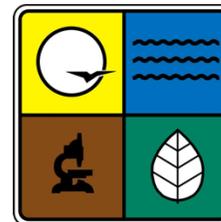


Long-Term Stewardship in Missouri

Hannah Humphrey, Long-Term Stewardship Unit Chief
Brownfields/Voluntary Cleanup Program



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

What is Long-Term Stewardship?

Hazardous
substance
sites
remediated
to restricted
use levels

Long-term stewardship (LTS)

encompasses activities at sites where continued management is necessary to prevent residual contamination from posing a risk to people or the environment following completion of cleanup, disposal or stabilization of hazardous substances.

What is Risk Management

Wikipedia definition:

Risk management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.

NOT Risk Management



Missouri Department of
Natural Resources

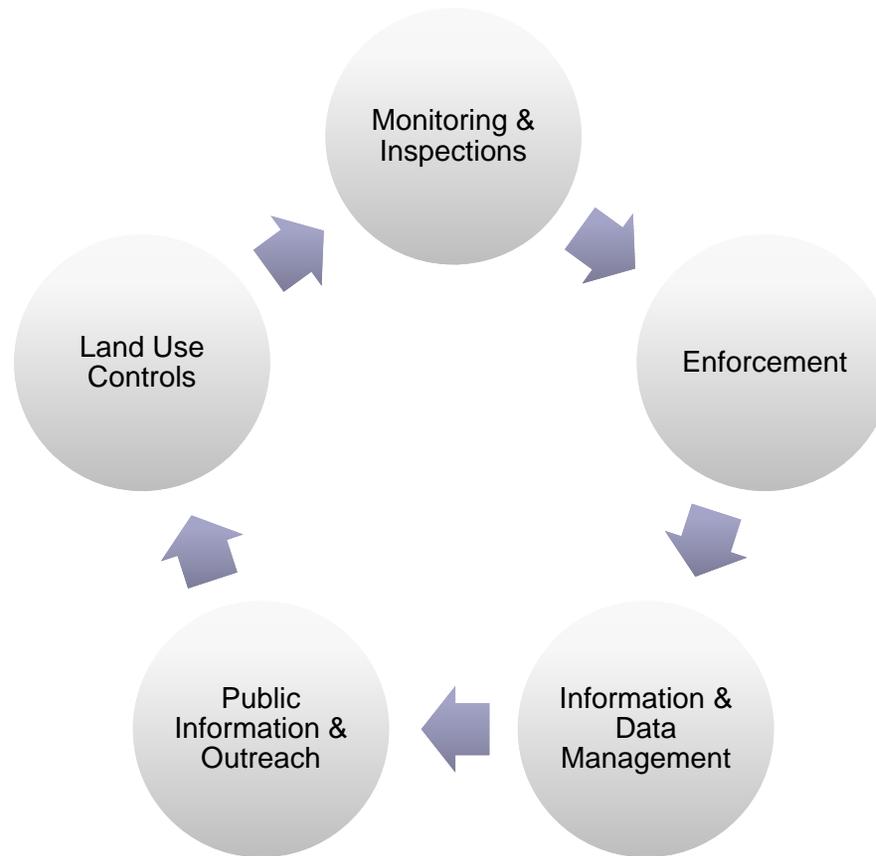
Question: What do these places have in common?



Answer: All are LTS sites.



Components of LTS

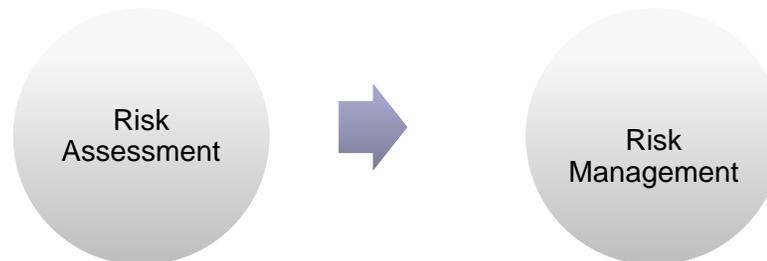


Remediation

Cleanup, or remediation, of hazardous substances in the Brownfields/Voluntary Cleanup Program is conducted under the Missouri Risk Based Corrective Action guidance

