

Technical Note: Light Non-Aqueous Phase Liquid Assessment and Remediation

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NSW Environment Protection Authority (EPA)
59–61 Goulburn Street, Sydney
PO Box A290
Sydney South NSW 1232

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Website: www.epa.nsw.gov.au

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1. Introduction

This technical note provides information on the assessment and remediation of Light Non-Aqueous Phase Liquid (LNAPL) in line with relevant legislation and policies.

Once released from spills or leaking underground petroleum storage systems, LNAPL petroleum hydrocarbons in the subsurface may provide an ongoing source for the dissolution of substances into groundwater resulting in a spreading dissolved phase plume.

Both LNAPL and the dissolved phase petroleum hydrocarbon plume can then pose risks from vapour intrusion; risks associated with groundwater extraction and use; the seepage of contaminated groundwater into, for instance, adjacent basements; or ecological risks from the discharge of contamination into surface waters.

The EPA expects that steps are taken to identify any release of LNAPL as soon practicable and that any release is stopped. In addition to stopping any further release, the following guidelines outline the EPA's general expectations in relation to the management and remediation of LNAPL contamination.

2. Explosion risk

The accumulation of vapours from LNAPL can cause an explosion risk. While this technical note does not address explosion risk, it is important that this risk is recognised and appropriately managed.

For further information on managing explosion risk, including action levels for immediate or short-term response, see [CRC CARE Technical Report 23 Petroleum hydrocarbon vapour intrusion assessment: Australian guidance](#).

3. Legislative requirements

The *Protection of the Environment Operations Act 1997* (POEO Act) requires the person carrying out the activity, or others with a knowledge of the incident, to [notify](#) the appropriate authorities and emergency services without delay if a leak or spill causes or threatens to cause material harm.

The EPA should be informed immediately of any incident by verbal notification. This must be followed up by a written notification which should be received by the EPA within seven days of the incident, as required by the Protection of the Environment (Underground Petroleum Storage Systems) Regulation 2014 (UPSS regulation).

The *Contaminated Land Management Act 1997* (CLM Act) also requires a person to [report contamination](#); this is separate to the notification required by the POEO Act.

Notification forms showing the information required under the UPSS Regulation and CLM Act are available on the [EPA website](#).

LNAPL and the resulting dissolved phase plume may also impact on the suitability of future use of contaminated land. This would need to be considered by the planning consent authority under [State Environmental Planning Policy No 55 – Remediation of Land](#) and [associated guidelines](#).

4. Stakeholder engagement

Stakeholder engagement is essential where LNAPL contamination or any associated dissolved phase or vapour phase plumes affects land not owned by the polluting party. The owners and occupants of the affected lands must be consulted. Agreement with affected land owners/occupants should be reached to mitigate any potential impacts, including long-term impacts caused by the contamination.

Other stakeholders that could also be impacted or potentially impacted (including local council or service owners/operators) should all be proactively engaged and kept informed.

The [National Environment Protection \(Assessment of Site Contamination\) Measure 1999 \(Schedule B8 Guideline on Community Engagement and Risk Communication\)](#) should be considered when developing a plan for stakeholder engagement.

5. Robust LNAPL Conceptual Site Model (LCSM)

The EPA expects that any LNAPL contamination is properly characterised in accordance with [CRC CARE Technical Report 34: A practitioner's guide for the analysis, management and remediation of LNAPL](#). In particular, a robust LCSM should be developed.

While it is recognised that LNAPL contamination can be a small-scale problem if the loss of LNAPL in the subsurface was minor, there are essential field data requirements to support a robust LCSM for any LNAPL contaminated site.

The Environmental Protection Plan (EPP)/site management plan will assist the development of the LCSM and planning for the assessment phase. Information that should be available in the EPP includes the location, age, material of construction, number of tanks and lines, potential contaminant pathways and receptors.

6. Risk assessment

A robust LCSM is used to identify potential risks. Depending on the risks identified, a qualitative or quantitative risk assessment will be required. The risk assessment must follow appropriate guidance documents including:

- [National Environment Protection \(Assessment of Site Contamination\) Measure 1999 – Schedule B4 Guideline on Site-specific Health Risk Assessment Methodology](#)
- [National Environment Protection \(Assessment of Site Contamination\) Measure 1999 – Schedule B5a Guideline on Ecological Risk Assessment](#)
- [CRC CARE Technical Report 23: Petroleum hydrocarbon vapour intrusion assessment: Australian guidance.](#)

7. LNAPL clean-up

The results of the risk assessment will guide the level of LNAPL clean-up that is required. LNAPL needs to be cleaned up to such an extent that further removal or treatment of LNAPL no longer reduces the level of risk. In any case, LNAPL clean-up should continue if the LNAPL is still spreading. The need for LNAPL clean-up would also be indicated by a dissolved phase plume that continues to spread.

The technologies used for the clean-up of LNAPL should be carefully selected and implemented. Relevant guidance should be considered including:

- [CRC CARE Technical Report 34: A practitioner's guide for the analysis, management and remediation of LNAPL](#)
- [CRC CARE Technical Report 18: Selecting and assessing strategies for remediating LNAPL in soils and aquifers.](#)

8. Dissolved phase and vapour phase plumes

Monitored Natural Attenuation (MNA) can be a management strategy for addressing the risks associated with dissolved phase and vapour phase plumes in groundwater. MNA guidelines include:

- [CRCCARE Technical Report 15: A technical guide for demonstrating monitored natural attenuation of petroleum hydrocarbons in groundwater](#)
- NSW EPA's [Guidelines for the Assessment and Management of Groundwater Contamination.](#)

More active remediation of the dissolved phase or the vapour phase may be required to address any plumes caused by the dissolution and volatilisation of LNAPL. The selection and implementation of appropriate technologies should consider available guidance documents including:

- [US EPA's Remediation Technologies web page](#)
- [US Federal Remediation Technologies Roundtable Remediation Technologies Screening Matrix and Reference Guide\).](#)

9. Project completion and ongoing management

Once active clean-up efforts have finished, there is often a need for ongoing groundwater monitoring and the need for long-term stewardship. For instance ongoing management could involve a longer term MNA strategy or ensuring any remaining contamination is considered in future planning decisions.

Where risks relating to future excavations remain, an Environmental Management Plan (EMP) should be developed and implemented. The 'Dial Before You Dig' service should also be used if subsurface works, including works on underground utilities, could expose workers to the contamination.