

Environmental Assessment 101– Part 2

Investigation & Cleanup

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INTRODUCTION: WHEN A REC HAS BEEN IDENTIFIED

- Discovery of a REC or contamination does not signal the end of your project!
- Smart site assessment uses:
 - risk-based cleanup strategies
 - targeted cleanup
 - Site risk-management strategies
- Consider integrating redevelopment and site clean-up for efficiency

SESSION OBJECTIVES

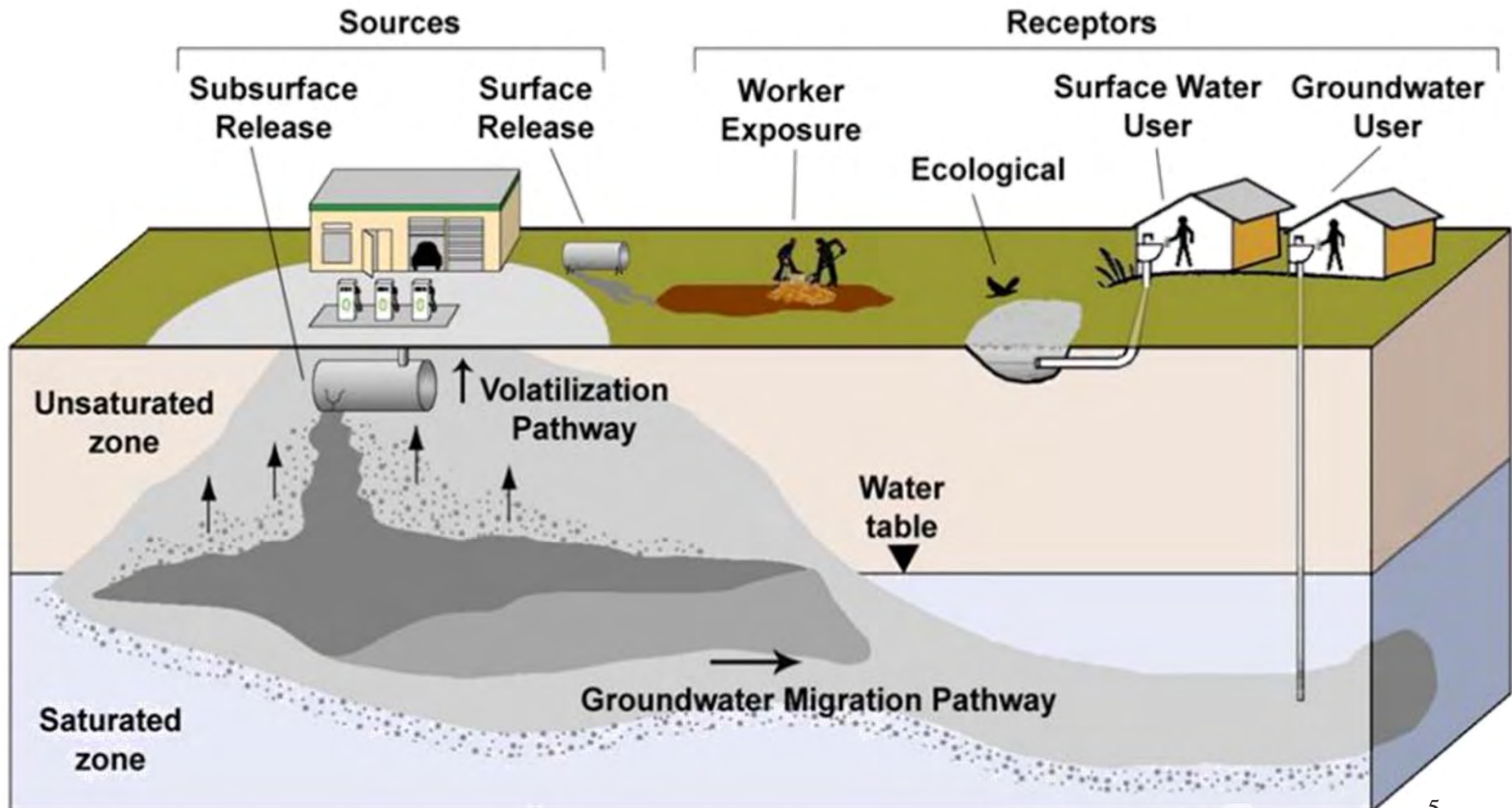
Gain an understanding of:

- Elements of an environmental investigation (i.e., site characterization)
- Relationship between site characterization and cleanup processes
- Elements of a Site Conceptual Model (SCM)
- Cleanup (remedial) strategies & alternatives
- Financially viable remediation strategies

PHASE II INVESTIGATION OBJECTIVES

- Determine whether constituents of concern (COCs) are present
- Define the nature and extent of contamination
- Define the physical characteristics of the site
- Identify/quantify hazardous building materials (e.g., lead paint, asbestos, mold, PCBs)
- Develop understanding of potential redevelopment constraints, including reliable clean-up cost estimates
- Develop beneficial relationship with regulatory agencies through appropriate oversight programs

ELEMENTS OF SITE CONCEPTUAL MODEL



PHASE II INVESTIGATION: TYPICAL TIME REQUIREMENTS

- Focused, small-scale investigation:
Typically 2 to 4 weeks
- Multiple REC, moderate-scale investigation:
Typically 3 to 12 weeks
- Broad scope, large-scale, multi-phase investigation: 2 to 6+ months
- Schedules can be accelerated to meet requirements of property acquisition and redevelopment process

SAMPLE COLLECTION



PHASE II INVESTIGATION: POSSIBLE OUTCOMES

- **No significant concerns identified**
mostly non-detects (“NDs”) in the sample testing results
- **Contamination identified, but data insufficient** to resolve RECs and/or obtain regulatory “No Further Action”
 - More investigation required
 - Determine remedial goals, perform risk assessment
- **Remedial action** needed
- **Re-evaluate project design** due to environmental constraints or evaluate **alternative properties** for redevelopment project

REMEDIAL ACTION AND RISK-BASED DECISION MAKING

Traditional remedial action approach

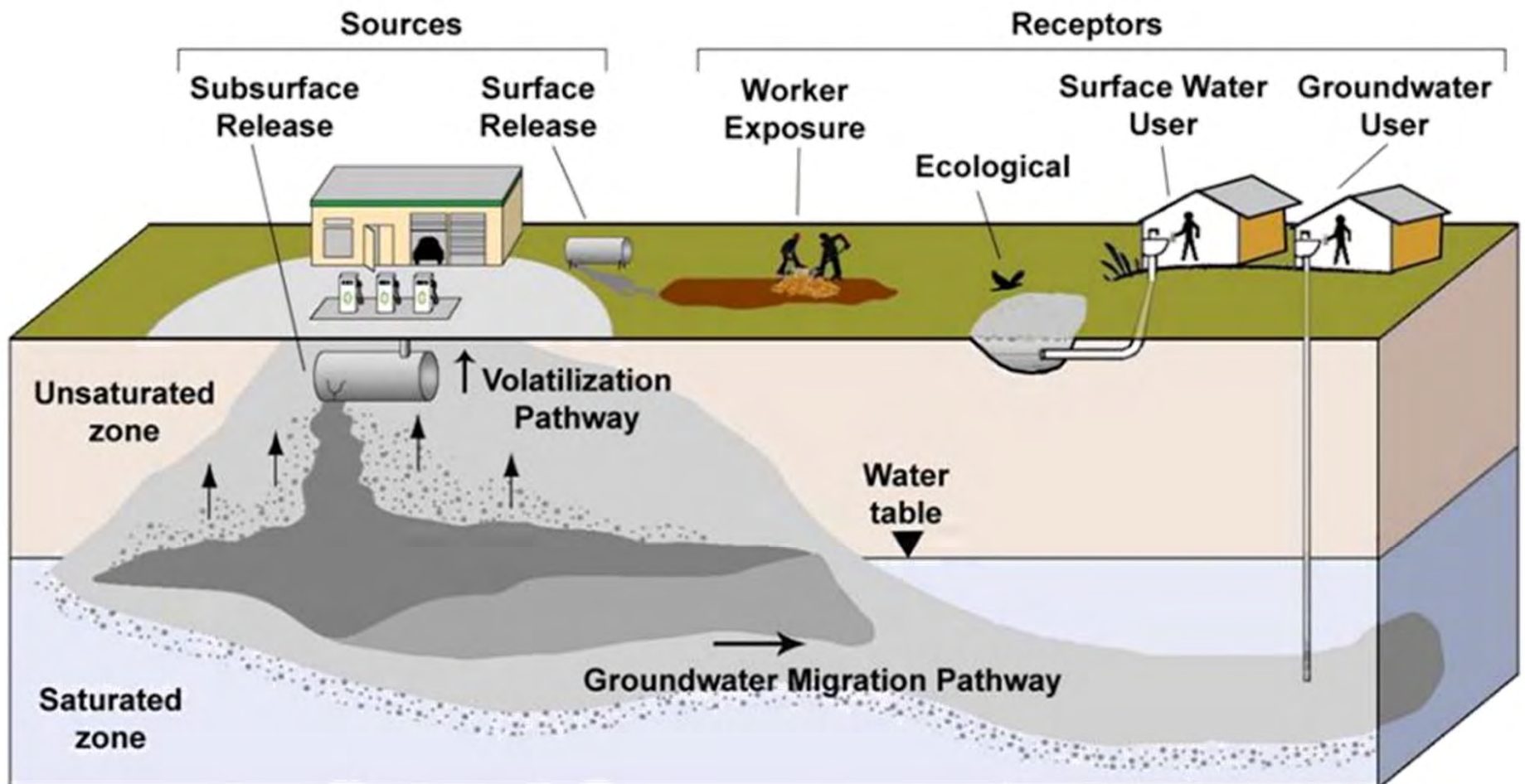
- Return property to “pre-contaminated” condition (“clean closure”)
- Based on assumed unrestricted site use with conservative assumptions for all possible exposure pathways

