File No.4076/95

Hydrogeology Report 1995/46

ASSESSMENT OF PCB CONTAMINATION AT THE BASE OF THE SUPERFICIAL FORMATIONS NEAR A HIGH TEMPERATURE INCINERATOR, WELSHPOOL ROAD PERTH METROPOLITAN AREA

By
P I Manning

Western Australia
Geological Survey
Perth, November 1995

Introduction

An industrial high temperature incinerator located in Felspar Street, is used to dispose of medical waste. In the 1980s however, the facility was also used to dispose of polychlorinated biphenyls (PCBs) derived from a variety of sources throughout the state.

The PCBs were stored at the incinerator site in steel drums prior to their disposal. However sampling (Wilkinson et al 1994) indicated that soils on the site were contaminated with PCBs due to leakage from the drums whilst in storage. Spillage may also have occurred during transfer to the incinerator and during drum wash-down upon completion of the disposal process.

A site characterisation study undertaken by the Geological Survey of Western Australia (GSWA) (Manning 1995) found that PCBs were present in significant concentrations in soil and groundwater both on and off-site. Contamination in soil directly beneath the site has a limited distribution due to the presence of a semi-continuous clay aquitard. Groundwater has been found to contain levels of PCBs in excess of the ANZECC threshold values both above and beneath the aquitard. This suggests that a breach may exist in the clay below the incinerator facility. PCBs were found in Borehole WP 2 at levels above threshold values, but not in other bores drilled through the clay aquitard. This implies that PCBs may have moved down slope under gravity along the contact with the Osborne Formation.

As a result of the study, the GSWA recommended that a number of monitoring bores be located some distance from the incinerator site to define the orientation of the erosional surface at the base of the superficial formations and also, to confirm the direction of groundwater flow and to determine whether the PCBs had moved a significant distance at the base of the superficial formations within groundwater. At the request of the Department of Environmental Protection (DEP) the GSWA undertook to locate and drill a further three monitoring bores to address these issues. This program was completed by 29 September, and the results are presented below.

Methods

Three boreholes were drilled by an independent drilling contractor using a hollow flight auger system. The program was carried out under the supervision of the Department of Minerals and Energy. Each borehole is constructed with 50 mm NB PVC casing with 6 m slotted intervals above the Osborne Formation contact. Sands within each bore were allowed to collapse over the screens to provide a filter medium to enable flow of groundwater through the screens. Cement grout was used to backfill the annulus of the bore to surface to prevent the ingress of other fluids into the hole after completion.

Drilling and sampling was carried out using procedures and decontamination protocols recommended by the US EPA for the investigation of contaminated sites.

Geology

The strata encountered during the course of the investigation were found to consist of generally fine to medium grained sands interbedded with clay bands overlying coarse sands to gravels which comprise the Guildford Clay (Davidson 1995).

Drilling indicates that the blue-grey clay aquitard is absent to the north of the incinerator site. The thick blue-grey clay is replaced in bore WP 28 (Figure 1) by thin stringers of grey sandy clay within a yellow brown sandy clay. In bore WP 29 this horizon is replaced entirely by a yellow brown clayey sand. This would suggest that the Guildford clay is interfingered with a sand unit which is considered to be the Bassendean Sand.

A drilling program run concurrently further to the north-west along Welshpool road, encountered clays with similar properties to the blue-grey clay. This would suggest that this particular clay horizon within the Guildford Clay is semi continuous towards the north-west and gradually pinches out towards the north. The extent of the clay to the north may have been restricted by erosional events which may lead to isolated pans of the clay existing within the profile. Without further investigative work to determine the extent of this clay layer the horizon must be assumed to be a local aquitard only.

The slope of the erosional surface which forms the contact between the superficial formation and the underlying Osborne Formation is generally towards the west (Figure 1). The average slope of the contact was found to be approximate 1 in 75. The contact is steep near the incinerator but flattens out to approximately 1 in 200 towards the west.

Water level readings taken from all the bores drilled during both phases of investigation suggest that there is no significant difference in water levels below the aquitard. It is unlikely that the aquitard (blue-grey clay) affects the groundwater flow in this part of the superficial formation.

