



RISK-BASED CLOSURE: IDENTIFYING ALTERNATIVE ENDPOINTS TO ENVIRONMENTAL CLEANUP

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SPEAKERS

IDENTIFYING ALTERNATE ENDPOINTS

PART 1 – RCRA HAZARDOUS WASTE SITES

Colorado's Conditional Closure Policy and Guidance (CCP&G) for Low-Threat Sites



PART 2 – COLORADO VOLUNTARY CLEANUP PROGRAM (VCUP) SITES
Utilizing Risk-Based Standards

Corrective Action Unit

- Resource Conservation and Recovery Act/Colorado Hazardous Waste Act (RCRA/CHWA)
 - “Cradle to grave” regulation of hazardous waste
 - EPA delegated authority to State of Colorado
- Corrective Action Sites:
 - Release of hazardous waste to the environment
 - 1980+
 - Investigations and remediation
- Order or Corrective Action Plan

Why We Needed the CCP&G

- Default required by law: Clean Closure
- Frustration within CDPHE and industry re: inability to close-out low threat sites
- CCP&G finalized in October 2014
- Not a No Further Action determination

CCP&G Purpose

- Mechanism to reduce burden of low threat sites
- Describes the requirements before a determination of no further active remediation or monitoring at a site where groundwater contamination in excess of the Colorado Groundwater Standards remains
- Provides discretion to determine that a site no longer requires active management and ground water quality monitoring can be discontinued

Two Related Documents

- Conditional Closure Policy sets out broad outlines for (mostly) exiting Corrective Action process -- what you need to show HMWMD
- Conditional Closure Guidance provides options for meeting the requirements set out in the Policy -- how you show HMWMD you meet the Policy
- Opportunities to apply Conditional Closure Policy & Guidance (CCP&G) more!

Not Regulation

“This guidance is meant to inform the regulated community of their opportunity to close low threat sites: it is not regulation, nor does it constitute an enforceable standard that must be complied with.”

8 Same with this slide deck . . . !

It is a Toolbox

- Satisfying Lines of Evidence (LOE) in Policy is mandatory, but not every factor below each LOE needs to be checked off or completed
- Level of effort/documentation is proportional to the complexity of the site, degree of contamination and the level of threat

“Division personnel will apply best professional judgment in each case.”

Eligibility

- Who is eligible - 1980+ Hazardous Waste contamination
- Who is not eligible -
 - CERCLA/Superfund National Priorities List (NPL) sites and NPL-caliber sites
 - Permitted RCRA / CHWA treatment, storage and disposal facilities

Option to apply CCP&G to Sites within Voluntary Clean-Up Program (VCUP) - More on this later!

What are low threat sites? (Policy)



What are low threat sites? (Policy)



Factors to Determine Conditional Closure for Low Threat Sites - Lines of Evidence

1. Characterization of the Site
2. Remediation of Source Areas
3. Evaluation of Exposure Pathways
4. Demonstration of Plume Stability / Concentration Trends
5. Timeframe for Achieving Remediation Goals
6. Institutional Controls OR Alternate Concentration Level OR Site Specific Standard

LOE 1: Characterization of the Site

- Nature and extent, distribution of the source areas and groundwater plume
- Site hydraulic, hydrogeologic, chemical, and geologic context
- Site uses

LOE 2: Remediation of Source Areas

- Source areas must be remediated to the extent practicable
- Good faith effort must be made to remediate
- Eliminate source loading to allow natural attenuation to reduce the contaminant concentrations in groundwater in a self-sustaining manner
- Data results drive completion

LOE 3: Evaluation of Exposure Pathways

- No current or reasonably anticipated future exposures
- Site use or use of surrounding properties
- Potential for cross-media transfer
- Hydraulic connections
- Potential damage to wildlife, crops, vegetation and physical structures
- Long-term durability of institutional controls

LOE 4: Demonstration of Plume Stability and Concentration Trends

- Plume size in all dimensions must be stable or decreasing
- Concentration trends must not depend on active remediation or containment systems
- Are there natural attenuation processes at work?