About Risk-Based Remediation

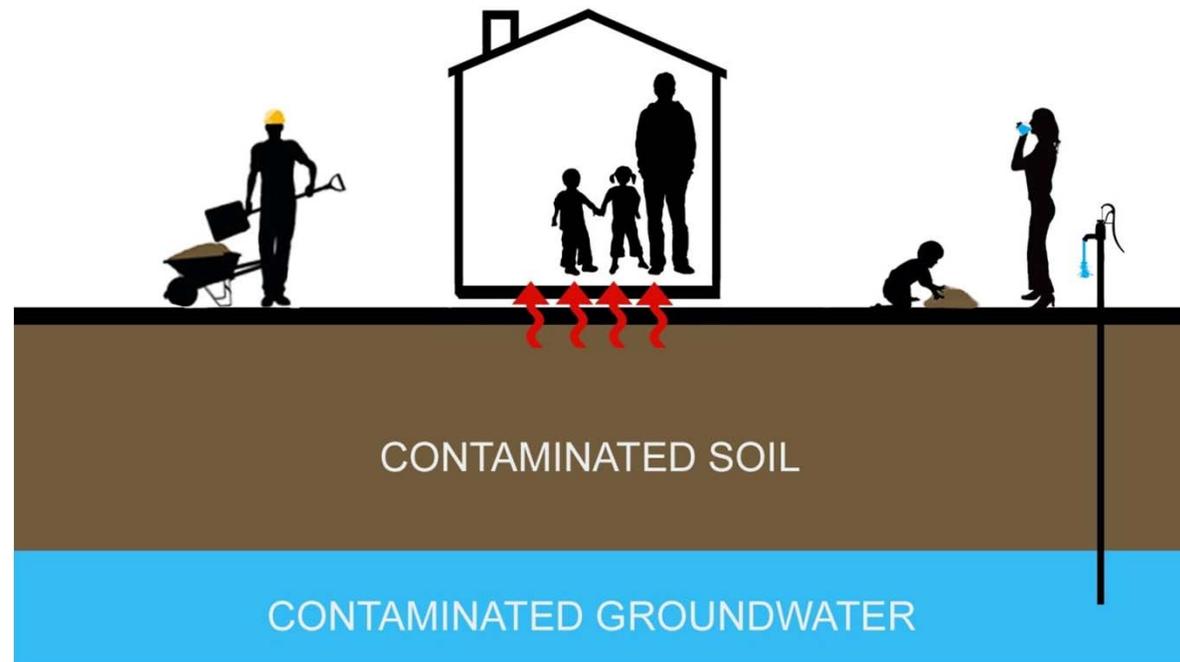
The risk-based remediation process includes evaluation of human and environmental exposure pathways and allows sites to be cleaned up based on reasonably anticipated land use.



About Risk-Based Remediation

Common exposure pathways in risk assessment:

Risk
Assessment



About Risk-Based Remediation



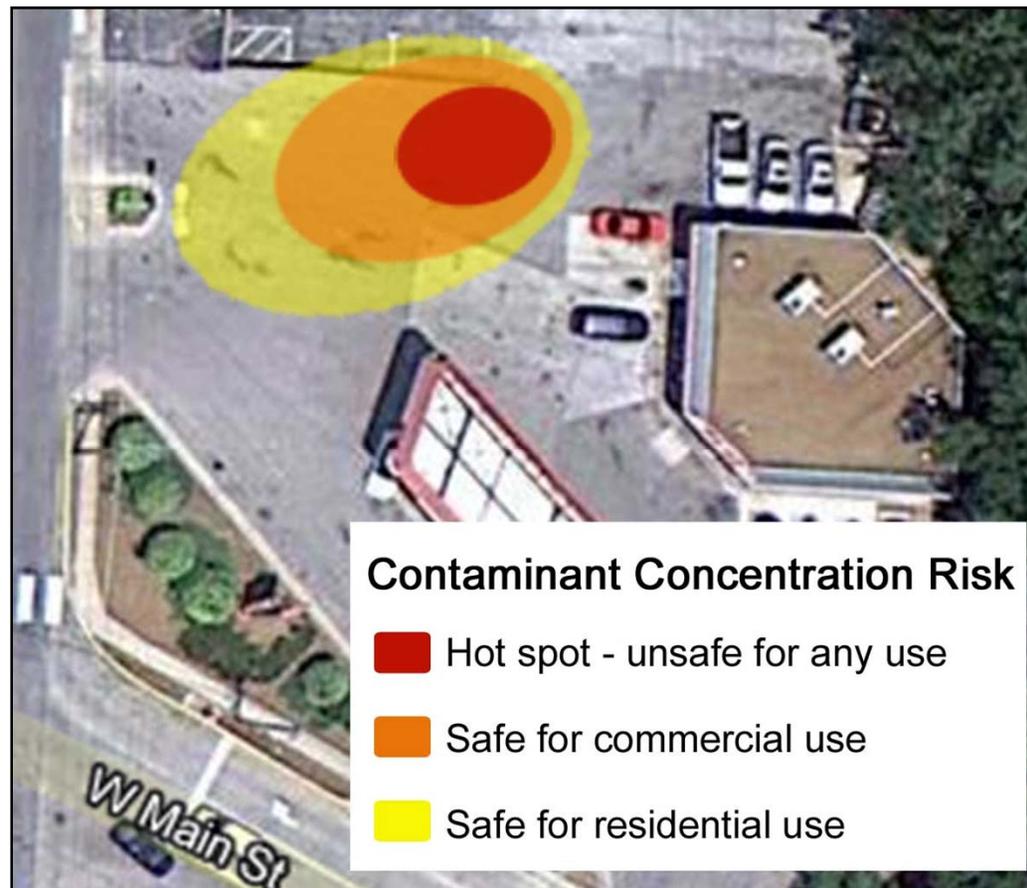
Table B-3
 Tier 1 Risk-Based Target Levels
 Residential Land Use
 Soil Type 2 (Silty)

