

# Developing CSMs That Facilitate Regulatory Decisions

**Ravi Arulanantham, Ph.D.**  
Geomatrix Consultants, Oakland, California  
rarulanantham@geomatrix.com

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# Risk Goals in UST Site Management

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1. Adequate site characterization
2. Removal of F.P. to the extent practicable
3. Removal of primary source(s)
4. Achieve a stable or receding plume
5. Prevent current / future public health hazards
6. Prevent current / future ecological hazards
7. Prevent current / future water resources impairment
8. Post remediation risk management plan in place

# What are the Characteristics of Low-Risk Sites?

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- ✓ There is no single yardstick to determine every low-risk site.
- ✓ Risk of public health, environment, and ground water resource degradation is determined by:
  - the characteristics of the **source(s)**, **pathways**, and the **receptors**
  - time frame for resource use
  - Stakeholders value

*Most commonly asked question: is site investigation adequate ?*

- This question should always be linked to the CSM.
- Ask, “if additional data is collected, is it probable that the SCM would change? Would answers to the basic questions listed above change”
- If the answer is “no”, then the existing site investigation data is inadequate

# Cleanup Decision-Making

Each site has particular risk factors:

- Risk Factors Related to Receptors
- Risk Factors Related to Pathways
- Risk Factors Related to Sources

