Pardon My (Vapor) Intrusion

Practical Approaches for Commercial Real Estate

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Meet Our Panelist

John Tanaka, P.E.

John Tanaka is a Senior Engineer at BBJ Group and manages the company's Remediation and Site Restoration practice. He has over 30 years of experience in environmental and civil engineering. His primary areas of technical expertise are site remediation, including design and operation; cost-effective site investigation; construction management; and regulatory compliance.

Remediation Experience	35Y
Vapor Intrusion Experience	15Y

jtanaka@bbjgroup.com

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Agenda

- Vapor Intrusion (VI) Overview
- State Regulations
- Mitigation Systems Design and Installation (Passive and Active)
- Cost Estimating

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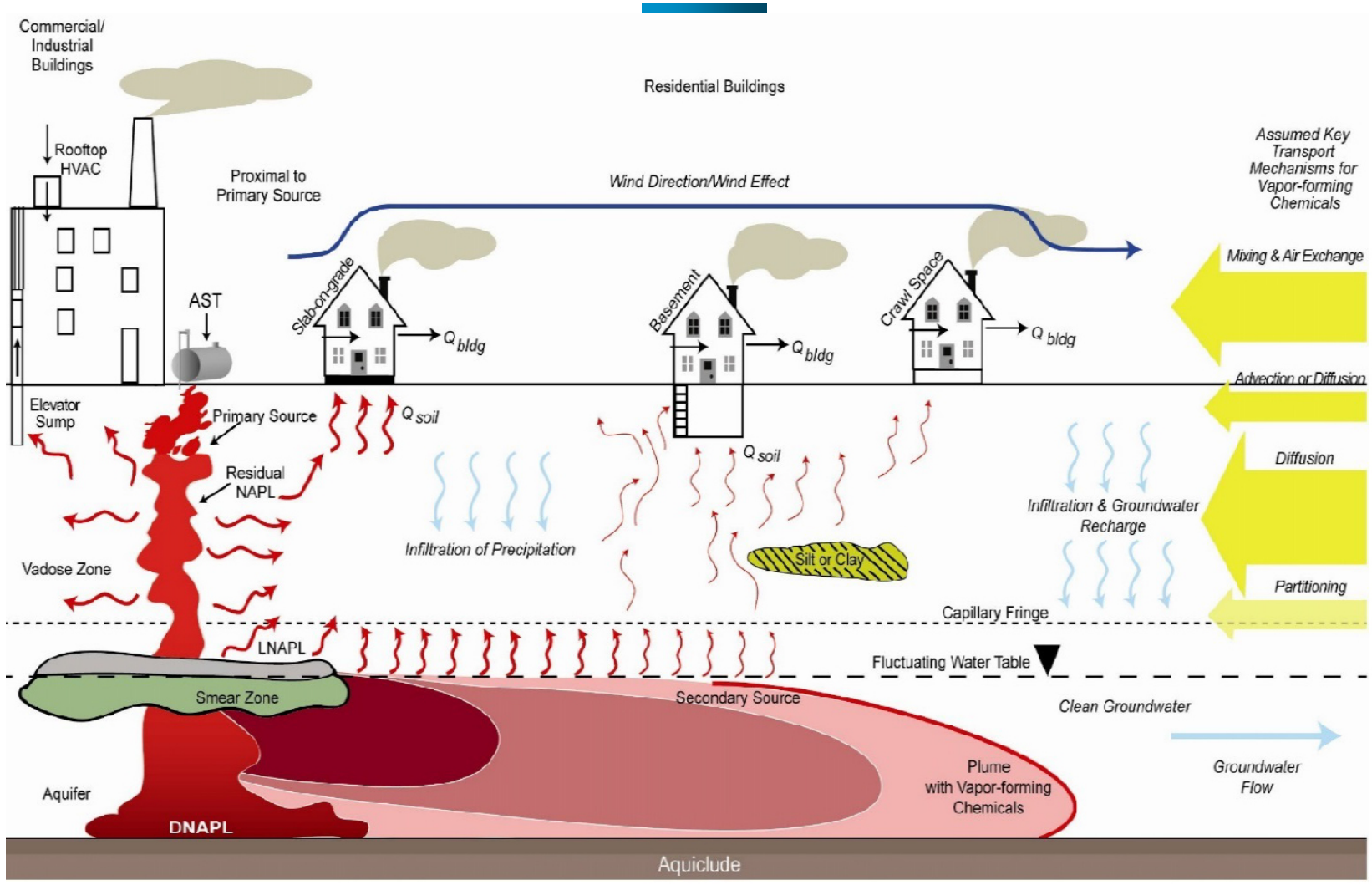
VI Overview



