FRIENDS of Great Salt Lake

Friends of Great Salt Lake Board Meeting

Saturday, February 6th 2016

Antelope Island

Map of US Magnesium and the surrounding communities

- Site: 75 mi^2 in Tooele County with an additional 5 mile boundary radius
- Nearest population center is Grantsville, approx. 25 miles away
- Site is within 3 mi of the Great Salt Lake shoreline mudflats
- EPA added US Magnesium to NPL listing of Superfund sites based on releases of hazardous substances into the air and soil
  - Chlorine emissions most prominently known
  - Dioxins/furans, HCB, PCB

Community Concerns

Environmental Concerns

- Chlorine transport via air and groundwater
- Contamination in Great Salt Lake ecosystem
- Contamination in brine shrimp and salt industries on lake

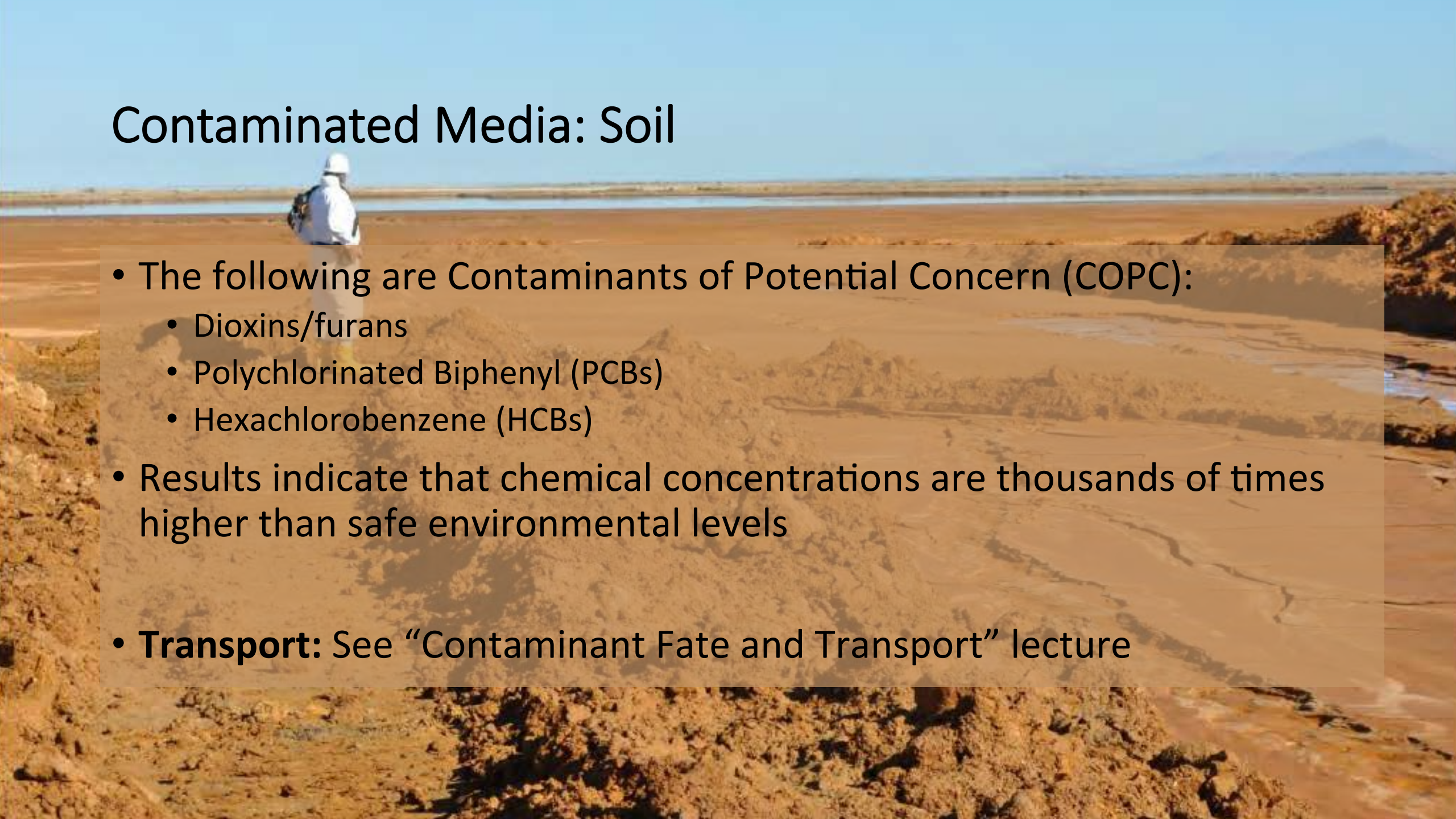
Health Concerns

- Health of workers and families—specifically due to chlorine
- Incidence of respiratory illness and cancer in workers
- Chlorine contamination in air
  - Salt Lake Valley and GSL wildlife
- Other contaminants and their full effects

Contaminants of Potential Concern

- Chlorine gas is most publically known concern
- Other contaminants exist on site
- Various contaminated media:
  - Soil
  - Groundwater
  - Surface water
  - Air

