

**Landfill Assessment and Soil Bore Analytical
Results
Army Aviation Centre Oakey, Queensland**

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ENOGGERA QLD 4051

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Prepared by:

IT Environmental (Australia) Pty Ltd
Level 2, 33 Longland Street, Newstead
Queensland, Australia

Written/Submitted by:

Matthew Chenery
Environmental Scientist

Reviewed/Approved by:

Tracy Berger
Geologist
IT - Defence Regional Project
Manager QLD

Reviewed/Approved by:

Mark Pillsworth
Senior Ecologist
IT - Defence Main Regional Contact
Person Qld/NT

IT Environmental (Australia) Pty Ltd
ABN 89 003 931 057
Tel: (07) 3252 5711, Fax: (07) 3252 5712
Email: Brisbane.Admin@theitgroup.com



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Abbreviations

AACO	Army Aviation Centre Oakey
ANZECC	Australian and New Zealand Environment and Conservation Council
CSIC	Corporate Services and Infrastructure Centre
C ₆ -C ₃₆	Hydrocarbon chainlength fraction
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CoC	Chain of Custody
EPA	Environmental Protection Agency
IER	Initial Environmental Review
IT	IT Environmental (Australia) Pty Ltd
mg/kg	milligrams per kilogram
MW	Monitoring Well
NATA	National Association of Testing Authorities
PID	Photoionisation Detector
ppb	Parts Per Billion
ppm	Part Per Million
QA	Quality Assurance
QC	Quality Control
SVOC	Semi-volatile Organic Compound
TPH	Total Petroleum Hydrocarbon
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Executive Summary

The Department of Defence (Defence) Corporate Services and Infrastructure Centre – South Queensland (CSIC-SQ) commissioned *IT Environmental (Australia) Pty Ltd (IT)* to undertake the Phase 2 component of the Environmental Management Plan (EMP) for the Army Aviation Centre Oakey (AACO). As per the recommended additional works from the Initial Environmental Review (IER) (2002) (J207965A-R01) this report covers the landfill assessment and includes the soil analytical results from the soil bores drilled across the site as part of the groundwater monitoring well installation program (see Water Quality Assessment and Monitoring Program, our ref J207965B-R01).

The objective of this assessment is to assess the potential impacts associated with former waste disposal areas and soil contamination identified within the soil bores drilled for the installation of groundwater monitoring wells to enable the development and implementation of an effective and accurate EMP.

The following scope of work was undertaken to achieve the stated objective:

- site staff (including the museum staff) were interviewed in regards to past waste burial;
- a backhoe was used to locate and to assess former disposal areas;
- characterisation of the capping layers of landfill areas;
- collection of soil samples from the soil surrounding the landfill to assess contamination from landfill contents;
- analysis of selected soil samples at a national association of testing authorities (NATA) certified laboratory for analysis of total petroleum hydrocarbons (TPH), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg) and semi-volatile organic compounds (SVOCs);
- assess groundwater quality impacts through installed monitoring wells (see Water Quality Assessment J207965B-R01); and
- preparation of this report detailing the findings.

Based on the results of the landfill assessment, *IT* concludes the following:

- past disposal of waste by burial has occurred at AACO although no documentation or records have been kept of the locations, types and volumes of waste;
- due to the size of AACO, the occupation of AACO land by leaseholders and the relatively small size of landfill areas, confirmed locations and conditions of all former landfill areas could not be achieved;
- within the former landfill that was able to be located, approximately 43m³ of scrap steel consisting of predominantly aircraft parts was identified;
- soil analytical results from surrounding the identified landfill were below the nominated investigation levels for commercial and industrial sites, although the soil within the cap and below the landfill material contained concentrations of metals above the DoE (1998) Environmental Investigation Levels;
- groundwater analytical results did not identify any impacts that appeared to have resulted from the landfill activities (see water quality assessment and monitoring program, our ref J207965B-R01);
- permeability by falling head analytical result indicated the material used for capping of the identified landfill did not meet ANZECC guidelines and therefore has the potential to allow penetration of water and generation of contaminated leachate; and
- hydrocarbon impacts above the nominated investigation levels were present at 12m adjacent to the tanker parking bay A, which is at the same location found to contain

separate phase hydrocarbons in the groundwater, indicating the failure of the underground storage tank (UST), intercept or associated infrastructure.

1 Introduction

The Department of Defence (Defence) Corporate Services and Infrastructure Centre – South Queensland (CSIC-SQ) commissioned *IT Environmental (Australia) Pty Ltd (IT)* to undertake the Phase 2 component of the Environmental Management Plan (EMP) for the Army Aviation Centre Oakey (AACO). As per the recommended additional works from the Initial Environmental Review (IER) (2002) (J207965A-R01) this report covers the landfill assessment and includes the soil analytical results from the soil bores drilled across the site as part of the groundwater monitoring well installation program (see Water Quality Assessment and Monitoring Program, our ref J207965B-R01).