LOE 5: Timeframe for Achieving Remediation Goals

- Facility will achieve Colorado groundwater standards within a reasonable time period
- When determining reasonable time frame consider the same factors for approving a stable plume (LOE 4)

LOE 6: Institutional Controls

- Institutional Controls (ICs): Restrictive Notice (Preference) or Environmental Covenant
- Local ordinance applying to multiple properties via Intergovernmental Agreement (IGA) can replace individual parcel ICs, except source property
- ICs or IGAs ensure that remedial decisions remain protective by eliminating exposure potential or activities that could disturb the plume
- ICs critical to both CHWA and Voluntary Cleanup Sites. More soon!

Alternate Concentration Limits / Site-Specific Standards

- In lieu of an IC, we can decide that a higher number remains protective due to scientific characteristics of the site
- Conditional: “The Director will establish an alternate concentration limit . . . if he/she finds that the constituent will not pose a substantial present or potential hazard to human health or the environment . . .”
- 60 day public comment period required
- HMWMD has never used an ACL, would be very selective
- Site Specific Standards (SSS) another option through WQCC

Brownfields Loans?

- If under CHWA, VCUP Program not available.
- However, even if under CHWA, Brownfields Revolving Loans may be available
- If under CHWA the site cannot be used for Revolving Loan collateral, the developer / borrower would need other collateral
- All Brownfields Revolving Loans involve site-by-site determination

Case Study

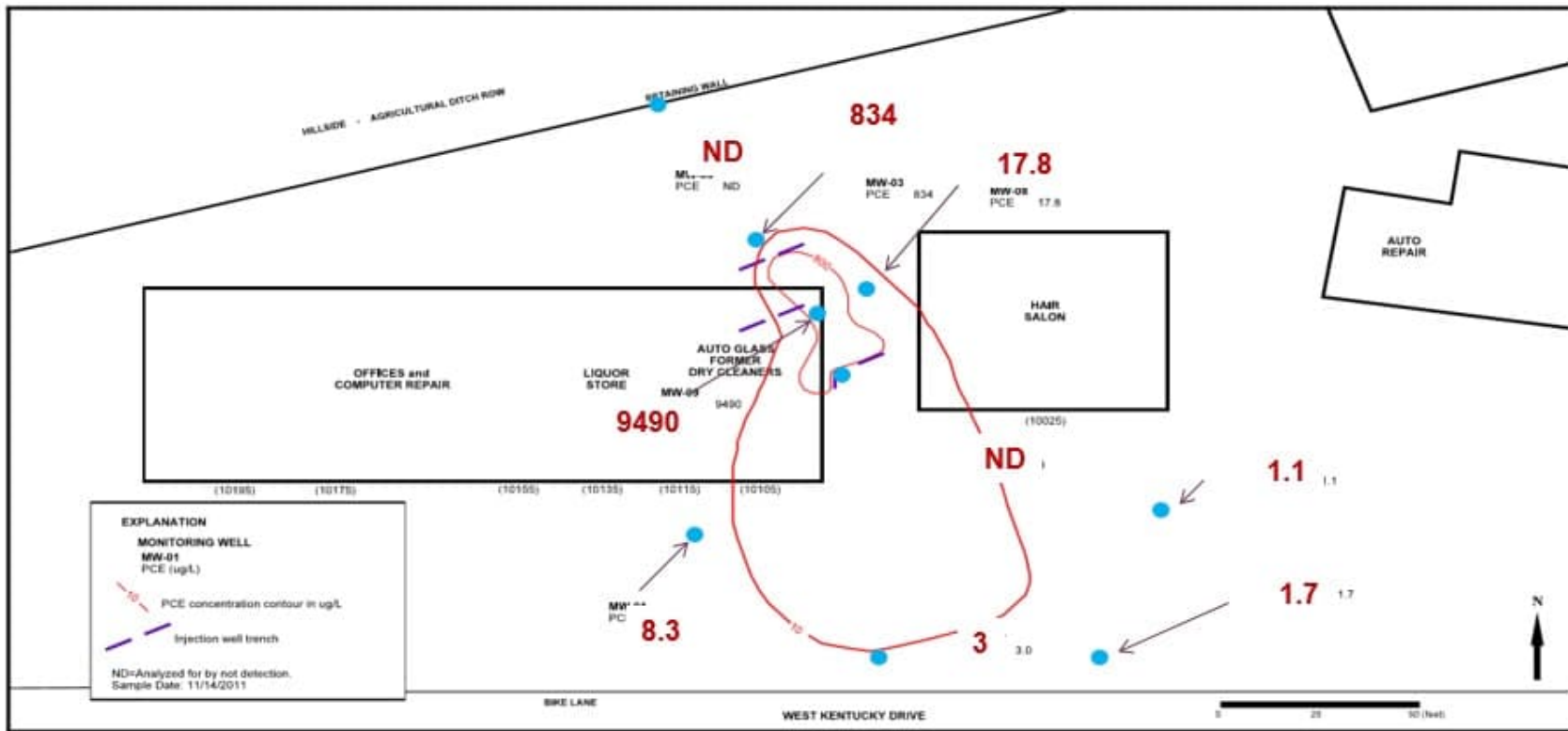
Sun Valley Shopette - Unique Cleaners Lakewood, CO