**Receptors depend on groundwater usage**

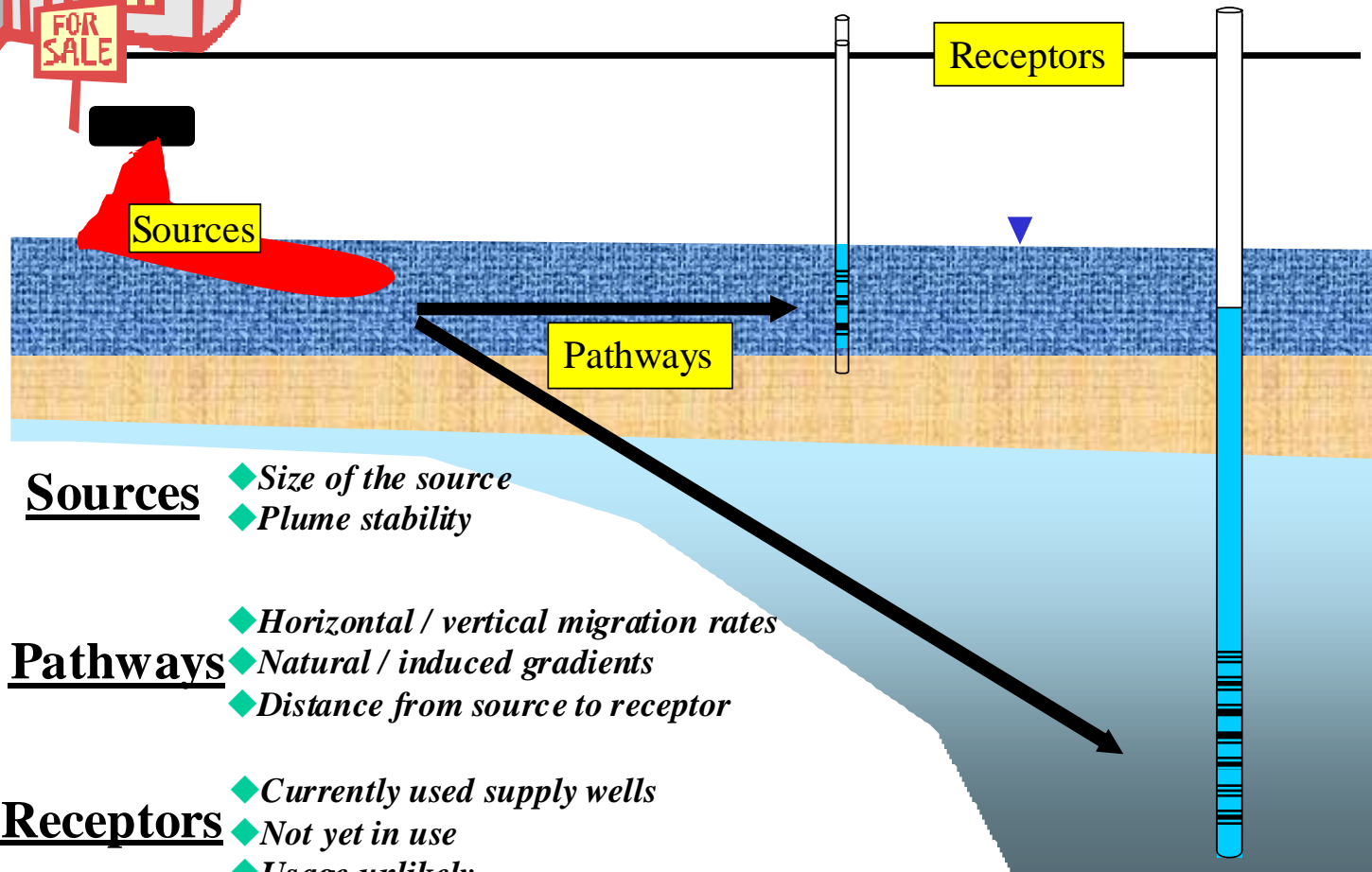
**Pathways depend on hydrogeology**

**Sources depend on release scenario & hydrogeology**

**TOGETHER, THESE RISK FACTORS FORM THE  
CONCEPTUAL MODEL OF THE SITE**



# Characteristics of Sources, Pathways & Receptors



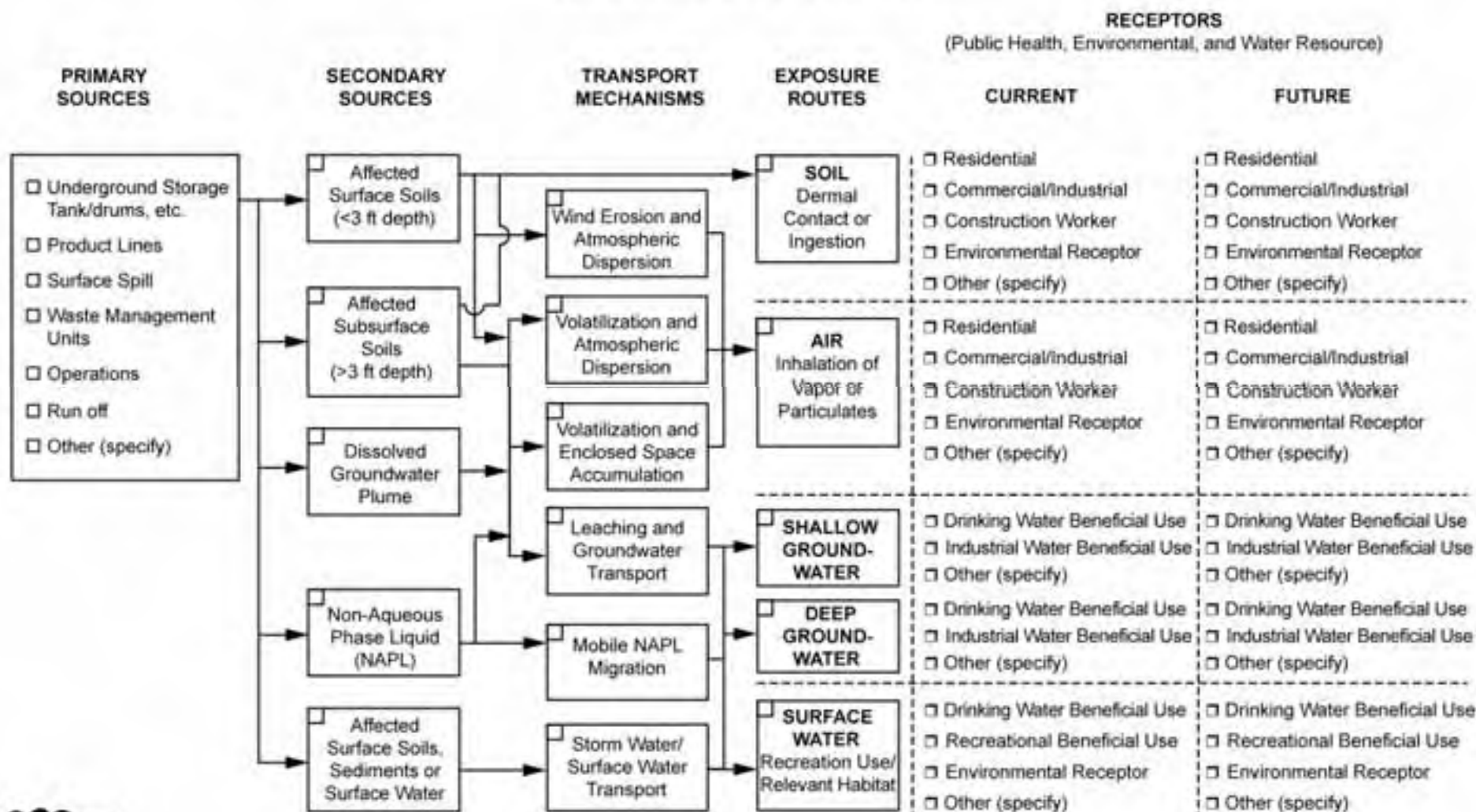
# The Conceptual Site Model

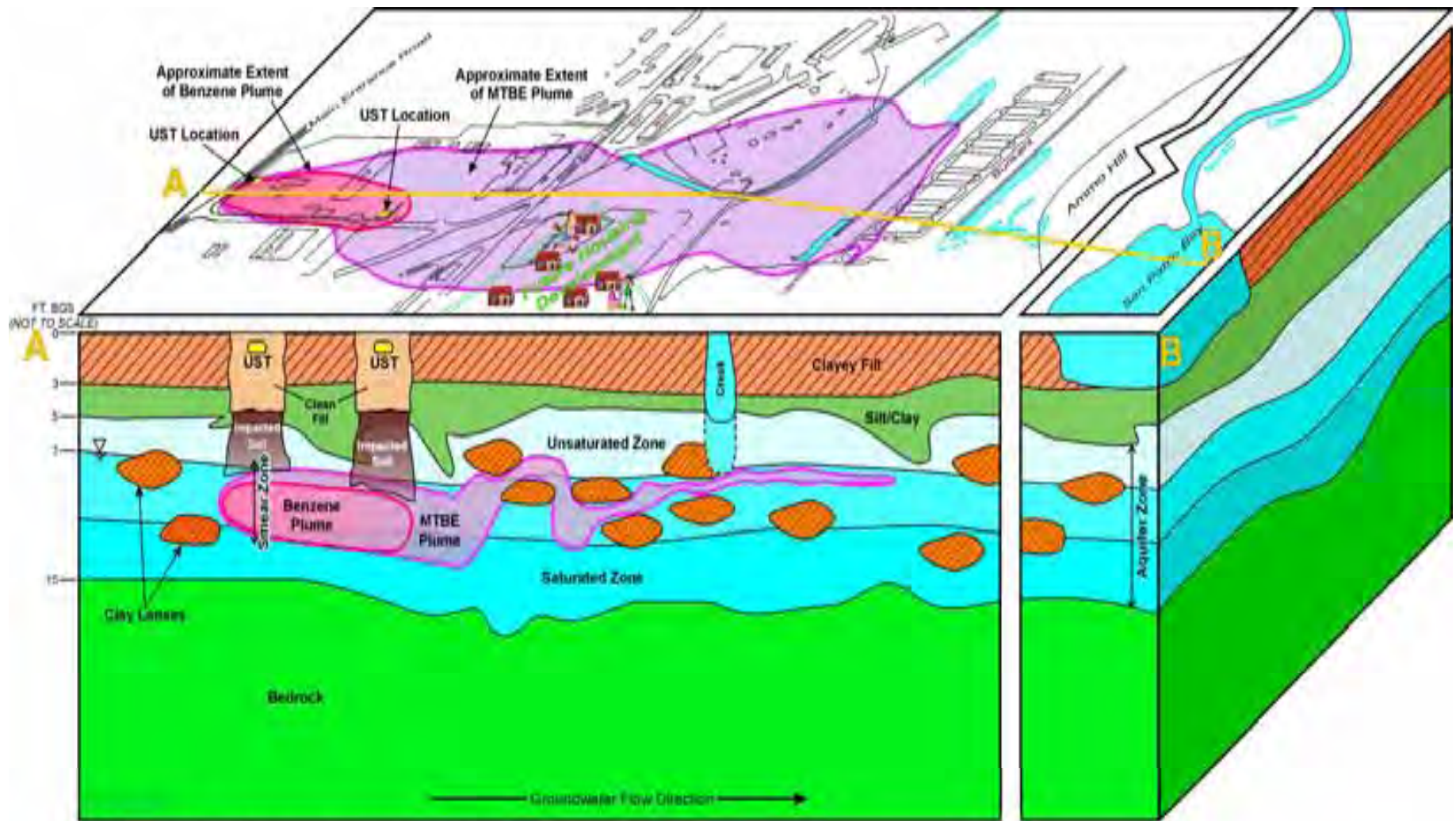
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- ✓ **The Conceptual Site Model (CSM) is a description of the sources, distribution, pathways, and receptors.**
- ✓ **Conceptual Site Exposure Model (CSEM)**
- ✓ **Conceptual Site Hydrogeologic Model (CSHM)**
- ✓ **Conceptual Site Remedial Model (CSRМ)**

## AN EXAMPLE CONCEPTUAL SITE EXPOSURE MODEL

(Source: ASTM E 1689-95)





Not a cross-section. Figure represents a conceptual model of typical subsurface conditions.

