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BOZEMAN LANDFILL SOIL GAS STUDY

Neighborhood Meeting

August 27, 2013

WELCOME AND INTRODUCTIONS

- WELCOME
- Mayor Sean Becker

- PUBLIC WORKS DIRECTOR
- Craig Woolard

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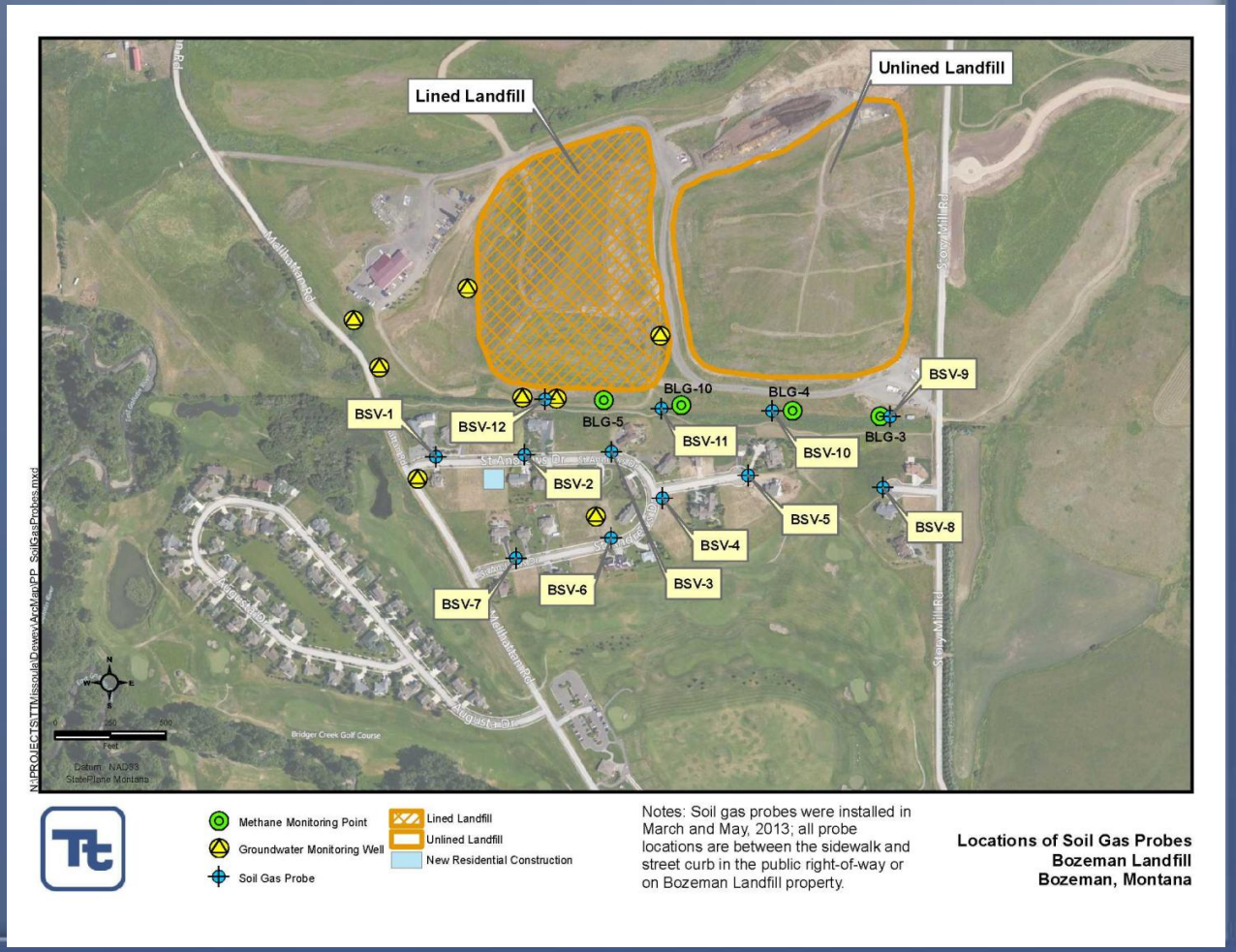
LOCATION AND HISTORY OF LANDFILLS

