Emerging Risks and Contaminants

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Emerging Risks / Contaminants

- Coal Combustion Residuals (CCR)
- Hydraulic Fracturing (Fracking)
- Cement Kiln Dust (CKD) Landfill Leachate
- 1,2,3-Trichloropropane (aerosol fumigant for agriculture)
- Perfluorinated Carbons (PFC)
- PCBs in window caulking
- Nitrates – California
- Vapor Intrusion
- *Legionella pneumophila*
- Endocrine Disruptors

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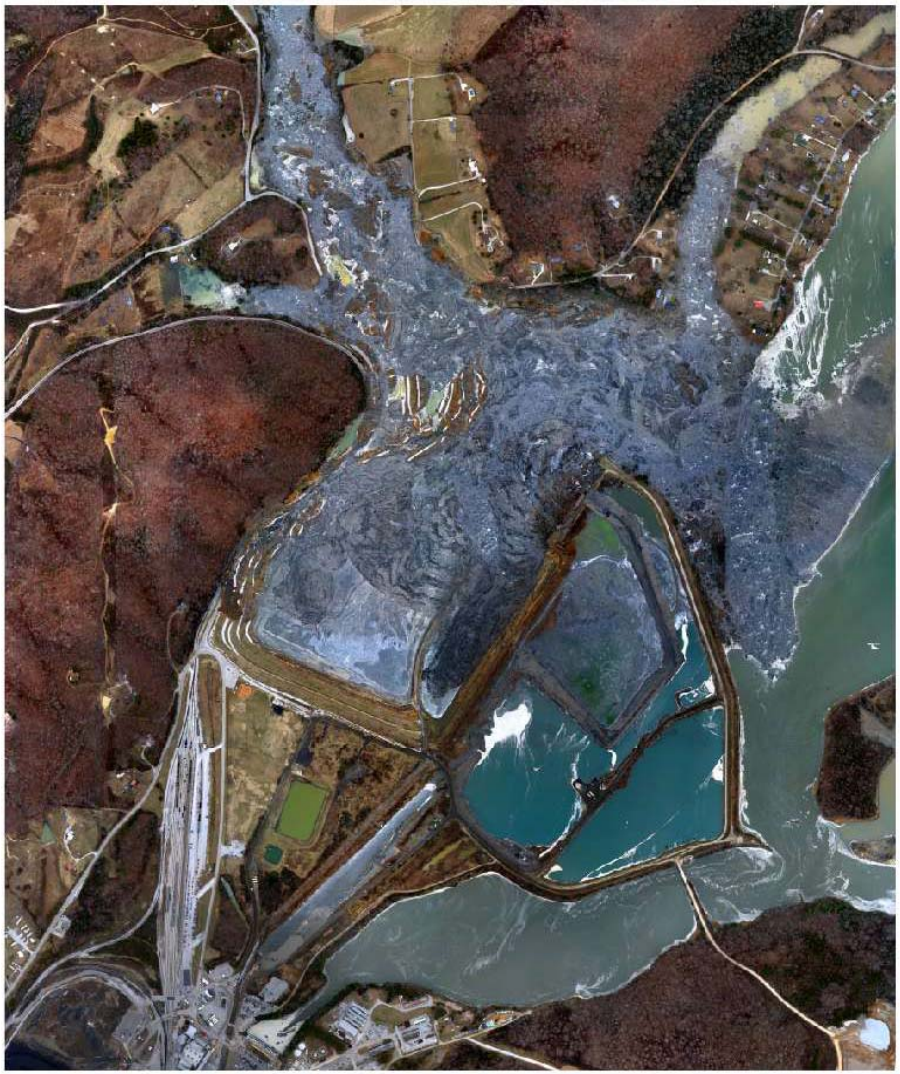
Coal Combustion Residuals (CCR)

