TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background

This report presents the results of a validation workplan for remediation activities conducted by Coffey Partners International Pty Ltd (Coffey) at the Flammable Liquids Pad (FLP) and Old Fire Training Pit (FTP) areas at the Country Fire Authority (CFA) Training College site at Fiskville, near Ballan, Victoria.

The project was commissioned by Mr Grant James of the CFA in correspondence dated 19 December 1997 and was conducted in accordance with our proposal Reference EP3632/1-AC dated 19 November 1997. An additional program of excavation and validation was undertaken in accordance with correspondence dated 26 February 1998 (Reference E3523/3-AJ) and a verbal commission from Mr Grant James of 27 February 1998.

1.2 Previous Investigations

Previous investigations at the site (Coffey1996a,1996b) identified several areas of soil contamination in the FLP and old FTP areas (refer Figure 1) which had arisen principally as a result of the storage and handling of fuels, use of liquid fuels in fire training exercises and disposal of fuel residues such as sludges. The chemicals of concern identified were predominantly petroleum hydrocarbons (TPHs) in the medium to heavier fraction range (C15-C36) with lower concentrations of phenol, BTEX and lead. No significant concentrations of polyaromatic hydrocarbons (PAHs), organochlorine pesticides, PCBs or other heavy metals were detected in the samples tested.

In April 1996, Rio Tinto Research and Technology (formerly CRA Bioremediation Services) were commissioned by CFA to review the environmental status and assess remedial option for the site at Fiskville (Rio Tinto, 1998). The results of this review, which were also reported to the EPA, provided for the excavation of contaminated soils from the FLP and old FTP areas with bioremediation at a constructed on-site treatment facility. A Draft Remediation Action Plan (RAP), prepared by Rio Tinto in December 1997, outlined the proposed works program.

Coffey were subsequently commissioned by CFA to direct the soil excavation activities and conduct a soil validation sampling program and the results of these activities are presented in this report.

2.0 STUDY METHODOLOGY

2.1 Objectives

The primary objective of the study was to facilitate the implementation of the RAP and to conduct a validation sampling and analytical program in areas where contaminated soil had been excavated.

2.2 Scope of Work

The scope of work completed during the course of the remediation activities included:

- overseeing construction of the on-site bioremediation facility;
- overseeing contaminated soil excavation in each of the two identified areas of environmental concern, i.e. the flammable liquids pad (FLP) and the old fire training pits (FTP);
- conducting field observations, undertaking photoionisation detector (PID) measurements to screen soil samples for volatile ionisable hydrocarbons;
- collection of soil samples from the base and sides of the excavations to validate the soil condition after soil excavation;
- overseeing cartage of contaminated spoil and stockpiling of spoil in the on-site bioremediation facility;
- liaison with Rio Tinto (RT) with regard to windrow management.

3.0 SITE INFORMATION

3.1 Site Description and Setting

The CFA Training College site has an area of approximately 146ha and is located on the Ballan-Geelong Road, approximately 10km south of Ballan. The main operational areas of the CFA facility are located in the central part of the site.

The college is located on a flat to gently undulating plateau with swamps and lakes formed in local depressions. Lake Fiskville is situated immediately to the west of the training complex.

The site generally drains toward the south via Yaloak Creek on the eastern side and Beremboke Creek to the west.

3.2 Geology and Hydrogeology

The Geological Survey of Victoria, 1:63,360 Ballarat Sheet, maps the site as Quaternary Olivine Basalts. Previous Coffey investigations (1996a, 1996b) have confirmed this profile with surface soils comprising silty clays generally not greater than 2m to 3m deep, overlying very stiff, high plasticity silty clays grading to variably weathered basalt. Shallow fill comprising crushed rock ("blue metal") is found on parts of the site, particularly in the FLP area.

Groundwater investigations (Coffey, 1996b) indicated that the site has only limited groundwater occurrence with low groundwater migration potential. Borehole BH2, a deep bore located in the basalt aquifer in the FLP area (refer Figure 2), intersected water at 10m below ground level, however, yields were low and water level recovery following borehole sampling was slow.

3.3 Extent of Remediation

As part of the RAP (Rio Tinto, 1997), two areas of soil contamination requiring remediation were identified and comprised:

- **FLP**: This area contained surficial soil contamination with fuel residues from the fire training activities. Crushed rock fill is contaminated with hydrocarbons at depths of approximately 0.1m to 0.5m and generally no deeper than 0.8m where it overlies residual clay. Total petroleum hydrocarbon concentrations ranged up to 1600mg/kg.

- **FTP**: Two decommissioned fire training pits, east of the FLP, contain a thin layer (<0.1m thick) of black hydrocarbon sludge at a depth of 0.1m to 0.6m. The sludge is covered by a 0.1m to 0.8m thick layer of surface fill comprising scoria gravel and some silty clay. High concentrations of total petroleum hydrocarbons up to 88,000mg/kg were detected in the sludge layer and soil from 0.6m to1.0m depth. Elevated lead levels (710mg/kg) were detected in one sample.

4.0 FIELD METHODOLOGY

4.1 General

The work was conducted in accordance with the Rio Tinto Remediation Action Plan (RAP) dated 11 December, 1997 (Rio Tinto, 1997) which specified full work requirements taking account of necessary health and safety issues, site constraints and technical requirements of the project. Two stages of site works were conducted.

Stage I site works were conducted over the period 12 to 23 January 1998. Stage II site works were conducted on 5 March 1998. A CFA appointed contractor, Burgin Contractors, was utilised for the excavation works in the full-time presence of a Coffey environmental scientist. A Caterpillar 215B Excavator and a Wabco IIIA 14t scraper were used for the excavation works.

4.2 Construction of the On-Site Bioremediation Facility

An initial area of approximately 80m by 40m had been designated by CFA for the treatment facility and was located east of University Road and approximately 100m south of the old FTP (refer Figure 1).

Whilst no design specifications or compaction standards were prescribed in the RAP (Rio Tinto, 1997), the existing grassed topsoil surface was scraped and graded to produce a flat surface on the topsoil on which the windrows of contaminated soil could be stockpiled. The grade of this surface has been measured at 2m fall over 80m (2.5% grade). A 0.5m wide 0.5m deep drainage trench was excavated around the treatment facility and the excavated natural clays were used to construct bund walls around the perimeter to a maximum height of 0.5m. The drainage trenches were designed to collect runoff from rain infiltration and downpours.

As excavation works progressed, the treatment facility was further extended to accommodate additional volumes of contaminated soil. The final dimensions of the treatment facility were approximately 200m long by 40m wide.

4.3 Excavation and Cartage of Contaminated Spoil

4.3.1 Underground Service Locations

Given no drawings for underground services existed for the areas to be excavated and prior to commencement of works, the approximate locations of underground services were identified during a site inspection between the Coffey site supervisor, CFA and the contractor. As a result, all excavation work was undertaken using a precautionary approach.

4.3.2 Excavation Strategy

Contaminated spoil in each of the two AEC's (i.e. the FLP and the FTP) was excavated by a contractor under the direction of a Coffey field supervisor. Initially, works commenced in the FLP area. Contaminated concrete and pipework was excavated from the FLP and stockpiled in an area to the north of the old fire training pits. Crushed rock ("blue metal") was subsequently excavated from across the FLP and placed onto the treatment facility in several windrows.

Areas of greatest contamination potential in the FLP were then targeted for excavation e.g. bunded fire training pits, the fuel mixing area, the open drain along Dam 1 boundary and interceptor pit/drainage pit (refer Figure 2). Excavations were then extended outwards from these hot-spots until the whole of the FLP area had been excavated.

For the FTP area, the scoria rock fill and contaminated sludges were excavated and placed in windrows in the treatment facility.

4.3.3 Health & Safety

Site works were conducted in accordance with the Health & Safety Plan included as Appendix 2 of the RAP. Safety webbing was supplied by CFA and used to barricade open areas of excavation and work areas.

4.3.4 Dust Control

During site excavations, spoil was watered by the contractor as appropriate to reduce movement of contaminated dusts.

4.4 Environmental Sampling and Validation Testing of Soils

Odour and visual observations of hydrocarbon contamination were used as a primary guide to determine the extent of soil remediation in each of the AEC's. A portable photoionisation detector (PID) was used to measure for the presence of hydrocarbon vapours in the soil during excavation activities and in the selection of samples for laboratory testing. Excavation was continued until the Coffey field supervisor was satisfied that apparent contamination had been removed.

Validation samples were collected from the base and sides of each excavation on a grid basis but with a bias toward areas of observed contamination. Sampling numbers were based on the final dimensions of the excavations. Soil samples were collected at approximately 0.1m depth below the surface as outlined in Table 4-1.

TABLE 4-1
PROPOSED GRID VALIDATION SAMPLING LOCATIONS

AEC	Dimensions (m)	Area (m^2)	Average Depth (m)	Sampling Grid (m)	No Sampling Locations	Sampling Strategy
FLP	90 x 80	7200	0.6	20	40	5 per side + 20 on base
Old FTP	55 x 40	2200	0.4	10	15	15 on base

All samples were collected in accordance with standard Coffey environmental protocols. Following collection, samples were transferred to glass jars (250mL) and immediately sealed. Samples for volatile analysis were collected in glass vials (20mL), sealed with a Teflon septa and crimped closed. All samples were uniquely labelled in accordance with QA/QC requirements (refer Section 4.5), placed in eskys with ice packs and dispatched to the laboratory for analysis under chain-of-custody conditions. A copy of the chain-of-custody records are included as Appendix A.

4.5 Quality Assurance/Quality Control (QA/QC) Measures

4.5.1 Decontamination Procedures

All equipment used in the excavation activities was decontaminated in the CFA truck-wash area and before leaving the site in accordance with the RAP.

All sampling equipment used for the collection of validation samples was decontaminated between locations. Decontamination procedures comprised:

- removal of encrusted material;
- brush scrub with detergent (Decon 90);
- water rinse;
- final rinse with site tap water.

4.5.2 Data Recording

Data recording protocols included:

- *Sample Labelling*; including details of time and date of sampling, requested analyses, preservation technique and name of sampler. Every sample was assigned a unique identifier describing the sampling location and nature of the sample collected.

- *Sample Transfer*; samples were transferred to the laboratory using standard chain-of-custody triplicate records detailing the persons relinquishing or taking over control, sample descriptions, preservation details and analytical requirements.

- *Field Instruments*; field instruments have an associated log book in which calibration, maintenance and service actions are recorded. Field instruments are normally calibrated at least once per day during use and more often if instrument drift problems occur.

- *Field Observation;* field observations were recorded in a site logbook. Data included soil logging, occurrence of odours, results of PID measurements, occurrence of health and safety issues, dust control measures, etc.. A grid survey control over the excavation areas was implemented to ensure observation locations and validation sampling locations were accurately recorded.

4.5.3 QC Field Samples

In addition to the primary samples, quality control duplicates and blanks were collected to assess aspects of field protocols and laboratory performance and to classify the validity of the laboratory data.

Duplicates were collected for 100% of the total samples collected. Equipment rinsate wash blanks, which are samples of the final rinse water used to rinse the soil sampling equipment following decontamination and preceding the next environmental sample are collected at the rate of 1 in 20 samples and used to check that the sampling equipment was not cross-contaminating the environmental samples. An equipment rinsate blank was collected per sampling day and kept in cold storage for subsequent analysis, should the need arise. Due to budget constraints, all field QC samples were not analysed but kept in cold storage for future analysis.

4.6 Laboratory Testing

Samples were analysed by the NATA registered laboratory of WSL Consultants Pty Ltd. Analytical methods were based on VICEPA, APHA and USEPA standard methods and are given in Table 4-2. Laboratory detection limits were set at or below one-tenth of ANZECC B levels wherever possible in accordance with normal practice.

TABLE 4-2
SUMMARY OF ANALYTICAL METHODS

Analytical Test	Analytical Method
Total Petroleum Hydrocarbons (TPHs)	WSL030 (GC:FID)
BTEX	WSL3810 (HSGC:FID)
Total Phenols	5530C (APHA 19th edn)
Lead	WSL023 (ICP)

Soil samples were tested in accordance with the RAP (Rio Tinto, 1997) and the brief prescribed by CFA and for Stage I comprised 50 validation samples for TPH, BTEX and total phenols and 20 samples for lead. Stage II analyses comprised 18 validation samples for TPH, BTEX, total phenols and lead.

5.0 RESULTS OF FIELD INVESTIGATIONS

5.1 Flammable Liquids Pad (FLP)

5.1.1 Stage I Excavation Activities

Approximately 4,300 m^3 of contaminated spoil was excavated from the FLP area during Stage I works. This represents an area of approximately 90m (east-west) by 80m (north-south). The depth of excavation was commonly 0.6m below the surface but in the vicinity of the fire training pits and the fuel mixing area, the excavation was up to 1.2m depth.

Field observations provided clear evidence of soil hydrocarbon contamination by way of soil staining and hydrocarbon odour (mainly diesel). A generalised subsurface profile for the FLP area is summarised in Table 5-1.

TABLE 5-1
GENERALISED SUBSURFACE PROFILE
FOR FLP AREA

Depth	Material Type
0.0 to 0.15m	Crushed rock fill ("Blue metal")
0.15 to 0.3m	Granitic sand fill, yellow-orange
0.3 to 0.6m	Clay fill with some blue metal in places
0.6 to 0.8m	Buried topsoil
0.8 to 0.9m	Buried topsoil including iron buckshot
> 0.9m	Residual clay, grey mottled yellow-orange

Following the break-up and removal of surface concrete structures and pipework, the surficial fill layers were removed with the scraper to a depth of approximately 0.5m to 0.6m. An excavator and trucks were used to remove the contaminated soil and pipework to a depth of 0.7m to 0.8m in some areas and up to 1.2m in the most heavily contaminated areas. The presence of agricultural drains at a depth of approximately 0.7m to 0.8m containing residual fuel oil, which had a diesel odour, resulted in substantial soil contamination in the FLP area. The general drainage direction was from beneath the FLP area toward Dam 1. Consequently, significant excavation works were required in the vicinity of these drains.

A summary of the soil samples collected for Stage I validation purposes from the base and sides of the FLP excavation are presented in Table 5-2. Soil sampling locations are shown on Figure 3.

TABLE 5-2
SUMMARY OF STAGE I VALIDATION SAMPLES
FLP EXCAVATION

Sample No.	Material type	Location	Approx depth.
FLP 1	Residual clay	Floor - SW cnr	0.6m
FLP 2	Residual subsoil (topsoil)	Floor - SW	0.6m
FLP 3	Clay fill	Floor - East	0.7m
FLP 4	Buried topsoil	Floor - E -mid	0.6m
FLP 5	Residual clay	Floor - NW	0.7m
FLP 6	Residual subsoil (topsoil)	Floor - N -mid	0.7m
FLP 7	Clay fill	Wall - SW	0.5m
FLP 8	Clay fill	Wall - W -mid	0.5m

cont...

Sample No.	Material type	Location	Approx depth.
FLP 9	Residual clay	Wall - W -north	1.0m
FLP 10	Residual clay	Wall - SW	0.4m
FLP 11	Residual clay	Wall - SW	0.7m
FLP 12	Residual clay	Wall - S -mid	0.8m
FLP 13	Clay fill	Wall - S -mid	0.3m
FLP 14	Clay fill	Wall - SE	0.3m
FLP 15	Buried topsoil	Floor - SE	0.5m
FLP 16	Buried topsoil	Floor - S -mid	0.6m
FLP 17	Buried subsoil (topsoil)	Floor - Mid	0.6m
FLP 18	Residual clay	Floor - E -mid	0.6m
FLP 19	Residual clay	Floor - E -mid	0.5m
FLP 20	Buried topsoil	Floor - N	0.5m
FLP 21	Buried subsoil (topsoil)	Floor - N	0.5m
FLP 22	Buried subsoil (topsoil)	Floor - N -mid	0.5m
FLP 23	Buried topsoil	Wall - NW	0.8m
FLP 24	Residual clay	Wall - NW	0.7m
FLP 25	Clay fill	Wall - NW	0.4m
FLP 26	Clay fill	Wall - NW	0.5m
FLP 27	Buried subsoil (topsoil)	Wall - N -mid	0.3m
FLP 28	Clay fill	Wall - NE	0.3m
FLP 29	Residual clay	Floor - NE	0.6m
FLP 30	Residual clay	Floor - NE	0.7m
FLP 31	Residual clay	Floor - E-SE	0.7m
FLP 32	Residual clay	Floor - SE	0.5m
FLP 33	Clay fill	Wall - NE	0.3m
FLP 34	Scoria fill	Wall - E -mid	0.3m
FLP 35	Blue metal fill	Wall - SE	0.3m
FLP 36	Residual clay	Floor - S- mid	1.2m
FLP 37	Residual clay	Floor - S - mid	1.0m
FLP 38	Residual clay	Floor - SW	1.2m
FLP 39	Residual clay	Floor - S -mid	1.2m
FLP 40	Residual clay	Floor - NW	1.2m

5.1.2 Stage II Excavation Activities

Following results from the Stage I activities (refer Section 6.2), additional excavations were undertaken in the vicinity of FLP40 and FLP35 (refer Figure 3).

* ***FLP40 Excavation***

Soil in the vicinity of FLP40 was excavated from the floor and the walls of the previous excavation. A diesel odour was apparent when the soil in this area was excavated. Soil hydrocarbon staining was observed in the western side wall near the interceptor pit and this soil was excavated. The soil in the floor of the excavation was not stained by hydrocarbon but did have a diesel odour and, as a result, the floor was excavated until the diesel odour could no longer be detected.

Following excavation in this area, validation samples were collected from the walls and the floor of the final excavation. A summary of the soil samples collected for Stage II validation purposes from the FLP40 excavation are presented in Table 5-3. Soil sampling locations are shown on Figure 5.

TABLE 5-3
SUMMARY OF STAGE II VALIDATION SAMPLES
FLP40 EXCAVATION

Sample No.	Material type	Location	Approx depth.
FLP 41	Residual clay	Floor	1.6m
FLP 42	Residual clay	Floor	1.6m
FLP 43	Residual clay	Wall-E	1.4m
FLP 44	Residual clay	Wall-N	1.4m
FLP 45	Residual clay	Wall-S	1.4m
FLP 46	Residual clay	Wall-W	1.4m

* ***FLP35 Excavation***

Additional soil in the vicinity of FLP35 from a triangular shaped excavation between University Road and the mains water pipeline (refer Figure 6). The depth of excavation was approximately 0.6m terminating on a residual clay surface. Soil hydrocarbon staining associated with the scoria fill adjacent to University Road was the main indicator used to assess the extent of the excavation in this area.

A summary of the soil samples collected for Stage II validation purposes from the base and sides of the excavation in the vicinity of FLP35 are presented in Table 5-4. Soil sampling locations are shown on Figure 6.

TABLE 5-4
SUMMARY OF STAGE II VALIDATION SAMPLES
FLP35 EXCAVATION

Sample No.	Material type	Location	Approx depth.
FLP 47	Residual clay	Floor	0.6m
FLP 48	Residual clay	Floor	0.6m
FLP 49	Residual clay	Wall-N	0.6m
FLP 50	Residual clay	Wall-W	0.6m
FLP 51	Residual clay	Wall-E	0.6m
FLP 52	Residual clay	Wall-S	0.6m

5.2 Old Fire Training Pits (FTP)

5.2.1 Stage I Excavation Activities

Approximately 1,000 m^3 of contaminated spoil was excavated from the old FTP during Stage I works. The area of excavation was approximately 55m long by 40m wide and is located to the east of University Road (refer Figure 1). The approximate depth of excavation was 0.4m along the eastern part of the excavated area and up to 1.2m depth in the western parts near University Road. These deeper excavations occurred in the vicinity of the former fire training pits whilst the excavated areas further to the east, where the scoria cover and the black sludge layer were substantially thinner, have occurred as a result of possible overflow spillage from the former pits.

Soil contamination was visually identified as a black sludge, nominally only millimetres thick but in the deeper parts of the excavation ranging up to tens of centimetres thick. The black sludge layer had since been covered with red scoria gravel. Residual clay associated with basalt occurred below the contaminated soil.

A general subsurface profile for the old FTP area is summarised in Table 5-5.

TABLE 5-5
GENERALISED SUBSURFACE PROFILE
FOR FTP AREA

Depth	Material type
0.0 to 0.2m	Red scoria gravel (fill);
0.2 to 0.3m	Buried topsoil;
0.3 to 0.4m	Buried topsoil;
>0.4m	Residual clay.

The black sludge was usually associated with the buried topsoil beneath the scoria fill but also with the residual clay below. The depth of the scoria layer ranged from 0.2m to 0.6 m.

A summary of the soil samples collected for validation purposes from the base of the excavation are presented in Table 5-6. Soil sampling locations are shown on Figure 4.

TABLE 5-6
SUMMARY OF VALIDATION SAMPLES
FTP EXCAVATION

Sample No.	Material Type	Location	Approx. Depth
FTP 1	Subsoil (topsoil)	Floor	0.3m
FTP 2	Subsoil (topsoil)	Floor	0.3m
FTP 3	Subsoil (topsoil)	Floor	0.3m
FTP 4	Residual clay	Floor	0.4m
FTP 5	Residual clay	Floor	0.4m
FTP 6	Residual clay	Floor	0.4m
FTP 7	Residual clay	Floor	1.2m
FTP 8	Residual clay	Floor	1.0m
FTP 9	Residual clay	Floor	0.5m
FTP 10	Residual clay	Floor	0.4m
FTP 11	Residual clay	Floor	1.2m
FTP 12	Residual clay	Floor	1.2m
FTP 13	Residual clay	Floor	0.7m
FTP 14	Residual clay	Floor	0.4m
FTP 15	Residual clay	Floor	0.4m

5.2.2 Stage II Excavation Activities

Following results from the Stage I activities (refer Section 6.2), additional excavations were undertaken in the vicinity of FTP14 (refer Figure 4).

An area approximately 6m by 10m located between sample location FTP14 and University Road was excavated to 1.2m depth, thereby extending the former excavation to the same depth in a westerly direction to University Road. In the northern part of this excavation, the excavation works proceeded to 2.5m depth where hydrocarbon contaminated waste material had been dumped in a deeper part of the old fire training pits. The contaminated material was subsequently excavated resulting in a small (2m by 2m) excavation of 2.5m depth.

A summary of the soil samples collected for Stage II validation purposes from the base and sides of the excavation in the vicinity of FTP14 are presented in Table 5-7. Soil sampling locations are shown on Figure 7.

TABLE 5-7
SUMMARY OF STAGE II VALIDATION SAMPLES
FTP14 EXCAVATION

Sample No.	Material type	Location	Approx depth.
FTP16	Residual clay	Floor	1.2m
FTP17	Residual clay	Floor	1.2m
FTP18	Residual clay	Floor	1.2m
FTP19	Residual clay	Wall-S	1.2m
FTP20	Residual clay	Wall-W	1.2m
FTP21	Residual clay	Wall-N	1.2m

6.0 RESULTS OF ENVIRONMENTAL TESTING

6.1 Reference Criteria

For the purpose of this report, the Victorian EPA Publication 448 (1995) *fill* criteria for Off-Site Disposal have been adopted in accordance with the RAP to assess the need for clean-up or otherwise of the FLP and FTP areas, i.e.,

- total petroleum hydrocarbons (TPH) C_6-C_9 100 mg/kg
- total petroleum hydrocarbons (TPH) > C_9 1000 mg/kg
- total phenols 1 mg/kg
- monocyclic aromatic hydrocarbons (BTEX) 7 mg/kg
- lead 300 mg/kg

While we understand these criteria are generally based on environmental investigation levels of ANZECC (1992), they are principally intended for the assessment of off-site disposal options and were not intended as generic clean-up criteria.

6.2 Laboratory Results

The results of the laboratory testing are summarised in Tables B1 and B2 of Appendix B. NATA certified laboratory results are included as Appendix C.

6.2.1 Stage I Activities

The test results (Table B1) generally indicate that TPH, BTEX, lead and total phenol concentrations are below VICEPA guidelines for off-site disposal as "clean" fill except for 2 samples collected from the FLP and 1 sample collected from the FTP which exhibited TPH (>C_9) concentrations greater than 1000mg/kg, i.e.

- **FLP35-0.1P**, blue metal fill sample, excavation depth of 0.3m, eastern wall of the easternmost extent of the FLP excavation abutting University Road (approximately 20m north of the southern boundary and approximately 15m north of the interceptor), exhibited TPH (>C_9) concentrations of 1450mg/kg;
- **FLP40-0.1P**, residual clay sample, excavation depth of 1.2m, base of the excavation in the fuel mixing area located in the north western corner of the FLP adjacent to the green shed, exhibited TPH (>C_9) concentrations of 2350mg/kg; and
- **FTP14-0.1P**, residual clay sample, excavation depth of 0.4m, western side of the westernmost extent of the FTP excavation abutting University Road, exhibited TPH (>C_9) concentrations of 1070mg/kg.

6.2.2 Stage II Activities

The test results generally indicate TPH, BTEX, lead and total phenol concentrations at or below laboratory detection limits except for a sample collected from the fire training pit location FTP17

where minor TPH (>C9) concentrations were detected. TPH concentrations at this location, however, were below VICEPA guidelines for off-site disposal as "clean" *fill.*

6.3 QC Results

WSL conducted an internal QA/QC program comprising laboratory blanks, matrix duplicates and spikes on sample matrices and laboratory blanks (refer Appendix C). RPDs between laboratory matrix duplicates were generally within the acceptable range of 30-50% of the mean. The results of laboratory blanks were below detection limits indicating that no sample contamination had occurred as a result of handling in the laboratory. Spiked sample analyses gave recoveries generally within acceptable control limits (80-120%) and are considered acceptable to validate the analytical dataset.

On the basis of the laboratory QC results, it is considered that the laboratory has provided an acceptable QA/QC program and accurate data confirmation.

7.0 CONCLUSIONS

This report presents the results of a validation sampling and analytical program conducted on the FLP and FTP areas of the CFA Training facility which form part of the on-site remediation activities outlined in Rio Tinto's RAP.

The results of the validation sampling and analytical program have confirmed the absence of contaminants, at levels exceeding the target concentrations adopted in the RAP (RioTinto, 1997), in soil profile samples collected from the base and sides of the FLP and FTP excavations. On this basis we recommend the excavations be backfilled with clean fill.

8.0 LIMITATIONS

The findings contained within this report are the result of discrete/specific sampling methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, do these findings represent the actual state of the site at all points.

Michael Robert

For and on behalf of
COFFEY PARTNERS INTERNATIONAL PTY LTD

REFERENCES

- ANZECC, (1990). *"Draft Australian Guidelines for the Assessment and Management of Contaminated Sites"*, publ Australian & New Zealand Environment and Conservation Council, National Health & Medical Research Council, June, 1990.

- ANZECC, (1992). *"Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites"*, publ Australian & New Zealand Environment and Conservation Council, National Health & Medical Research Council, January, 1992.

- APHA (1989). *"Standard Methods for the Examination of Water and Wastewater"*, 17th edn, publ by American Public Health Association (APHA), American Water Works Association, Water Pollution Control Federation.

- Coffey Partners International Pty Ltd, (1996a). *"CFA Training College, Field Site Appraisal and Sampling, Ballan, Victoria"*, report Reference E3517/1-AD dated 7 August 1996.