- LOCATION OF LANDFILL
- HISTORY OF OPERATION



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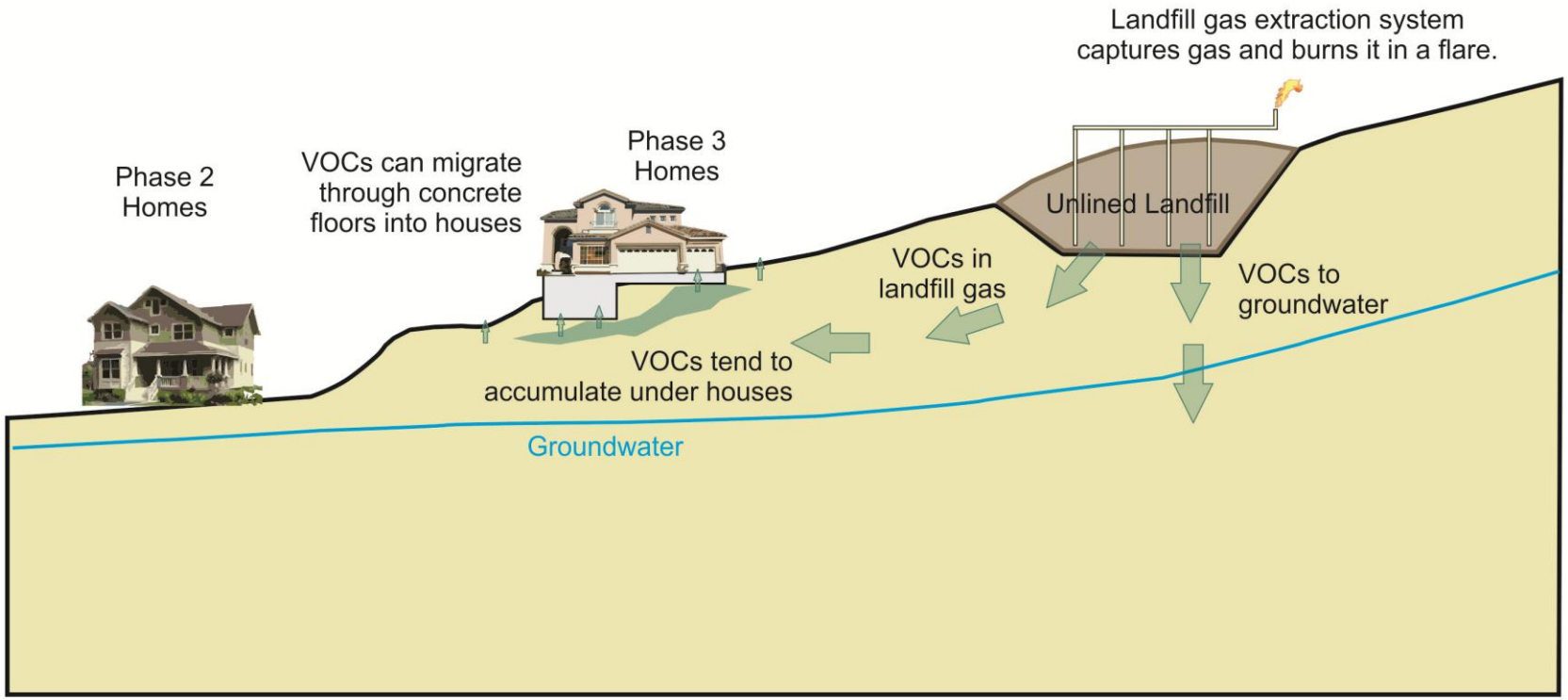
GROUNDWATER AND METHANE MONITORING AT BOZEMAN LANDFILL



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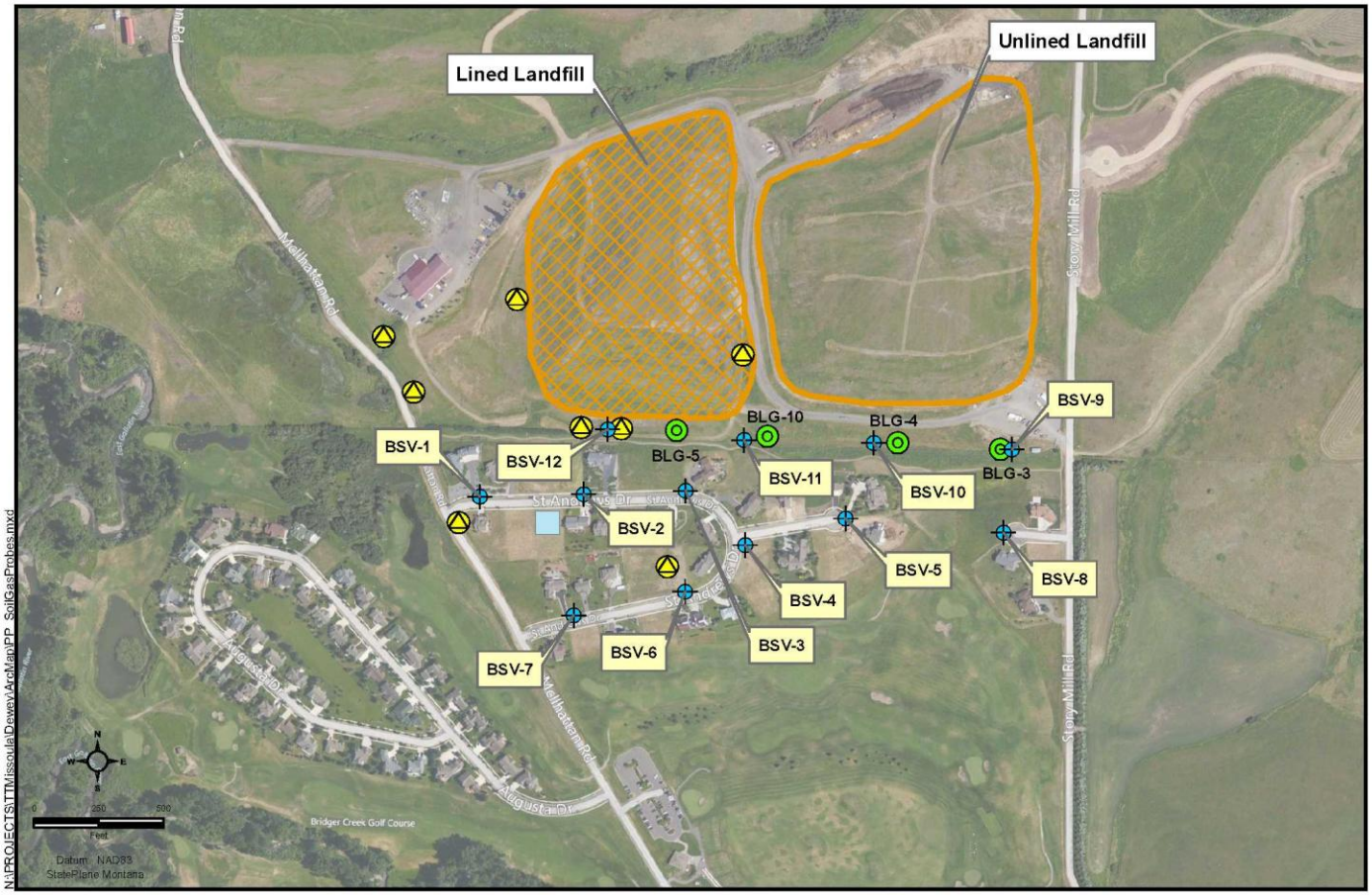
SOIL GAS STUDY AT BOZEMAN LANDFILL