Sampling

Selective soil samples were collected from each borehole to determine the extent of the clay aquitard, and the extent of the PCB contamination above the aquitard and at the base of the superficial aquifer. Piezometers were installed at the base of the superficial aquifer to detect any PCB contamination at this surface.

Samples represent a 6 m interval in each bore. Each bore was purged of approximately 200 litres of water to develop the bore and to remove any particulate material remaining in the screens from drilling. Standard practice of removing three casing volumes of water from each bore was followed prior to taking the bailed sample. Groundwater samples were recovered from each monitoring bore using disposable bailers to minimise cross-contamination between each bore.

Results

In total 15 soil samples and 3 groundwater samples were submitted to the Chemistry Centre of Western Australia (CCWA) for analysis. Individual results of the analysis are shown in Appendix 2.

The results indicate that none of the soil samples have detectable levels of PCB where detection limits are recognised at 0.5 mg/kg.

Groundwater samples were analysed for PCBs and organochlorines. The resultant analysis indicated that no appreciable levels of either compound were present in the

samples. Chlordane a commonly used pesticide for the treatment of white ants was found in extremely low concentrations in WP 28 and WP 29 at 16 m and 2.5 m below surface respectively. A gas chromatography and mass spectrometry scan of the three groundwater samples did not identify any other organic compounds.

Analysis of the results obtained from this program suggests that there has been no appreciable movement of PCBs from the incinerator facility along the Osborne Formation.

Conclusions

The lack of contamination in any of the recently drilled bores confirms that PCB contamination is generally restricted to the immediate vicinity of the incinerator site.

References

ANZECC (Australian and New Zealand Environment and Conservation Council) & NHMRC (National Health and Medical Research Council), 1992-Australian and New Zealand guide-lines for the assessment and management of contaminated sites. *ANZECC/NHMRC publication.*

Appleyard, S.J., 1994-Groundwater contamination by PCBs and chlorinated organic compounds at an incinerator site, Felspar Street Welshpool. *GSWA Hydrogeology Report 1994/R14 (unpublished).*

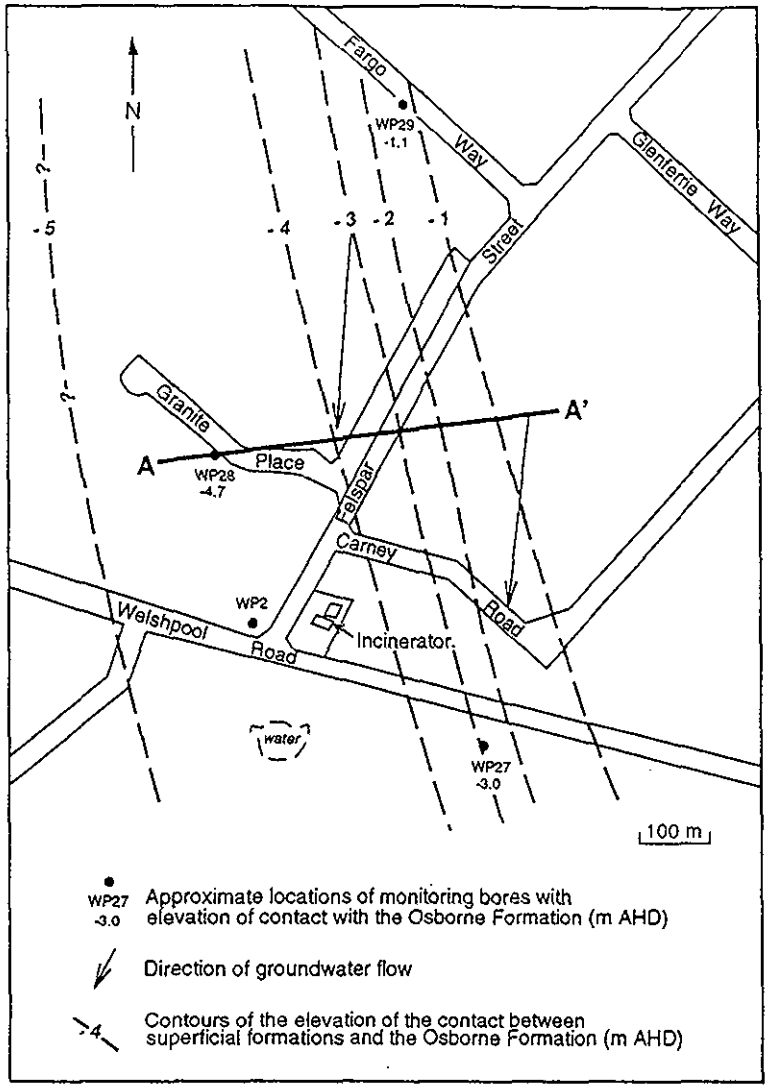
Davidson, W.A., 1995-Hydrogeology and groundwater resources of the Perth Region of Western Australia. *GSWA Bulletin 142.*