- Coffey Partners International Pty Ltd, (1996b). *"CFA Training College, Groundwater Monitoring Network Installation, Ballan, Victoria"*, report Reference E3522/1-AK dated 15 October 1996.

- Diomedes & Associates Pty Ltd, (1996). "Excerpts from an Environmental Investigation of the CFA Training College", Reference DA1108/SD3000 dated 27 June 1996.

- Rio Tinto Research and Technology Development, (1997). *"Draft Fiskville Training College Remediation Action Plan"*, Project No A912B dated 11 December 1997.

- Rio Tinto Research and Technology Development, (1998). *"Fiskville Training College Remediation Action Plan"*, Project No CAV002 dated 13 January 1998.

- Standards Australia, (1997). *"AS4482.1: Guide to the Sampling and Investigation of Potentially Contaminated Soil; Part 1: Non-Volatile and Semi-Volatile Compounds"*.

- USEPA (1989). *"Risk Assessment Guidance for Superfund, Vol 1 - Human Evaluation Manual, Part A"*; EPA/540/1-89/002, US Environment Protection Agency, December 1989.

- VICEPA, (1995). *"Classification of Wastes"*, Publication 448, Environment Protection Authority of Victoria, May.

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

important information about your environmental site assessment

These notes have been prepared by Coffey Partners International Pty. Ltd. (CPI) using guidelines prepared by ASFE;The Association of Engineering Firms Practicing in the Geosciences. They are offered to help you in the interpretation of your Environmental Site Assessment (ESA) reports.

REASONS FOR CONDUCTING AN ESA

ESA's are typically, though not exclusively, carried out in the following circumstances:

- as pre-acquisition assessments, on behalf of either purchaser or vendor, when a property is to be sold;
- as pre-development assessments when a property or area of land is to be redeveloped or have its use changed — for example, from a factory to a residential subdivision;
- as pre-development assessments of greenfield sites, to establish "baseline" conditions and assess environmental, geological and hydrological constraints to the development of, for example, a landfill; and
- as audits of the environmental effects of an ongoing operation.

Each of these circumstances requires a specific approach to the assessment of soil and groundwater contamination. In all cases, however, the objective is to identify and if possible quantify the risks which unrecognised contamination poses to the proposed activity. Such risks may be both financial, for example, clean-up costs or limitations on site use, and physical, for example, health risks to site users or the public.

THE LIMITATIONS OF AN ESA

Although the information provided by an ESA can reduce exposure to such risks, no ESA, however diligently carried out, can eliminate them. Even a rigorous professional assessment may fail to detect all contamination on a site. Contaminants may be present in area that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled.

AN ESA REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

Your environmental report should not be used:

- When the nature of the proposed development is changed, for example, if a residential development is proposed instead of a commercial one;
- when the size or configuration of the proposed development is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or
- for application to an adjacent site.

To help avoid costly problems, refer to your consultant to determine how any factors which have changed subsequent to the date of the report may affect its recommendations.

ESA "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site assessment identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise its impact. For this reason, owners should retain the services of their consultants through the development stage, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions are changed by natural processes and the activity of man. Because an ESA report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on an ESA report whose adequacy may have been affected by time. Speak with the consultant to learn if additional tests are advisable.

ESA SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Every study and ESA report is prepared in response to a specific Brief to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. A report should not be used by other persons for any purpose. No individual other than the client should apply a report even apparently for its intended purpose without first conferring with the consultant. No person should apply a report for any purpose other than that originally contemplated without first conferring with the consultant.

AN ESA REPORT IS SUBJECT TO MIS-INTERPRETATION

Costly problems can occur when design professionals develop their plans based on misinterpretations of an ESA. To help avoid these problems, the environmental consultant should be retained to work with appropriate design professionals to explain relevant findings and to review the adequacy of their plans and specifications relative to contamination issues.

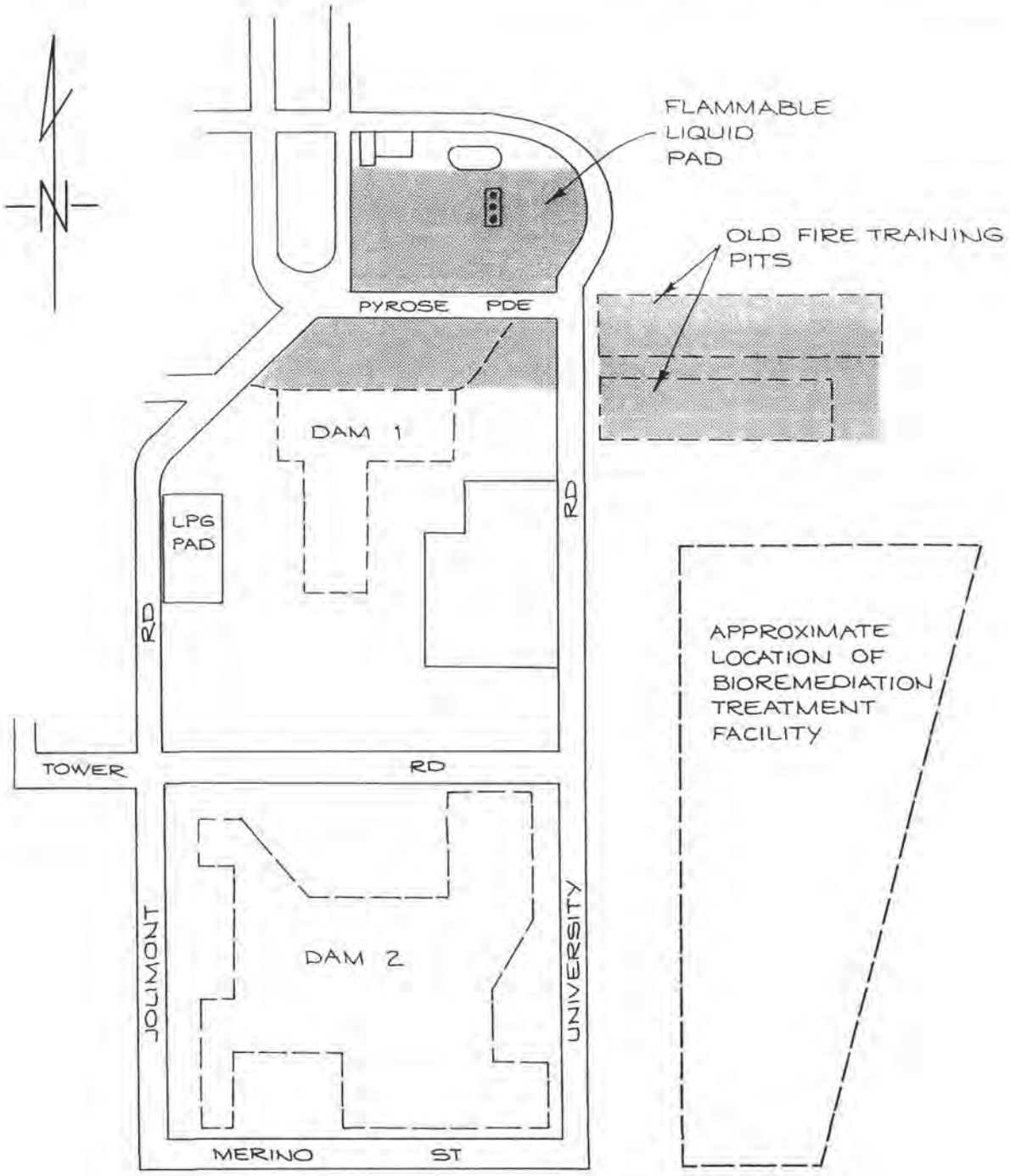
LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final borehole or test pit logs are developed by environmental scientists, engineers or geologists based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final logs are customarily included in our reports. These logs should not under any circumstances be redrawn for inclusion in site remediation or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimise the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To reduce the likelihood of boring log misinterpretation, the complete report must be available to persons or organisations involved in the project, such as contractors, for their use. Those who do not provide such access may proceed under the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing all the available information to persons and organisations such as contractors helps prevent costly construction problems and the adversarial attitudes which may aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because an ESA is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are not exculpatory clauses designed to foist liabilities onto some other party. Rather, they are definitive clauses which identify where your consultant's responsibilities begin and end. Their use helps all parties involved recognise their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your ESA report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.



LEGEND

APPROXIMATE AREAS TO BE EXCAVATED

FROM CRA-ATD DRAWING
IN REMEDIATION ACTION PLAN
DATED 13 JAN, '98

0 50m
Scale (approx.)

CFA.3342.0015.011.0027

Coffey Partners International Pty Ltd

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources A.C.N. 003 692 019

drawn	MP/SA
approved	MP
date	25/2/98
scale	1:2000 approx.

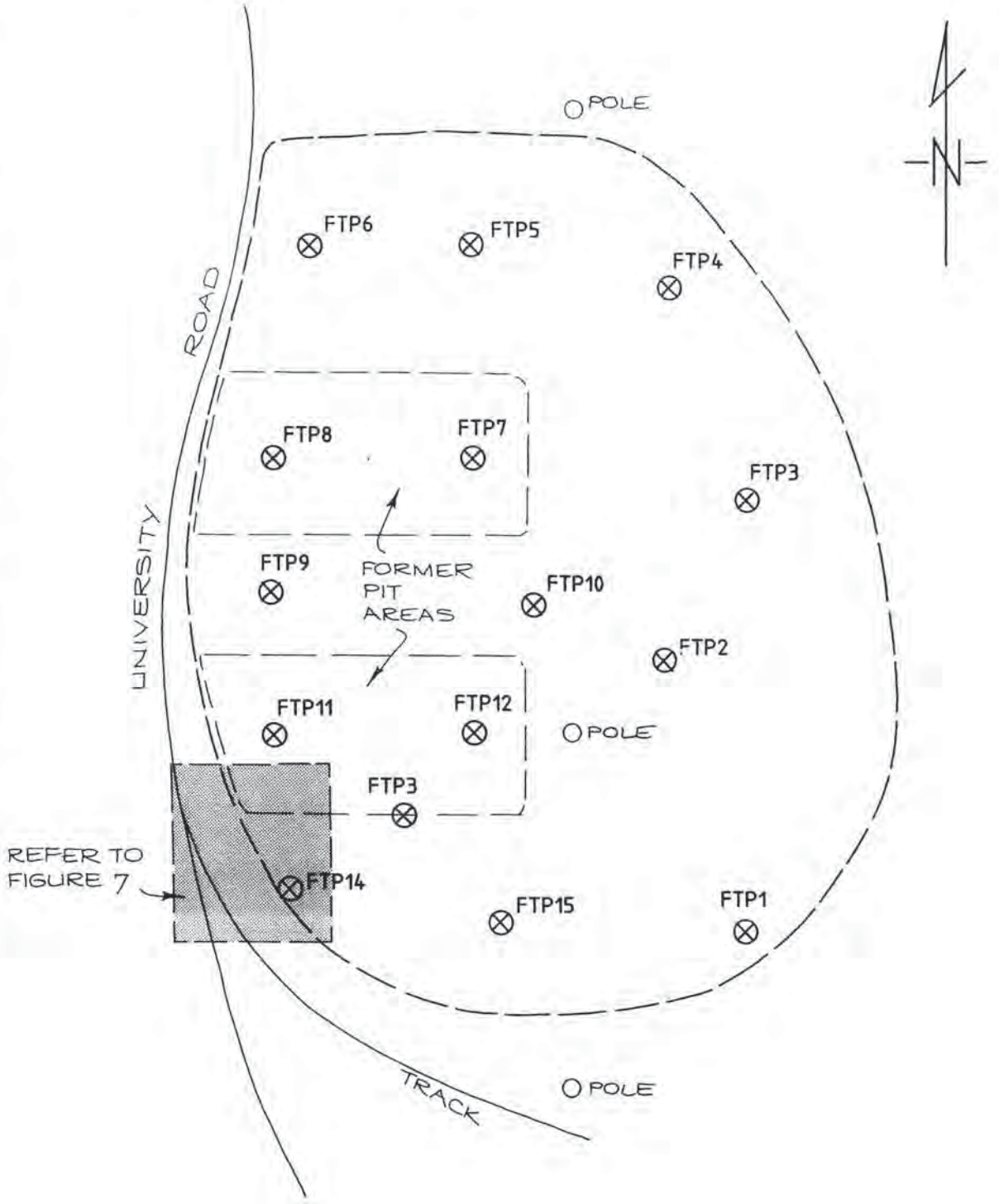
CFA TRAINING COLLEGE

SOIL REMEDIATION AND VALIDATION PROGRAM
LOCALITY PLAN

COFFEY

FIGURE 1

job no: E3523/3-AI



LEGEND

⊗ FTP1 SAMPLING LOCATIONS

0 5 10 15
Scale (metres)

CFA.3342.0015.011.0028

Coffey Partners International Pty Ltd

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources A.C.N. 003 692 019

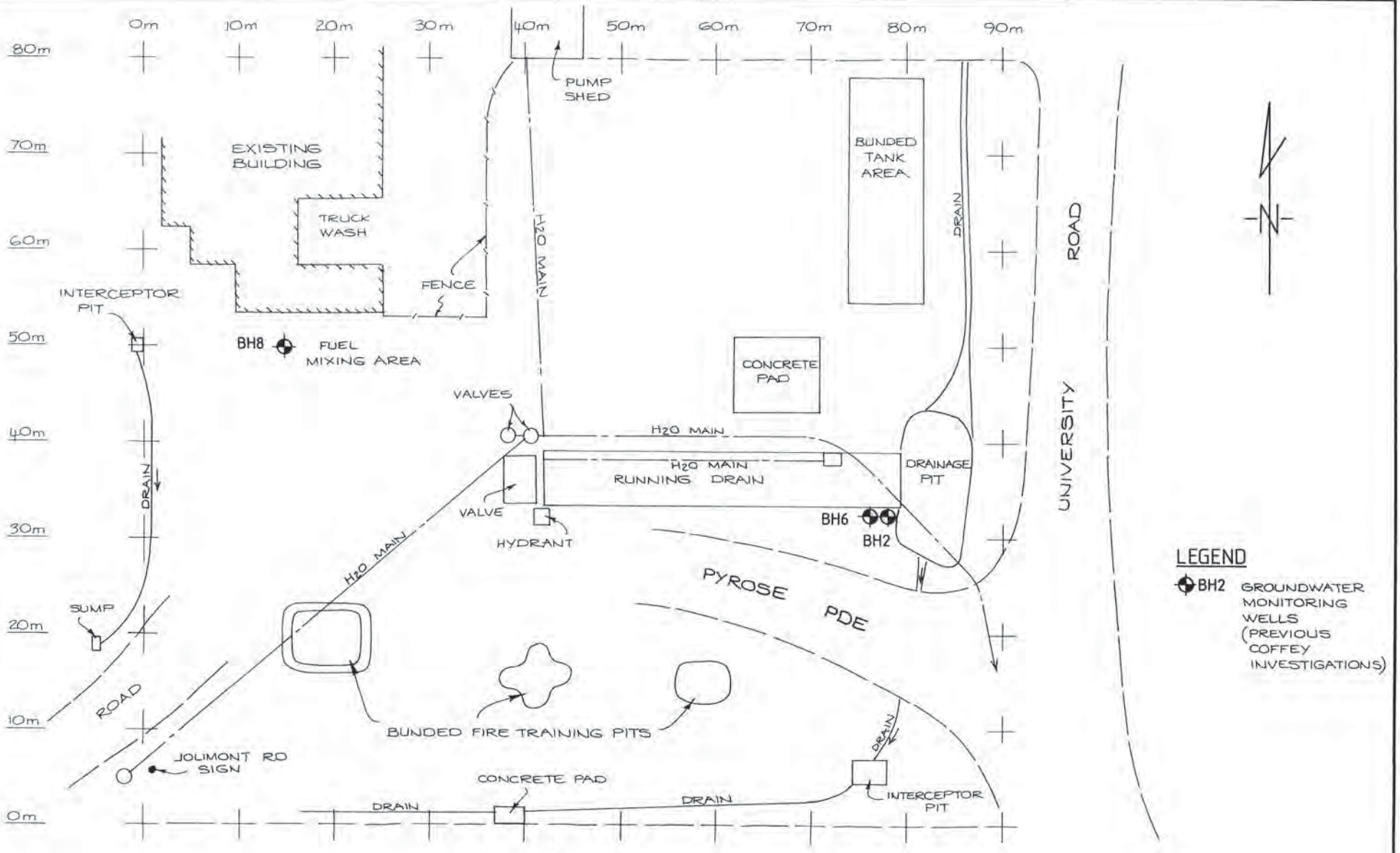
drawn	GE/SA
approved	
date	25/2/98
scale	1:400

CFA TRAINING COLLEGE
SOIL REMEDIATION AND VALIDATION PROGRAM
OLD FIRE TRAINING PITS
VALIDATION SOIL SAMPLING LOCATIONS

COFFEY

FIGURE 4

job no. E3523/3-AI



DAM 1

Coffey Partners International Pty Ltd A.C.N. 003 892 019

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources

4 0 4 8 12 16 20
scale (metres)
1:400

revision	description	drawn	approved	date

drawn	GE/SA
checked	MP
date	20/2/98

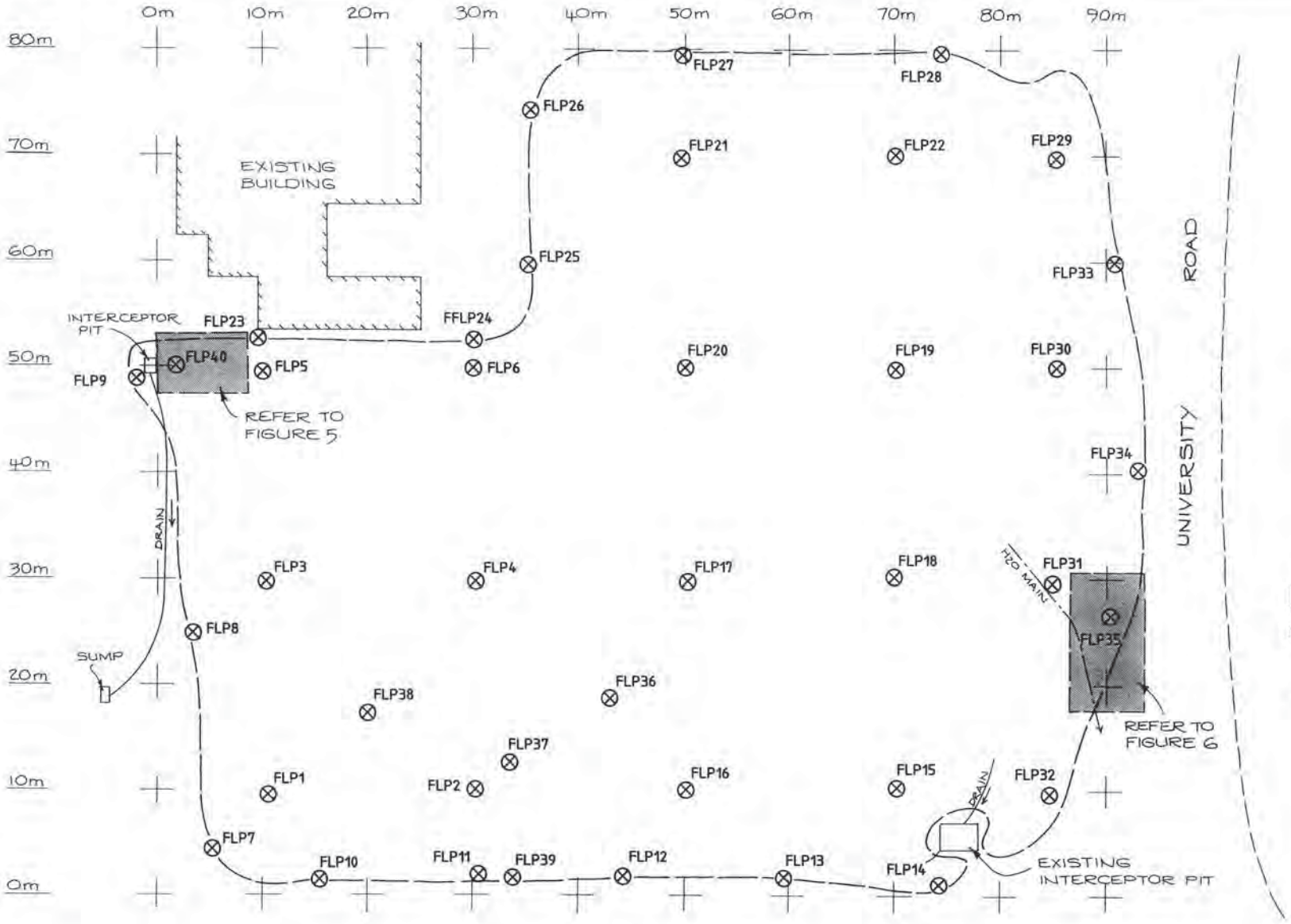
CFA TRAINING COLLEGE
SOIL REMEDIATION AND VALIDATION PROGRAM
FLAMMABLE LIQUIDS PAD
PRE-EXCAVATION PLAN SHOWING EXISTING STRUCTURES

COFFEY

FIGURE 2

job no. E3523/3-AI

CFA.3342.0015.011.0029



DAM 1

Coffey Partners International Pty Ltd A.C.N. 003 892 019

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources

4 0 4 8 12 16 20
scale (metres)
1:400

revision	description	drawn	approved	date

drawn	GE/SA
checked	MP
date	20/2/98

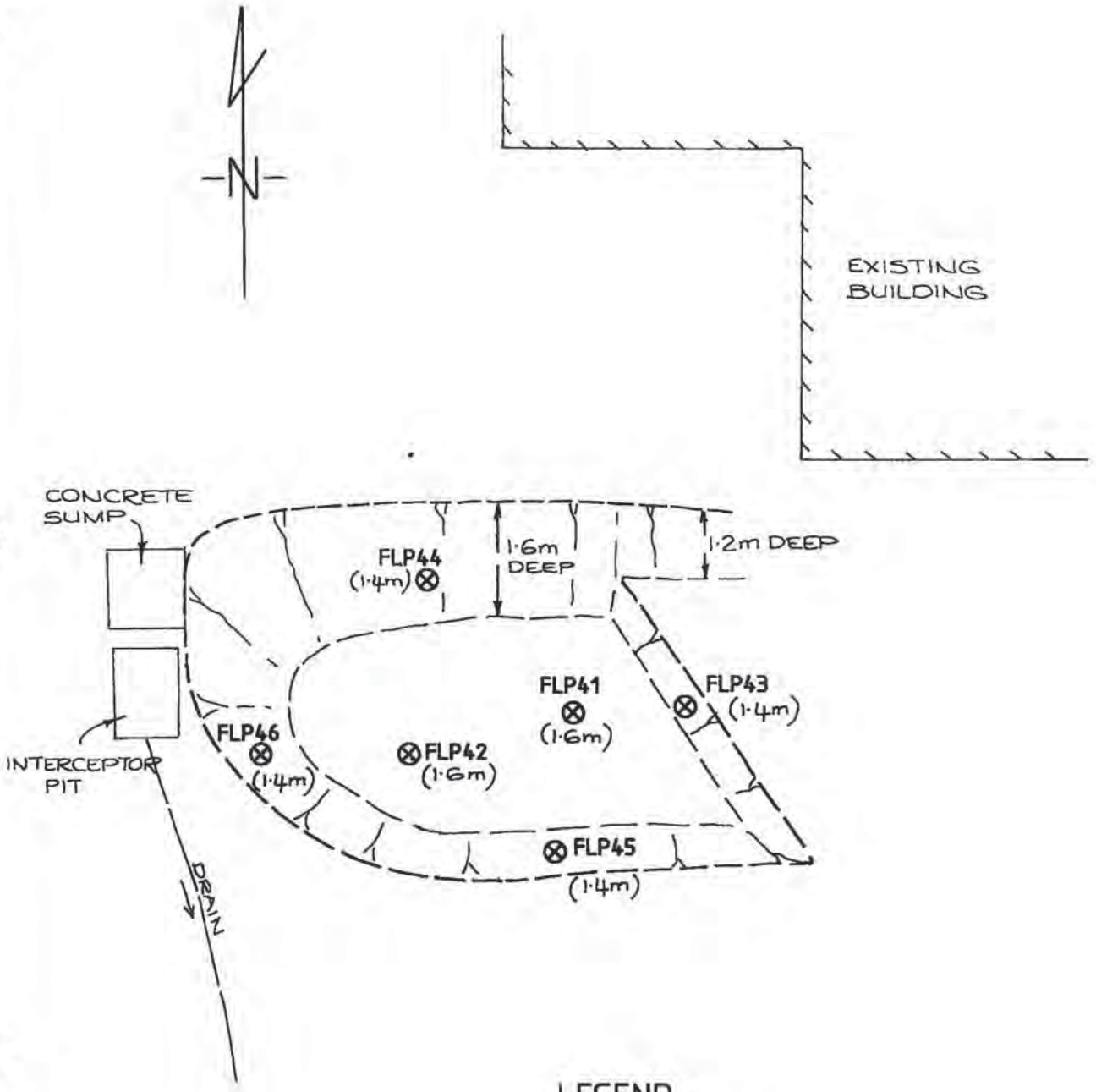
CFA TRAINING COLLEGE
SOIL REMEDIATION AND VALIDATION PROGRAM
FLAMMABLE LIQUIDS PAD
VALIDATION SOIL SAMPLING LOCATIONS

COFFEY

FIGURE 3

job no. E3523/3-AI

CFA.3342.0015.011.0030



LEGEND

⊗ FLP41 SAMPLING LOCATIONS

(1·6m) SAMPLING DEPTHS

NOTE: 1. ALL SAMPLES IN RESIDUAL CLAY.