SOURCE: OSWER 9200.2-154

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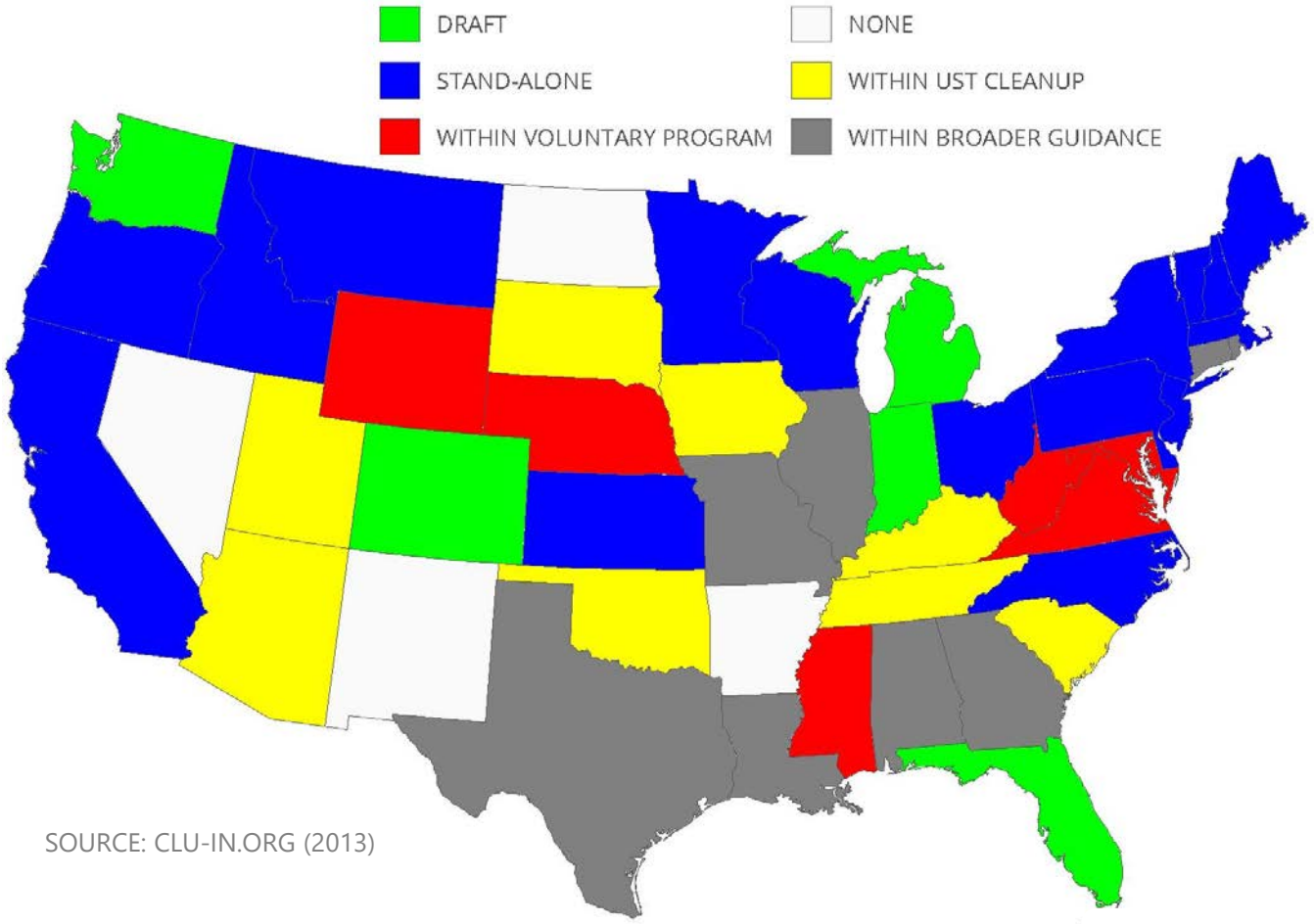