Contaminated Media: Soil



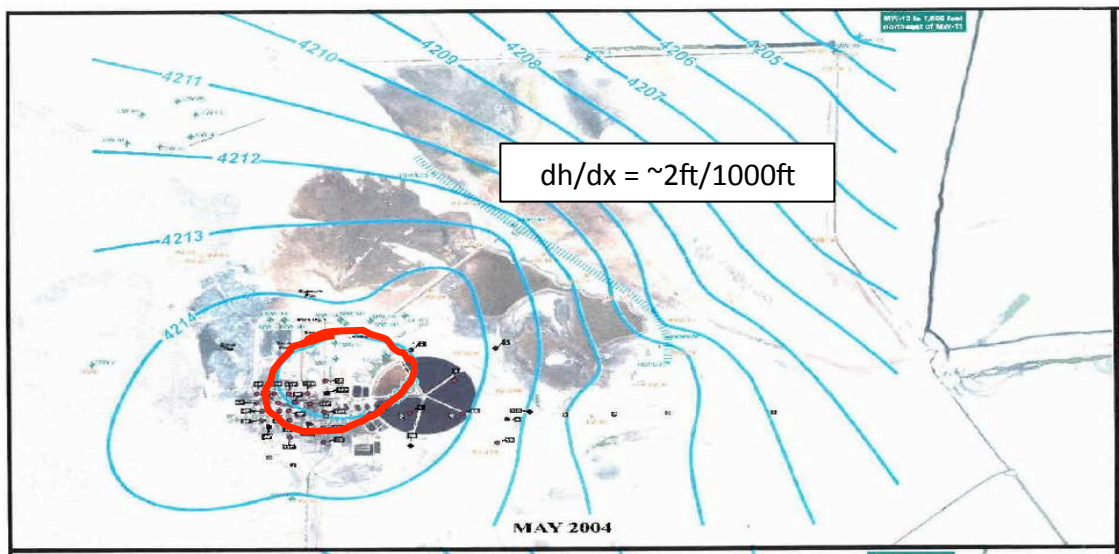
- The following are Contaminants of Potential Concern (COPC):
  - Dioxins/furans
  - Polychlorinated Biphenyl (PCBs)
  - Hexachlorobenzene (HCBs)
- Results indicate that chemical concentrations are thousands of times higher than safe environmental levels

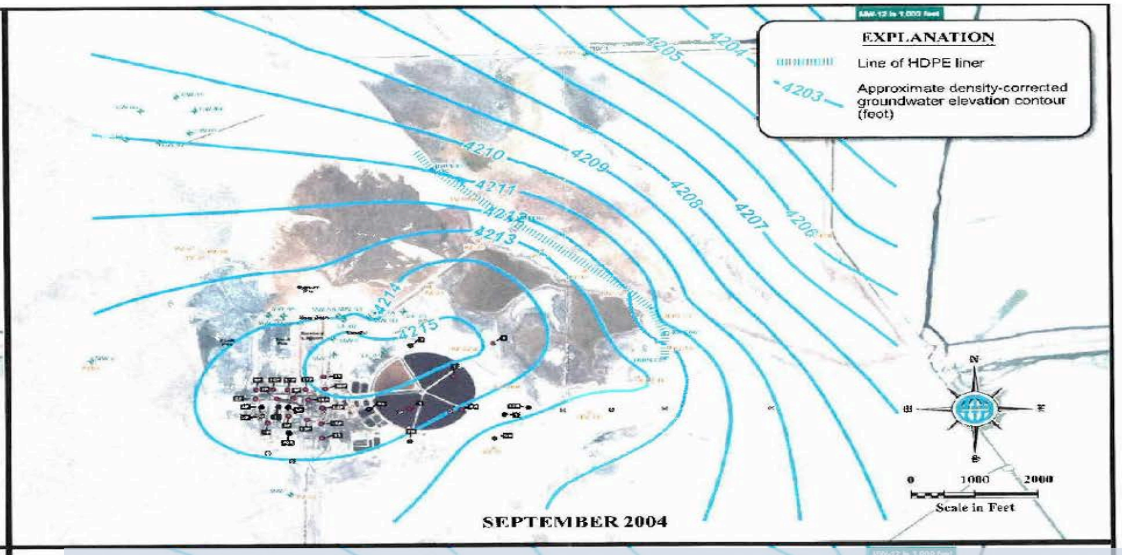
- **Transport:** See “Contaminant Fate and Transport” lecture

