

Determining the Concentration and Chemical Composition of Oxygenated Hydrocarbons Released from the Valdez Marine Terminal

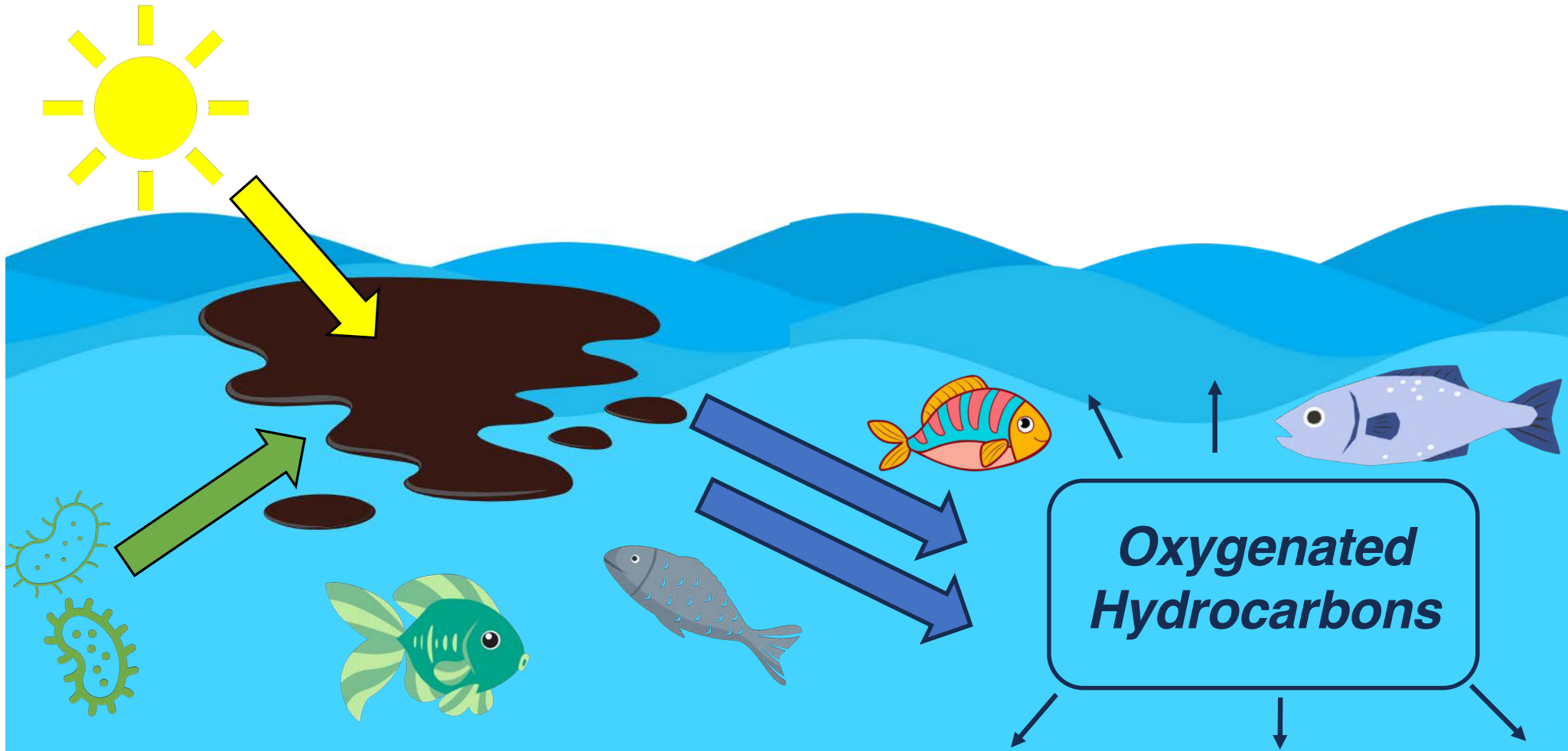
Maxwell L. Harsha & David C. Podgorski

University of New Orleans

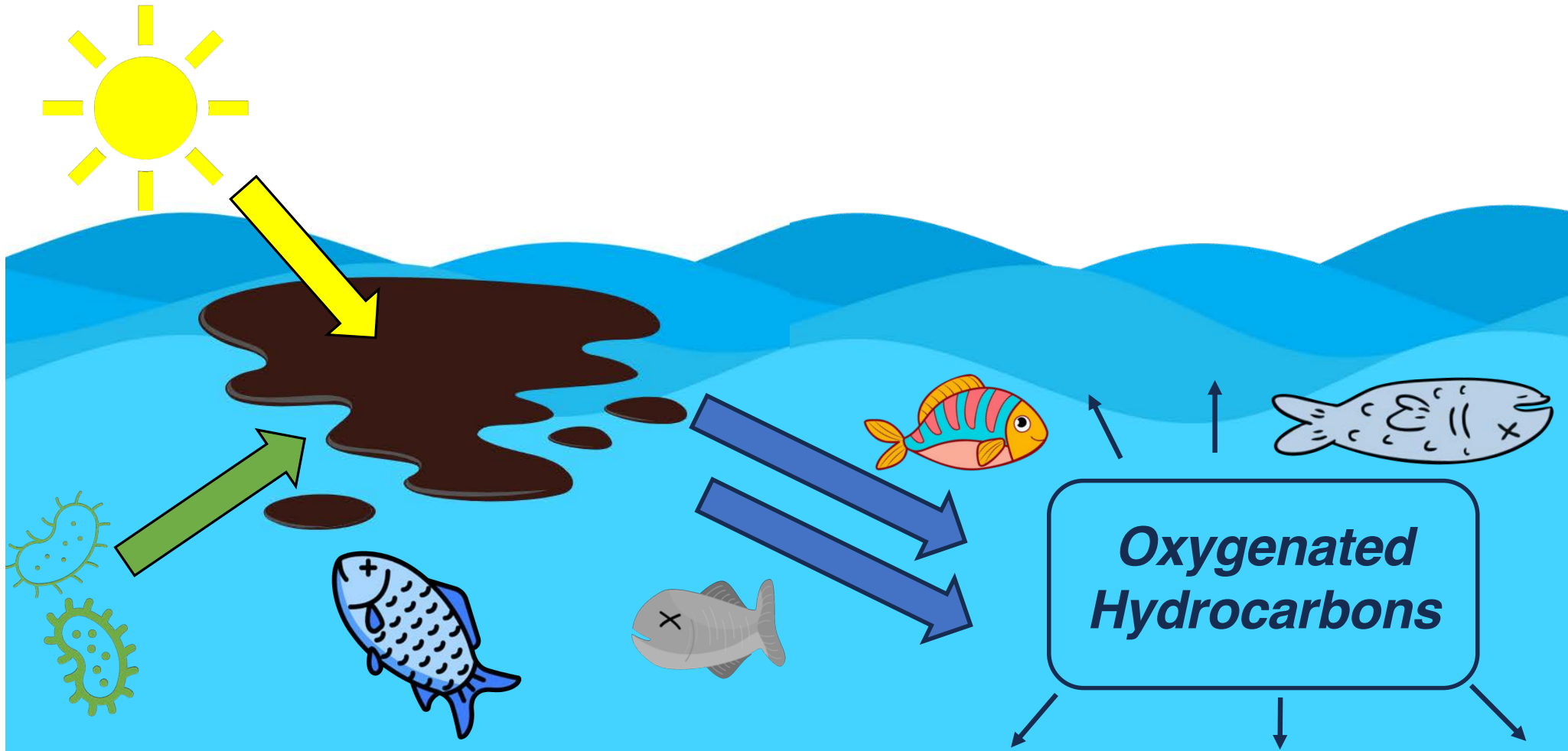
PWSRCAC Board of Directors Meeting

September 22, 2023

Oxygenated Hydrocarbons



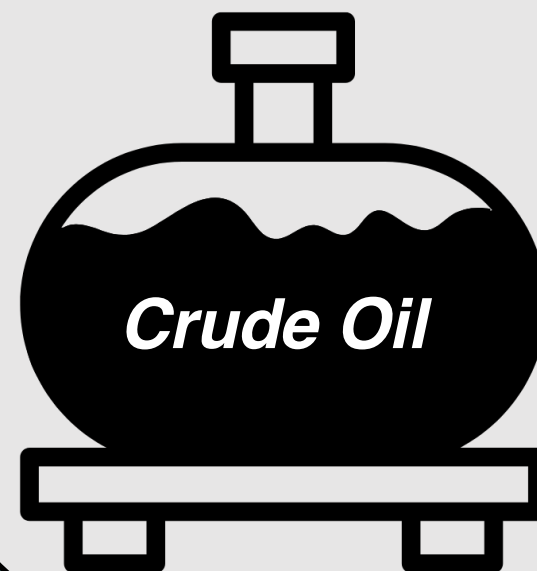
Oxygenated Hydrocarbons



Ballast Water



Cargo Area

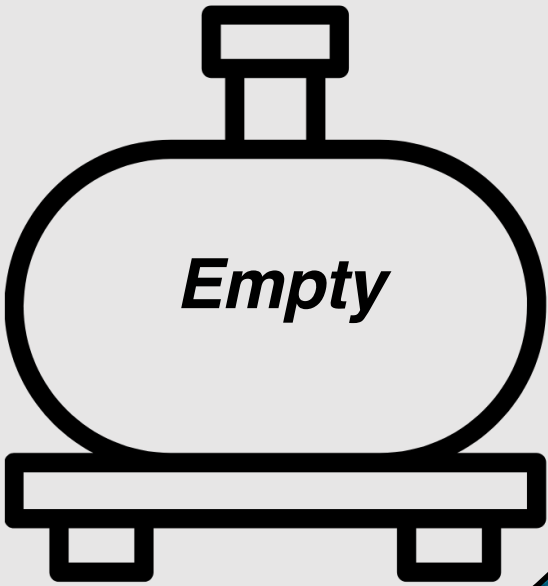