Aerial Image of Kingston Ash Slide Pre-Event 2008

0 500 1,000 1,500 2,000 Feet

Tennessee Valley Authority
OE&R - ER&S
Geographic Information & Engineering

Aerial Image of Kingston Ash Slide 12/23/2008



0 500 1,000 1,500 2,000 Feet

Tennessee Valley Authority
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Coal Combustion Residuals

Headlines…

- Tennessee Valley Authority (TVA) Kingston Ash Spill (2008):
  - 5.4M cubic yards of coal ash over 300 acres into Emory and Clinch Rivers and nearby homes
  - $1.2B estimated clean-up costs (does not include long term monitoring or additional remediation costs)
  - Increased public scrutiny
  - Federal regulatory changes for ash management
- We Energies Oak Creek Power Plant (2011):
  - 25K cubic yards of coal ash from bluff collapse
  - 725 cubic yards into into Lake Michigan
  - Clean-up costs - unknown

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Coal Combustion Residuals

What is CCR?

- Waste produced from the burning of coal
  - Fly ash
  - Bottom ash
  - Boiler slag
  - Flue gas desulfurization (FGD) gypsum

- Used in concrete, cement, wallboard, road base, embankments, or for mine reclamation (beneficial reuse)

Coal Combustion Residuals

Why is CCR an emerging risk?

- Regulatory uncertainty
  - Characterization of CCR from solid (Subtitle D) to hazardous (Subtitle C) or combination (Subtitle D1)
    - ✓Beneficial reuse
    - ✓Future characterization testing (TCLP)
    - ✓Cost
- Public perception
- Litigation potential
- Third-party bodily injury or property damage claims
- Clean-up costs

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Coal Combustion Residuals

Understanding the Exposure

How do you evaluate CCR exposures?

- **Engineering Information**
  - ✓Impoundment/landfill inspection data
  - ✓Groundwater monitoring data
  - ✓Permits
  - ✓Sensitive Receptor/Surrounding Environment evaluation
  - ✓ECHO / Envirofacts – Notice of Violations (NOV), Compliance Issues
  - ✓Off-site disposal
  - ✓By-product end use
  - ✓Loss history

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Hydraulic Fracturing or Fracking

Hydraulic Fracturing - *Headlines…*

- Battles Escalate Over Community Efforts to Ban Fracking
  http://news.nationalgeographic.com/news/energy/2013/08/130823-battles-escalate-over-towns-banning-fracking/

- Disposal of Marcellus Shale fracking waste caused earthquakes in Ohio
  http://phys.org/news/2013-08-disposal-marcellus-shale-fracking-earthquakes.html

- 'Fracking' Debate Divides Britain
  http://www.nytimes.com/2013/08/16/world/europe/Fracking-Debate-Fractures-Britain.html?_r=0

- Fracking linked to well water methane
  http://www.usatoday.com/story/news/nation/2013/06/24/water-fracking-pennsylvania/2452023/

- New York Imports Pennsylvania's Radioactive Fracking Waste Despite Falsified Water Tests
  http://www.dcbureau.org/201308148881/natural-resources-news-service/new-york-imports-pennsylvanias-radioactive-fracking-waste-despite-falsified-water-tests.html