SOURCE: CLU-IN.ORG (2013)

State VI Regulations

- System Design and Diagnostic Data
- System Performance Criteria
- Project Documentation
- Post-Mitigation Sampling, Inspections, and Monitoring

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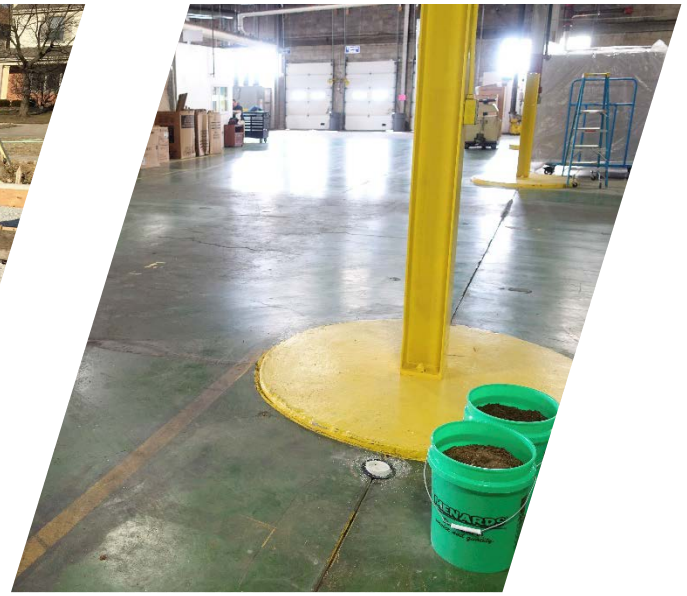

Building Evaluation

- New or Existing Construction / Additions Slab Construction (Thickness, Base Course Material, Columns, Joints)
- Utilities, Sumps and Drains
- Crawl Spaces
- HVAC Systems

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Passive Mitigation Options

Spray-On Membrane or Geomembrane

- Typically for New Construction
- Vapor-resistant
- Multi-layer for Protection During Slab Installation
- Optional Provisions for Converting to Active System
- Specialty Contractors

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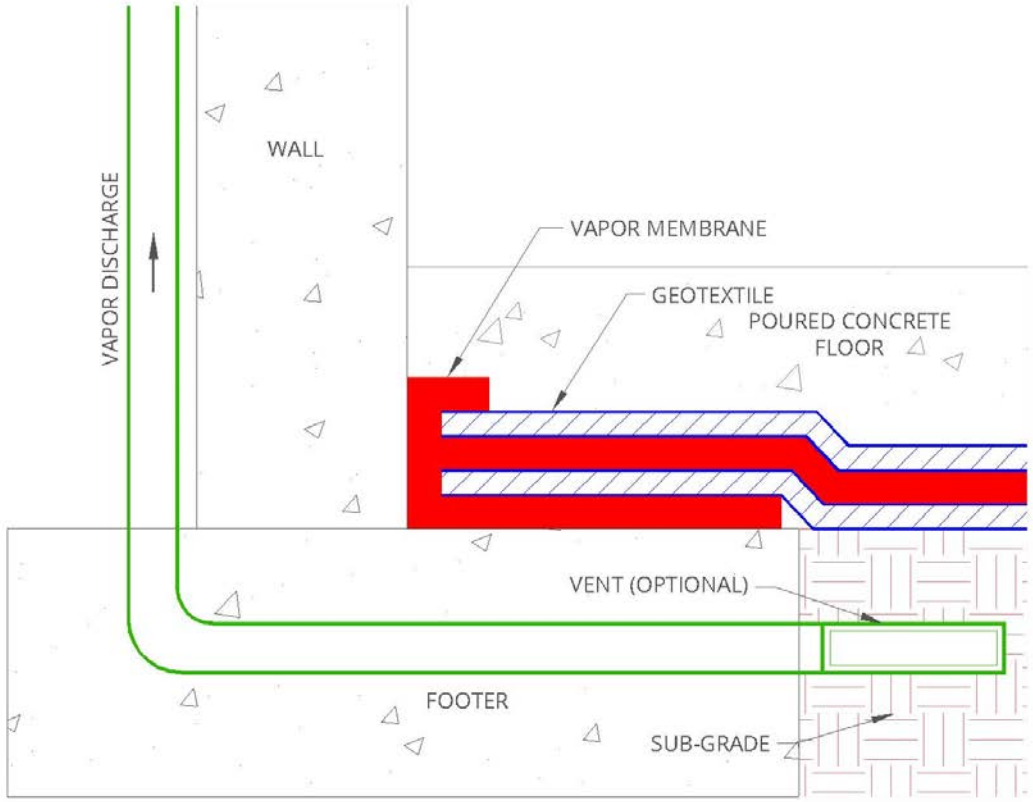
Passive Mitigation
Design