Methane Monitoring Point
Groundwater Monitoring Well
Soil Gas Probe
Lined Landfill
Unlined Landfill
New Residential Construction

Notes: Soil gas probes were installed in March and May, 2013; all probe locations are between the sidewalk and street curb in the public right-of-way or on Bozeman Landfill property.

Locations of Soil Gas Probes
Bozeman Landfill
Bozeman, Montana

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WHAT HAS THE CITY DONE SINCE LAST PUBLIC MEETING?

- CONDUCTED INDOOR AIR SAMPLING IN 25 OF 26 HOMES IN BRIDGER CREEK PHASE 3
- PRODUCED LETTER REPORTS FOR EACH HOMEOWNER
- MET WITH 10(?) HOMEOWNERS TO DISCUSS RESULTS
- MEETINGS ARE ONGOING
- CONDUCTED SUBSLAB SAMPLING OF EIGHT HOMES
- INITIATED DESIGN OF MITIGATION SYSTEMS FOR FOUR HOMES
- STARTED SELECTION PROCESS FOR RADON MITIGATION CONTRACTORS

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In-home concentrations of VOCs

Compound	Range of Concentrations in indoor air from Phase 3 Homes (µg/m3)
Benzene	0.14 - 34
Carbon Tetrachloride	0.31 - 0.84
Chloroform (Trichloromethane)	0.05 - 18
1,2-Dichloroethane (Ethylene Dichloride)	.042 - 7.3*
1,4-Dioxane (Dioxane)	0.18 - 12
Ethylbenzene	0.3 - 30
Tetrachloroethene	0.02 - 15
Trichloroethene	0.01 - 3.1
1,2,4-Trimethylbenzene	0.26 - 52
m,p-Xylene	0.08 - 140
Vinyl Chloride	0.007 - 0.25

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In-home concentrations of VOCs

Compound	Range of Concentrations in indoor air from Phase 3 Homes (µg/m3)	EPA RSL[(a)] (µg/m^3)
Benzene	0.14 - 34	0.31
Carbon Tetrachloride	0.31 - 0.84	0.406
Chloroform (Trichloromethane)	0.05 - 18	0.11
1,2-Dichloroethane (Ethylene Dichloride)	.042 - 7.3*	0.094
1,4-Dioxane (Dioxane)	0.18 - 12	0.316
Ethylbenzene	0.3 - 30	0.97
Tetrachloroethene	0.02 - 15	9.4
Trichloroethene	0.01 - 3.1	0.43
1,2,4-Trimethylbenzene	0.26 - 52	7.3
m,p-Xylene	0.08 - 140	104
Vinyl Chloride	0.007 - 0.25	0.16

In-home concentrations of VOCs

Compound	Range of Concentrations in indoor air from Phase 3 Homes (µg/m3)	EPA RSL[a] (µg/m^3)	Average Concentration in Montana Homes[b] (µg/m^3)
Benzene	0.14 - 34	0.31	1.3
Carbon Tetrachloride	0.31 - 0.84	0.406	-
Chloroform (Trichloromethane)	0.05 - 18	0.11	-
1,2-Dichloroethane (Ethylene Dichloride)	.042 - 7.3*	0.094	0.23
1,4-Dioxane (Dioxane)	0.18 - 12	0.316	-
Ethylbenzene	0.3 - 30	0.97	1.1
Tetrachloroethene	0.02 - 15	9.4	0.14
Trichloroethene	0.01 - 3.1	0.43	-
1,2,4-Trimethylbenzene	0.26 - 52	7.3	-
m,p-Xylene	0.08 - 140	104	3.6
Vinyl Chloride	0.007 - 0.25	0.16	-

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Sources of VOCs in Indoor Air

- Fuels stored in garage
- Paints and solvents
- Smoking
- Carpets and cabinets
- Dry cleaned clothes or draperies
- Pesticides
- Cooking