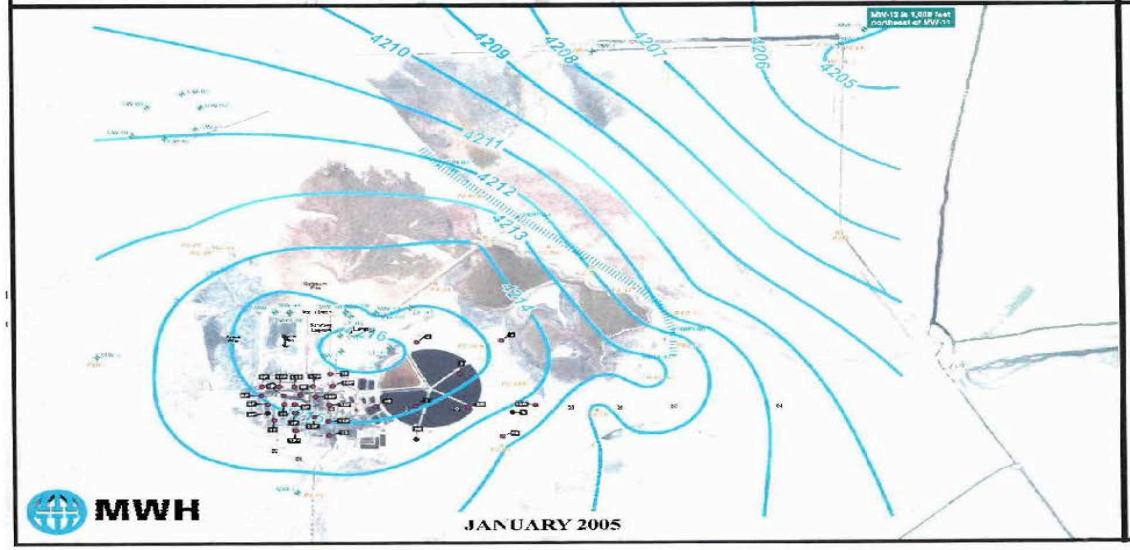
Contaminated Media: Groundwater

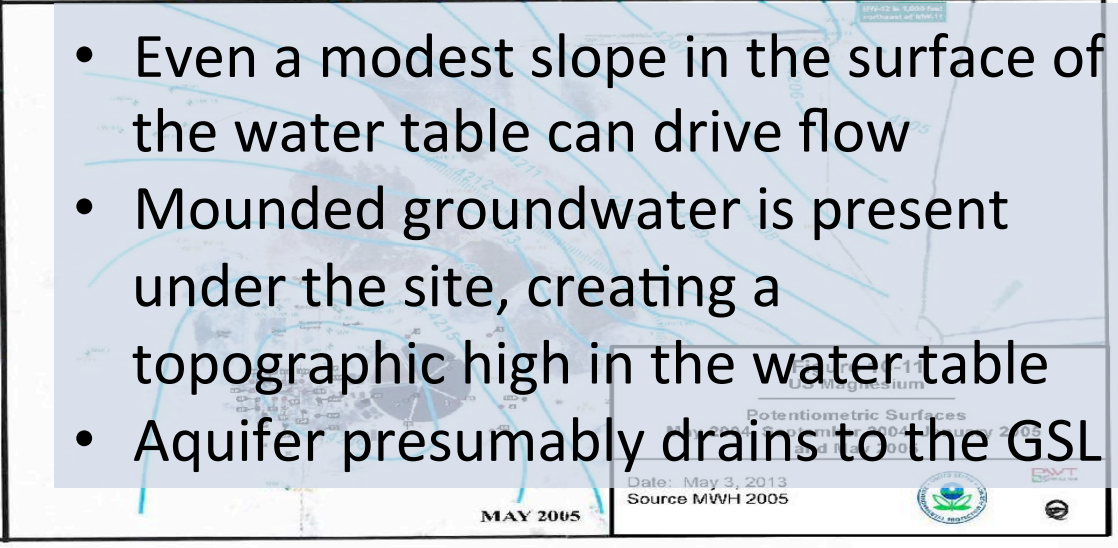
- The following are COPC:
  - Hexachlorobenzene (HCB)
  - Dioxins
  - Polychlorinated dibenzofurans in isolated areas
  - Localized Volatile Organic Compound plume
- Less extensive than soil and sediment contamination, but possible leakage from acidic waste impoundments
- Contaminants stay in environment (10s of years):
  - Unreactive
  - Insoluble
  - Do not vaporize quickly into the atmosphere

Transport: Groundwater- Slope



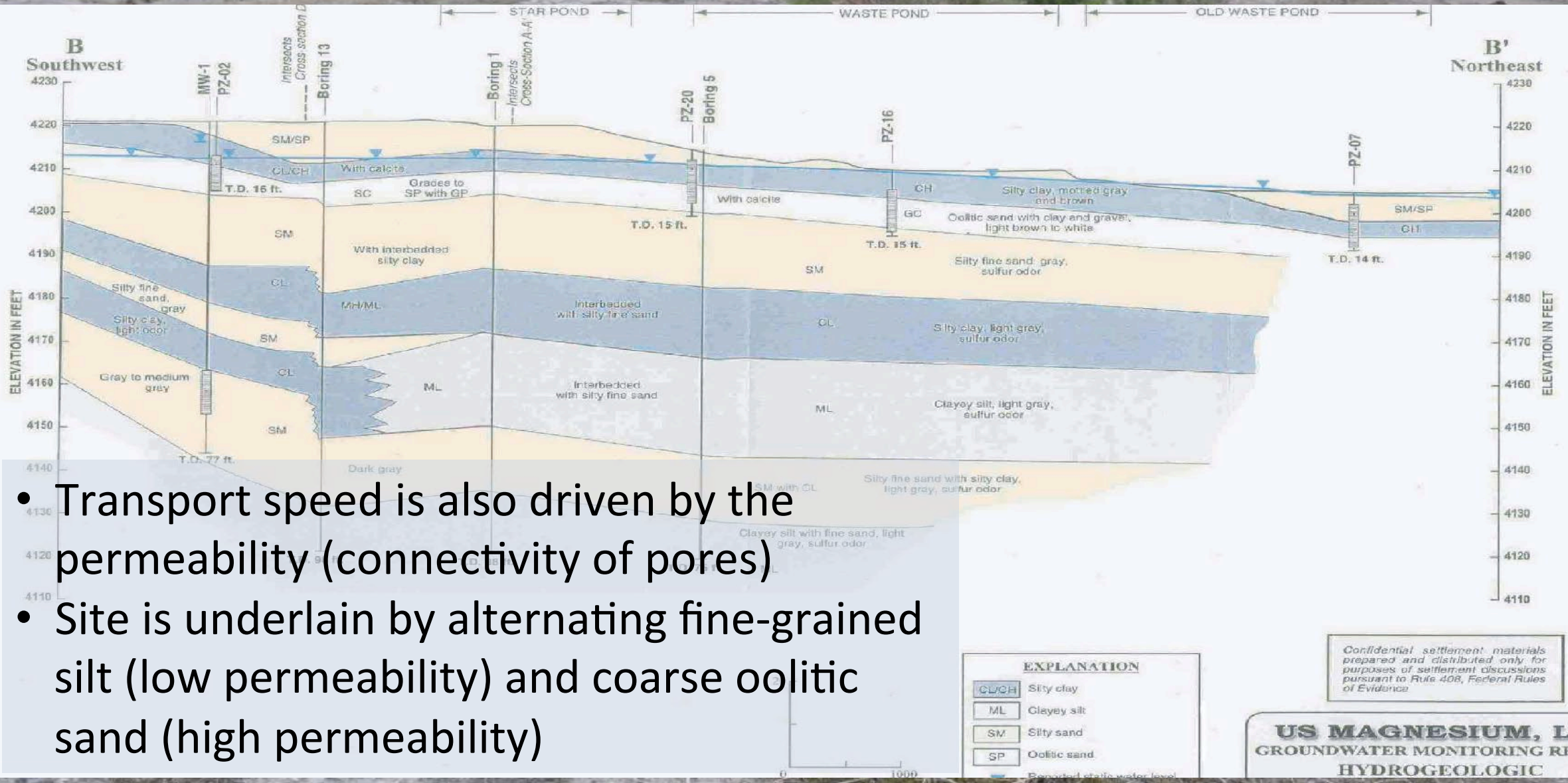






- Even a modest slope in the surface of the water table can drive flow
- Mounded groundwater is present under the site, creating a topographic high in the water table
- Aquifer presumably drains to the GSL

Transport: Groundwater- Material



- Transport speed is also driven by the permeability (connectivity of pores)
- Site is underlain by alternating fine-grained silt (low permeability) and coarse oolitic sand (high permeability)

Contaminated Media: Surface Water

- Areas of highest concern:
  - Sanitary lagoon
  - Active waste pond
  - Gypsum pile
  - Old waste pond near the former inlet.