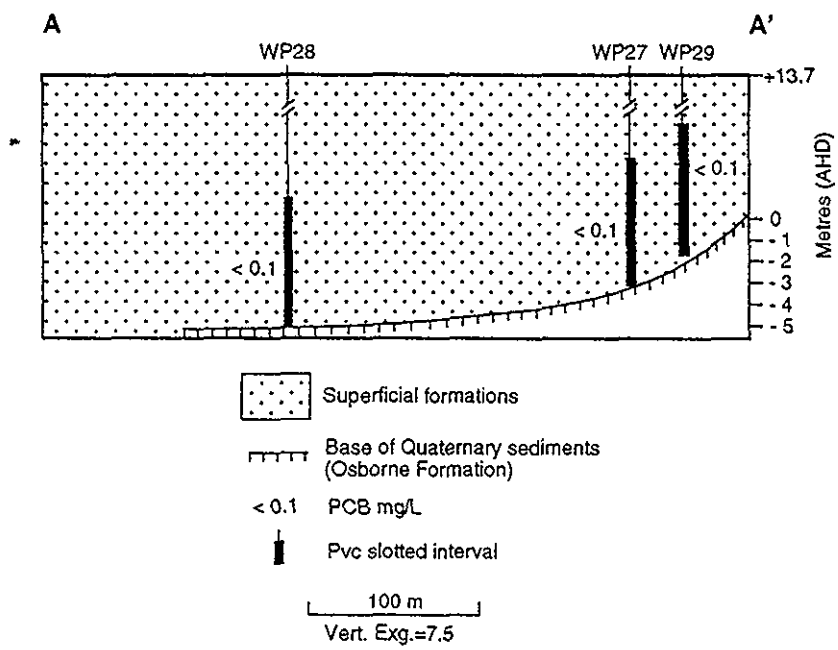
Manning, P.I., 1995-Investigation of PCB contamination in soil and groundwater at an industrial incinerator site, Welshpool Road Perth metropolitan area. *GSWA Hydrogeology Report 1995/36 (unpublished).*

Wilkinson, S.P., McGuire, J., 1994-Investigation of the Stephenson and Ward Incinerator site, corner of Welshpool Road and Felspar Street, Welshpool, August 1994. *CCWA Report 94E393 (unpublished).*

Appendix 1

Borehole completion reports





GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

	INITIAL	DATE
COMP	PIM	10/95
DRAWN	LJC	11/95
APVD	SJA	11/95

SCHEMATIC DIAGRAM OF BORE CONSTRUCTION, TRANSPOSED ONTO SECTION LINE A —A'

MAP INDEX

TO ACCOMPANY 1995 / 46

PIM1

15.11.95

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BORE COMPLETION REPORT

INVESTIGATION OF PCB CONTAMINATION-WELSHPOOL

BORE-SITE: WP 27

LOCATION AND IDENTIFICATION

OWNER:	Department of Environmental Protection	
LOCATION:	On road reserve about 80 m southeast of Incinerator site, Welshpool Road, Welshpool.	
GSWA REF:	N/R 20331 A 1175	
SWRIS REF:	N/R	
MAP SHEET:	1:250 000:	Perth
	1:5000:	BG 34 8.08
AMG REF:	Easting:	403740
	Northing:	6458640
ELEVATION:	Top of casing:	12.721 mAHD
	Natural surface:	12.721 mAHD

CONSTRUCTION

DRILLED BY: J & S Drilling.

METHOD: Hollow stem auger with wireline coring, using bentonite-based mud.