Membrane Materials and Thickness

- Chemical Resistance
- Various Vendors
- Thickness – 60 mil Typ.
- Geotextile (Bonding and Protection)

Vents or Redundancy/Future Active Mitigation

- Address Variable or Incomplete VI Assessment
- Radon?



SPRAY-APPLIED PASSIVE MEMBRANE
SCHEMATIC CROSS-SECTION

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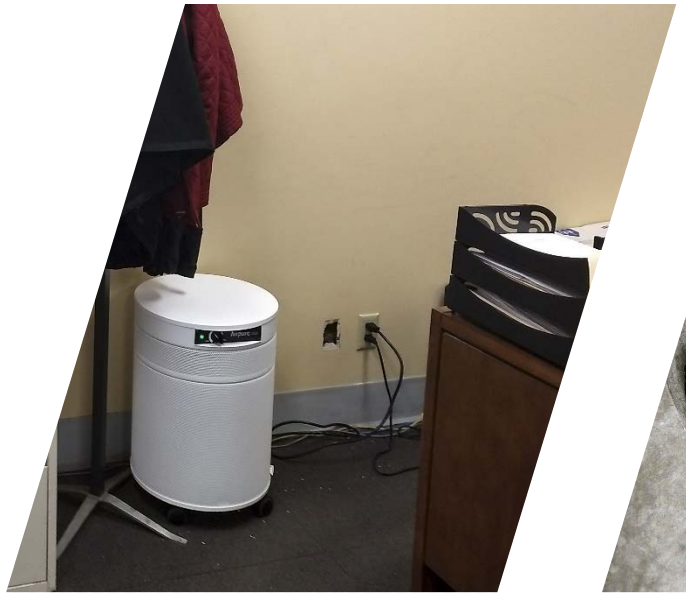

Active Mitigation Options

- Air Purifiers (Temporary)
- Sub-slab Depressurization (SSD) – Slab on Grade
- Sub-membrane Depressurization (SMD) – Crawl Space
- Building Pressurization (If HVAC System Already Maintains Positive Pressure)

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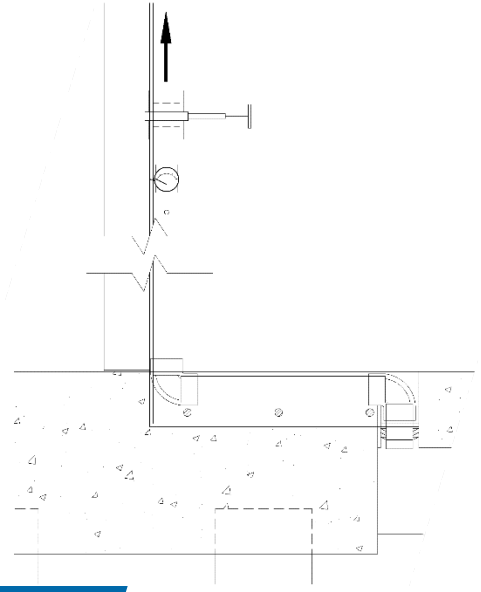
Active Mitigation Design

- Diagnostic Testing
- Extraction Point Layout
- Fan Selection
- Piping and Instrumentation
- Multi-use Buildings (Strip Malls) – varying air flow characteristics



