

CASE STUDY



Pipeline Fuel Spill – Little River, Victoria

Aquifer

A layer of soil or rock with relatively higher porosity and permeability than surrounding layers. This enables usable quantities of water to be extracted from it.

Watertable

Water table is the upper surface of groundwater in the aquifers.

Background

The White Oil Pipeline (WOPL) is operated by the Shell Company of Australia Limited (Shell) and runs between the Shell Refinery in Geelong and the Shell bulk petroleum Terminal at Newport. Its purpose is to transport refined hydrocarbon products, including motor fuels (unleaded petrol and lead replacement petrol), solvents (xylanes), diesel, jet fuel (kerosene) and AvGas from the refinery to the terminal. It is an 8 inch (200mm) high pressure pipeline and has been in use since 1953.

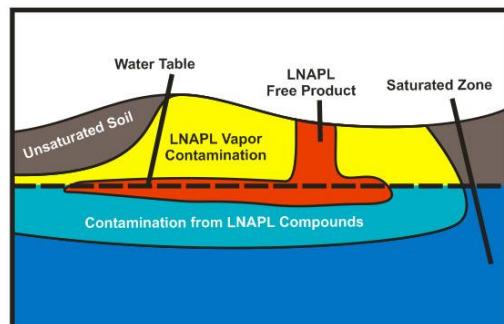
In May 2004, the EPA confirmed fuel discharging to the land surface adjacent to the Princess Highway near Avalon airfield and near the WOPL. On investigation, Shell identified a failure in the pipe 1mm wide and approximately 80mm long where the pipe crosses over an elevated area formed by an old basalt flow (Figure 1). The pipe was subsequently repaired, and contaminated soils around the pipe excavated and removed.

FIGURE 1: ELEVATED “STONEY RISE” SHOWING THE PATH OF AN OLD LAVA FLOW.



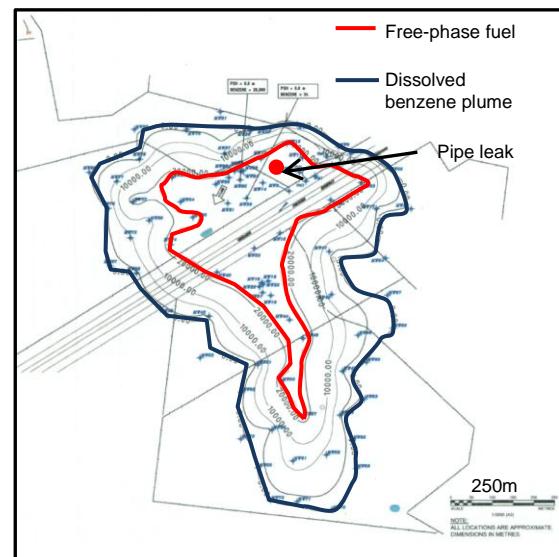
Further investigation identified an extensive plume of free phase fuels on-top of the watertable. Fuel is a Light, Non-Aqueous Phase Liquid (LNAPL) – that is when it leaks it floats on top of the groundwater as free fuel (Figure 2). Some fuel dissolves into the groundwater to form a further dissolved plume of contaminated groundwater (Figure 3).

FIGURE 2: HOW LNAPL MOVES AND DISSOLVES



The free phase fuel flows in fractures in the basalt (Figure 4) in the direction of the watertable surface. This resulted in fuel products flowing beneath the Princess Highway and toward Port Phillip Bay. The dissolved phase plume mirrored the free phase plume, but had spread further.

FIGURE 3: EXTENT OF FREE PHASE FUEL (LNAPL) AND DISSOLVED CONTAMINANT (BENZENE) PLUME



Understanding the extent of the spill

From the time the spill was detected, significant work was undertaken to confirm its origin, understand how far the fuel had moved, and to understand the physical processes of fuel and groundwater movement through the basalt. “Fingerprinting” of recovered fuel, which is looking at its composition compared to the composition of fuels Shell had transported down the pipe, confirmed that the spill comprised Shell products. Based on the composition, it was also established that the spill had commenced sometime after 2000 based on the absence of certain products.

A key part of any investigation of a spill is to understand what risks it might pose. Although it was not possible to know the amount of fuel that had leaked, it was estimated as being in the tens of thousands of litres. The land overlying the spill is mostly open farm land. This made the investigation easier, and also meant that there were fewer things that the fuel spill could impact on. An environmental audit was carried out to evaluate the risks and to review the proposed remediation program.

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FIGURE 4: FRACTURES IN THE BASALT ALLOW WATER AND FUEL TO MOVE THROUGH THE ROCK.



The salinity of the groundwater (between 3,000mg/L and 10,000mg/L) meant its primary potential uses were for stock watering, commercial uses (such as in manufacturing) and supporting environmental values. The nearest waterways were 7 to 8 km from the site. There were no groundwater bores within 500m of the spill site. There were several "Domestic and Stock" bores within 1000m of the site, but they were primarily north and east away from the contamination flow direction. There were no other users of groundwater. Overall the audit concluded that the spill posed no immediate risks. However, there was potential for risk if the land use changed from rural to residential.

By late 2005, the plume had been identified, and a detailed plan of remediation developed. The environmental audit supported the clean-up plan (or remediation action plan – RAP).

Clean-up of the spill

Remediation commenced on the south side of the Princess Highway to ensure the fuel did not continue to move toward Port Phillip Bay. In order to separate the fuels and treat the water effectively, a dedicated treatment plant was set up. A network of bores brought fuel and groundwater to the treatment plant. Where possible, free fuel was removed and recycled. The water was then oxygenated to assist degradation of the dissolved contaminants, and then re-injected into the groundwater. In the late 2000's, a second separation system was set up on the north side of the highway to extract free phase fuel. Clean-up of the site is ongoing.

Going Further

Search for information about other fuel leaks (hint: include the word "Newport" in your search). Compare the information on the two spills – what are the differences and similarities?

Sources of information used for this Case Study

The primary source of information was the Environmental Audit Report: *Risk to the Environment, White Oil Pipeline (WOPL), Little River, Victoria*. Available from EPA Victoria.



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Note: This information sheet is wholly or in part from existing information. For more details, readers are referred to the source information sites.