DRILLING: Commenced: 27/9/95
Completed: 27/9/95

DIAMETER: 150 mm nominal.

TOTAL DEPTH: 16.0 m

CASING:

Depth (mbns)	*Type*	*ID (mm)*	*Aperture (mm)*
0-9.7	PVC(class 18)	50	
9.7-15.7	PVC(class 18)	50	1

ANNULUS: Natural sand pack 8.2m to 16 m, backfilled with cement grout to surface.

HEADWORKS: Iron valve cover (gatic cap) cemented flush to ground level, locked (581 key) bung in PVC casing.

GEOLOGICAL DATA

SAMPLES: Core samples from 2.0-2.5 m and 15.0-16.0 m.

LOGGED BY: P M Thorpe (GSWA).

SUMMARY LOG:

Depth (m)	*Lithology*
0.0-0.5	TOPSOIL. Grey quartz sand and organic material.
0.5-2.49	SAND. Pale grey, medium grained, sub-angular quartz sand.
2.49-3.0	CLAY. Grey green sandy clay. Fine to medium grained quartz sand.
3.0-15.5	SAND. Pale grey coarse sand to fine gravel grade, sub-angular to sub-rounded quartz sand. 5% white feldspar grains.
15.5-15.74	CLAYEY SAND. Pale grey green, coarse sand to fine gravel grade, sub-angular to sub-rounded quartz sand with minor pale green clay.
15.74-16.0	CLAY. Dark green grey glauconitic silty clay. Laminated, layers of dark grey green glauconitic clay and pale green quartz silt. *Top of Osborne Formation at 15.7 m (-3.0 m AHD).*

HYDROGEOLOGICAL DATA

Date	Observation interval	Pump rate (L/min)	Water level (mbtc)	Water level (mAHD)
3/10/95	9.7-15.7	6	1.2	11.521

CHEMICAL ANALYSES

Soil samples:

Sample interval	GSWA#	CCWA 95EH0118
2.0-2.5	139708	1
15.5-15.61	139709	2
15.61-15.84	139710	3
15.84-16.0	139711	4

Water samples

GSWA#	139725
Pump blank	N/R
CCWA#	16

GEOPHYSICS

Log Type:	*Date:*
Gamma	N/R
Resistivity	N/R
Conductivity	N/R

File: 4097/95

BORE COMPLETION REPORT

INVESTIGATION OF PCB CONTAMINATION-WELSHPOOL

BORE-SITE: WP 28

LOCATION AND IDENTIFICATION

OWNER:	Department of Environmental Protection	
LOCATION:	Road verge on left hand side of Granite Place approximately 150 m from intersection with Felspar Street	
GSWA REF:	N/R 20331A 1176	
SWRIS REF:	N/R	
MAP SHEET:	1:250 000:	Perth
	1:5000:	BG 34 8.08
AMG REF:	Easting:	402490
	Northing:	6458930
ELEVATION:	Top of casing:	13.788 mAHD
	Natural surface:	13.788 mAHD

CONSTRUCTION

DRILLED BY: J & S Drilling.

METHOD: Hollow stem auger with wireline coring, using bentonite-based mud.

DRILLING: Commenced: 28/9/95
Completed: 28/9/95

DIAMETER: 150 mm nominal.

TOTAL DEPTH: 19.2 m

CASING:

Depth (mbns)	*Type*	*ID (mm)*	*Aperture (mm)*
0-13.2	PVC(class 18)	50	
13.2-19.2	PVC(class 18)	50	1

ANNULUS: Natural sand pack 12 m to 19.2 m, backfilled with cement grout to surface.

HEADWORKS: Iron valve cover (gatic cap) cemented flush to ground level, locked (581 key) bung in PVC casing.

GEOLOGICAL DATA

SAMPLES: Spot cored.

LOGGED BY: P I Manning (GSWA).