Chemicals of Concern	AIR				SURFACE SOIL				SUBSURFACE SOIL				SOIL VAPOR				GROUNDWATER												
	Inhal	CH AA A	CN A C	Dermal Contact	CH AA A	CN A C	Ingestion	CH AA A	CN A C	Outdoor Inhalation	CH AA A	CN A C	Inhalation (Vapor Emission and Particulates and Dermal Contact)	CH AA A	CN A C	Inhalation (Vapor Emission)	CH AA A	CN A C	Inhalation (Vapor Emission)	CH AA A	CN A C	Dermal Contact	CH AA A	CN A C	Domestic Water Use	CH AA A	CN A C		
	[mg/m ³ -air]				[mg/kg]				[mg/kg]				[mg/m ³ -air]				[mg/l]												
Chromium (VI)	2.14E-06	AA	C	4.82E-09	AA	C	1.52E-01	AA	C	7.58E-03	AA	C	1.47E-01	AA	C	NA	NA	NA	NA	NA	NA	2.81E-01	AA	C	3.37E-06	AA	C		
Copper	5.97E-04	CH	NC	1.12E-05	CH	NC	1.13E-03	CH	NC	2.12E-06	CH	NC	1.04E-03	CH	NC	NA	NA	NA	NA	NA	NA	2.21E-02	CH	NC	8.24E-01	CH	NC		
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.66E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.58E-02	NA	NA		
Manganese	2.99E-05	CH	NC	3.91E-05	CH	NC	1.10E-04	CH	NC	1.66E-05	CH	NC	9.60E-03	CH	NC	NA	NA	NA	NA	NA	NA	7.62E-02	CH	NC	2.19E-00	CH	NC		
Mercury	1.76E-04	CH	NC	NA	NA	NA	NA	NA	NA	4.63E-01	CH	NC	4.03E-01	CH	NC	4.17E-01	CH	NC	3.37E-01	CH	NC	8.77E-01	CH	NC	NA	NA	NA		
Molybdenum	2.86E-03	CH	NC	1.40E-04	CH	NC	3.91E-02	CH	NC	1.66E-07	CH	NC	3.89E-02	CH	NC	NA	NA	NA	NA	NA	NA	2.79E-03	CH	NC	7.86E-02	CH	NC		
Nickel	5.37E-05	CH	NC	5.50E-04	CH	NC	1.56E-03	CH	NC	1.91E-04	CH	NC	1.11E-03	CH	NC	NA	NA	NA	NA	NA	NA	5.93E-02	CH	NC	3.11E-01	CH	NC		
Selenium	1.19E-04	CH	NC	1.40E-04	CH	NC	3.91E-02	CH	NC	4.21E-05	CH	NC	3.89E-02	CH	NC	NA	NA	NA	NA	NA	NA	2.79E-03	CH	NC	1.06E-02	CH	NC		
Silver	5.97E-06	CH	NC	1.40E-04	CH	NC	3.91E-02	CH	NC	2.12E-04	CH	NC	3.74E-02	CH	NC	NA	NA	NA	NA	NA	NA	4.66E-01	CH	NC	7.81E-02	CH	NC		
Vanadium	NA	NA	NA	1.60E-06	CH	NC	4.49E-04	CH	NC	NA	NA	4.57E-04	CH	NC	NA	NA	NA	NA	NA	NA	NA	3.91E-01	CH	NC	8.37E-01	CH	NC		
Chloroform	5.97E-05	CH	NC	2.51E-02	CH	NC	6.26E-00	CH	NC	2.12E-05	CH	NC	6.00E-00	CH	NC	NA	NA	NA	NA	NA	NA	4.47E-01	CH	NC	1.25E-01	CH	NC		
Trichloroethylene	2.86E-05	CH	NC	1.56E-04	CH	NC	8.48E-02	CH	NC	1.66E-05	CH	NC	5.39E-02	CH	NC	NA	NA	NA	NA	NA	NA	1.91E-01	CH	NC	1.09E-01	CH	NC		
Xylenes	NA	NA	NA	8.33E-05	CH	NC	2.35E-04	CH	NC	NA	NA	2.20E-04	CH	NC	NA	NA	NA	NA	NA	NA	NA	2.79E-03	CH	NC	4.09E-01	CH	NC		
Asbestos	5.97E-02	CH	NC	NA	NA	NA	NA	NA	NA	1.55E-04	CH	NC	1.55E-04	CH	NC	1.45E-01	CH	NC	1.10E-02	CH	NC	NA	NA	NA	1.05E-01	CH	NC		
Cyanide	2.86E-03	CH	NC	5.99E-03	CH	NC	1.56E-03	CH	NC	1.66E-07	CH	NC	1.22E-03	CH	NC	NA	NA	NA	NA	NA	NA	1.12E-02	CH	NC	3.12E-01	CH	NC		
Cresols (m, o, p)	NA	NA	NA	1.21E-04	CH	NC	1.19E-03	CH	NC	NA	NA	3.46E-03	CH	NC	NA	NA	NA	NA	NA	NA	2.21E-02	CH	NC	2.06E-01	CH	NC			
Dibenz(a,h)anthracene	1.02E-01	CH	NC	2.51E-04	CH	NC	3.04E-01	CH	NC	4.97E-04	CH	NC	4.94E-01	CH	NC	1.97E-01	CH	NC	1.25E-04	CH	NC	6.68E-01	CH	NC	5.97E-01	CH	NC		
Fluoride (as Sodium Fluoride)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.00E-01	CH	NC			
Perchlorate	NA	NA	NA	1.60E-02	CH	NC	6.40E-01	CH	NC	NA	NA	4.20E-01	CH	NC	NA	NA	NA	NA	NA	NA	NA	1.91E-01	CH	NC	1.09E-02	CH	NC		
Polynuclear Aromatic Hydrocarbons	5.97E-05	CH	NC	5.99E-03	CH	NC	1.56E-03	CH	NC	1.66E-07	CH	NC	1.13E-00	CH	NC	2.21E-01	CH	NC	2.07E-00	CH	NC	1.85E-02	CH	NC	1.13E-01	CH	NC		
Total Petroleum Hydrocarbons																													
TPH-C10																													
Aliphatics <C10	1.18E-01	CH	NC	NA	NA	NA	4.02E-05	CH	NC	3.69E-06	CH	NC	3.54E-05	CH	NC	7.20E-02	CH	NC	7.55E-05	CH	NC	3.47E-01	CH	NC	NA	NA	1.81E-01	CH	NC
Aliphatics >C10	1.11E-01	CH	NC	NA	NA	NA	3.91E-05	CH	NC	3.87E-06	CH	NC	3.84E-05	CH	NC	4.69E-02	CH	NC	7.96E-05	CH	NC	1.63E-01	CH	NC	NA	NA	2.17E-01	CH	NC
Aliphatics <C10-C10	6.06E-01	CH	NC	NA	NA	NA	7.82E-03	CH	NC	1.57E-05	CH	NC	7.45E-03	CH	NC	6.90E-01	CH	NC	1.89E-04	CH	NC	5.99E-01	CH	NC	NA	NA	6.83E-01	CH	NC
Aliphatics >C10-C10	1.19E-01	CH	NC	NA	NA	NA	3.13E-03	CH	NC	3.08E-04	CH	NC	2.64E-03	CH	NC	1.54E-02	CH	NC	7.62E-03	CH	NC	1.79E-01	CH	NC	NA	NA	1.72E-01	CH	NC
TPH-C15																													
Aliphatics <C15-C15	1.18E-00	CH	NC	6.41E-01	CH	NC	1.31E-01	CH	NC	3.77E-05	CH	NC	1.10E-01	CH	NC	7.91E-01	CH	NC	9.20E-04	CH	NC	3.06E-02	CH	NC	NA	NA	3.18E-01	CH	NC
Aliphatics >C15-C15	6.06E-01	CH	NC	2.79E-04	CH	NC	7.82E-03	CH	NC	1.57E-05	CH	NC	5.58E-03	CH	NC	4.94E-02	CH	NC	1.89E-04	CH	NC	1.73E-01	CH	NC	NA	NA	6.83E-01	CH	NC
Aliphatics <C15-C16	6.06E-01	CH	NC	3.79E-04	CH	NC	7.82E-03	CH	NC	1.57E-05	CH	NC	5.88E-03	CH	NC	2.25E-01	CH	NC	3.88E-04	CH	NC	1.68E-02	CH	NC	NA	NA	1.58E-01	CH	NC
Aliphatics >C15-C16	NA	NA	NA	5.99E-05	CH	NC	1.56E-05	CH	NC	NA	NA	1.22E-05	CH	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.13E-01	CH	NC	
Aliphatics <C16-C16	1.19E-01	CH	NC	1.12E-04	CH	NC	1.13E-03	CH	NC	3.08E-04	CH	NC	2.24E-01	CH	NC	8.29E-01	CH	NC	7.62E-03	CH	NC	3.89E-01	CH	NC	NA	NA	1.72E-01	CH	NC
Aliphatics >C16-C16	1.09E-01	CH	NC	1.12E-04	CH	NC	1.13E-03	CH	NC	3.08E-04	CH	NC	2.24E-01	CH	NC	4.34E-03	CH	NC	7.62E-03	CH	NC	1.51E-02	CH	NC	NA	NA	1.72E-01	CH	NC
TPH-C20																													
Aliphatics <C20-C20	NA	NA	NA	6.41E-01	CH	NC	1.31E-01	CH	NC	NA	NA	1.12E-05	CH	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.09E-01	CH	NC
Aliphatics >C20-C20	NA	NA	NA	5.99E-05	CH	NC	1.56E-05	CH	NC	NA	NA	1.22E-05	CH	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.13E-01	CH	NC	
TPH-C25																													
Aliphatics <C25-C25	NA	NA	NA	5.99E-05	CH	NC	1.56E-05	CH	NC	NA	NA	1.12E-05	CH	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.13E-01	CH	NC	
Aliphatics >C25-C25	NA	NA	NA	6.45E-01	CH	NC	2.25E-01	CH	NC	NA	NA	1.12E-05	CH	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.09E-01	CH	NC	

