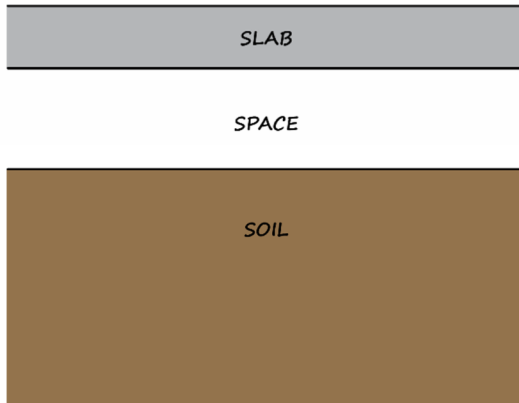
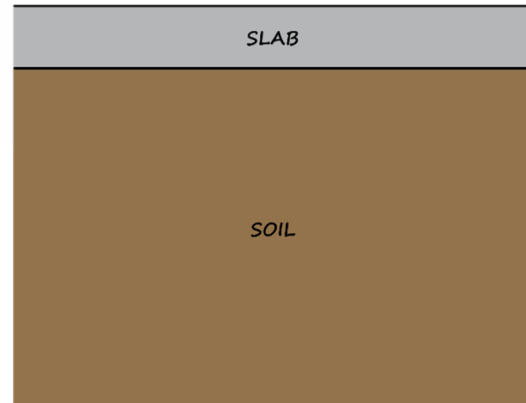


ISOLATED SLAB



NON-ISOLATED SLAB



International Plumbing Code New Language in the 2024 Edition

Explicitly requires protection of plumbing from expansive soil and defines when expansive soil is present.

Allows buried plumbing under Slabs-on-Ground.

Requires complete isolation of plumbing under Slab-on-Crawlspace and Slab-on-Voidwork: "***It shall not be permitted for the plumbing, hangers and supports below the slab or below the framing to be in contact with soil or any assemblage of materials that is in contact with soil within the active zone.***"

Exception 1 allows buried pipe for drainage of crawl spaces

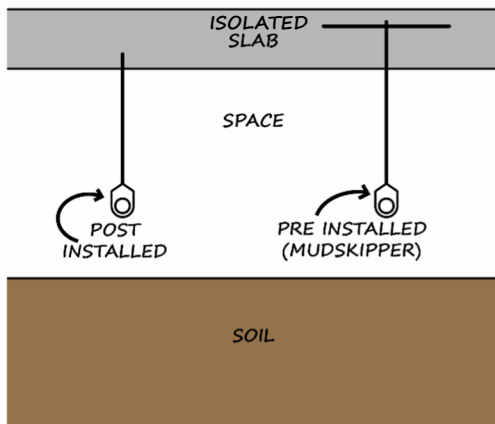
Exception 2 allows attachment to piers if the plumbing, hangers and supports are otherwise isolated.



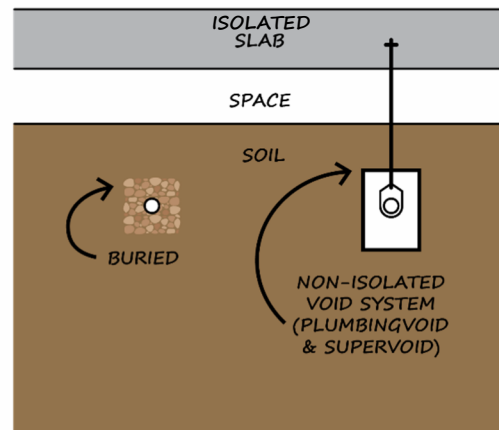
BH

Slide 109 of the 2023 ASPE Tech Symposium presentation by B. Hendrix, M. Roland and J. Mushmann titled "Failures of Non-Isolated Plumbing in Expansive Soil".