- Water in the active waste pond (and most ditches) has a pH <1
  - causes distress to birds that comes into contact with the water

- **Transport:** Not immediate issue unless GSL level dramatically rise

Contaminated Media: Air

- The following are potential COPC:
  - Chlorine gas
  - Volatile Organic Compounds (VOCs)
  - Semivolatile Organic Compounds (SVOCs)
  - Trace elements

- Releases of gases, aerosol, and/or particulates from
  - Stacks
  - Fugitive emission from process system
  - Fugitive dust from waste piles

Transport: Air

There are 6 stacks:

3 Spray Dryer Systems, 1 melt reactor/chorine-plant tail-gas , 1 chlorine bypass scrubber, and 1 Emergency off gas scrubber

- Anode box
- Chlorine gas is already monitored
- Air was not characterized in Phase 1A, more information in Phase 1AB

Toxicity: Communities at risk?

- Ecological Risk
  - Birds
  - Mammals
  - Terrestrial and aquatic plants
  - Terrestrial invertebrates
  - Aquatic invertebrates
  - Amphibians and Reptiles

- Human Risk
  - Full-time workers at US Magnesium
  - Workers at nearby facilities
  - Episodic workers
  - State and Federal land managers
  - Off-site recreational visitors
  - Hunters
  - Ranchers
  - Seasonal workers

Toxicity: Exposure Route and Target Organs

- Dermal
  - Skin: tolerates 100 to 1000 greater exposures relative to other two exposure routes
  - Vascular system

- Inhalation
  - Lungs: most detrimental effects

- Ingestion
  - Gastrointestinal Tract
  - Liver
  - Kidneys

Toxicity: Exposure Pathways

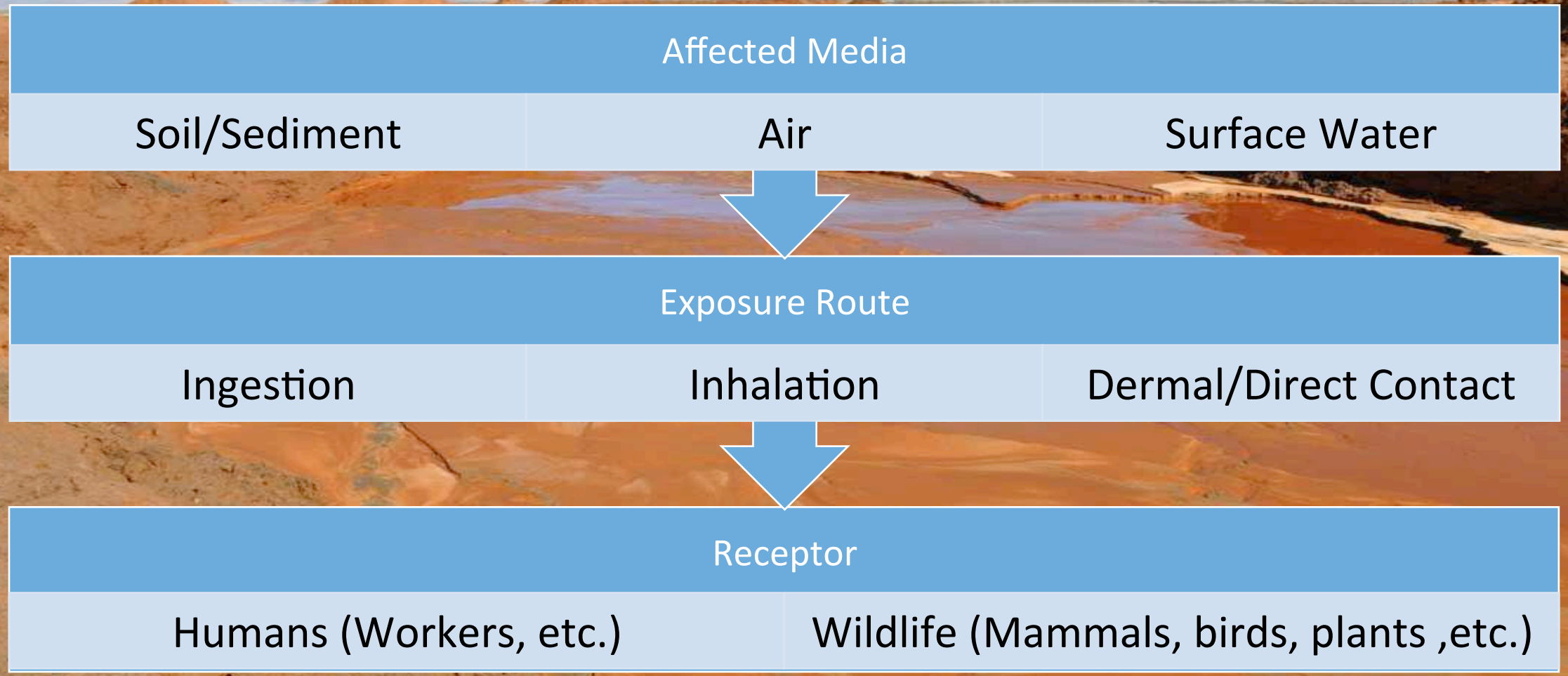
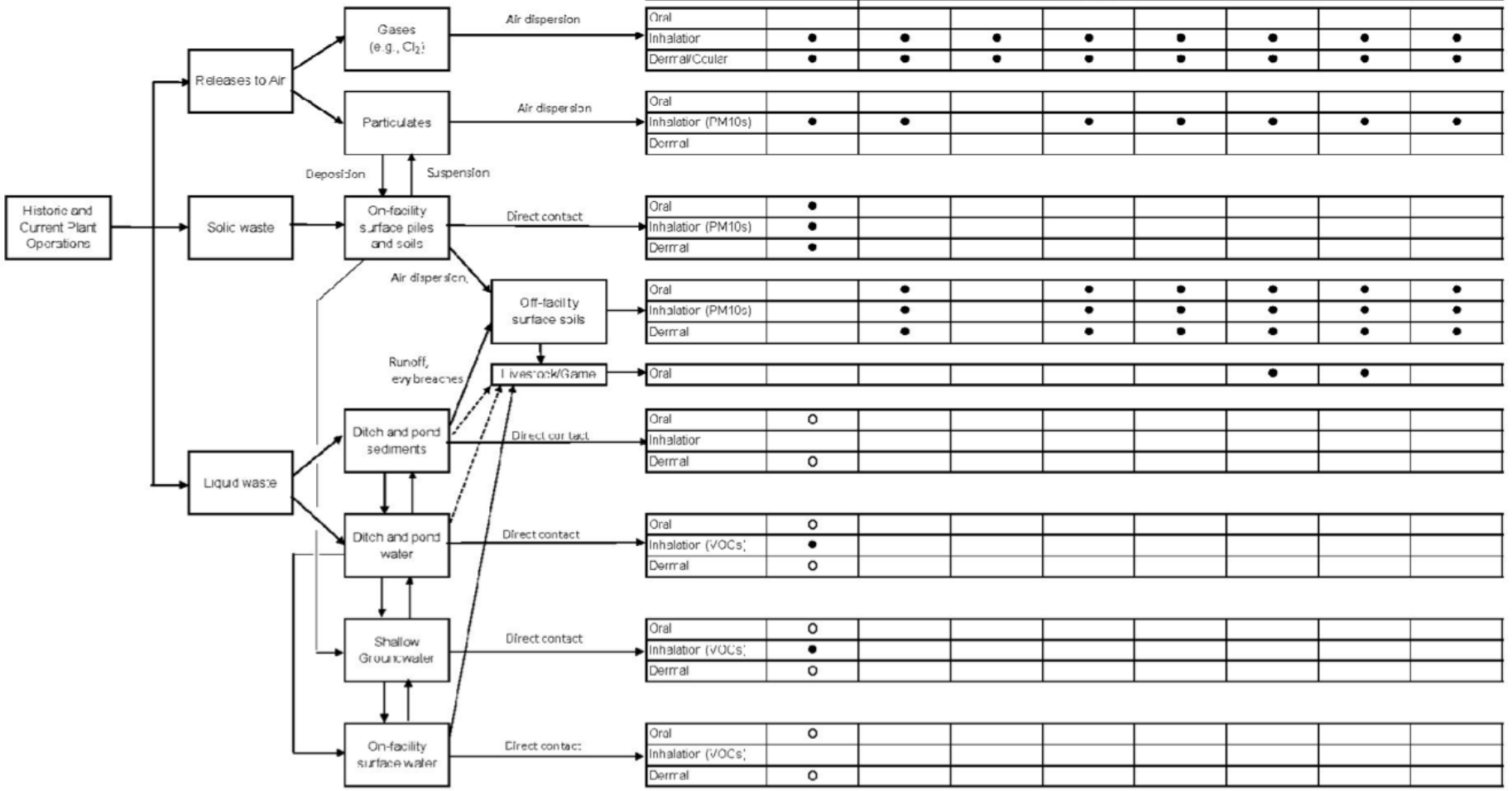