Crude Oil

Ballast Water

Cargo Area

Empty



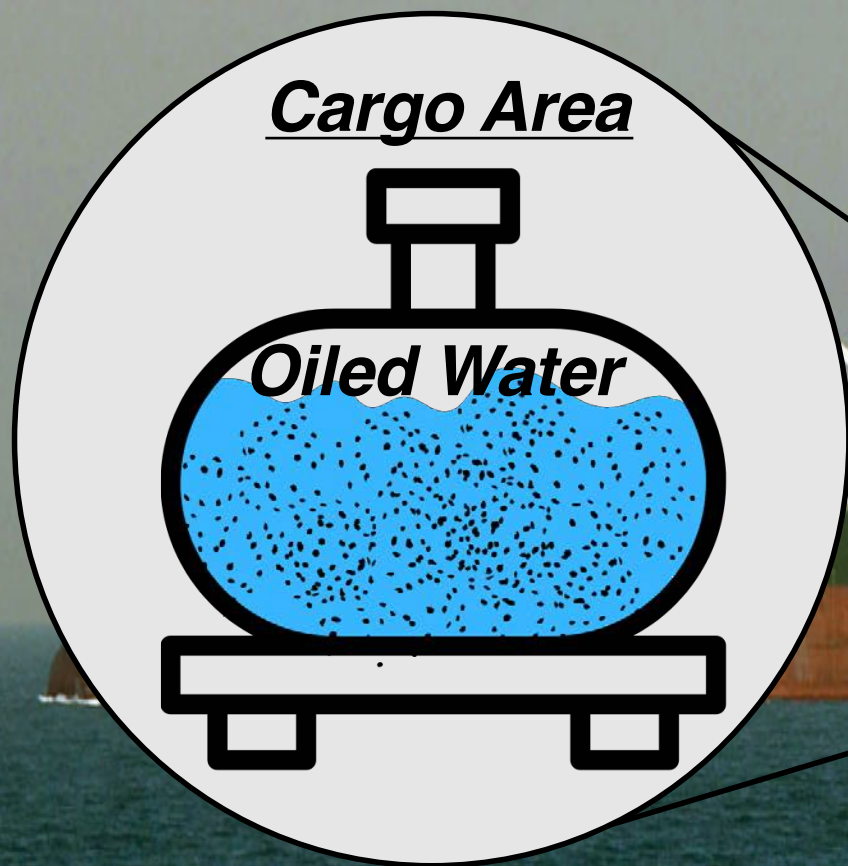
Ballast Water

M/V Cougar Ace



uscgalaska.com

Ballast Water



Ballast Water Offloading



Ballast Water Treatment Facility



Valdez Marine Terminal

Regulations

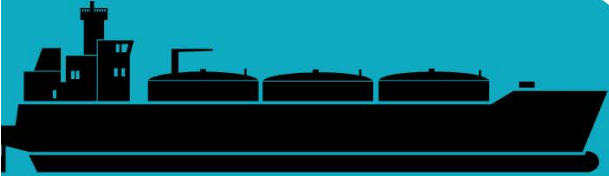
- Regulated by the *Alaska Department of Environmental Conservation*.
- Oil contamination levels monitored by amount of *BTEX*.
- *BTEX does not account for oxygenated hydrocarbons.*