ISOLATED PLUMBING



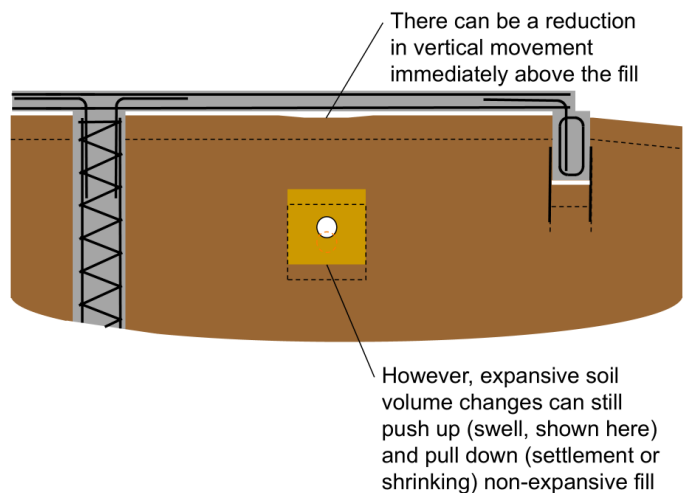
NON-ISOLATED PLUMBING



FOCUS: NON-ISOLATED PLUMBING UNDER ISOLATED SLABS

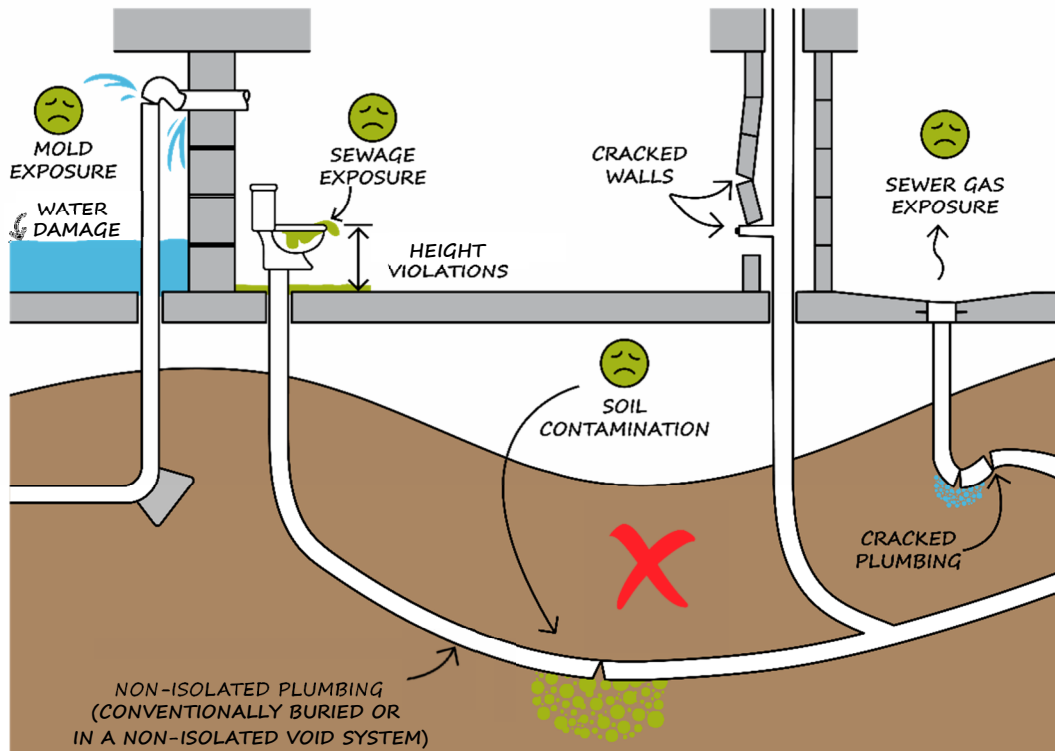
JF

Non-Expansive Fill in the Active Zone



Slide 99 of the 2022 Building Professional Institute (BPI) presentation by J. Focht, D. Penn and M. Lee titled "Protection of Plumbing from Expansive Soils Under Foundations".

NON-ISOLATED PLUMBING PROBLEMS



These organizations have all taken action against this practice:



INTERNATIONAL
CODE
COUNCIL®



THE STRUCTURAL ENGINEERS
ASSOCIATION OF TEXAS



GEOPROFESSIONAL
BUSINESS
ASSOCIATION



The American
Institute
of Architects



Slide 49 of the course titled "Protection of Plumbing from Expansive Soil", approved for continuing education by the American Society of Plumbing Engineers (ASPE) and presented to many ASPE local chapters in 2024.

