

# Multi point sampling beneath landfills

presented by

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# Items to be discussed

- **Horizontal access benefits**
- **How the FLUTe LAHD system works**
- **The design used in Indiana**
- **The drilling sequence**
- **The liner installation**
- **The results**

# **The many advantages of horizontal access**

- **Access to pore fluids directly beneath the possible contaminant source region**
- **Greater probability of intercept of vertical flow paths (e.g., fractures, macro pores)**
- **The hole does not provide a vertical flow path for contaminant spread**
- **It does not require the violation of landfill liners or other barriers**
- **It does not disrupt critical areas/activities such as runways, building interiors, tank volumes, etc....**

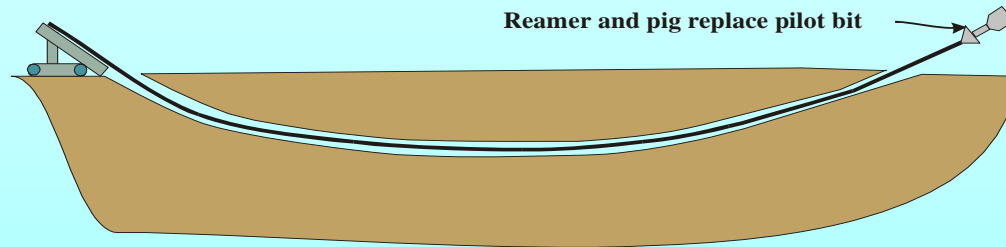
# How the LAHD FLUTE system works

- **The horizontal pilot hole traverses beneath the surface and exits to the surface on the far side.**
- **The pilot bit is exchanged for a reamer, swivel and pig.**
- **The liner propagates against the pig, following the reamer back to the entrance.**
- **The liner can be a blank liner or one instrumented with tubing and ports for sampling.**
- **The sampling interval is defined by an external permeable surround on the liner called a spacer.**

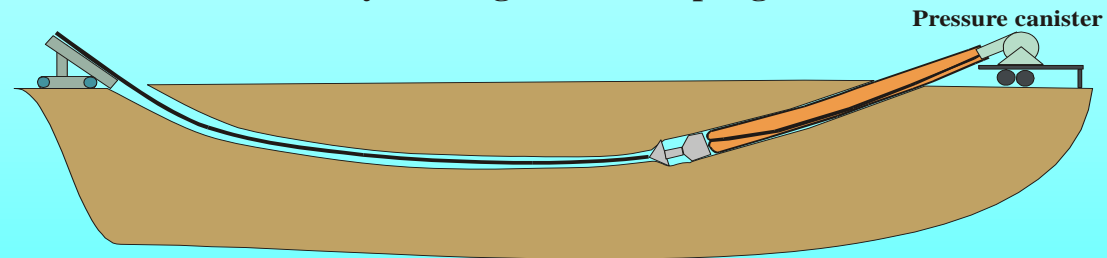
# The design for installation in Indiana

## Installation sequence for LAHD FLUTE sampling system

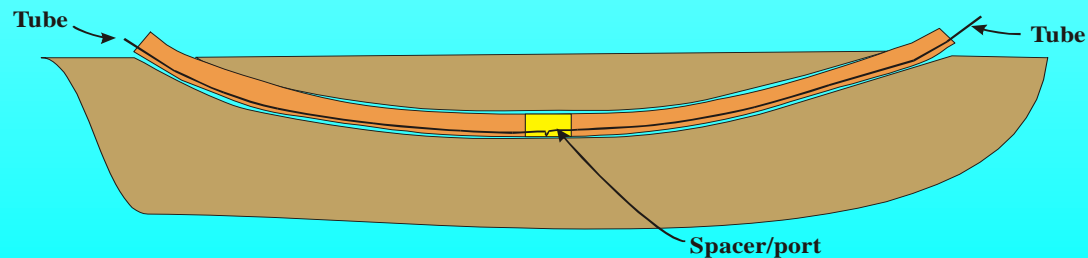
Pilot hole drilled with entrance and exit, reamer attached



