



REMTECH 2009

Drumheller Institution: Kitchen & Health Centre Crawlspace Remediation

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Drumheller Institution: Kitchen & Health Centre Crawlspace Remediation

CLIENT: Public Works and Government Services Canada
Steve Phypers, Project Manager

CONSULTANT: AECOM
Jim Clare, Project Manager

CONTRACTOR: IONA Contractors Ltd,
Tony Stevens Project Manager

Introduction

1. History
2. Problem
3. Client expectations
4. Engineering
5. Construction

History



History

- Buildings construction
 - Exterior grade beam on footings
 - Floor: structural slab with piles on spread footings
 - Earth floor in crawlspace with approximately 1 to 1.5 metres of head room
 - Utility and heating piping hung from the underside of floor slab



Problem



PROBLEM

- Joints in utility piping develop leaks
- Leaking at locations where pipes pass thorough floor slab
- Heating pipes develop leaks
- Leaking pipes causes considerable areas of ponding dirty contaminated water



PROBLEM

- Ponding water raised concerns with air quality in the crawl space
- Limited head room created maintenance issues
- Due to air quality issues the crawl space was considered a Class A confined space by PWGSC
 - Air packs required
 - Safety harnesses required



PROBLEM

- Due to air quality concerns PWGSC had an environmental assessment report completed in 2004
- The environmental assessment found:
 - Soils samples indicated the presence of total coliform bacteria and *E.coli*,
 - The presence of small areas of *Penicillium/Aspergillus* Mould



PROBLEM



Client Expectations



Requirements

- Propose and design remediation/modifications/improvements to both crawlspaces beneath the kitchen and healthcare to remove the risk of exposure to contractors and employees to bacteria, noxious gases, mould and other hazards from sewage contamination and historical water intrusion;
- Design is to provide a long term solution for sewage back-ups in the crawlspace (can expect that inmate actions will result in the problem recurring);
- Design to include leakage repairs;
- Design must also limit or prevent any of the air in the crawlspace from accessing the occupied spaces.



Requirements

- Wanted a design that would allow ease of maintenance to repair future leaks. Ideally maintenance personnel wanted to be able to stand up in crawlspace, (dig a basement);
- Any geosynthetic liner had to support maintenance and be easy to repair;
- Remediation must seal off contaminated soil and prevent ponding of water;
- Prevent movement of air into occupied space above



Engineering



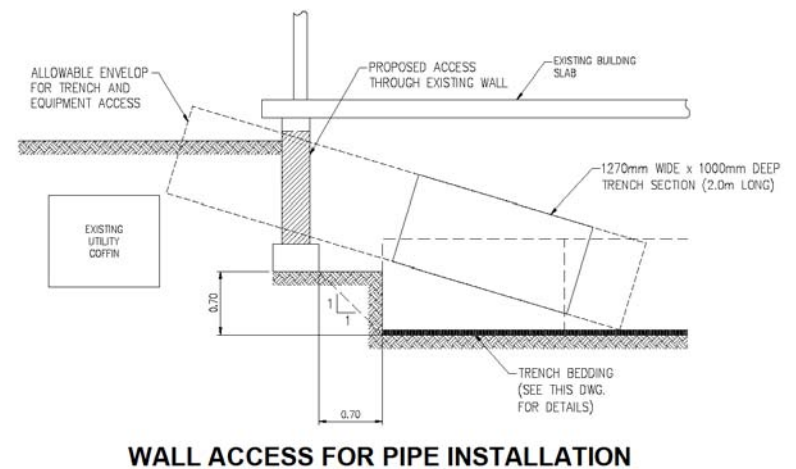
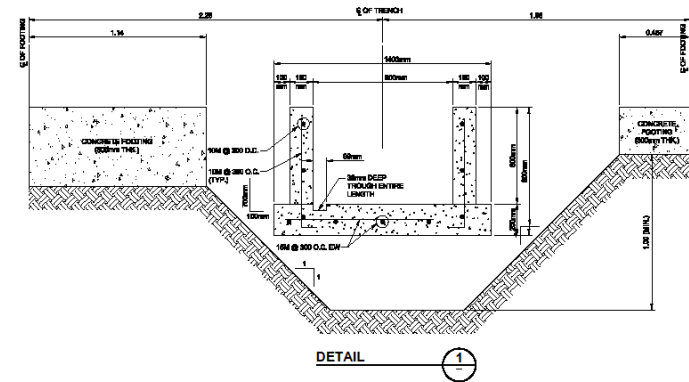
Issues

- Large areas of ponding water
- Considerable amount of debris strewn across the earth floor of crawlspaces;
- Electrical cables incased in concrete on top of crawlspace floor