Example where Buried Plumbing was Installed under Slab-on-Voidwork and Plumbing Damage Occurred



Close-Up View of a Cracked P-Trap Under a Floor Drain
(No Trap Seal Due to Cracks)



Multiple Cracks in P Traps



Crates of Broken P Traps

BH

Slide 65 of the 2023 ASPE Tech Symposium presentation by B. Hendrix, M. Roland and J. Mushmann titled "Failures of Non-Isolated Plumbing in Expansive Soil".

Example where Non-Isolated Plumbing was Installed under Slab-on-Crawlspace and Plumbing Damage Occurred



Cracked Plumbing

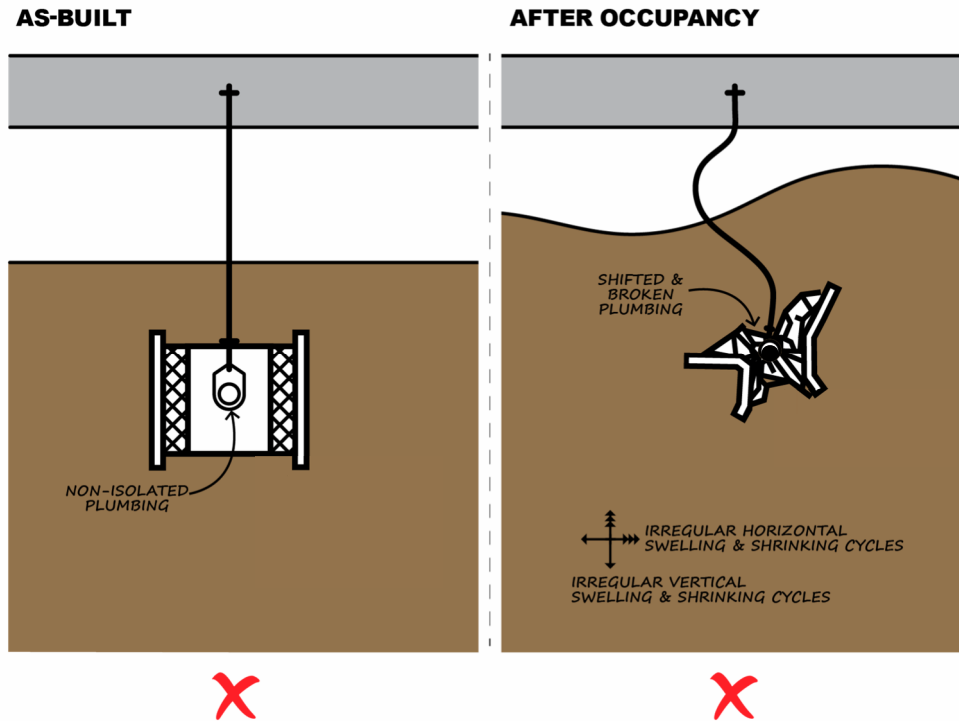


Backdraining Plumbing

BH

Slide 67 of the 2023 ASPE Tech Symposium presentation by B. Hendrix, M. Roland and J. Mushmann titled "Failures of Non-Isolated Plumbing in Expansive Soil".

NON-ISOLATED VOID SYSTEMS



An illustration depicting a combination of some of the failure modes identified in the 2022 Building Professional Institute presentation by J. Focht, D. Penn and M. Lee titled "Protection of Plumbing from Expansive Soils Under Foundations".

Example where a Non-Isolated Void System was Installed under Slab-on-Voidwork and Plumbing Damage Occurred