FIGURE 10-32 US MAGNESIUM SITE
CONCEPTUAL SITE MODEL FOR HUMAN EXPOSURE



Receptor

Pathway	US Mag onsite worker	Worker at nearby facilities	Episodic Worker	Land managers and environmental researchers	Off-site recreational visitor	Hunter	Rancher	Seasonal worker and family
Gases: Oral								
Gases: Inhalation	●	●	●	●	●	●	●	●
Gases: Dermal/Ocular	●	●	●	●	●	●	●	●
Particulates: Oral								
Particulates: Inhalation (PM10s)	●	●		●	●	●	●	●
Particulates: Dermal								
On-facility surface piles and soils: Oral	●							
On-facility surface piles and soils: Inhalation (PM10s)	●							
On-facility surface piles and soils: Dermal	●							
Off-facility surface soils: Oral		●		●	●	●	●	●
Off-facility surface soils: Inhalation (PM10s)		●		●	●	●	●	●
Off-facility surface soils: Dermal		●		●	●	●	●	●
Livestock/Game: Oral						●	●	
Ditch and pond sediments: Oral	O							
Ditch and pond sediments: Inhalation								
Ditch and pond sediments: Dermal	O							
Ditch and pond water: Oral	O							
Ditch and pond water: Inhalation (VOCs)	●							
Ditch and pond water: Dermal	O							
Shallow Groundwater: Oral	O							
Shallow Groundwater: Inhalation (VOCs)	●							
Shallow Groundwater: Dermal	O							
On-facility surface water: Oral	O							
On-facility surface water: Inhalation (VOCs)								
On-facility surface water: Dermal	O							

KEY

● Pathway is complete and could be significant; quantitative evaluation

O Pathway is potentially complete, but data are needed on U.S. Magnesium worker activity patterns to determine if quantitative assessment is needed

