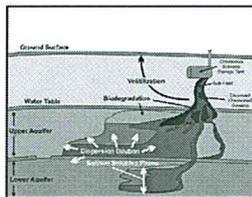


Demystifying Contaminated Soil Management in Vermont

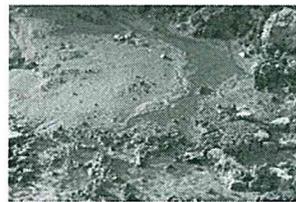


Kurt Muller, P.E.
SR. Project Engineer
The Johnson Company, Inc.

Environmental Issues: What may affect my project?



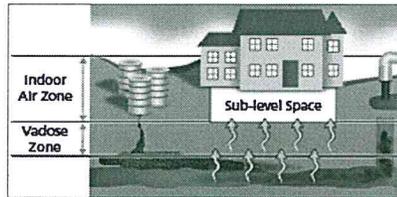
Groundwater



Surface water



Sediment

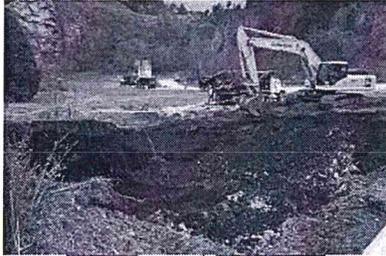


Subsurface Vapor (Intrusion)

AND



Soil



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Common Soil Contaminants



- PAHs
- Metals
- VOCs
- PCBs
- Dioxins



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“Development Soils”

- PAHs, Lead, and / or Arsenic Impacted Soil only
- Does not adversely impact groundwater
- No unreasonable exposure risk to humans, if managed appropriately
- Origin of soil - designated downtown development district, growth center, neighborhood development area, TIF district, or village center

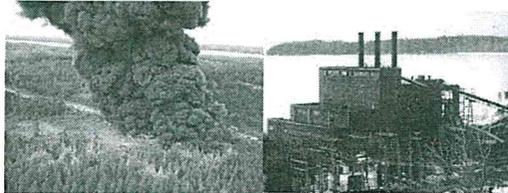
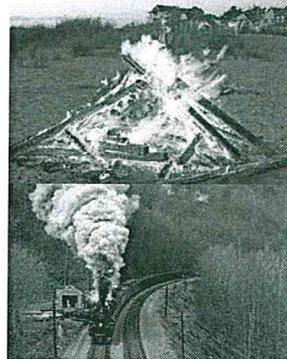
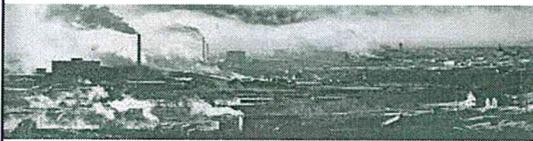


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Where do PAHs, Lead, and Arsenic come from?



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Assume you will encounter development soils



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Development Soil Disposal Options