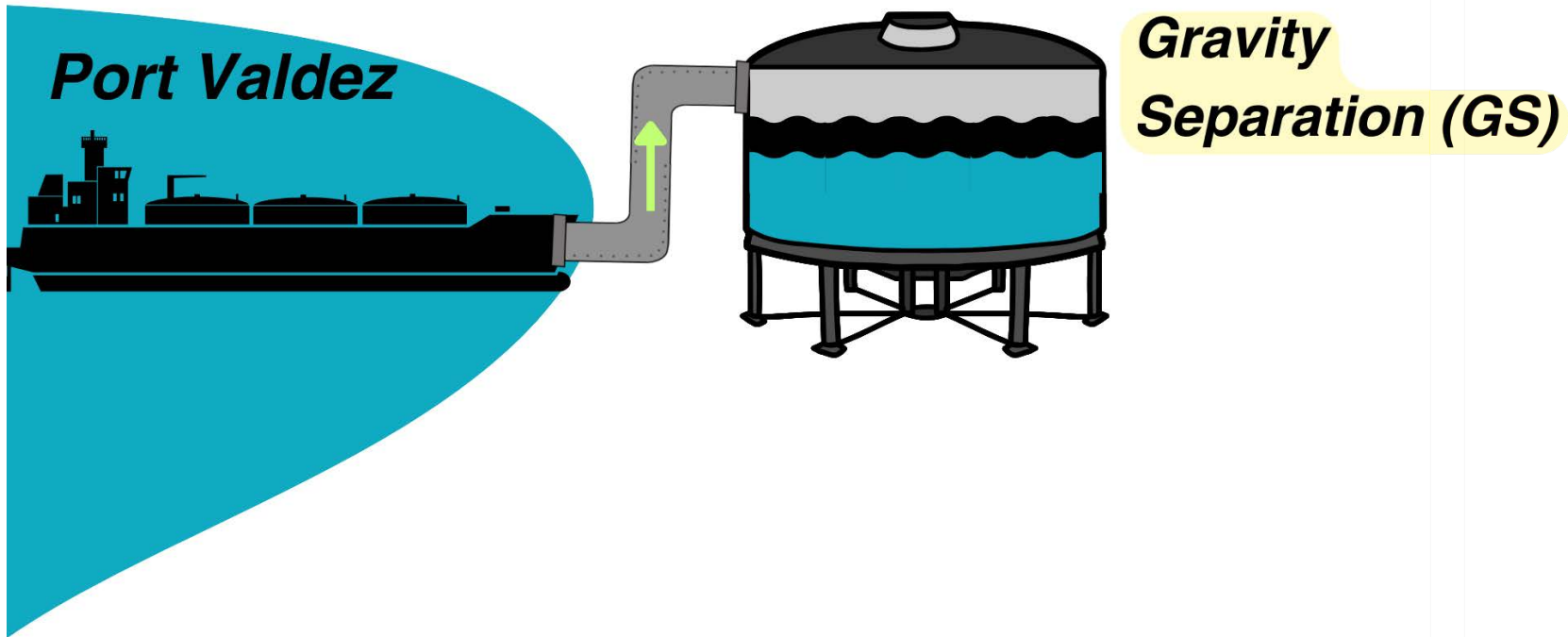
dec.alaska.gov

Ballast Water Treatment Facility (BWTF)

