

1,4-DIOXANE

Case Study, Eastham Landfill

Eastham, Massachusetts

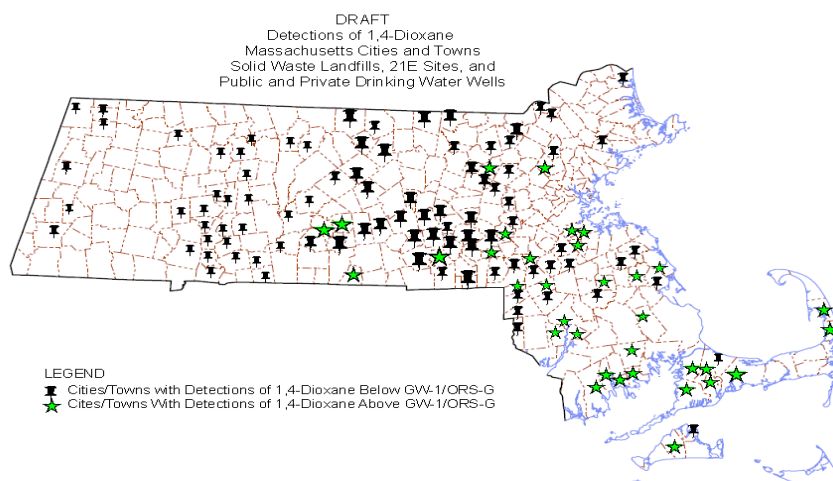
Northeast Waste Management Officials
Association Seminar
September 2015

Paul Locke, MassDEP
Gerard Martin, MassDEP
Angela Gallagher, MassDEP



MassDEP 1,4-Dioxane Case Study

Occurrence of 1,4-D in Groundwater in Massachusetts



Source: UCMR3 Data, MassDEP Site File Viewer, MassDEP Solid Waste Files

THIS DATA IS FOR REFERENCE ONLY; THIS DATA IS NOT INTENDED TO BE USED FOR DECISION MAKING.

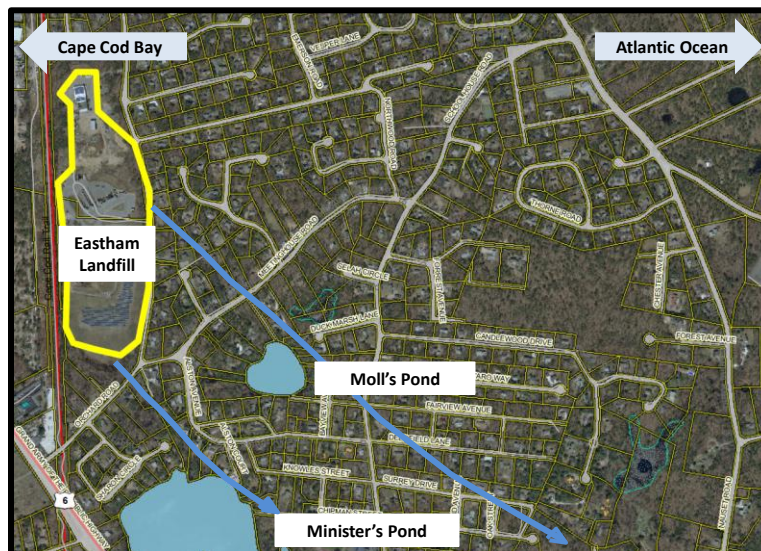
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Site Location



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Background Information



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Geology/Contaminant Profile

- Site Hydrogeology
 - Depth to groundwater at 45 feet
 - Outwash aquifer consisting of stratified sand and gravel to 60 feet
 - Sandy till with silt and clay to 150
 - Sand and blue at depths greater than 150
- Shallower groundwater high iron and nitrates
- Groundwater at greater depths found to contain VOCs in past
 - Vinyl chloride in the groundwater migrating from the landfill travelled in the deeper portion of the outwash aquifer and at greater distances than landfill leachate indicator parameters



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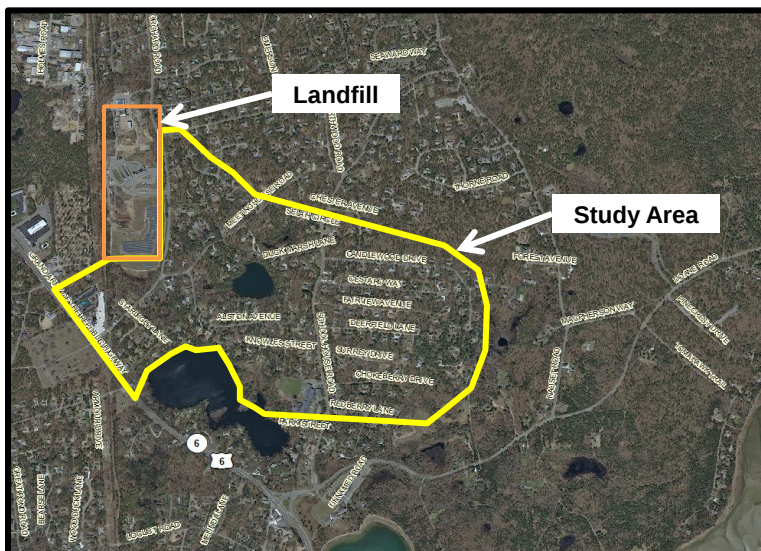
Immediate Response Action (IRA)

