When is a hydrocarbon not a contaminant?

A gap in NZ Background Values

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Introduction

- Why do we test for TPH?
- Detection vs ‘above background’
- What is the risk?
- Natural vs anthropogenic hydrocarbons - how can you tell?
- Lines of evidence approach
- What else should we think about?

Why do we test for TPH?

- Looking at total petroleum hydrocarbons (TPH) in soil data in particular.
- Sometimes used as a screening tool when source of historic fill is unknown.
- Most familiar scenario = sites where fuel handling has taken place, hydrocarbons indicate presence of petroleum hydrocarbon contamination (e.g. petrol, diesel, oil etc).
- However – TPH can *also* be detected above laboratory limits of reporting (LOR) as a result of natural organic matter being present in the soil.
- This can be challenging when trying to apply NZ's contaminated land regulations to site data.

Detected vs ‘above background’

Regulatory Terminology

NES – CS[1]:

- Regulation 5(9): *regulations do not apply to a piece of land …. about which a detailed site investigation exists that demonstrates that any contaminants in or on the piece of land are* ***at, or below, background concentrations***.

WasteMINZ[2]

- Class 5 (Clean-fill) Waste Acceptance Criteria – set at values derived from the MfE Guidelines criteria for managing Petroleum Hydrocarbon Contaminated sites in New Zealand 1999, revised 2011: Tier I soil acceptance criteria for TPH, for residential land use.

1. *Resource Management (National Environmental Standard for Assessing and Managing contaminants in Soil to Protect Human Health) Regulations 2011* https://www.legislation.govt.nz/secondary-legislation/pco-drafted/2011/361/en/latest/
2. *Waste Management Institute New Zealand (WasteMINZ), September 2023: Technical Guidelines for Disposal to Land* https://environment.govt.nz/assets/publications/Waste/Version-3.1-TG-for-Disposal-to-Land-September-2023.pdf

Detected vs ‘above background’

Published Background Levels

- Greater Wellington Regional Council[3]: *Total TPH concentration ranges given for each soil type*
- Waikato Regional Council[4]: *“Small amounts of hydrocarbon compounds (e.g. BaP, PAHs and TPH) may be present naturally due to natural bush fires, volcanic eruptions and decaying organic matter but, as these are extremely variable, background data is not presented for these compounds.”*
- Other councils – background numbers published for heavy metals, sometimes PAHs, TPH not mentioned.

3. Greater Wellington Regional Council, URS 2003: Determination of Common Pollutant Background Soil Concentrations for the Wellington Region
https://www.gw.govt.nz/assets/Documents/2022/12/2003-URS-Determination-of-common-pollutant-background-soil-concentrations-for-the-Wellington-Region-551878-1.PDF

4. https://www.waikatoregion.govt.nz/services/waste-hazardous-substances-and-contaminated-sites/contaminated-sites/natural-background-concentrations/

What is the risk?

- Is it present at a concentration that presents a potential risk to human health or the environment?
- Does it require management / control during soil disturbance or removal?
- Does it require disposal to a suitably licensed facility?
- Does it need to be identified for future land users to enable long term risk management?

If not…

- Should the NES-CS apply?

The trouble with TPH

- **Petrogenic / Anthropogenic:** Hydrocarbons compounds derived from petroleum products or petroleum sources.

- **Phytogenic / Biogenic:** Hydrocarbon compounds derived from plants – may include natural organic matter such as plant-based resins, oils and natural hydrocarbons.

Total Petroleum Hydrocarbons (TPH) testing picks up both.

Natural vs anthropogenic hydrocarbons - how can you tell?