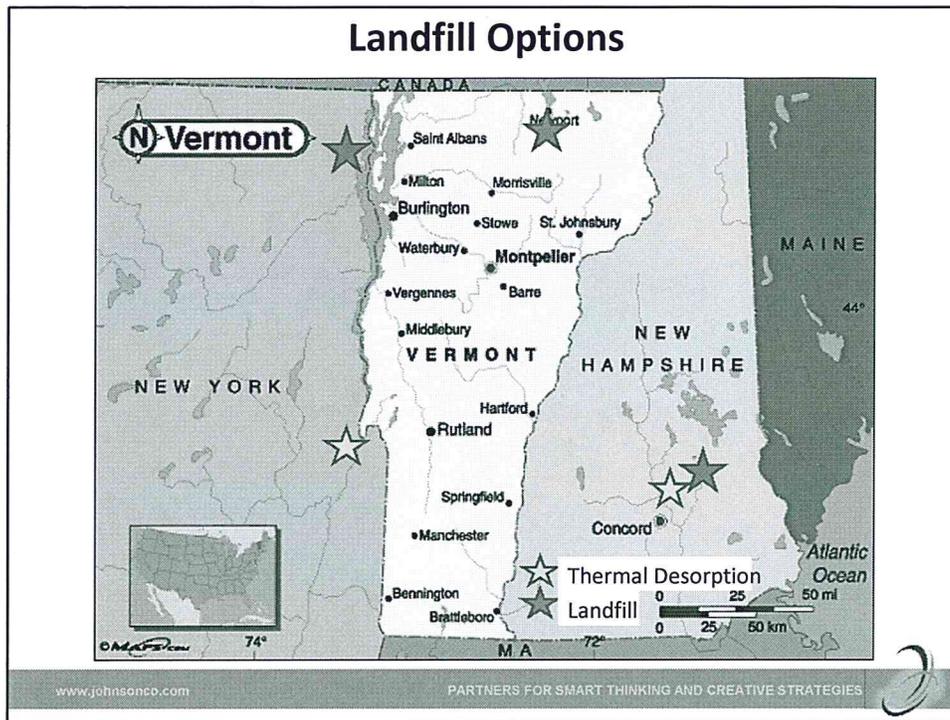
Before Legislation



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