1.1 Objective

The objective of this assessment is to assess the potential impacts associated with former waste disposal areas and soil contamination identified within the soil bores drilled for the installation of groundwater monitoring wells to enable the development and implementation of an effective and accurate EMP.

1.2 Scope of Work

The following scope of work was undertaken to achieve the stated objective:

- site staff (including the museum staff) were interviewed in regards to past waste burial;
- a backhoe was used to test pit in areas potentially containing buried waste to determine the extent of former disposal areas and types of wastes contained within the areas identified and to collect soil samples;
- characterisation of the capping layers of landfill areas;
- collection of soil samples from the soil surrounding the landfill to assess contamination from landfill contents during backhoe test pitting (samples OTP01 0-0.3 and OTP01 1.5-1.6);
- analysis of selected soil samples at a national association of testing authorities (NATA) certified laboratory for analysis of total petroleum hydrocarbons (TPH), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg) and semi-volatile organic compounds (SVOCs);
- assess groundwater quality impacts via installed groundwater monitoring wells (see Water Quality Assessment J207965B-R01); and
- preparation of this report detailing the findings.

Due to the lack of documented information regarding the location and nature of past landfill areas and the potential for ground disturbance resulting from other site activities, a backhoe was used to examine areas potentially containing buried wastes.

2 Background Information

Museum staff were interviewed in relation to the location of former landfill areas as they had undertaken a number of test holes surrounding AACO in an attempt to locate possible buried aircraft. Museum staff indicated that excavation of some former waste disposal areas was undertaken by metal recyclers. The metal recyclers removed steel products that could be recycled off site.

Museum staff interviewed were unable to provide exact locations of past landfill activities, and information held was all anecdotal evidence predominantly from World War II obtained from older locals. The museums predominant interest in buried waste relates to a spit fire aircraft reputedly buried in crates after World War II. Investigations conducted by the museum have been unable to locate the spit fire.

No on site records of former landfills were available. The areas targeted for backhoe excavation to locate and assess former landfill areas was based on anecdotal evidence supplied by museum staff.

As part of the Water Quality Assessment (our ref J207965B-R01) soil bores were drilled at locations of potential contamination from site activities including areas known to contain buried wastes. Where groundwater or perched saturated zones were intersected groundwater monitoring wells were installed and samples collected for analysis. Details of the installation and locations of the groundwater monitoring wells is contained in within the Water Quality Assessment (our ref J207965B-R01). Figure 1 shows the location of the groundwater monitoring wells and the identified former landfill.

2.1 Nominated Investigation Levels

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As AACO is considered an industrial and commercial site, the nominated investigation levels for the purpose of this report are the National Environmental Protection (Assessment of Site Contamination) Measure (1999), health based investigation levels (Exposure Setting F) for commercial and industrial sites. As the National Environmental Protection Council (NEPC) do not specify any guidelines for the total TPH the Queensland Environmental Protection Agency (EPA) accepted CHEM Unit (1992) guidelines have been used, which are considered to be conservative for commercial/industrial exposure settings.

3 Field Work

3.1 Landfill Test Pitting

Field investigations were conducted on 22 May 2002. The assessment was undertaken using a local backhoe for the excavation of test pits through areas potentially containing buried wastes. When buried materials were located, the area and depth of buried materials was assessed through excavation of trenches through the landfill material.

Due to the size of the area potentially containing buried materials and the inaccuracy of anecdotal evidence, it was difficult to pin point exact areas to enable assessment. One area of buried aircraft parts was uncovered in the south east corner of the site adjacent to OMW01 (Figure 1) and is estimated to contain 43m³ of waste materials. Anecdotal evidence also suggests that former landfills are present within lease areas and private property on the northern side of AACO and it is likely that wastes were disposed of at former coal mines after World War II.

A number of locations were test pitted in the south eastern portion of AACO, however only one location was found to contain buried wastes. Permission to access leased areas was denied by Defence staff due to lease agreements restricting access. Anecdotal evidence indicated that a majority of the landfilling operations were undertaken during World War II or shortly after when the base was operated by the Airforce. Due to the age of the landfills, no eye witness accounts of the landfilling operations were available. Therefore the test pitting operations to locate the landfills were on a hit and miss basis with only one former landfill located.

Two samples (OTP01 0-0.3 capping material and OTP01 1.5-1.6 underlying soil) were selected for analysis. The samples were analysed for TPH, SVOCs and metals.

3.2 Soil Bore Drilling

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Drilling of the soil bores was undertaken on 15, 16 and 17 April 2002. Locations of the soil bores are shown on Figure 1 and soil logs are included as Appendix A of the Water Quality Assessment (our ref J207965B-R01). Soil bores were drilled with a mechanical drill rig to a maximum depth of 14 metres. Soil bores targeted areas of potential contamination including:

- landfill (OSB01);
- underground storage tanks (UST) used for on-site vehicle refuelling (OSB02);
- hazardous liquid waste tank adjacent to Facility C22 and C23 (OSB03);
- disused waste oil UST located in the museum complex (OSB04);
- tanker parking bay A and associated valve, intercept and liquid waste UST (OSB05); and
- former fuel farm (OSB06).