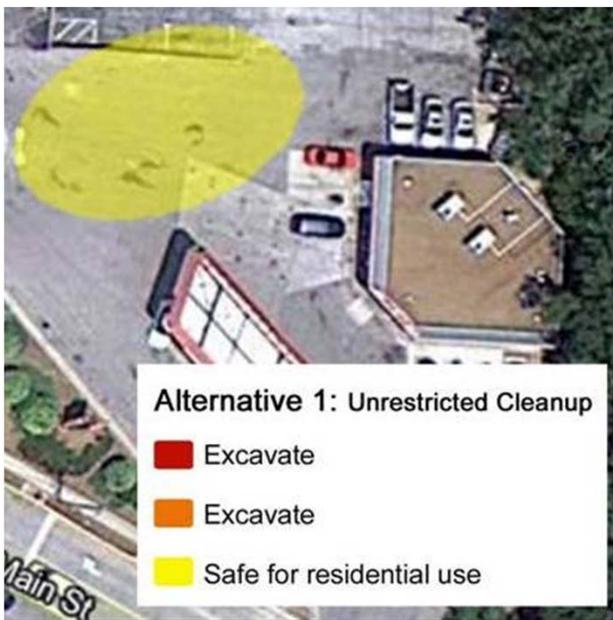
A: Air; CH: CHM; AA: Aq-Adjusted; C: Carcinogenic; CN: Non-carcinogenic; M: MCL; NA: Not available.
 * Calculated target level exceeded saturated soil concentration. Calculated value is shown.
 # Calculated target level exceeded water solubility. Calculated value is shown.
 = Calculated target level on nond saturated vapor concentration. Calculated value is shown.
 For chemicals without EPA standard method for analysis or the chemical without PQL, refer to Table B-2.