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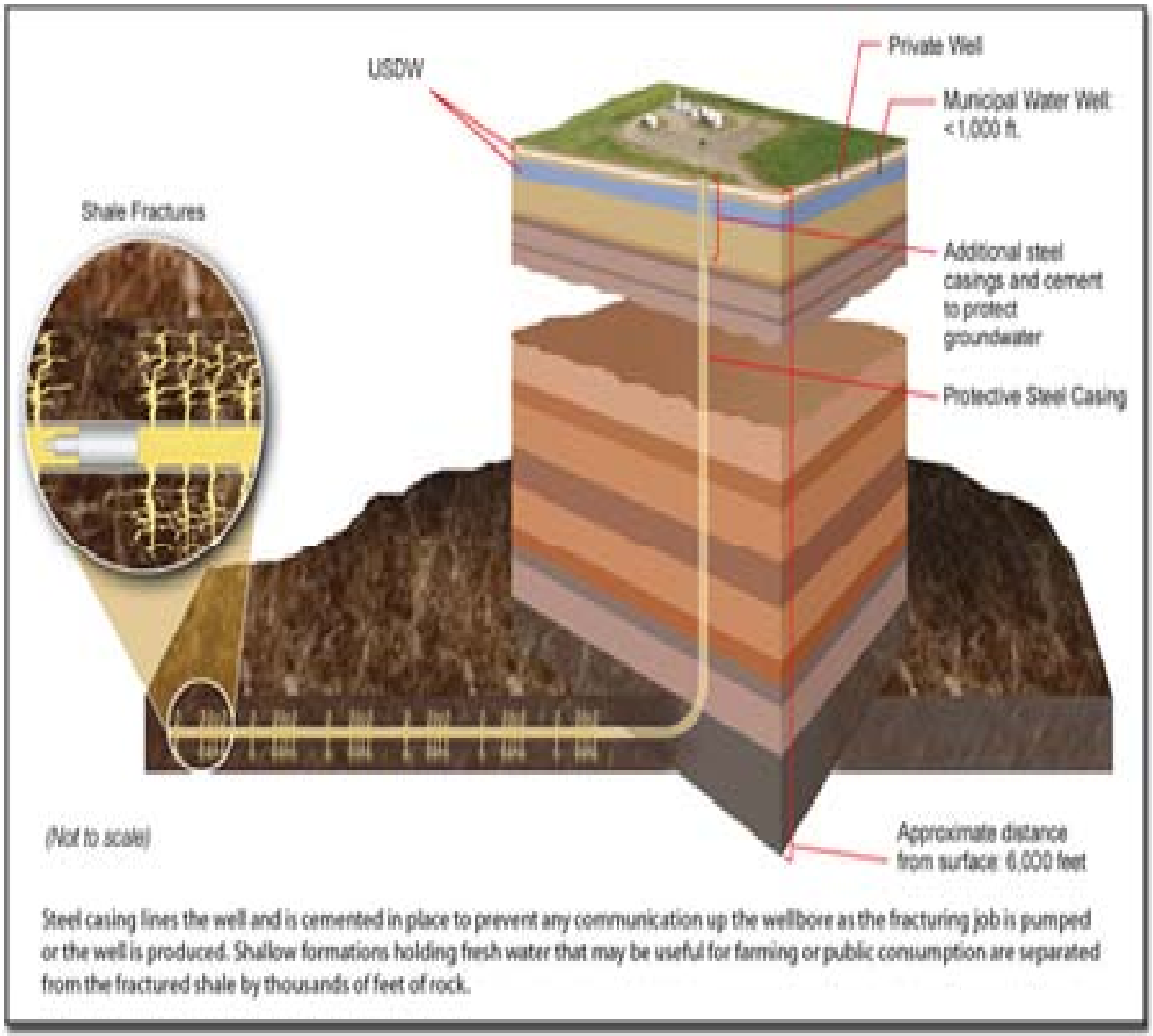
Hydraulic Fracturing

What is hydraulic fracturing, hydrofracturing, or fracking?

- A technique where water is mixed with sand and chemical additives and then the mixture is injected at high pressures into a wellbore to physically break dense or tight rock formations to increase permeability and stimulate well production.

Hydraulic Fracturing



Hydraulic Fracturing

How is fracking done and what is in the fluid?

- **Four stages**
  - Acid stage
  - Pad stage
  - Prop sequence stage
  - Flushing stage
- **Water & Sand** (98%-99%)
- **Chemical Additives** (1%-2%)
  - Gelling agents
  - Acid
  - Corrosion inhibitor
  - Friction reducing agents
  - Iron control/stabilizing agents
  - Cross-linking agent and breaker
  - Scale inhibitor
  - Biocide or disinfectant

Hydraulic Fracturing

Why is Fracking an emerging risk?