Sun Valley Shopette - Unique Cleaners

- Dry cleaning occurred at this location for more than 30 years.
- PCE discovered in groundwater in February 2004 during a limited Phase II ESA.
- Sources of release suspected to be from dumping or spills inside and outside the building, and/or release from sanitation sewer lines and the associated floor drain system inside the dry cleaners.
- Greatest concentration of PCE ever detected at the site was 16,000 ug/L.
- Water level has fluctuated between 11 feet to 24 feet below ground surface.
- Site underlain by shallow weathered and fractured bedrock with sand and clay interbeds, presenting a challenge to cleanup.
- Submitted a Corrective Action Plan to the CDPHE in 2007.

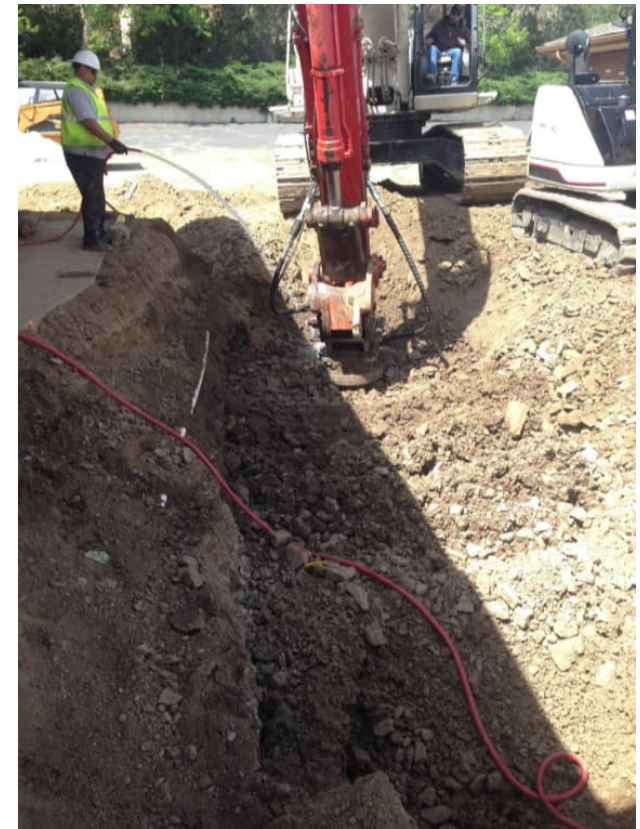
LOE 1: PCE Plume in Groundwater, Nov. 2011