Issues

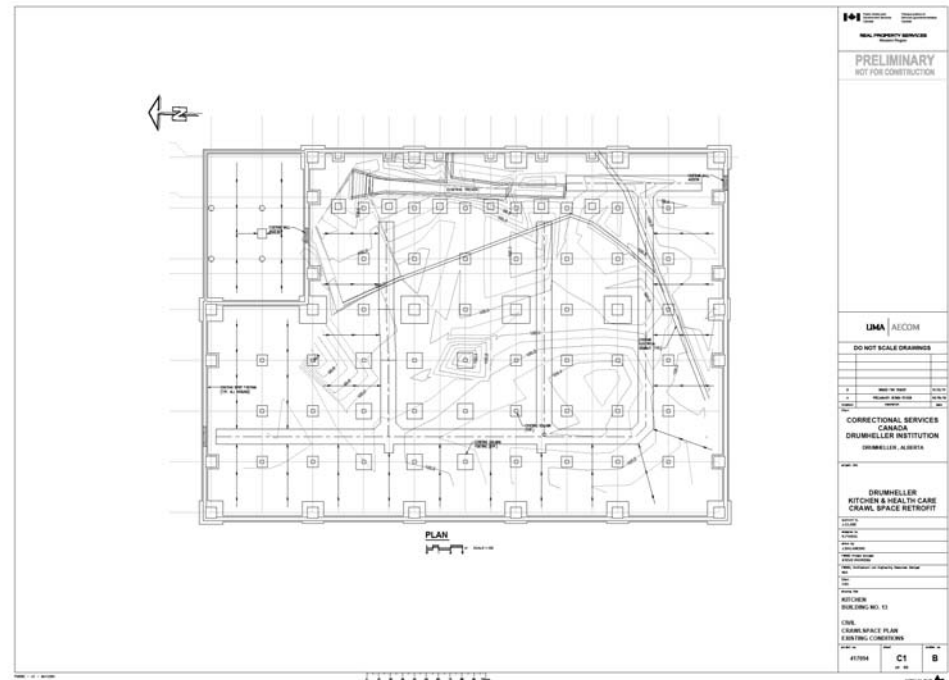
- Building supported by columns on spread footings – two different sizes; design had to prevent compromising the building foundation
- Limited access – one existing exterior and one interior
- Access into the space limited due to foundation design



Engineering Design

Health and Safety Plan

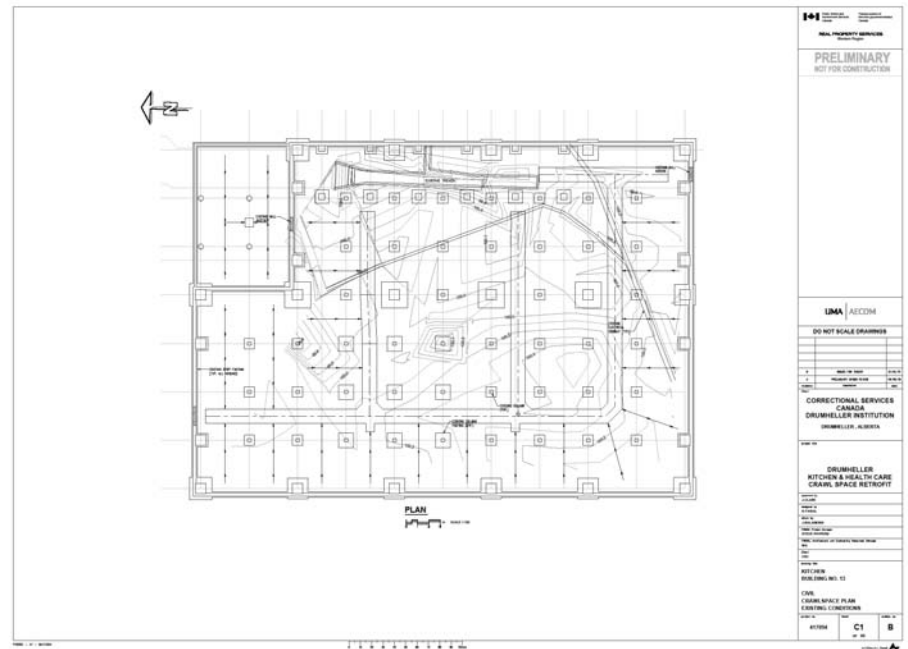
- Clinical Microbiologist engaged to provide H&SP
- PPE
 - Tyvek suits to prevent contamination to clothing
 - NIOSH approved half mask
 - Latex gloves
 - Rubber boots
- Instruction on use of PPE
- Access to hand washing



Conducted existing condition survey of the crawlspace

Design Approach

- Provide a series of trenches
 - Collect water
 - Provides access for maintenance
- Trenches sloped to drain to sumps