Pathway is not complete or is negligible; quantitative evaluation not needed

→ Primary transport or exposure pathway

⇢ Minor transport or exposure pathway

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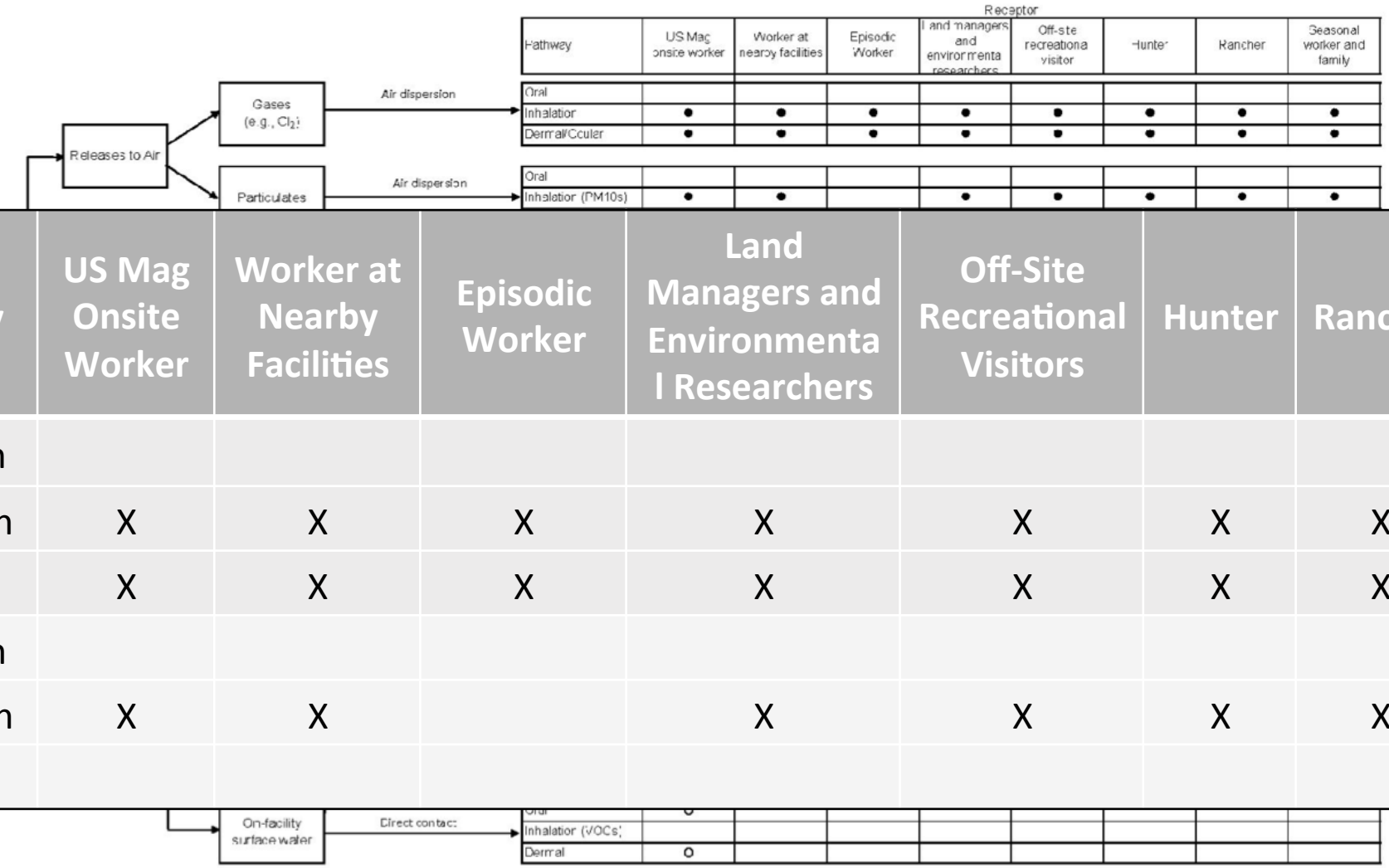

	Pathway	US Mag Onsite Worker	Worker at Nearby Facilities	Episodic Worker	Land Managers and Environmental Researchers	Off-Site Recreational Visitors	Hunter	Rancher	Seasonal workers and family
Gasses	Ingestion								
	Inhalation	X	X	X	X	X	X	X	X
	Dermal	X	X	X	X	X	X	X	X
Particulates	Ingestion								
	Inhalation	X	X		X	X	X	X	X
	Dermal								