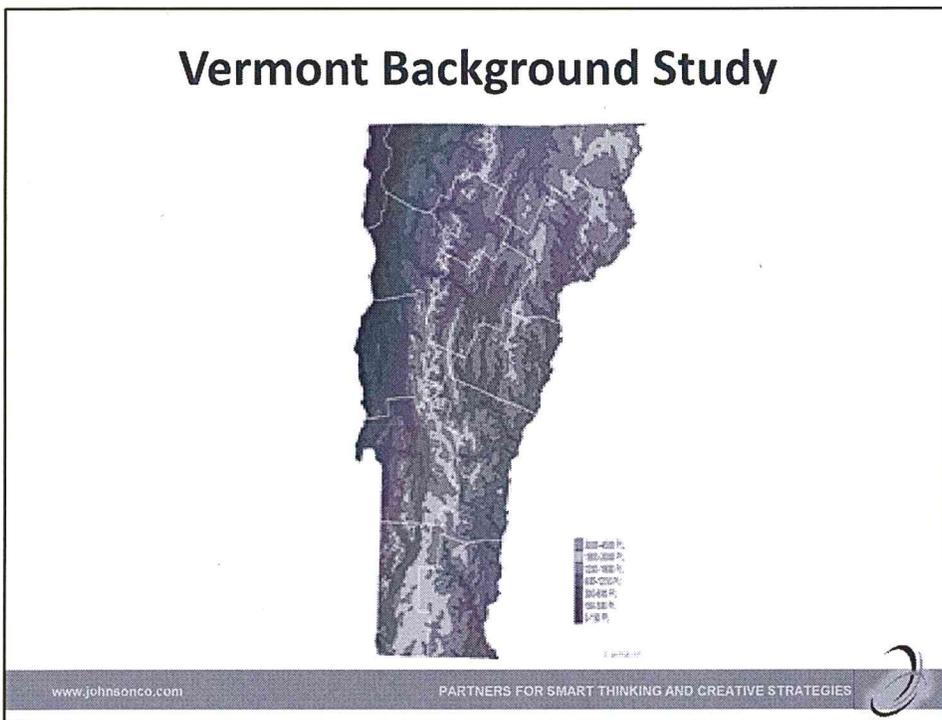
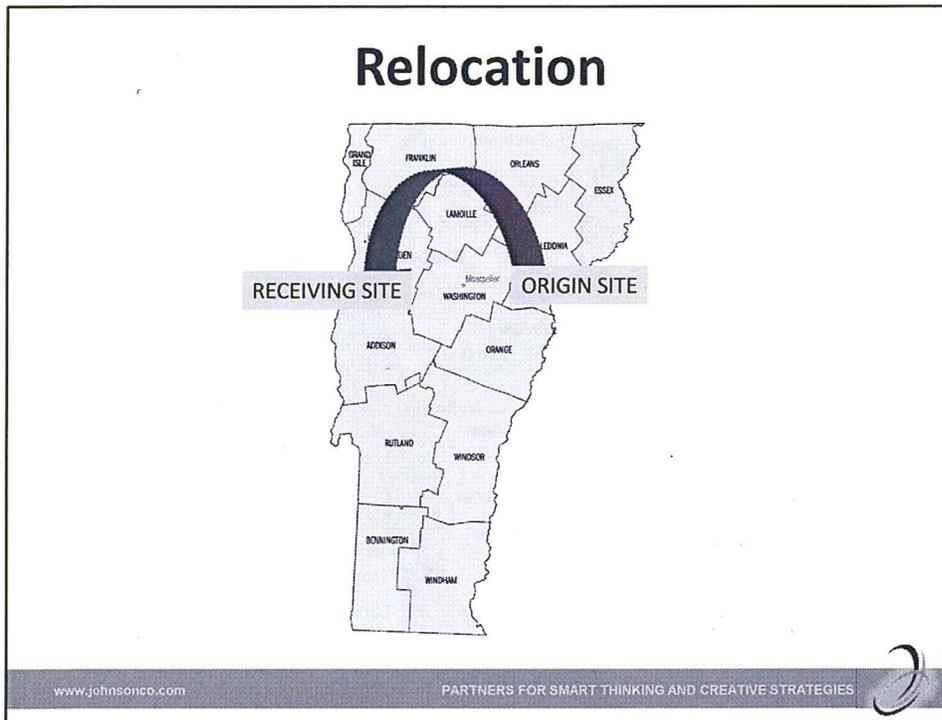
PARTNERS FOR SMART THINKING AND CREATIVE STRATEGIES