Risk-based approach

- Based on actual site conditions and redevelopment plans
- Allows for contamination (some or all) to remain, but only if no unacceptable risks to human health or the environment remain
- Often requires long-term obligations (maintenance and monitoring)
- Usually more efficient and cost effective if compatible with long-term land uses

DETERMINING EXPOSURE PATHWAYS

SITE CONCEPTUAL MODEL



ESTABLISHING CLEANUP GOALS

HOW CLEAN IS CLEAN?

- “Goals” are risk-based target concentrations of COCs in soil, soil gas, and groundwater
- Target clean-up levels are calculated to be protective of human health and environment at the project site
- Attainment of goals indicates:
 - Site risks are considered at an “acceptable” level (e.g.: HI<1.0: Incr. carcinogenic risk: 10^{-4} to 10^{-6})
 - Site is then considered “safe” for intended land use

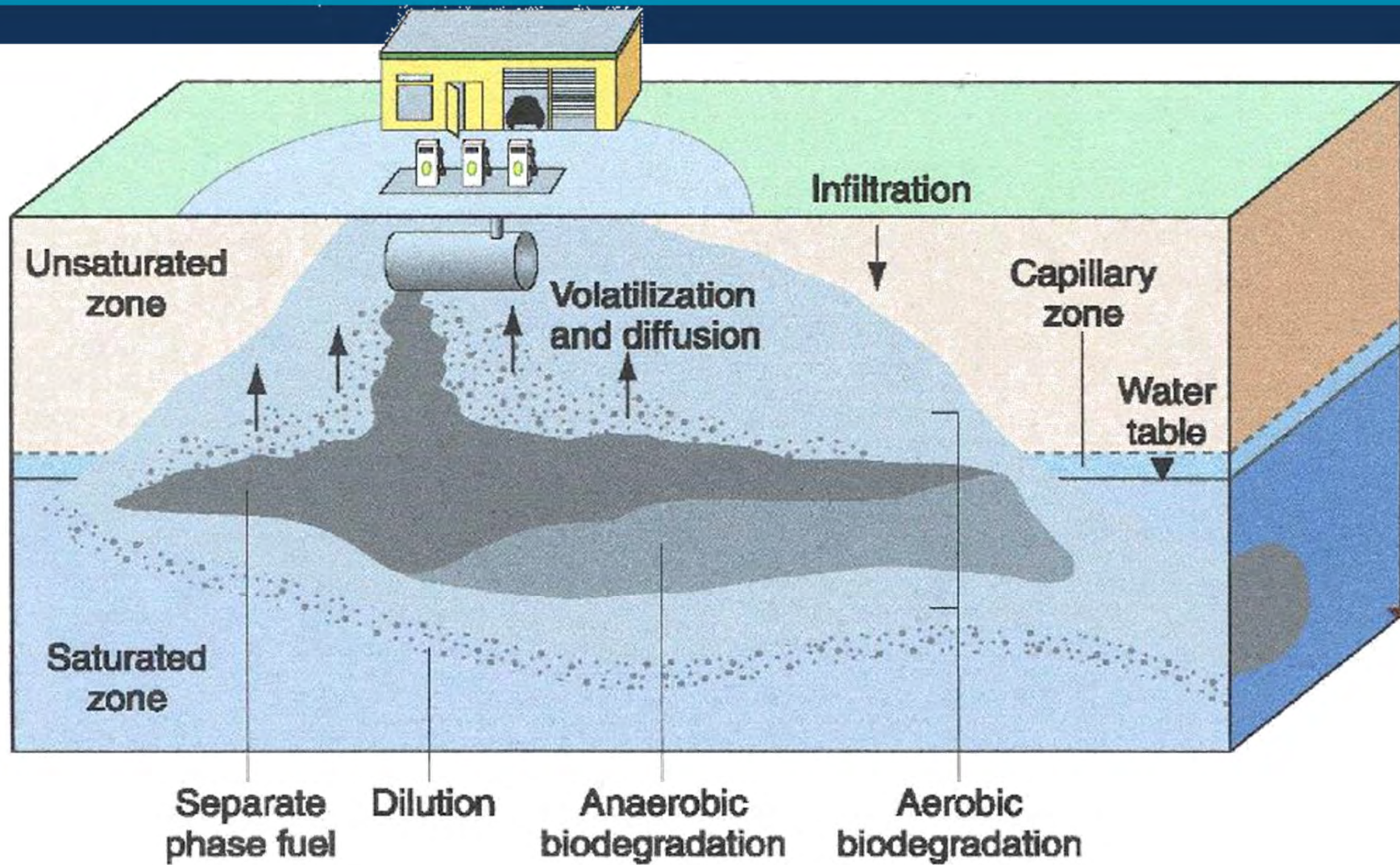
Note: Cleanup goals are a moving target as the underlying science is evolving.