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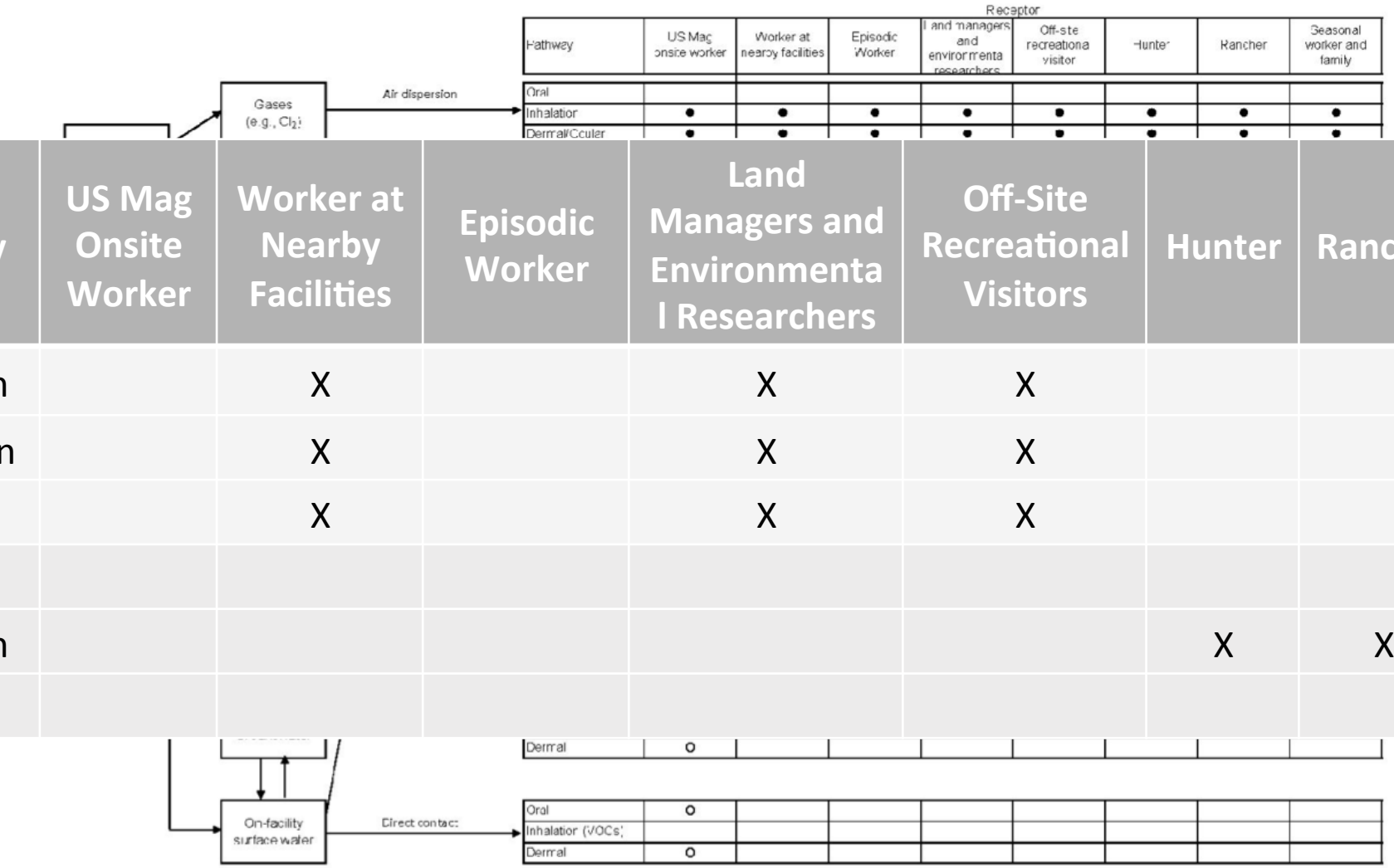
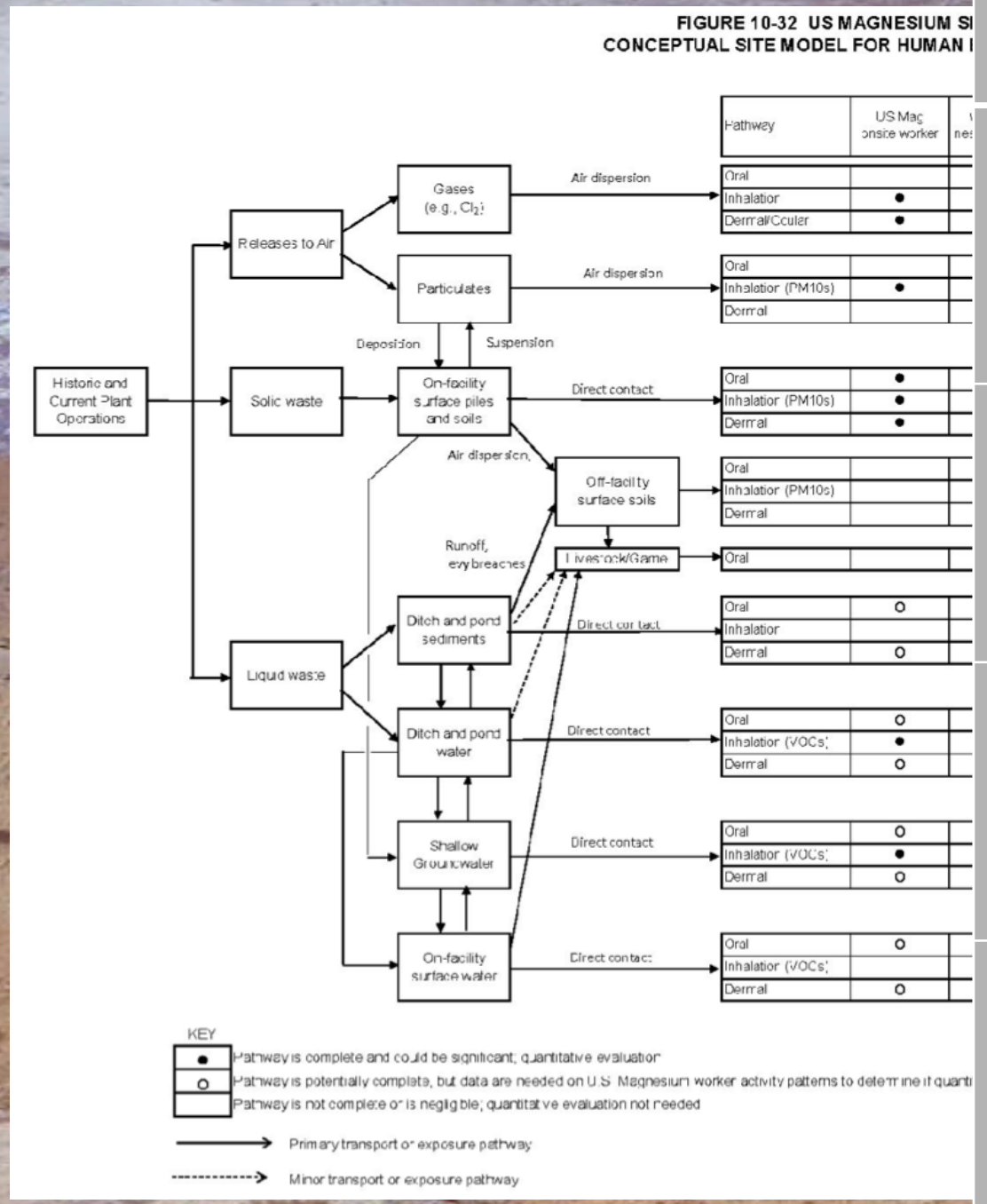


