

Strecker Forest Development Site Human Health Risk Assessment



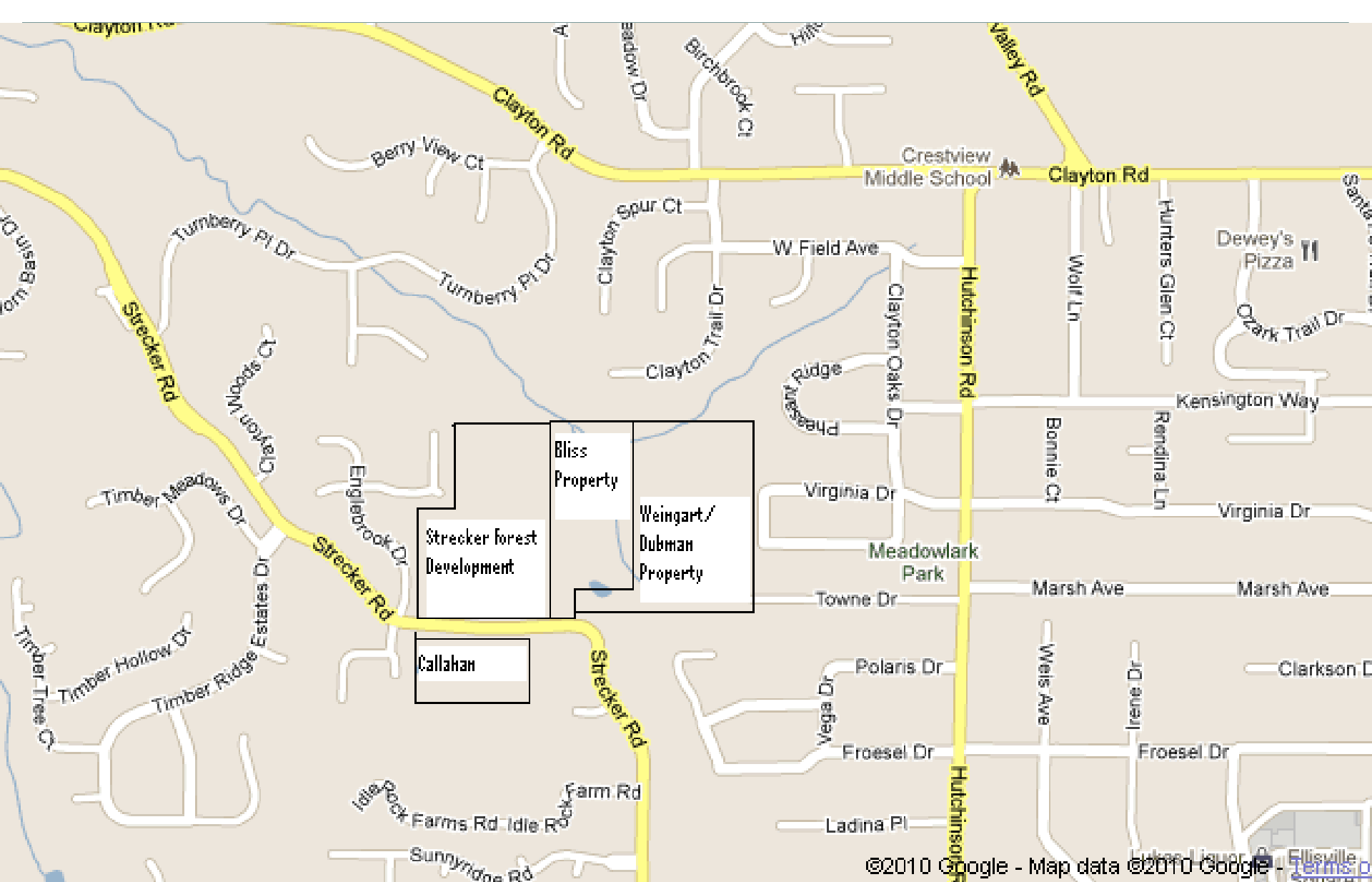
Presentation to
Wildwood City Council
March 14, 2011

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Environmental Stewardship Concepts, LLC
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Henshel EnviroComm

Human Health Risk Assessment History



- City Council action – health concerns
- Previous site assessments
 - Mundell & Associates, Inc.
- Sampling data
- History of contamination
 - Bliss-Ellisville Superfund site
- Risk assessment
- Revisions – following comments
 - EPA, MO, citizens
 - Accepted many EPA recommendations

