DoE Subsurface Investigation Workshop

1 – 3 August 2011

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LANL Subsurface Survey Program.

- LANL
 - ~11k people
- Was 46 now 36 square miles in Area
- More 400 buildings, many date from early 50's

LANL Subsurface Survey Program

- Electrical Safety & Penetration Programs
 - Program started 1996 jackhammer 13.2kV strike that resulted in fatality
- Centralized PRID (Permits and Requirements Identification System)
 - All penetrations and excavations require permit and review except simple <2" (still needs the paper work)
 - Sticking pins in the wall does not require permit

LANL Subsurface Survey Program

- Electronic permitting process (software footprints data) controls review work flow Controls all permits to include LANL building official, RCRA & NEPA
- Penetration procedure Separated into interior and exterior
- Interior
 - 2 types of penetrations
 - <2" in masonry / concrete / gypsum board
 - No subsurface investigation required
 - >2"
 - Requires subsurface investigation
 - Request for GPR via PRID.

LANL Subsurface Survey Program

- Plan review by PIC or project engineer (work package)
 - Usually ineffective as secondary utilities within facilities are not mapped accurately on as built drawings
 - GPR scan and a 2nd technology per penetration investigation procedure usually radio frequency type is required (think hilti)
- Using GPR - General
 - Using GSSI SIR3000
 - No post processing software
 - No invert data
 - No attempt to verify material dielectric strength
 - Only XY location of parabolas are marked in real time

LANL Subsurface Survey Program

- Floor/wall marking
 - All "anomalies" marked
 - No attempt to differentiate between rebar or conduits or anything else
- GPR group uses defined symbology
- GPR tech delivers hand drawing to work package
- Survey Data not captured electronically

LANL Subsurface Survey Program

- Penetration Process
 - Assumption is floor is hot:
 - Workers are required to wear dielectric gloves/boots
 - Double insulated or battery operated power tools
 - Drill stops circuit interrupters have been used
 - GPR technician usually attends penetration pre-job
 - Final authorization to work as required by work control document
 - If risk indicates, electrical engineer required to perform arc flash analysis

LANL Subsurface Survey Program

- Interior Penetration Issues
 - Many issues result from people thinking GPR more powerful than it really is
 - If strike a conduit helps to follow the procedure.

LANL Subsurface Survey Program

- Exterior
 - Ground excavation by permit via PRID
 - GPR not used often outside due to soil conditions,
 - GIS mapping and traditional RF methods
 - RCRA and NEPA reviews are more important at LANL.
 - Footprints software to track excavation permit request

- Pot holing with air (or water) excavation
 - Sometimes but not always pot hole data used to obtain inverts for plan & Profile

LANL Subsurface Survey Program

- Exterior Excavation Considerations
 - Incidents Geology helps in general
 - Undisturbed TUFF solid, hard to dig
 - Most utility corridors are easily observable from surface.
 - Strong GIS program for primary utilities (steam, water/sewer, electricity) tied to benchmarked coordinates.
 - LANL Guide Specifications require Surveys of subsurface utilities prior to burial
 - Few unmapped primary utilities at LANL
 - Most occurrences are to secondary utilities with backhoe, excavators, etc.

LANL Subsurface Survey Program

- LANL Procedures that help avoid utility strikes.
 - All primary electrical concrete encased with red concrete
 - All utilities have metalized marker tape.
 - Underground utility strikes are rare
 - Surface survey to verify GIS data
- Issues that cause utility strikes.
 - Lots of projects don't budget either time or funding to accurate surface feature survey which would stop most strikes.

LANL Subsurface Survey Program

- **INCIDENTS:**
 - Root cause due failure to follow penetration procedure
 - Miscommunication
 - Failure to verify or understand floor/wall markings
 - Walking off the farm.... Extrapolating floor marking to unscanned areas