About Risk-Based Remediation

Risk
Management



About Risk-Based Remediation



About Risk-Based Remediation

Response actions may include risk management tools such as:

Risk
Management

- Restrict land use with environmental covenant



- Construct and maintain cap



Advantages of Risk-based Cleanups for Brownfields

- Leverages cleanup funds to allow remediation of more property
- Safe reuse of land with proper risk management
- Improves area property values
- Utilizes existing infrastructure and labor concentration

Land Use Controls

Legal and/or administrative mechanisms and physical installations that modify or guide human behavior at properties with residual contamination to prevent exposure to residual contamination.



Types of Land Use Controls

- Engineered controls – Physical controls intended to prevent human and ecological exposure to contamination
- Institutional Controls – Legal or administrative instruments intended to minimize the potential for human exposure to contamination by limiting land or resource use
 - Governmental controls
 - Proprietary controls
 - Enforcement and permit tools
 - Informational devices

About Engineered Controls

Engineered Controls are physical measures that:

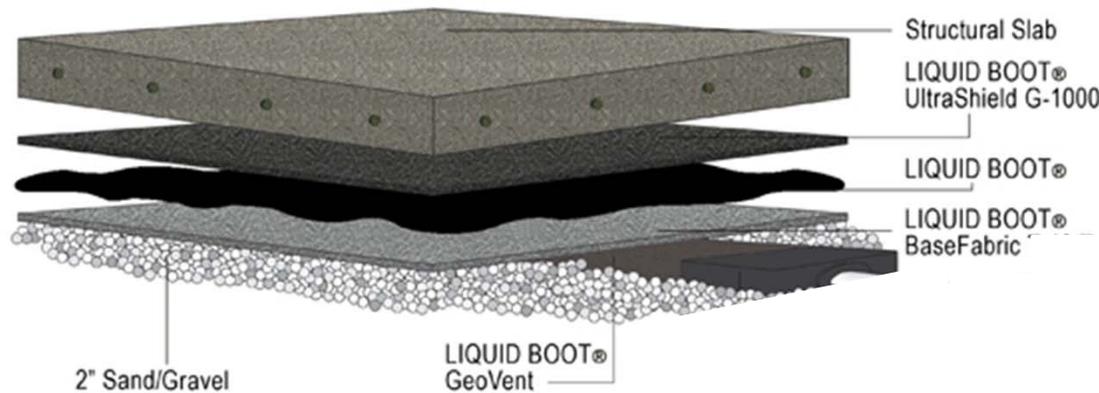
- Limit direct contact
- Reduce contamination levels, or
- Control migration of contaminants

Engineered Controls: Examples

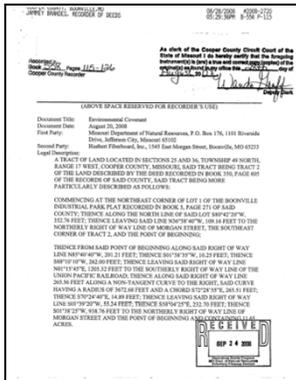
Cap



Vapor Barrier

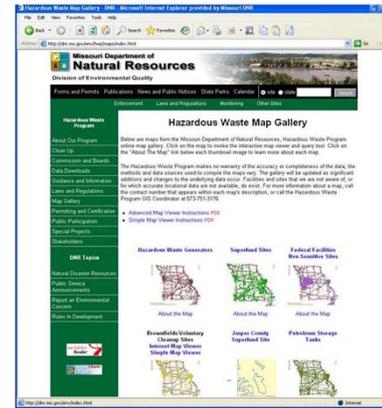


Institutional Controls



- Proprietary controls
 - Environmental Covenants (Restricting land use)