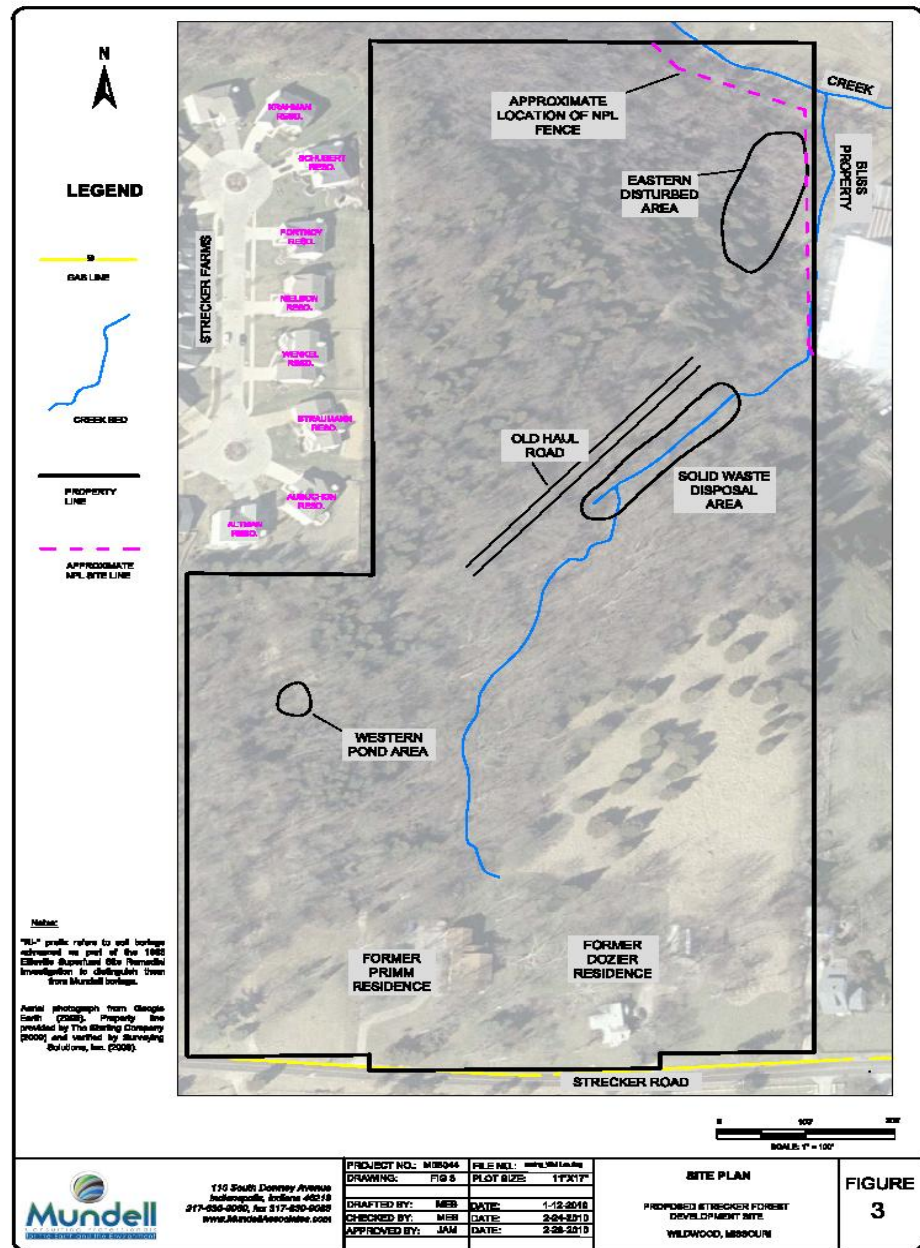


Strecker Forest Development Site and vicinity

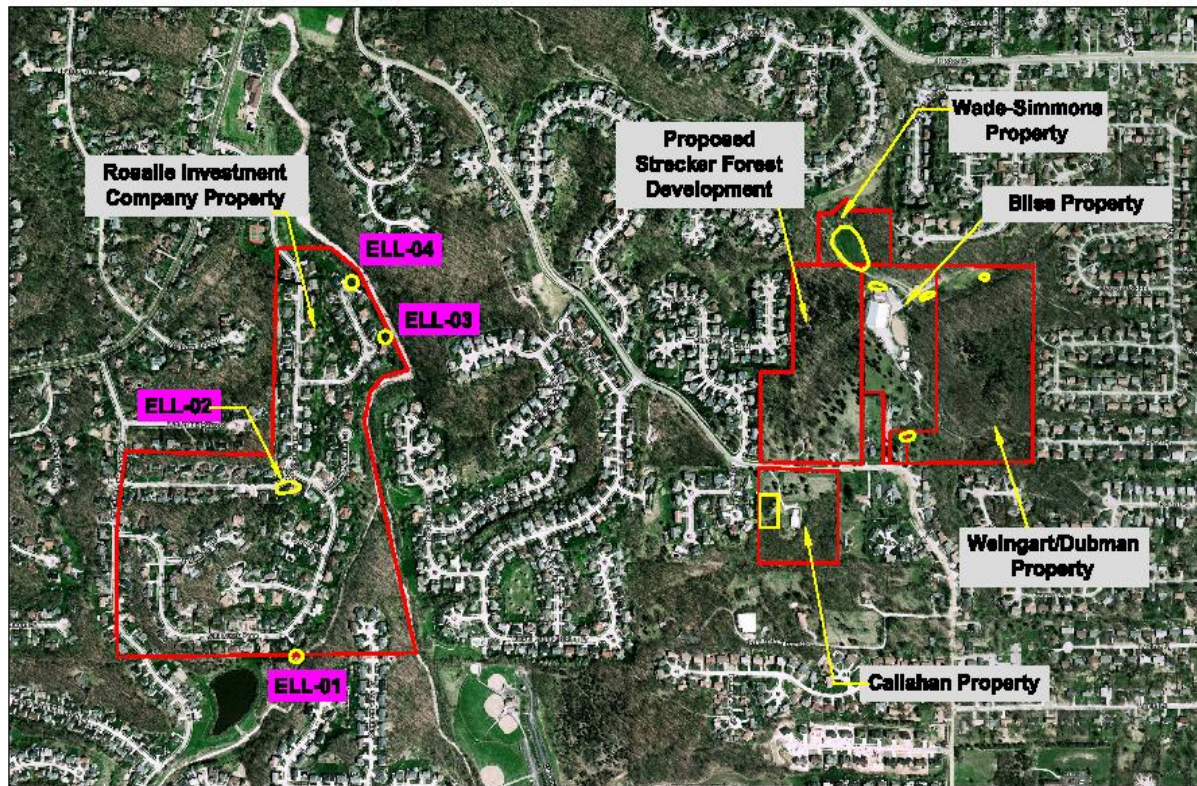
Strecker Forest

Main areas of concern:

- Western Pond Area
- NPL/Eastern Disturbed Area
- Solid Waste Disposal Area



Bliss-Ellisville and Contiguous Properties Superfund Site



- LEGEND**
- APPROXIMATE PROPERTY BOUNDARY
 - WASTE DISPOSAL AND/OR DRUM BURIAL LOCATION
 - ELL-01 1983 ELLISVILLE SUPERFUND SITE REMEDIAL INVESTIGATION SAMPLING AREA

Note:
 Bliss Property and contiguous Properties area depicted drum burial locations are based on Figure 2 map included in EAE 1983 Additional Remedial Investigation report. As shown, only drum burial locations are depicted for these areas.
 Callahan Property drum burial location based on Site Map provided in MDNR 2000 Site Remediation Post Remedial Sampling Report.
 Rosalie Investment Property drum burial locations based on Figure 8 provided in EAE and Veach 1983 Remedial Investigation report.



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PROJECT NO. B0804	FILE NO. Not available
DRAWING: FIG 2	PLOT SIZE: 17X17"
DRAFTED BY: MEB	DATE: 1-12-2010
CHECKED BY: MEB	DATE: 2-24-2010
APPROVED BY: JAM	DATE: 2-28-2010

SURROUNDING AREA MAP
 PROPOSED STRACKER FOREST DEVELOPMENT SITE
 WILDWOOD, MISSOURI

FIGURE
 2

Bliss-Ellisville Superfund Site



- Bliss Waste Oil Company – 1970s
- Placed on NPL (Bliss & contiguous properties, Callahan, Rosalie) – 1983
- Contiguous properties – 1986
 - Dubman and Weingart property
 - Primm property (Proposed Strecker Forest Development Site)
 - Wade and Mercantile Trust Company property
 - Russell, Evelyn, and Jerry Bliss property
 - EPA reports that spraying, dumping, and burying of drums occurred on these properties
- Amended cleanup remedy – 1991
- Cleanup done “construction completed” – 1997

Major elements of HHRA revision



- Conversion factor for exposure estimates revised
- Clarifying text and documentation
 - EPA position on dioxin
 - Karst
- Technical editing language and references
- Agencies recommended other values
 - Revise calculations
- Response to Comments section
- Next Steps list

State Soil Cleanup Levels for Dioxin



- The cleanup levels for dioxin provided by the EPA are “guidance levels”
- The EPA’s draft Interim Proposed Remediation Goal for Dioxin is 72 ppt for residential properties
- Health risks from dioxin caused some states/territories to adopt standards far lower than 1,000 ppt
- The following table is adapted from the U.S. EPA’s 2009 Review of State Soil Cleanup Levels for Dioxin