In-home concentrations of VOCs

Compound	Range of Concentrations in indoor air from Phase 3 Homes (µg/m3)	EPA RSL[(a)] (µg/m^3)	Average Concentration in Montana Homes[(b)] (µg/m^3)	Occupational Exposure Levels (OSHA or ACGIH)[(c,d)] (µg/m^3)
Benzene	0.14 - 34	0.31	1.3	31,943[c]
Carbon Tetrachloride	0.31 - 0.84	0.406	-	62,904[c]
Chloroform (Trichloromethane)	0.05 - 18	0.11	-	240,000[c]
1,2-Dichloroethane (Ethylene Dichloride)	.042 - 7.3*	0.094	0.23	202,454[c]
1,4-Dioxane (Dioxane)	0.18 - 12	0.316	-	360,327[c]
Ethylbenzene	0.3 - 30	0.97	1.1	100,000[c]
Tetrachloroethene	0.02 - 15	9.4	0.14	678,119[c]
Trichloroethene	0.01 - 3.1	0.43	-	537,423[c]
1,2,4-Trimethylbenzene	0.26 - 52	7.3	-	123,000[c]
m,p-Xylene	0.08 - 140	104	3.6	435,000[d]
Vinyl Chloride	0.007 - 0.25	0.16	-	2,600[c]

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SUBSLAB SAMPLING

- VOCs ACCUMULATE UNDER HOMES
- SUBSLAB SAMPLING ENTAILS DRILLING A HOLE IN YOUR FLOOR AND INSTALLING A SAMPLING PORT THAT ALLOWS GAS ACCUMULATED BELOW SLAB TO BE COLLECTED
- THIS DATA IS COMPARED WITH INDOOR AIR SAMPLES TO HELP US CONFIRM WHAT IS COMING FROM LANDFILL GAS AND WHAT MIGHT BE COMING FROM INSIDE THE HOME.
- SUBSLAB DATA HELPS US DESIGN AND MONITOR THE PERFORMANCE OF MITIGATION SYSTEMS
- CITY STARTED SUBSLAB SAMPLING OF HOMES IN PHASE 3 ON AUGUST 21ST AND IS OFFERING THIS SAMPLING TO ALL RESIDENTS IN PHASE 3.
  - IF YOU HAVE NOT ALREADY SCHEDULED SUBSLAB SAMPLING PLEASE CONTACT RICK HIXSON.

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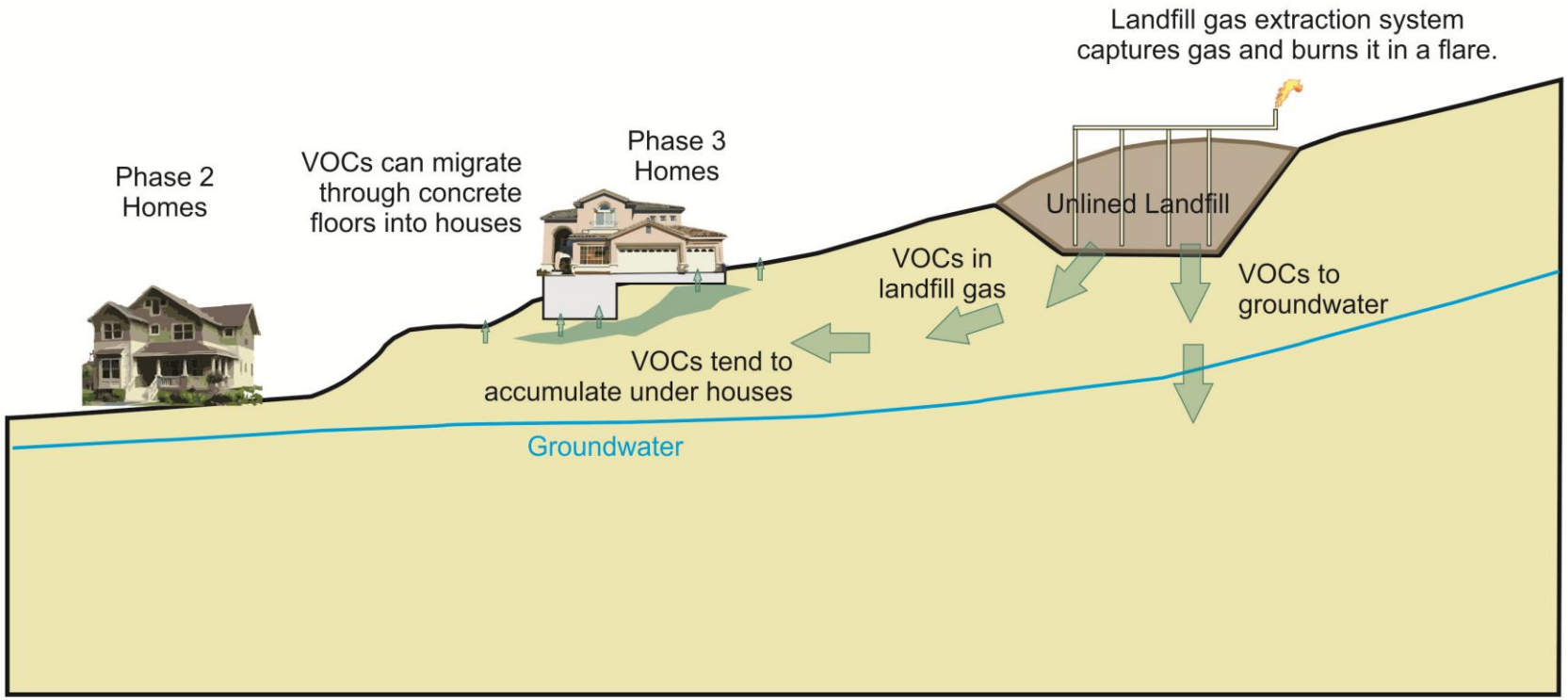
CONCEPTUAL MODEL SHOWING ACCUMULATION UNDER HOMES