Bellevue, Washington
20 **ASPE** 23
TechSymposium



Steel Mesh and Plywood
Non-Isolated Void System

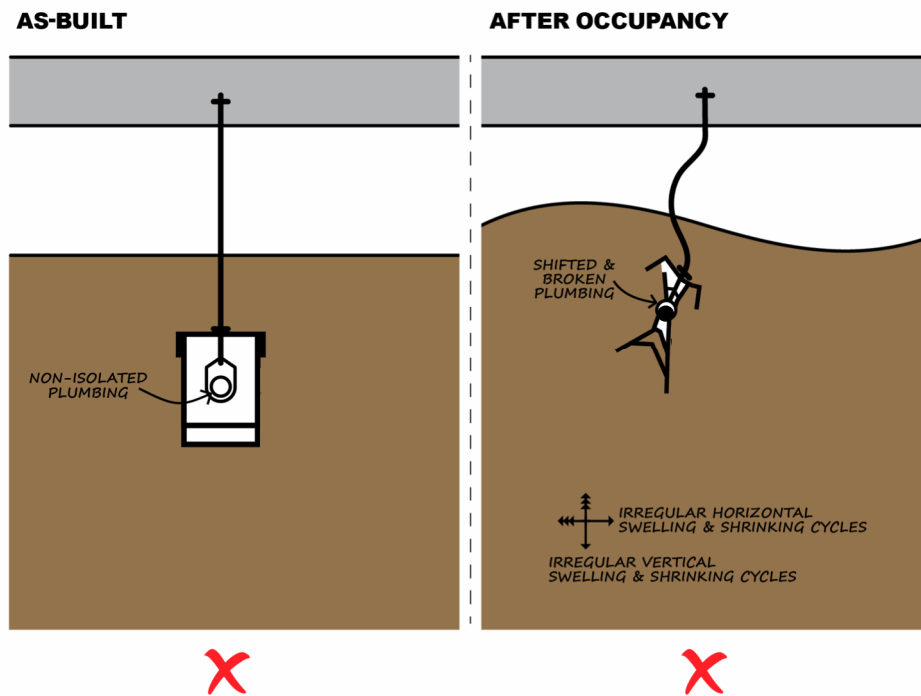


Buckled Hanger Rod and
Displaced Plumbing

BH

Slide 69 of the 2023 ASPE Tech Symposium presentation by B. Hendrix, M. Roland and J. Mushmann titled "Failures of Non-Isolated Plumbing in Expansive Soil".

NON-ISOLATED VOID SYSTEMS



An illustration depicting a combination of some of the failure modes identified in the 2022 Building Professional Institute presentation by J. Focht, D. Penn and M. Lee titled "Protection of Plumbing from Expansive Soils Under Foundations".

Example where a Non-Isolated Void System was Installed under Slab-on-Voidwork and Plumbing Damage Occurred

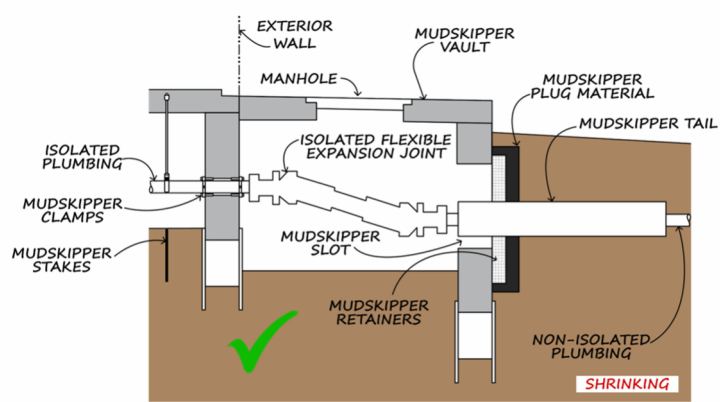
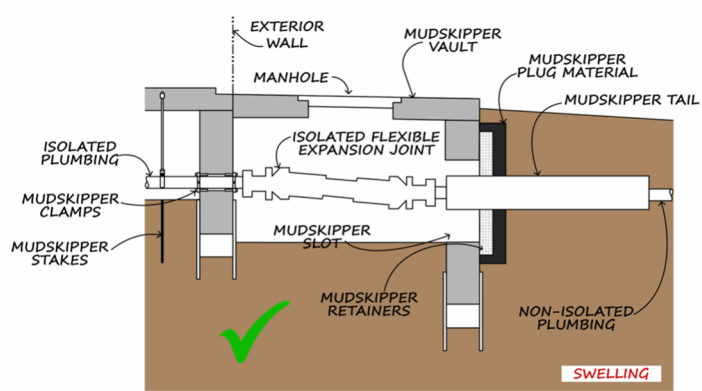
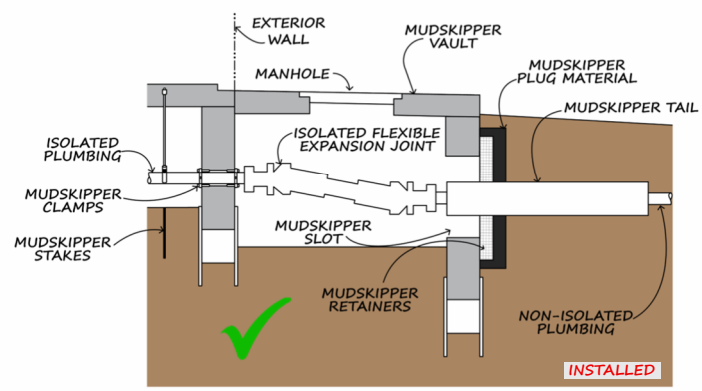