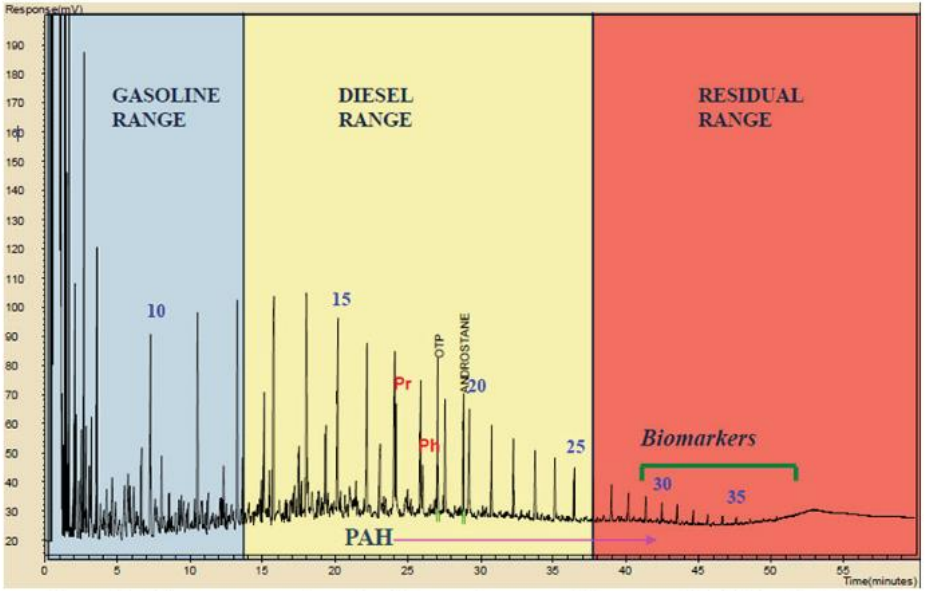
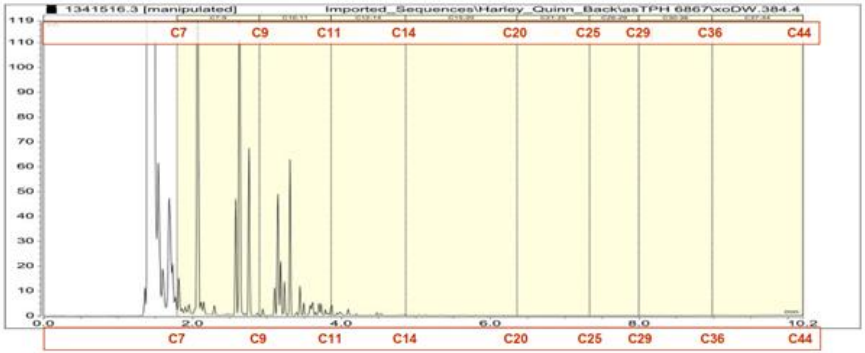


Figure A5-1. Chromatogram of a crude oil. Due to the nonspecific nature of the TPH analysis, TPH chromatograms should be routinely reviewed as part of the QA/QC process before TPH analytical results are used for decision making and if one ever receives questionable TPH results from the laboratory, one of the first actions should be a review of the chromatograms.
(Source: Modified after Chevron, ETC, OT&S, 2018.)

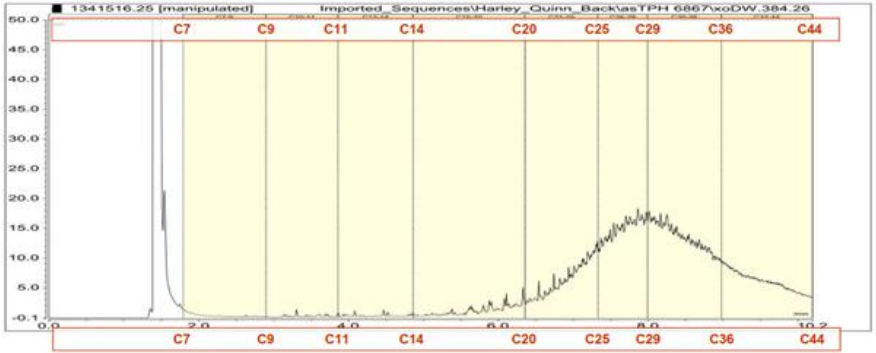
https://tphrisk-1.itrcweb.org/wp-content/uploads/2018/11/tph_fact_sheet_a5_chromatograms__11_4_18.pdf