2. AREA APPROXIMATELY 9m x 6m.

0 1 2 3 4

Scale (metres)

CFA.3342.0015.011.0031

Coffey Partners International Pty Ltd

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources A.C.N. 003 692 019

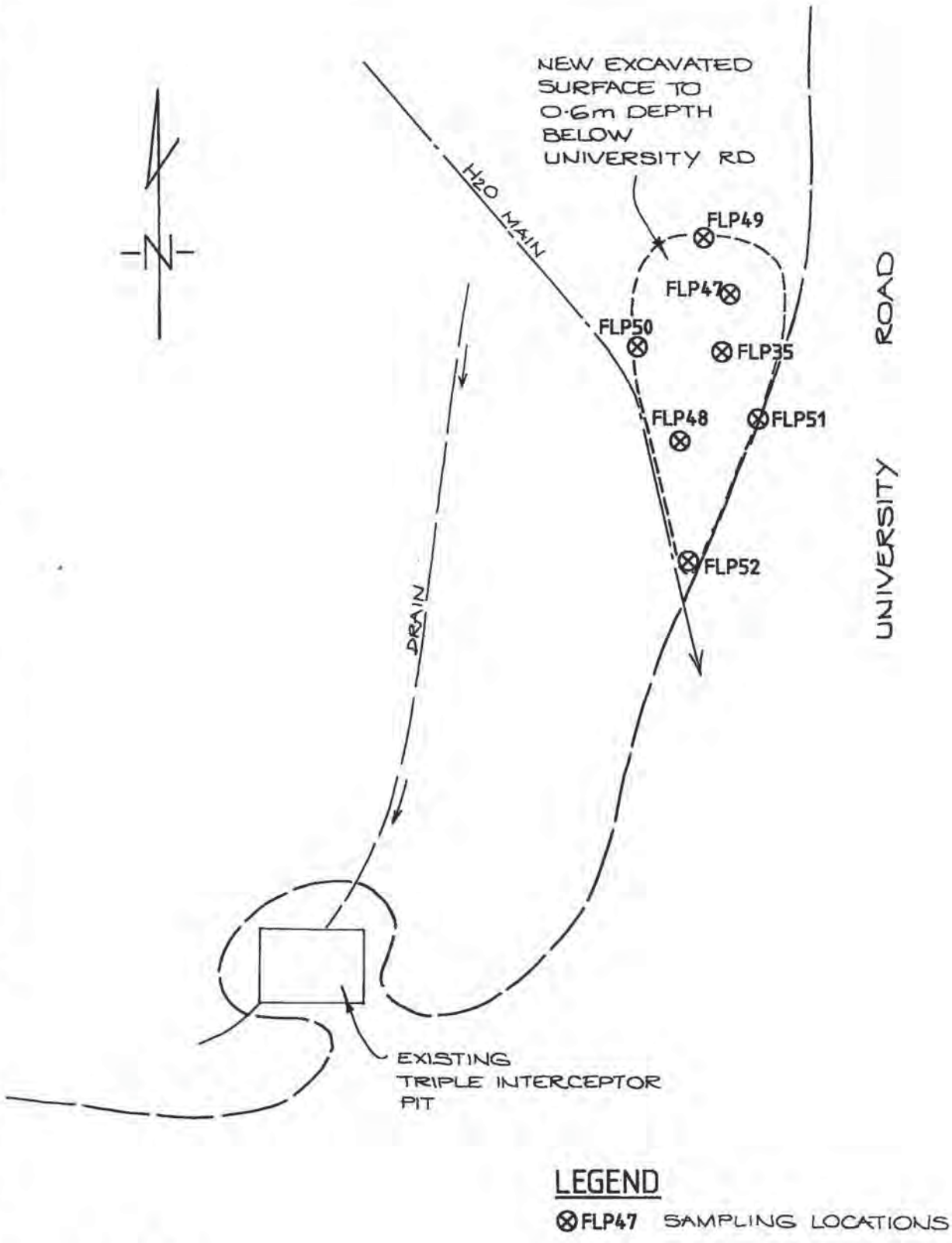
drawn	GE/SA
approved	
date	10/3/98
scale	1:100

CFA TRAINING COLLEGE
SOIL REMEDIATION AND VALIDATION PROGRAM
FLAMMABLE LIQUIDS PAD
ADDITIONAL EXCAVATION IN VICINITY OF FLP40

COFFEY

FIGURE 5

job no: E3523/3-AI



CFA.3342.0015.011.0032

Coffey Partners International Pty Ltd

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources A.C.N. 003 692 019

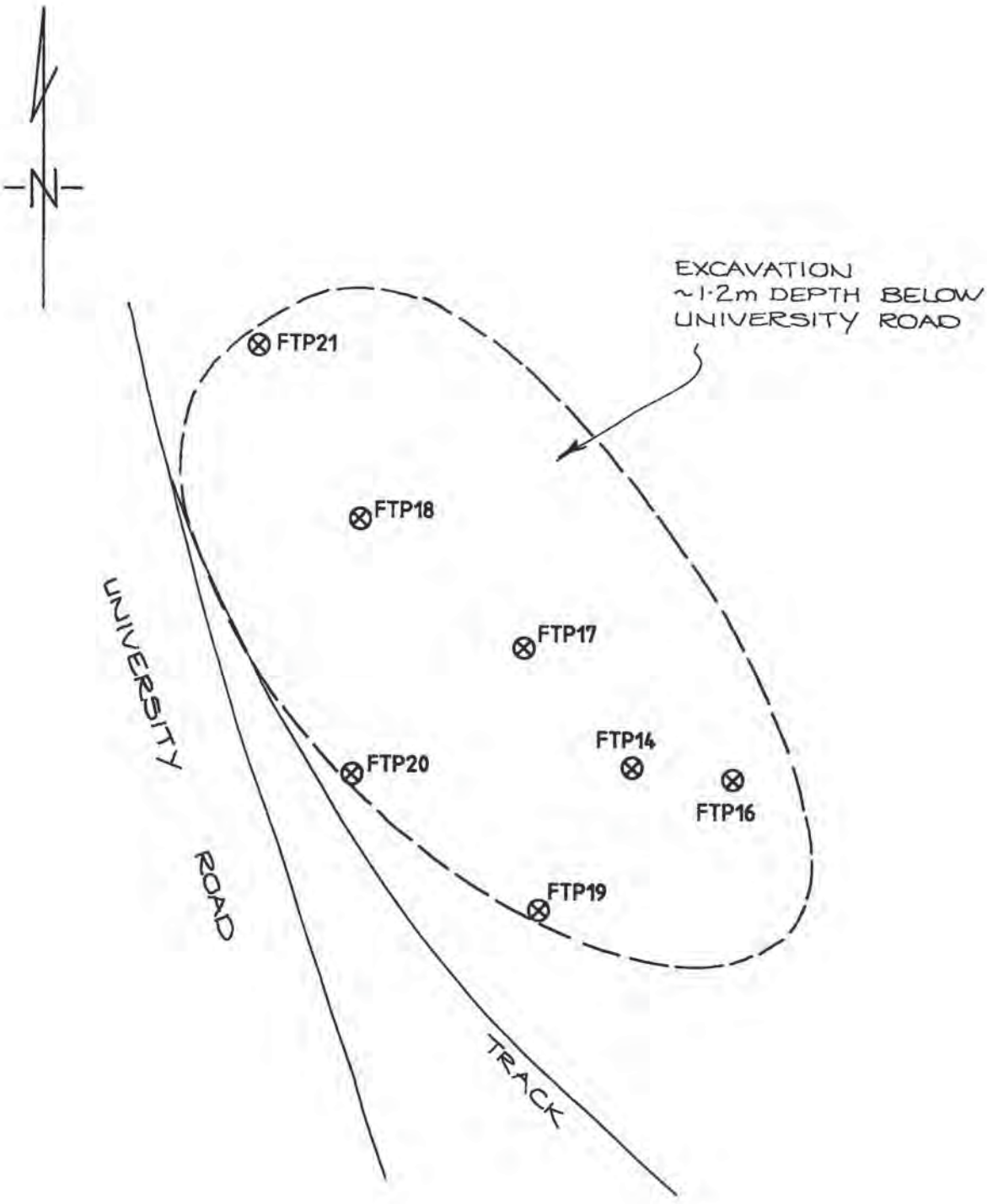
drawn	GE/SA
approved	MP
date	10/3/98
scale	1:200

CFA TRAINING COLLEGE
SOIL REMEDIATION AND VALIDATION PROGRAM
FLAMMABLE LIQUIDS PAD
ADDITIONAL EXCAVATION IN VICINITY OF FLP35

COFFEY

FIGURE 6

job no: E3523/3-AI



LEGEND

⊗ FTP16 SAMPLING LOCATIONS

0 1 2 3 4
Scale (metres)

CFA.3342.0015.011.0033

Coffey Partners International Pty Ltd

Consulting Engineers, Managers and Scientists
Environment • Geotechnics • Mining • Water Resources A.C.N. 003 692 019

drawn	GE/SA
approved	MP
date	10/3/98
scale	1:100

CFA TRAINING COLLEGE

SOIL REMEDIATION AND VALIDATION PROGRAM
OLD FIRE TRAINING PITS
ADDITIONAL EXCAVATION IN VICINITY OF FTP14

COFFEY

FIGURE 7

job no: E3523/3-AI

APPENDIX A

APPENDIX A

CHAIN OF CUSTODY RECORDS

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 1 of 5

chain of custody

No: 13773 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Willms

sampled by: (signature) AE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 27/1/98
courier service:
consignment note no:

GOODS RECEIVED UNCHECKED
27 JAN 1998
SIGNED...

relinquished by	date	time	received by	date	time
MP	27/1/98	2300			

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
Ballan	Soil, 250g glass jar + 20ml VOC vial	FLP 1, 0.1, P	23/1/98	TPH, Total phenols, BTEX	
		FLP 3, 0.1, P		TPH, Total phenols, BTEX, + Pb	
		FLP 4, 0.1, P		TPH, Total phenols, BTEX	
		FLP 5, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 6, 0.1, P		TPH, Total phenols, BTEX	
		FLP 7, 0.1, P		" " "	
		FLP 8, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 9, 0.1, P		TPH, Total phenols, BTEX	
		FLP 10, 0.1, P		" " "	
		FLP 11, 0.1, P		" " "	

special laboratory instructions:

detection limits:

turnaround required:

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

CFA.3342.0015.011.0036

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 2 of 5

chain of custody

No: 13774 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Willms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 27/1/98
courier service:
consignment note no:

GOODS RECEIVED UNCHECKED
27 JAN 1998
SIGNED

relinquished by	date	time	received by	date	time
MP	27/1/98	2.30 p			

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
Ballan	SOIL, 250g glass jar + 20 ml VOC vial	FLP 12, 0.1, P	23/1/98	TPH, Total phenols, BTEX + Pb	
		FLP 13, 0.1, P		TPH, Total phenols, BTEX	
		FLP 14, 0.1, P		" " "	
		FLP 15, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 16, 0.1, P		TPH, Total phenols, BTEX	
		FLP 17, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 18, 0.1, P		" " " "	
		FLP 19, 0.1, P		" " " "	
		FLP 20, 0.1, P		TPH, Total phenols, BTEX	
		FLP 21, 0.1, P		TPH, Total phenols, BTEX + Pb	

special laboratory instructions:

detection limits:

turnaround required:

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

CFA.3342.0015.011.0037

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 3 of 5

chain of custody

No: 13775 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Willms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 27/1/98
courier service:
consignment note no:

relinquished by	date	time	received by	date	time
MP	27/1/98	2.30 p.m.	GOODS RECEIVED UNCHECKED 27 JAN 1998 SIGNED:		

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
Ballan	SOIL, 250g glass jar + 20 ml VOC vial	FLP 22, 0.1, P	23/1/98	TPH, Total phenols, BTEX	
		FLP 23, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 24, 0.1, P		TPH, Total phenols, BTEX	
		FLP 25, 0.1, P		" " "	
		FLP 26, 0.1, P		" " "	
		FLP 27, 0.1, P		" " "	
		FLP 28, 0.1, P		" " "	
		FLP 29, 0.1, P		" " "	
		FLP 30, 0.1, P		" " "	
		FLP 31, 0.1, P		" " "	

special laboratory instructions:

detection limits:

turnaround required:

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

CFA.3342.0015.011.0038

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 4 of 5

chain of custody

No: 13776 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Willms

sampled by: (signature) GNE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 27/1/98
courier service:
consignment note no:

relinquished by	date	time		date	time
MP	27/1/98	2.30 pm			

GOODS RECEIVED
UNCHECKED
27 JAN 1998
SIGNED

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
Ballan	Soil 250 g glass jar + 20 ml VOC vial	FLP 32, 0.1, P	23/1/98	TPH, Total phenols, BTEX + Pb	
		FLP 33, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 34, 0.1, P		TPH, Total phenols, BTEX [redacted]	
		FLP 35, 0.1, P		" " " [redacted]	
		FLP 36, 0.1, P		[redacted] " " " [redacted]	
		FLP 37, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FLP 38, 0.1, P		" " " "	
		FLP 40, 0.1, P		" " " "	
		FTP 1, 0.1, P		TPH, Total phenols, BTEX	
		FTP 2, 0.1, P		" " "	

CFA.3342.0015.011.0039

special laboratory instructions:

detection limits:

turnaround required:

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 5 of 5

chain of custody

N°: 13777 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Wilms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 27/1/98
courier service:
consignment note no:

GOODS RECEIVED UNCHECKED
27 JAN 1998
SIGNED.....

relinquished by	date	time		date	time
MJ	27/1/98	2.39			

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
Balman	SOIL, 250g glass jar + 20ml VOC vial	FTP 4, 0.1, P	23/1/98	TPH, Total phenols, BTEX	
		FTP 6, 0.1, P		" " "	
		FTP 7, 0.1, P		TPH, Total phenols, BTEX + Pb	
		FTP 8, 0.1, P		" " " "	
		FTP 9, 0.1, P		TPH, Total phenols, BTEX	
		FTP 10, 0.1, P		TPH, Total phenols, BTEX, +Pb	
		FTP 11, 0.1, P		" " " "	
		FTP 12, 0.1, P		" " " "	
		FTP 13, 0.1, P		TPH, Total phenols, BTEX	
		FTP 14, 0.1, P		" " "	

special laboratory instructions: Please complete matrix blank & spike & duplicate on our sample batch.

detection limits:

turnaround required:

CFA.3342.0015.011.0040

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

Missing Samples as per batch 27/1/98

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: of

chain of custody

No: 10336 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: Vic Wilms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 28-1-98
courier service: MKSP
consignment note no:

relinquished by	date	time	received by	date	time
MP	28/1/98	1445		28/1	1:45

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
	Soil				
	250g jar	FTP4-0.1P	23/1/98	MSSURP sample as per COC# 13777	
	20ml vial	FLP4-0.1P		" " " COC# 13773	
	"	FTP2-0.1P		" " " COC # 13776	
	* Please note = Sample FTP3 0.1P (jar) which was received in 27/1/98 batch should be held in cold storage - no analysis is required @ this stage - MP 28/1/98				

special laboratory instructions:

detection limits:

turnaround required:

CFA.3342.0015.011.0041

NOTE — JOB NUMBER ***MUST*** BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

Coffey Partners International Pty Ltd
A.C.N. 003 892 019

COFFEY

job no: E3523/3
box no: 1 of 4

chain of custody

N°: 11034 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) NAL
attention: V. Willms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 6/3/98
courier service:
consignment note no:

relinquished by	date	time	received by	date	time
GWE	6/3/98	10.40	GOODS RECEIVED UNCHECKED 6 MAR 1998 SIGNED		10.40am

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
CFA	SOIL, 250 g glass jar	FLP 41, 0.1, P	5/3/98	TPH, Total phenols, Lead (Pb)	
		FLP 42, 0.1, P			
		FLP 43, 0.1, P			
		FLP 44, 0.1, P			
		FLP 45, 0.1, P			
		FLP 46, 0.1, P			
		FLP 47, 0.1, P			
		FLP 48, 0.1, P			
		FLP 49, 0.1, P			
		FLP 50, 0.1, P			

special laboratory instructions:

detection limits:

turnaround required:

CFA.3342.0015.011.0042

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

chain of custody

No: 11035 Laboratory Quotation No. (if applicable)

COFFEY

job no: E3523/3
box no: 2 of 4

despatch to: (address & phone no) WSL
attention: V. Willms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 6/3/98
courier service:
consignment note no:

relinquished by	date	time	received	date	time
GWE	6/3/98	10.40	GOODS RECEIVED UNCHECKED 6 MAR 1998 SIGNED		10.40am

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
CFA	SOIL, 250 g glass jar	FLP 51, 0.1, P	5/3/98	TPH, Total phenols, Lead (Pb)	
		FLP 52, 0.1, P			
		FTP 16, 0.1, P			
		FTP 17, 0.1, P			
		FTP 18, 0.1, P			
		FTP 19, 0.1, P			
		FTP 20, 0.1, P			
		FTP 21, 0.1, P			
	SOIL, 20 ml VOC vial	FLP 41, 0.1, P		BTEX	
		FLP 42, 0.1, P		BTEX	

special laboratory instructions:

detection limits:

turnaround required:

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

CFA.3342.0015.011.0043

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 3 of 4

chain of custody

N°: 11036 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Williams

sampled by: (signature) GWE
project manager: (report results to) MKS1

consigning office: Hawthorn
date despatched: 6/3/98
courier service:
consignment note no:

relinquished by	date	time	received by	date	time
GWE	6/3/98	10.40	GOODS RECEIVED UNCHECKED 6 MAR 1998 SIGNED		10.40 am

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
CFA	SOIL, 20 m VOC vial	FLP 43, 0.1, P	5/3/98	BTEX	
		FLP 44, 0.1, P			
		FLP 45, 0.1, P			
		FLP 46, 0.1, P			
		FLP 47, 0.1, P			
		FLP 48, 0.1, P			
		FLP 49, 0.1, P			
		FLP 50, 0.1, P			
		FLP 51, 0.1, P			
		FLP 52, 0.1, P			

special laboratory instructions:

detection limits:

turnaround required:

CFA.3342.0015.011.0044

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

COFFEY

job no: E3523/3
box no: 4 of 4

chain of custody

No: 11037 Laboratory Quotation No. (if applicable)

despatch to: (address & phone no) WSL
attention: V. Willms

sampled by: (signature) GWE
project manager: (report results to) MKSP

consigning office: Hawthorn
date despatched: 6/3/98
courier service:
consignment note no:

relinquished by	date	time	received by	date	time
[signature]	6/3/98	10.40	GOODS RECEIVED UNCHECKED 6 MAR 1998 SIGNED [signature]		10.40 am

sample locality (borehole etc)	sample type	sample number	date sampled	analysis requested	sample condition upon receipt
CFA	SOIL, 20m/VOC vial	FTP 16, 0.1, P	5/3/98	BTEX	
		FTP 17, 0.1, P			
		FTP 18, 0.1, P			
		FTP 19, 0.1, P			
		FTP 20, 0.1, P			
		FTP 21, 0.1, P			

CFA.3342.0015.011.0045

special laboratory instructions:

detection limits:

turnaround required:

NOTE — JOB NUMBER *MUST* BE REFERENCED ON ALL SUBSEQUENT COMMUNICATIONS

APPENDIX B

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS

TABLE B1
STAGE I EXCAVATION ACTIVITIES
SUMMARY OF SOIL RESULTS FOR LEAD, TOTAL PHENOLS, BTEX AND TPHs

COFFEY

Job Reference : E3523/3
Location: CFA Training College, Fiskville nr Ballan
Results expressed in mg/kg dry weight

Sample No	Sample Type (F = Fill) (N = Natural)	Lead	TOTAL PHENOLS	Benzene	Toluene	Ethyl Benzene	Xylenes	TPH C6-C9	TPH C10-C14	TPH C15-C28	TPH C29-C36
Lab Detection Limits:			*0.1*	*0.5*	*0.5*	*0.5*	*0.5*	*20*	*20*	*50*	*50*
VicEPA- Fill criteria		*300*	*1*	*{ ----- — TOTAL BTEX = 7 ——— }*				*100*	*{ —— — 1000 ——— }*		
FLP1-0.1P	N		0.5	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP3-0.1P	F	14	0.3	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP4-0.2P	N		0.2	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP5-0.1P	N	13	0.6	<0.5	<0.5	<0.5	<0.5	<20	<20	53	<50
FLP6-0.1P	N		0.5	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP7-0.1P	F		0.3	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP8-0.1P	F	21	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP9-0.1P	N		0.3	<0.5	<0.5	<0.5	<0.5	<20	28	170	<50
FLP10-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP11-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP12-0.1P	N	19	<0.1	<0.5	<0.5	<0.5	<0.5	<20	70	400	<50
FLP13-0.1P	F		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	110	<50
FLP14-0.1P	F		0.3	<0.5	<0.5	<0.5	<0.5	<20	<20	460	230
FLP15-0.1P	N	15	0.3	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP16-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP17-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP18-0.1P	N	12	0.2	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP19-0.1P	N	18	0.2	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP20-0.1P	N		0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP21-0.1P	N	10	0.2	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP22-0.1P	N		0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP23-0.1P	N	12	0.5	<0.5	<0.5	<0.5	<0.5	<20	<20	320	<50
FLP24-0.1P	N		0.5	<0.5	1.5	0.8	4.2	<20	<20	88	<50
FLP25-0.1P	F		0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP26-0.1P	F		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP27-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP28-0.1P	F		0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP29-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP30-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP31-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP32-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	65	<50
FLP33-0.1P	F	56	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	370	120
FLP34-0.1P	F		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP35-0.1P	F		<0.1	<0.5	<0.5	<0.5	<0.5	<20	31	1200	220
FLP36-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP37-0.1P	N	15	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP38-0.1P	N	14	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP40-0.1P	N	10	<0.1	<0.5	<0.5	<0.5	<0.5	<20	350	2000	<50
FTP1-0.1P	N	38	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	130	110
FTP2-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	120	130
FTP4-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	290	390
FTP6-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	260	280
FTP7-0.1P	N	10	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FTP8-0.1P	N	9	0.3	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FTP9-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	79	93
FTP10-0.1P	N	13	0.2	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FTP11-0.1P	N	11	0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FTP12-0.1P	N	15	0.2	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FTP13-0.1P	N		0.3	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FTP14-0.1P	N		<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	310	760

Concentrations exceeding VICEPA fill criteria

TABLE B2
STAGE II EXCAVATION ACTIVITIES
SUMMARY OF SOIL RESULTS FOR LEAD, TOTAL PHENOLS, BTEX AND TPHs

Job Reference : E3523/3
Location: CFA Training College, Fiskville nr Ballan
Results expressed in mg/kg dry weight

Sample No	Sample Type (F = Fill) (N = Natural)	Lead	TOTAL PHENOLS	Benzene	Toluene	Ethyl Benzene	Xylenes	TPH C6-C9	TPH C10-C14	TPH C15-C28	TPH C29-C36
Lab Detection Limits:			*0.1*	*0.5*	*0.5*	*0.5*	*0.5*	*20*	*20*	*50*	*50*
VicEPA- Fill criteria		*300*	*1*	*{ —— — TOTAL BTEX = 7 ——— }*				*100*	*{ —— — 1000 ——— }*		
FLP41-0.1P	N	14	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP42-0.1P	N	14	0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP43-0.1P	N	13	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP44-0.1P	N	19	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP45-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP46-0.1P	N	15	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP47-0.1P	N	16	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP48-0.1P	N	14	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP49-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP50-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP51-0.1P	N	32	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLP52-0.1P	N	27	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLT16-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLT17-0.1P	N	13	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	200	190
FLT18-0.1P	N	12	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLT19-0.1P	N	14	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLT20-0.1P	N	22	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50
FLT21-0.1P	N	16	<0.1	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50

APPENDIX C

E3523/3-AI
18 March 1998

APPENDIX C

NATA CERTIFIED LABORATORY RESULTS

WSLConsultants

Enviroscience

BL:ek:13052

13 February 1998

Coffey Partners International Pty Ltd
P.O. BOX 40
KEW VIC 3101
Attention: Mr. M. Probert

RE: SOIL ANALYSES
Job No: E3523/3

Certificate of Analysis

WSL Report No. 37612 - Chemical Analyses

Date Sampled 27/01/98
Received by WSL Consultants on 27/01/98
Instructions were received on 27/01/98
Analyses were commenced on 27/01/98

Soil samples were tested in accordance with the analytical methods described in "Chemical Analysis of Polluted Soils" VIC EPA, Publication 139, Nov. 1981 and WSL in-house methods, with the results expressed as **mg/kg dry weight unless stated otherwise.**

Water samples were tested in accordance with the analytical methods described in "Standard Methods for the Examination of Water & Waste Water", APHA 19th Edn. 1995 and WSL in-house methods, with the results expressed as **mg/Litre unless stated otherwise.**

Results pertain to samples as received.

Details of this Test Report were faxed as a preliminary report on 4 February 1998.

Yours faithfully
WSL CONSULTANTS PTY LTD

B.J LYONS
PRINCIPAL CHEMIST

NATA

CFA.3342.0015.011.0052

This Laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of registration. This document shall not be reproduced except in full.