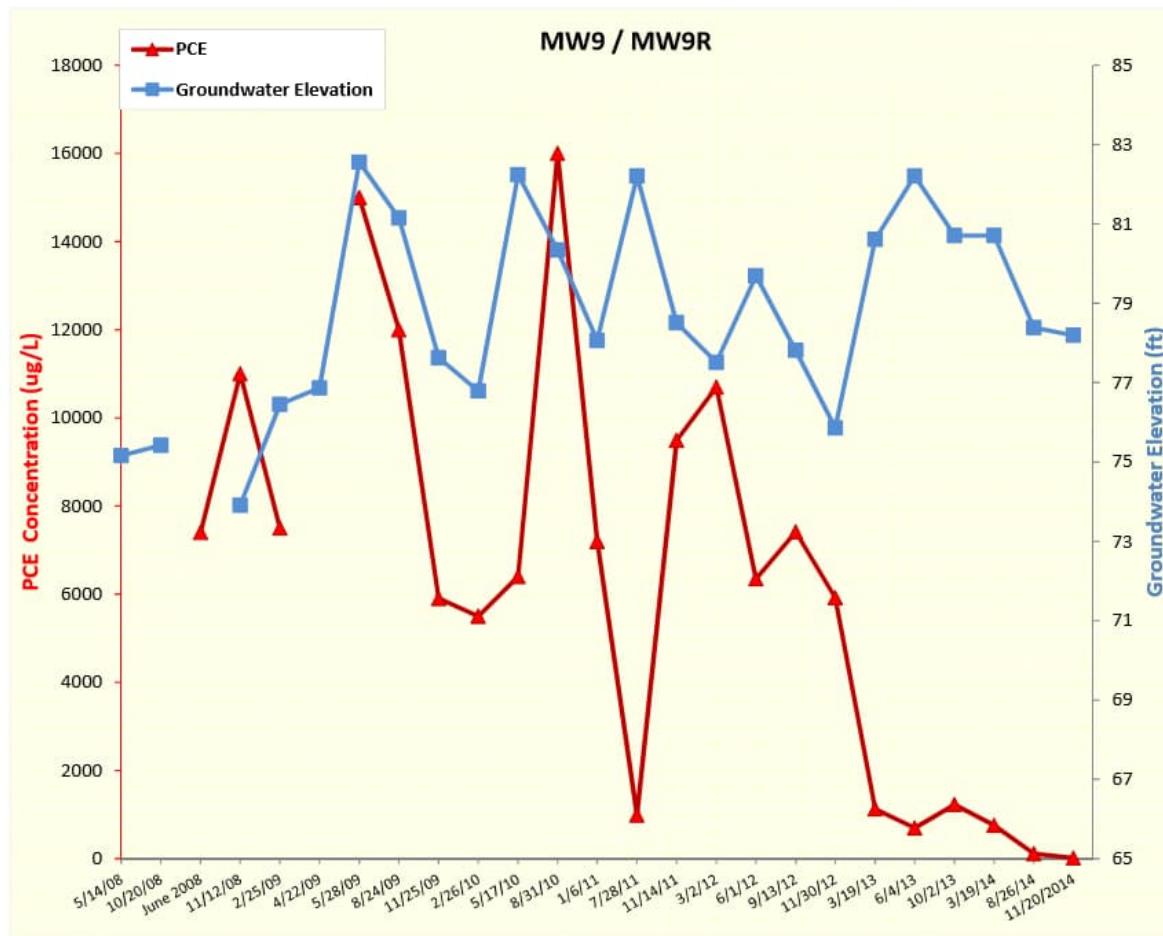
CGS = Colorado Groundwater Standard, WQCC Reg 41

LOE 2: Remediation Technologies

- In-situ soil mixing in three cells of Ferox-Flow™ (ZVI Reactive Iron Powder), ELSTM bioremediation amendment, and Daramend® reagents using a hydraulically powered axial mixing head capable of grinding up siltstone and claystone.
- Both biotic reductive dechlorination and abiotic reduction of PCE.



LOE 4: Demonstration of Plume Stability and Concentration Trends (MW-9)



LOE 6: Institutional Controls

- A Notice of Environmental Use Restriction was filed on the property on December 22, 2016
- Use restrictions include:
 - no groundwater may be withdrawn
 - residential use is prohibited
 - no uses that could expose children to residual soil contamination
 - no soil disturbances or activities that would disturb concrete flooring in unit 10105 except as allowed in Materials Management Plan (MMP)

Request for Conditional Closure

Former Unique Cleaners
10025 West Kentucky Drive
Lakewood, Colorado
Jefferson County