- Informational Devices
 - Tracking Databases



- Governmental controls
 - Local zoning restrictions, building permits, local ordinances

About Risk-Based Remediation



Limited Funds

Risk-based Remediation



More Property
Ready for Reuse

Missouri Environmental Covenants Act

The Missouri Environmental Covenants Act (MoECA), found in the Missouri Revised Statutes at sections 260.1000 to 260.1039, RSMo. and effective January 1, 2008, creates a uniform standard for environmental covenants and directs the Missouri Department of Natural Resources to create a public database of properties with restrictions provided for by this law.

Why is MoECA important?

MoECA ensures the **durability** and **enforceability** of environmental covenants used in risk-based remediation to establish site-appropriate activity and use limitations on current and future land use.



About MoECA Covenants

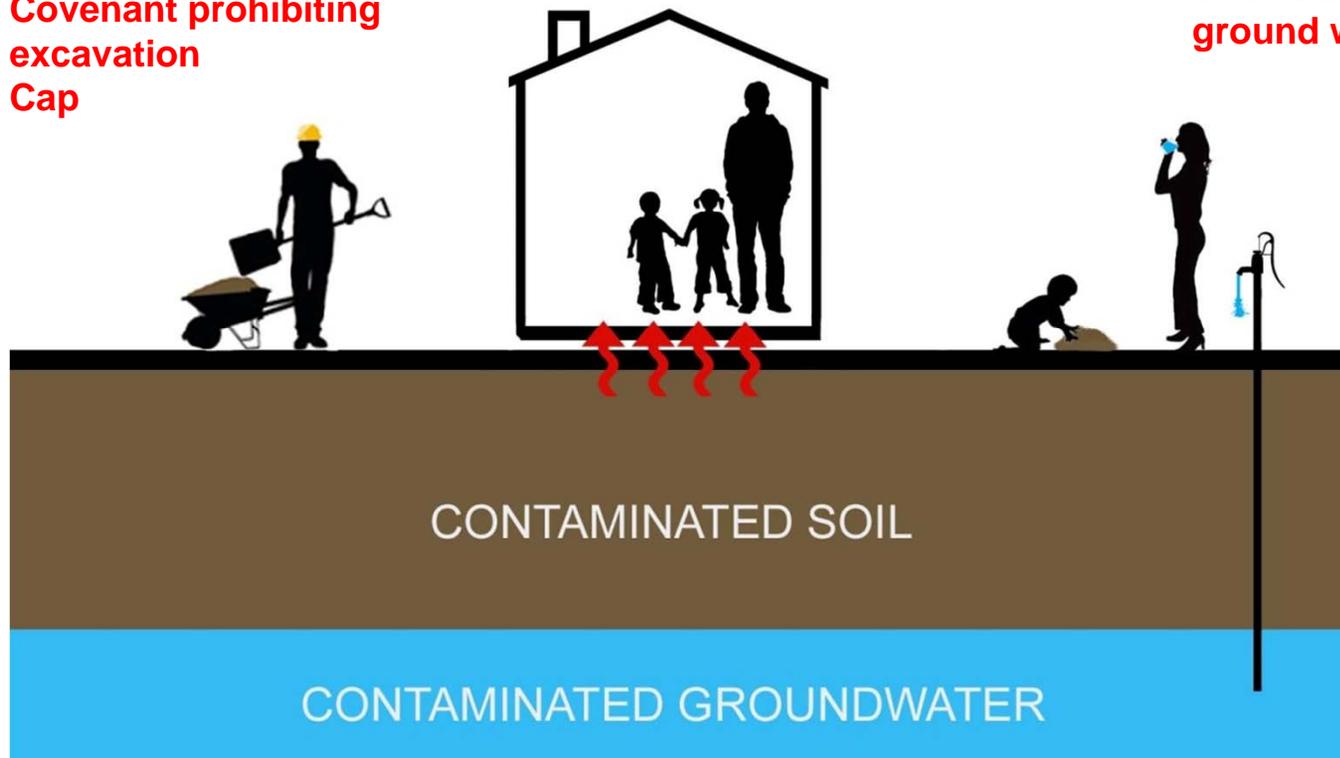
- Environmental covenants describe limitations on future land use and activities at a specific property in order to minimize or eliminate exposure to remaining contamination.
- Covenants are recorded in a property's chain of title.
- Covenants intended to notify prospective buyers of specific AULs due to the environmental condition of the property.
- Covenants clearly explain the condition of the property and the department's involvement in any cleanup or other environmental actions.
- Covenants run with the land.
- Covenants are perpetual unless certain conditions defined by statute allow amendment or termination.

