

MONITORED NATURAL ATTENUATION AND HEALTH RISK ASSESSMENT FOR TOTAL PETROLEUM HYDROCARBONS (TPH)



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MNA FOR HYDROCARBONS: KEY QUESTIONS

- Any health risk while MNA is underway?
- Monitoring
 - What to monitor for?
 - Where to monitor?
- When am I done?

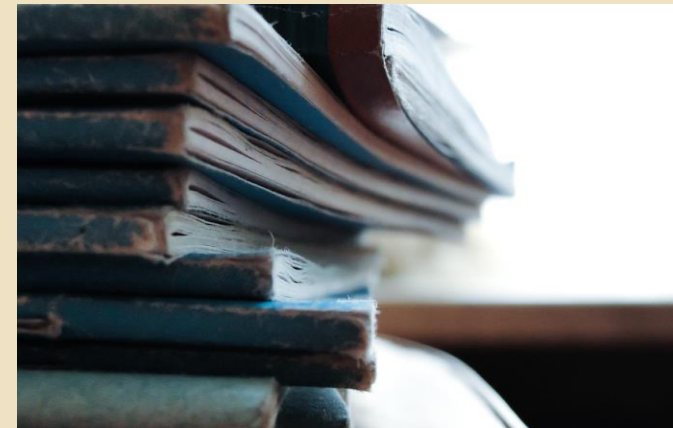


TOTAL PETROLEUM HYDROCARBONS (TPH)



MONITORED NATURAL ATTENUATION (MNA)

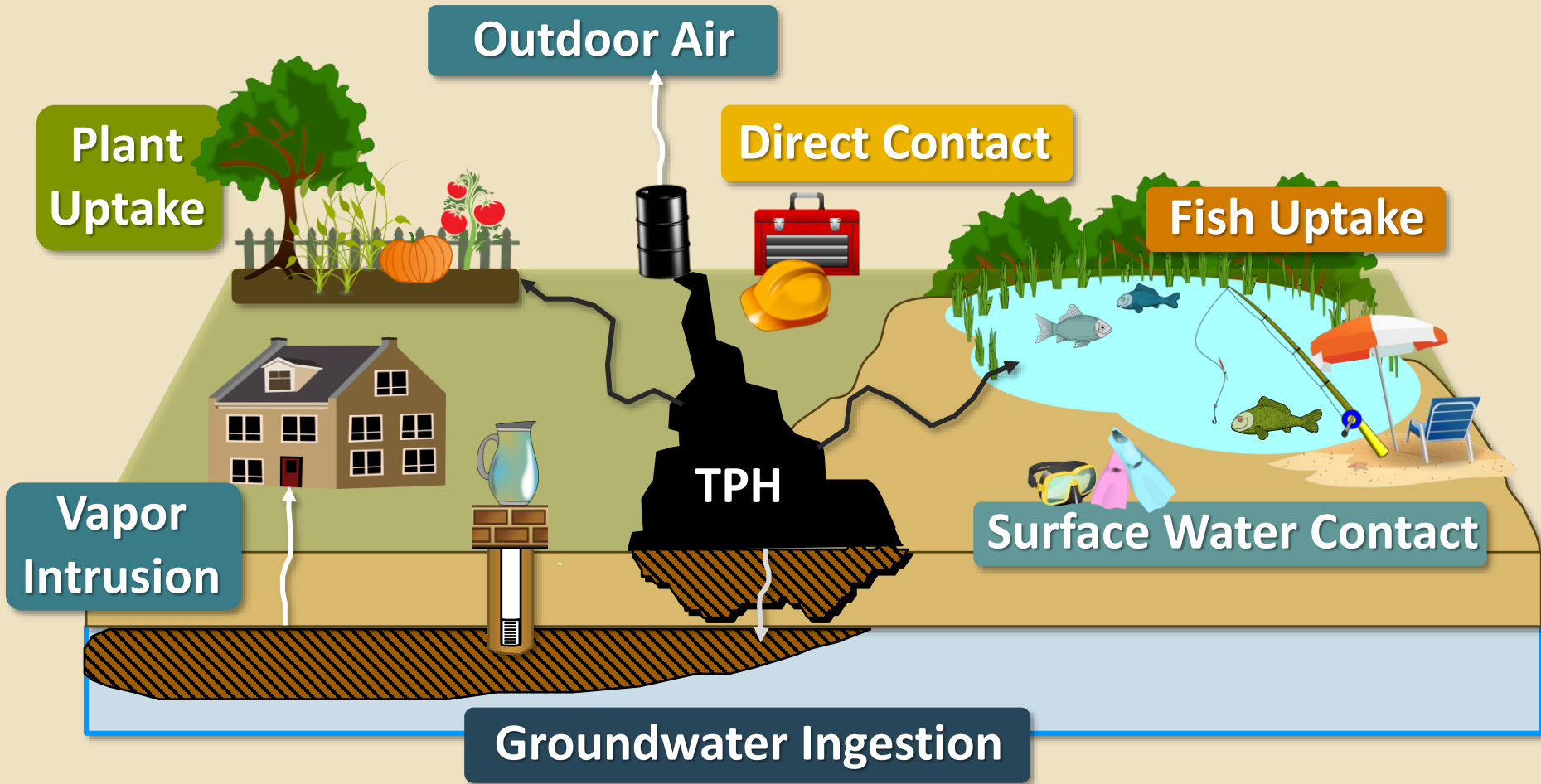
- **Widely applied in the US**
 - Component in >20% of U.S. National Priority List (NPL) sites¹
 - Typical component of every chlorinated-solvent site remedy²
- **Numerous guidances**
 - Federal agencies
 - State agencies
 - Corporations
 - Professional & Industry Associations
 - Public/Private Consortium