APPROVED



Resources and Sources

1. Colorado Conditional Closure Policy and Guidance (October 2014)
 - <https://cdphe.colorado.gov/hm/conditional-closures>
2. National Academy of Sciences, *Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites* (2012)
 - <http://dels.nas.edu/Report/Alternatives-Managing-Nation/14668>

IDENTIFYING ALTERNATE ENDPOINTS



Introduction to Risk-Based Standards



Tools for Establishing Risk-Based Standards



Case Study

INTRODUCTION TO RISK-BASED STANDARDS

Default Screening Levels

- Colorado Regulation 41 (Groundwater), 1×10^{-6} Cancer Risk

GROUNDWATER ORGANIC CHEMICAL STANDARDS (in micrograms per liter)	
PARAMETER	STANDARD
Trichlorophenol 2,4,5	700
Trichlorophenol 2,4,6	3.2
Trichlorophenoxypropionic acid (2,4,5-tp) (Silvex)	50
Vinyl Chloride	0.023 to 2
Xylenes (total)	1,400 to 10,000

Health-Based vs
MCL

INTRODUCTION TO RISK-BASED STANDARDS

Default Screening Levels

- USEPA Regional Screening Levels: Cancer Risk 1×10^{-6} , Hazard Quotient 1.0 or 0.1

Land Use by Media
Residential Soil
Industrial Soil
Residential Air
Industrial Air
Tap Water
Protection of Groundwater – Risk-based Soil Screening Level
Protection of Groundwater – MCL-based Soil Screening Level

Exposure Routes
Ingestion
Dermal
Inhalation

Receptors
Adults
Children

INTRODUCTION TO RISK-BASED STANDARDS

Establishing Site-Specific Cleanup Standards for VCUP Sites

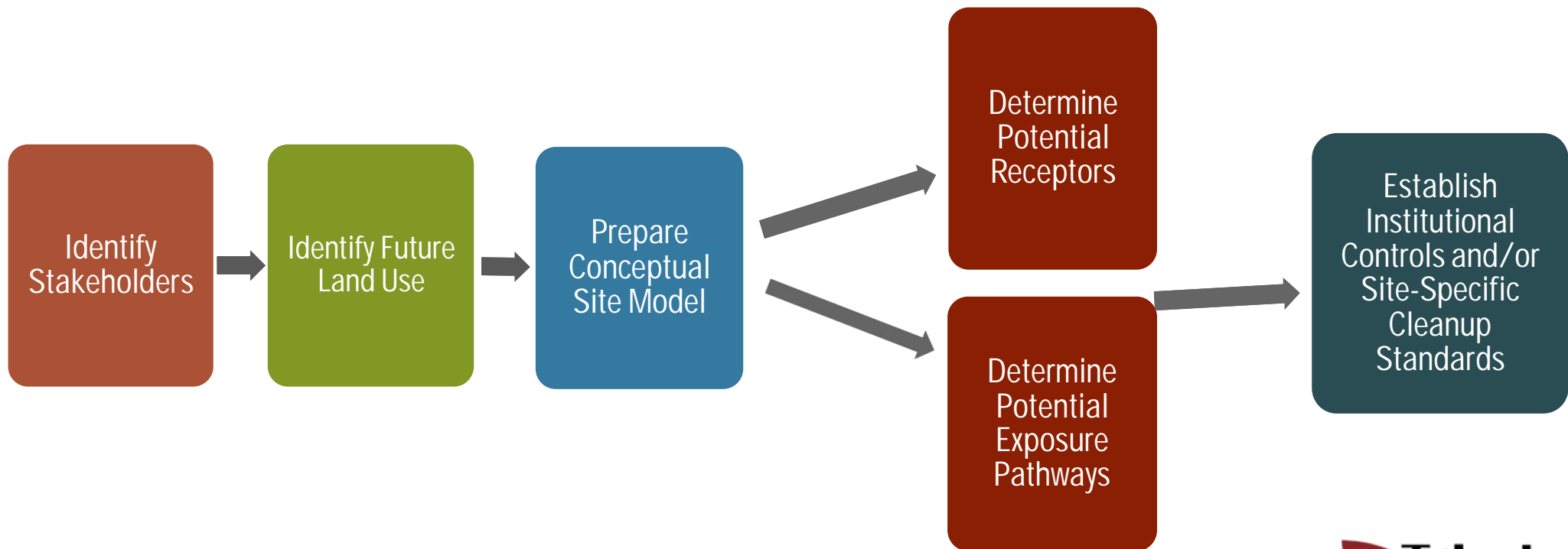
- Adjustments made to:
 - Receptors
 - Land use
 - Exposure routes
 - Other assumptions