Design Approach

- Surface of crawl space re-graded to allow drainage to the trenches
- Provide ventilation system to maintain a negative pressure in the crawlspace



Design Considerations

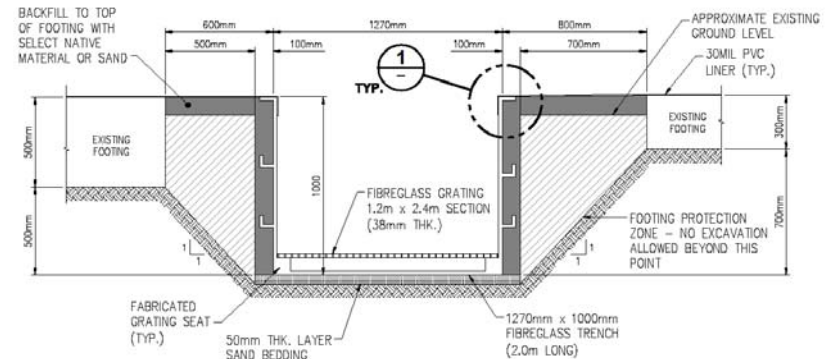
Approach was to seal contamination not try to remove

1. Concrete slab - not recommended
 - Cost
 - Cracking of slab
 - Placing reinforcing steel in confined space
2. HDPE Liner – not recommended
 - Deploying liner
 - Welding liner in confined space
 - Damage repair
 - Sealing to wall columns, wall, pipes other penetrations
3. Spray on Liners – not recommended
 - Potential for VOC migration into spaces above, were told not possible to control
 - Major advantage was ability to seal to columns, walls pipes and other penetrations
4. PVC Liner
 - Liner system selected 30 mil
 - Ease of deployment
 - Ease of jointing – solvent weld
 - Ease of repair – solvent weld
 - Major disadvantage is seal to columns, walls, pipes and other penetrations

Design Considerations

Trench system chosen was fiberglass

- Ability to pre-construct in short lengths to allow easy entrance into the crawlspace
- Lightweight
- Provided grate system to provide non slip surface and separation from drainage water



TRENCH DETAIL

Construction



CONSTRUCTION

- Construction Challenges
 - Working in a maximum security setting
 - All employees required security clearance
 - Delivery of supplies and materials required inspection
 - Had to establish a security compound area for construction otherwise all materials and equipment would have had to be moved from construction site to outside of the secure area
 - All excavated soils had to be checked by security before leaving compound
 - Security escorts monitored each man and tools

CONSTRUCTION

Tight construction Conditions

- All materials had to go in and out through one access point



CONSTRUCTION

- Air quality
 - Prior to any construction, cored holes for the new fans and installed temporary fans to provide adequate ventilation
 - Monitored air quality daily

CONSTRUCTION

Excavation

- Soils excavated with a walk behind Bobcat and conveyors
- Bobcat was smallest machine made and just fit through access hole
- Hand excavated until enough room to bring in machine
- Excavated a turn around at the first trench intersection point



CONSTRUCTION

- Excavating trench with Bobcat
- Finished excavated trench
- Placing sand backfill around fiberglass trench
- On going need to manage and address system leaks



CONSTRUCTION

Unforeseen challenges

- Large area of concrete dumped during construction of the building had to be removed to facilitate grading