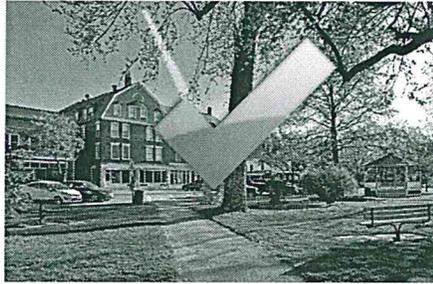
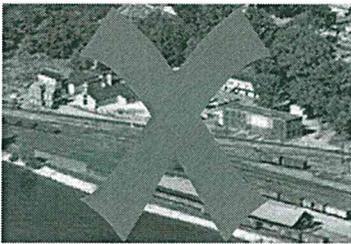


Proposed Management Alternatives for Development Soil under H269 Legislation (Act 52).

- Relocation
- Background Study
- Categorical Facility
- Alternate Daily Cover



Statewide Background Soil Study



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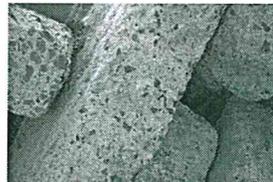
Categorical Waste Facility Certification



Stumps



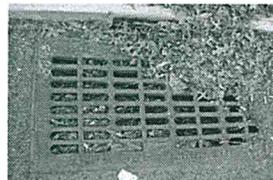
Asphalt



Concrete



Street sweepings



Catch basin grit

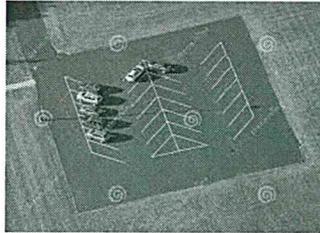
AND  **“DEVELOPMENT SOIL”**

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If Possible



- Reuse
- Isolate onsite
- Plan Ahead
- Get creative



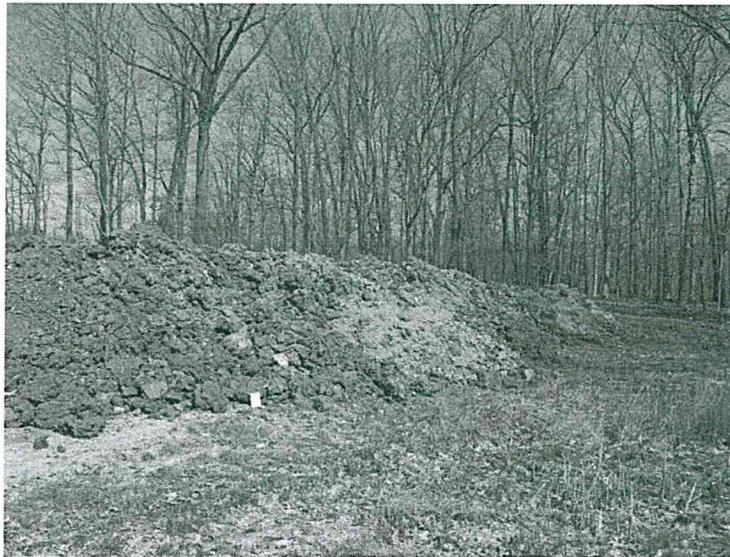
- Befriend the owner of a Categorically Certified Waste Facility

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Bad Onsite Management

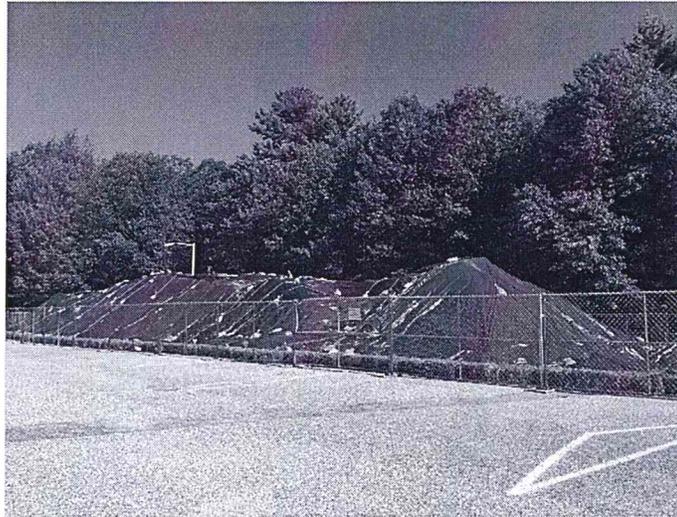


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Good Onsite Management

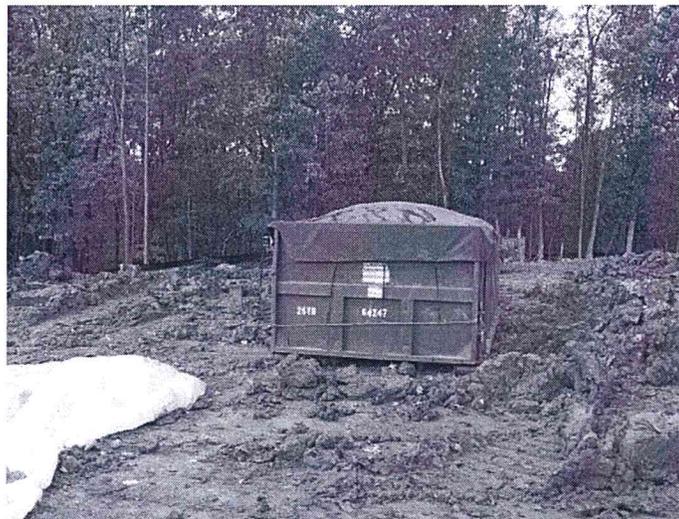


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Good Onsite Management

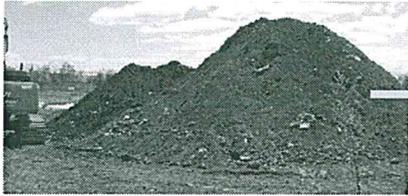


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How to move this pile?



Dump trailers – ~28 tons/load



55 gallon drum – small quantity



Roll off – about 8 tons max

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Take Aways

PLANNING: Managing development soil is challenging and it must be treated as such in terms of planning, schedule, and budget.