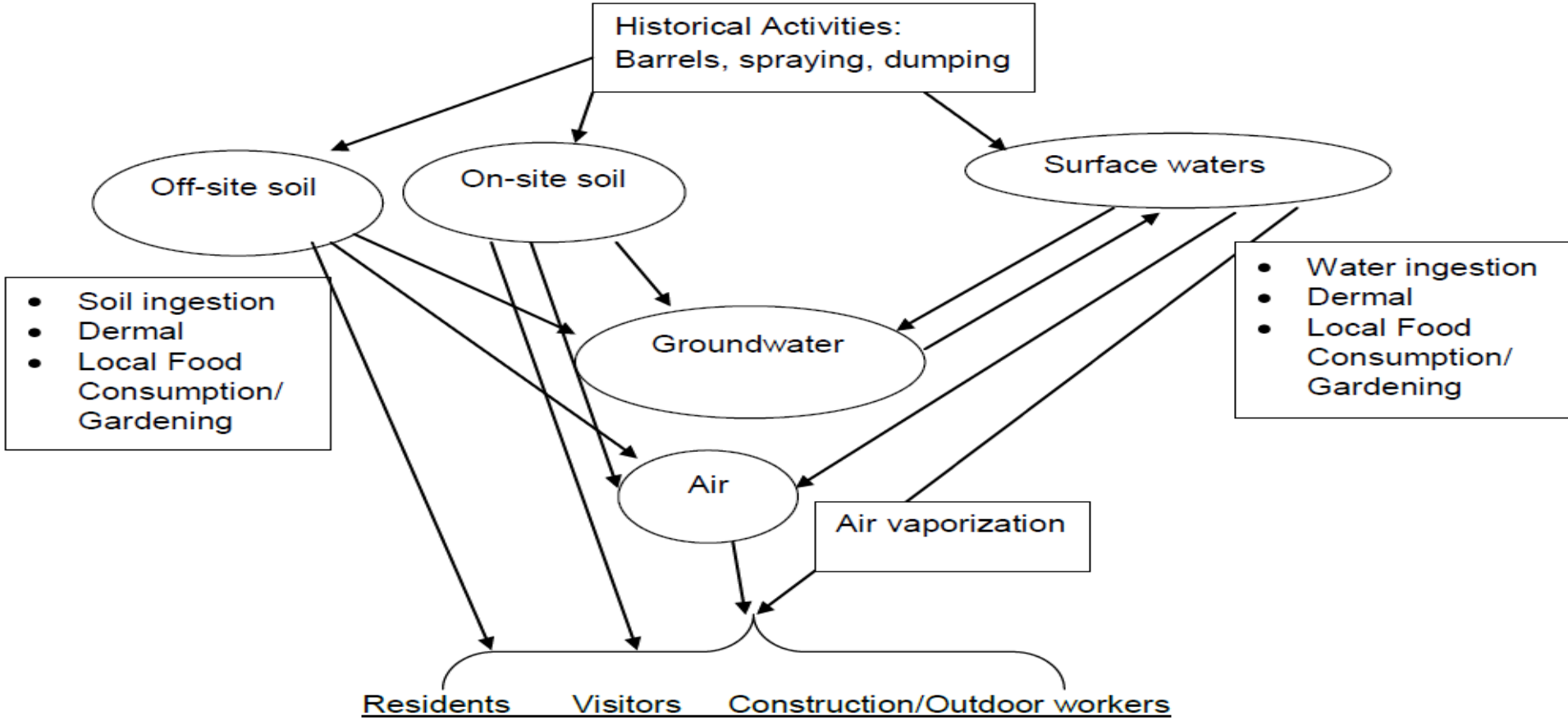
State Soil Cleanup Levels for Dioxin

State	Soil Dioxin Cleanup Level (ppt)	Year
Georgia	8	1992
Delaware	4	1999
Pennsylvania	120	2001
Mississippi	4.26	2002
Florida	7*	2005
Michigan	90*	2006
Arizona	4.5	2007
Kansas	60	2007
New Hampshire	9	2008
Alaska	38	2008
American Samoa	450*	2008
Guam	450*	2008
Hawaii	390*	2008
Nevada	3.9	2008
NMI	450*	2008
Iowa	19	2009
Indiana	60	2009
Maryland	4.5	2009
Maine	10*	2009
Minnesota	20*	2009
Ohio	35.8*	2009
Oregon	4.5	2009
Washington	11	2009
Wyoming	4.5	2009

EPA
NCEA,
2009

*Basis is
for TEQ
instead
of
TCDD

Conceptual Site Model



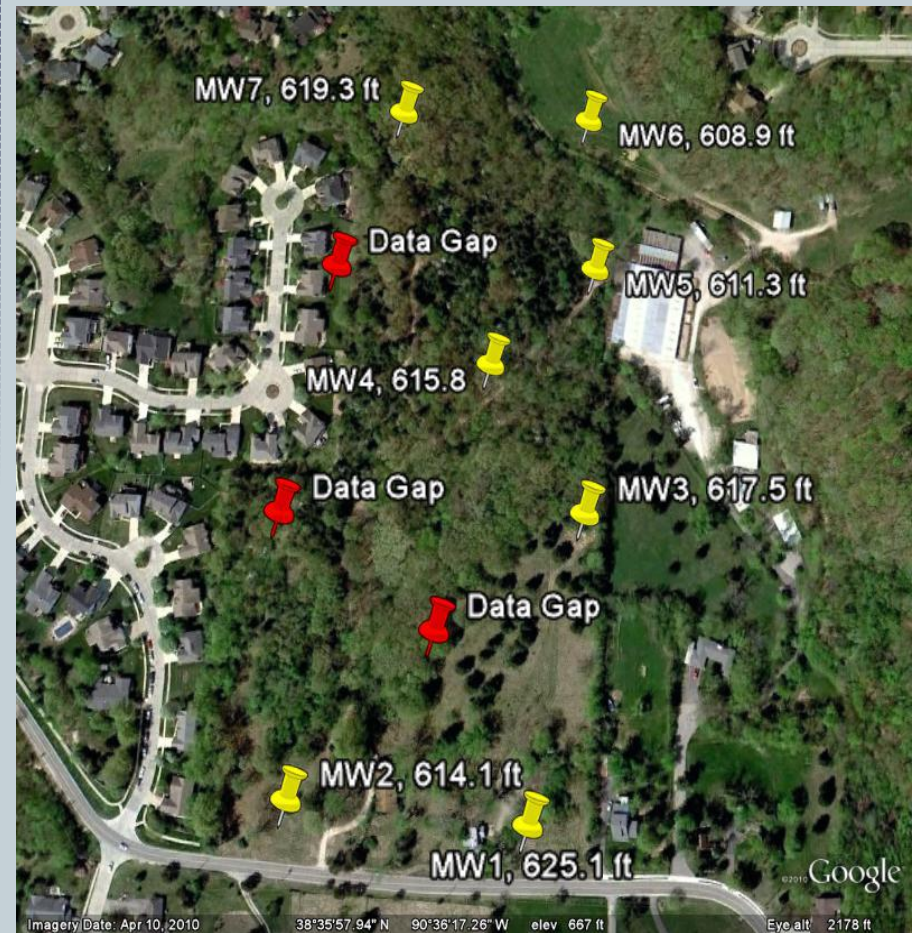
- Soil ingestion
- Dermal
- Local Food Consumption/ Gardening