Port Valdez



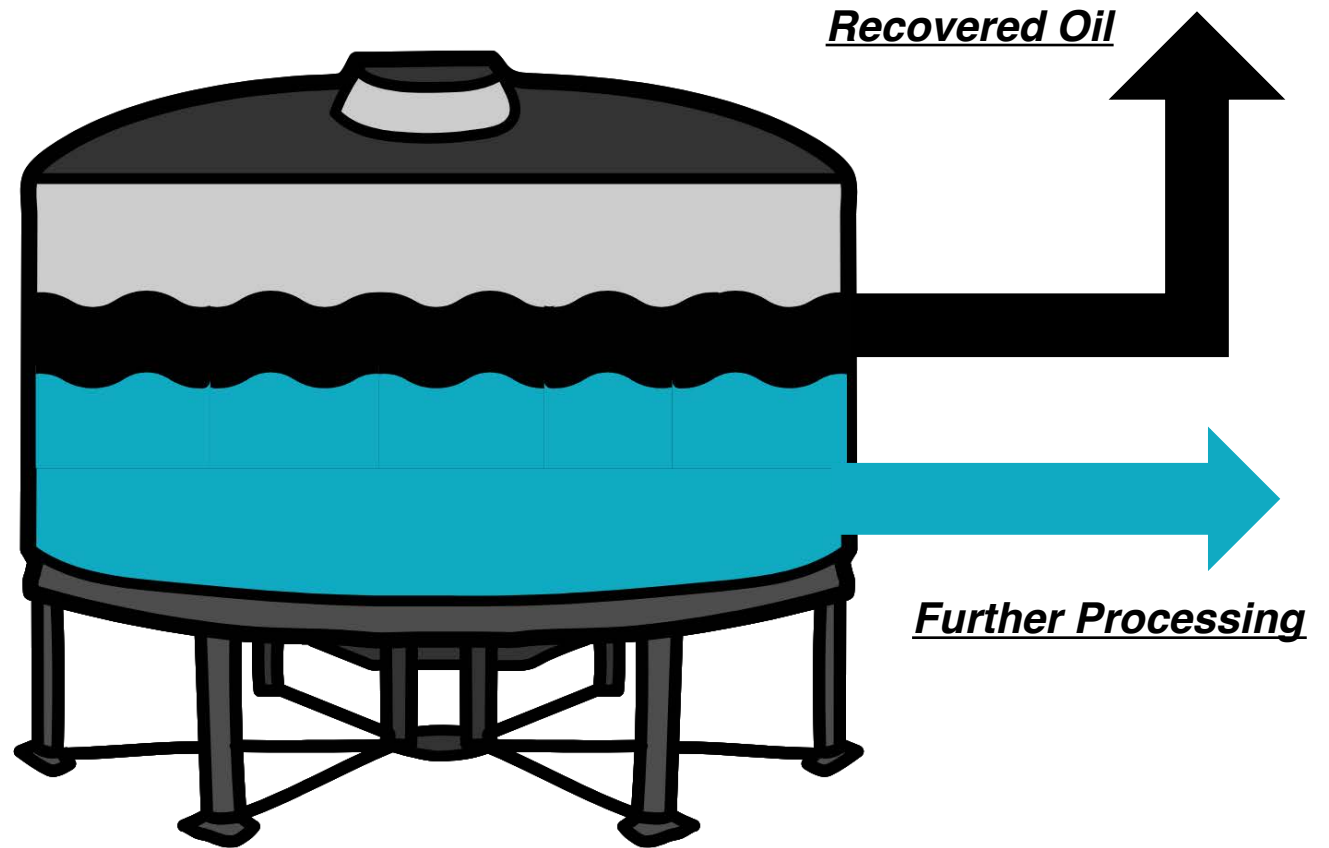
BWTF Step 1: Gravity Separation



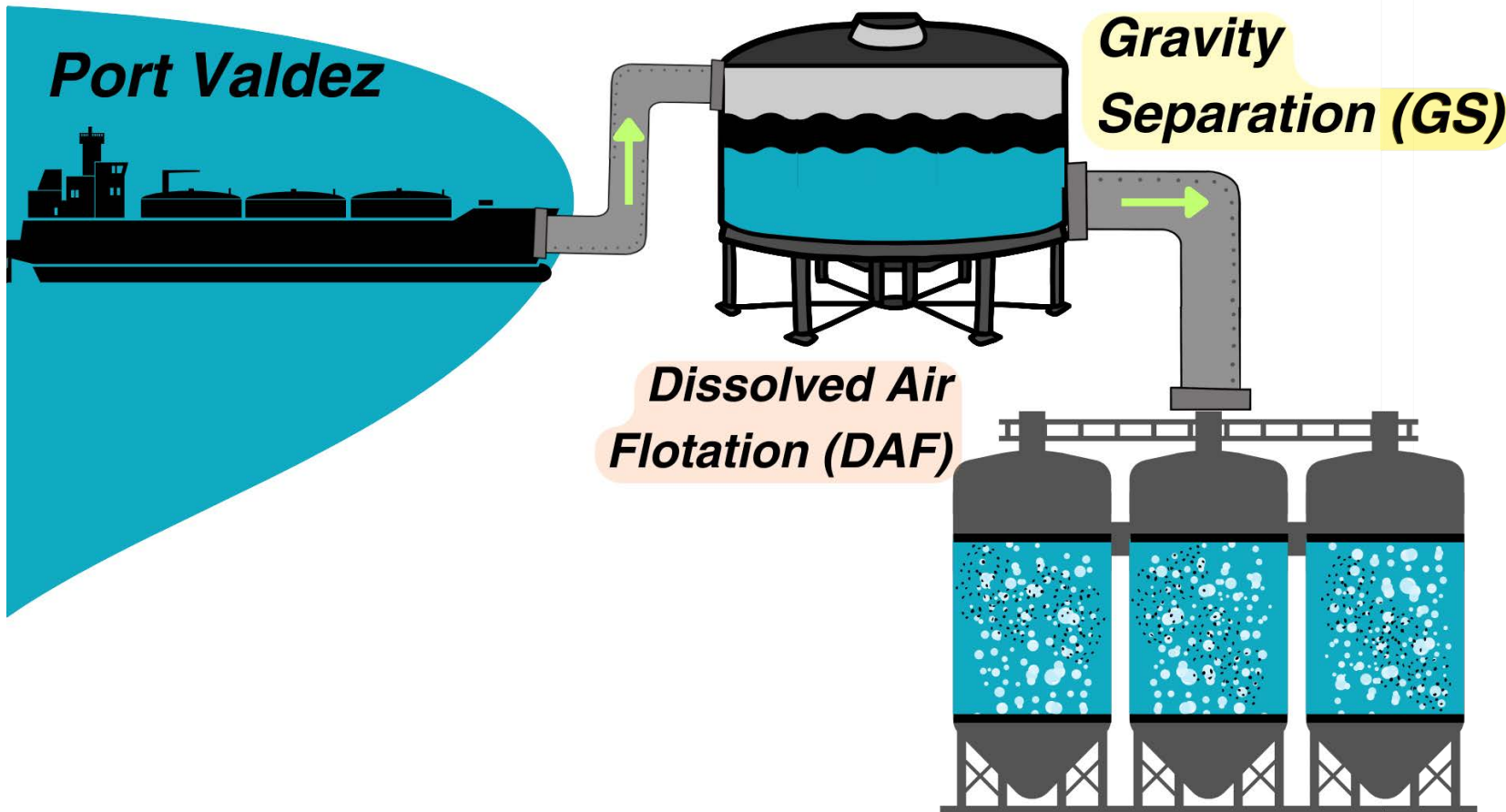
BWTF Step 1: Gravity Separation



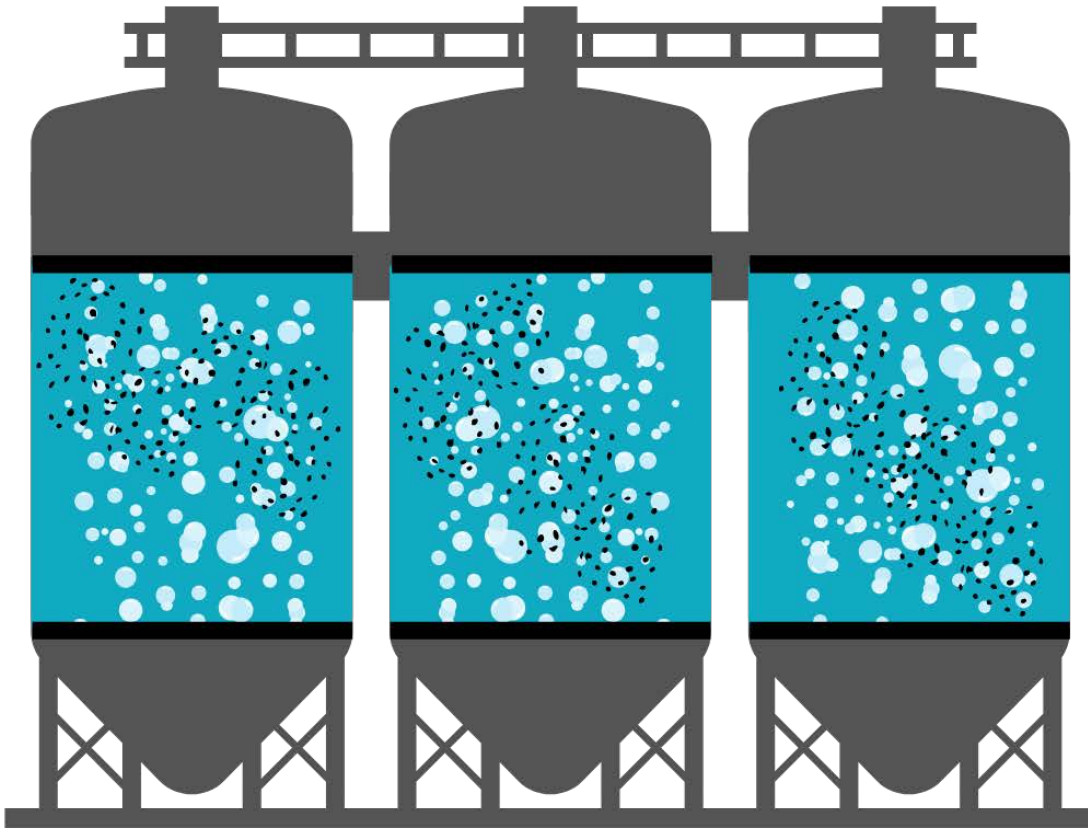