TPH Chromatograms

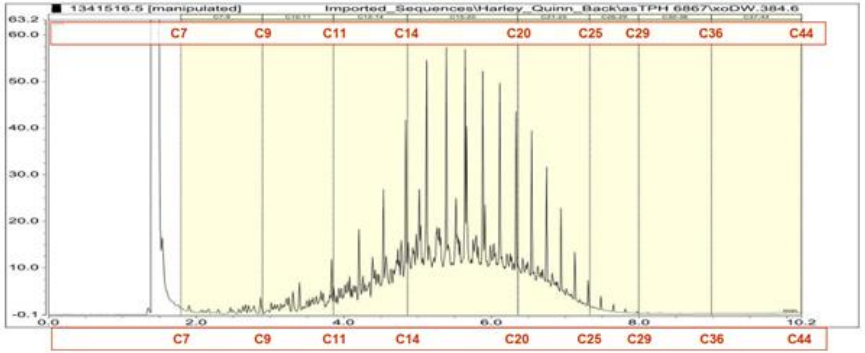
Petrol



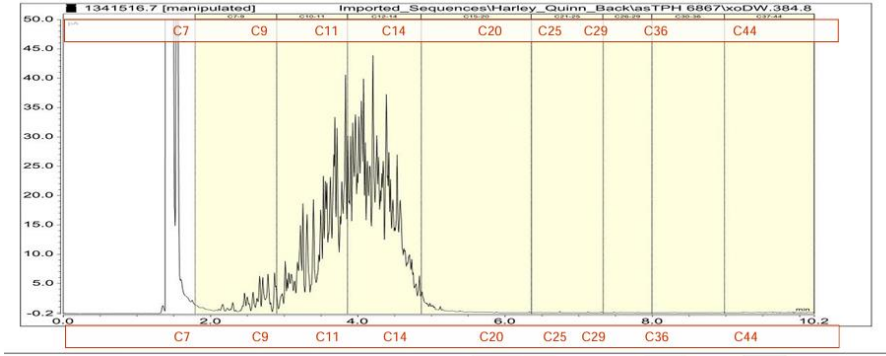
Used Car Oil



Diesel



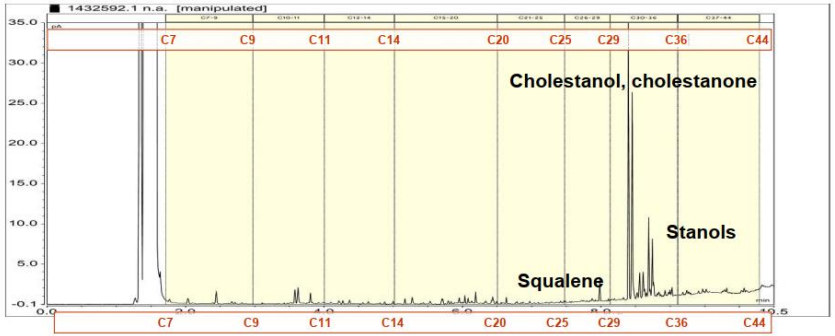
Kerosene



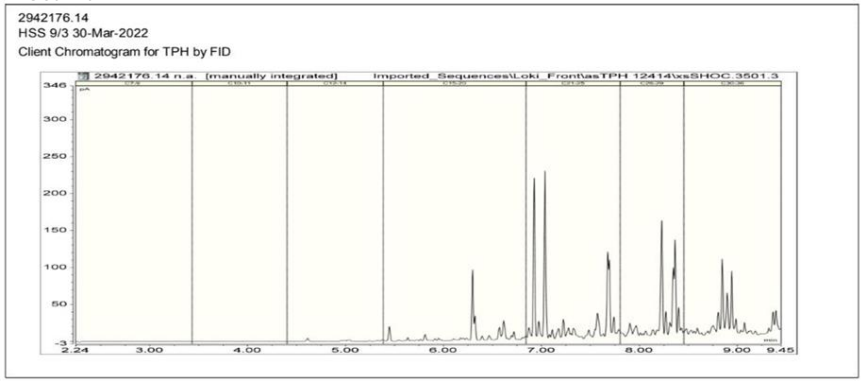
https://www.hill-labs.co.nz/media/cwcl5aag/30491a8_tph-reference-chromatograms-compilation.pdf

TPH Chromatograms

Sewage



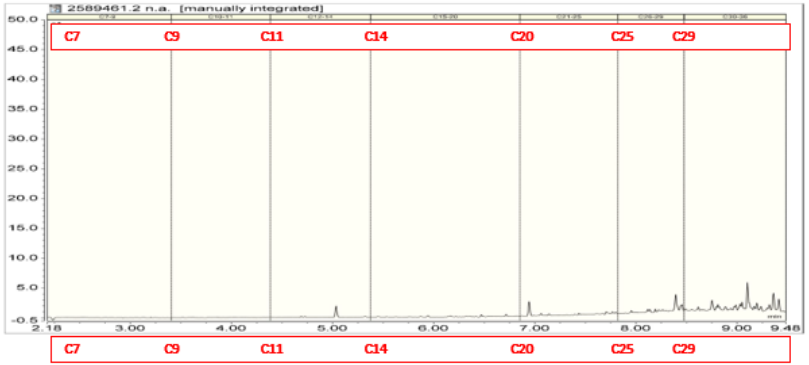
Coal Tar



https://www.hill-labs.co.nz/media/cwcl5aag/30491a8_tph-reference-chromatograms-compilation.pdf

TPH Chromatograms

Natural Organic Matter



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Lines of Evidence

Desktop data:

- Is your site a fuel station? / Is your site a peat bog?
- Is there likely to have been imported material from contaminated sources?
- Site history - have there been spill events?

Field observations:

- Are there signs of anthropogenic fill?
- Is there organic matter in your soil samples?

Lab Data

- What does the TPH chromatogram look like?
- Other analytical results – BTEX, PAHs, organic matter content
- Any other anthropogenic contaminants?

Food for thought

- Is there too much reliance on published background values?
- Do we consider imported clean-fill to be contamination, if it exceeds background numbers for the site?
- Is TPH a valuable test?
- Is the NES-CS too blunt an instrument?

What else can we do?

- Work towards adding TPH background numbers to regional background datasets.
- Provide multiple lines of evidence.
- Think critically about the sources of your contaminants – both as a consultant / client and as a regulator / reviewer.

Mā te mahi tahi
Driving impact through **collaboration**

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