WSL Consultants Pty. Ltd. A.C.N. 004 752 676
2-8 Harvey Street, Richmond, Victoria 3121, Australia
Telephone: +61 3 9429 4666 Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

A NATA Accredited Laboratory
An Approved Quarantine Premises
An Approved EPA Auditor & Analyst

RECYCLED

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

PHENOLS & LEAD - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Phenols	Lead						
	DESCRIPTION	LOCATION	DEPTH								
99005	FLP1,0.1,P			0.5							
99006	FLP3,0.1,P			0.3	14						
99007	FLP4,0.2,P			0.2							
99008	FLP5,0.1,P			0.6	13						
99009	FLP6,0.1,P			0.5							
99010	FLP7,0.1,P			0.3							
99011	FLP8,0.1,P			<0.1	21						
99012	FLP9,0.1,P			0.3							
99013	FLP10,0.1,P			<0.1							
99014	FLP11,0.1,P			<0.1							
99015	FLP12,0.1,P			<0.1	19						
99016	FLP13,0.1,P			<0.1							
99017	FLP14,0.1,P			0.3							
99018	FLP15,0.1,P			0.3	15						
99019	FLP16,0.1,P			<0.1							
99020	FLP17,0.1,P			<0.1	12						
99021	FLP18,0.1,P			0.2	12						
99022	FLP19,0.1,P			0.2	18						
99023	FLP20,0.1,P			0.1							
99024	FLP21,0.1,P			0.2	10						
	METHODS		SOIL	5530C	WSL 023 A						
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

PHENOLS & LEAD - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Phenols	Lead						
	DESCRIPTION	LOCATION	DEPTH								
99025	FLP22,0.1,P			0.1							
99026	FLP23,0.1,P			0.5	12						
99027	FLP24,0.1,P			0.5							
99028	FLP25,0.1,P			0.1							
99029	FLP26,0.1,P			<0.1							
99030	FLP27,0.1,P			<0.1							
99031	FLP28,0.1,P			0.1							
99032	FLP29,0.1,P			<0.1							
99033	FLP30,0.1,P			<0.1							
99034	FLP31,0.1,P			<0.1							
99035	FLP32,0.1,P			<0.1	12						
99036	FLP33,0.1,P			<0.1	56						
99037	FLP34,0.1,P			<0.1							
99038	FLP35,0.1,P			<0.1							
99039	FLP36,0.1,P			<0.1							
99040	FLP37,0.1,P			<0.1	15						
99041	FLP38,0.1,P			<0.1	14						
99042	FLP40,0.1,P			<0.1	10						
99043	FTP1,0.1,P			<0.1	38						
99044	FTP2,0.1,P			<0.1							
	METHODS		SOIL	5530C	WSL 023 A						
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

PHENOLS & LEAD - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Phenols	Lead						
	DESCRIPTION	LOCATION	DEPTH								
99045	FTP4,0.1,P			<0.1							
99046	FTP6,0.1,P			<0.1							
99047	FTP7,0.1,P			<0.1	10						
99048	FTP8,0.1,P			0.3	9.3						
99049	FTP9,0.1,P			<0.1							
99050	FTP10,0.1,P			0.2	13						
99051	FTP11,0.1,P			0.1	11						
99052	FTP12,0.1,P			0.2	15						
99053	FTP13,0.1,P			0.3							
99054	FTP14,0.1,P			<0.1							
	METHODS		SOIL	5530C	WSL 023 A						
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

QUALITY CONTROL DATA - PHENOLS & LEAD - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Phenols	Lead				
	DESCRIPTION	LOCATION	DEPTH						
	Duplicate								
99020D	FLP17,0.1,P				11				
99047 D	FLP7,0.1,P				9.4				
99007 D	FLP4,0.2,P			0.2					
99045 D	FTP4,0.1,P			<0.1					
99054 D	FTP14,0.1,P			<0.1					
	Spike	(%) Recovery							
99020 S	FLP17,0.1,P				92				
99047 S	FLP7,0.1,P				84				
99024 S	FLP21,0.1,P			102					
99046 S	FTP6,0.1,P			99					
	Spike Duplicate	(%) Recovery							
99020 S	FLP17,0.1,P				89				
99047 S	FLP7,0.1,P				84				
99024S	FLP21,0.1,P			96					
99046S	FTP6,0.1,P			93					
151896	Blank Recovery			<0.1	<5				
	METHODS		SOIL	5530C	WSL 023 A				
			WATER						

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

TOTAL PETROLEUM HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			C 6 - C 9	>C 9 - C 14	>C 14 - C 28	>C 28 - C 36				
	DESCRIPTION	LOCATION	DEPTH								
99005	FLP1,0.1,P			<20	<20	<50	<50				
99006	FLP3,0.1,P			<20	<20	<50	<50				
99007	FLP4,0.1,P			<20	<20	<50	<50				
99008	FLP5,0.1,P			<20	<20	53	<50				
99009	FLP6,0.1,P			<20	<20	<50	<50				
99010	FLP7,0.1,P			<20	<20	<50	<50				
99011	FLP8,0.1,P			<20	<20	<50	<50				
99012	FLP9,0.1,P			<20	26	170	<50				
99013	FLP10,0.1,P			<20	<20	<50	<50				
99014	FLP11,0.1,P			<20	<20	<50	<50				
99015	FLP12,0.1,P			<20	70	400	<50				
99016	FLP13,0.1,P			<20	<20	110	<50				
99017	FLP14,0.1,P			<20	<20	460	230				
99018	FLP15,0.1,P			<20	<20	<50	<50				
99019	FLP16,0.1,P			<20	<20	<50	<50				
99020	FLP17,0.1,P			<20	<20	<50	<50				
99021	FLP18,0.1,P			<20	<20	<50	<50				
99022	FLP19,0.1,P			<20	<20	<50	<50				
99023	FLP20,0.1,P			<20	<20	<50	<50				
99024	FLP21,0.1,P			<20	<20	<50	<50				
	METHODS		SOIL	WSL 030	WSL 030	WSL 030	WSL 030				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

TOTAL PETROLEUM HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			C 6 - C 9	>C 9 - C 14	>C 14 - C 28	>C 28 - C 36				
	DESCRIPTION	LOCATION	DEPTH								
99025	FLP22,0.1,P			<20	<20	<50	<50				
99026	FLP23,0.1,P			<20	<20	320	<50				
99027	FLP24,0.1,P			<20	<20	88	<50				
99028	FLP25,0.1,P			<20	<20	<50	<50				
99029	FLP26,0.1,P			<20	<20	<50	<50				
99030	FLP27,0.1,P			<20	<20	<50	<50				
99031	FLP28,0.1,P			<20	<20	<50	<50				
99032	FLP29,0.1,P			<20	<20	<50	<50				
99033	FLP30,0.1,P			<20	<20	<50	<50				
99034	FLP31,0.1,P			<20	<20	<50	<50				
99035	FLP32,0.1,P			<20	<20	65	<50				
99036	FLP33,0.1,P			<20	<20	370	120				
99037	FLP34,0.1,P			<20	<20	<50	<50				
99038	FLP35,0.1,P			<20	31	1200	220				
99039	FLP36,0.1,P			<20	<20	<50	<50				
99040	FLP37,0.1,P			<20	<20	<50	<50				
99041	FLP38,0.1,P			<20	<20	<50	<50				
99042	FLP40,0.1,P			<20	350	2000	<50				
99043	FTP1,0.1,P			<20	<20	130	110				
99044	FTP2,0.1,P			<20	<20	120	130				
	METHODS		SOIL	WSL 030	WSL 030	WSL 030	WSL 030				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

TOTAL PETROLEUM HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			C 6 - C 9	>C 9 - C 14	>C 14 - C 28	>C 28 - C 36				
	DESCRIPTION	LOCATION	DEPTH								
99045	FTP4,0.1,P			<20	<20	290	390				
99046	FTP6,0.1,P			<20	<20	260	280				
99047	FTP7,0.1,P			<20	<20	<50	<50				
99048	FTP8,0.1,P			<20	<20	<50	<50				
99049	FTP9,0.1,P			<20	<20	79	93				
99050	FTP10,0.1,P			<20	<20	<50	<50				
99051	FTP11,0.1,P			<20	<20	<50	<50				
99052	FTP12,0.1,P			<20	<20	<50	<50				
99053	FTP13,0.1,P			<20	<20	<50	<50				
99054	FTP14,0.1,P			<20	<20	310	760				
	METHODS		SOIL	WSL 030	WSL 030	WSL 030	WSL 030				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

QUALITY CONTROL DATA - TOTAL PETROLEUM HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			C 6 - C 9	>C 9 - C 14	>C 14 - C 28	>C 28 - C 36				
	DESCRIPTION	LOCATION	DEPTH								
	Duplicate										
99017 D				<20	<20	390	200				
99027 D				<20	<20	85	<50				
99038 D				<20	25	1100	180				
99046 D				<20	<20	290	310				
	Spike	(%) Recovery									
99018 S				91 (Total)							
99031 S				83 (Total)							
99054 S				98 (Total)							
	Spike Duplicate	(%) Recovery									
99018 S				91 (Total)							
99031 S				85 (Total)							
99054 S				112 (Total)							
	Blank Recovery			<20	<20	<50	<50				
	METHODS		SOIL	WSL 030	WSL 030	WSL 030	WSL 030				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

MONOCYCLIC AROMATIC HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Benzene	Toluene	Ethyl Benzene	Xylenes				
	DESCRIPTION	LOCATION	DEPTH								
99005	FLP1,0.1,P			<0.5	<0.5	<0.5	<0.5				
99006	FLP3,0.1,P			<0.5	<0.5	<0.5	<0.5				
99007	FLP4,0.1,P			<0.5	<0.5	<0.5	<0.5				
99008	FLP5,0.1,P			<0.5	<0.5	<0.5	<0.5				
99009	FLP6,0.1,P			<0.5	<0.5	<0.5	<0.5				
99010	FLP7,0.1,P			<0.5	<0.5	<0.5	<0.5				
99011	FLP8,0.1,P			<0.5	<0.5	<0.5	<0.5				
99012	FLP9,0.1,P			<0.5	<0.5	<0.5	<0.5				
99013	FLP10,0.1,P			<0.5	<0.5	<0.5	<0.5				
99014	FLP11,0.1,P			<0.5	<0.5	<0.5	<0.5				
99015	FLP12,0.1,P			<0.5	<0.5	<0.5	<0.5				
99016	FLP13,0.1,P			<0.5	<0.5	<0.5	<0.5				
99017	FLP14,0.1,P			<0.5	<0.5	<0.5	<0.5				
99018	FLP15,0.1,P			<0.5	<0.5	<0.5	<0.5				
99019	FLP16,0.1,P			<0.5	<0.5	<0.5	<0.5				
99020	FLP17,0.1,P			<0.5	<0.5	<0.5	<0.5				
99021	FLP18,0.1,P			<0.5	<0.5	<0.5	<0.5				
99022	FLP19,0.1,P			<0.5	<0.5	<0.5	<0.5				
99023	FLP20,0.1,P			<0.5	<0.5	<0.5	<0.5				
99024	FLP21,0.1,P			<0.5	<0.5	<0.5	<0.5				
	METHODS		SOIL	WSL 3810B	WSL 3810B	WSL 3810B	WSL 3810B				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

MONOCYCLIC AROMATIC HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Benzene	Toluene	Ethyl Benzene	Xylenes				
	DESCRIPTION	LOCATION	DEPTH								
99025	FLP22,0.1,P			<0.5	<0.5	<0.5	<0.5				
99026	FLP23,0.1,P			<0.5	<0.5	<0.5	<0.5				
99027	FLP24,0.1,P			<0.5	1.5	0.8	4.2				
99028	FLP25,0.1,P			<0.5	<0.5	<0.5	<0.5				
99029	FLP26,0.1,P			<0.5	<0.5	<0.5	<0.5				
99030	FLP27,0.1,P			<0.5	<0.5	<0.5	<0.5				
99031	FLP28,0.1,P			<0.5	<0.5	<0.5	<0.5				
99032	FLP29,0.1,P			<0.5	<0.5	<0.5	<0.5				
99033	FLP30,0.1,P			<0.5	<0.5	<0.5	<0.5				
99034	FLP31,0.1,P			<0.5	<0.5	<0.5	<0.5				
99035	FLP32,0.1,P			<0.5	<0.5	<0.5	<0.5				
99036	FLP33,0.1,P			<0.5	<0.5	<0.5	<0.5				
99037	FLP34,0.1,P			<0.5	<0.5	<0.5	<0.5				
99038	FLP35,0.1,P			<0.5	<0.5	<0.5	<0.5				
99039	FLP36,0.1,P			<0.5	<0.5	<0.5	<0.5				
99040	FLP37,0.1,P			<0.5	<0.5	<0.5	<0.5				
99041	FLP38,0.1,P			<0.5	<0.5	<0.5	<0.5				
99042	FLP40,0.1,P			<0.5	<0.5	<0.5	<0.5				
99043	FTP1,0.1,P			<0.5	<0.5	<0.5	<0.5				
99044	FTP2,0.1,P			<0.5	<0.5	<0.5	<0.5				
	METHODS		SOIL	WSL 3810B	WSL 3810B	WSL 3810B	WSL 3810B				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

MONOCYCLIC AROMATIC HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Benzene	Toluene	Ethyl Benzene	Xylenes				
	DESCRIPTION	LOCATION	DEPTH								
99045	FTP4,0.1,P			<0.5	<0.5	<0.5	<0.5				
99046	FTP6,0.1,P			<0.5	<0.5	<0.5	<0.5				
99047	FTP7,0.1,P			<0.5	<0.5	<0.5	<0.5				
99048	FTP8,0.1,P			<0.5	<0.5	<0.5	<0.5				
99049	FTP9,0.1,P			<0.5	<0.5	<0.5	<0.5				
99050	FTP10,0.1,P			<0.5	<0.5	<0.5	<0.5				
99051	FTP11,0.1,P			<0.5	<0.5	<0.5	<0.5				
99052	FTP12,0.1,P			<0.5	<0.5	<0.5	<0.5				
99053	FTP13,0.1,P			<0.5	<0.5	<0.5	<0.5				
99054	FTP14,0.1,P			<0.5	<0.5	<0.5	<0.5				
	METHODS		SOIL	WSL 3810B	WSL 3810B	WSL 3810B	WSL 3810B				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

QUALITY CONTROL DATA - MONOCYCLIC AROMATIC HYDROCARBONS - SOIL

REPORT NO	37612
Received:	27/01/98

LAB NO	SAMPLE DETAILS			Benzene	Toluene	Ethyl Benzene	Xylenes				
	DESCRIPTION	LOCATION	DEPTH								
	Duplicate										
99026 D	FLP23,0.1,P			<0.5	<0.5	<0.5	<0.5				
99027 D	FLP24,0.1,P			<0.5	0.7	0.6	3.4				
99051 D	FTP11,0.1,P			<0.5	<0.5	<0.5	<0.5				
	Blank Recovery			<0.5	<0.5	<0.5	<0.5				
	METHODS		SOIL	WSL 3810B	WSL 3810B	WSL 3810B	WSL 3810B				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants

Enviroscience

BL:tp:13052

17 March 1998

Coffey Partners International Pty Ltd
P.O. BOX 40
KEW VIC 3101
Attention: Mr. M. Probert

RE: SOIL ANALYSES
Job No: E3523/3

Certificate of Analysis

WSL Report No. 38578 - Chemical Analyses

Date Sampled 05/03/98
Received by WSL Consultants on 06/03/98
Instructions were received on 06/03/98
Analyses were commenced on 06/03/98

Soil samples were tested in accordance with the analytical methods described in "Chemical Analysis of Polluted Soils" VIC EPA, Publication 139, Nov. 1981 and WSL in-house methods, with the results expressed as **mg/kg dry weight unless stated otherwise.**

Water samples were tested in accordance with the analytical methods described in "Standard Methods for the Examination of Water & Waste Water", APHA 19th Edn. 1995 and WSL in-house methods, with the results expressed as **mg/Litre unless stated otherwise.**

Results pertain to samples as received.

Details of this Test Report were faxed as a preliminary report on 16 & 17 March 1998.

Yours faithfully
WSL CONSULTANTS PTY LTD

B.J LYONS
PRINCIPAL CHEMIST

NATA CFA.3342.0015.011.0065

This Laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of registration. This document shall not be reproduced except in full.

WSL Consultants Pty. Ltd. A.C.N. 004 752 676
2-8 Harvey Street, Richmond, Victoria 3121, Australia
Telephone: +61 3 9429 4666 Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

A NATA Accredited Laboratory
An Approved Quarantine Premises
An Approved EPA Auditor & Analyst

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

PHENOLS & LEAD - SOIL

REPORT NO	38578
Received:	06/03/98

LAB NO	SAMPLE DETAILS			Phenols	Lead						
	DESCRIPTION	LOCATION	DEPTH								
05256	FLP 41,0.1,P			<0.1	14						
05257	FLP 42,0.1,P			0.1	14						
05258	FLP 43,0.1,P			<0.1	13						
05259	FLP 44,0.1,P			<0.1	19						
05260	FLP 45,0.1,P			<0.1	12						
05261	FLP 46,0.1,P			<0.1	15						
05262	FLP 47,0.1,P			<0.1	16						
05263	FLP 48,0.1,P			<0.1	14						
05264	FLP 49,0.1,P			<0.1	12						
05265	FLP 50,0.1,P			<0.1	12						
05266	FLP 51,0.1,P			<0.1	32						
05267	FLP 52,0.1,P			<0.1	27						
05268	FLT 16,0.1,P			<0.1	12						
05269	FLT 17,0.1,P			<0.1	13						
05270	FLT 18,0.1,P			<0.1	12						
05271	FLT 19,0.1,P			<0.1	14						
05272	FLT 20,0.1,P			<0.1	22						
05273	FLT 21,0.1,P			<0.1	16						
	METHODS		SOIL	5530C	WSL 023 A						
			WATER								

CFA.3342.0015.011.0066

Soil results expressed as mg/kg dry weight unless stated otherwise.

RECYCLED

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: COFFEY PARTNERS INTERNATIONAL PTY LTD
RE: SOIL ANALYSES
JOB NO: E3523/3

QUALITY CONTROL DATA - PHENOLS & LEAD - SOIL

REPORT NO	38578
Received:	06/03/98

LAB NO	SAMPLE DETAILS			Phenols	Lead						
	DESCRIPTION	LOCATION	DEPTH								
	Duplicate										
05256 D	FLP 41,0.1,P				14						
05261 D	FLP 46,0.1,P				17						
05272 D	FTP 20,0.1,P				23						
05259 D	FPL 44,0.1,P			<0.1							
	Blank Recovery			<0.1	<5						
	METHODS		SOIL	5530C	WSL 023 A						
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

CFA.3342.0015.011.0067

RECYCLED

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

TOTAL PETROLEUM HYDROCARBONS - SOIL

REPORT NO	38578
Received:	06/03/98

LAB NO	SAMPLE DETAILS			C 6 - C 9	>C 9 - C 14	>C 14 - C 28	>C 28 - C 36				
	DESCRIPTION	LOCATION	DEPTH								
05256	FLP 41,0.1,P			<20	<20	<50	<50				
05257	FLP 42,0.1,P			<20	<20	<50	<50				
05258	FLP 43,0.1,P			<20	<20	<50	<50				
05259	FLP 44,0.1,P			<20	<20	<50	<50				
05260	FLP 45,0.1,P			<20	<20	<50	<50				
05261	FLP 46,0.1,P			<20	<20	<50	<50				
05262	FLP 47,0.1,P			<20	<20	<50	<50				
05263	FLP 48,0.1,P			<20	<20	<50	<50				
05264	FLP 49,0.1,P			<20	<20	<50	<50				
05265	FLP 50,0.1,P			<20	<20	<50	<50				
05266	FLP 51,0.1,P			<20	<20	<50	<50				
05267	FLP 52,0.1,P			<20	<20	<50	<50				
05268	FTP 16,0.1,P			<20	<20	<50	<50				
05269	FTP 17,0.1,P			<20	<20	200	190				
05270	FTP 18,0.1,P			<20	<20	<50	<50				
05271	FTP 19,0.1,P			<20	<20	<50	<50				
05272	FTP 20,0.1,P			<20	<20	<50	<50				
05273	FTP 21,0.1,P			<20	<20	<50	<50				
	METHODS		SOIL	WSL 030	WSL 030	WSL 030	WSL 030				
			WATER								

CFA.3342.0015.011.0068

Soil results expressed as mg/kg dry weight unless stated otherwise.

RECYCLED

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

QUALITY CONTROL DATA - TOTAL PETROLEUM HYDROCARBONS - SOIL

REPORT NO	38578
Received:	06/03/98

LAB NO	SAMPLE DETAILS			C 6 - C 9	>C 9 - C 14	>C 14 - C 28	>C 28 - C 36				
	DESCRIPTION	LOCATION	DEPTH								
	Duplicate										
05260 D	FLP 45,0.1,P			<20	<20	<50	<50				
05270 D	FTP 18,0.1,P			<20	<20	<50	<50				
	Spike	(%) Recovery									
05263 S	FLP 48,0.1,P			94 (Total)							
05273 S	FTP 21,0.1,P			95 (Total)							
	Blank Recovery			<20	<20	<50	<50				
	METHODS		SOIL	WSL 030	WSL 030	WSL 030	WSL 030				
			WATER								

Soil results expressed as mg/kg dry weight unless stated otherwise.

WSLConsultants
Enviroscience
ACN 004 752 676
2-8 Harvey Street,
Richmond, Victoria 3121
Telephone: +61 3 9429 4666
Facsimile: +61 3 9429 2294
Email: wslcon@ozemail.com.au

CLIENT: **COFFEY PARTNERS INTERNATIONAL PTY LTD**
RE: **SOIL ANALYSES**
JOB NO: **E3523/3**

MONOCYCLIC AROMATIC HYDROCARBONS - SOIL

REPORT NO	38578
Received:	06/03/98

LAB NO	SAMPLE DETAILS			Benzene	Toluene	Ethyl Benzene	Xylenes				
	DESCRIPTION	LOCATION	DEPTH								
05256	FLP 41,0.1,P			<0.5	<0.5	<0.5	<0.5				
05257	FLP 42,0.1,P			<0.5	<0.5	<0.5	<0.5				
05258	FLP 43,0.1,P			<0.5	<0.5	<0.5	<0.5				
05259	FLP 44,0.1,P			<0.5	<0.5	<0.5	<0.5				
05260	FLP 45,0.1,P			<0.5	<0.5	<0.5	<0.5				
05261	FLP 46,0.1,P			<0.5	<0.5	<0.5	<0.5				
05262	FLP 47,0.1,P			<0.5	<0.5	<0.5	<0.5				
05263	FLP 48,0.1,P			<0.5	<0.5	<0.5	<0.5				
05264	FLP 49,0.1,P			<0.5	<0.5	<0.5	<0.5				
05265	FLP 50,0.1,P			<0.5	<0.5	<0.5	<0.5				
05266	FLP 51,0.1,P			<0.5	<0.5	<0.5	<0.5				
05267	FLP 52,0.1,P			<0.5	<0.5	<0.5	<0.5				
05268	FTP 16,0.1,P			<0.5	<0.5	<0.5	<0.5				
05269	FTP 17,0.1,P			<0.5	<0.5	<0.5	<0.5				
05270	FTP 18,0.1,P			<0.5	<0.5	<0.5	<0.5				
05271	FTP 19,0.1,P			<0.5	<0.5	<0.5	<0.5				
05272	FTP 20,0.1,P			<0.5	<0.5	<0.5	<0.5				
05273	FTP 21,0.1,P			<0.5	<0.5	<0.5	<0.5				
	QC Data										
	Blank Recovery			<0.5	<0.5	<0.5	<0.5				
	METHODS		SOIL	WSL 3810B	WSL 3810B	WSL 3810B	WSL 3810B				
			WATER								

CFA.3342.0015.011.0070

Soil results expressed as mg/kg dry weight unless stated otherwise.

RECYCLED

Country Fire Authority

DRAFT

Fiskville Training Centre

Report on
Upgrade of Flammable Liquids Training Pad

May 1998

GHD

Gutteridge Haskins & Davey Pty Ltd

CONSULTING ENGINEERS • ENVIRONMENTAL SCIENTISTS & PLANNERS • PROJECT MANAGERS

A.C.N. 008 488 373

Country Fire Authority

Fiskville Training Centre

DRAFT

Report on
Upgrade of Flammable Liquids Training Pad

May 1998

GUTTERIDGE HASKINS & DAVEY PTY LTD
Consulting Engineers, Environmental Scientists & Planners, Project Managers
A.C.N. 008 488 373

TABLE OF CONTENTS

APPENDICES

1. Introduction

GHD was commissioned by the Country Fire Authority (CFA) to prepare a functional design for an upgrade of the Flammable Liquids Training Pad (FLTP) at Fiskville, including supply systems for flammable liquids and gases, and a system for collection and treatment of pad runoff.

Fiskville Training College is the major training facility operated by the CFA, and runs hot fire training courses for CFA career and volunteer fire fighters, and for external clients.

The purpose of the FLTP and the Extinguisher Training Pad (ETP) is to provide realistic simulations of a range of real-life fire situations for trainees to learn and practice methods of fire attack and suppression.

It is essential that each simulation be controllable and repeatable.

The FLTP comprises specially designed pads on which a range of props are mounted and set alight to simulate real life fire situations. Trainees under instruction are then required to attack and put out the fires.

The original FLTP had reached the end of its useful life and was sitting on a depth of soil contaminated by years of exposure to flammable liquids and fire retardent foam. The contaminated soil was removed and at the time of this report was undergoing rehabilitation.

This report has been prepared to set out options and provide recommendations on:

- the most appropriate arrangement and construction of a new FLTP and adjacent ETP; and
- the most appropriate collection and treatment system for the pad runoff.

2. Statutory and Policy Requirements

The CFA has resolved that the works involved in this project are to comply with all relevant Commonwealth, State and Local Government regulations.

Occupational Health & Safety (OH&S) regulations also apply to the working environment for CFA staff and trainees using the FLTP.

The Office of Gas Safety oversees regulations affecting the proposed LPG systems for the FLTP, but the CFA has requested a partial exemption from the regulations for the "unusual" gas fittings and installation conditions at individual props on the FLTP.

The requirements of the Environment Protection Authority (EPA) will apply to the possible discharge of water to watercourses and groundwater.

To meet the EPA requirements the works will be designed to include:

- either surface treatments or a subsurface layer to prevent seepage from the FLTP reaching groundwater; and
- a treatment system to bring the runoff from the FLTP to comply with the quality requirements of the State Environment Protection Policy - Waters of Victoria.

3. Existing Site

3.1 Site Layout

The layout of the existing training facilities at the Fiskville site is shown on Figure 3.1.

The original FLTP area is shown immediately north of Pyrose Parade and comprised an area of approximately 70 metres x 70 metres.

Water supply to the FLTP is via a ring main pressured by the main pumps in the Main Pump House north of the FLTP, and by a safety line pumped from the dams.

FLTP runoff runs through an interceptor pit at the south east corner of the FLTP, and then into Dam No. 1. This dam also takes runoff from the two LPG pads, and from other roads and surface areas north of Tower Road.

Dam No. 1 has an overflow into Dam No. 2 via a 300 mm diameter pipeline under Tower Road. Dam No. 2 also takes runoff from the pads on Jolimont Road and Merino Street and the multi-storey fire training site on Tower Road. A new pump on the University Road side of Dam No. 2 pressurises the safety line with water from Dam No. 2.

A valved outlet from Dam No. 2 allows discharge to Dam No. 3 via open channel flow. Dam No. 3 is located approximately 500 metres west of Dam No. 2. In periods of heavy rainfall Dam No. 3 has a runoff to a creek which in turn flows into one of the water supply catchments for Barwon Water.

Lake Fiskville

Diesel and petrol (unleaded) for use on the FLTP are stored in tanks on Compound Road, while the LPG storage comprises 3 No. Bullets in Jolimont Road adjacent to the LPG Pads.

3.2 Soil and Water Quality

In 1996 Coffey Partners International Pty Ltd was commissioned by the CFA to install a number of groundwater monitoring bores, and undertake a program of sediment and surface water sampling.

Coffey Partners October 1996 Report (Ref E3523/1-AK) concluded that there was a general absence of significant groundwater resources on the site, and that where groundwater was encountered it appeared to be of limited extent with water bearing zones of low permeabilty.

The single bore which did encounter groundwater showed no signs of hydrocarbon contamination, and the heavy metals which were encountered were considered to be commensurate with likely background conditions.

The generalised subsurface profile comprises 0.8 - 2.0 metres of silty clay over 14.0 - 18.0 metres of generally dense, unjointed basalt.

Coffey Partners concluded that given the nature of the residual clays contaminant migration from localised contaminant sources was unlikely unless permeability conditions were enhanced by clay fissuring or man-made features such as trenches.

Coffey Partners Sediment and Surface Water Sampling Report, also October 1996, Reference No. E3523/2-AD, indicated hydrocarbon contamination in Dam No. 1 and Dam No. 2. However, test results indicated that by the time any water reaches Dam No. 3 (Lake Fiskville) hydrocarbon contaminants are below laboratory detection limits. Heavy metal concentrations are typical of normal "background" conditions in the area.

Sediment samples collected from Dam No. 2 contained TPH compounds at detectable concentrations. While samples were not collected from Dam No. 1, Coffey Partners expected that more extensive lake sediment contamination would be found in Dam No. 1.

A program of sampling and testing by Central Highlands Water Laboratory Services over the period May 1996 - December 1997 yielded the following results for water in Dams Nos. 1, 2 and 3.

Table 3.1: Summary of Water Quality Test Results

Parameter (in mg/L unless stated otherwise)	Range		
	Dam No. 1	Dam No. 2	Dam No. 3
Ammonia (as N)	Not tested	Not tested	≤ 0.1
BOD_5	10-40	5-10	5-15
Oil and Grease	<5 - 10	<5 - 10	Not tested
Organic Nitrogen (as N)	Not tested	Not tested	2.7 - 4.3
Total Phosphate (as P)	Not tested	Not tested	0.13 - 0.31
Suspended Solids	9 - 66	19 - 50	14 - 53
Total Oxidised Nitrogen (as N)	Not tested	Not tested	< 0.01 - 0.04
E coli (orgs/100 mL)	Not tested	Not tested	12 - 500

3.2 Previous Flammable Liquids Training Pad

The previous FLTP comprised a mainly crushed rock operating surface over a depth of fill placed originally to raise the pad level. Raising the level was necessary to provide fall to the runoff storage dams.

Years of training sessions had led to contamination of the underlying fill by petrol, diesel and other fuels used in the simulations, and by chemical foams used by the trainees for fire suppression. To deal with the contamination the FLTP was taken out of service, and the contaminated soil was excavated and placed in stockpiles elsewhere on the site for remediation.

At the time of this report the soil had been partly treated by the addition of mulch to promote bacterial action, and was due for a further addition of mulch to continue the remediation. It was expected that the soil would not be available for reuse until around April, 1999.

In any event, the addition of mulch had made the soil unsuitable for reuse as fill material under the reconstructed pad.

A number of concrete structures on the original pad were to be retained, including valve pits. Large concrete footings for a radio mast (associated with the previous use of the Fiskville site) were also in the original pad. They had been left in the pad because they were too deep to remove without considerable effort and cost.