sciencephoto.com



BWTF Step 2: Dissolved Air Flotation

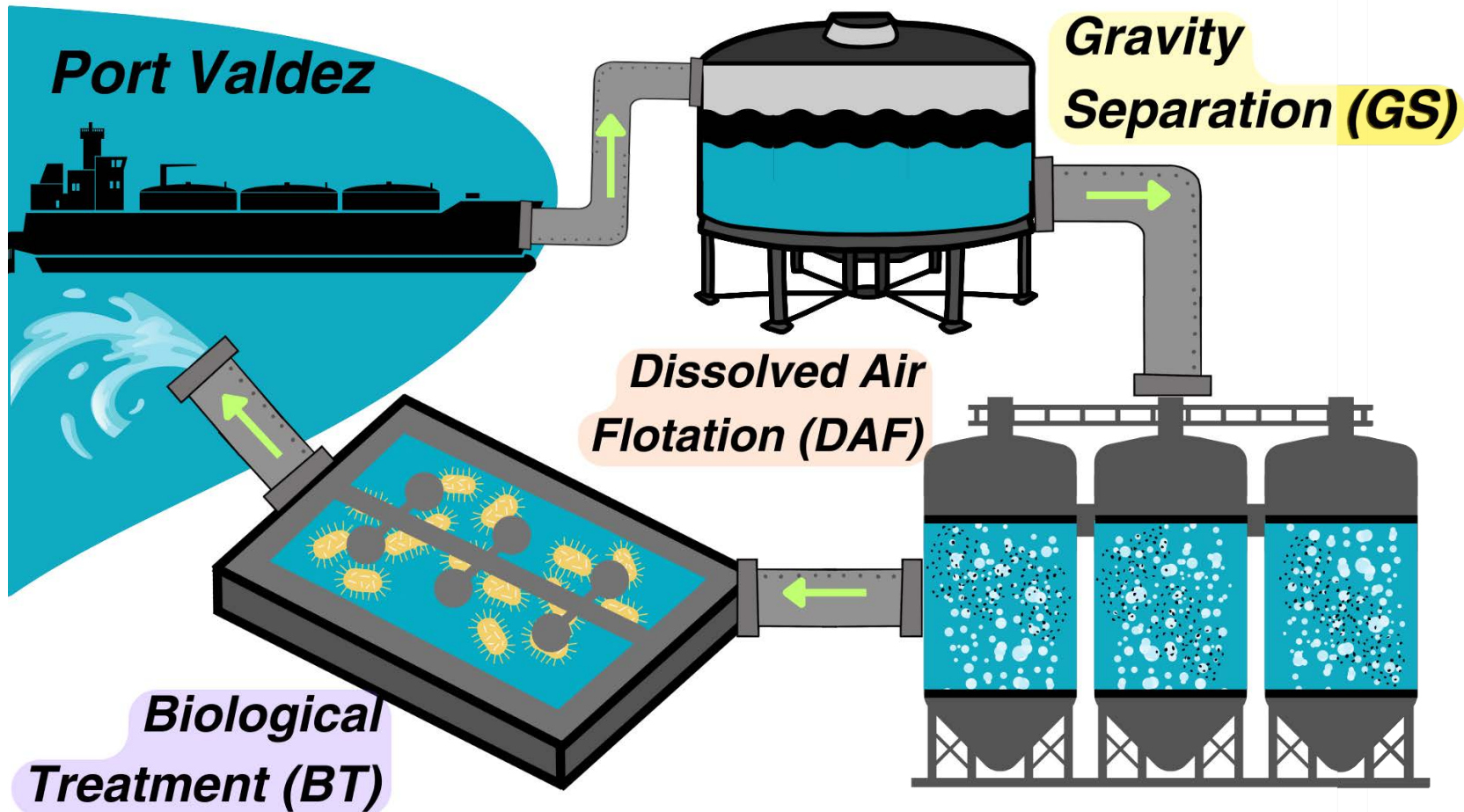


BWTF Step 2: Dissolved Air Flotation

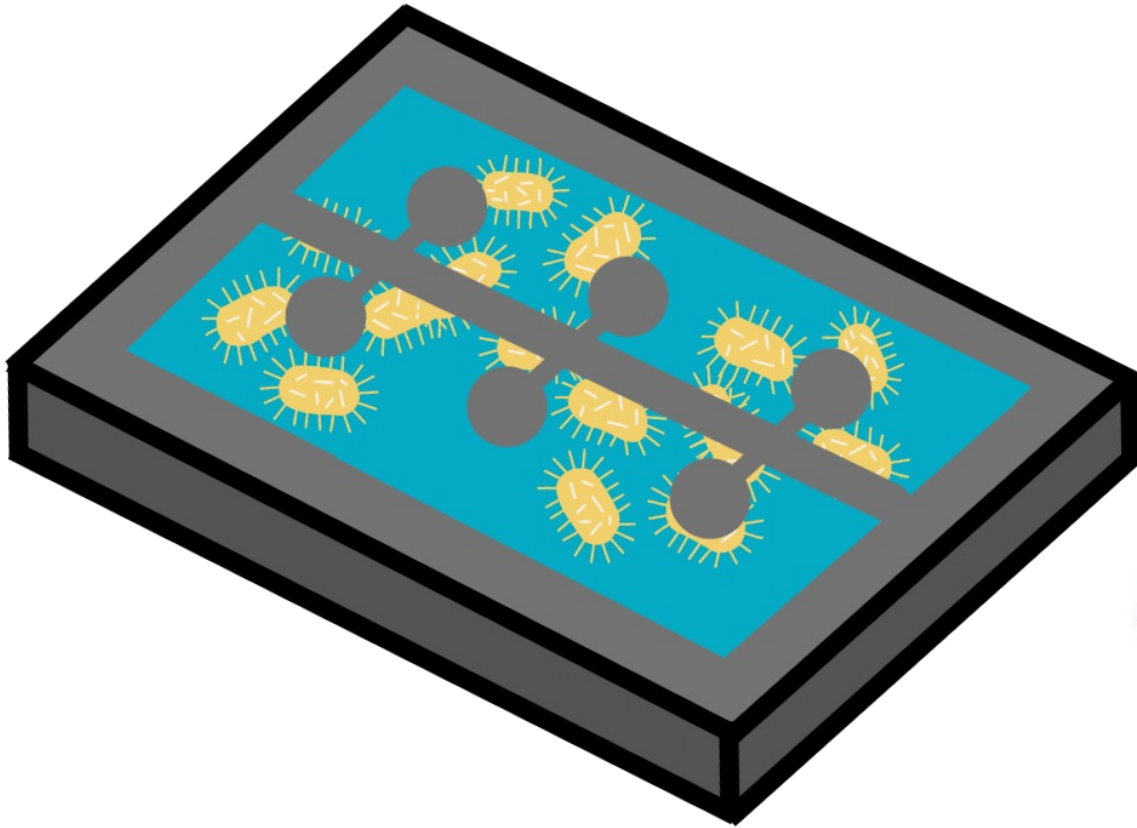


[giphy.com](https://www.giphy.com)