- Regulatory uncertainty
- Public perception
- Litigation potential
- Third-party bodily injury and property damage claims
- Clean-up costs

Hydraulic Fracturing

Understanding the Exposure

How do you evaluate Fracking exposures?

- **Engineering Information**
  - ✓Best Management Practices
    - Well construction and integrity guidelines
    - Pre-drilling water quality baseline survey
  - ✓Water Management Plan
  - ✓Pollution Prevention Plan
  - ✓Erosion and Sediment Control Plan
  - ✓Waste Disposal Plans
  - ✓Sensitive Receptor/Surrounding Environment evaluation
  - ✓Loss history

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Cement Manufacturing

Source: http://www.epa.gov/osw/nonhaz/industrial/special/ckd/index.htm

Cement Manufacturing

The Process

- Burning mixtures at high temperatures (up to 2000 degrees Fahrenheit) in a special rotary kiln
  - Limestone, minerals and other additives
- Hot air mixing with the raw materials creates a chemical reaction and produces "clinker"
  - Marble-sized pellets and sand-sized particles. The clinker is removed from kiln, cooled, finished, and ground for bagging

- Cement Kiln Dust (CKD)
  - Fine-grained, solid, highly alkaline waste
  - Removed from exhaust gas by air pollution control devices
  - Can be recycled back into the manufacturing process

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Cement Manufacturing

Cement Kiln Dust (CKD)

- CKD not returned to the production is typically:
  - Disposed in a land-based disposal unit (landfill, waste pile, surface impoundment)
  - May be sold for 'Beneficial Reuse'
- Characterized by EPA as a "Special Waste"
  - Temporarily exempted from RCRA Sub-Title C Landfill Regulations
  - Proposing to regulate as Sub-Title D Landfill (non-haz)
  - Draft Regulations have been prepared
- Environmental Issues
  - Storm water Run-Off
    - Elevated pH – as high as 12.5
    - Dissolved Metals – antimony, cadmium, lead, mercury, selenium, silver, and zinc.
    - May also contain arsenic, chromium or strontium

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Cement Manufacturing

Understanding the Exposure

How do you evaluate CKD Landfill Exposures?

- **Engineering Information**
  - ✓Groundwater Monitoring Data
  - ✓Emissions data
  - ✓Stormwater Management Practices
  - ✓Sensitive Receptor Evaluation (Surface water, drinking water sources)
  - ✓ECHO / Envirofacts – Notice of Violations (NOV), Compliance Issues
  - ✓Loss History

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1, 2, 3 – Trichloropropane (TCP)

- **Emerging groundwater contaminant** - past pesticide & solvent use
  - Pesticide - impurity in soil fumigants primarily used prior to 1985
    - Vegetables, fruits, and cotton - most common crops
    - 1,3-dichloropropene / Telone II (0.2% TCP); 7MM lbs of used in CA in 2003.
  - Solvent / Degreasing Agent: 1-10MM lbs used in 2002

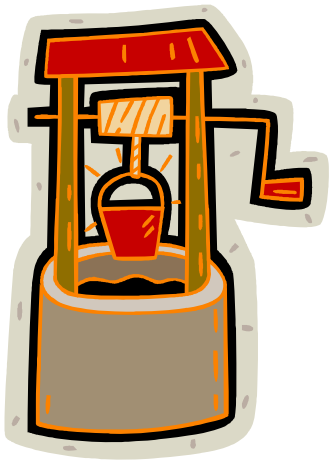
1, 2, 3 – Trichloropropane (TCP)