- Water ingestion
- Dermal
- Local Food Consumption/ Gardening

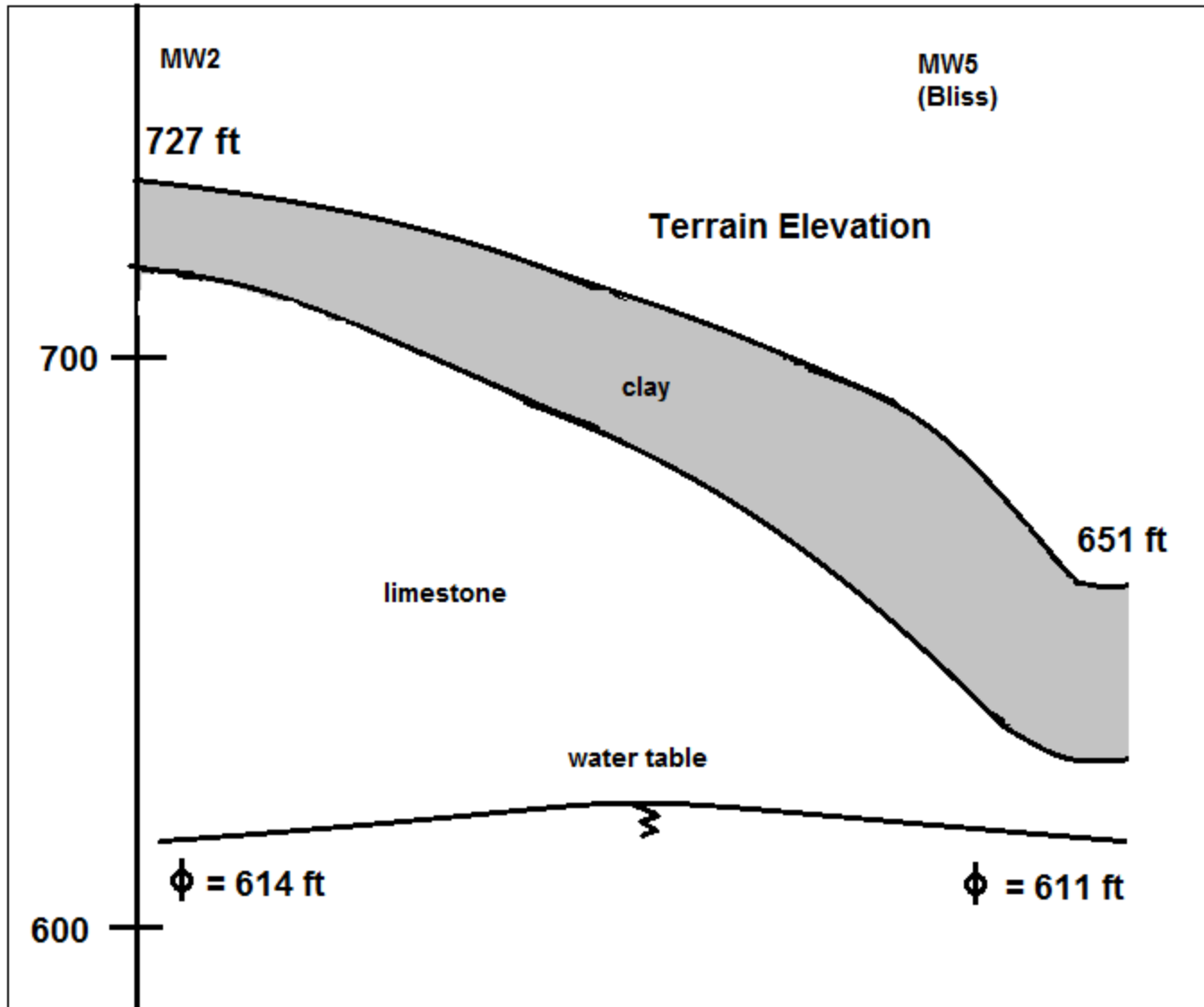
	Residents		Visitors	Construction/Outdoor workers	
	Children	Adults	Children	Adults	Adults
Soil ingestion	x		x		x
Vapor inhalation	x		x		x
Dermal exposure	x		x		x
Water ingestion		x		x	
Local Food Consumption		x		x	

Source: Groundwater

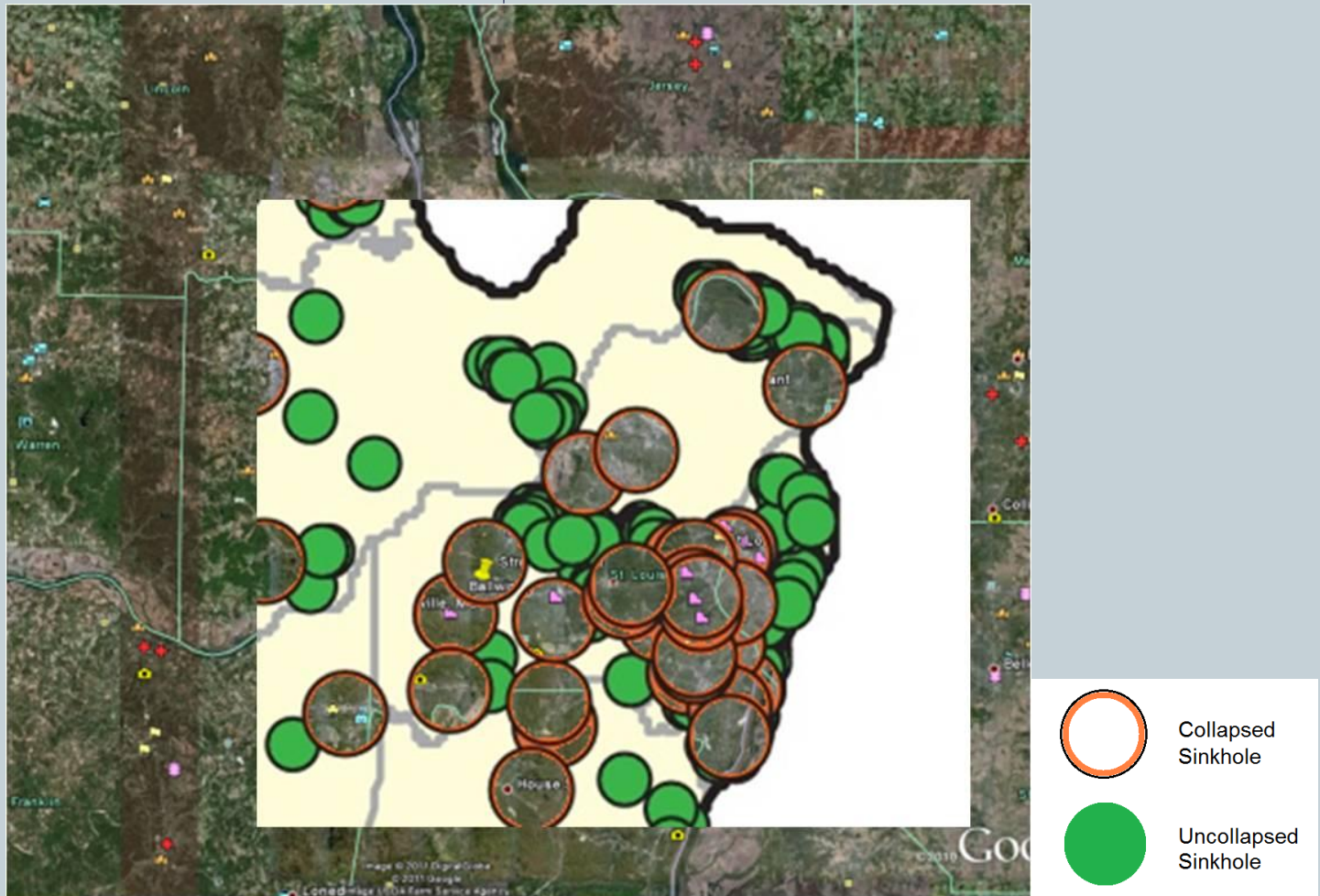
- Karst aquifer
- Movement through conduits
- Variable water table levels
- Highly variable
- Potential contaminant movement from Bliss & Callahan properties
- Lack of information
 - Monitoring well locations
 - Seasonal data