¹ Wilson JT. 2011. Applications of Monitored Natural Attenuation in the USA (Presentation). Presented at 2011 International Conference on Groundwater Contamination and Water System Security, Beijing, China.

² ITRC. 2008. Enhanced Attenuation: Chlorinated Organics. Interstate Technology & Regulatory Council (ITRC). April.

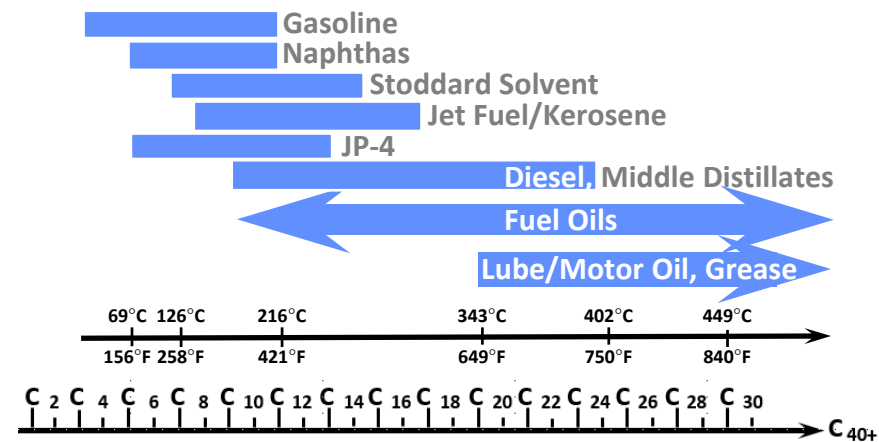
CONCEPTUAL SITE MODEL



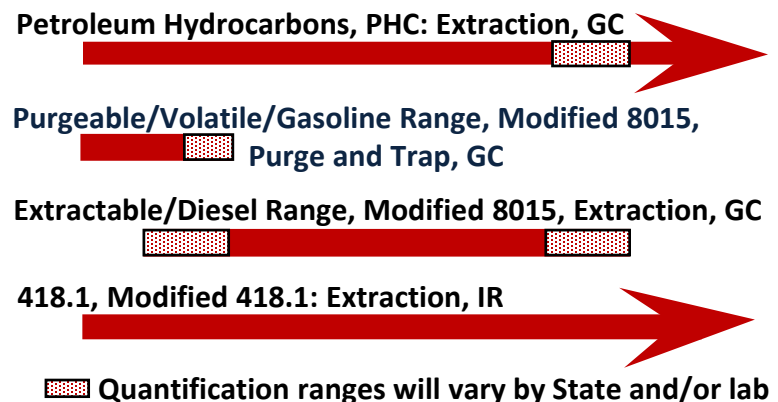
CHEMICALS OF POTENTIAL CONCERN (COPC) FOR EXPOSURE ASSESSMENT

- **Aromatic / Aliphatic**
 - **Carbon Ranges¹:**
 - **C5-8, C9-18, C19-32**
- **TPH Indicators**
 - **Aromatic C5-8: Benzene, Toluene, Ethylbenzene, Xylenes**
- **TPHg, TPHd, TPHr**
- **Variable, dynamic mixtures**

