Health Impacts of Hazardous Wastes

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The Key Issues to Healthy Living

- Clean Air
- Clean Water
- Abundance of Safe Food
How Can Hazardous Waste Affect Health?

- Affecting the air (Bhopal, Landfill gas)
- By polluting groundwater or surface water supplies (Smithville, Landfill)
- Interfering with the supply of food (Bichhri)
How Are People and the Environment Affected by Hazardous Waste?

- Accidental Release
  - Bhopal for example
- Inadvertent
  - When a company goes bankrupt and walks away from site (Smithville)
- Deliberate dumping of material at an industrial site
  - Bad disposal practices (Bichhri)
- Poor practices at Landfills
Issues Relating to Hazardous Waste

- Worldwide problem
  - Industrial sites
  - Landfills
  - Mining sites
Health Effects Relating to Hazardous Wastes

◆ Cancer Effects
  - Arsenic – lung, skin, bladder, liver
  - PCBs – lung, skin bladder, liver

◆ Systemic effects – neurological
  - Lead and mercury – damage to neurological and gastrointestinal systems, death
  - Toluene – damage to nervous and neurological systems
  - Dioxins and furans – birth defects
Specific Examples

- Bhopal in India
- Hazardous Waste site in Canada
- Smithville in Canada
- Bichhri in India
Bhopal India

- In 1984, Union Carbide had a release to the air of methyl isocyanate
- Effects of exposure are death, cancer, birth defects to name a few
- 3,800 people died from inhalation of polluted air, 40 people were permanently disabled, 2,680 people experienced permanent partial disability
- There is some permanent lung injury in some members of the population
- Massive compensation
Canadian Examples
Hazardous Waste Landfill

- If site poorly maintained can result in potential health effects such as cancer, birth defects, genetic mutations especially in children
- Exposure from
  - Air
  - Groundwater
  - Soil
Safety Kleen Site

- Only commercial hazardous waste site in Ontario
- Released substantial amounts of mercury and dioxins to the environment
- Lead and nickel present in large amounts
- Leading polluter
- Incinerator also present on site
  - Releases of cadmium and arsenic to air
Smithville Background - 1

- Former Chemical Waste Management Limited company accepted hazardous and industrial waste including PCBs and other cancer causing compounds from 1978 to 1985
- PCB contamination identified on property and organics found in groundwater
- PCBs on site incinerated and “pump-and-treat” implemented to stop contaminant spread in ground water
Smithville Background - 2

- Site handed over to the Ontario Ministry of the Environment
- Drinking water provided from nearby town
- Need to remediate site to ensure protection of human health and environment
Former Chemical Waste Management Location
The Hazardous Waste Storage Pit
Maximum Inferred Lateral Extent of Shallow Bedrock DNAPL Plume
Current Treatment
Remedial Options

- Natural Attenuation
- Thermal Wells
- Excavation and exsitu Treatment
- Hydromill Excavation
- Ground Freezing
- Permeation Grouting
- Secant Piling
- Extraction Wells
- Integrated Grouting and Extraction Wells
How Was The Remedial Option Selected?

- Used Risk Assessment Methodology to determine the most appropriate remedial option
- Considered both protection of human health and ecological health
Pathways Considered
Key Pathways

- Air
- Groundwater - direct use and vapour routes
- Groundwater seepage to surface water
What Option was Selected?

- The best options in terms of cost and feasibility was either the placement of a barrier to stop the groundwater plume migration or to continue to pump and treat.
- No remediation done to date as it is too costly.
- Continue to pump and treat to keep plume contained until new technologically feasible and cost effective remediation strategies emerge.
REMEDIATION / RECLAMATION OF HAZARDOUS WASTE CONTAMINATED AREAS IN BICHHRI VILLAGE, RAJASTHAN
Background

- Located in Udaipur District, 20 km east of Udaipur
- Dye plant which made H-Acid close to a village
- Bherach River flows near the plant
- Irrigation Canal runs near by
- Area east of HACL plant cleared for agriculture
- Possible injection wells inside HACL facility which pumped effluent into the groundwater
The Plant and Setting
What is H-Acid?

- By-product of the dye making Industry
- Limited information available
- Breakdown products are more toxic than the original compound
- Some of the breakdown products cause cancer
- Other breakdown products cause damage to the liver and kidney and cause blood abnormalities
The Effluent Effects
Water Quality
Issues Related to Remediation of Groundwater

- Groundwater needed to be treated to bring to drinking water quality so that truck-borne water could be stopped
- Need to treat large amount of water since also used for agricultural purposes
- Substantial cost
Soil Quality
Issues Relating to Remediation of Soil

- Soil has widespread:
  - low levels of H acid contamination in upper 0.5m
  - low plant productivity due TDS in irrigation water
  - high cadmium (regional phenomenon)

- Soil has local:
  - high lead and zinc near HACL

- Needed to be treated so can be used again for agricultural purposes

- Substantial cost
Risk Informed Decision Framework

GOAL

Select Alternative

FACTORS

Human Health

Cost

Quality Of Life

ALTERNATIVES

Do Nothing

Replace Water Supply

In Situ Management

Water Supply

Do Nothing

Replace Water Supply

In Situ Management
Conclusions

- Issues and impacts of hazardous waste not limited to underdeveloped nations
- Risks are multidimensional (human health, water quality, quality of life)
- Legacy sites revert to government
- Expensive to remediate
- On going issue – Better to design to prevent!