



Overview of Long Term Stewardship

A Perspective for Today's Workshop

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Does not imply Agency Policy

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What is Long-Term Stewardship (LTS)?¹

- “**activities** ... [to] ... ensure”:
 - “the *ongoing protection* of human health and the environment”
 - “at sites with *contamination remaining*”²

¹Collated text from website/memo/reports to focus on the core definition for Vapor Intrusion

²Long-Term Stewardship: Ensuring Environmental Site cleanup Remain Protective Over Time”

More specifically: Long-Term Stewardship ...¹

- LTS “applies to sites where *long-term management of contaminated environmental media is necessary* to protect human health”
- LTS “generally includes the
 - establishment and maintenance of physical and legal controls,
 - implementation entities, authorities, accountability mechanisms,
 - information and data management systems, and resources
 - that are *necessary to ensure* that these sites **remain protective** of human health and the environment.”¹

¹http://www.epa.gov/landrevitalization/ltstf_report/whatis_longterm_stewardship.htm

Does VI meet the Threshold for LTS?

- Does VI meet the (“applies to”) threshold for LTS?
 - Is LTS “necessary to protect human health” from VI?
 - Does contaminated media remain on- &/or off-site?
- Buildings of concern for VI are:
 - Overlying/proximate-to vapor-forming **contamination**
 - i.e., VI-Source Media Conc. > VI generic screening values*
 - So there is a **potential** for inappropriate (VI) exposures, &
 - Evidence** indicates VI is highly variable over time
 - Thus, it appears:
 - “*Long-term* management of contaminated environmental media [i.e., LTS] is necessary to protect human health” for VI

*where >5% of site were found to have < atten., & unacceptable VI? [using <2009 methods]

**100% of intensively/continuously monitored long-term chem. (& Rn) residential data sets

Why is Long-Term Stewardship Important?

- “LTS activities are *critical* at sites with **contamination remaining** and are used by EPA and its Federal and State partners to ensure:
 - The **ongoing protection** of human health and the environment;
 - The *integrity of remedial or corrective actions* so they continue to *operate properly*; and
 - The ability of people to **reuse** [for VI, continue to use] **sites** [for VI, homes/buildings] in a safe and protective manner.”¹

¹http://www.epa.gov/landrevitalization/ltstf_report/whyis_longterm_stewimport.htm
Blue text inserted to highlight common current scenarios for the VI pathway

Why consider LTS now?

- LTS is typically considered post-remedy construction
- But for VI:
 - Pre-remedy 'construction' periods can be longer* &
 - Even a preliminary VI assessment can take significant time
 - Relative to some 'short' exposure-periods of concern (e.g., for TCE)
 - Inappropriate VI exposures can be occurring/on-going during assessment/between monitoring events
 - **Regardless of the stage of source-remediation efforts**
- So
 - LTS-type protection can be inevitable & considering it sooner rather than later - appears appropriate (especially for TCE)

*Particularly; 1) since the VI pathway has a decades-late start relative to other pathways, & 2) GW plume characterization for VI exposures can be more complex & time consuming 6

Why should Long-Term (LTS) Controls be considered for VI?

- VI should consider the same ‘End Game’ objectives used for other pathways
 - “ongoing [verifiable] protection”
 - e.g., Monitored Natural Attenuation (MNA) for Groundwater ingestion
- VI exposures are at least equally important as those from other pathways:
 - Exposure factors - via both magnitude & probability
 - e.g., 5 ug (/m³ or /liter) in 20 m³ vs. 2 liters/day [10:1]
 - Inability (of those potentially-exposed) to easily avoid
 - e.g., breathing (20 m³) vs. drinking (2 liters/day, from a contaminated groundwater source)
- VI has an apparently endless Number & Scale of Changes possible:
 - Source (e.g., GW; gross mobility & w/n plume pulses)
 - Migration (vapors in subsurface)
 - Building (the #1 factor of variability; incl. both natural & man-made changes)
 - Driving forces (weather/climate)
 - Assessment Methods (improved technol. to ‘see’ more VI are *on the way/coming*)
 - Health effects of concern (conc. goals & exposure durations of concern)

Benefits of a LTS perspective now?