Activity and Use Limitations

- **No Residential Land Use**
- **Restricted Residential Land Use**
- **No Drilling or Use of Groundwater**
- **No Disturbance of Soil**
- **Construction Worker Notice**
- **Engineered Controls for Soil**
- **Engineered Controls for Groundwater**
- **No Construction Worker Exposure to Groundwater**
- **Construction Worker Notice**

Risk Management

- Covenant prohibiting excavation
- Cap
- Vapor barrier or mitigation system required
- Covenant preventing residential use
- Covenant prohibiting ground water use

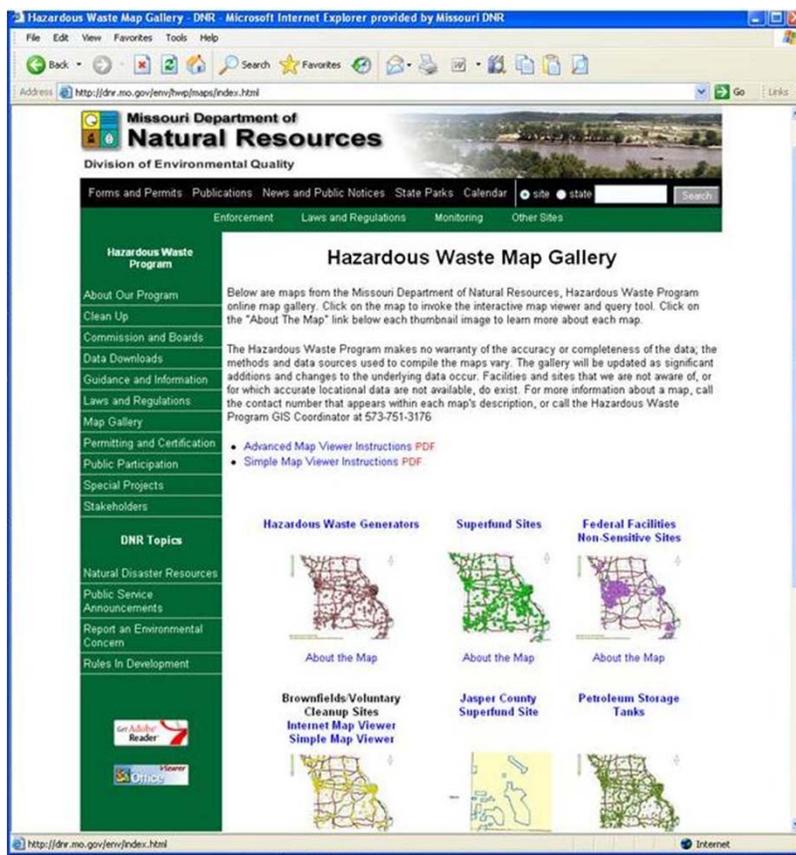


MoECA Provisions: Access to Information

Directs the department to create and maintain a readily accessible database of sites with known contamination and record the creation, amendment, and termination of covenants. The system must distinguish three categories of sites contaminated with hazardous substances:

- Active
- Restricted Use
- Completed with no restrictions

LTS Information Sharing



LTS Example Site: Huebert Brothers



Huebert Brothers

COOPER COUNTY, BOONVILLE, MO
 JAMNEY BRANDES, RECORDER OF DEEDS

08/28/2008 #2008-2720
 03:29:36PM B-558 P-115

As clerk of the Cooper County Circuit Court of the State of Missouri I do hereby certify that the foregoing instrument(s) is (are) a true and correct copy (copies) of the original(s) as found in my office this 28th day of August, 2008.

Recorded in Book 538 Pages 115-126
 Cooper County Recorder

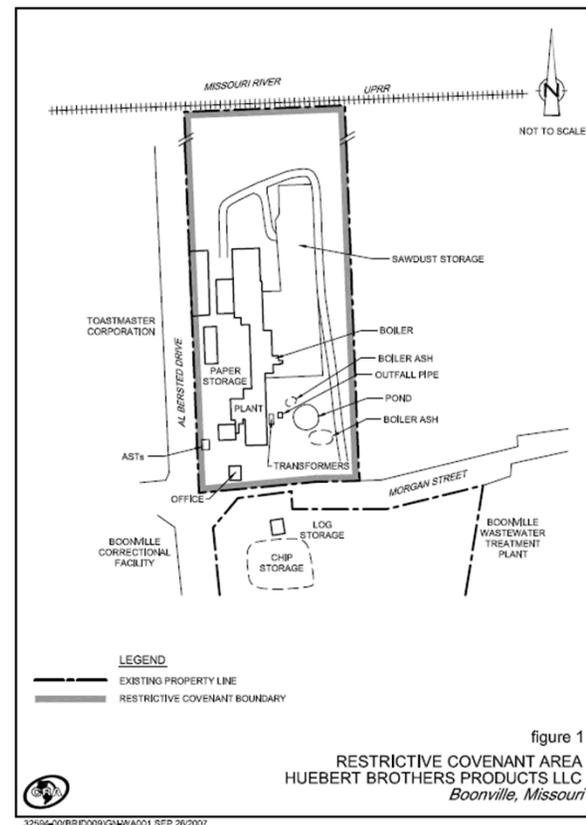
[Signature]
 Deputy Clerk

(ABOVE SPACE RESERVED FOR RECORDER'S USE)