Reamer followed into hole by everting FLUTE sampling liner

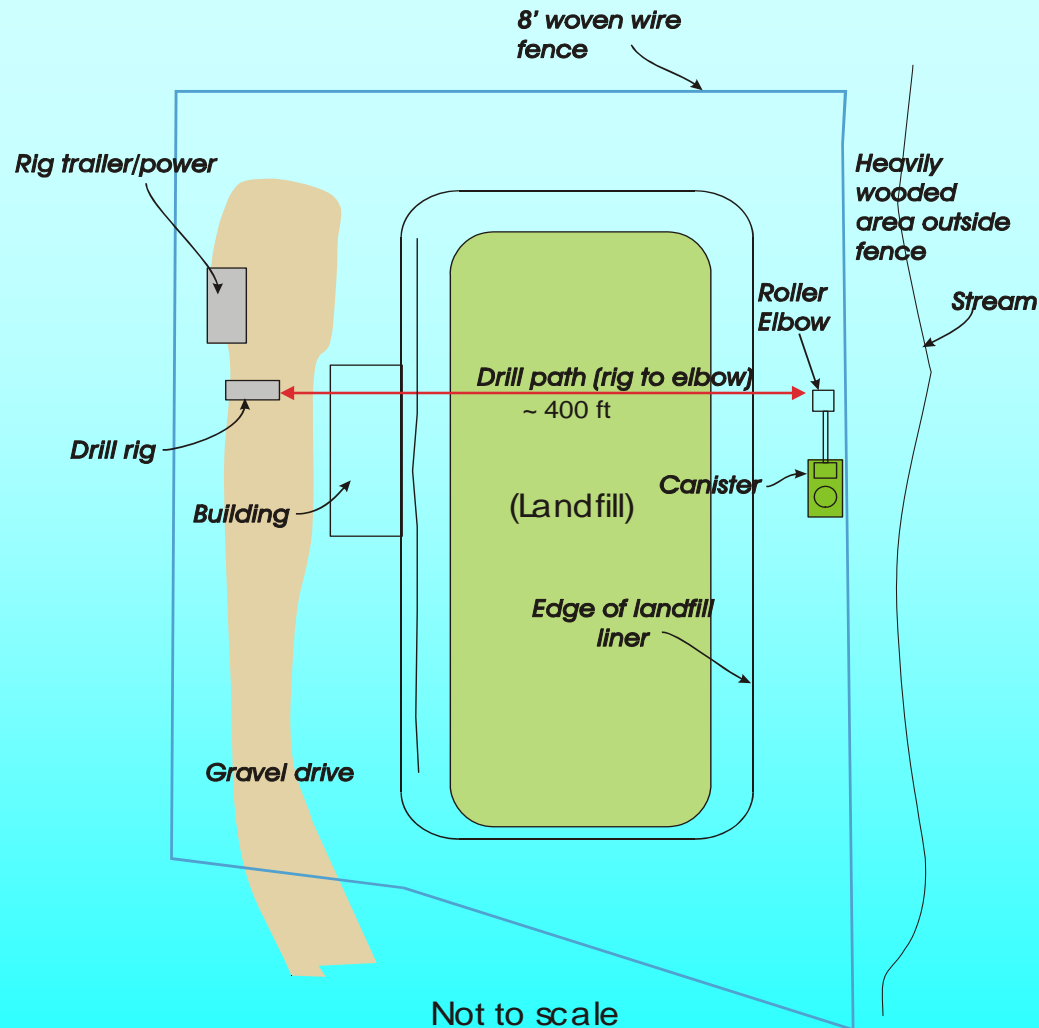


Sampling liner in place with one sampling system shown



Note, FLUTE holds 4 patents on this technique; see last slide.