SUMMARY LOG:

Depth (m)	*Lithology*
0.0-1.0	FILL
1.0-3.25	SAND slightly clayey, yellow fine grained grading downwards to coarse, sub-rounded, mod sorted
3.25-3.7	SAND clayey, yellow grey firm medium grained sub-rounded change to soft sandy CLAY.
3.7-4.75	CLAY sandy, yellow grey, sub-rounded to occasionally sub angular poorly sorted.
4.75-8.0	SAND, clayey yellow grey mod consolidated firm, medium grained sub-rounded, mod sorted
8.0-16.0	SAND, grey, medium to coarse grained well sorted sub-rounded trace feldspar
16.0-18.5	GRAVELLY SAND, fine approx 3mm, grey white quartz sub-rounded to minor angular grains. Poorly consolidated, loose. 10% feldspar grains, white soft. Gravel size increases with depth to approx 25 mm predominantly quartz
18.5-19.5	CLAY sandy, green firm glauconitic, fine to medium angular grained. *Top Osborne Formation at 18.5 m (-4.7 m AHD).*

HYDROGEOLOGICAL DATA

Date	Observation interval	Pump rate (L/min)	Water level (mbtc)	Water level (mAHD)
3/10/95	13.2-19.2	6	1.72	12.068

CHEMICAL ANALYSES

Soil samples:

Sample interval	GSWA#	CCWA 95EH0118
2.5-3.25	139712	5
3.25-3.6	139713	6
3.6-4.0	139714	7
4.0-4.75	139715	N/A
16-16.5	139716	8
16.5-17.25	139717	9
18.0-18.5	138718	10
18.5-18.75	138719	N/A

Water Samples:

GSWA#	139726
Pump blank	N/R
CCWA#	17

GEOPHYSICS

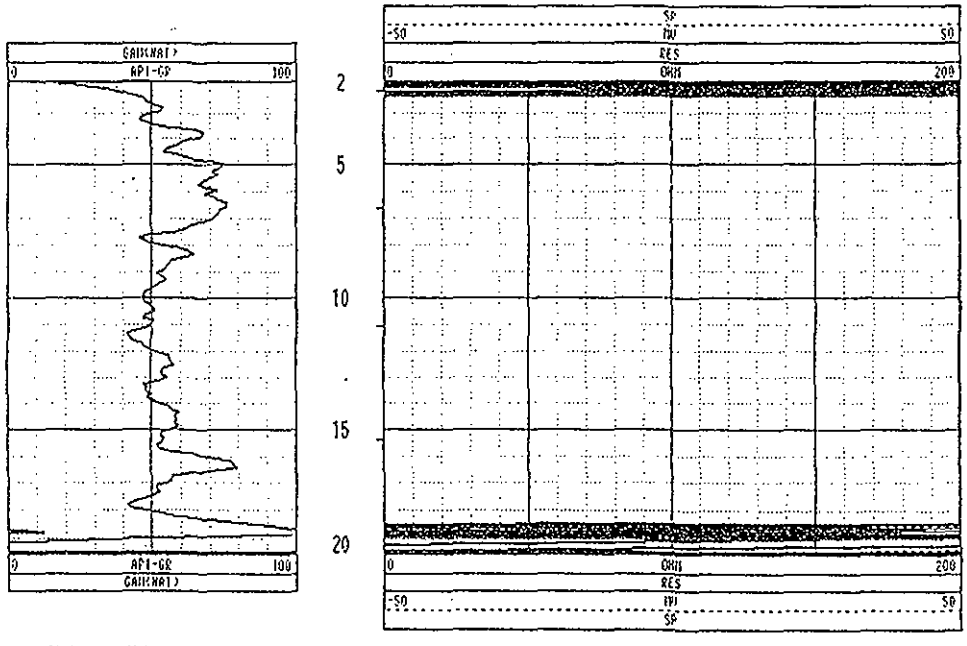
Log Type:	*Date:*
Gamma	10/95
Resistivity	N/R
Conductivity	N/R

Century GEOPHYSICAL CORP.