**CHGM**

# Conceptual Site Model (CSM)

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- ✓ **A written or pictorial representation of a release scenario and the likely distribution of chemicals at the site**
- ✓ **Identifies potential current and future receptors**
- ✓ **Identifies what the subsurface looks like**
- ✓ **Identifies what chemical are present and where**
- ✓ **Identifies the distribution of chemicals in space and time**
- ✓ **Identifies how the distribution of chemicals are changing in in space and time**

- ✓ **Links potential sources to potential receptors through transport of chemicals in air, soil and water (pathways)**
- ✓ **Identifies fate & transport characteristics of the site**
- ✓ **Identifies environmental issues that need to be investigated in an organized approach (and those issues that do not need to be addressed)**
- ✓ **Provides a framework for the entire project and a communication tool for the regulators, PRPs, and other stakeholders**

***CSM is the cornerstone of good RBDM***

# Why Use a CSM?

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**All involved persons develop their own ideas  
Of “What is Happening”**

- ✓ **Assist in organizing first impressions**
- ✓ **Bring forward Assumptions**
- ✓ **Weigh significance of data gaps**
- ✓ **Focus on collection of “correct” data**

# Simple Site Model

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- ✓ **Gasoline spill on concrete pad**
  - known material and volume
  - known time of release
  - Known behavior
- ✓ **Response action options identified by past experience**
- ✓ **Validate by visual observation**

# LUST Site Model

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- ✓ **Gasoline Leak**
  - material and behavior known
  - volume and time unknown
  - some knowledge of sub-surface
- ✓ **Response action options identified by past experience**
- ✓ **Validate by soil, soil gas, and ground water sampling**

# Complex Site Model

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- ✓ **Multi-chemicals in drinking water well located in bedrock**
  - unknown source, unknown material
  - unknown time and amount of release
  - uncertain behavior in uncertain system
- ✓ **Comprehensive Response actions**
- ✓ **Long-term project with unknown outcome**

# Site Assessment to Validate a SCM

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## 1. Receptor information (human, ecological, water resources)

- backyard dermal contact
- Domestic wells
- construction workers
- Municipal wells
- consumption of shellfish
- Irrigation wells
- Indoor air
- Construction details of the wells
- Pumping rates of the wells

## 2. Hydraulic definition and contour maps

- Identify/define lateral & vertical ground water flow regime
- Assess hydraulic communications

## 3. Stratigraphy

- Generate detailed geologic cross sections
- Understand the stratigraphy of the unsaturated zone and the zone of saturation.

## **4. Contaminant delineation & plume contours**

- **Understand how the monitor well's screened interval relates to the stratigraphy**
- **Understand how the screened interval affects the water level and concentration gradient in the zone of saturation.**
- **Identify/define horizontal & vertical extent**
- **Estimate horizontal & vertical migration rates**

## **5. Estimation of contaminant mass**

- **Extent of any floating product**
- **NAPL concen. above & below water table in source area**
- **Mass remaining in plume**

## **6. Conduit survey**

- **Sewers, water lines, electrical lines etc.**
- **Abandoned wells**

## **7. Ground water & contaminant monitoring**

- **At least two years of continuous monitoring, using properly screened and constructed wells**
- **Establish plume contours**
- **Groundwater flow regime needs to be well-characterized**

## **8. Concentration versus time curves for source area wells**

- **Understand NAPL depletion rates**
- **Understand hydraulic influences**

## **9. Concentration versus distances for centerline wells**

- **Define plume stability over a time period - again, groundwater flow regime critical to doing this defensibly**

# Low-Risk Site Characteristics

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## Source:

- NAPI depleted (either by remediation or natural attenuation)
- Little mass remaining (G.W. concentrations <500 ppb)
- Age of the plume (>10 years old)
- Favorable biogeochemistry (aerobic)

## Pathways:

- Low ground water velocities (<0.1 feet/day)
- Long distance to the supply well (>5000 feet)
- Low hydraulic connectivity

## Receptors:

- Poor water quality (high TDS)
- Long time frame for beneficial use (>25 years)

Thank You