- November 2012 through January 2013
 - Landfill Sampling event indicated groundwater from MW-3D contained 1,4-D >3.0 µg/L near a private water supply well
 - Sampled residential private wells immediately downgradient of Landfill
 - 1.7 µg/L 1,4-D in sample from private well
 - Provided bottled water
 - Expanded private water supply well sampling
 - Three properties provided bottled water
 - MassDEP issues Conditional Approval of written IRA Plan with requirement to submit quarterly Status reports and continue private water supply wells sampling
 - Town of Eastham has samples analyzed with a < 0.3 µg/L detection limit to meet ORS-Guideline



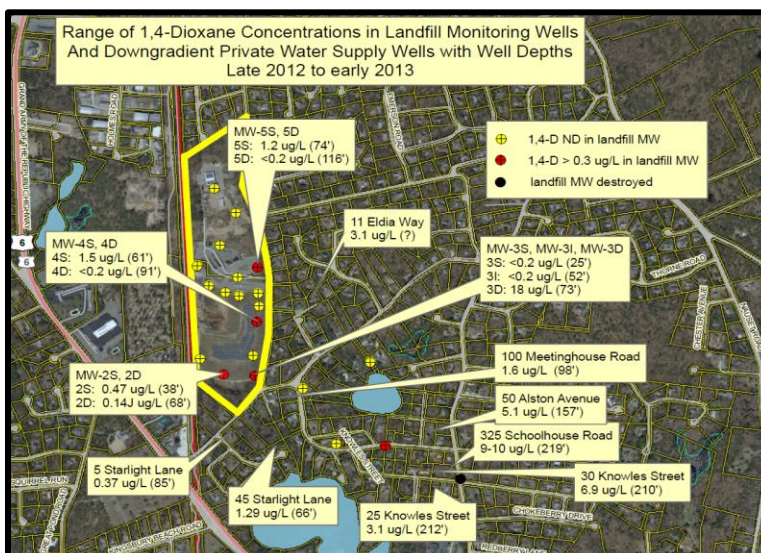
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Approximate Study Area



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Preliminary Analytical Results



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MassDEP, EPA and BU Partnering

- EPA Personnel
 - Provided four personnel from Chelmsford lab to conduct sampling of private water supply wells (analyses paid for by Town) in April/May 2013
- MassDEP personnel assisted
 - Provided risk communication assistance
 - Door to door visits to gain access
 - Provided information to owners regarding “what to expect”, “next steps”, “how to read analytical data”
- BU Superfund Research Project Personnel
 - Provided additional risk communication

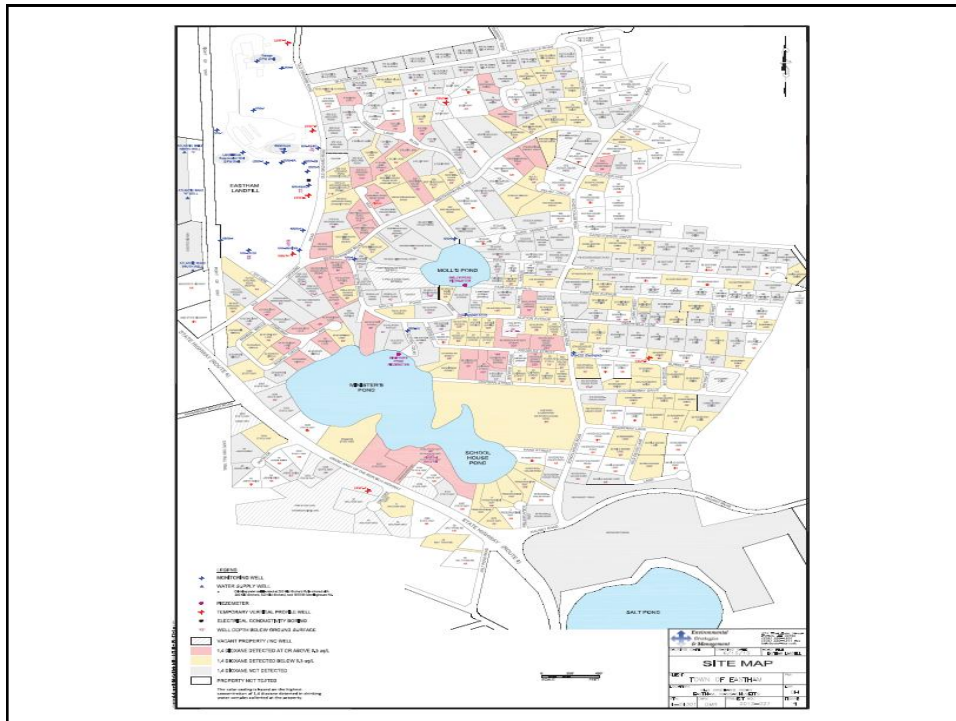


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Large-Scale Sampling Program