Plastic Panel Non-Isolated Void System and Cracked Plumbing

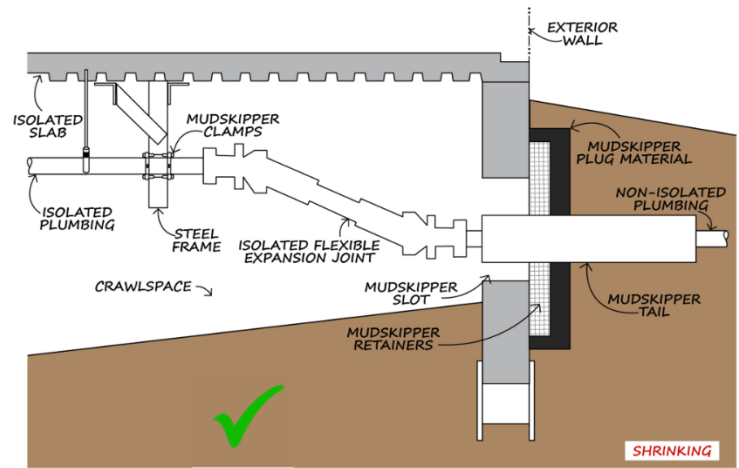
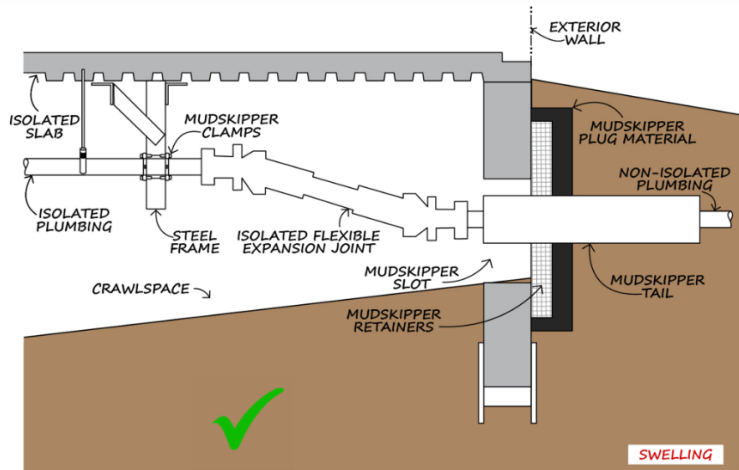
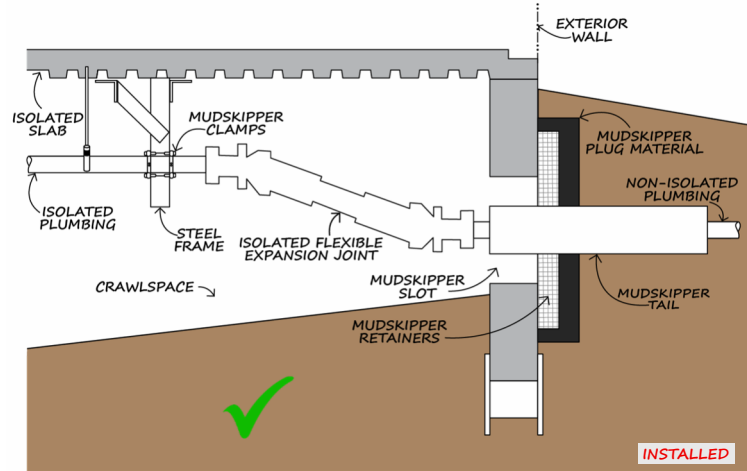
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Slide 71 of the 2023 ASPE Tech Symposium presentation by B. Hendrix, M. Roland and J. Mushmann titled "Failures of Non-Isolated Plumbing in Expansive Soil".