CONSTRUCTION



CONSTRUCTION

- Completed trench with drainage sump
- Completed trench with grating

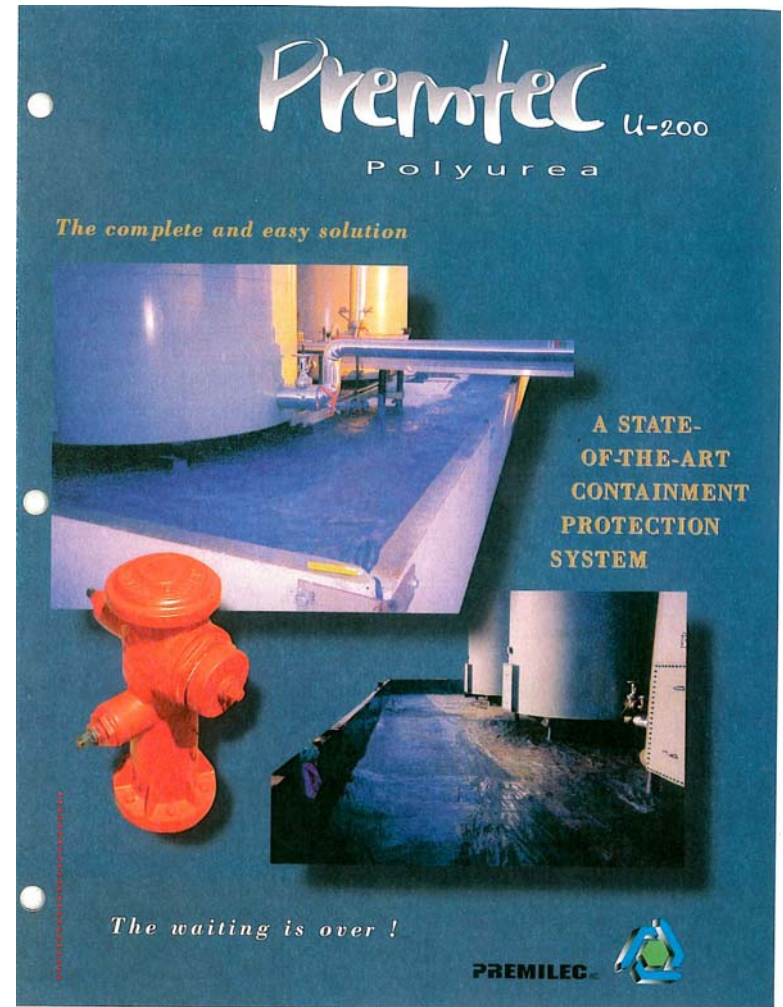


CONSTRUCTION

Liner alternative

Iona approached early on with request to approve an alternative spray on liner system – PREMTEC U-200

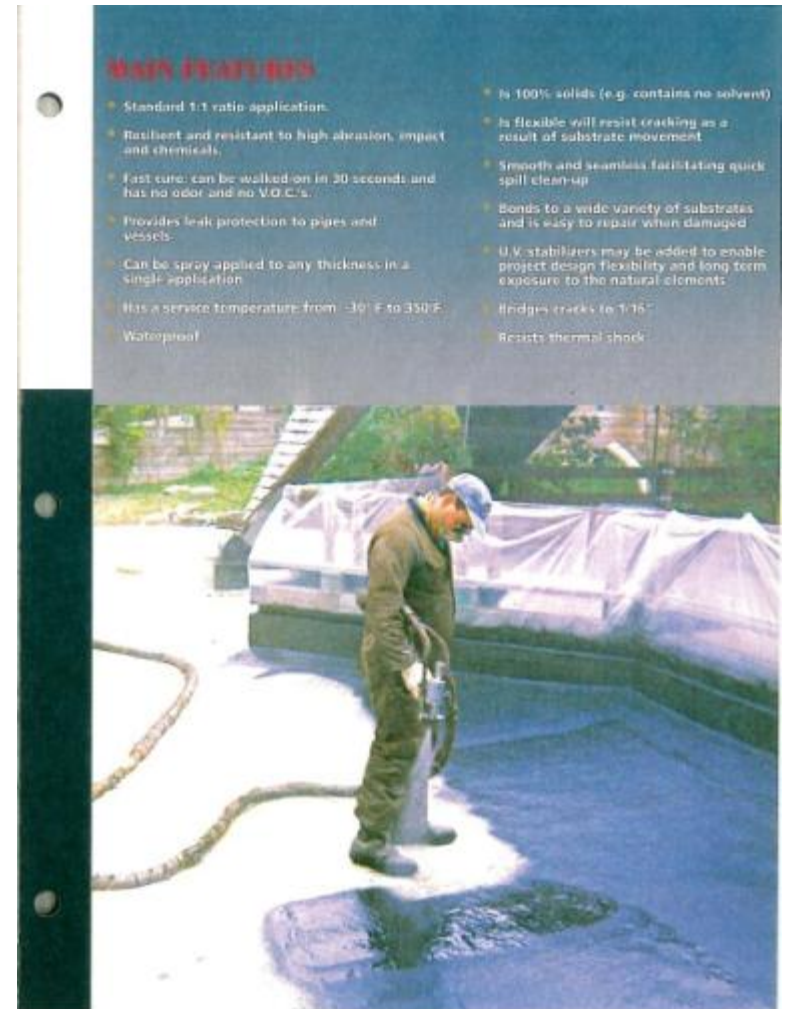
- Two component polyurea elastomer
- Fast cure can be walked on in 30 seconds no odor and no V.O.C.'s



CONSTRUCTION

Confirmation of Performance

- IONA conducted third party testing with air quality testing to confirm performance of material



CONSTRUCTION



- Premtec sprayed at a 30 mil thickness over filter fabric



CONSTRUCTION - Results



CONSTRUCTION - Results



CONSTRUCTION - Results



Before



After



CONSTRUCTION - Results



CONSTRUCTION - Results

A project that met Client Expectations

- Contamination sealed
- Easy access for future repairs
- A surface that is sloped to drain, easy to clean and maintain
- Positive ventilation that mitigates compromised atmosphere from entering occupied spaces above



Questions