Terrain Elevation vs. Water Table Levels



Sinkholes in the area of the Strecker Forest Development Site



Yellow pin indicates Strecker Forest Site; source is USGS

Soil



- Soil concentration levels measured in dioxin TEQ
- Clustered around pond, ravine, Bliss property
- Data gaps – northwest and southern areas
- Extrapolation of dioxin TEQ for areas without data using a kriging method
- Heterogeneity of the area exaggerated
- Fate of contaminants
 - Enter groundwater
 - Spread by runoff

Soil Measurement Data Gaps

Identification of data gaps (outlined in blue) that prevented accurate interpolation in the Northwestern and Southern portions of the Strecker Forest region.

Data Gaps (outlined in blue)

Legend

Dioxin TEQ

TEQ

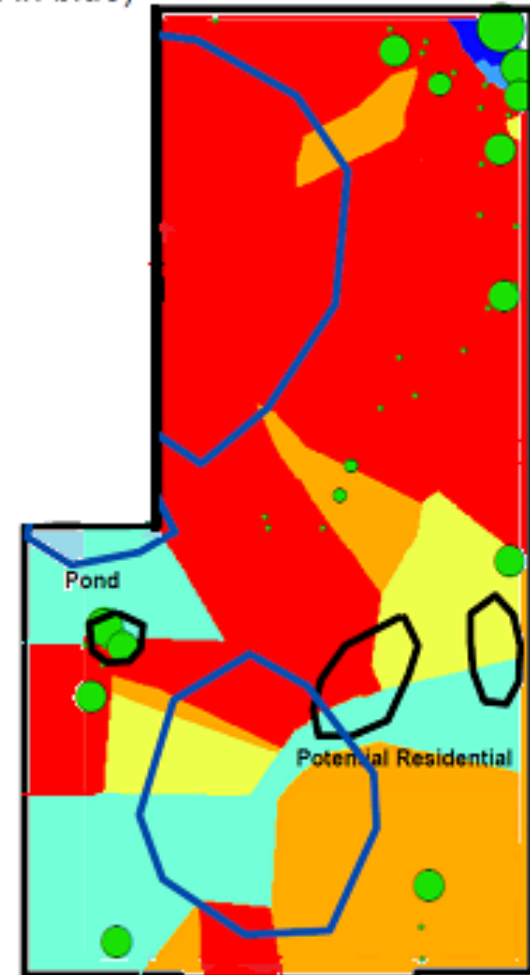
- 0.06 - 4.00
- 4.01 - 4.50
- 4.51 - 5.00
- 5.01 - 20.00
- 20.01 - 400.00
- 400.01 - 6527.20

Kriging

TEQ

- 0.06 - 4
- 4.01 - 4.5
- 4.51 - 5
- 5.01 - 20
- 20.01 - 400
- 400.01 - 6527.20

TEQ in ppt



0 380 760 1,520 Feet



Sample Soil Extrapolation for the Site

Linear kriging interpolation of TEQ levels at Strecker Forest. Interpolation was based on all points within a 1000 ft distance (data from Mundell & Associates, Inc. 2010).

Linear Kriging of TEQ (maximum conduit transport)

Legend

Dioxin TEQ

TEQ

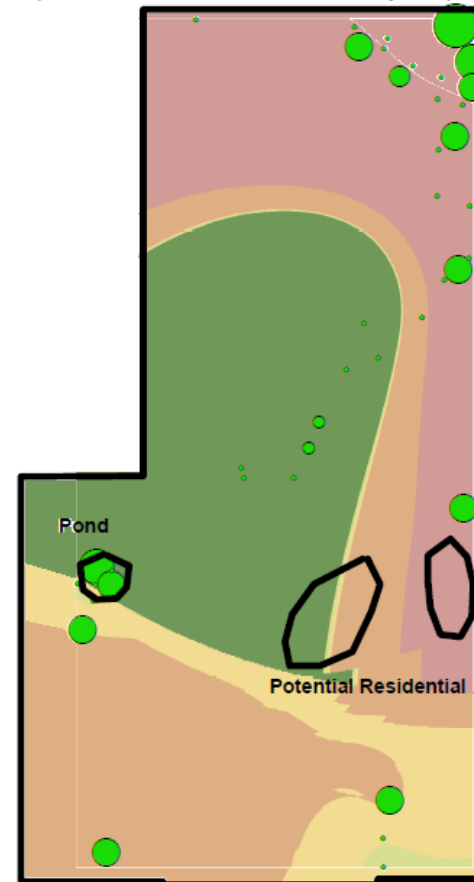
- 0.06 - 4.00
- 4.01 - 4.50
- 4.51 - 5.00
- 5.01 - 20.00
- 20.01 - 400.00
- 400.01 - 6527.20