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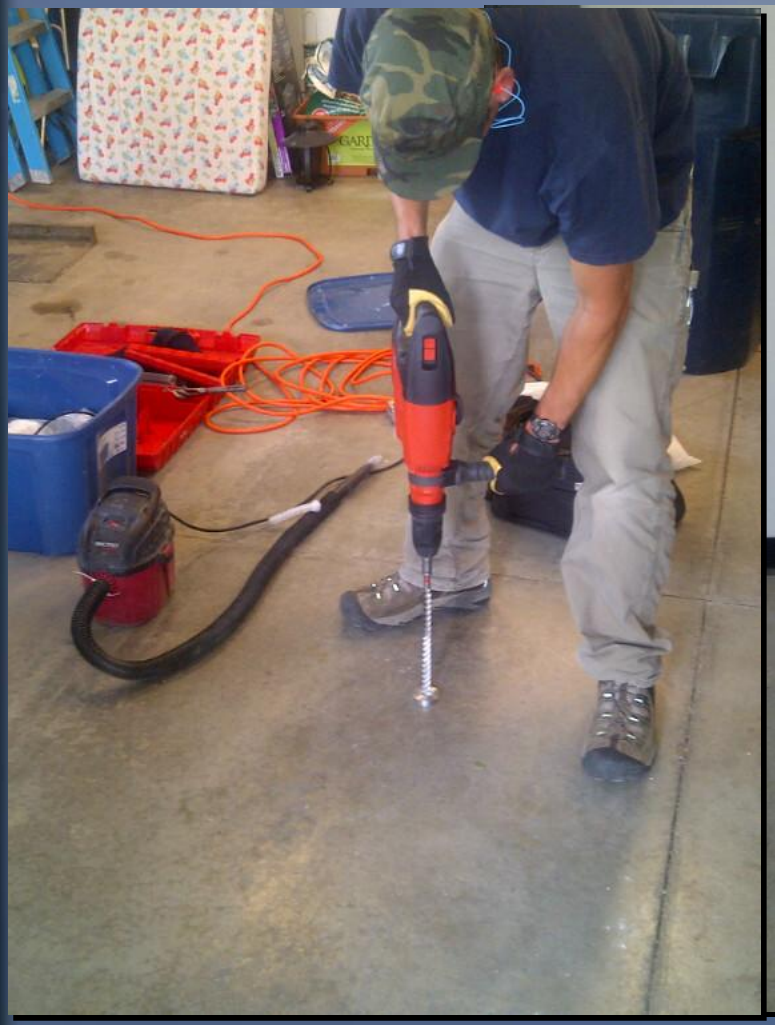
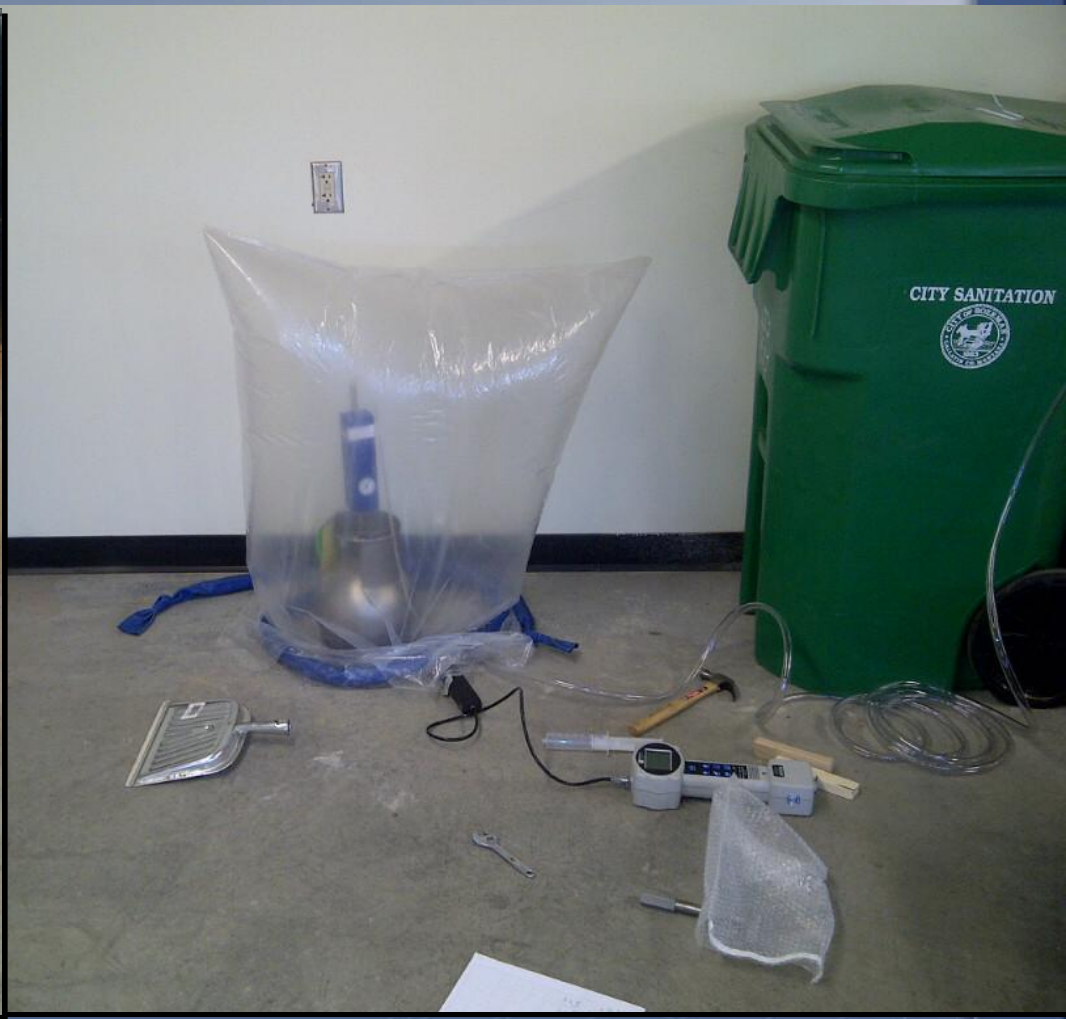
PHOTOS OF SUBSLAB SAMPLING