Document Title: Environmental Covenant
 Document Date: August 20, 2008
 First Party: Missouri Department of Natural Resources, P.O. Box 176, 1101 Riverside Drive, Jefferson City, Missouri 65102
 Second Party: Huebert Fiberboard, Inc., 1545 East Morgan Street, Boonville, MO 65233
 Legal Description:
 A TRACT OF LAND LOCATED IN SECTIONS 25 AND 36, TOWNSHIP 49 NORTH, RANGE 17 WEST, COOPER COUNTY, MISSOURI, SAID TRACT BEING TRACT 2 OF THE LAND DESCRIBED BY THE DEED RECORDED IN BOOK 350, PAGE 605 OF THE RECORDS OF SAID COUNTY, SAID TRACT BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:
 COMMENCING AT THE NORTHEAST CORNER OF LOT 1 OF THE BOONVILLE INDUSTRIAL PARK PLAT RECORDED IN BOOK 5, PAGE 271 OF SAID COUNTY; THENCE ALONG THE NORTH LINE OF SAID LOT S89°42'20"W, 352.76 FEET; THENCE LEAVING SAID LINE N36°58'40"W, 109.16 FEET TO THE NORTHERLY RIGHT OF WAY LINE OF MORGAN STREET, THE SOUTHEAST CORNER OF TRACT 2, AND THE POINT OF BEGINNING;
 THENCE FROM SAID POINT OF BEGINNING ALONG SAID RIGHT OF WAY LINE N85°40'40"W, 201.21 FEET; THENCE S01°38'35"W, 10.25 FEET; THENCE S88°10'10"W, 262.00 FEET; THENCE LEAVING SAID RIGHT OF WAY LINE N01°15'45"E, 1205.32 FEET TO THE SOUTHERLY RIGHT OF WAY LINE OF THE UNION PACIFIC RAILROAD; THENCE ALONG SAID RIGHT OF WAY LINE 265.56 FEET ALONG A NON-TANGENT CURVE TO THE RIGHT, SAID CURVE HAVING A RADIUS OF 3672.68 FEET AND A CHORD S72°28'55"E, 265.51 FEET; THENCE S70°24'40"E, 14.89 FEET; THENCE LEAVING SAID RIGHT OF WAY LINE S01°39'20"W, 55.24 FEET; THENCE S58°04'25"E, 232.70 FEET; THENCE S01°38'25"W, 938.76 FEET TO THE NORTHERLY RIGHT OF WAY LINE OF MORGAN STREET AND THE POINT OF BEGINNING AND CONTAINING 11.65 ACRES.

RECEIVED
 SEP 24 2008
 Missouri Department of Natural Resources
 Voluntary Cleanup Section

Restrictive Covenant



Restricted Area

Huebert Brothers



Huebert Brothers Site - 2012 LTS Inspection

LTS Costs to Responsible Parties

The full cost of risk-based remediation must be considered:



- Capital
- Long-term operation of engineered controls, including maintenance and replacement
- Property value
- Potential liability associated with contaminants left in place



LTS Costs to Regulators



Institutional or Programmatic Costs

- Design, implementation and operation of LTS program infrastructure
- Indirect program costs (Directors and financial/administrative staff)
- Direct administrative costs (LTS supervisors)
- Design, implementation and maintenance of a LTS information system to provide information to the public

\$\$



Site Specific Costs

- Design, approval and implementation of site-specific plans (such as Environmental Covenants and Operation & Maintenance plans)
- Audits, monitoring, inspection of LTS sites
- Termination (in the event controls are no longer necessary)
- Enforcement (if controls are not maintained)
- Emergency response measures (should controls fail)
- Revisions of covenant or contingency plans
- Operation & Maintenance oversight
- Responding to inquiries

\$\$

DNR LTS Consolidation

Hazardous Waste Program initiated a LTS consolidation effort in 2012

- Develop LTS budget and staffing plan
- Improve the interactive LTS map
- Promote integration of LTS information into the business processes of utilities and local governments and planning agencies

Summary



- Risk-based remediation allows more sites to be cleaned up by basing cleanup on reasonably anticipated land use and using land use controls
- Land use controls are used to manage risk at sites with residual contamination

Links

MDNR Hazardous Waste Program's Long-Term Stewardship webpage:

<http://dnr.mo.gov/env/hwp/lts.htm>

Missouri Department of Natural Resources MoECA Fact Sheet:

<http://www.dnr.mo.gov/pubs/pub2414.pdf>

ITRC's Introduction to Land Use Control Management Systems:

<http://www.itrcweb.org/Documents/BRNFLD-3.pdf>

Contact:

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Long Term Stewardship Unit
Hazardous Waste Program
(573) 751-1080
hannah.humphrey@dnr.mo.gov