Carbon and Boiling Ranges of Petroleum Products



TPH Methods: Carbon Ranges

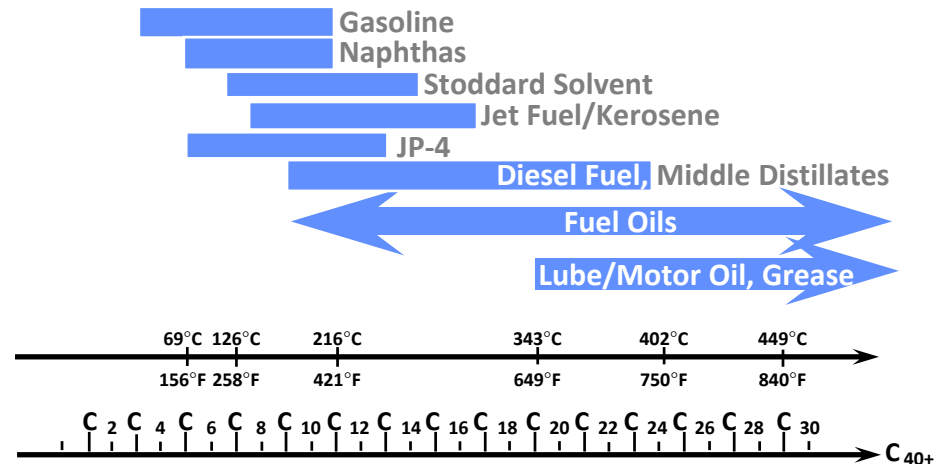


¹USEPA 2009. PPRTV.

TPH CHARACTERIZATION CHALLENGES

- Variable and dynamic chemical composition
 - Large number of isomers
- Analyses are not composition specific
- Inconsistencies in state regulatory approaches