# The site required a roller elbow at the liner entrance to the hole



# The drilling system used is relatively small





# The 5'' pilot bit exits into a pit





**The pilot bit is exchanged for a reamer, swivel and pig**



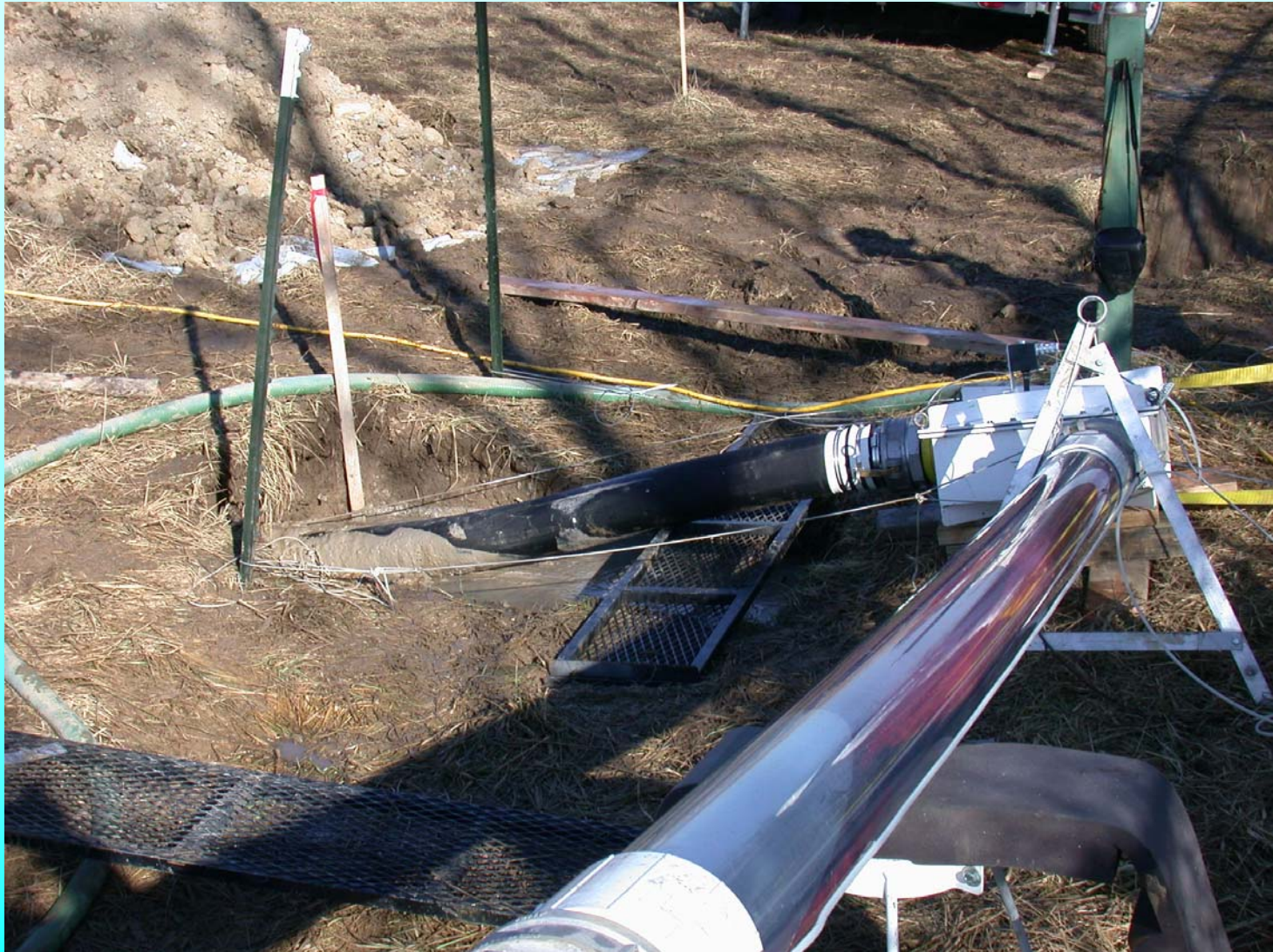


**The liner follows the pig into the hole**





**The liner is deployed from a large canister via a 90 deg. elbow**





# The 48" canister deploys the liner with water and air pressure





# The liner emerges at the drill rig, clean!





**The wellhead at each end contains the  
sampling tubes**



# **The samples gathered were of good quality**

- **The formation was a silty clay with sand lenses**
- **The 8 sample tubes refilled at very different rates**
- **The sample water was displaced from the tubing by compressed nitrogen.**
- **The sample volumes varied from 100 to 1200 ml in a 24 hr period.**
- **The chemical results were quite varied with no evidence of cross contamination by the drilling operation, or failure of the liner to seal the hole.**

# **Advantages of the FLUTE LAHD technique**

- **A relatively small hole is used (6" total).**
- **The slightly oversize liner displaces the mud and cuttings out of the hole like a piston (at 20 psi), leaving a relatively clean hole.**
- **There is no annulus outside of a casing that must be filled between sampling points.**
- **It is possible to complete the drilling and liner installation in one day.**

# Thanks for considering our methods

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FLUTe patent numbers 5,803,666; 5816,345; 5853,049 and 6,109,828 are explicit to the LAHD technique.