Assumptions	Default Screening Levels	Site-Specific Cleanup Levels
Cancer Risk	1×10^{-6}	1×10^{-6} to 1×10^{-4}
Non-Cancer Hazard	0.1 or 1	1 to 3
Land Use	Residential or Industrial	Site-specific
Receptors	Adult and Children, Residents and Workers	Only receptors likely to use the property
Exposure Routes/Pathways	Dermal	Only complete routes/pathways
	Ingestion	
	Inhalation	
	Migration to Groundwater (Soil)	
	Air (Indoor and Outdoor)	

INTRODUCTION TO RISK-BASED STANDARDS

- “Alternate Cleanup Levels” or ACLs: An acceptable human-health or ecological risk value determined for a specific point of exposure, site-specific attenuation factor, and demonstrated cleanup at the point of compliance.
 - RCRA: 40 CFR 264.94(b)
 - TSCA: 40 CFR 761.120(c)
 - Colorado Water Quality Commission: 41.5(D)
- Disadvantages
 - Slow – Requires formal regulatory approval and public review
 - Expensive – Large data sets required to evaluate risks to human health and environment
 - Uncertainty - Can result in the same as the default or does not yield a significant benefit

RISK EVALUATION PROCESS

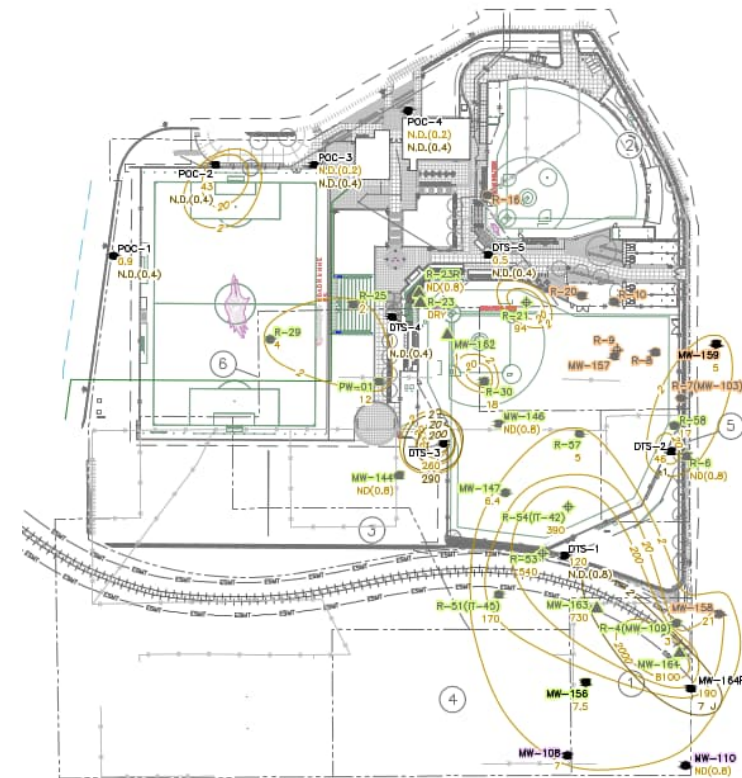


TOOLS FOR DEVELOPING RISK-BASED STANDARDS WITH CDPHE



CASE STUDY – DENVER TOLUENE SITE

- Groundwater impacted with CVOCs
- Entered CDPHE VCUP in 2001-2006 – 6 Parcels
- Established Site-Specific Standards:
 - 1×10^{-4} cancer risk
 - Industrial-mixed land use
 - Construction worker receptors
- VCUP No Action Determinations for 5 Parcels 2003-2004, and 1 Parcel (GW) in 2020
- Deed restriction



QUESTIONS?



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