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MITIGATION STATUS

- INSPECTED FIVE HOMES TO DATE TO COLLECT INFORMATION FOR MITIGATION DESIGN.
- FURTHER INSPECTIONS AND MITIGATION INSTALLATION PLANNED STARTING IN SEPTEMBER BASED ON SAMPLE RESULTS
- WHERE LANDFILL GAS AFFECTS INDOOR AIR QUALITY ABOVE RSLs THE CITY WILL PAY TO INSTALL MITIGATION SYSTEMS
- WORKING WITH LOCAL RADON MITIGATION COMPANIES TO INSTALL MITIGATION SYSTEMS

MITIGATION PROCEDURE

- MITIGATION ENTAILS PULLING SOIL GAS FROM BENEATH YOUR FOUNDATION TO FORM A LOW PRESSURE (VACUUM) BARRIER AND VENTING TO THE OUTSIDE AIR.
  - Similar to radon gas mitigation systems, but will be engineered to ensure coverage under the slab and may have more extraction points
  - Vapor monitoring points (VMPs) installed during subslab sampling will be used to verify barrier extent
  - Existing radon systems will be tested and expanded as needed to prevent soil gas from entering house
- WILL SAMPLE AIR IN HOMES AFTER SYSTEM IS RUNNING AND CHECK VACUUM AT VMPs

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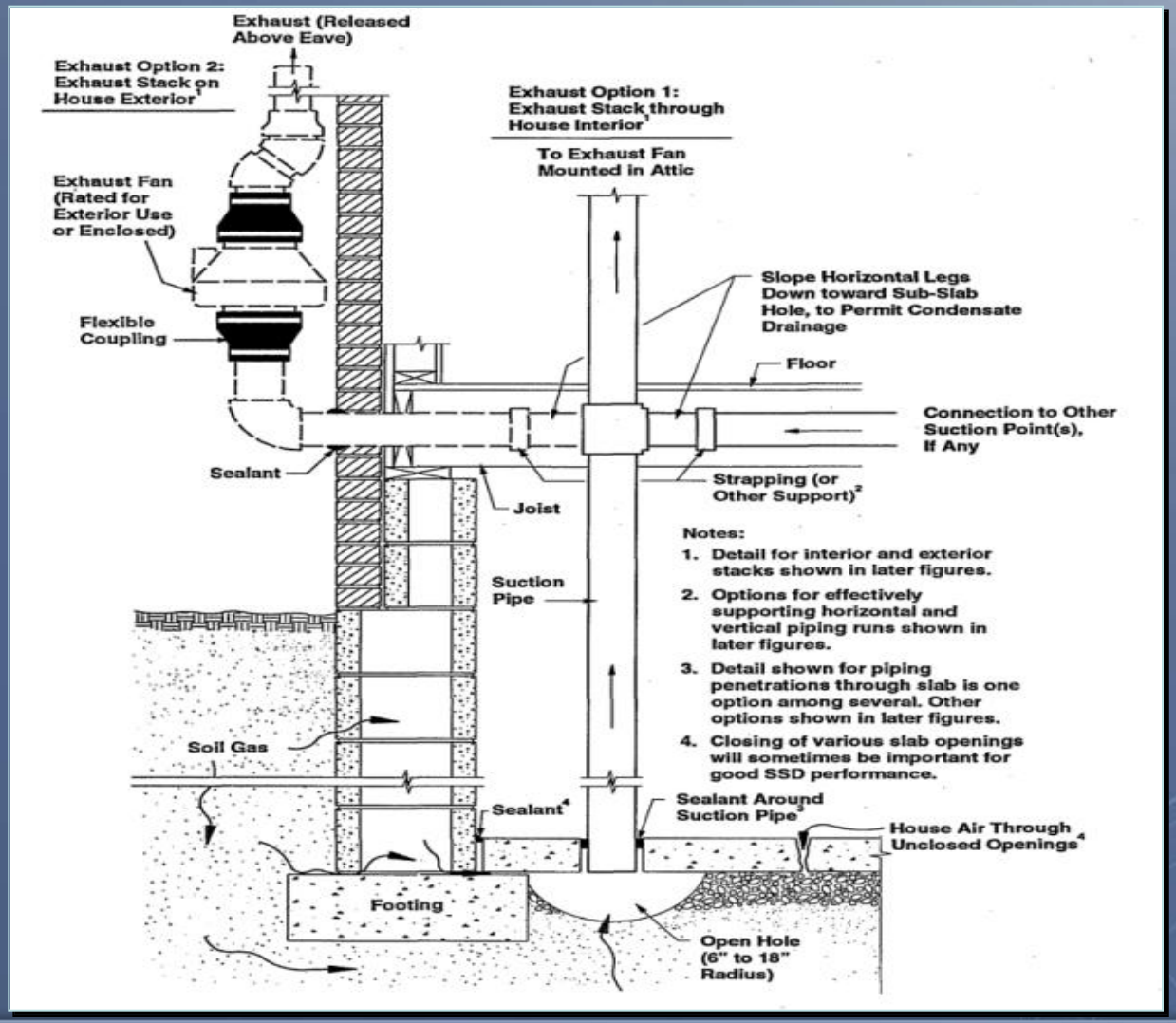
Mitigation System (Sub-Slab Depressurization) Schematic