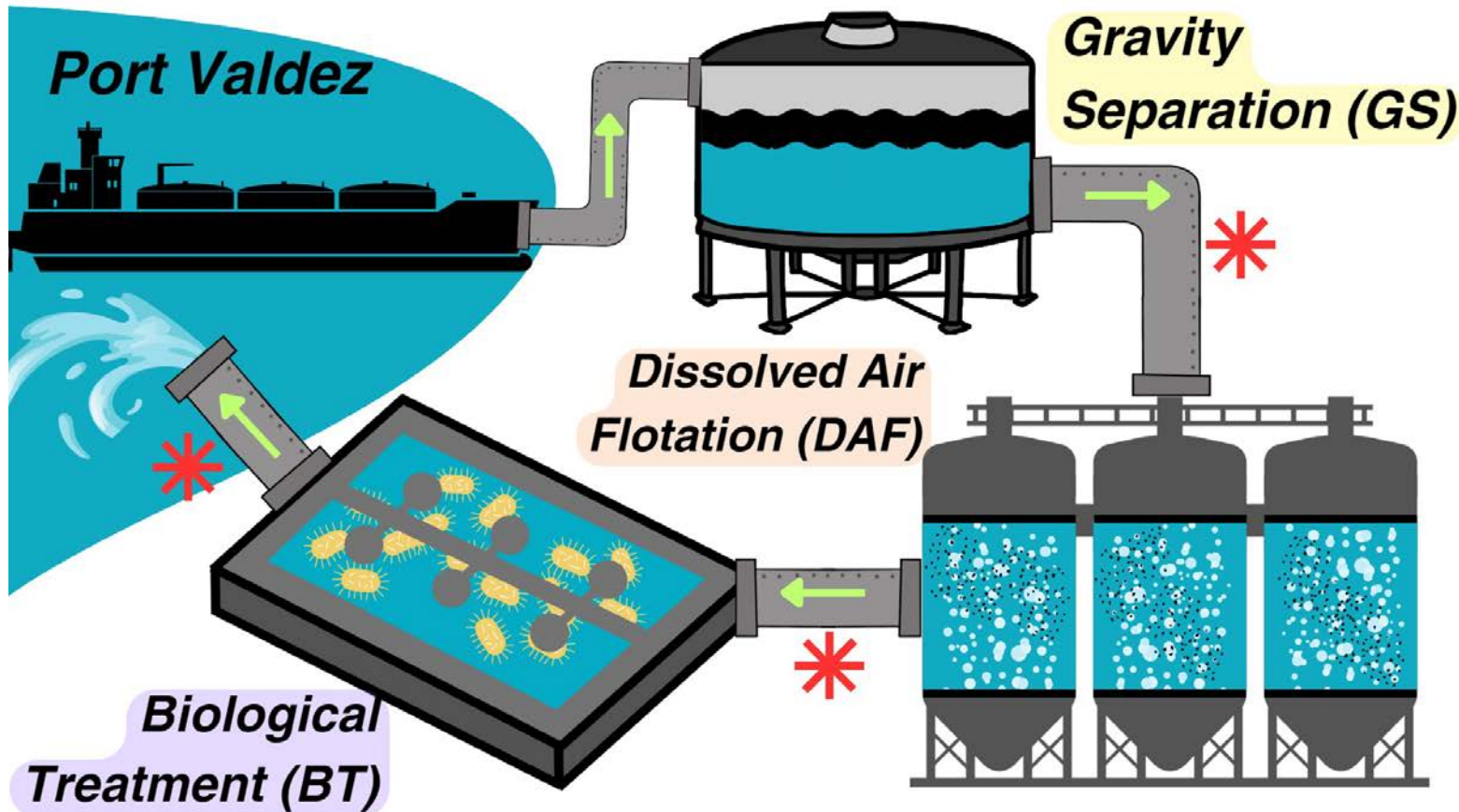
BWTF Step 3: Biological Treatment



BWTF Step 3: Biological Treatment



BWTF Sampling

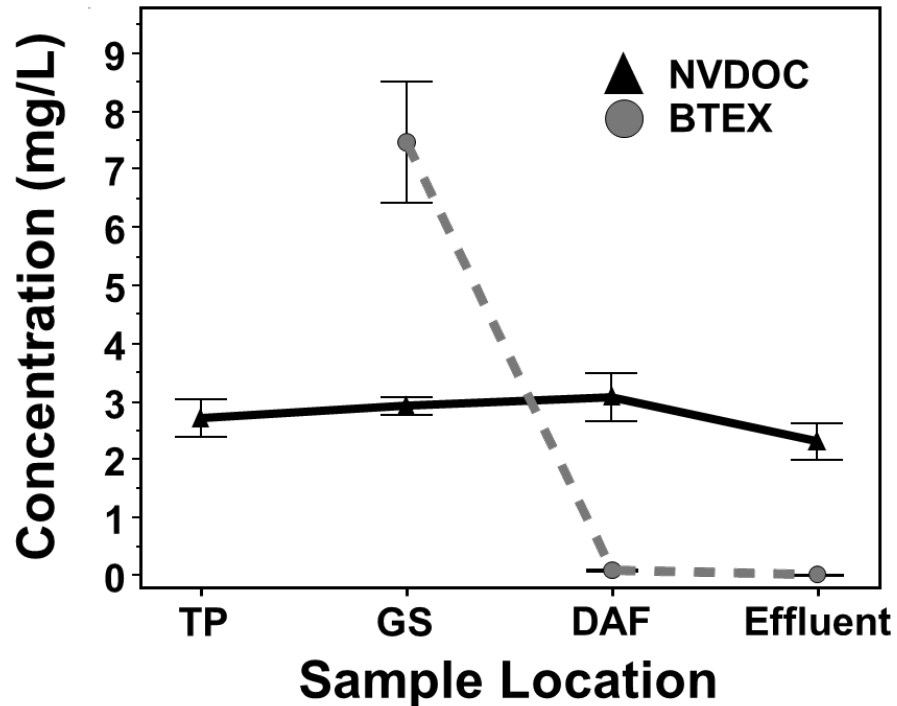


Asterisks (*) represent a sampling point.

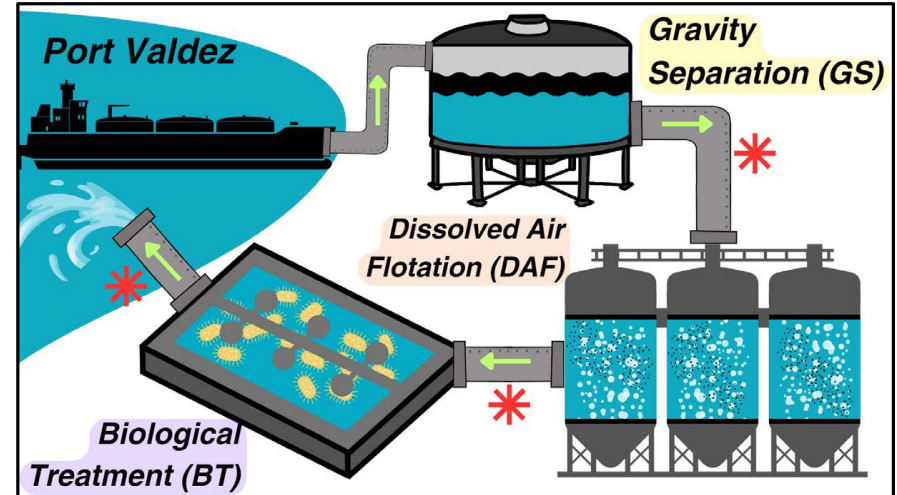
Opportunistic sampling over one year.

Fourth sampling point added to second half of dataset to collect wastewater from the gravity separation tank prior (TP) to ballast offloading.