REMEDIATION ALTERNATIVES

WHAT CAN WE DO ABOUT IT?

- **Options:**
 - No further action (usually evaluated as baseline)
 - Natural attenuation (clean-up via natural processes)
 - Removal actions, source controls and containment, engineered system treatments
 - Institutional controls (e.g., land-use controls)
 - Recalcitrant conditions: may be no viable option
- **Drivers:** redevelopment schedule, remedial planning, regulatory requirements, community considerations, costs, tolerance for controls
- **Look for opportunity to combine cleanup alternatives with redevelopment**

NATURAL ATTENUATION



CONTAMINATED SOIL REMEDIES: REMOVAL, TREATMENT METHODS, AND ENGINEERING CONTROLS

- **Removal**
 - Excavation, transportation, and disposal
 - Considerations
 - Reliable & long term solution; liability risks?
 - Can be costly to implement, but often quicker
- **Treatment**
 - In place (in-situ) treatments
 - Excavation and at the surface (ex-situ) treatments
- **Contain and Manage in-place**
 - Engineered “cap” or “cover” remedies
 - Vertical and hydraulic barriers
 - Vapor intrusion mitigation systems

Excavation & Remediation





Excavation & Remediation



EXCAVATION & REMEDIATION



GROUNDWATER CLEANUP TECHNOLOGIES (SOME EXAMPLES)

- Remove (pump) & treat the groundwater
- Hydraulic or physical controls
- Air Sparging – from liquid to vapor
- Soil Vapor Extraction (SVE)
- Dual-Phase Extraction
- In-Situ Remediation Technologies
 - Biological (typically bacterial) remediation
 - Chemical oxidation
 - Stabilization/Fixation



Soil Vapor Extraction / Air Sparging



Pump & Treat



Dual Phase Extraction



Vapor Barrier: "Liquid Boot"



INSTITUTIONAL CONTROLS

Goal: To materially reduce or eliminate the potential for exposure to the COC

- Legal and/or physical restrictions on:
 - Allowed land use
 - Site access
- Controls can take the form of:
 - Deed covenant with use restrictions
 - Site-specific permitting restraints
 - Zoning restrictions

REGULATORY CASE CLOSURE

- **Regulatory Closure**
 - Linkage to legal liability issues & immunities
 - Certificate of Completion
 - No further action (NFA) documentation
- **Post-Closure Care (non-clean closures)**
 - Monitoring, yearly inspections, 5-yr. review
 - Operations & Maintenance Agreements

SUMMARY: USEFUL CONCEPTS

- Seek efficiencies by integrating redevelopment and remediation – during project design and construction
- Intelligent site assessment supports risk-based strategies, targeted remediation, and reliable cost estimates
- Collaborate with regulatory agency staff - positively incorporate them into your redevelopment project – on technical, community and funding