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EXTERIOR FAN & PIPE

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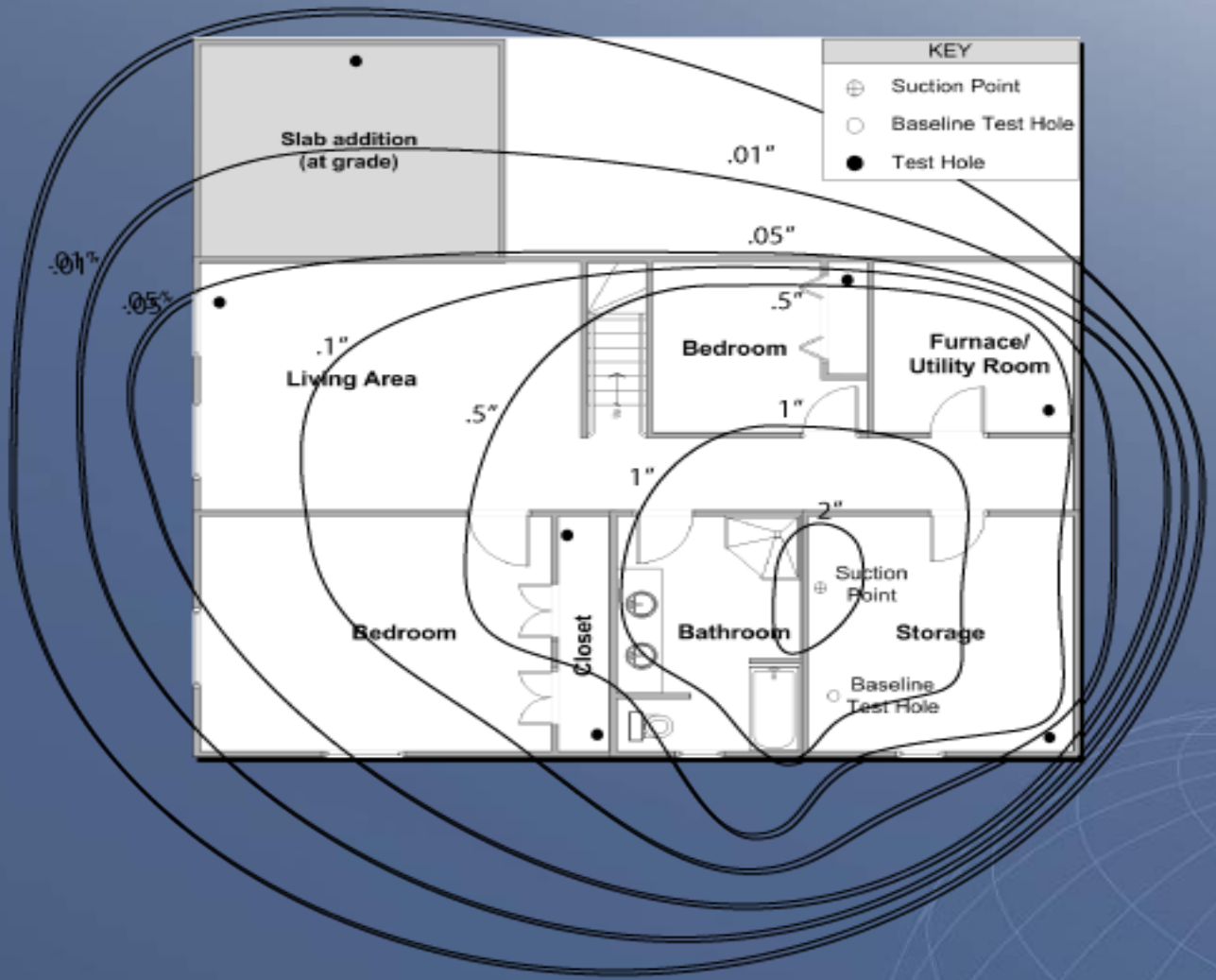
Low Pressure (Vacuum) Barrier to Gas Migration into Indoor Air (Also Known as Sub-Slab Depressurization)