- Considering the Long Term (Stewardship) perspective now may help more Regulators, PRP's and Communities see:
 - The LTS objective of “remain protective” through time, highlights the need to also be Protective now/soon (especially for TCE VI)
 - **Interim Actions**, such as VI mitigation - can buy time (‘known’ to be w/o exposures) to allow fuller characterization of sources, vapor migration, intrusion, and options for source remediation (e.g., MNA)
 - Decisions made now (w/ consideration of LTS objectives) should not need to be reconsidered/apologetically-reconfigured later once exposures are confirmed and/or a formal LTS program is started

LTS Controls (& Devices) for VI

- Physical (**Engineering Controls**)
 - Active
 - Passive
- Legal (**Institutional Controls**)
 - Use restrictions (current/future)
 - Requirements for:
 - **New buildings** - assessment and/or preemptive construction requirements
 - **Ongoing monitoring** (e.g., as long as source/poten. remains) e.g., 5-yr reviews
 - Under **un-controlled/natural** (attenuation) conditions [Mon. Nat. (Vapor) Attenuation]
 - Under **controlled/engineered/mitigated** (attenuation) conditions*
- Informational Devices
 - Non-enforceable information devices to increase awareness and allow the opportunity for potential receptors to avoid unnecessary (& readily avoidable) exposures [e.g., Maps of ICs & **VI potential areas**]

*Along with Operations & Maintenance (O&M) requirements

Challenges for LTS¹ [for VI]

- Controls:
 - Selecting (Physical, Legal, Informational)
 - Implementing
 - Monitoring
 - [& if using VI-COCs in indoor air - New indoor sources possible w/time]
 - Enforcing
- Roles & Responsibilities
- Institutional Controls (ICs) [incl. Building changes?*
- Engineering Controls (ECs) [incl. O&M & Monitoring]
- Costing
- Funding and Resources
- Information Management [role of maps & community org?]

¹http://www.epa.gov/landrevitalization/ltstf_report/exec_summary.htm

* e.g., Earthquakes, Occupants, Use, Renovations (new porch exhaust fan/dryer/furnace)

Benefits of LTS

- “allows for beneficial and protective use of these properties”¹ [[regulated-VI-chemicals](#)]
- [Collateral benefits](#) - from Physical VI Controls:
 - Physical controls are “protective” for all soil gas
 - Soil gas includes unhealthy conc. of a number of gases:
 - Carbon dioxide, Carbon monoxide, Methane, Radon, Moisture/Mold, Sewer/Septic gases, Chloroform, Pesticides from yard & foundation applications, ...
 - But one stands out for very-well-documented high risks
 - Radon ... & Dr. Angell will discuss this in detail at 4:25 PT