Approximate Carbon and Boiling Ranges of Petroleum Products



TPH Methods: Approximate Carbon Ranges

Petroleum Hydrocarbons, PHC: Extraction, GC



Purgeable/Volatile/Gasoline Range, Modified 8015, Purge and Trap, GC



Extractable/Diesel Range, Modified 8015, Extraction, GC

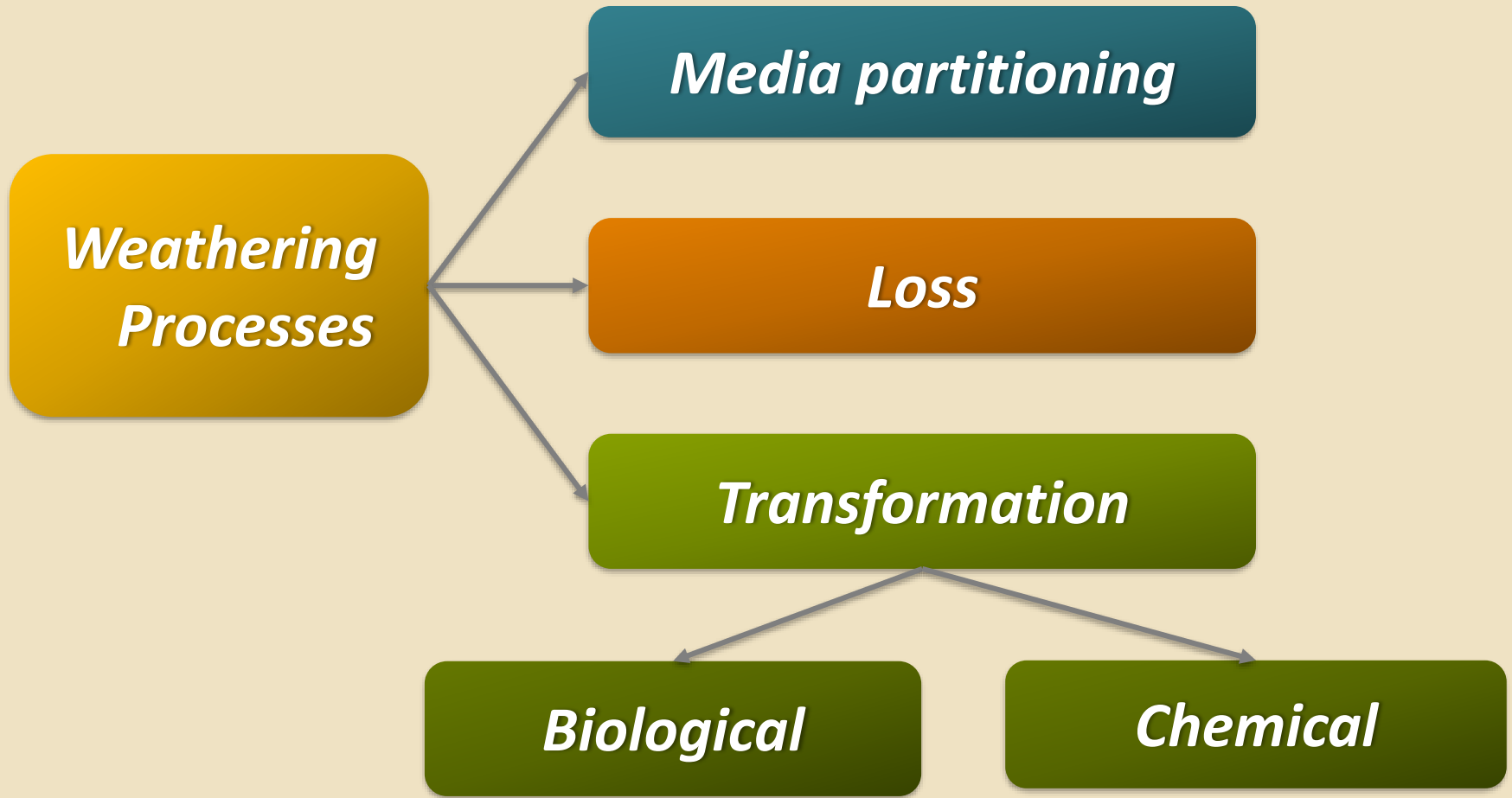


418.1, Modified 418.1: Extraction, IR



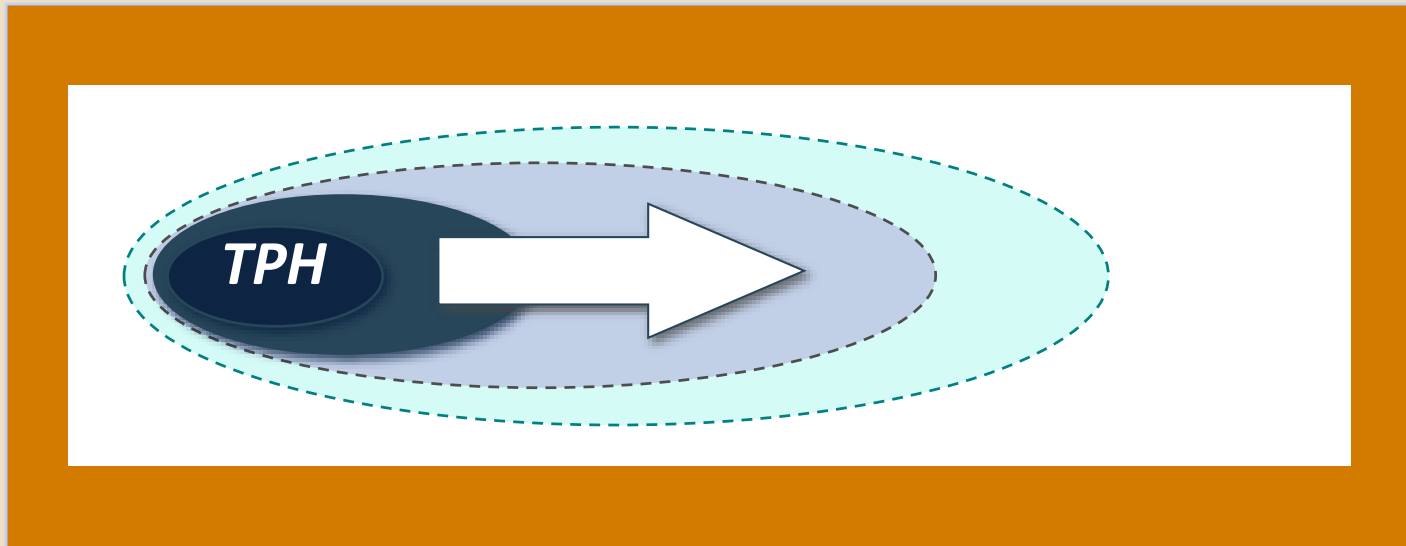
 Ranges used for quantitation may differ depending on State and/or lab