A section of 100 mm diameter DICL ring main passed under part of the original pad, together with a second underground main to a fire plug near the middle of the pad. It is proposed that the section of ring main be relaid around the outside of the new pad, but that the second main to the fire plug be retained.

4. New Flammable Liquids Training Pad

4.1 Flammable Liquids to be Used

Fire fuels to be used on the new FLTP include diesel, petrol (unleaded), and LPG (liquid) LPG (Gas) will be used for the standing pilot flames.

To minimise costs to the CFA it is intended that LPG will provide the major proportion of all fuel burnt. This will be done by using LPG as the initial fuel to set the prop alight, and continuing to burn LPG until the trainees in the exercise have sufficiently organised themselves to commence an approach to the fire. At that time, either diesel or petrol will be added to the prop to be burnt as the fire to be put out by the trainees.

4.2 Retardent Foams to be Used

The main retardent foam to be used on the FLTP is "B" class foam which is primarily used for "B" class (flammable liquids) fires:

The occasional use of Aqueous Film Forming Foam (AFFF) may occur. No allowance has been made for the use of alcohol based foams (ATC).

Technical data on the "B" class foams indicates that each contains a mixture of water and surfectants, and varying amounts of chemicals and detergents. Data sheets for these foaming agents are enclosed in Appendix A.

Technical data from 3M on AFFF states that the major components of 3M AFFF usage wastes are water (99%), a biodegradable solvent (< 1%), and a mixture of biodegradable and partially biodegradable surfactants (< 0.3%). The recommended method of disposal is to a biological wastewater treatment system.

The data also suggests that foaming can be avoided in the aeration section of the treatment plant by either limiting the concentration of the foam entering the aeration section, or by adding an antifoaming agent to the waste stream.

4.3 Proposed Pad Arrangement

The upgraded pad is proposed to include nine sites for props on an area 70 metres x 80 metres.

In each bunded area a prop will be set up with supply lines for flammable liquids and/or LPG, together with water for site base cooling and for prop cooling..

Requirements for each of the nine sites are set out at the end of this section.

The proposed layout for the FLTP incorporating the nine sites is shown on Drawing No. 5485-09-01 in Appendix B. The difference between each layout is in the provisions for fire vehicle access. For each layout, however, access onto the FLTP has been limited to the same four points, two each at the east and west ends. This limitation is to meet CFA requirements relating to pedestrian safety around the Training Centre.

The Fuel Filling Gantry site incorporates a section of railway track and a tanker rail car. It is proposed that the rail car be removable by crane. To facilitate this the site has been located at the south west corner of the FLTP, so that the crane can extract the rail car without needing to drive onto the FLTP.

The fuel control booth has been located at the edge of the FLTP between the two western vehicle entrances as requested by CFA staff.

It is proposed that the existing concrete footings for the old radio mast will be demolished down to a level at least 500 mm below the finished surface of the FLTP.

Table 4.1: Prop Sites Requirements

Site No.	Site Name	Bund Dimensions (m)			No. of Burners		
		Length	Width	Depth	LPG	Petrol	Diesel
1.	Drum Rack	17	14	Varies	1	1	1
2.	Tanker	23	4	Varies	2	2	2
3.	Fuel Filling Gantry	11	12.4	Varies	2	2	2
4.	Low Flash Point Pit	11	14	0.3	1	1	1
5.	Vertical Tanks	21	9.4	0.7	1	-	-
6.	High Flash Point Pit	4	3	0.3	1	1	1
7.	Cracking Tower	15	14	Varies	3	3	3
8.	Bulk Tank	15	14	0.7	1	1	1
9.	Running Drain	30	4	Varies	-	2	2

4.4 Proposed Pad Construction

EPA requirements for the FLTP are that runoff to watercourses be prevented, and seepage to groundwater also be prevented.

Runoff will be controlled by the bunds and drainage systems discussed later.

Each site bund and bunded area floor will be of concrete construction. The concrete will be designed to resist heat from the fires by specifying a relatively high strength concrete with a low water/cement ratio.

Prevention of seepage to groundwater will require an impermeable barrier either at the surface of the FLTP, or below the material which forms the operating surface of the FLTP.

The impermeable barrier will be provided by constructing a concrete pad over the entire training area. This will be designed to carry the loads of vehicles and fire fighting appliances in accordance with the following assumptions:

- maximum axle load of 13.5T for a dual tyre axle
- a design life of 50 years
- maximum of 10 Truck movements per week

In order to control shrinkage cracks the slab will either have to be jointed at regular intervals or be heavily reinforced. While extra reinforcing will increase costs, this may be the better option if a joint sealant that is resistent to petrochemicals cannot be identified.

The need to have sufficient fall for runoff from the FLTP to Dam No. 1 means that it will need to be built with surface levels grading from RL102.10 m at the NW Corner to R101.44 m at the SE Corner. This will require the placement of around 2700 cubic metres of imported material under the FLTP surface. The use of a compacted clay for this imported material would obviate the need for either a proprietary liner, or a concrete surface outside each site.

4.5 Cooling Water

All props will require cooling water sprayed onto the concrete surface to prevent spalling under fire conditions. Final details of this would be finalised during detailed design.

In addition, some steel props such as the gantry will require prop cooling. Prop water will be provided for the high and low flash point pits, bulk tank bund, drain rack and the running drain.

The cooling water is currently drawn from Dam No. 1 via a pump. For the new FLTP and ETP the cooling water would be drawn from the back up supply as this will provide circulation through this system.

Cooling water connections for each prop will take the form of 50mm flanged connections inside the bund wall. Control will be via manual valves located outside the bund. Piping from this flange to the prop will form part of the prop piping.

4.6 Runoff Collection

It is proposed that the High and Low Flash Point Pits will be operated with water in the bunded area during the fire simulation. A water depth of 100 mm - 150 mm is envisaged, with the LPG to be released underwater, burning when it reaches the water surface, and the diesel/petrol to be released on top of the water to burn as required.

For a bunded arrangement, this will require a valved drainage system so that drainage outlet valves can be closed to retain water during the training exercise. The valves will be located outside the bunds.

Each area and outlet will connect to a main spoon drain system leading to a surge pit and new interceptor pit.

Access road drainage and surface runoff from areas outside the bunds will also be directed via surface drains to the surge and interceptor pits.

Design of the interceptor and surge pits will be based on the following flows:

a) peak flow of 60 to 65 L/s, based on 4 No. ∅ 63 hoses operating simultaneously.

b) average flow of 10 L/s over four hours.

The surge pit will have a capacity of 34m3, which is approximately 9 mins of peak flow and one hour at average flow. The pit will be built to enable access by a back hoe or similar to clean out silt and debris that will build up. The surge pit will reduce cleaning and desilting maintenance of the interceptor pit and dam No. 1.

The interceptor pit will be designed to cater for the average flow. It will have three equal compartments, each 2.50 m wide by 2.7 m long x 1.7 m deep. The chambers will each be interconnected by two pipes in parallel which will collect wastewater from the bottom. There will be provision in the design of the pit to enable ?? bale screens to be installed in each chamber.

The pipe system will be ductile iron, with handwheel operated gate valves for each bund outlet.

4.7 Control Booth

The control booth will be located at the western end of the pad and will contain the following:

- electrical distribution board
- emergency stop buttons
- flammable liquid control panels

- pump controls
- pad light switches

Two operator panels will be provided for separate control of flammable liquids to the north and south ends of the pad. This will enable two training exercises to be conducted simultaneously.

Good observation of the entire pad is essential in all conditions. The booth will be elevated and windows fitted with wipers. An extended roof will keep most rain off the glass. Additionally the booth will be lined and insulated and fitted with a heater/air conditioning unit.

The intention is to keep the control booth designation non-hazardous by either totally removing flammable liquids from the room or if manual valves are adopted, by putting the pipework outside the room and providing positive pressurisation to prevent any hazardous vapours entering the booth. Standard electrical equipment, light fittings, radios etc will be adopted in the control booth.

4.8 Area Lighting

A reasonable level of lighting is required over the entire pad area so unrestricted training may occur at night.

The suggested average light intensity used in the design is 100 LUX. This is a typical light intensity used for night football training.

Four poles, each twenty metres high, and located outside the bund wall is recommended to minimise shadows and achieve the desired lighting levels.

Light switches will be located in the control booth. An additional smaller external light with an automatic switch (photo electric cell) will provide lighting around the booth.

4.9 Fire Water Reticulation

Two fire water reticulation system will provide water supply to the FLTP.

The existing reticulation system would be modified to supply 4 above ground hydrants, 2 located at each end of the pad. This supply would provide the "~~safety line~~" supply to the pad.

A new reticulation system would be provided from the No 2 Dam and the existing pumphouse. This water system would supply:

- 4 in ground hydrants, 2 at each end of the pad
- cooling water to the props
- cooling water to the concrete surfaces of the prop surrounds.

Main Piping reticulation would generally be in-ground DICL piping.. Reticulation piping to the pod perimeter would be above ground steel piping with mechanical coupling joints.

Cooling water to the props would be controlled by normal isolating valves outside the prop area and piped to a flange located adjacent to the prop. Piping from this flange to the prop is part of the prop piping.

Cooling water to the concrete surfaces will be controlled by manual isolating valves located outside the prop area and piped to an above ground spray system distributing water to those areas considered to be at risk.

Cooling water to the running drain would consist of 2 systems, one above ground pipe adding water to the running drain. A second supply would be to above ground sprays distributing water below the props.

The layouts and details would be finalised as part of the detail design.

5. New Extinguisher Training Pad

In addition to the upgraded FLTP, and new Extinguisher Training Pad (ETP) is to be established as a separate project west of the FLTP.

The ETP is to be 20 metres x 20 metres located generally west of the FLTP, and is to be enclosed all round with a 2.1 metre high fence incorporating one personnel gate and one vehicle size pair of double gates. The two sets of gates are to be located such that either forms an alternative emergency exit for the other.

Pad runoff and bunds drainage will be collected and transferred to the new interceptor pit at Dam No. 1 via an underground piped drainage system.

The flammable liquid requirements to this training pad have not been considered, awaiting definition of the requirements to this area.

6.0 Flammable Liquids Supply to New Pad

6.1 Description

A schedule of the fuels to be supplied to each prop is given in Table 4.1. As noted in the schedule some props require multiple supplies of each fuel.

In most cases fuel supplies will consist of flanged connections which penetrate the bund wall at each prop. All valves (manual and/or automatic) will be located outside the bund wall. The scope of this report does not include details of the piping or burners at each prop.

The Running Drain will have fixed underground piping.

Pressurised air/gas pilots will be provided at each set of burners. These pilots will be manually controlled by valves located outside the compound perimeter, but accessible from inside the compound (for ease of operation). Swagelok type connections for small bore SS piping will be provided to service each prop.

All main fuel flows with the exception of pilots will be controlled remotely from the Control Booth. Continuous recirculation of the liquid fuels reduces the possibility of heat build up in the distribution systems.

A fail-safe emergency shut down system will be provided to enable isolation of actuated valves at all props and storages, and stop the pumps.

6.2 Existing facilities

Following demolition of the existing FLTP, the following facilities remain.

- 3 LPG bullets complete with supply systems to the existing LPG pad.
- Air compressor/compressed air supply for control valve operation and supply to premixed LPG pilot flames.
- Diesel and unleaded petrol bulk storage tanks complete with delivery lines to a location adjacent to the north west corner of the extinguisher pad.

It is noted that the 2 bulk liquid storage tanks have several installation problems including porous unlined bunds, mid level piping offtakes and absence of automatic block valves.

The compliance of this installation with AS 1940 and good industry practices has not been checked and does not form part of this commission.

We understand the existing underground diesel/ULP lines are 50∅ galvanised steel lines, direct buried with no corrosion protection. We also understand these lines have been damaged with a backhoe. We are not intending to reuse these lines.

6.3 Proposed Works

The development of the FLTP will include the following:

- For each of the 3 fuel storages (LPG, unleaded petrol and diesel)
  - installation of a new pump (3 total)
  - isolation valves, relief valves and pneumatic actuated isolation valve
  - delivery pipework to the pad
  - recirculation pipework (return to tank)
  - flow totalizer (one only per fuel)

- LPG (gas) pipework to pad for pilots
- Compressed air to pad for pneumatic valves and pilots
- Isolation valves, non-return valves and pressure regulators at each pilot for both air and LPG (gas).
- Fuel liquid control system as required for each prop comprising:
  - operator controls in the control booth
  - remote isolation valves
  - rate control valves
  - emergency isolation/shut down system

A second LPG pump is proposed for the FLTP for 2 reasons.

- the existing LPG circulating pump has capacity to support approximately 4 props. With the possibility of both the LPG pads and FLTP pads both operating 4 props simultaneously, it is likely the pump would not support 8 operating props.

- the use of a second pump provides an inherent safety in that each pad has control of its own pump, reducing the likelihood the pump being left operating.

The pumps would be located adjacent to the existing storage facilities to avoid any suction head problems with the pumps. Fire safe isolation valves would be provided at the new tank nozzles.

Also locating the pumps adjacent to the tanks allows these operations to be confined to one area.

The existing air compressor will be used for the control and pilot air supplies. It will be necessary for the FLTP operators to start this compressor locally and turn on air to the FLTP. We have not considered automating this facility.

6.4 Flammable Liquid Control

Following manual lighting of the pilot burners all other control of flammable liquids throughout the pad is conducted at the operator booth. Control includes:

- starting fires
- changing fuels (separate burners)
- rate control

Emergency stop buttons located at the control booth will close all actuated valves and stop all pumps. Pneumatic valves will be fitted with fail closed actuators.

To reduce the cost and complexity of the system, it is proposed to adopt pneumatic control valves where possible. The use of pneumatic has several advantages.

- no requirement for hazardous areas electrics
- the use of HDPE lines are fail safe as any excessive heat application will melt the tube, allowing the fail safe valves to close.
- the HDPE air lines are easily installed and are easily required by site staff if a problem occurs.

The alternate use of metallic air lines was not considered.

Two types of control system are considered:

- Manual flow rate control from within the booth with the valves located adjacent to the control booth and extended spindles entering the control booth.

- Remote flow rate control by use of pneumatic activated control valves located around the perimeter of the FLTP.

1. Manual flow rate adjustment

Liquid flow to each burner is controlled from a manual valve located at the control booth. A remote pneumatic isolation valve provides positive isolation close to the burner.

- Refer to the attached system schematic Appendix D.

Advantages:
- simplified pneumatic control system
- secondary isolation of liquid lines provided

Disadvantages:
- flammable liquids in the vicinity of the control booth
- more complex pipework since an individual pipe is required from the booth to each burner; 38 burners proposed.

2. Remote flow rate adjustment

- Refer to the attached system schematic in Appendix D.

Flammable liquid main headers would be installed around the entire pad with local offtakes adjacent to each burner.

Rate control is provided by an adjustable pneumatic control valve at each burner.

Advantages
- simplified pipework
- flammable liquids are remote from control booth

Piping around the pad will be above ground and located outside the bund wall. Protection is required above the piping from heat and flames. It is proposed to locate valves outside each prop inside covered chambers.

Recommendation

The recommendation is for system 2; remote flow rate adjustment. This system offers the advantages noted above and our initial cost estimate indicates it will be cheaper to install. Refer to Appendix C.

7.0 Runoff Treatment and Recycle

7.1 Runoff Constituents

Runoff from the FLTP and the ETP will generally comprise:

- water
- foam
- flammable liquids: LPG, Unleaded Petrol, Diesel
- suspended solids
- prop debris

The flammable liquids will be present in the runoff both as free liquids and as emulsions with the water.

7.2 Quality Requirements for Reuse

Water quality for reuse in Victoria is governed by the EPA Guidelines for Wastewater Reuse, Publication 464, March 1996.

7.3 Water Treatment

7.3.1 Survey

A brief survey was conducted of wastewater treatment systems at fire service training facilities around Australia.

Fire authority training centres in New South Wales, Queensland, South Australia and Western Australia were contacted by telephone and surveyed about their wastewater treatment systems at their training facilities. The contacts were:

Organisation	Group	Telephone	Contact
NSW State Figure Brigade	Engineearing/Supply	(02) 9742 7499	Graham Robertson (Property Officer)
Queensland Fire & Rescue Authority	Public Safety	(07) 3247 5750	-
South Australian Fire Service	Training Department	(08) 8204 3876	Keith
Fire & Rescue Service, WA	Training Academy	(08) 9454 0777	Barry Moore

In New South Wales and South Australia, state of the art facilities exist. Due to concern about environmental side effects, petrochemical fires are not used in training. Instead, petrochemical fires are simulated by bubbling a mixture of propane and butane gas through water. Such fires "burn clean" as they only produce water and carbon dioxide as combustion products, and do not create an organic residue in the wastewater.

Subsequently, these facilities only use simple, biodegradable training foam in all training exercises. All demonstrations are performed within a graded bunded area. Wastewaters are collected and stored in a dam/drying pan. After a 20 day detention period, the water is discharged to the environment. However, at many facilities, the water has evaporated by this time.

In Queensland, no real training facilities exist at present, although there are plans for the construction of a facility in the future.

In Western Australia, real petrochemical fires are used as part of training. The wastewater system consists of an oil water separator and a holding dam. Oil wastes are periodically removed offsite. Biodegradable aqueous wastes are sent to a holding dam before being discharged. The Western Australian experience is that certain foams clog the filters in the oil separation unit.

The conclusions drawn from the survey are:

1. Training facilities in other states typically use simple systems e.g. d?? basins, to treat the fire fighting wastewater. In many cases, the wastewater would completely evaporate before needing to be discharged

2. None of the facilities surveyed used aerators. We understand that aerating at Fiskville has improved effluent quality and we recommend that this is continued.

3. The use of a training facility similar to that used in New South Wales and South Australia would simplify the process required to treat any wastewater. Complex oil/water separators would not be required, and the separated organic wastes would not have to be stored and transported offsite.

7.3.2 Fiskville

At Fiskville the recommended waterwater treatment system comprises the following:

Interceptor pit	-	new
Dam #1 aerator (...kW)	-	existing
Dam # 2	-	existing

An interceptor pit will be required to remove floating hydrocarbons and debris from the wastewater prior to discharge to Dam # 1.

Dissolved material and emulsions will pass through the interceptor and break down biologically with the assistance of mechanical aeration. The volume of Dam #1 is estimated at 1700 kL. Assuming a peak week averaging 30 000 gallons/day, i.e. 955 kL/week, the detention time would be 10 days, allowing for some short circuiting.

Effluent from Dam # 1 flows to Dam # 2 which has an estimated volume of 6100 kL. This would provide an additional detention time of 36 days under peak week conditions (allowing for some short circuiting).

The total estimated detention time in the system is thus around 46 days. Systems in other states typically operate with a detention time of around 20 days (see Appendix D). It thus appears that the capacity of the existing system would be sufficient. This is supported by anecdotal evidence by CFA staff which suggests that the effluent quality is good (there were no analytical results of the effluent characteristics available for this study).

Discharge of foaming agents to the aerated dam could cause foaming. Dosing of an anti foaming agent may be required. As it is uncertain that an anti-foaming agent will be required (currently foaming is not a problem) we recommend that this is closely monitored.

We suggest that the system as outlined is adopted and that the effluent quality is monitored on say a monthly basis. A review of the effluent quality is then required after say six and twelve months to ascertain the efficacy of the treatment system and make the necessary modifications, if required.

8.0 Methods of Project Delivery

8.1 Design and Tender

In this method the works are designed in detail and documentation prepared inviting tenders for the works. The successful contractor is required to build to the requirements and details provided.

This approach is most suitable where the precise details are clearly known and there is limited scope for modifications to the design.

For this project the design of the civil works for the FLTP and ETP and any works for the dams is an example of work for which the project delivery approach is suited.

8.2 Design and Construct

This approach comprises preparation of a performance-based specification which is much less prescriptive than a detailed design.

It is commonly used where alternative designs could be used to achieve the same performance, and prevents the principal from being locked in to any one design.

For this project the LPG system and any runoff water treatment equipment (such as aerators and chemical dosing) would be better tendered in this way.

8.3 Recommended Methods

It is recommended that for this project "Design and Tender" be used for the civil works, and "Design and Construct" be used for the flammable liquids works and any water treatment equipment other than the separator.

9. Recommendations

It is recommended that the CFA:

1. Adopts this report on the basis for design of the Flammable Liquids Training Pad upgrade.

2. Instructs GHD to proceed with detailed design of the required works.

Appendix A

Retardent Foam Data

3M AUSTRALIA PTY LIMITED
2-74 Dunheved Circuit ST MARYS NSW 2760
Phone: (02) 9833-5405 (Toxicology Department)
Fax: (02) 9833-5170
EMERGENCY PHONE: (02) 9833-5333 (available 24 hours)

MATERIAL SAFETY DATA SHEET

Document ID	: 07-5217-0	Issue date	: 03/09/96
Version	: 1.01	Supersedes date	: 02/09/96
Document status	: Issued		

This MSDS has been prepared by 3M Australia Pty Limited
Toxicology Department

1 IDENTIFICATION

NOTE: Hazardous according to criteria of Worksafe Australia.

PRODUCT NAME
FC-3045 3M BRAND SUPERCONCENTRATED TRAINING FOAM

3M Product ID
AJ-9000-3045-0 0328684 0328696

DIVISION
SPECIALTY CHEMICALS DIVISION

INTENDED USE OF PRODUCT
Fire fighting foam

UN NUMBER	Not applicable.
CORRECT SHIPPING NAME	Not applicable.
HAZCHEM CODE	Not applicable.
DANGEROUS GOODS CLASS	Not applicable.
SUBSIDIARY RISK	Not applicable.
PACKAGING GROUP	Not applicable.
POISONS SCHEDULE	Not applicable.
E.P.G.:	Not applicable.

Data Sheet No: F02-04/N2
Page 1 of 4
Issue/Date: 3/1.6.95
Supersedes: 2/11.12.92

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

MATERIAL SAFETY DATA SHEET

1. PRODUCT INFORMATION

1.1 Product Identification
FP70 PLUS

1.2 Application and Use
Fire Fighting foam concentrate

1.3 Manufacturer/Supplier
Angus Fire Armour (Australia) Pty. Ltd, 1001 Mountain Highway, Boronia, Vic., 3155
(03) 9729 3433

Emergency Telephone Number
for information for supply: Angus Fire (03) 9438 4114 , (03) 9305 6606, or (03) 9560 7463

1.4 Product Description
Hydrolysed protein solution containing fluorosurfactants and glycol solvent.

2. COMPOSITION

Substance	Synonyms	Concentration %	Cas-No.
Hexylene glycol	1,2 Hexanediol 2-Methylpentan -2,4-diol	1 - 10	107-41-5
Sodium chloride		5 - 10	7647-14-5
Zinc oxide		<1	1314-13-2
Bactericide		<2	
Fluorosurfactants		<5	
Balance water			

3. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Liquid	pH at 20°C:	7
Colour:	Dark brown	Boiling Point:	100°C at 760 mm Hg
Odour:	Organic odour	Freeze Point:	-15°C
		Flash Point:	>102°C
		Flammability:	Not flammable
		Solubility:	Miscible with water in all proportions
		Viscosity at 20°C:	30cs
		Specific Gravity:	1.16-1.18

2 PHYSICAL/CHEMICAL PROPERTIES

Appearance and Odour	Light yellow to straw-coloured liquid
Boiling point	100 C
Vapour pressure	ca 17 mmHg Calc. @ 20C
Vapour density	ca 0.89 Air=1 Calc. @ 20C
Evaporation rate	Not applicable
Solubility in Water	Complete
Specific gravity	ca 1.04 Water=1
Volatile organic compounds	262 g/L Calc. @ 20C
pH	7 - 8
Viscosity	20 centistoke @ 20C
Melting point	-8 C
Flash point	None
Flammable Limits - LEL	Not applicable
Flammable Limits - UEL	Not applicable
Autoignition temperature	Not applicable

3 COMPOSITION

Ingredient Name	CAS number	Percentage
WATER	7732-18-5	45 - 52
DIETHYLENE GLYCOL BUTYL ETHER	112-34-5	25
ALKYL SULFATE AMINE SALT +(6074P)	---	10 - 12
SURFACTANTS (2) +(6080P, 6083P)	---	10 - 12
SODIUM ALKYL SULFATE +(6077P)	---	3 - 7
TOLYL TRIAZOLE	29385-43-1	0.1 - 1

4 HEALTH HAZARDS

Effects from Eye Contact
Will cause irritation to the eye.

Effects from Skin Contact
May cause mild skin irritation (more likely after prolonged or repeated contact).

Effects from Inhalation
Single overexposure, above recommended guidelines, may cause: Central Nervous System Depression: signs/symptoms can include headache, dizziness, drowsiness, lack of coordination, slowed reaction time, slurred speech, giddiness and unconsciousness. Irritation to upper respiratory tract.

Effects from Ingestion
Ingestion is unlikely to be a route of exposure. Ingestion may cause: Irritation to the gastrointestinal tract.

5 FIRST AID

EYE CONTACT
In case of contact with eyes, rinse immediately with plenty of water. If irritation persists contact a doctor.

SKIN CONTACT
Wash off with plenty of water. If irritation persists, contact a doctor.

INHALATION
Remove person to fresh air. If in breathing difficulties, call a doctor.

SWALLOWED
If swallowed, give two glasses of water and contact a doctor or Poisons Information Centre immediately.

6 FIRE FIGHTING MEASURES

SUITABLE EXTINGUISHING MEDIA
Product is a fire-extinguishing agent.

FIRE FIGHTING MEASURES (Continued)

FIRE FIGHTING PROCEDURES
Wear full protective clothing, including helmet, self-contained, positive pressure or positive pressure demand self-contained breathing apparatus, tunic and pants, bands around arms, waist and legs, full facepiece, and protective covering for exposed areas of the head.

UNUSUAL FIRE AND EXPLOSION HAZARDS
None known.

Special Instructions for Fire Fighting
None known

7 ACCIDENTAL RELEASE MEASURES (SPILL)

Personal Precautions
Observe precautions from other sections of this Material Safety Data Sheet.

Spill Response
Ventilate area. Contain spill. Cover with absorbent material. Collect spilled material. Clean up residue with water. Place in a closed container. For information on the 3M range of Sorbent materials, call 3M OH&ES on Freecall 1800 024-464.

Methods for Disposal
Discharge spent solutions and small quantities (20L) to a wastewater treatment system. Reduce discharge rate if foaming occurs. Large quantities may adversely affect biological wastewater treatment systems. Incinerate large quantities in an industrial or commercial incinerator. Combustion products will include HCl.

8 HANDLING AND STORAGE

Storage Requirements
Store at temperatures below 50 degrees C. Store at temperatures above 0 C. Keep container closed when not in use. Store out of direct sunlight.

Recommended Ventilation
Keep container in well-ventilated area.

HANDLING AND STORAGE (Continued)

Use Instructions
Keep container tightly closed.

9 EXPOSURE CONTROLS/PROTECTION

Eye Protection
Avoid eye contact with vapour, spray, or mist. Wear full-face shield.

Hand Protection
Wear appropriate gloves when handling this material. Gloves made from one of the following material(s) are recommended: butyl rubber.

Skin Protection
Avoid skin contact.