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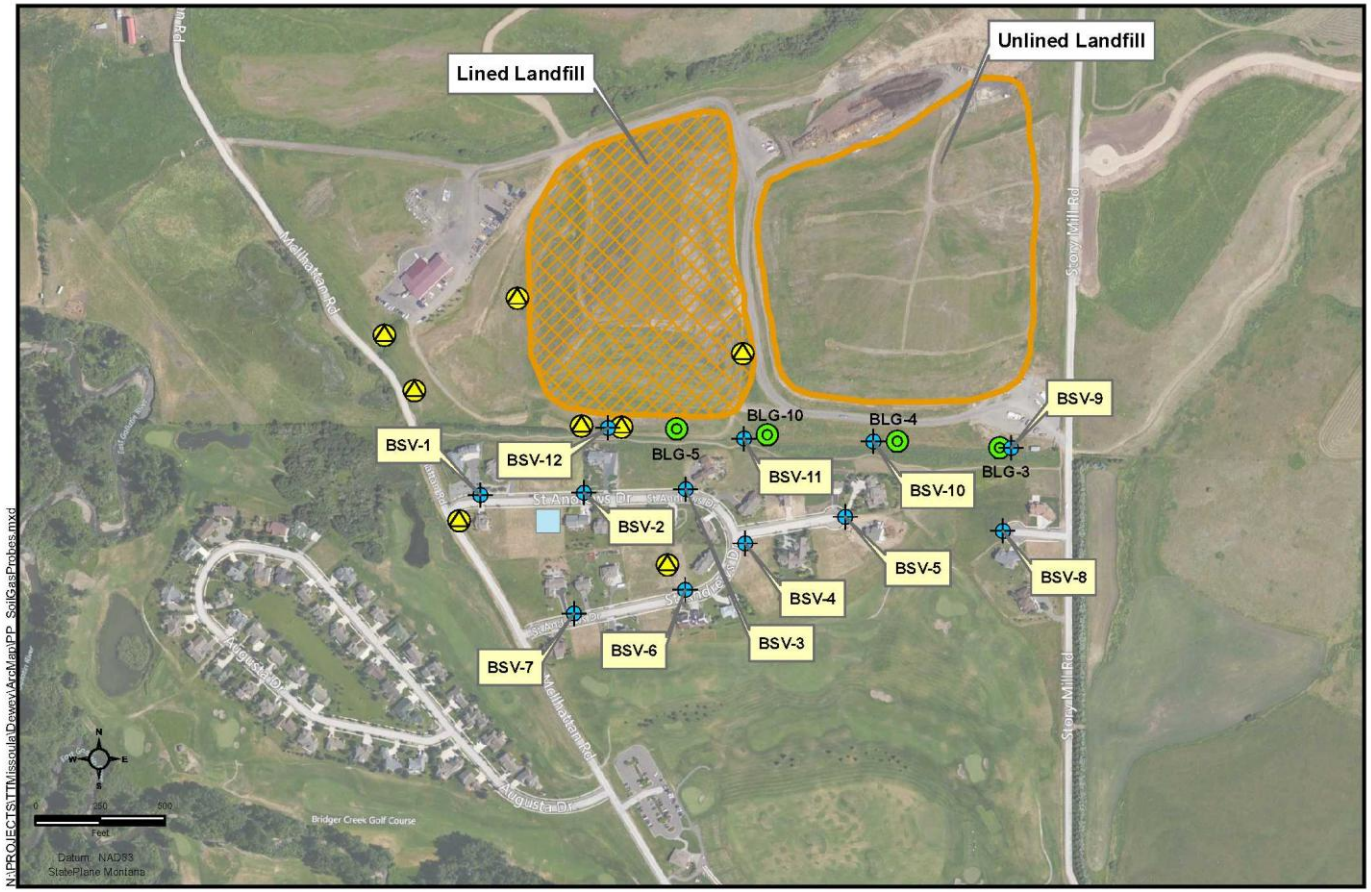
WHAT IS NEXT?
GEOGRAPHIC EXPANSION OF INVESTIGATION



Notes: Soil gas probes were installed in March and May, 2013; all probe locations are between the sidewalk and street curb in the public right-of-way or on Bozeman Landfill property.

Locations of Soil Gas Probes
Bozeman Landfill
Bozeman, Montana

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SOURCE REMEDIATION

- ULTIMATE OBJECTIVE IS TO CONTROL OR ELIMINATE THE SOURCE OF VOCs ON THE LANDFILL PROPERTY.
- CITY WILL INSTALL MORE PROBES AND GROUNDWATER MONITORING WELLS ON LANDFILL PROPERTY.
- THIS WILL SUPPORT THE DESIGN OF A REMEDIATION SYSTEM TO CONTAIN LANDFILL GASSES ON THE LANDFILL PROPERTY

SCHEDULE

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WRAP UP AND QUESTIONS

MAYOR SEAN BECKER

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