WP 28

COMPANY	: GSWA			OTHER SERVICES:	
WELL	: WP 28				
LOCATION/FIELD	:				
COUNTY	:				
STATE	: WA				
SECTION	:	TOWNSHIP	: WELSH	RANGE	:
DATE	: 09/17/95	PERMANENT DATUM	:	ELEVATIONS	
DEPTH DRILLER	: 19	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 19.66	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 2.04	DRL MEASURED FROM:		GL	:
CASING DRILLER	:	LOGGING UNIT	: PC3		
CASING TYPE	: PVC	FIELD OFFICE	:		
CASING THICKNESS:		RECORDED BY	: DR		
BIT SIZE	:	BOREHOLE FLUID	:	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: 9060
MATRIX DENSITY	:	RM TEMPERATURE	:	LOG	: 4
FLUID DENSITY	:	MATRIX DELTA T	:	PLOT	: 9060 0
NEUTRON MATRIX	:	FLUID DELTA T	:	THRESH:	2000
REMARKS	:				

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



File: 4097/95

BORE COMPLETION REPORT

INVESTIGATION OF PCB CONTAMINATION-WELSHPOOL

BORE-SITE: WP 29

LOCATION AND IDENTIFICATION

OWNER:	Department of Environmental Protection	
LOCATION:	Road verge on left hand side of Fargo Way (Fargo Way has two road access points from Felspar, this site located on first entry at Welshpool Rd end).	
GSWA REF:	N/R 20342B 1040	
SWRIS REF:	N/R	
MAP SHEET:	1:250 000	Perth
	1:5000	BG 34 8.08
AMG REF:	Easting	403690
	Northing	6459240
ELEVATION:	Top of casing:	14.936 mAHD
	Natural surface:	14.936 mAHD

CONSTRUCTION

DRILLED BY: J & S Drilling.

METHOD: Hollow stem auger with wireline coring, using bentonite-based mud.

DRILLING: Commenced: 29/9/95
Completed: 29/9/95

DIAMETER 150 mm nominal.

TOTAL DEPTH: 16.85 m

CASING:

Depth (mbns)	*Type*	*ID (mm)*	*Aperture (mm)*
0-10.0	PVC(class 18)	50	
10.0-16.0	PVC(class 18)	50	1

ANNULUS: Natural sand pack 9.0 m to 16.0 m, backfilled with cement grout to surface.

HEADWORKS: Iron valve cover (gatic cap) cemented flush to ground level, locked (581 key) bung in PVC casing.

GEOLOGICAL DATA

SAMPLES: Spot cored.

LOGGED BY: P I Manning (GSWA).

SUMMARY LOG:

Depth (m)	*Lithology*
0.0-0.5	FILL
0.5-2.0	SAND slightly clayey, grey fine grained grading downwards to medium, sub-rounded, mod sorted 5% fines at silt size
2.0-4.0	SAND clayey, yellow grey firm medium grained sub-rounded thin bands of dark brown silty sand. Changes to coarser sand between 3.75 and 4.0 m
4.0-5.5	SAND, grey-white medium to coarse grained rounded, poorly sorted
5.5-8.0	SAND/GRAVEL, grey coarse grained well sorted in two fractions, sands sub-rounded mod sorted, gravels 3 mm to 8 mm rounded.
8.0-16.1	GRAVEL sandy, generally to approx 3mm, grey white quartz rounded occasionally angular sand grains. 3% feldspar grains, white soft.
16.1-16.85	SAND gravelly, fine to medium angular grained. Micas and feldspars to approx 2 mm. Fragments of hard oxidised sandy siltstone with occasionally glauconite. *Top of Osborne Formation at 16.1 m (-1.16 m AHD).*

HYDROGEOLOGICAL DATA

Date	Observation interval	Pump rate (L/min)	Water level (mbtc)	Water level (mAHD)
3/10/95	10.0-16.0	6	2.2	12.736

CHEMICAL ANALYSES

Soil samples:

Sample interval	GSWA#	CCWA 95EH0118
2.5-3.25	139720	11
3.25-4.0	139721	12
4.75-5.5	139722	13
16.0-16.75	139724	15
16.75-16.85	138723	14

Water Samples:

GSWA#	139727
Pump blank	N/R
CCWA#	18

GEOPHYSICS

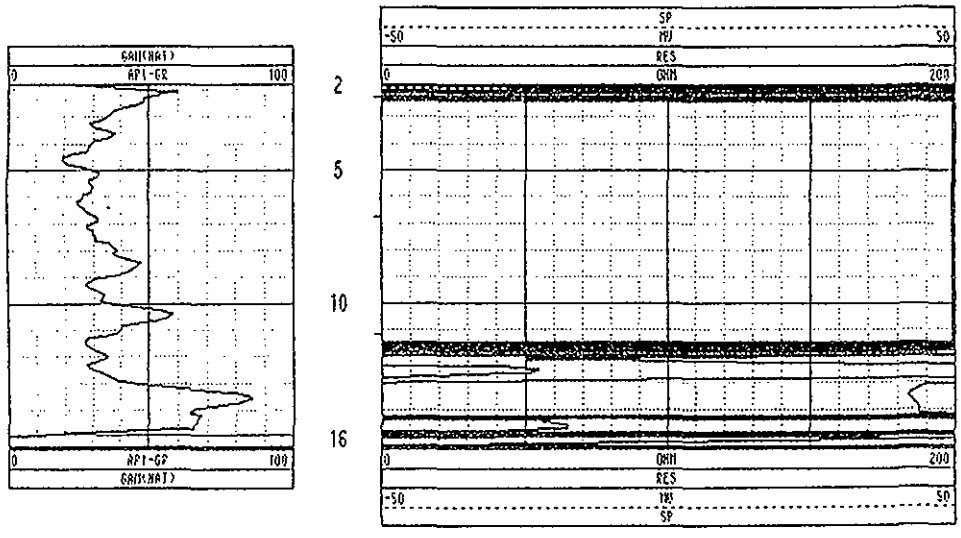
Log Type:	*Date:*
Gamma	10/95
Resistivity	N/R
Conductivity	N/R

Century GEOPHYSICAL CORP.

WP 29

COMPANY	: GSHA			OTHER SERVICES:	
WELL	: WP 29				
LOCATION/FIELD	:				
COUNTY	:				
STATE	: WA				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 09/17/95	PERMANENT DATUM	:	ELEVATIONS	
DEPTH DRILLER	: 17	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 15.59	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 2.04	DRL MEASURED FROM:		GL	:
CASING DRILLER	:	LOGGING UNIT	: PC3		
CASING TYPE	: PVC	FIELD OFFICE	:		
CASING THICKNESS:		RECORDED BY	: DR		
BIT SIZE	:	BOREHOLE FLUID	: /	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: 90600
MATRIX DENSITY	:	RM TEMPERATURE	:	LOG	: 1
FLUID DENSITY	:	MATRIX DELTA T	:	PLOT	: 90600 0
NEUTRON MATRIX	:	FLUID DELTA T	:	THRESH:	2000
REMARKS	:				

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



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Appendix 2

Geochemical results

Stephenson&Ward
95EH0118
SP Wilkinson
222 3021

Department of Environmental Protection
141 St George's Tce
Perth WA 6000

ATTENTION: Dr. Paul Vogel

REPORT OF EXAMINATION OF: 15 samples of soil, 3 samples of water
MARKED: as below
RECEIVED FROM: P.Manning/GSWA
ON: 3-Oct-1995

RESULTS
PCBs and OCs

Lab No 95EH0118	GSWA No	PCB (Arochlor 1260)	Total Chlordane
Soil		mg/Kg	mg/Kg
1	13708	<0.05	<0.005
2	13709	<0.05	<0.005
3	13710	<0.05	<0.005
4	13711	<0.05	<0.005
5	13712	<0.05	<0.005
6	13713	<0.05	<0.005
7	13714	<0.05	<0.005
8	13716	<0.05	0.08
9	13717	<0.05	<0.005
10	13718	<0.05	<0.005
11	13720	<0.05	0.04
12	13721	<0.05	<0.005
13	13722	<0.05	<0.005
14	13723	<0.05	<0.005
15	13724	<0.05	<0.005
Water		ug/L	ug/L
16	13725	0.02	<0.005
17	13726	<0.02	<0.005
18	13727	<0.02	<0.005

Organic Scan
No other organics were detected.

METHOD

PCB, OC: Solvent extraction followed by Gas Chromatography with Electron Capture detection.
Organic Scan: Solid Phase Microextraction- Gas Chromatography/Mass Spectrometry

Dr. S.P.Wilkinson
Principal Chemist
Environmental Chemistry Laboratory
24 October, 1995

D.Hide
Chemist & Research Officer