Respiratory Protection
Avoid breathing of vapours, mists or spray. Select and use respirators in accordance with AS/NZS 1715.
When required, use one of the following:
Half-mask organic vapour respirator with organic vapour (Type A) and particle filter (Type P). Full-face organic vapour respirator with dust/mist filter. For information about respirators, call 3M on 1800 024064.

Prevention of Accidental Ingestion
Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water.

Recommended Ventilation
Use with adequate dilution ventilation.

10 EXPOSURE STANDARDS

COMMENT: No Worksafe exposure standards have been set for any of the ingredients of this product.

11 STABILITY AND REACTIVITY

STABILITY AND REACTIVITY
Stable. Hazardous polymerisation will not occur.

INCOMPATIBILITY-MATERIALS TO AVOID
Not applicable

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon Monoxide, Carbon Dioxide, Oxides of Nitrogen, Irritant Vapours or Gases. Oxides of Sulfur Hydrogen Chloride Amine Compounds,

12 ECOTOXICITY

ENVIRONMENTAL DATA
Not determined

Other Ecotoxicity Information
Chemical Oxygen Demand (COD): 0.419g/g; 5-Day Biochemical Oxygen Demand (BOD5): 0.140g/g; 10-Day Biochemical Oxygen Demand (BOD10 0.240g/g; 20-Day Biochemical Oxygen Demand (BOD20): 0.330g/g; 48-Hr EC50, Daphnia magna: 22mg/L; 96-Hr LC50, Fathead minnor (Pimephales promelas): 23mg/L; 30-min EC50, Photobacterium phosphoreum (Microtox System): 15mg/L; 3-Hr IC50, Activiated Sludge respiration (OECD Method 209): >1000mg/L.

13 DISPOSAL CONSIDERATIONS

Special Instructions for Disposal
Contact your local waste authority to determine suitable disposa methods.

14 REGULATORY INFORMATION

Product Certifications
AICS - Yes; components checked

15 OTHER INFORMATION

The information on this data sheet represents our current data and best opinion as to the proper use in handling of this product under normal conditions. Any use of the product which is not in conformance with this data sheet, which involves using the product,or otherwise than in accordance with instructions of use on product packaging is the responsibility of the user.

If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact the Regulatory Compliance Chemist on (02) 9833-5401.

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

4. HAZARD INFORMATION

4.1 Health Hazard Information

Inhalation
Inhalation of hazardous amounts is unlikely when used as intended. Is irritant to respiratory tract when inhaled.

Ingestion
Low oral risk when used as intended. May cause nausea, vomiting and diarrhoea when ingested.

Contact to eyes or skin
Low risk if appropriate precaution measures are taken (see section 6). Can cause skin and eye irritation when contact to eyes or skin.

4.2 Occupational Exposure

Occupational Exposure Limit
Pure Hexylene glycol: Occupational Exposure Standard (OES)
Long term exposure limit (8 hour time weighed average) : 25ppm
Short term exposure limit (10 minutes) : 25ppm

Other Limits
Pure Hexylene glycol: ACGIH : Threshold Limiti Value (TLV)
Ceiling concentration : 25ppm

FP70 PLUS is available for use at 3% dilution.

4.3 Fire and Explosion

General Hazards
FP70 PLUS is not flammable or explosive.

Hazardous Decomposition Products
Do not expose containers to heat or flame, since the containers are made from high density polyethylene and will burn. Thermal decomposition of containers and/or products may generate acrid smoke and fumes and traces of Na_2O,Cl^-,SO_x,No_x,ZnO and HF.

Fire Fighting Measures
Fire Fighting measures are not applicable as FP70 PLUS is a fire extinguishing media. If product containers are involved in fire, then a suitable extinguishing agent should be applied.

4.4 Stability and Reactivity

Generally stable. As with all aqueous solutions FP70 PLUS Should be excluded from contact with any materials which have violent reactions with water.

4.5 Sources of Information

Clayton, G.D. and F.E. Clayton: Patty's Industrial Hygiene and Toxicology. Fourth edition volumes I - III (1991).
Sax, N.I. and R.J. Lewis, Sr: Dangerous Properties of Industrial Materials. Seventh edition volumes I - III (1991).
Health & Safety Executive: Occupational Exposure Limits (EH 40/92).
Note: EH40 is revised on an annual basis and newest issue should be applied.

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

5. FIRST AID MEASURES

5.1 General
First aiders should know and take the precautions appropriate to avoid danger to themselves and the casualty. Take casualty together with material safety data sheet of this product to hospital or doctor, if necessary.

5.2 Inhalation
Remove casualty from exposure. If there is breathing difficulty or cough keep patient at rest seated in position of maximum comfort.

5.3 Ingestion
If ingestion is suspected, do not induce vomiting, send casualty to hospital immediately.

5.4 Contact to eyes
If there is eye contact, wash immediately with plenty of clean, gently flowing water for 10 minutes, then send casualty promptly to a doctor or hospital.

5.5 Contact to skin
If there is skin contact, wash immediately with plenty of clean, gently flowing water.

6. EXPOSURE CONTROL/PERSONAL PROTECTION

6.1 Personal Protective Equipment - Fire Fighting

Angus Fire Foam Concentrates will be used by professional firefighters to control and extinguish flammable liquid fires. The nature of this process may involve exposure to heat, flame and possibly toxic vapours and fumes. It is normal procedure to wear appropriately designed personal protective equipment designed for use in firefighting situations. Angus Fire advises that this form of personal protective equipment should be used if the packaging materials become involved in fire.

6.2 Personal Protective Equipment - Other Handling

Avoid prolonged, extensive or repeated inhalation or contact to eyes and skin.

Hand Protection Wear impervious gloves of an approved type (e.g. neoprene).

Eye Protection Wear safety goggles of an approved type (BS 2092).

7. HANDLING/STORAGE/DISPOSAL

7.1 Handling and Storage
No special handling techniques required. For best results, the product should be stored in sealed, original containers above -15°C and below 40°C. Freezing and thawing do not affect the substance properties but care must be taken to avoid freezing the container and its contents since the expansion of the container contents may cause cracking of a completely rigid container as ice forms.

7.2 Accidental Release
SPILLAGE: The practice of washing spills into drains should be avoided if at all possible and should under no circumstances be allowed without first consulting the local Water Authority and National Rivers Authority. Absorb spillage with absorbent granules and transfer to container.

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

7.3 Disposal

Waste should be disposed via local authority waste collections service or registered waste carrier. Ensure the destination is a licensed facility.

7.4 Transport

Special transport techniques are not required. No classification for supply or carriage by road required.

8. TOXICOLOGICAL INFORMATION

8.1 Aquatoxicity

Rainbow Trout (Oeorhynchus mykiss)
LC_{50} (3hrs) > 10000 ppm
LC_{50} (6hrs) > 10000 ppm
LC_{50} (24hrs) > 10000 ppm
LC_{50} (48hrs) > 10000 ppm
LC_{50} (72hrs) 5400 ppm
LC_{50} (96hrs) 4200 ppm

8.2 Sources of Information

Huntingdon Research Centre: AFA 14(b)/911375

9. ECOLOGICAL INFORMATION

9.1 Biodegradation

Biodegradable

Chemical oxygen demand
COD 0.65 gg^{-1}

9.2 Sources of Information

Huntingdon Research Centre: AFA 15(c)/911451

3M AUSTRALIA PTY LIMITED
2-74 Dunheved Circuit ST MARYS NSW 2760
Phone: (02) 9833-5405 (Toxicology Department)
Fax: (02) 9833-5170
EMERGENCY PHONE: (02) 9833-5333 (available 24 hours)

MATERIAL SAFETY DATA SHEET

Document ID	: 05-8714-7	Issue date	: 19/08/96
Version	: 1.02	Supersedes date	: 13/06/96
Document status	: Issued		

This MSDS has been prepared by 3M Australia Pty Limited
Toxicology Department

1 IDENTIFICATION

NOTE: Not classified as Hazardous according to criteria of Worksafe Australia.

PRODUCT NAME
FC-3150 3M. (TM) FIRE-BRAKE BFFF CONCENTRATE

3M Product ID
AJ-9000-3150-8 XR-1815-5347-4 XR-1815-5348-2 0295337
0299214 0328710

DIVISION
SPECIALTY CHEMICALS DIVISION

INTENDED USE OF PRODUCT
To extinguish bushfires

UN NUMBER	Not applicable.
CORRECT SHIPPING NAME	Not applicable.
HAZCHEM CODE	Not applicable.
DANGEROUS GOODS CLASS	Not applicable.
SUBSIDIARY RISK	Not applicable.
PACKAGING GROUP	Not applicable.
POISONS SCHEDULE	Not applicable.
E.P.G.:	Not applicable.

FC-3150 3M (TM) FIRE-BRAKE BFFF CONCENTRATE

2 PHYSICAL/CHEMICAL PROPERTIES

Appearance and Odour	Clear, light yellow liquid
Boiling point	100 C (Typical)
Vapour pressure	118 mmHg @ 55C
Vapour density	1.0 Air=1
Evaporation rate	Not determined
Solubility in Water	Complete
Specific gravity	ca 1.0 Water=1
Volatile organic compounds	95 g/L (g/L of material)
pH	7 - 9
Viscosity	Not determined
Melting point	Not applicable
Flash point	None
Flammable Limits - LEL	Not applicable
Flammable Limits - UEL	Not applicable
Autoignition temperature	Not applicable

3 COMPOSITION

Ingredient Name	CAS number	Percentage
WATER	7732-18-5	81.0 - 85.0
DIETHYLENE GLYCOL BUTYL ETHER	112-34-5	8.0 - 9.0
ALKYL SULFATE AMINE SALT +(6076P)	---	3.0 - 4.0
SODIUM ALKYL SULFATE +(6079P)	---	1.0 - 2.0
SURFACTANTS +(6082P, 6058P)	---	3.0 - 4.0
TOLYL TRIAZOLE	29385-43-1	< 0.5

4 HEALTH HAZARDS

Effects from Eye Contact
May cause mild eye irritation.

Effects from Skin Contact
May cause mild skin irritation (more likely after prolonged or repeated contact).

Effects from Inhalation
Inhalation may cause: Irritation to upper respiratory tract.

Effects from Ingestion
Ingestion is unlikely to be a route of exposure. Ingestion may cause: Irritation to the gastrointestinal tract.

5 FIRST AID

EYE CONTACT
In case of contact with eyes, rinse immediately with plenty of water. If irritation persists contact a doctor.

SKIN CONTACT
Wash off with plenty of water. If irritation persists, contact a doctor.

INHALATION
Remove person to fresh air. If in breathing difficulties, call a doctor.

SWALLOWED
If swallowed, give two glasses of water and contact a doctor or Poisons Information Centre immediately.

6 FIRE FIGHTING MEASURES

SUITABLE EXTINGUISHING MEDIA
Product is a fire-extinguishing agent.

FIRE FIGHTING PROCEDURES
Not applicable. Product is a fire-extinguishing agent.

FIRE FIGHTING MEASURES (Continued)

UNUSUAL FIRE AND EXPLOSION HAZARDS
None known.

Special Instructions for Fire Fighting
None known

7 ACCIDENTAL RELEASE MEASURES (SPILL)

Personal Precautions
Observe precautions from other sections of this Material Safety Data Sheet.

Spill Response
Ventilate area. Cover with absorbent material. Collect spilled material. Clean up residue with water. Place in a container. Seal the container. For information on the 3M range of Sorbent materials, call 3M OH&ES on Freecall 1800 024-464.

Methods for Disposal
Slowly discharge spent solutions and small quantities (less than 20L) to a wastewater treatment system. Reduce discharge rate if foaming occurs. Incinerate large quantities in an industrial or commercial incinerator. Combustion products will include HCl.

8 HANDLING AND STORAGE

Storage Requirements
Do not store containers on their sides. Store at room temperature. Keep container closed when not in use.

Use Instructions
Keep container tightly closed.

9 EXPOSURE CONTROLS/PROTECTION

Eye Protection
Avoid eye contact with vapour, spray, or mist. The following should be worn alone or in combination, as appropriate, to prevent eye contact: Vented goggles.

EXPOSURE CONTROLS/PROTECTION (Continued)

Hand Protection
Wear appropriate gloves when handling this material. Gloves made from one of the following material(s) are recommended: butyl rubber.

Skin Protection
Avoid skin contact.

Respiratory Protection
Avoid breathing of vapours, mists or spray.

Prevention of Accidental Ingestion
Wash hands after handling and before eating. Do not ingest.

Recommended Ventilation

10 EXPOSURE STANDARDS

COMMENT: No Worksafe exposure standards have been set for any of the ingredients of this product.

11 STABILITY AND REACTIVITY

STABILITY AND REACTIVITY
Stable. Hazardous polymerisation will not occur.

INCOMPATIBILITY-MATERIALS TO AVOID
Not applicable

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon Monoxide, Carbon Dioxide, Oxides of Nitrogen, Irritant Vapours or Gases. Oxides of Sulfur Hydrogen Chloride Amine Compounds,

12 ECOTOXICITY

ENVIRONMENTAL DATA
Not determined

ECOTOXICITY (Continued)

Other Ecotoxicity Information
Chemical Oxygen Demand(COD):0.419 g/g; 5-Day Biochemical Oxygen Demand (BOD5): 0.140 g/g; 10-day Biochemical Oxygen Demand (BOD10): 0.240g/g; 20-Day Biochemical Oxygen Demand (BOD20): 0.330 g/g;48-Hr EC50,Daphnia magna: 72 mg/L; 96-Hr LC50, Fathead minnow(Pimephales promelas): 75mg/L; 30-Min. EC50, Photobacterium phosphoreum (Microtox System): 49 mg/L; 3-Hr IC50, Activated Sludge respiration (OECD METHOD 209): >1000 mg/L.
Since regulations vary, consult applicable regulations or authorities before disposal.

13 DISPOSAL CONSIDERATIONS

Special Instructions for Disposal
Contact your local waste authority to determine suitable disposal methods.

14 REGULATORY INFORMATION

Product Certifications
AICS-Yes TSCA-Yes CDSL-Yes EINECS-Yes MITI-No

15 OTHER INFORMATION

The information on this data sheet represents our current data and best opinion as to the proper use in handling of this product under normal conditions. Any use of the product which is not in conformance with this data sheet, which involves using the product,or otherwise than in accordance with instructions of use on product packaging is the responsibility of the user.

If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact the Regulatory Compliance Chemist on (02) 9833-5401.

Material Safety Data Sheet No: F04-01/N1
Page 1 of 4
Issue/Date: 5/01.06.95
Supersedes: 4/11.12.92

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

MATERIAL SAFETY DATA SHEET

1. PRODUCT INFORMATION

1.1 Product Identification
EXPANDOL

1.2 Application and Use
Fire Fighting foam concentrate (designed for use at between 1% and 6% dilution with water [depending on application])

1.3 Manufacturer/Supplier
Angus Fire Armour (Australia) Pty., Ltd, 1001 Mountain Highway, Boronia, Vic., 3155
(03) 9729 3433

Emergency Telephone Number
For information and supply: Angus Fire (03) 9438 4114, (03) 9305 6606 or (03) 9560 7463

1.4 Product Description
Hydrocarbon surfactants, glycol solvents and foam stabiliser

2. COMPOSITION

Substance	Synonyms	Concentration %	Cas-No.
Ethylene glycol monobutyl ether	Butoxyethanol	10 - 25	111-76-2
Disodium fatty monoethanolamido sulphosuccinate		< 10	
Primary alcohol ether sulphates		5-20%	
Detergent alcohol		< 4	
Balance water			

3. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Liquid	pH at 20°C:	7
Colour:	Pale yellow	Boiling Point:	100°C at 760 mm Hg
Odour:	Solvent odour	Freeze Point:	-6.5°C
		Flash Point:	>93°C
		Flammability:	Not flammable
		Solubility:	Miscible with water in all proportions
		Viscosity at 20°C:	7cs
		Specific Gravity:	1.0

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

4. HAZARD INFORMATION

4.1 Health Hazard Information

Inhalation
Inhalation of hazardous amounts is unlikely when used as intended. Is irritant to respiratory tract when inhaled.

Ingestion
Low oral risk when used as intended. May cause nausea, vomiting and diarrhoea when ingested.
Ethylene glycol monobutyl ether is an experimental teratogen.

Contact to eyes or skin
Low risk if appropriate precaution measures are taken (see section 6). Can cause skin and eye irritation when contact to eyes or skin.

4.2 Occupational Exposure

Occupational Exposure Limit
Pure ethylene glycol monbutyl ether: Maximum Exposure Limit (MEL)
Long term exposure limit (8 hour time weighed average) : 25ppm

EXPANDOL is available for use at 1% to 6% dilution.

4.3 Fire and Explosion

General Hazards
EXPANDOL is not flammable or explosive.

Hazardous Decomposition Products
Do not expose containers to heat or flame, since the containers are made from high density polyethylene and will burn. Thermal decomposition of containers and/or products may generate acrid smoke and fumes and traces of Na_2O,Cl^-,SO_x,No_x.

Fire Fighting Measures
Fire Fighting measures are not applicable as EXPANDOL is a fire extinguishing media. If product containers are involved in fire, then a suitable extinguishing agent should be applied.

4.4 Stability and Reactivity

Generally stable. As with all aqueous solutions EXPANDOL should be excluded from contact with any materials which have violent reactions with water.

4.5 Sources of Information

Clayton, G.D. and F.E. Clayton: Patty's Industrial Hygiene and Toxicology. Fourth edition volumes I - III (1991). Sax, N.I. and R.J. Lewis, Sr: Dangerous Properties of Industrial Materials. Seventh edition volumes I - III (1991).
Health & Safety Executive: Occupational Exposure Limits (EH 40/92).
Note: EH40 is revised on an annual basis and newest issue should be applied.

5. FIRST AID MEASURES

5.1 General

First aiders should know and take the precautions appropriate to avoid danger to themselves and the casualty. Take casualty together with material safety data sheet of this product to hospital or doctor, if necessary.

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

5.2 Inhalation
Remove casualty from exposure. If there is breathing difficulty or cough keep patient at rest seated in position of maximum comfort.

5.3 Ingestion
If ingestion is suspected, do not induce vomiting, send casualty to hospital immediately.

5.4 Contact to eyes
If there is eye contact, wash immediately with plenty of clean, gently flowing water for 10 minutes, then send casualty promptly to a doctor or hospital.

5.5 Contact to skin
If there is skin contact, wash immediately with plenty of clean, gently flowing water.

6. EXPOSURE CONTROL/PERSONAL PROTECTION

6.1 Personal Protective Equipment - Fire Fighting

Angus Fire Foam Concentrates will be used by professional firefighters to control and extinguish flammable liquid fires. The nature of this process may involve exposure to heat, flame and possibly toxic vapours and fumes. It is normal procedure to wear appropriately designed personal protective equipment designed for use in firefighting situations. Angus Fire advises that this form of personal protective equipment should be used if the packaging materials become involved in fire.

6.2 Personal Protective Equipment - Other Handling

Avoid prolonged, extensive or repeated inhalation or contact to eyes and skin.
Hand Protection Wear impervious gloves of an approved type (e.g. neoprene).
Eye Protection Wear safety goggles of an approved type (BS 2092).

7. HANDLING/STORAGE/DISPOSAL

7.1 Handling and Storage
No special handling techniques required. For best results, the product should be stored in sealed, original containers above -10°C and below 40°C. Freezing and thawing do not affect the substance properties but care must be taken to avoid freezing the container and its contents since the expansion of the container contents may cause cracking of a completely rigid container as ice forms.

7.2 Accidental Release
SPILLAGE: The practice of washing spills into drains should be avoided if at all possible and should under no circumstances be allowed without first consulting the local Water Authority and National Rivers Authority. Absorb spillage with absorbent granules and transfer to container.

7.3 Disposal
Waste should be disposed via local authority waste collection service or registered waste carrier. Ensure the destination is a licensed facility.

Angus Fire Armour (Australia) Pty. Ltd.
1001 Mountain Highway, Boronia, Vic., 3155
Tel : 03 9729 3433 Fax : 03 9729 7571

ANGUS FIRE

7.4 Transport

Special transport techniques are not required.

CHIP Classification and label for supply:	X_n: Harmful. R20/21/22-37: Harmful by inhalation, in contact with skin if swallowed. R20/21/22-37: Harmful by inhalation, in contact with skin and if swallowed. S24/25: Avoid contact with skin and eyes.
EEC-Label:	203-905-0
CHIP classification and label for carriage:	Harmful substance.
Substance identification no:	2369.
Packing group:	III.

8. TOXICOLOGICAL INFORMATION

8.1 Aquatoxicity

Rainbow Trout (Oncorhynchus mykiss)
LC_{50} (3hrs) >180ppm
LC_{50} (6hrs) >180ppm
LC_{50} (24hrs) 89ppm LC_{50} (48hrs) 60ppm LC_{50} (72hrs) 45ppm LC_{50} (96hrs) 45ppm

Water Flea (Daphnia magna)
EC_{50} (24hrs) 37ppm
EC_{50} (48hrs) 10ppm

8.2 Sources of Information

Huntingdon Research Centre: AFA 13(a)/91123.
Acer Environmental: RT-ESV-020-01/R3a.

9. ECOLOGICAL INFORMATION

9.1 Biodegradation

Biodegradable
Chemical oxygen demand
COD 0.62gg^{-1}

Biochemical oxygen demand
5-day BOD_5 0.087 gg^{-1} (14%)
15-day BOD_{15} 0.30 gg^{-1} (49%)
28-day BOD_{28} 0.33 gg^{-1} (53%)

9.2 Sources of Information

Acer Environmental: RT-ESV-003-01.

DATE: 10/15/90 CURRENT DOCUMENT NBR: 10-3869-4

MATERIAL SAFETY
DATA SHEET

3M
3M CENTER
ST. PAUL, MINNESOTA
55144-1000
612/733-1110

DUNS NO.

DIVISION: INDUSTRIAL CHEMICAL PRODUCTS DIVISION
TRADE NAME:
FC-600 LIGHT WATER BRAND ATC/AFFF
3M I.D. NUMBER: CF-1206-0172-3 CF-1206-0173-1 CF-1206-0212-7 CF-1206-0213
CG-7900-7591-7 ZF-0000-3815-6 ZF-0000-3816-4 ZF-0000-3817
ZF-0002-0109-3 ZF-0002-0176-2 ZF-0002-0198-6 98-0211-0334
98-0211-0335-7 98-0211-1798-5

ISSUED: AUGUST 13, 1990
SUPERSEDES: SEPTEMBER 6, 1988
DOCUMENT: 10-3869-4

1. INGREDIENT

INGREDIENT	C.A.S. NO.	PERCENT	EXPOSURE VALUE	UNIT
WATER	7732-18-5	82.0	NONE	NONE
ETHANOL,2-(2-BUTOXYETHOXY)-	112-34-5	12.0	35	PPM
SYNTHETIC DETERGENTS +(5157P, 5036P)	TS	< 5.0	NONE	NONE
FLUOROALKYL SURFACTANTS +(5132P, 5144P)	TS	< 5.0	NONE	NONE
THICKENER +(5127P, 5123P)	TS	< 5.0	NONE	NONE

SOURCE OF EXPOSURE LIMIT DATA:
CMRG: CHEMICAL MANUFACTURE RECOMMENDED GUIDELINES
NONE: NONE ESTABLISHED

NOTE: NEW JERSEY TRADE SECRET REGISTRY (EIN) 04499600-+

THIS PRODUCT CONTAINS THE FOLLOWING TOXIC CHEMICAL OR CHEMICALS SUBJECT TO THE REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR PART 372:
ETHANOL,2-(2-BUTOXYETHOXY)-

2. PHYSICAL DATA

BOILING POINT (INITIAL): ..... CA. 93.00 C
VAPOR PRESSURE CALC. @ R.T.: ..... CA. 30.4000 MMHG
VAPOR DENSITY CALC. @ R.T.: ..... CA. 0.62 AIR = 1
EVAPORATION RATE: ..... < 1.00 BUTYL ACETATE = 1
SOLUBILITY IN WATER: ..... MISCIBLE
SP. GRAVITY: ..... CA. 1.030 WATER = 1
PERCENT VOLATILE: ..... CA. 94.00 %
VOLATILE ORGANICS: ..... N/D
PH: ..... CA. 7.00-8.50
VISCOSITY: ..... N/D
APPEARANCE AND ODOR: CLEAR, AMBER COLORED LIQUID.

3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: ..... NONE (SETAFLASH CC)
FLAMMABLE LIMITS - LEL: ..... N/A
FLAMMABLE LIMITS - UEL: ..... N/A
AUTOIGNITION TEMPERATURE: ... N/D
EXTINGUISHING MEDIA:
FC-600 IS A FIRE EXTINGUISHING AGENT.

BREVIATIONS: N/D - NOT DETERMINED N/A - NOT APPLICABLE

3. FIRE AND EXPLOSION HAZARD DATA (CONTINUED)

SPECIAL FIRE FIGHTING PROCEDURES:
NONE KNOWN
UNUSUAL FIRE AND EXPLOSION HAZARDS:
TOXIC BY-PRODUCTS, INCLUDING SMALL AMOUNTS OF HF, MAY BE FORMED. SEE SECTION 6.

4. REACTIVITY DATA

STABILITY: STABLE
INCOMPATIBILITY - MATERIALS TO AVOID:
NOT APPLICABLE
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
HAZARDOUS DECOMPOSITION PRODUCTS:
THERMAL DECOMPOSITION MAY PRODUCE TOXIC MATERIALS INCLUDING HF. DECOMPOSITION OF USAGE CONCENTRATIONS DOES NOT PRESENT A HAZARD.

5. ENVIRONMENTAL INFORMATION

SPILL RESPONSE:
OBSERVE PRECAUTIONS FROM OTHER SECTIONS. COVER WITH ABSORBENT MATERIAL. COLLECT SPILLED MATERIAL. CLEAN UP RESIDUE WITH WATER.

RECOMMENDED DISPOSAL:
BLEED SPENT SOLUTIONS AND SMALL PRODUCT QUANTITIES, (5 GAL.), TO A WASTEWATER TREATMENT SYSTEM. REDUCE DISCHARGE RATE IF FOAMING OCCURS. MIX WITH FLAMMABLE MATERIAL AND INCINERATE IN AN INDUSTRIAL OR COMMERCIAL INCINERATOR. COMBUSTION PRODUCTS WILL INCLUDE HF. DISPOSAL ALTERNATIVE: DISPOSE OF COMPLETELY ABSORBED WASTE PRODUCT IN A FACILITY PERMITTED TO ACCEPT CHEMICAL WASTES. SINCE REGULATIONS VARY, CONSULT APPLICABLE REGULATIONS OR AUTHORITIES BEFORE DISPOSAL. U.S. EPA HAZARDOUS WASTE NO.: NONE

ENVIRONMENTAL DATA:
96-HR. LC50, BLUEGILL SUNFISH(LEPOMIS MACROCHIRUS)=1500 MG/L; 96 HR LC50, FATHEAD MINNOW(PIMEPHALES PROMELAS)=1700 MG/L; 48 HR. EC50. DAPHNIA MAGNA=2800 MG/L; COD=0.35 G/G; BOD20=0.21 G/G.

SARA HAZARD CLASS:
FIRE HAZARD: NO PRESSURE: NO REACTIVITY: NO ACUTE: YES CHRONIC: YES

6. SUGGESTED FIRST AID

EYE CONTACT:
IMMEDIATELY FLUSH WITH PLENTY OF WATER. CONTINUE FOR 10 MINUTES. CALL A PHYSICIAN.