BTEX vs Oxygenated Hydrocarbons



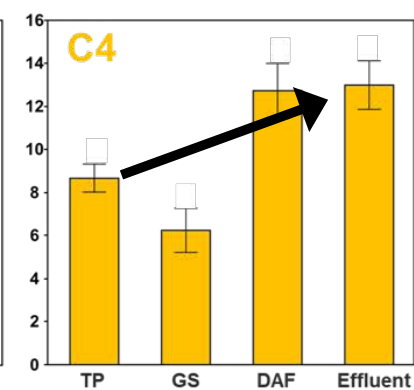
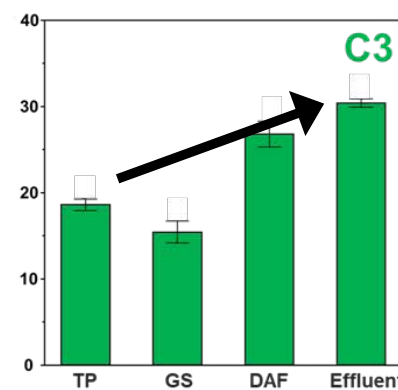
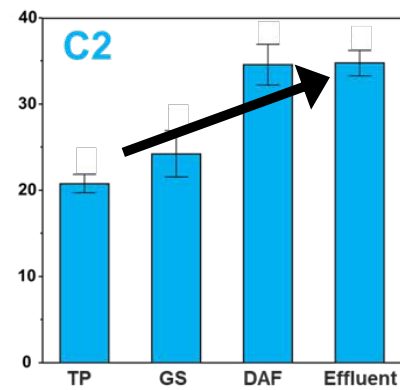
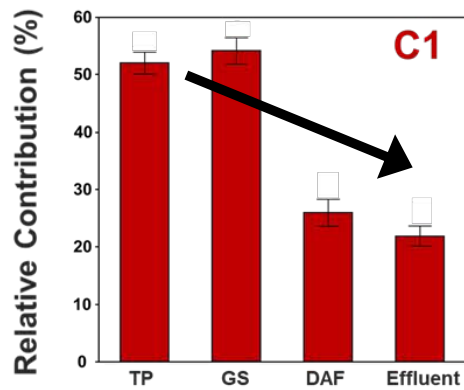
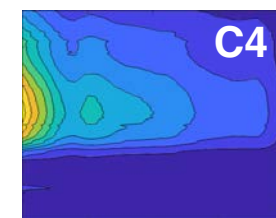
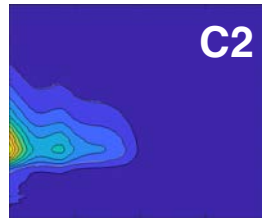
BTEX are effectively removed.



Concentration of oxygenated hydrocarbons is **unchanged**.

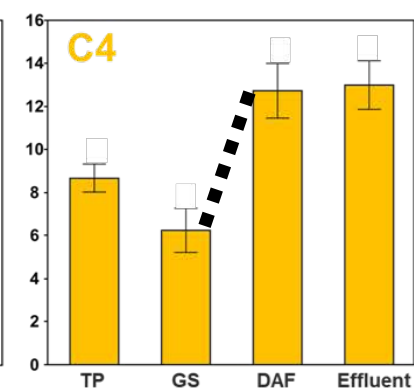
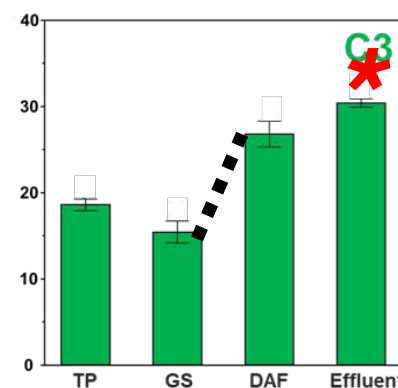
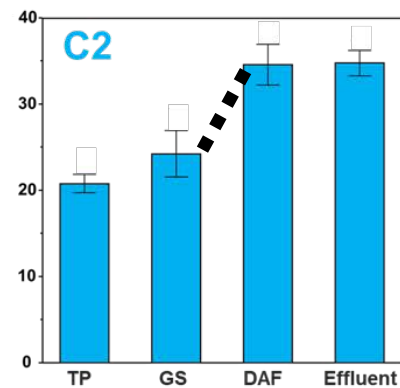
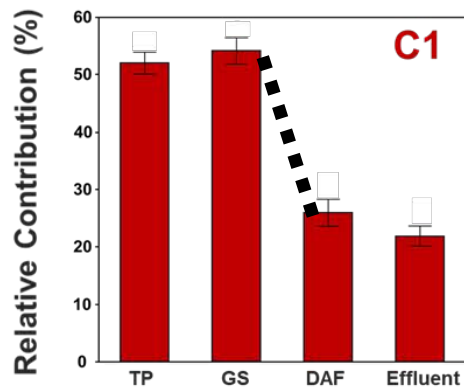
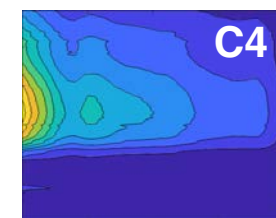
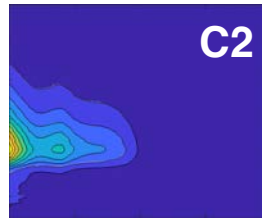
15 kg of oxygenated hydrocarbons released into Port Valdez daily!

Composition



Treatment process causes *composition change* in oxygenated hydrocarbons.

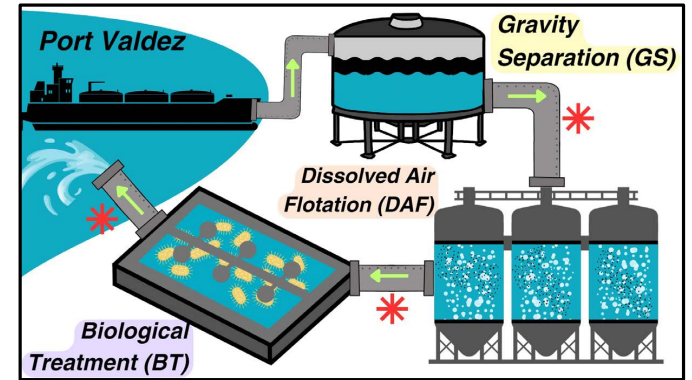
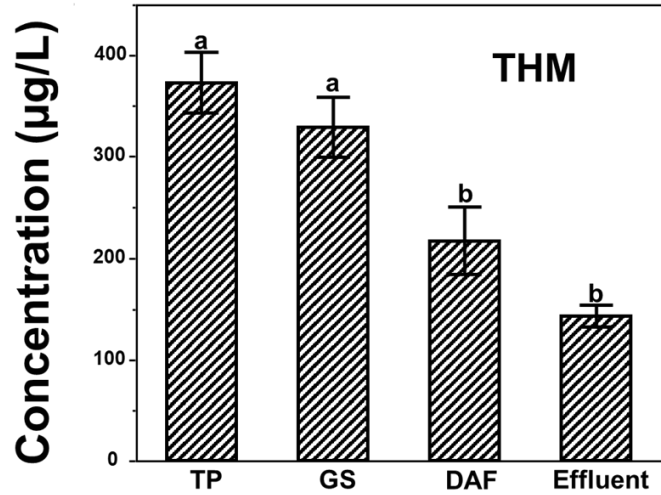
Composition