	Pathway	US Mag Onsite Worker	Worker at Nearby Facilities	Episodic Worker	Land Managers and Environmental Researchers	Off-Site Recreational Visitors	Hunter	Rancher	Seasonal workers and family
Off-facility Surface Soil	Ingestion		X		X	X			
	Inhalation		X		X	X			
	Dermal		X		X	X			
Livestock and Game									
	Ingestion						X	X	

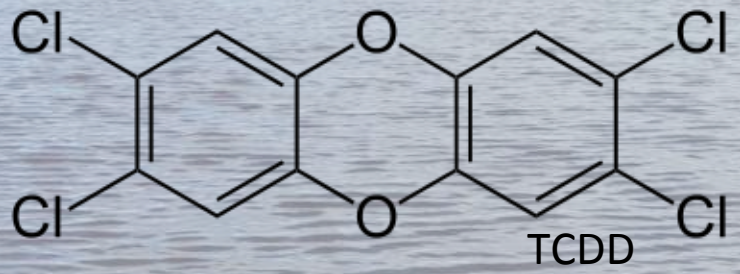


	Pathway	US Mag On-site Worker
Ditch and Pond Sediments	Ingestion	☐
	Inhalation	
	Dermal	☐
Ditch and Pond Water	Ingestion	☐
	Inhalation	X
	Dermal	☐
Shallow Groundwater	Ingestion	☐
	Inhalation	X
	Dermal	☐
On-Facility Surface Water	Ingestion	☐
	Inhalation	
	Dermal	☐

Human Toxicology: Carcinogenic & Non-Carcinogenic

Dioxins:

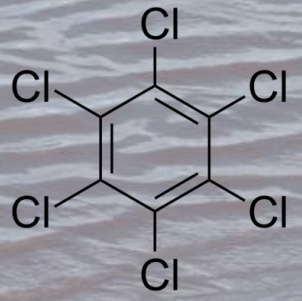
- Toxic dioxins among most potent human carcinogens
- Non-cancer risks:
  - Strong correlation with diabetes
  - Immunotoxicity



TCDD

Hexachlorobenzene (HCB):

- Bioaccumulates in fatty tissue (takes 15 years to rid HCB from the body)
- Probable human carcinogen



Non-cancer risks:

- Linked to diabetes
- Immunotoxicity (can lead to cancer)
- Liver damage
- Miscarriage/infant death

Human Toxicology: Carcinogenic & Non-Carcinogenic

Contaminant	Maximum Concentration	Location	Media
Dioxin (TEQ)	1.1 ppm	Central Ditch	Soil
Dioxin (TEQ)	2.41E-6 ppm	Monitoring Well 8A	Groundwater
HCB	2100 ppm	Central Ditch	Soil
HCB	2.8 ppb	Monitoring Well 8A	Groundwater
PCB	75.02 ppm	Main Ditch	Soil
PCB	NA	NA	Groundwater

Human Toxicology: Carcinogenic & Non-Carcinogenic

Waste Management Unit	**Estimated Cancer Risk**
Central Ditch	8E-3
Western Ditch	3E-3
Chlorine Ditch	2E-3
Main Ditch	2E-3
Old Waste Pond-Inlet Area	5E-4
400 Acre Waste Pond	4E-4
Courtyard	2E-4
Old Waste Pond-Area Away from Inlet	1E-4
Gypsum Pile	9E-5
Boron Ditch	9E-6
Smut Pile	1E-6
Barium Sulfate Area	2E-7

Any risk above 1E-6 is considered elevated and unsafe

Degrandchamp Expert Report 2007

Human Toxicology: Carcinogenic & Non-Carcinogenic

Contaminant	Average Body Burden	Maximum Body Burden (ppt)	Average Carcinogenic Risk	Maximum Carcinogenic Risk	Average Non-Carcinogenic Hazard
HCB*	3.4 ppb	19.0 ppb	NA	2 .0E-4	2.7 X safe levels
Dioxin**	41.5 ppt	175.9 ppt	8.2E-3	3.5E-2	5 X safe levels

*Degrandchamp Expert Report, 2007
**Degrandchamp Expert Rebuttal Report 2007

Human Toxicology: Comparative Risk

Table 2
Some Commonplace Risks
(mean values with uncertainty)

Action	Lifetime Risk	Uncertainty
Motor vehicle accident (total)	1.7×10^{-2}	10≈
Motor vehicle accident (pedestrian only)	2.9×10^{-3}	10≈
Home accidents	7.7×10^{-3}	5≈
Electrocution	3.7×10^{-4}	5≈
Air pollution, eastern United States	1.4×10^{-2}	Factor of 00 downward only
Cigarette smoking, one pack per day	2.5×10^{-1}	Factor of 3
Sea-level background radiation (except radon)	1.4×10^{-3}	Factor of 3
All cancers	2×10^{-1}	10≈
Four tablespoons peanut butter per day	6×10^{-4}	Factor of 3
Drinking water with EPA limit of chloroform	4×10^{-5}	Factor of 10
Drinking water with EPA limit of trichloroethylene	1×10^{-7}	Factor of 10
Alcohol, light drinker	1×10^{-3}	Factor of 10
Police killed in line of duty (total)	1.5×10^{-2}	20≈
Police killed in line of duty (by felons)	9.1×10^{-3}	10≈
Frequent flying professor	4×10^{-3}	50≈
Mountaineering (mountaineers)	4×10^{-2}	50≈

Source. Based on annual risks presented by Wilson and Crouch, *Science*, April 17, 1987.

Above risks are voluntary, site risks are imposed

Technical Assistance Grant

- Technical Advisor:
  Independent expert who can explain technical information and express public's concerns to EPA

- Grant of up to $50,000 given to Friends of Great Salt Lake (FoGSL)

- Deliverables:
  - Literature Review of produced documents
  - Presentations to FoGSL and general public about site
    - Site Timeline
    - Site Hydrogeochemistry
    - Community Involvement Plan
    - Contaminant Generating Activities at US Magnesium Facility
    - Contaminant Fate and Transport Principles
    - Contaminated Media at US Magnesium
    - Human Toxicological Risk Assessment Principles
    - Potentially Exposed Communities