SKIN CONTACT:
WASH AFFECTED AREA WITH SOAP AND WATER.

INHALATION:
REMOVE TO FRESH AIR.

ABBREVIATIONS: N/D - NOT DETERMINED N/A - NOT APPLICABLE

6. SUGGESTED FIRST AID (CONTINUED)

IF SWALLOWED:
GIVE TWO GLASSES OF WATER. CALL A PHYSICIAN OR POISON CONTROL CENTER

OTHER FIRST AID:
NONE

7. PRECAUTIONARY INFORMATION

USE ONLY IN WELL VENTILATED AREAS WITH SUFFICIENT AIR MOVEMENT TO MAINTAIN AIRBORNE LEVELS AT RECOGNIZED HEALTH AND SAFETY LEVELS. AVOID PROLONGED BREATHING OF VAPORS. AVOID EYE AND SKIN CONTACT. STORE ABOVE 30 DEGREES F.
SPECIAL PROTECTION:
EYE PROTECTION: SAFETY GLASSES OR GOGGLES
SKIN PROTECTION: RUBBER GLOVES
VENTILATION: GENERAL VENTILATION ADEQUATE.
RESPIRATORY PROTECTION: ABOVE COMPONENT EXPOSURE LIMITS, USE ORGANIC VAPOR CARTRIDGE RESPIRATOR.

8. HEALTH HAZARD DATA

EYE CONTACT: CAN CAUSE MODERATE IRRITATION OF THE EYE ON DIRECT CONTACT WITH THE CONCENTRATE. DILUTED FC-600 (6 PARTS FC-600 IN 94 PARTS WATER) IS MINIMALLY IRRITATING TO THE EYES.

SKIN CONTACT: CAUSES MODERATE IRRITATION OF SKIN ON DIRECT CONTACT WITH FC-600 CONCENTRATE. CAUSES MINIMAL IRRITATION OF SKIN ON DIRECT CONTACT WITH FC-600 DILUTED (6 PARTS FC-600 AND 94 PARTS WATER). MAY BE ABSORBED THROUGH THE SKIN IN HARMFUL AMOUNTS.

INHALATION: MIST OR VAPORS MAY CAUSE IRRITATION OF RESPIRATORY SYSTEM. VERY HIGH CONCENTRATION OF VAPORS MAY CAUSE VOMITING, NAUSEA, DIARRHEA, ABDOMINAL PAIN, PULMONARY EDEMA AND STUPOR. SYMPTOMS OF OVEREXPOSURE MAY INCLUDE UNCONSCIOUSNESS; REPEATED OVEREXPOSURE MAY INCLUDE NYSTAGMUS, RECURRENT UNCONSCIOUSNESS, HEMOLYSIS AND BONE MARROW DEPRESSION.

INGESTION: UNDILUTED FC-600 HAS AN ACUTE ORAL LD50 (RAT) GREATER THAN 10 GRAMS PER KILOGRAM OF BODY WEIGHT. THIS CLASSIFIES THIS PRODUCT AS BEING PRACTICALLY NON-TOXIC ORALLY.

ABBREVIATIONS: N/D NOT DETERMINED N/A NOT APPLICABLE

THE INFORMATION ON THIS DATA SHEET REPRESENTS OUR CURRENT DATA AND BEST OPINION AS TO THE PROPER USE IN HANDLING OF THIS MATERIAL UNDER NORMAL CONDITIONS. ANY USE OF THE MATERIAL WHICH IS NOT IN CONFORMANCE WITH THIS DATA SHEET OR WHICH INVOLVES USING THE MATERIAL IN COMBINATION WITH ANY OTHER MATERIAL OR ANY OTHER PROCESS IS THE RESPONSIBILITY OF THE USER.

ANGUS FOREXPAN S CLASS A FOAM CONCENTRATE

ChemWatch Material Safety Data Sheet
Date of Issue: Thu 6-Nov-1997

IDENTIFICATION

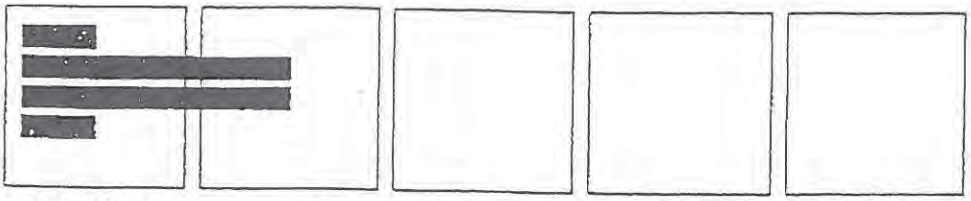
STATEMENT OF HAZARDOUS NATURE

Not classified as hazardous according to Worksafe Australia criteria

SUPPLIER

Company: Angus Fire Armour (Australia) P/L
Address:
1001 Mountain Highway (PO Box 525)
Boronia
Victoria 3155
Australia
Telephone: (03) 9729 3433
Telephone: (03) 9729 2366
Fax: (03) 9729 7571

CHEMWATCH HAZARD RATINGS



Product Name:	Angus Forexpan S Class A Foam Concentrate
Other Names:	Forexpan S 10/93
CAS RN No(s):	None
UN Number:	None
Dangerous Goods Class:	None
Packaging group:	None
Subsidiary Risk:	None
Hazchem Code:	None
Poisons Schedule Number:	None

USE

The foam concentrate is diluted with water (to 0.1-1%) and used to extinguish fires in Class A materials.

PHYSICAL DESCRIPTION/PROPERTIES

APPEARANCE

Water white liquid with a sweet wax like odour; mixes with water.

Boiling Point (deg C):	100
Melting Point (deg C):	-15
Vapour Pressure (kPa):	Not available
Specific Gravity:	1.03
Flash Point (deg C):	>116
Lower Explosive Limit (%):	Not applicable
Upper Explosive Limit (%):	Not applicable
Solubility in Water (g/L):	Miscible

INGREDIENTS

NAME	CAS RN	%
diethylene glycol monobutyl ether	112-34-5	<30^
lauryl alcohol	112-53-8	<10

continued ...

ANGUS FOREXPAN S CLASS A FOAM CONCENTRATE

IDENTIFICATION continued ...

sodium lauryl C10-16 alkyl ether sulfate	68585-34-2	<25
ingredients determined to be non hazardous and not regulated by WORKSAFE Australia		10-30
water	7732-18-5	<30

HEALTH HAZARD

ACUTE HEALTH EFFECTS

At normal use levels the diluted material is essentially non-toxic and non-hazardous.

SWALLOWED

Considered an unlikely route of entry in commercial/industrial environments. The concentrate is discomforting to the gastro-intestinal tract and may be harmful if swallowed in quantity.

EYE

The concentrate is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

SKIN

The concentrate is slightly discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis from repeated exposures over long periods.

INHALED

The vapour/mist is discomforting to the upper respiratory tract. Not normally a hazard due to non-volatile nature of product. Inhalation of vapour is more likely at higher than normal temperatures. Acute effects from inhalation of high vapour concentrations may be chest and nasal irritation with coughing, sneezing, headache and even nausea.

CHRONIC HEALTH EFFECTS

Principal routes of exposure are usually by skin contact with the material. As with any chemical product, contact with unprotected bare skin; inhalation of vapour, mist or dust in work place atmosphere; or ingestion in any form, should be avoided by observing good occupational work practice.

FIRST AID

SWALLOWED

If poisoning occurs, contact a doctor or Poisons Information Centre. If swallowed, do NOT induce vomiting. Give a glass of water.

EYE

If this product comes in contact with the eyes: Immediately hold the eyes open and wash with fresh running water.

continued ...

ANGUS FOREXPAN S CLASS A FOAM CONCENTRATE

HEALTH HAZARD continued ...

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.
Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

If product comes in contact with the skin: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

INHALED

Concentrate
Remove patient to fresh air, lay down, rest.
If not breathing, make sure airway is clear and apply artificial resuscitation. Keep warm. Transport to hospital or doctor.

ADVICE TO DOCTOR
Treat symptomatically.

PRECAUTIONS FOR USE

EXPOSURE STANDARDS
None assigned. Refer to individual constituents.
diethylene glycol monobutyl ether
No exposure limits set by NOHSC or ACGIH.

<lauryl alcohol>
Dusts not otherwise classified, as inspirable dust
ES TWA: 10 mg/m3.
** for the following **
<lauryl alcohol>
<sodium lauryl C10-16 alkyl ether sulfate>
No exposure limits set by NOHSC or ACGIH.

ENGINEERING CONTROLS
Use in a well ventilated area, preferably outdoors.
If risk of overexposure exists, wear SAA approved respirator.
Correct fit is essential to obtain adequate protection.
Respirators should be approved to Standard AS 1716
Provide adequate ventilation in warehouse or closed storage areas.

PERSONAL PROTECTION

EYE

Chemical goggles approved to AS / NZS 1337, or
Goggles or Face visor giving equivalent level of protection.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

continued ...

ANGUS FOREXPAN S CLASS A FOAM CONCENTRATE

PRECAUTIONS FOR USE continued ...

HANDS/FEET

HANDS
Barrier cream and Neoprene gloves or Nitrile gloves.
FEET
Rubber boots.

OTHER

Overalls.
Ensure that there is ready access to eye wash unit.

RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	A -AUS P	-
1000	50	-	A -AUS P
5000	50	Airline *	-
5000	100	-	A -2 P
10000	100	-	A -3 P
	100+	-	Airline **

* - Continuous Flow ** - Continuous-flow or positive pressure demand.
The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information, consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

SAFE HANDLING

STORAGE AND TRANSPORT

SUITABLE CONTAINER

Polyethylene or polypropylene container.
Plastic pail Polylined drum Packing as recommended by manufacturer
Check all containers are clearly labelled and free from leaks.
Stainless steel, glass fibre or bitumen lined tanks.

STORAGE INCOMPATIBILITY

Avoid storage with oxidisers.

STORAGE REQUIREMENT

Store between -9 and 50 deg.C.
Store in original containers. Keep containers securely sealed.
Store in a cool, dry, well-ventilated area.
Store away from incompatible materials and foodstuff containers.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.

continued ...

ANGUS FOREXPAN S CLASS A FOAM CONCENTRATE

SAFE HANDLING continued ...

TRANSPORTATION

No restrictions.

SPILLS AND DISPOSAL

MINOR SPILLS

For Concentrate
Slippery when spilt. Clean up all spills immediately.
Avoid breathing vapours and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Wipe up. Place in a suitable labelled container for waste disposal.

MAJOR SPILLS

For Concentrate
Slippery when spilt. Minor hazard. Clear area of personnel.
Alert Fire Brigade and tell them location and nature of hazard.
Control personal contact by using protective equipment as required.
Prevent spillage from entering drains or water ways.
Contain spill with sand, earth or vermiculite.
Collect recoverable product into labelled containers for recycling.
Absorb remaining product with sand, earth or vermiculite and place in appropriate containers for disposal.
Wash area and prevent runoff into drains or waterways.
If contamination of drains or waterways occurs, advise emergency services.

DISPOSAL

Recycle wherever possible or consult manufacturer for recycling options.
Consult State Land Waste Management Authority for disposal.
Evaporate and bury residue in an authorised landfill.
Recycle containers wherever possible, otherwise dispose of in an authorised landfill.

FIRE/EXPLOSION HAZARD

The material is not combustible under normal conditions. However, it will breakdown under fire conditions and the organic component may burn.
Not considered to be a significant fire risk.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Decomposes on heating and may produce toxic fumes of carbon monoxide (CO).
May emit acrid smoke.
Other decomposition products include carbon dioxide (CO_2) and sulfur oxides (SOx).

CONTACT POINT

CONTACT
AUSTRALIAN POISONS INFORMATION CENTRE
24 HOUR SERVICE :- 13 11 26
POLICE OR FIRE BRIGADE :- 000 (exchange):-1100

continued ...

ANGUS FOREXPAN S CLASS A FOAM CONCENTRATE

CONTACT POINT continued ...

NEW ZEALAND POISONS INFORMATION CENTRE

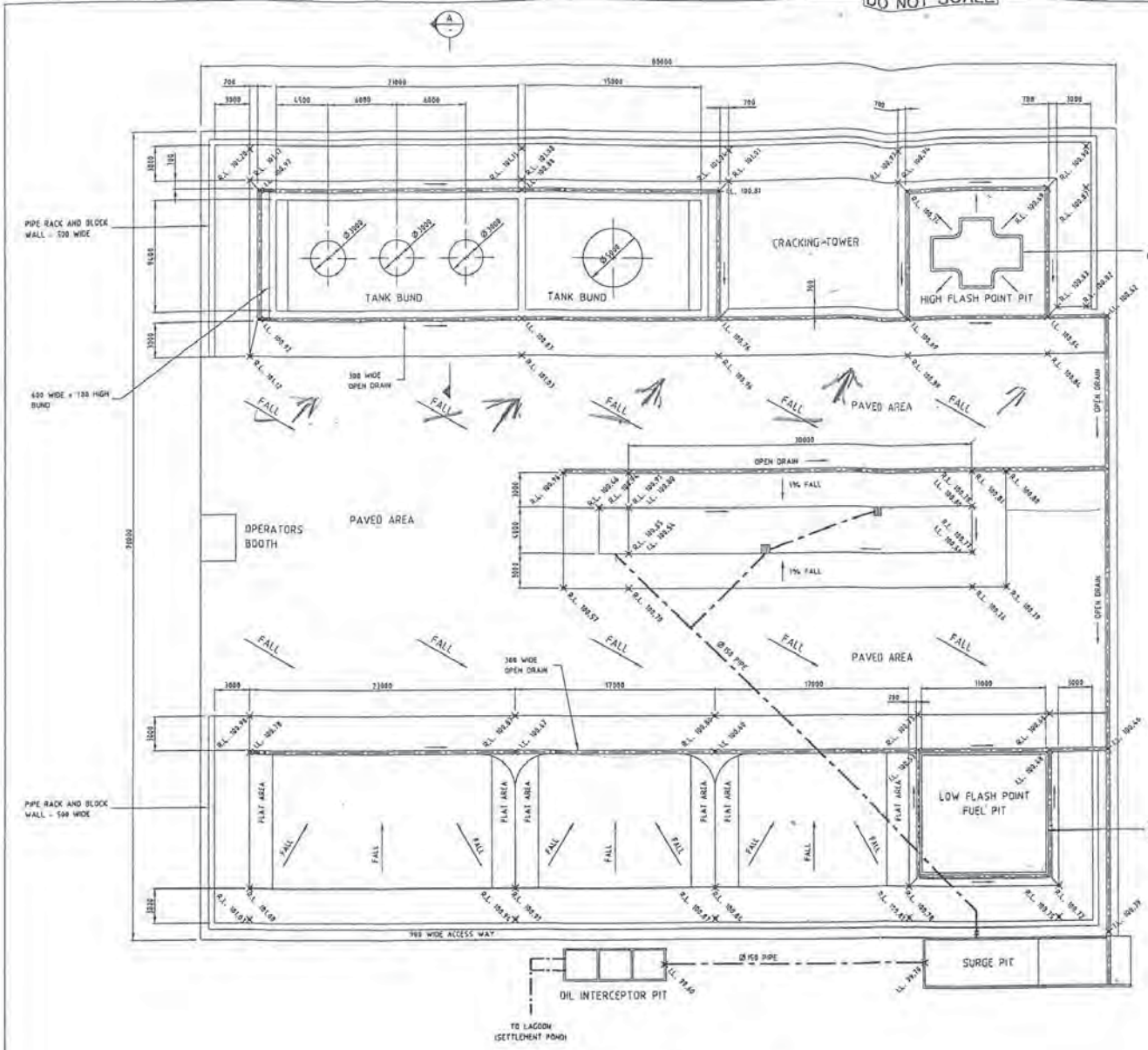
Dunedin	:-(03)479 1200	(Normal Hours)
	:-(03)474 0999	(Emergency)

End of Report

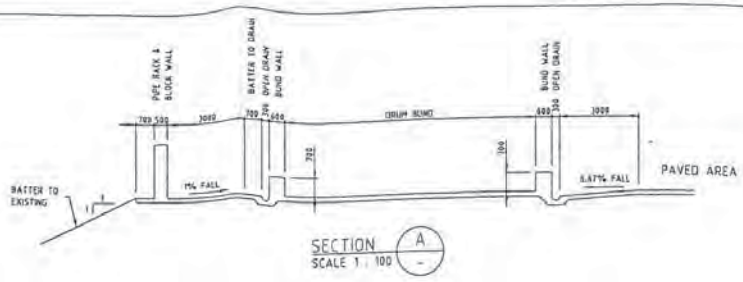
Date of Preparation: Thu 6-Nov-1997
Print Date: Thu 6-Nov-1997

1/ CLEAN OUT DAM HAS BEEN LEFT TO LATE AS WATER FROM TRAINING IS RUNNING BACK IN AS FAST AS COULD BE PUMPED OUT.		1,600
2/ DISPOSAL OF WASTE FROM DAM HEAVILY CONTAMINATED.		?
3/ FILL AREA DUG OUT. 6,000 SQ MT. WITH GRAVEL AT $13.A METRE. WAS TO BE FILLED WITH SOIL OFF THE PROPERTY BUT HAVE BEEN TOLD WILL NOT GET COMPACTION RATE WITH SOIL TO PUT CONCRETE SLAB ON.		78,000
4/ CONCRETE SLAB		
	100 MTS X 100 MTS X 6"	580,000
	80 MTS X 80 MT X 6"	400,000
	100 X X 100 X 8".	700,000
5/ WATER MAINS BACK UP.		-
6/ FUEL LINES		
7/ BOOTHS.		

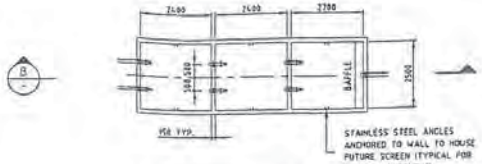
DO NOT SCALE



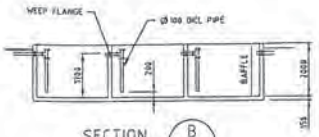
GENERAL ARRANGEMENT - PLAN
SCALE 1:100



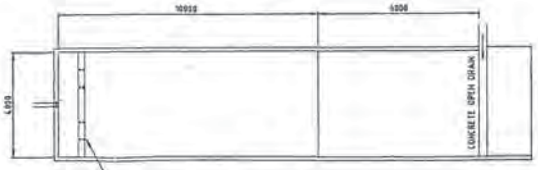
SECTION A
SCALE 1 : 100



OIL INTERCEPTOR PIT - PLAN
SCALE 1:100

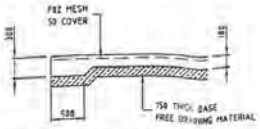


SECTION B
SCALE 1 : 100



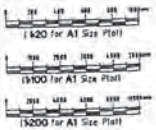
SURGE PIT - PLAN
SCALE 1:100

SECTION C
SCALE 1 : 100



TYPICAL SLAB EDGE DETAIL
SCALE 1:20

TYPICAL CONSTRUCTION/ CONTRACTION JOINT
SCALE 1:20



No.	Revision	Engineer Approved	Date	M/Film
1	ISSUED WITH DRAFT REPORT		21/10/98	

PRELIMINARY 02-JUL-98/16:47:33

Drawing File No.
T:\5485\09\5485090102.DWG

Gutteridge Haskins & Davey Pty Ltd
INCORPORATING THE PRACTICE OF SMITH, SALE AND BURBURY
CONSULTING ENGINEERS • ENVIRONMENTAL SCIENTISTS & PLANNERS • PROJECT MANAGERS
ACN 009 488 373
152 Macquarie Street, Hobart, Tasmania 7000
Telephone (03) 6223 7733 Facsimile (03) 6223 8246

Scale	AS SHOWN
Drawn/Traced	C.A.M. /6/98
Engineer Design	R.A.C. /6/98
Draft Check	
Engineer Check	
Approved	

This Drawing must not be used for Construction unless signed as Approved

Client and Job: COUNTRY FIRE AUTHORITY
FISKVILLE FLAMMABLE LIQUIDS TRAINING PAD UPGRADE
Title: LAYOUT AND DETAILS
Size: A1
Drg. No. 5485 - 09 - 02

RIO
TINTO

Telephone: 03 9272 3176
Facsimile: 03 9242 3222

16 JUN 1999

15 June 1999

Roger Kershaw
Manager
CFA Training College
Fiskville, 3342

Dear Roger

Enclosed are two copies of our report entitled *Remediation of Hydrocarbon Contaminated Soil CFA Training College, Fiskville* (one copy for yourself and one for Don Hendy, if you could forward a copy onto Don that would be much appreciated). As you requested I have forwarded a copy of the report to Julia Caluzzi (Vic EPA).

I have also enclosed an invoice for preparation of the draft report which you received a couple of weeks ago. The invoice is for a total of $4,754.

If you have any questions regarding the report, or would like to discuss any issues that the Vic EPA may raise, please don't hesitate to contact me.

Yours faithfully

Leigh Bernoth
Superintendent Laboratory and Projects

Rio Tinto Research and Technology Development, Melbourne
1 Research Avenue Bundoora 3083 Australia
Telephone (+61 3) 9242 3111 Facsimile (+61 3) 9242 3222

RIO TINTO

Research & Technology Development Melbourne

Technical Report

Remediation of Hydrocarbon Contaminated Soil CFA Training College, Fiskville

Prepared for:	Roger Kershaw, CFA Fiskville
External copies to:	Julia Caluzzi, EPA Victoria Don Hendy, CFA Fiskville
Author/s:	Leigh Bernoth +61 3 9242 3176
	Marghanita Johnson Stuart Rhodes
Contributor/s:	Karen Elkin
Responsible Manager:	Ian Firth
Internal copies to:	File T039.004.005
Document information:	TR00025.doc Composting, CAV002
Version:	1
Original Date: **Issue Date:**	23 April 1999 03 June 1999

SUMMARY

Project Focus

Environmental investigations conducted at the Country Fire Authority (CFA) Training College, Fiskville during 1996 identified several areas of soil contamination requiring remediation. The results of these investigations were then used to develop and evaluate remedial options. A remediation plan was subsequently prepared, and implemented in 1998.

The remediation was conducted in two stages. The excavation, validation and reinstatement of two contaminated areas was carried out by Coffey Partners (now Coffey Geosciences).[1] Rio Tinto Research and Technology Development was commissioned in February 1998 to manage the on site treatment of this excavated soil. This report describes the treatment process and presents the results of the final validation sampling conducted in early 1999.

Research Conducted

Soil was excavated as per recommendations made by Coffeys, and stockpiled on site. The total volume of contaminated soil (ie TPH concentration > 1,000 mg/kg) was ~4,300 m^3. The soil was stockpiled into 4 piles, on a bunded area. Approximately 35% (by volume) of raw materials (green tree waste, cow manure, gypsum and nutrients) were added to initiate composting. The piles were kept moist during the summer months, but no other maintenance was performed.

Once the composting process was initiated, the windrows were sampled after two months, and followed up with a second round of sampling after six months.

Findings

After 6 months treatment the average TPH concentration was 730 mg/kg (with a 95% CI of 1,030 mg/kg) meeting the Victorian EPA clean fill criteria.

There are no other contaminants of significance in the treated material.

Implications

CFA have indicated that for the foreseeable future the soil and compost piles will be left in place (ie stockpiled in the bunded and drained area). In its current state the soil compost does not pose an unacceptable risk to human health or the environment.

The treated material could be used as fill under a new training pad as per the original strategy outlined by CFA.

There are alternative disposal options. A possible course of action would be to rehabilitate the treatment area, levelling the soil and compost piles within the bund walls, and allowing revegetation to take place. The remediated soil and compost could also be spread over the surrounding paddocks where it would provide some organic enhancement (due to the added green tree waste, cow manure and nutrients).

1 Coffey Partners International Pty Ltd Report No. E3523/3-AI, Soil Remediation and Validation Program, March 1998.

CONTENTS

Tables

Figures

RIO TINTO

DETAILS

1 Project Focus

Environmental investigations conducted at the Country Fire Authority (CFA) Training College, Fiskville during 1996 identified several areas of soil contamination requiring remediation.

The results of these investigations were then used to develop and evaluate remedial options. A remediation plan was subsequently prepared, and implemented in 1998.

The remediation was conducted in two stages. The excavation, validation and reinstatement of two contaminated areas was carried out and reported by Coffey Partners (now Coffey Geosciences).[2]

Rio Tinto Research and Technology Development was commissioned in February 1998 to manage the on site treatment of this excavated soil. This report describes the treatment process and presents the results of the final validation sampling conducted in early 1999.

1.1 Site background

1.1.1 Location

The CFA Training College is located at Fiskville, Victoria, approximately 50 km north of Geelong and 10 km south of Ballan. The site covers an area of approximately 146 ha, and is situated on the western side of the Ballan-Geelong Road.

1.1.2 Land use

The site is in a rural pasture setting, and is currently used by CFA as a Training College for fire and emergency services personnel from within CFA, and from external organisations. This principally involves fire fighting exercises at a number of "props", using both gas and liquid fuels.

The site has been used for such training for approximately 20 years. Prior to this few buildings existed on the site.

The main areas of the site comprise (Figure 1):

- Flammable Liquid Pad (FLP) and Fuel Mix Areas (FMA) used for fire training
- Two interconnecting dams, collecting run off from the FLP, and draining to Lake Fiskville
- Bulk fuel storage area
- Light industrial facilities, including stores, workshops and underground diesel storage tanks
- Training centre, administration and accommodation facilities

[2] Coffey Partners International Pty Ltd Report No. E3523/3-AI, Soil Remediation and Validation Program, March 1998.

All of the industrial facilities are located in the central part of the site.

The surrounding land is essentially rural.

1.1.3 Topography and drainage

The college is located on a flat to gently undulating plateau, with lakes and wetlands formed in local depressions. Lake Fiskville is situated immediately south-west of the training complex.

A central north-south ridge forms a break in the site drainage. The site drains generally towards the south, via Yaloak Creek on the eastern side, and Beremboke Creek to the west. Drainage to the east is towards the Werribee River water supply catchment.

1.1.4 Subsurface conditions

Previous site investigations have confirmed that the site lies over Quaternary Olivine Basalts. Surface soils are residual silts and clays, generally no more than 2-3 m deep, overlying very stiff, high plasticity residual clays, grading to variably weathered basalt.[3,4]

Shallow fill, comprising gravel or road base, is found on parts of the site, particularly in the area of the Flammable Liquids Pad. A summary of the site stratigraphy is given in Table 1.

Table 1. Generalised Subsurface Profile

Soil Unit	Depth to Top of Layer (m)	Thickness (m)	Description
1	0	0.1 - 0.8	FILL: fine to coarse grained sandy gravel, silty clay or medium plasticity red clay.
2	0.2 - 1.0	0.1 - 0.2	RESIDUAL SILTY CLAY: medium plasticity, grey to grey-brown, may comprise rounded buckshot gravel (2 to 5mm) with clay.
3	0.3 - 1.2	0.5 - 1.8	SILTY CLAY: high plasticity, yellow-grey to yellow-brown, mottled orange-yellow. Residual clay formed on basalt.
4	0.8 - 2	14 - 18	BASALT
5	16 - 18.8	3.2 - 6.0	VOLCANIC ASH

During investigations in which eight bores (four deep bores to 20 m, and four shallow to 2 m) were installed, groundwater was encountered in only in two of these bores[5]:

[3] Coffey Partners International Pty Ltd, Report No. E3517/1-AD, Field Site Appraisal and Sampling, August 1996
[4] Diomides & Associates Pty Ltd, Report DA1108/SD3000, Environmental Site Assessment, June 1996
[5] Coffey Partners International Pty Ltd, Report No. E3523/1-AK, Groundwater Monitoring Network Installation, October 1996

- BH2, a deep bore located in basalt aquifer in the FLP area, intersected water at 10 m bgl.
- BH5, a shallow bore located immediately adjacent to the backfilled drum burial trenches, probably a consequence of locally enhanced recharge occurring in the trench backfill.