ESTABLISH AN EXPERIENCED TEAM: Developer, Design Engineer, Environmental Consultant, Contractor, Regulatory Agencies, Attorneys, etc.

COMMUNICATION: It's the key to a successful project.

DUE DILIGENCE: It pays to know what you have; both short term and long term

STAY TUNED: Soil management rules are changing, be sure you know what applies to your project

PUBLIC PERCEPTION: Technically these soils contain carcinogens and the public sees them as dangerous. Should they not be managed appropriately, the legal implications can be significant

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Contaminant Acronyms Defined

PAHs: polycyclic aromatic hydrocarbons

PAHs are byproducts of petroleum processing or from the incomplete combustion of hydrocarbons, such as coal and gasoline. In general PAHs are ubiquitous environmental pollutants and are formed from both natural and anthropogenic sources. The latter are by far the major contributors. Natural sources include forest fires (Blumer and Youngblood, 1975), volcanic eruptions (Ilnitsky and others, 1977), and degradation of biological materials, which has led to the formation of these compounds in various sediments and fossil fuels (White and Lee, 1980). Major anthropogenic sources include the burning of coal refuse banks, coke production, automobiles, commercial incinerators, and wood gasifiers." - Lesage and Jackson, 1992

VOCs: volatile organic compounds

Many VOCs are human-made chemicals that are used and produced in the manufacture of paints, adhesives, petroleum products, pharmaceuticals, and refrigerants. They often are compounds of fuels, solvents, hydraulic fluids, paint thinners, and dry-cleaning agents commonly used in urban settings. VOC contamination of drinking water supplies is a human-health concern because many are toxic and are known or suspected human carcinogens." - U.S. Geological Survey, 2005. Hydrocarbon compounds that have low boiling points, usually less than 100°C, and therefore evaporate readily. Some are gases at room temperature. Propane, benzene, and other components of gasoline are all volatile organic compounds." - Art, 1993

Dioxins: CDDs [chlorinated dibenzo-p-dioxins]

Dioxins are a class of chemical contaminants that are formed during combustion processes such as waste incineration, forest fires, and backyard trash burning, as well as during some industrial processes such as paper pulp bleaching and herbicide manufacturing. The most toxic chemical in the class is 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD). The highest environmental concentrations of dioxin are usually found in soil and sediment, with much lower levels found in air and water. Humans are primarily exposed to dioxins by eating food contaminated by these chemicals." - National Institute of Environmental Health Sciences, 2011

PCBs: Polychlorinated biphenyls

PCBs are a group of man-made compounds that were widely used in the past, mainly in electrical equipment, but also surface coatings, inks, adhesives, flame-retardants, caulking, cutting oils, hydraulic oils, and paints. PCBs were banned at the end of the 1970s in many countries because of environmental concerns. Because these compounds are generally very stable, they remain present in the environment today. PCBs are stable which explains their persistence in the environment. At high temperatures, PCBs can burn and generate dangerous by-products such as dioxins. PCBs tend not to evaporate or to dissolve easily in water. However, they are very soluble in fat and similar substances, which explains why PCBs can build up in animal fat and along the food chain.

Art, H.W., 1993, Volatile organic compounds, in Art, H.W., ed., A dictionary of ecology and environmental science: New York, New York, Henry Holt and Company, p. 581.

Blumer, M., and Youngblood, W.W., 1975, Polycyclic aromatic hydrocarbons in soils and recent sediments: *Science*, v. 188, p. 53.

Ilnitsky, A.P., Mischenko, V.S., and Shabad, L.M., 1977, New data on volcanoes as natural sources of carcinogenic substances: *Cancer Letters*, v. 3, p. 227.

National Institute of Environmental Health Sciences, 2011, Dioxins: National Institutes of Health, access date May 26, 2011.

U.S. Geological Survey, 2005, Water resources data--Definition of terms: U.S. Geological Survey, access date May 28, 2010.

White, C.M., and Lee, M.L., 1980, Identification and geochemical significance of some aromatic components of coal: *Geochimica et Cosmochimica Acta*, v. 44, p. 1825.