Linear Interpolation

TEQ max

- 0-4
- 4-4.5
- 4.5-5
- 5-20
- 20-400
- 400-6527.2

TEQ in ppt



0 380 760 1,520 Feet



Surface Water



- Intermittent stream
- Observed flooding in ravine
- TEQ estimation:
 - Scenario: three months of heaviest average precipitation
 - Water table levels rise
 - ✦ Connects groundwater to outflow of flooded ravine
- Contaminants attach to sediment spread by streamflow leaving the ravine

Risk Characterization



- Risk posed by a given chemical to people (receptor) in a given exposure pathway
- Carcinogenic risk
 - ✦ = Chronic daily intake x Cancer slope factor
- Noncarcinogenic hazard
 - ✦ Expressed as the hazard quotient (HQ)
 - ✦ Oral = Chronic daily intake / Reference dose
 - ✦ Inhalation = CDI / Reference concentration
- Total risk = Sum all the pathway specific risks

Findings



- Partial characterization of site contamination
- VOCs, metals and pesticides didn't receive attention
- Dioxin levels below 1000 ppt left in place- some higher
- Data gaps
- Three ways people may be exposed to contaminants:
 - Inhaling vapors or dust
 - Consuming water or soil
 - Absorbing contaminants across skin
- Groundwater contamination by VOCs are above background or regulatory drinking water standards

Summary of Response to General Comments

- ESC/HE revised calculations as needed: cancer risks still exceed benchmark values
- Concerns about the karst characterization addressed and ESC/HE further documented- EPA and other publications indicate karst geology
- Overall, assumptions required because of the limited sampling data and data gaps that ESC/HE was contracted to work with
 - ✦ Assumptions are an essential part of the Risk Assessment Process
- Assumptions and possible scenarios in HHRA provide a protective approach for the well-being of the future residents of the Strecker Forest Development site

Critical information



- Soil contaminants at depth
- Dioxin in groundwater
- Karst
- No data on heavy metals or pesticides
- VOCs in groundwater not natural occurring

Conclusions



- Some risk estimates exceed cancer of 1 in a million
- Groundwater contamination varies greatly due to karst geology
 - Even uphill contamination can move in multiple directions
- Vapor intrusion from VOCs possible in future or neighboring residences
- People may be exposed in several ways, resulting in appreciable risk, especially for resident children
- Not enough data to conclude that risks are low

Recommendations

- Potential or actual risks at the site are sufficient to warrant further investigation
 - Soil and groundwater sampling across the site, by season for groundwater and streams
- The site should be secured
 - Restrict access to site: fence, signage
 - Kids should not explore this area nor area directly north until characterized and remediated
- Structures on site:
 - Not safe to “demolish,” need to assess hazardous materials before dismantling and disposal
- Notification of neighboring residences
- Superfund: reopen

Next steps and Questions



- Publish on web and send response to comments
- Bound copies of report to City Administrator





Risk Assessment 101



- Estimates the harmful potential effects of chemicals within an environment on the human population
- Four parts:
 - Site Characterization/Hazard Identification
 - ✦ Health hazards associated with chemicals
 - Exposure Assessment
 - ✦ Different modes of contact with chemicals
 - Dose-Response Assessment
 - ✦ Chemical dose/human health response
 - Risk Characterization
 - ✦ Total chemical effects on exposed population

Hazard Identification



- Chemical made contaminate of concern list if:
 - Detectable
 - Above risk-based target levels
 - Available information:
 - ✦ Reference dose (RfD)
 - ✦ Reference concentration (RfC)
 - ✦ Cancer slope factor
- COCs include: dioxins, furans, PCBs; VOCs and SVOCs; metals

Chemicals Found above Detection Limits



Bromomethane
Methylene chloride
Toluene
Trichlorofluoromethane
Tetrachloroethene
Benzene
Ethylbenzene
Naphthalene
Sec-butylbenzene
1,2,4-trichlorobenzene
1,2,4-trimethylbenzene
1,2-dichlorobenzene
1,3,5-trimethylbenzene
Isopropylbenzene
m-xylene & p-xylene
n-butylbenzene
n-propylbenzene
o-xylene
p-isopropyltoluene
Bis(2-ethylhexyl)phthalate
di-n-octyl phthalate
2,4,5-trichlorophenol
2-methylphenol
4-methylphenol
Acenaphthene
Benzo(a)pyrene
Benzo(b)fluoranthene

Benzo(ghi)perylene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Naphthalene
Phenanthrene
Phenol
Pyrene
Trichlorotrifluoroethane
Toluene
Xylenes (m&p)
2-Methylnaphthalene
2-Methylphenol
3-Nitroaniline
4-Nitroaniline
Benzoic Acid
Naphthalene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2,4-Trimethylbenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
2-Butanone (MEK)