It was concluded that "the basalts are generally dense and unjointed without significant primary or secondary porosity to enable groundwater flow"[5]. The residual clays are also of low water bearing potential. As a result, the occurrence of any significant groundwater is precluded, and the potential for contaminant migration via groundwater is very limited.

1.2 Soil contamination

Soil and sediment contamination was present on the CFA Training College site, predominantly as petroleum hydrocarbons, with lower concentrations of phenol, BTEX and lead.

This contamination principally resulted from storage and handling of fuels, use of liquid fuels in fire training activities, and disposal of fuel residues such as sludges.

The petroleum hydrocarbons were generally medium to heavier fractions (C_{15}-C_{36}), as expected from the nature of the activities on the site. Some light hydrocarbons (C_6-C_9 and C_{10}-C_{14}), including BTEX constituents, were present in the drum burial area.

This area also contains slightly elevated concentrations of phenols. No phenols were detected in either of the other two areas.

One sample from the old fire training pits contained elevated lead (710 mg/kg). No significant concentrations of polynuclear aromatic hydrocarbons or other heavy metals were found at the site.

No organochlorine pesticides or PCBs were detected in any sample tested.

1.3 Extent of remediation

Two areas of soil contamination were identified requiring remediation, as part of development plans for the site, as follows (Figure 2):

- **Flammable liquids pad**. This large area contained obvious and unsightly superficial soil contamination with fuel residues from fire training activities. Figure 3 shows the site as it was prior to excavation. Crushed rock fill was contaminated with hydrocarbons at depths of 0.1-0.5 m, but generally no deeper than 0.8 m. Total petroleum hydrocarbon concentrations ranged up to 1600 mg/kg.

Figure 3. The contaminated site at CFA Fiskville prior to excavation

- Old Fire Training Pits (FTP). Two decommissioned fire training pits, east of the FLP contained a thin layer (less than 10 cm thick) of black hydrocarbon sludge, at a depth of 0.1 to 0.6 m. The sludge was covered by a 0.1 to 0.8 m thick layer of surface fill comprising silty clay, silt and gravel. High concentrations of total petroleum hydrocarbons, up to 88,000 mg/kg, were found in the sludge layer and in soil from 0.6 to 1.0 m. Elevated lead (710 mg/kg) was found in one sample.

Contaminated sediments, particularly in Dam 1, and a small area of soil contamination at the Drum Burial Area were not addressed in this project. Following the soil remediation works, CFA planned to upgrade facilities in the FLP/FMA, with the objective of preventing further hydrocarbon contamination in Dam 1. Dam 1, and the drum burial pits, were to be the subject of future remedial work.

1.4 Remediation objectives

The goal of this remediation work at the Fiskville Training College was to enable the upgrade of the FLP/FMA facilities, to provide for better management of liquid fuels and hydrocarbon contaminated effluents and so prevent further soil and water contamination from the fire training and other site activities conducted in this area.

The primary objective was the removal and on site treatment of the contaminated soils and buried wastes identified in the FLP, and fire training pits.

1.4.1 Excavation criteria

Remediation of the identified areas with soil contamination involved excavation of all soil exceeding specified criteria for organic contaminants and lead, and transport to a treatment area constructed elsewhere on the Fiskville site.

The criteria adopted for the excavation work were the Victorian EPA guidelines for off site disposal of contaminated soil as clean fill[6]:

- total petroleum hydrocarbons (TPH) ($\bullet C_9$) 100 mg/kg
- total petroleum hydrocarbons (TPH) ($>C_9$) 1000 mg/kg
- phenols 1 mg/kg
- mono-aromatic hydrocarbons (BTEX) 7 mg/kg
- lead 300 mg/kg

Removal of soils exceeding these criteria will minimise any future risks of surface or groundwater contamination.

The remediation work was successfully carried out and reported by Coffey Partners.[7]

1.4.2 Soil treatment

The excavated contaminated soil was treated by on site composting.

Given the contaminants were predominantly medium-heavy hydrocarbons, the aim of the treatment was to stabilise the soil so that it could be reused on site as fill material, for example under a new training pad. Two criteria were proposed. Either the average concentration of TPH should fall below 1000 mg/kg or the composting process should reach completion.

Two measures were used to assess the status of the composting process: temperature, and rate of hydrocarbon biodegradation. A very low rate of biodegradation would be considered as representing a natural, or environmentally acceptable endpoint for the composting process. At this stage, the residual petroleum hydrocarbons can be considered to be 'biostabilised', effectively immobile and unavailable for further uptake and biodegradation, and thus unlikely to adversely affect the quality of the soil or water with which it may come into contact.

[6] EPA Publication 448 "Classification of Wastes', September 1995.
[7] Coffey Partners International Pty Ltd Report No. E3523/3-AI, Soil Remediation and Validation Program, March 1998.

Table 2. Composition of soil compost windrows

Compost Windrow	Green Tree Waste (m^3)	Cow Manure (m^3)	Gypsum (m^3)	Total Volume of raw materials (m^3)	Contaminated Soil Volume (m^3)	Total Initial Volume (m^3)
1	270	75	50	395	940	1335
2	280	75	50	405	1035	1440
3	265	75	60	400	1185	1585
4	280	75	50	405	1180	1585
			Total	**1,605**	**4,340**	**5,945**

RIO TINTO

Figure 4. The mixing process during the formation of the windrows

2.3 Monitoring and maintenance

For the first two months of composting, the internal temperature of the compost windrows was monitored using thermocouples linked to a field datalogger. Results for the temperature recordings are detailed in Appendix 7.

The soil compost piles were kept moist during the dry summer months with regular watering. No other maintenance on the piles was performed.

2.4 Sampling protocol

Once the composting process was initiated, the windrows were sampled after two months, and followed up with a second round of sampling after six months composting.

R&TD staff, following sampling programs designed by R&TD (with the assistance of Treleon Pty Ltd – sampling consultants) performed both rounds of sampling. The full sampling programs are discussed in Appendix 1, and summarised here.

2.4.1 Sampling after 2 months

Samples were collected on 22 April 1998. From Row 1, samples were taken at 7 locations along the windrow, and at three different depths (top, middle and bottom). Additionally, in order to determine the variation associated with sampling additional samples were taken from this row. Field duplicate samples were taken 0.5 m from the original samples. This resulted in a total of 42 samples being collected from

Row 1. From each of the other 3 rows, samples were taken from the middle depth and at 3 locations along each row.

2.4.2 Sampling after 6 months

Samples were collected on 6 and 7 October 1998. Samples were taken at 7 intervals along each windrow, again at three different depths. This resulted in a total number of 84 samples.

The samples were collected by taking multiple composite samples from the loader bucket. In order to determine the variation associated with this sampling technique a set of 20 separate samples were taken from one bulldozer bucket and analysed.

3 Findings

3.1 After 6 months treatment the average TPH concentration was 730 mg/kg, below Victorian EPA clean fill criteria

The initial average concentration of TPH ($>C_9$-C_{36}) in the excavated contaminated soil (~4,300 m^3) was 3,075 mg/kg. Overall, however, TPH concentrations ranged between 1,000 mg/kg and 7,900 mg/kg.

The complete set of analytical data (from AMDEL, a NATA registered laboratory) for the initial assessment (time = 0) is provided in Appendix 3.

The second sampling program performed two months after setting up the compost piles determined the average[8] TPH concentration for the four piles to be 900 mg/kg. Complete analytical data from NATA registered laboratory Amdel is in Appendix 4. There is some variation in the TPH concentrations between the four piles, and also within the piles. This variation was analysed statistically (Appendix 2). The total error was found to be ± 41 %, ie. the TPH concentration overall was 900 ± 370 mg/kg (Table 3). The variation of 41% is due to both sampling and analytical errors, and is typical for environmental sampling of this kind.

Table 3. TPH concentrations in soil compost

	TPH concentration (mg/kg total dry matter[9])			
Compost Pile	**Average Initial**	**Average 2 Months**	**Average 6 Months**	**Upper 95% Confidence Limit at 6 months[10]**
1	2,800	1,200	1,080	1,500
2	4,500	850	810	1,100
3	3,400	780	530	750
4	1,800	770	510	740
Average	**3,100 ± 1,270**	**900 ± 370**	**730 ± 300**	**1,230**

While the average TPH concentration was below the target after 2 months, the 95% upper confidence limit for the total compost mass for this sampling program was 1,270 mg/kg. It was recommended that the treatment be continued.

A third sampling program was performed six months after the piles were established. At this time, the average TPH concentration was 730 mg/kg (Appendix 5). Error analysis was again performed (Appendix 2) which indicated a total error of ±41%, as found in the initial error analysis. In conclusion, after six months treatment the average TPH concentration for all four compost windrows was 730 ± 300 mg/kg (Table 1).

[8] Weighted average calculated from the total mass of TPH present and the total mass of compost.
[9] All data is given to 2 significant figures. Concentrations are not adjusted for dilution from added organic matter.
[10] 95% Upper Confidence Limit = Average Concentration + 40%.

Figure 5 shows the time course data, in comparison with the criterion used for the excavation (1,000 mg/kg TPH).

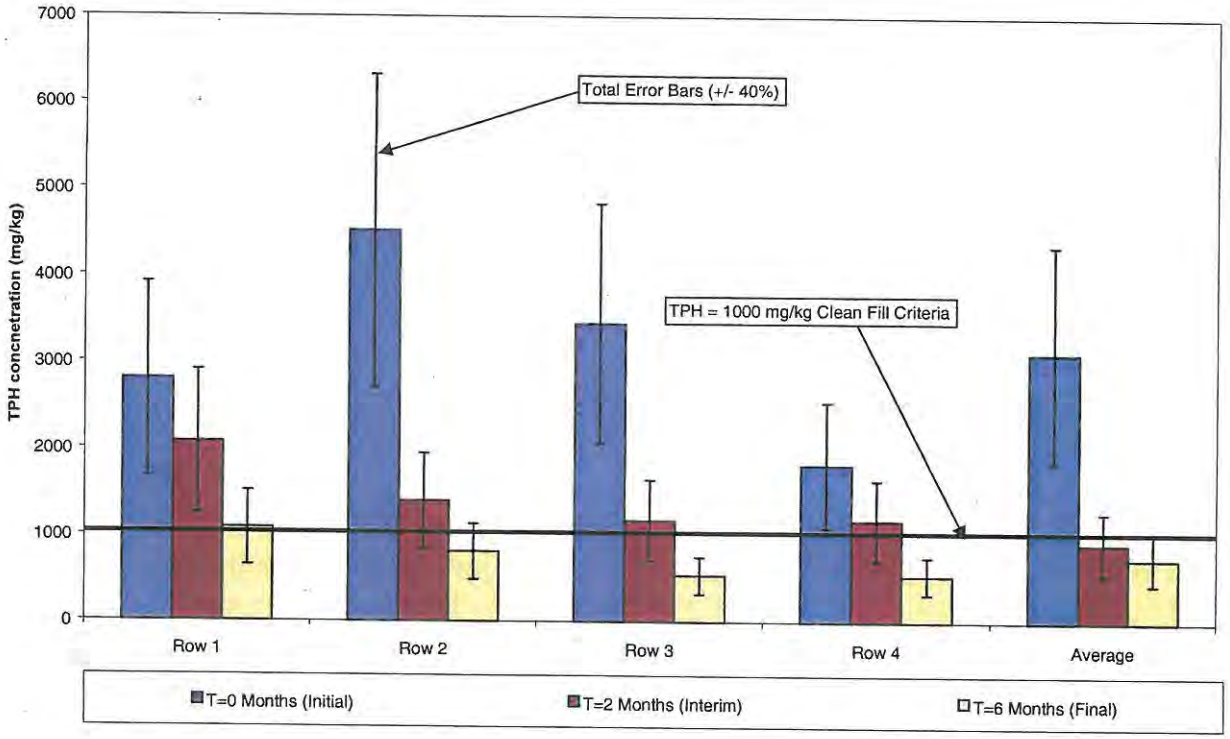


Figure 5. TPH concentrations over time, compared with EPA "clean fill" criterion

While the upper 95% confidence limits for Rows 1 & 2 exceed 1,000 mg/kg TPH (1,500 and 1,100 respectively), the average TPH concentration across the four piles after six months of treatment is clearly below the criterion.

3.2 There are no other contaminants of significance in the treated material

Lead (Pb) is the only other contaminant in the compost treated soil that may be of concern[11]. Elevated Pb concentrations were identified in one sample taken from the Fire Training Pit (FTP) which represents approximately 30% of the total material in the compost piles. The rest of the compost piles consist of material sourced from the Flammable Liquid Pad (FLP) and the Fuel Mix Area (FMA) which reported acceptable concentrations of Pb. After mixing the material it was expected that the Pb "hotspot" would have been dispersed and diluted.

[11] *Fiskville Training College Review of Site Assessments and Remediation Options*, CRA ATD Report 28 Nov 1996

Results of the lead analysis (at T=6 months, Appendix 6) showed that the average Pb concentration of all the material was 55 mg/kg, which is well below the 300 mg/kg Victorian EPA clean fill and ANZECC B soil quality guidelines[12]. All of the samples assayed were below these guidelines (Table 4).

Table 4. Extent of lead contamination in compost piles

Compost Pile	Lead Concentration (mg/kg)		
	Average	Minimum	Maximum
1	60*	42	69
2	38	20	82
3	48	22	82
4	55	33	97

*One sample from Pile number 1 assayed at ~360 mg/kg Pb. Another sub-sample was taken and assayed, this yielded a result of 60 mg/kg Pb. The first assay is considered an outlier, and has been omitted from the statistical analysis.

In the lead sampling program, 20 replicate samples were analysed (the same samples were used as those used for TPH analysis at 6 months). This found that the sub sampling and analytical error for the lead analysis was 13%. An estimation of total error was not made due to insufficient data, but all the data are well below the threshold.

The average initial phenol concentration in the segregated, uncomposted, material was 2.5 mg/kg and the maximum was 9.3 mg/kg. In the soil to be composted the initial average phenol concentration was even lower, at 1.6 mg/kg, with a maximum 4.1 mg/kg. It is reasonable to expect that following the treatments of both soil batches, the phenol concentrations would be lower still.

The Victorian guideline concentrations for "clean fill" and "low level" contaminated soil are 1 mg/kg and 10 mg/kg respectively. No value for phenols is included in the ANZECC guidelines. A guideline is provided by the Dutch (1994) soil intervention value of 40 mg/kg[13]. The current draft Australian risk-based health *investigation* levels for phenol are higher still (eg 8,500 mg/kg for a residential setting[14]). In light of the current land use at the site, and the absence of any significant groundwater resource, we consider that the phenol concentrations of the treated soil do not represent a significant risk to human health or the environment.

[12] Australian and New Zealand Environment and Conservation Council and NHMRC (1992), Australian and New Zealand Guidelines for the Assessment of Contaminated Sites.ANZECC (1992) soil quality guidelines and Dutch intervention values.

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

[14] National Environmental Protection Measure for the Assessment of Site Contamination. Draft Guideline 1 – Investigation Levels for Soil and Groundwater. March 1999.

4 Implications

4.1 Composting is complete, and the soil poses no unacceptable risks

It is expected that without further maintenance of the compost windrows (ie watering, aeration) contaminant degradation will continue, albeit slowly. Grasses have already begun to colonise the area, therby stimulating phytoremediation processes that will further promote contaminant degradation.

CFA have indicated that for the foreseeable future the soil and compost piles will be left as is (ie stockpiled in the bunded and drained area). In its current state it poses no unacceptable risk to human or environmental health. We consider that maintenance of the bund walls may be advisable (until the compost piles are sufficiently vegetated) to prevent potential run-off of sediment laden water.

4.2 The treated material could be used as fill under a new training pad

The original strategy outlined by CFA was to dispose of the treated material as fill, under capping in the construction of a new training pad. This was to reduce the risk from any residual contamination (eg leaching to the groundwater). However, given the low residual contaminant concentrations achieved it seems likely this would not be required. If capping is desired for other reasons (eg in the design of a training pad) there may also be geo-technical issues to consider, due to the possible poor compaction quality of the treated material.

4.3 There are alternative disposal options

Another possible course of action would be to rehabilitate the treatment area, levelling the soil and compost piles within the bund walls, and allowing revegetation to take place. This would aerate the soil and stimulate further biotreatment.

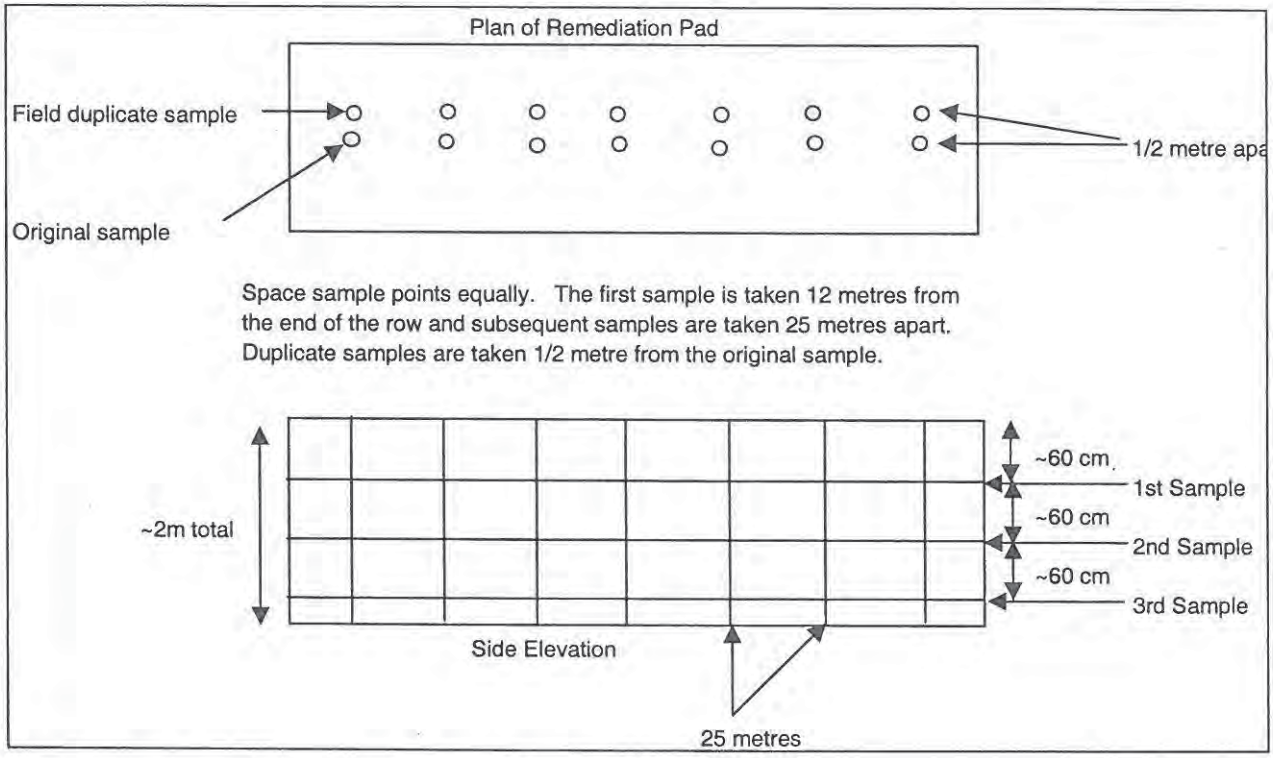
The remediated soil and compost could also be spread over the surrounding paddocks where it would provide some organic enhancement. The existing piles have already been colonised by grasses and these will quickly re-establish in the field. This will enhance further bioremediation and phytoremediation of the any remaining hydrocarbons contaminants in the soil.

Appendix 1

Sampling Protocols Used

Time = 2 Months Sampling Program

In order to determine the variation associated with sampling a large number of samples were taken from Row 1. The following figure details the sample plan was used for sampling Row 1 at Time = 2 months. For Row 1, samples were taken at 7 locations along the windrow, and at three different depths (top, middle and bottom). Field duplicate samples were taken 0.5 m from the original samples. This resulted in a total of 42 samples being collected from Row 1. From each of the other 3 rows, samples were taken from the middle depth and at 3 locations along each row.



Sample Plan used at Time = 2 months.

Further information on how the results of this sampling program were applied during the error analysis is shown in Appendix 2.

Time = 6 Months Sampling Program

The attached sample plan prepared by Trevor Smith (Trelon Pty Ltd), was used during the sampling at Time = 6 months.

Treleon Pty Ltd
ACN 080 080 093
Fax: 03 9459 0770
Mobile: 0417 503 065
Email
trel@ivanhoe.starway.net.au

Memo

To: Leigh Bernoth (Rio Tinto Technology Development)

From: Trevor Smith

CC:

Date: 8/4/98

Re: Sampling to Determine TPH Variation in CFA Remediated Windrows.

This sampling plan has been derived to determine the variation in TPH content both along and down the 4 remediated windrows in the CFA project. The plan has been derived based on 100 assay samples which is the maximum allowable in the allocated budget. An equal number of samples will be taken from each windrow.

Sampling Plan

I recommend that a maximum of 21 samples will be taken be taken from each windrow with the actual number being dependent upon the time at our disposal. Sampling will be uniform across all windrows (ie 2 samples will be taken from each windrow in sequence until the allocated budget has been exhausted or 21 samples have been taken from each windrow). These samples would be taken at 3 depths approximately 20 metres apart with the first sample being taken 15 metres from the end of the windrow. Samples will be taken by CFA backhoe. The backhoe will cut a sample trenches across the windrow at $1/3^{rd}$, $2/3^{rd}$ and bottom of the windrow depth. Five portion grab samples (on a grid pattern) will be taken from every $1/3^{rd}$ backhoe shovel until the entire cross section is sampled. At least 3 backhoe lots will be sampled from each cross section. The total sample weight taken from each shovel will be approximately 2.5 kg. All grab samples from each cross section (7.5kg) will be combined to constitute a sample.

Sample Preparation

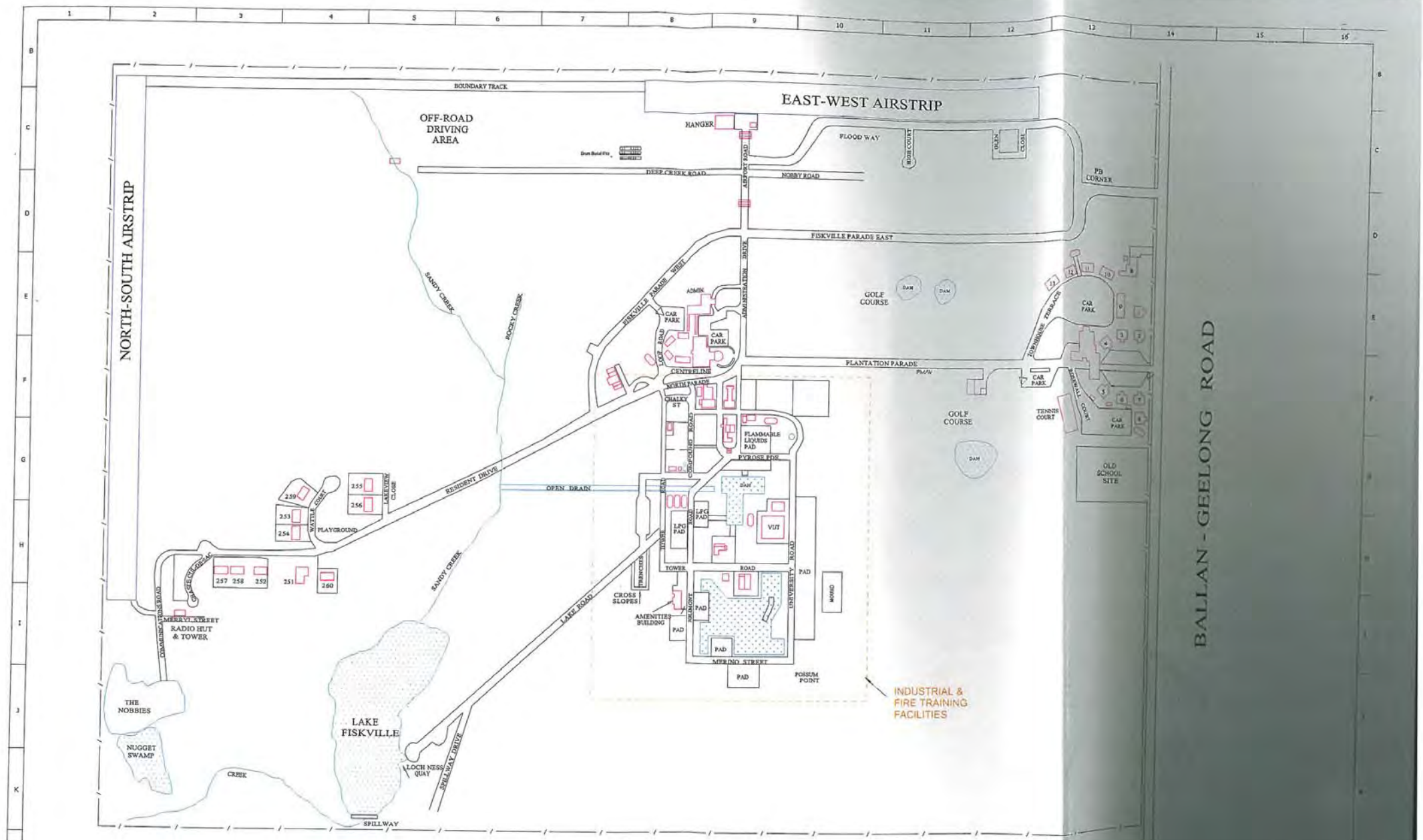
All grab samples from each cross section will be mixed by shovelling in a plastic box (sample tote boxes would be ideal). Sub samples for assay will be removed by the continous shovelling technique and this will be repeated until a 1 kg portion is obtained. This will be returned to Bundoora for further sub sampling to obtain a laboratory portion. Boxes must be cleaned between samples.

Variability Sample
The variability between samples from the same backhoe bucket must be determined. This can be achieved by taking and preparing a sequence of samples, in an identical manner to the routine samples, until the contents of the bucket have diminished or 20 samples have been taken.

Timing and Duration of Sampling
This sampling and sample preparation program will involve 2 people for 2 days (October 6 & 7).

Costs
My charges for this work will be $40/hour plus $130 for the preparation of this plan.

Trevor Smith



Drawn	Checked	Date
SHR	M.L	24 May 99

RIO TINTO

Research & Technology Development

Figure 1. Site Plan.
CFA Training College, Fiskville

Customer: Country Fire Authority

Project: Composting of Hydrocarbon Contaminated Soils at CFA, Fiskville

Project Code: CAV002

File: n:\CAV002...\Figure 1.dwg