HYDROCARBON WEATHERING



MONITORING DEGRADATION PRODUCTS

- Polar compounds can move farther than parent hydrocarbons



POLAR COMPOUNDS POSE MONITORING CHALLENGES

- May be present as naturally occurring background



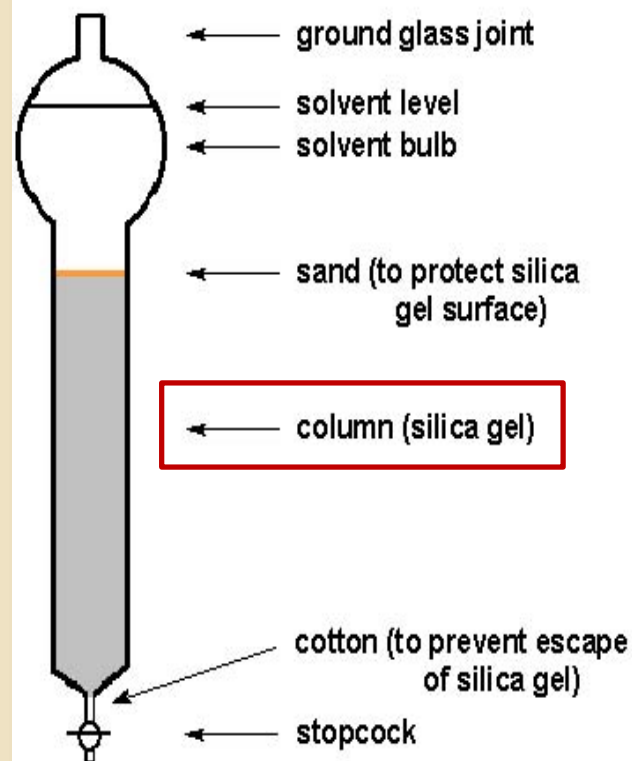
- May be sampling artifacts

SILICA GEL CLEANUP

- Can prevent false positive results from background substances
- Can result in missing polar degradation products



The Chromatography Column



TOXICITY

Basis of TPH Toxicity Values¹: Surrogates (S) and Indicators (I)

Carbon Range	Aliphatic		Aromatic	
C5-C8	S	N-hexane	I	BTEX ²
C9-C18	S	Mid-range aliphatics	S	High-flash aromatic naphtha
			I	Naphthalene , 2-Methylnaphthalene
C19-C32	S	White mineral oil	S	Fluoranthene

Hydrocarbons

Weathering

Degradation Products
Toxicity??

¹USEPA 2009. PPRTV. ²Benzene, toluene, ethylbenzene, xylenes (BTEX).

RISK CHARACTERIZATION

Carcinogens

Indicators

BTEX

Naphthalene

Non-carcinogens

Hazard Quotient

Indicators

or

**Mixtures of Reference
Doses (RfD); Surrogates**

MNA AND HYDROCARBONS: GOING FORWARD

- **New monitoring challenge:**
 - Differentiating polar background products from degradation products
 - Route-specific monitoring methods
- **How to evaluate toxicity of polar degradation products?**
- **Deeper understanding of hydrocarbon risk assessment issues in professional community**
- **More consistency in regulatory approaches?**

QUESTIONS?

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