Details of the collected soil samples and analyses selected are detailed on the Chain of Custody documentation which is attached to the laboratory analytical report contained in Appendix A. Samples selected for analysis and the type of analyses conducted are summarised in Tables 1 and 2. Analyses selected for soil samples collected from soil bores were based on the potential impacts from the activities being targeted.

4 Results

Metal, TPH and BTEX laboratory analytical results are summarised in Tables 1 and 2 with the nominated investigation levels. The laboratory analytical certificates are contained in Appendix A. Sample numbers and locations are shown on Figure 1.

4.1 Landfill Test Pitting Results

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Samples analysed as part of the landfill test pitting program were Oakey Test Pit OTP01 capping layer (0-0.3m) and OTP01 (1.5-1.6m) underlying soil. A groundwater monitoring well (OMW01) was installed adjacent to the identified landfill area.

All soil laboratory analytical results from the land fill area are below the Exposure Setting F guidelines. However cadmium, copper, lead, nickel and zinc were recorded at concentrations above the DoE (1998) environmental investigation levels in both the samples collected from the cap and the underlying soil. Therefore any proposed use of the area for a more sensitive land use would require further investigation and possibly remediation. Results of the soil bore soil samples indicate the metal impacts identified are not natural background concentrations.

Groundwater analytical results from the monitoring well installed adjacent to landfill are addressed in the Water Quality Assessment (our ref J207965B-R01). No impacts were identified within the groundwater adjacent to the landfill that are believed to be the result of landfill leachate.

The permeability by falling head analytical report for the landfill capping material is contained in Appendix A. Samples were re-compacted in the laboratory to 85-90% of the maximum dry density to simulate the equivalent of track rolling of the soil cover. The permeability result (2×10^{-7} m/s) does not meet the ANZECC *Guidelines for the Assessment of On-site Containment of Contaminated Soil* for compacted clay low permeability barriers (1×10^{-9} m/s). Due to the high permeability of the capping layer, the landfill has the potential to generate leachate through contamination of infiltrated water.

4.2 Soil Bore Results

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Soil analytical results from the well installation program indicate the soil bore located adjacent to the tanker parking bay A contained a concentration of Total Petroleum Hydrocarbons (TPH) above the nominated investigation thresholds at 12 metres. The hydrocarbon chainlengths present were predominantly C₆ to C₁₄ which are consistent with light fraction fuels. Groundwater in-situ monitoring indicated that separate phase hydrocarbons were present floating on the groundwater at this location. Field observations and photoionisation detector (PID) readings indicated that soil contamination is present from the groundwater table to at least two metres below the surface.

All other soil bore analytical results were below the Exposure Setting F guidelines.

5 Conclusions

Based on the results of the landfill and soil bore assessment, *IT* concludes the following.

- anecdotal evidence and confirmation by test pitting of one location indicated that past disposal of waste by burial has occurred at AACO although no documentation or records have been kept of the locations, types and volumes of waste;
- due to the size of AACO, the occupation of AACO land by leaseholders and the relatively small size of landfill areas, confirmed locations and conditions of all former landfill areas could not be achieved;
- within the former landfill that was able to be located, approximately 43m³ of scrap steel consisting of predominantly aircraft parts was identified;
- soil analytical results from surrounding the identified landfill were below the nominated investigation levels for commercial and industrial sites, although the soil within the cap and below the landfill material contained concentrations of metals above the DoE (1998) Environmental Investigation Levels;
- groundwater analytical results did not identify any impacts believed to have been sourced from former landfill activities (see Water Quality Assessment Report, our ref J207965B-R01);
- permeability by falling head analytical result indicated the material used for capping of the identified landfill did not meet ANZECC guidelines and therefore has the potential to allow penetration of water and generation contaminated leachate; and
- hydrocarbon impacts above the nominated investigation levels were present at 12m adjacent to the tanker parking bay A, which is at the same location found to contain separate phase hydrocarbons on the groundwater, indicating the failure of the underground storage tank (UST), intercept or associated infrastructure.

6 References

ANZECC (1999) Guidelines for the Assessment of On-Site Contaminated Soil, Australian and New Zealand Environment and Conservation Council.

Department of Environment (1998) Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland.

National Environmental Protection Council (1999) National Environmental Protection (Assessment of Site Contamination) Measure.

Netherlands (1994) Environmental Quality Objectives in the Netherlands. Ministry of Housing, Spatial Planning and the Environment, Netherlands Government.

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Tables

Landfill Assessment and Soil Bore Analytical Results
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Appendix A

Laboratory Analytical Results

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