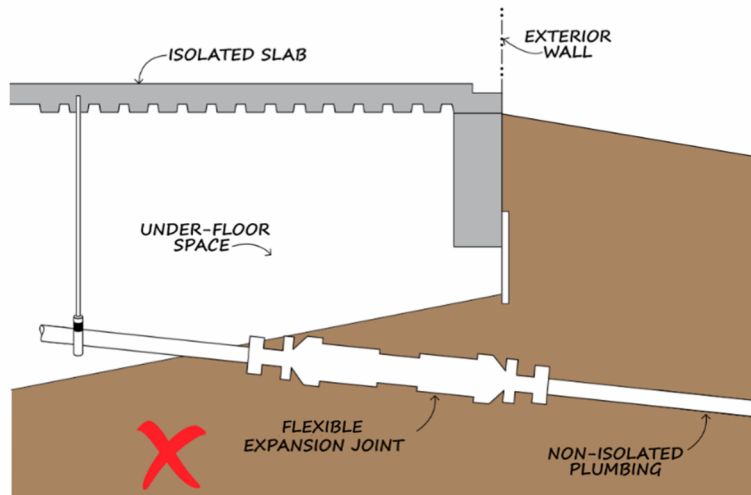
**MUDSKIPPER TRANSITION
(SLAB-ON-VOIDWORK EXAMPLE)**



MUDSKIPPER® TRANSITION (SLAB-ON-CRAWLSPACE EXAMPLE)



NON-ENGINEERED TRANSITION (ONE EXAMPLE OF MANY CONFIGURATIONS)



Photograph of a public school building in the San Antonio area of Texas, provided by a forensic engineer.

Reasons Practitioners Prohibit Non-Isolated Plumbing Under Any Isolated Slabs (Any Plumbing Code, Any Edition)

1. **Fundamentally Incompatible:** Non-isolated plumbing that cannot tolerate expansive soil movement will move under a slab that is designed to not move. Engineering analysis of stresses and strains cannot justify the specification of conventional plumbing in these conditions.
2. **Reports of Plumbing Failures:** Numerous failures of non-isolated plumbing under isolated slabs have increasingly become public over the last few decades, including failures where non-isolated void systems and conventionally buried plumbing have been used, invalidating empirical claims.
3. **Unbudgeted Remediations:** Remediations of cracked plumbing, cracked walls, water damage and fixture height violations are all commonly necessary when non-isolated plumbing moves, costing some owners millions of dollars per building each time while problems occur again & again.
4. **Hidden HSW Dangers:** Non-isolated plumbing movement is known to create dangers to public health, safety, and welfare that are hidden until problems become great enough to trigger a complaint, such as sewer gas exposure, sewage exposure, mold exposure and soil contamination.
5. **Maintenance Violations:** It is not feasible for a building owner to know of all the numerous occasions when expansive soil is expected to trigger a need for code-required maintenance of non-isolated plumbing before a complaint, making it not suitable for intended use.
6. **Numerous Lawsuits:** Failures have prompted building owners (even those wanting non-isolated plumbing before construction) to sue design professionals (& win), with significant claims (e.g. \$23M) because the resolution often requires installing isolated plumbing after occupancy.
7. **Geotechnical Fine Print:** Geotechnical reports sometimes include recommendations assuming non-isolated plumbing will be installed but often have statements effectively prohibiting non-isolated plumbing, like "...design plumbing to accommodate movement..." which is not feasible.
8. **Misleading Claims:** Plumbing failures have raised awareness that some claims by manufacturers of non-isolated void systems (e.g. that they isolate plumbing or that they've never had an unsuccessful project or plumbing failure) are misleading.
9. **Structural Engineering Criticism:** Mechanical engineers specifying soil-retaining products such as PlumbingVoid and SuperVoid are practicing structural engineering. Structural engineers have publicly noted that systems like these can be as much as 100 times overstressed (not just 100%).
10. **Code Clarifications:** These failures prompted the International Plumbing Code to clarify long-standing provisions by categorically prohibiting non-isolated plumbing (plumbing buried or in non-isolated void systems like PlumbingVoid and SuperVoid) under isolated slabs where expansive soil is present.
11. **Mechanical Engineering Criticism:** Specification of non-isolated plumbing is contrary to long-standing, published mechanical engineering principles and guidance, and has been publicly condemned by mechanical engineers over the last 5 years.
12. **Isolated Plumbing Costs Less:** The potential costs associated with owning non-isolated plumbing as described above (e.g. \$230/sf of a foundation footprint) dwarf any potential differences in installation costs comparing non-isolated plumbing to isolated plumbing approaches.