2-Hexanone
4-Methyl-2-pentanone (MIBK)
acetone
Benzene
carbon disulfide
cis-1,2-dichloroethene
Dichlorodifluoromethane
Ethylbenzene
Isopropylbenzene
n-Butylbenzene
n-Propylbenzene
o-Xylene
p-isopropyltoluene
Tetrachloroethene
Total Xylenes
trans-1,2-Dichloroethene
Trichloroethene
Vinyl Chloride
Arsenic
Barium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver
Dioxins, Furans, PCBs

Dioxins, Furans, PCBs

Similar structures



http://www.foxriverwatch.com/dioxins_pcb_pcbs_1.html

- dissolve in fats and oils
- almost insoluble in water
- “lock and key” mechanism
- Toxic Equivalency (TEQ)
- 2,3,7,8 TCDD = 1.0

Similar effects

- Cancer
- Reproductive impairments
- Birth defects
- Developmental disorders
- Problems with:
 - Cardiovascular
 - Immune
 - Thyroid
 - Digestive
 - Skin

VOCs and SVOCs

Characteristics

- Solvents and oils
- Gasoline compounds
- Vaporize easily
- Natural and man-made sources
- Water solubility varies
- Found in site groundwater and soil

Health Effects

- Mild
 - Headaches
 - Nausea
 - Skin, eye, nose, throat irritation
- Severe
 - Loss of coordination
 - Organ damage
 - Death

Metals

In site groundwater

Above EPA's MCL:

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead

Health effects

- Skin irritation
- Kidney damage
- Neurological damage
- Developmental damage
- Cancer
- Death

Exposure Assessment

Populations (receptors)

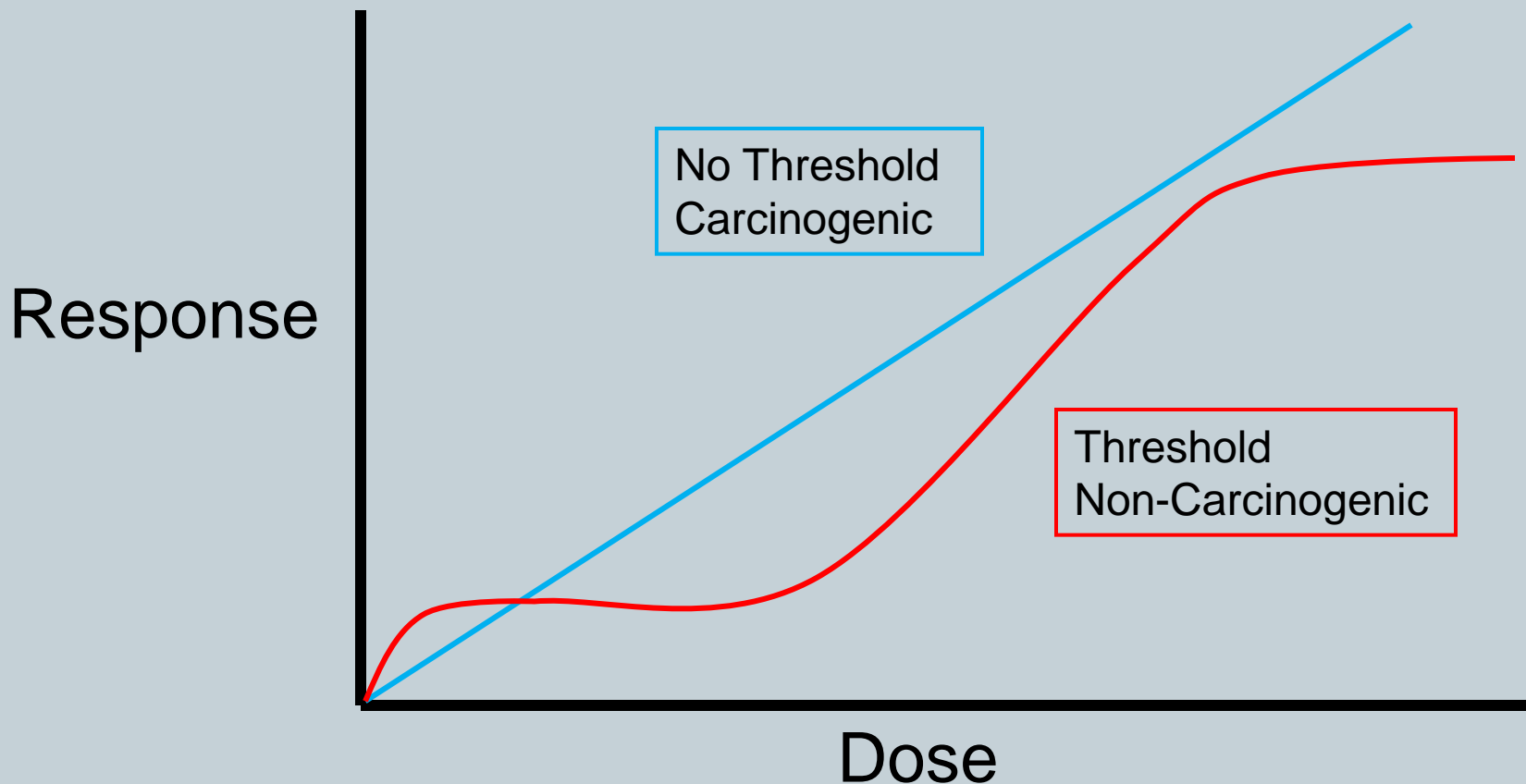
- Residential
 - Adult
 - Child
- Visitor
 - Adult
 - Child
- Outdoor worker
 - Adult

Exposure pathways

- Soil ingestion
- Vapor inhalation
- Water ingestion
- Vegetable gardening
- Dermal Contact

Dose-Response Assessment

- Leads to appropriate equations to help determine total risk



Historical Activities on Strecker Site

Metal Barrels



Creek Bed