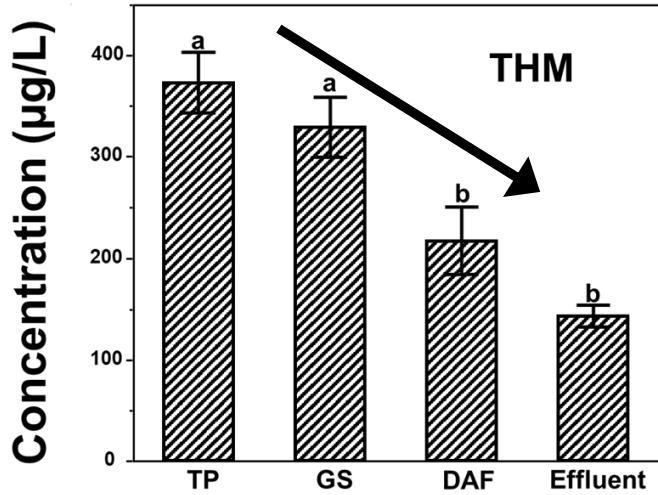
Dissolved air treatment is important for compositional change.

Biological treatment increases amount of potentially ***toxic*** composition.

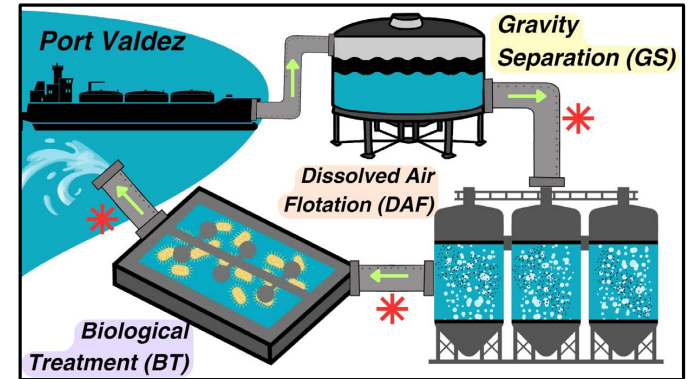
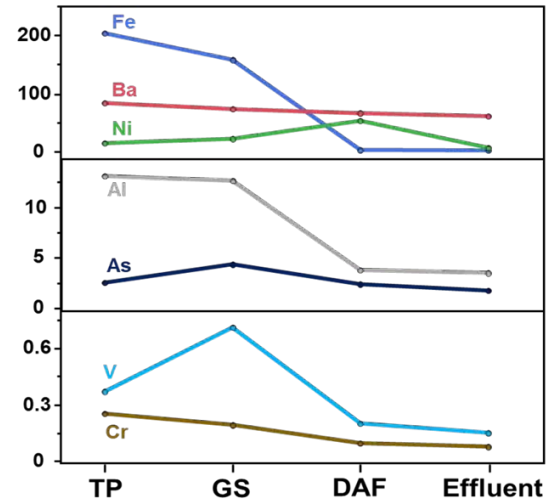
Heavy Metal Contamination



Heavy Metal Contamination



Sample Location



Treatment process **decreases** concentration of heavy metals.

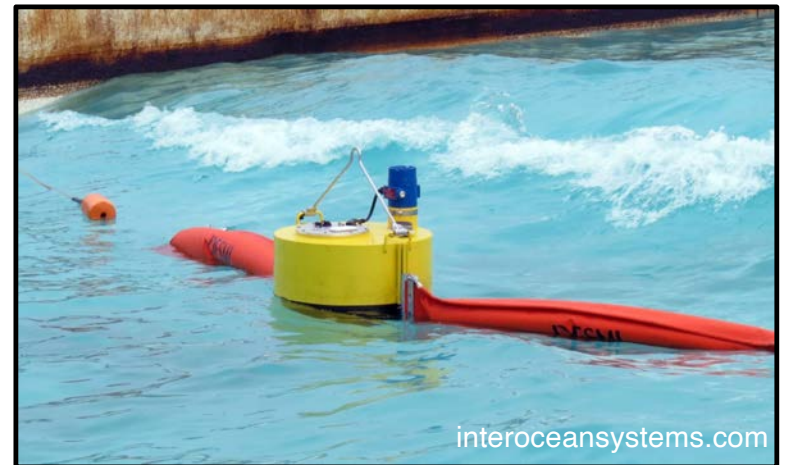
Concern with **sorption and accumulation in sediment** of discharged heavy metals.

Dissolved air treatment is important.

11 g of arsenic released into Port Valdez daily!

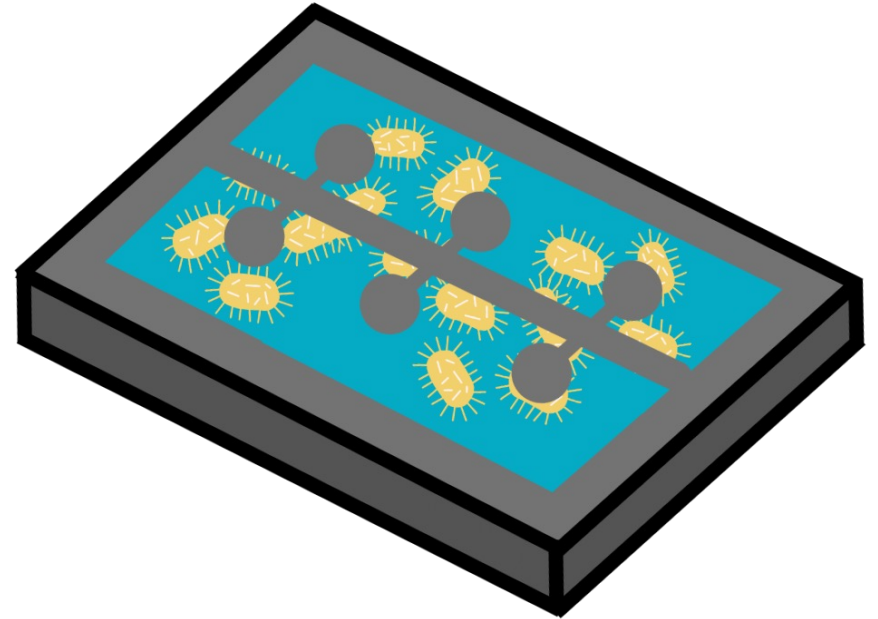
Recommendation #1: Remote Sensors

- *Use optical remote sensors during treatment process.*
- *Track composition of oxygenated hydrocarbons throughout process.*



Recommendation #2: Biological Treatment

- *Properly maintain biological treatment process.*
- *Potential to remove oxygenated hydrocarbons.*



Recommendation #3: Alternative Treatments

- *Explore alternative treatments for removal of oxygenated hydrocarbons.*
- *UV Radiation*
- *Ozonation*



Conclusion

BTEX is not an appropriate metric for oil contamination.

Optical signatures can track compositional shifts in oxygenated hydrocarbons during treatment process.

Discharged heavy metals are of concern for accumulation in sediment.

Identifies gaps and possible solutions for treatment of oxygenated hydrocarbons.

Acknowledgements

Dr. Danielle Verna

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