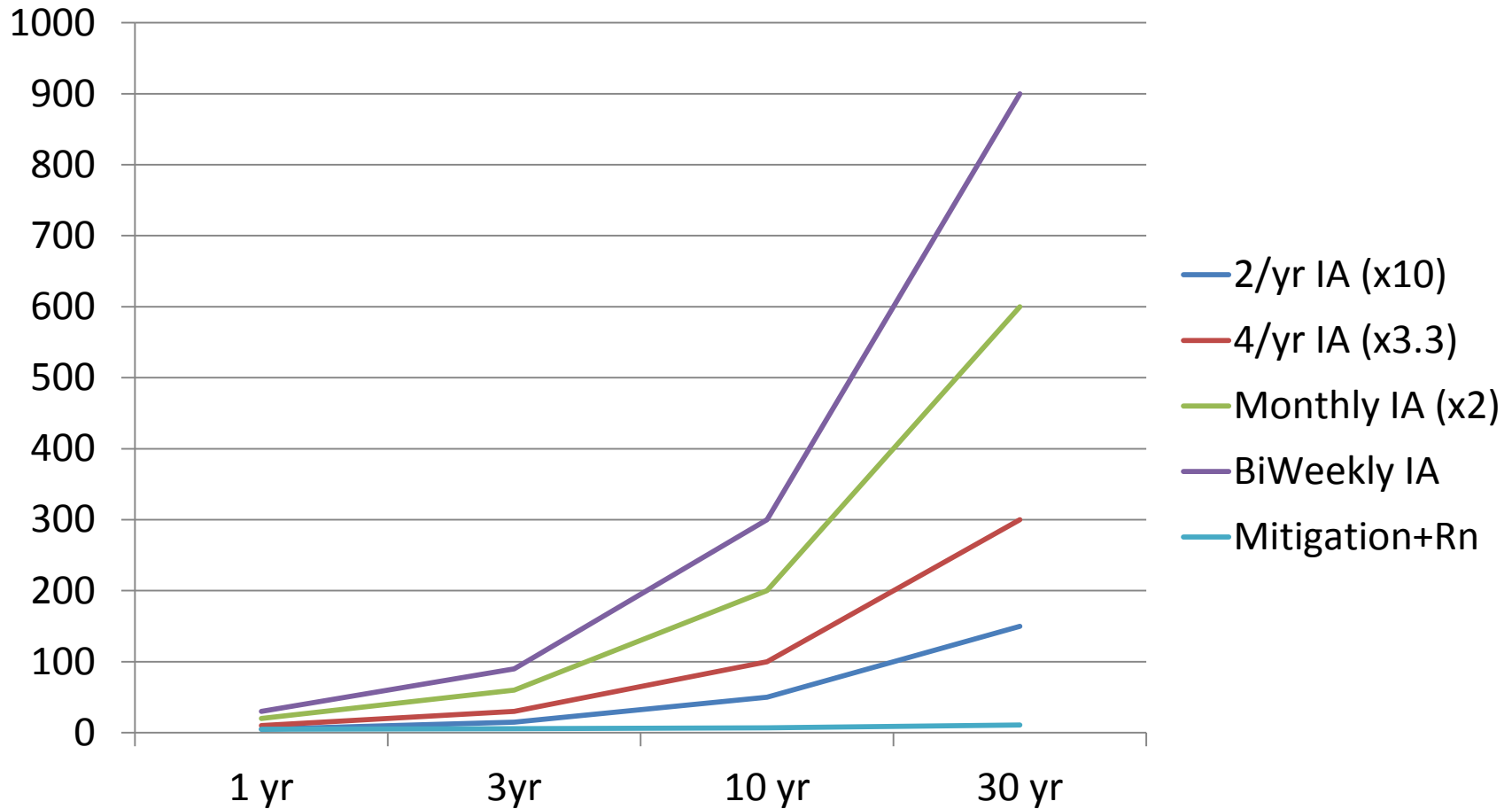
¹http://www.epa.gov/landrevitalization/ltstf_report/exec_summary.htm

#1 Challenge for LTS [& for VI?]

- Roles and responsibilities are not clearly delineated¹
 - For as long as source remains
- For VI we need to/should be clear on Roles for:
 - Monitoring for exposures under either:
 - Natural Attenuation conditions [Mon. Nat. Vapor Atten.]
 - PRP or Gov.
 - Engineered Attenuation [*& given ~100x reduction in SG/VI*]
 - Occupants/Owners?, Community org w/ Local (expert) oversight?
 - VI-Source Monitoring/cleanup/management
 - e.g., GW - PRP or Gov.

¹“Long-Term Stewardship: Ensuring Environmental Site cleanup Remain Protective Over Time”

(HQ) Conceptual LTS Lifecycle [Monitoring vs. Mitigation⁺] Cost \$k per Residence* Challenge



⁺Includes the cost of mitigation system installation & OM&M

*At approx. equal confidence levels, e.g., 95% (note, Uncertainty Factors for infrequent samples)

But we should also consider the cost of errors; Un-observed exposures vs. 'unneeded' mitigation

Summary - from a Personal (Public Health) Perspective

- The Science is clear
 - There is nothing good about having soil gas in indoor air
 - Anthropogenic chemicals are only the most recently added
 - Long list of hazardous/ deleterious components in Soil Gas
 - Actions that minimize SG/VI into indoor air will improve health - no question about it*
- Review the VI evidence in-hand & presented today
 - w/ a Long-Term (Stewardship) perspective, e.g.,
 - Full lifecycle costs & benefits in mind
- **Interim Actions** controlling SG/VI could lead to:
 - Peace of mind [for chemical VI] for all parties (sooner) &
 - ‘Soil Gas Safe’ communities [safe⁺ from all soil gas hazards]

*Maybe only subtly - but hard (repeatable) science for a number of effects

⁺Substantially reduced (~100x) via ‘Best Management Practices’ for SG/VI?

Best wishes

- With your VI sites