- **Persistent in groundwater; does not adhere to soil**
  - CA, HI, NJ, NY, NH –contaminated drinking water supplies
    - Hawaii MCL – 0.6 µg/L
    - California – 0.005 µg/L Notification level / 0.5;
    - California Department of Public Health - currently developing an MCL, which is expected to be released for public comment in the latter half of 2013 or early 2014
    - NJ Groundwater Quality Standard – 0.03 µg/L;
    - EPA Region 9 Preliminary Remediation Goal (tap water)- 0.00065 µg/L
- **Laboratory methods are currently being developed**
- **Litigation**
  - Livingston, CA won a $9M lawsuit against Dow/Shell (manufacturers); several other lawsuits initiated in CA (Clovis, Bakersfield, and others)

1, 2, 3 – Trichloropropane (TCP)

Engineering concerns:

- Water Supply Companies
- Municipalities
- Private Wells
  - Is Groundwater a source of public water?
  - State? (California most active)
  - Location? Agricultural areas?
  - Vegetables/fruits/cotton
  - Monitoring for TCP
- Chemical Manufacturers / Industrial Sites:
  - History of TCP use?
  - Has TCP been tested for?
  - Are the detection levels low enough (<1 ppb)?



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PFCs

What are PFCs (Perfluorinated Compounds)?

- aka perfluoro-octane sulphonate (PFOS) and perfluorooctanoic acid (PFOA)
- Synthetic (man-made) chemical that does not occur naturally in the environment - sometimes called **"C8"**
- Surfactant and emulsifier used to make Flouropolymers
- Used for Fire resistance, oil and water repellency, non-stick surfaces, waterproof membranes, carpet stain guards, fire-fighting foams, paints, cleaning products, paper coatings, and engineered coatings, food packaging
- Teflon and GoreTex –Notable Brands
- DuPont and 3M – Notable Manufacturers
- Used since the 1940s and 1950s

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PFCs

Why are PFC's an Emerging Contaminant?

- They can be found in soil, sediment and water
  - ✓Persistent in the environment
  - ✓Found at very low levels both in the environment and in the blood of the general U.S. population
  - ✓Remains in people for a very long time
  - ✓May cause developmental and other adverse effects in laboratory animals
  - ✓New Study suggests they may reduce the effectiveness of vaccines on children

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PFCs – Groundwater Protection

- ***Currently no Federal MCL for these chemicals***
  - ✓US EPA has established a Provisional Drinking Water Health Advisory of 0.4 (µg/L)
  - ✓WV residents must be provided with alternative drinking water if levels exceed 0.5 µg/L
  - ✓MN regulatory standard of 0.3 µg/L
  - ✓NC has proposed, but not adopted, a regulatory standard of 1.6 µg/L

- PFOA and related compounds are not currently analyzed in public drinking water systems
- EPA, Dupont and 8 other manufacturers agreed to phase out use by 2015 – 3M already has

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PFCs – Remediation & Engineering

***Remediation*:**

- Persistent in GW – does not degrade
- Remediation is difficult
  - Incineration appears to be most effective treatment
  - Reverse osmosis, nano-filtration, and activated charcoal

Engineering:

- Awareness of historical manufacturing use
- Drinking Water Supplies (Sensitive Receptors)
- Municipalities (Public Drinking Water Wells)
  - Currently No EPA requirement to analyze or treat

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Nitrates

Source: http://www.usda.gov/wps/portal/usda/usdahome

Nitrates

- Widespread groundwater contaminant
  - Community water supplies (< 200 connections) and private wells in agricultural areas at most risk
- US EPA suggests exposure to infants and pregnant women can result in illness, including shortness of breath and baby blue syndrome*
- Sources – Agricultural/Fertilizer; CAFO; Rendering Facilities
- Federal MCL of 10 mg/L
  - California's Central Valley
    - ✓14% of community systems have 1 or more well with nitrate > MCL. Serve over 1 million residents.
- Treatment is expensive – reverse osmosis / water softeners
  - Treatment costs range from $100,000 to $7.5 million per system.

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Nitrates

How do we evaluate Nitrate Exposures?