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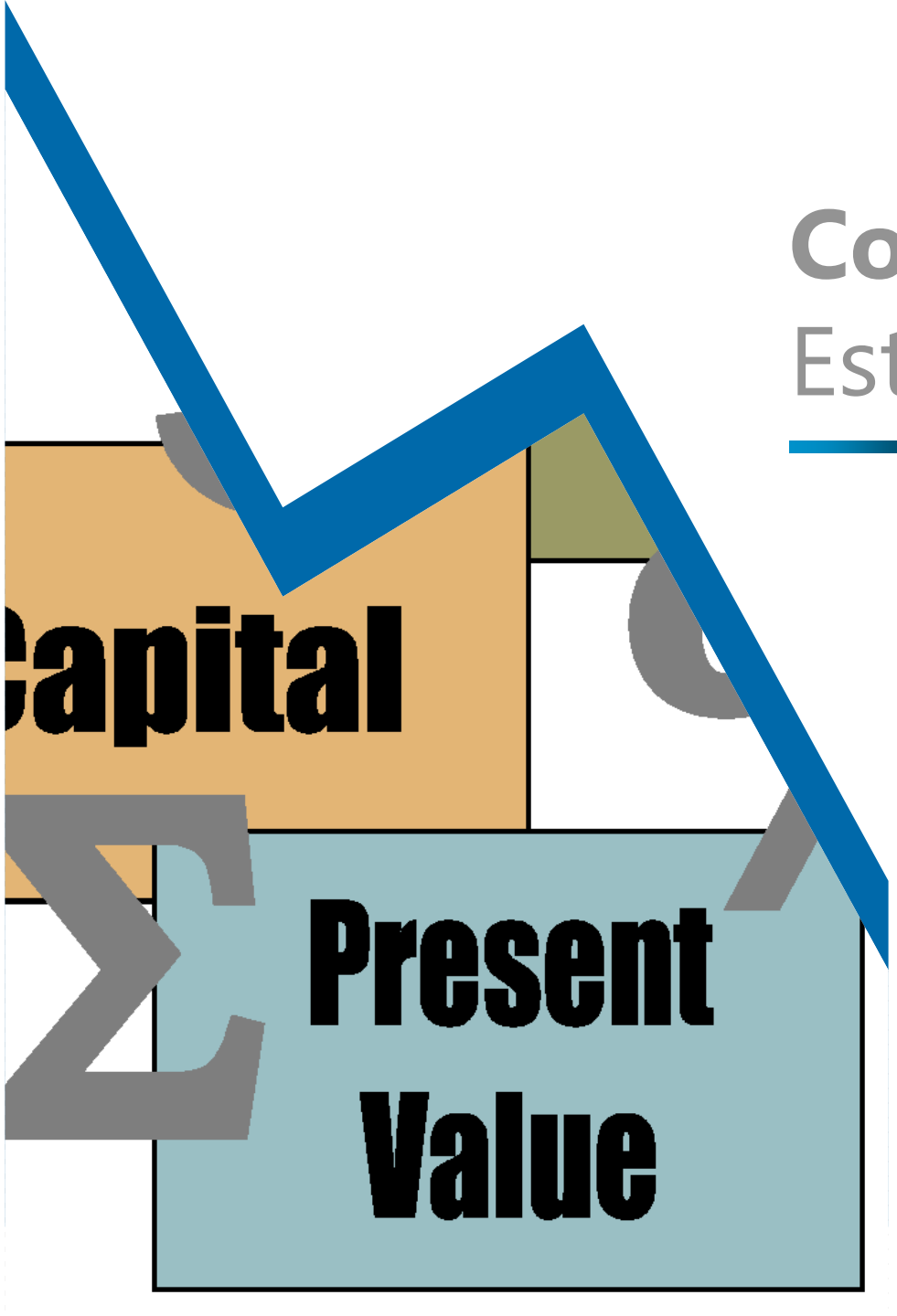

Cost Estimating

- Baseline Budgetary Cost Estimates Based on Building Size (Design, Construction, and Construction Management)
- Factors that Increase Baseline Cost
  - Contaminated Soil, ACM and Lead Paint
  - Labor (Local Cost, Night, and Weekend Work)
  - Permitted Facility or Site under Enforcement
  - Special Regulatory Agency Approval Confirmation Testing for VOCs
  - Vapor Treatment (Uncommon)
- Operation and Maintenance

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Factors that Increase SSD Costs

- Significant Cracks and Control Joints in Floor Slabs
- Old Construction (Asbestos, Lead Paint)
- Footers and Thickened Floor Slabs (Dead Zones)
- Special Finishing Requirements (Floor Coatings, Pipe Chases, Fire Stops)