- March 2013 (1st IRA Status report)
 - 8 properties (6 residential private wells) with 1,4-dioxane > 0.3 µg/L
 - Approximately 20 additional private wells with detections of 1,4-dioxane < 0.3 µg/L
- June 2015 (10th and latest IRA Status report)
 - A total of 293 private wells tested in the landfill study area
 - 42 properties (38 private wells) with 1,4-Dioxane > 0.3 µg/L
 - 108 additional private wells with detections of 1,4-dioxane < 0.3 µg/L
 - 143 private wells with 1,4-dioxane not detected
 - Selected private wells were sampled outside of the study area for background purposes
 - 1,4-dioxane detected in samples from some of those wells, but below 0.3 µg/L





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Granulated Activated Carbon (GAC) Pilot Test

- GAC point-of-entry treatment system installed at one residence
 - 110 pounds of acid washed, coconut based, 12x40 virgin GAC in two vessels
 - Sample valves to collect influent, midpoint, and effluent water samples
 - Flow meter to determine volume treated
- Samples were collected weekly to evaluate breakthrough at first carbon vessel
 - Influent concentration ranged between 1.3 to 2.2 µg/L
- Carbon change-out at 90 days
 - Secondary GAC unit is moved to the primary location
 - Removed primary and replaced with virgin carbon
 - Total volume of water before breakthrough appears to be approximately 10,000 gallons
 - Carbon treatment system adsorbed approximately 73 mg of 1,4-dioxane



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Advanced Oxidation Pilot Test

- Zuvo point-of-entry filtration system
 - Five step process:
 - disinfect water and remove lead via ozone
 - Apply UV light
 - Photo oxidation
 - Filtration, and
 - Post filtration UV light
 - UV and ozone reportedly successful in destroying 1,4-dioxane
 - Bench test using water sample from Eastham
 - Results were promising



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Advanced Oxidation Pilot Test

- Installed at a residential property
 - Influent and effluent samples collected after 92 minutes of operation
 - Influent: 2.0 µg/L; Effluent 1.8 µg/L
 - 10% removal efficiency
 - Influent/Effluent samples after 158 minutes:
 - Influent 2.0 µg/L; Effluent 1.6 µg/L
 - 20% removal efficiency



NOT EFFECTIVE AT TREATING 1,4-dioxane



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Conceptual Site Model

- Does 1,4-dioxane migrate in groundwater the same as vinyl chloride?
 - Observed 1,4-dioxane in groundwater from deeper overburden aquifer and downgradient of groundwater with measurable leachate parameters
 - However, also observed 1,4-dioxane at concentrations above 0.3 µg/L in groundwater cross-gradient groundwater flow lines extending from the landfill of leachate plume contain 1,4-dioxane
- Confounding Sources
 - Cosmetic and personal care products (such as laundry detergent) from septic systems
- Sample Septic Systems



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Private Septic System Sampling

Analytical Results – Residential Properties
Private wells versus Septic Grey Water

	Residence 1			Residence 2			Residence 3		
	2/19/2013	4/14/2014	6/19/2014	7/23/2013	3/27/2014	6/16/2014	4/30/2013	5/8/2014	6/17/2014
Private well	0.26	<0.144	.0910J	.11J	5.03	0.217	.075J	<0.144	
Gray water			0.887			3.7			0.596

- Consultant concluded that these residences using products containing 1,4-D, and the Landfill is not a source
- Other issue – private water supply wells re-circulating groundwater impacted with 1,4-dioxane water through septic system



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Municipal Water Issue

- No municipal water in the Town of Eastham
 - Trying to vote in municipal water since the 1970s
 - Several attempts by proponents and Selectmen to vote in municipal water
 - 1,4-dioxane was not the only issue
 - High nitrates
 - High fire insurance rates (no fire hydrants)
 - Higher costs for business owners maintaining community water supplies
 - In May 2015 the Town voted to build an municipal water system
 - Currently being installed



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Status of IRA

- IRA status reports are required until the impacted residences are connected to municipal water without a cross-connection
- Site is “adequately regulated” under MCP, and will revert back to Solid Waste once IRA is completed
- Continued activities under Solid Waste Landfill Monitoring Program to define extent of 1,4-dioxane



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THANK YOU

Contact Information

Paul Locke: Paul.Locke@state.ma.us

Gerard Martin: Gerard.Martin@state.ma.us

Angela Gallagher: Angela.Gallagher@state.ma.us