- **Submission Materials / Engineering**
  - Where is your site? Agricultural State/Area? Central Valley?
  - Use of Site
    - Public Water Supply, Municipality (PLC Policy)
    - Private Well On-Site
    - Source of Nitrates (CAFO, Rendering Plant, etc.)
  - Groundwater Monitoring Data / Plans – Concentration Trends
  - Aquifer Type (confined or unconfined)
  - Management Plans for the application of Fertilizers
  - Run-off Management Plans

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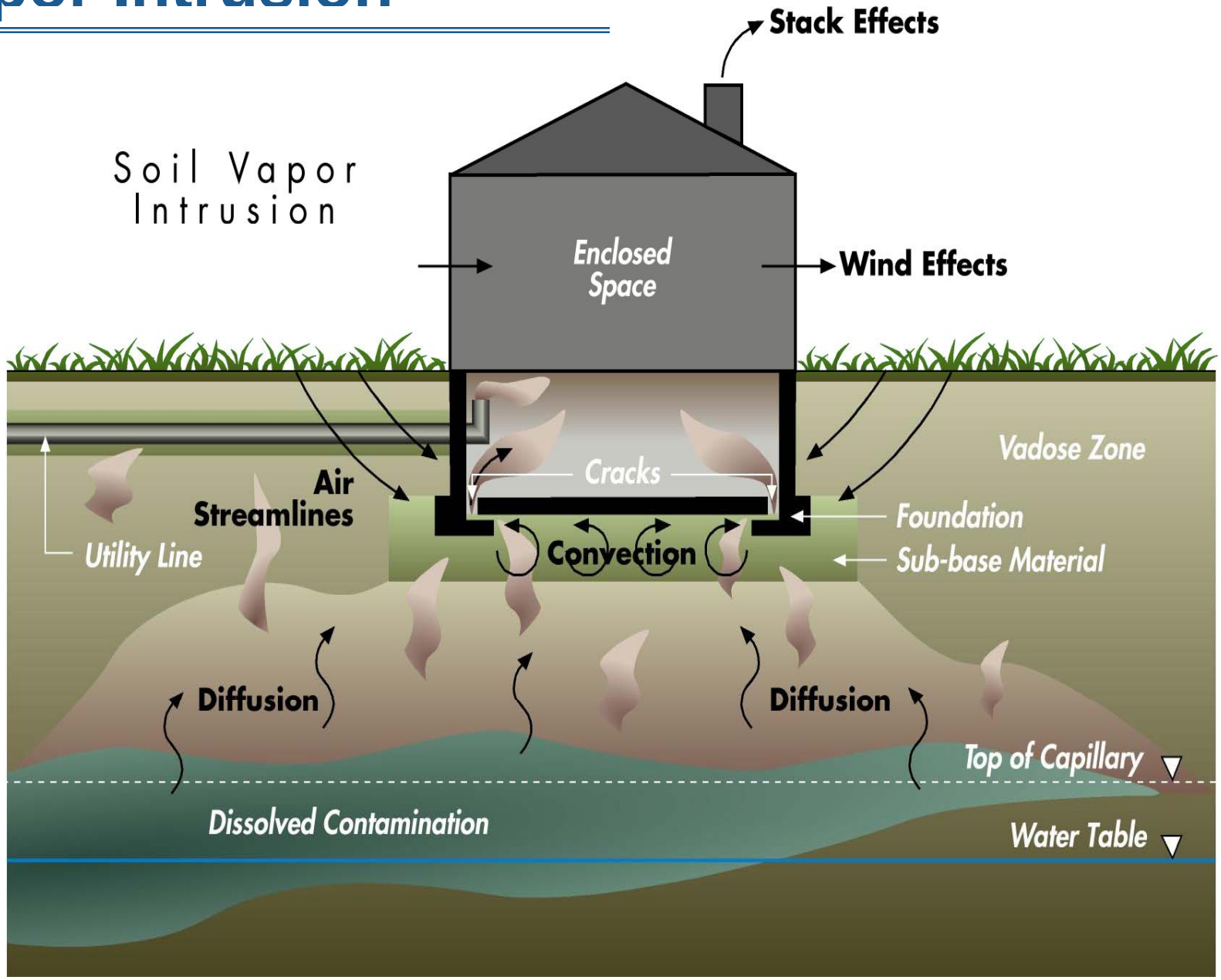
Vapor Intrusion