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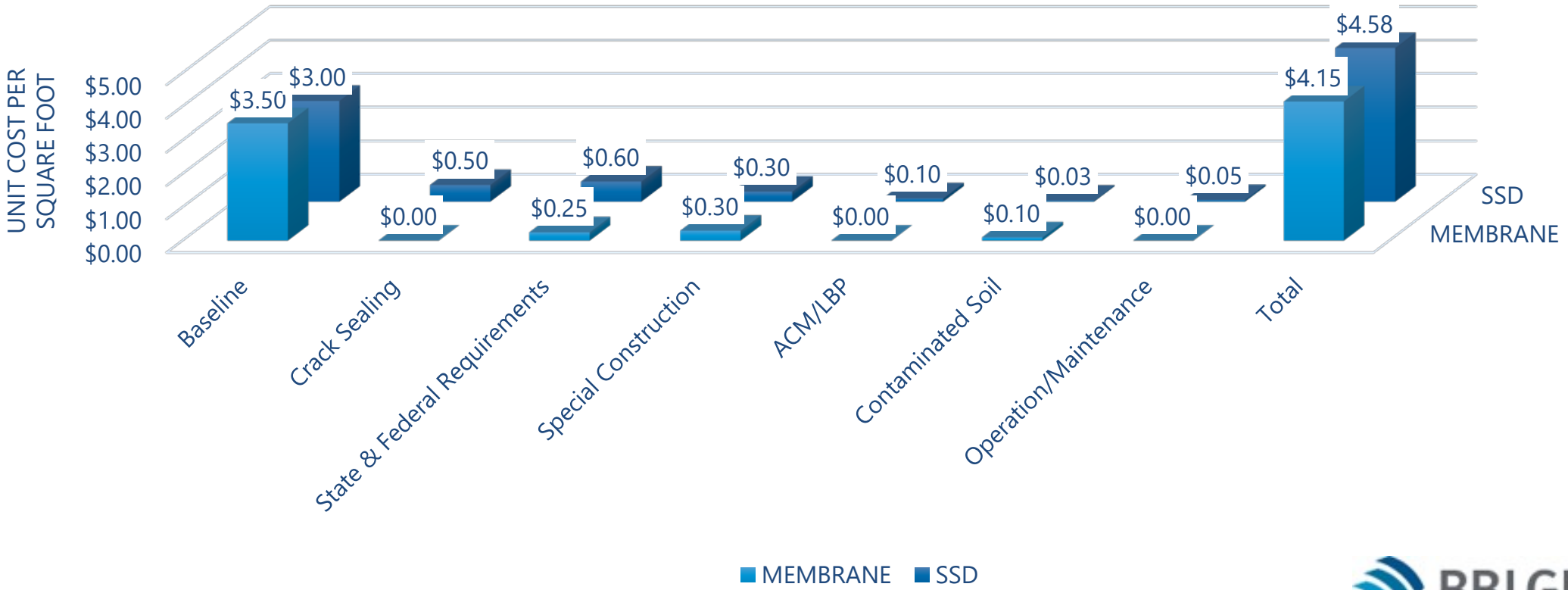
Cost Summary

EXAMPLE UNIT COST COMPARISON: SPRAY-ON MEMBRANE VS. SUB-SLAB DEPRESSURIZATION SYSTEM



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Summary

- Active Mitigation – Existing Construction
- Passive Mitigation – New Construction
- Trend Toward Proactive Installation to Prevent Future Claims
- Cost Estimating: Baseline “Rules of Thumb” Plus Add-ons for Site-specific Circumstances

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Learn More

ASTM. 2003. E2121-03 "Standard Practice for Installing Radon Mitigation in Existing Low Rise Buildings. http://www.astm.org

Naval Facilities Engineering Command. "Vapor Intrusion Mitigation in Construction of New Buildings Fact Sheet." https://drycleancoalition.org/download/vapor_intrusion_NAVFAC.pdf

Naval Facilities Engineering Command. "Vapor Intrusion Mitigation in Existing Buildings Fact Sheet." https://clu-in.org/download/issues/vi/final_navy_vapor_existing_bldg_doc.pdf.

USEPA. 2008. "Engineering Issue - Indoor Air Vapor Intrusion Mitigation Approaches." EPA/600/R-08-115. October. https://clu-in.org/download/char/600r08115.pdf

USEPA Radon Zones. https://geopub.epa.gov/Radon/

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Questions?

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Get in Touch

WEB:
www.bbjgroup.com

PHONE:
800 875 1756

EMAIL:
info@bbjgroup.com

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