Source: Adapted from USEPA

Vapor Intrusion:
Technical Guidance Documents

- USEPA OSWER Draft Guidance (2002)
  - EPA Plans to Issue Final Subsurface Vapor Intrusion Guidance in 2013.
- ITRC Guidance (2007)
- ASTM
- Specific State Guidance Documents
  - NJDEP Vapor Intrusion Technical Guidance (January 2012)
  - PADEP Land Recycling Program Technical Guidance Manual Section IV.A.4 - Vapor Intrusion into Buildings from Groundwater and Soil Under the Act 2 Statewide Health Standard - Effective January 24, 2004

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Vapor Intrusion:
Technical Guidance Documents

- Vary significantly from state to state
- Some risk based, some based on concentrations in source & depth to groundwater
- Evolving Guidance & Regulations
- “Reopeners” a concern

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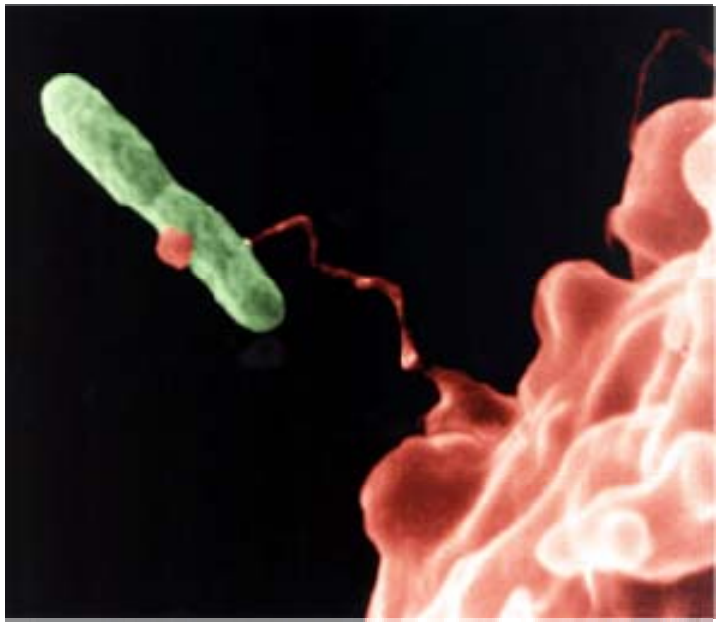
Legionellosis, aka Legionnaires' Disease

***Legionellosis*:**

- Type of pneumonia - lung infection
  - •High Mortality Rate: 5-30%
  - •Incubation: 2-20 Days
  - •High Fever: 102-105 °F
  - •Difficulty in Breathing
  - •Cough
  - •Chills
  - •Successful treatment with antibiotics



Legionella bacteria

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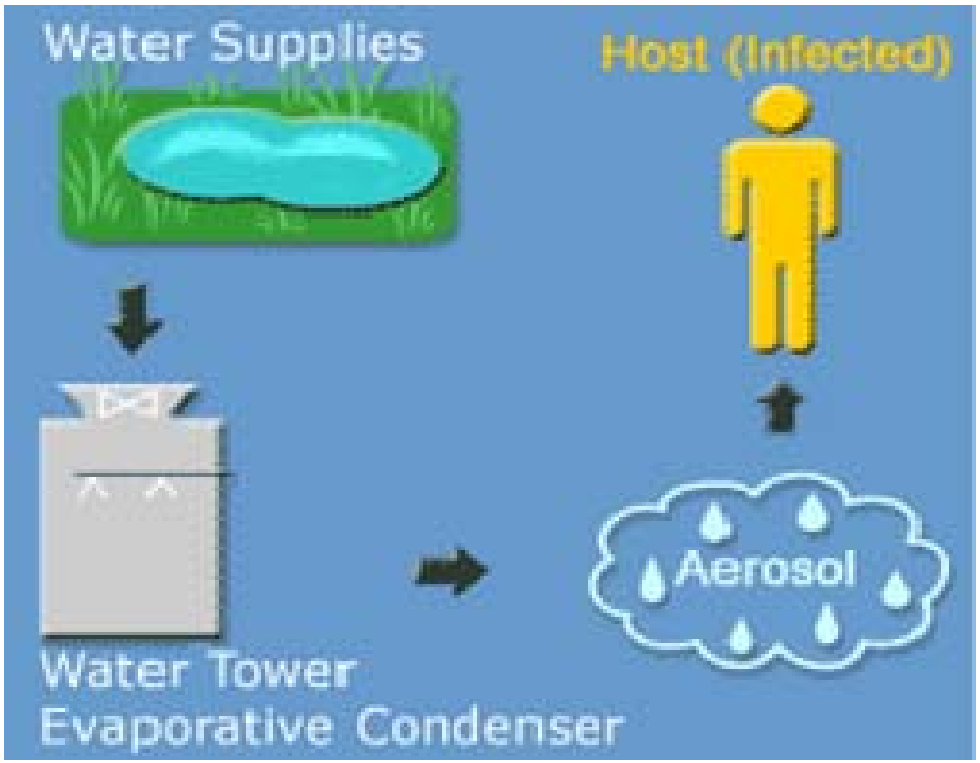
Legionella: Sources of Outbreaks

- Naturally Occurring
- Cooling towers
- Potable water systems
- Humidifiers
- Spas and Hot tubs
- Many other systems
  - i.e. water sprayer at produce dept., cooling misters, metal working fluid in auto plants/plating operations



Legionella: Why Outbreaks Occur

Rarely a single cause – usually a combination of factors

- Mechanical:
  - *Maintenance failure*
  - *Design failure*
  - *Operational Failure*

- Human Exposure:
  - *Exposure to bacteria*
  - *Compromised immune system*

Old water tank:

Legionella: Prevention & Response

- Maintenance/Control of water system in facilities
- Thermal disinfection - water distribution systems, hyper chlorination, copper-silver ionization,
- Routine testing – determine vigilance
- Record keeping
- Response from PIER (Pollution Incident and Environmental Response)® or Crisis Management companies

Industries Impacted by *Legionella*

- Hospitality Industry
  - Gaming and casinos, hotels, lodging, restaurants, resorts
- Healthcare organizations
  - Inpatient hospitals, rehab centers, long-term care facilities, ambulatory clinics
- Hospices
- Age Restricted Facilities

Cooling towers usually sit on top of a building. Mist from their operations pass over coils. This important piece of an HVAC system can often be the site of legionella growth.

Other Emerging Contaminants

- Pharmaceuticals and Personal Care Products
- Nanoparticles
- Asphalt Sealants – PAH
- 1,4-Dioxane
- Selenium

- Explosives – RDX; 2,4-Dintrotouene
- Endocrine Disruptors

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Endocrine Disruptors

- May interfere with endocrine system and may produce adverse developmental, reproductive, neurological, and immune effects in both humans and wildlife.
  - PBDE (polybrominated diphenyl ethers) - flame retardant
  - BPA (bisphenol A) - used in can linings
  - Phthalates - used in plastics; bottles, shampoos, cosmetics
  - Atrazine - Herbicide (banned in Europe)

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In Conclusion…

- To manage exposures associated with emerging risks or contaminants, it is important to understand the regulatory environment, public perception, litigation potential, and the companies best management practices.

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