

**APPENDIX D**

**Glossary**

**Abiotic**

Not involving biological activity. A term used to describe chemical degradation processes.

**Absorption**

Chemical assimilation or incorporation of liquids in solids or gases in liquids.

**Accuracy**

Degree of agreement between a measured value and a true or expected value.

**Adsorption**

The attraction and adhesion of a layer of ions from an aqueous solution to the solid surface with which it is in contact.

**Advection**

The process by which solutes are transported by the motion of flowing groundwater.

**Aerobic**

Environment where oxygen is present.

**AHD**

Australian Height Datum - a standard reference point for the elevation of a location.

**Anaerobic**

Reducing environment or without oxygen.

**Aqueous Phase**

Contaminants dissolved in water

**Aquifer**

An underground geological formation that contains water and is capable of yielding water to a well or spring; a water bearing formation.

**Aquitard**

A low permeability unit that can store groundwater and also transmit it slowly from one aquifer to another.

**Attenuation**

The removal or reduction of contaminants in groundwater with time and with distance travelled.

**Biodegradation**

The breaking down of compounds by biological processes including microorganism activity.

**Biotic**

Involving biological activity.

**Bioremediation**

Removal of in situ organic contamination by utilising naturally occurring or specifically engineered or introduced bacteria.

**Biotransformation**

Structural alteration of a chemical by an organism. In regard to organic compounds, it refers primarily to their decomposition by micro-organisms.

**BIP**

Botany Industrial Park

**Block 1**

The portion of the parcel of land known as Orica Southlands located to the east of Springvale Drain.

**Block 2**

The portion of the parcel of land known as Orica Southlands located to the west of Springvale Drain.

**Bore/Borehole**

An uncased well drill hole.

**Bore Log**

See - Geological Log

**Botany Groundwater Cleanup (BGC) Project**

The project to hydraulically contain and treat CHC contaminated groundwater in a Groundwater Treatment Plant (GTP) on BIP, and its associated infrastructure requirements, including groundwater extraction, effluent disposal and treated water distribution.

**Botany Sands**

The stratigraphic name given to unconsolidated sediments comprised predominantly of sand which underlie the Orica Plant site and adjoining areas.

**BP**

See Bundle Piezometer

**BTEX**

BTEX is an acronym for benzene, toluene, ethylbenzene, and xylene

**Bundle Piezometer**

A cluster of narrow diameter piezometers with very short screens at different depths in the same hole.

**CAP**

ChlorAlkali Plant – located in the south-eastern portion of Botany Industrial Park.

**CPWE**

Car Park Waste Encapsulation – located in the northern portion of Botany Industrial Park.

**Central EDC Plume**

Plume inferred to originate from the EDC storage tanks.

**CFM**

Trichloromethane (Chloroform)

**Chain-of-Custody**

Procedure to ensure that samples are traceable from the sample collection through to laboratory analysis and reporting.

**CHC**

Chlorinated Hydrocarbon

**Chemical Reduction**

Degradation of chemicals in an oxygen deficient environment.

**CTC**

Tetrachloromethane (Carbon Tetrachloride)

**1,2-DCB**

1,2-Dichlorobenzene

**1,3-DCB**

1,3-Dichlorobenzene

**1,4-DCB**

1,4-Dichlorobenzene

**Dehalogenation**

Selective removal of halogen (fluorine, chlorine, bromine and iodine) molecules

**Density**

The mass or quantity of a substance per unit volume.

**Diffusion**

The process by which both ionic and molecular species dissolved in water move from areas of higher concentration to areas of lower concentrations.

**Desorption**

Reverse of Adsorption, (ion movement from solid phase to aqueous)

**Dispersion**

The phenomenon by which a solute in flowing groundwater is mixed with uncontaminated water and becomes reduced in concentration. Dispersion is caused by both differences in the velocity that the water travels at the pore level and differences in the rate at which it travels through different strata in the flow path.

**Dissolution**

The process of dissolving DNAPL into the aqueous phase.

**Dissolved Phase**

See Aqueous Phase

**Distribution Coefficient**

The slope of a linear isotherm (Freundlich Isotherm). A numerical parameter used to quantify the ability of compounds in solution to be adsorbed onto the surface of solid particles e.g. soils, organic matter etc.

**DNAPL**

Dense Non-Aqueous Phase Liquid - an organic chemical or mixture of organic chemicals that does not readily mix with water and is heavier than water.

**DNAPL Ribbons**

Cloth impregnated with hydrophobic dye, used to determine the presence of DNAPL.

**DNAPL Source Zones**

Zones where residual or free phase DNAPL is present

**Drawdown**

A lowering of the water table of an unconfined aquifer or the potentiometric surface of a confined aquifer caused by pumping from wells.

**DQOs**

Data Quality Objectives

**EC – Electrical Conductivity**

Electrical Conductivity – A measure of the conductance of water which is general an indication of the salinity – see TDS.

**EDC**

1,2-Dichloroethane (Ethylene Dichloride), an intermediate compound in the production of vinyl chloride.

**EDC Lights**

A waste stream from distillation of EDC, more volatile than pure EDC.

**EDC Heavies**

A waste stream from distillation of EDC, less volatile than pure EDC.

**EDC Tars**

A waste stream from distillation of EDC Heavies, less volatile than EDC Heavies.

**Equipotential**

A line in a two-dimensional groundwater flow field such that the total hydraulic heads are equal for all points along the line.

**Extraction Well**

A well installed to enable in-situ groundwater remediation by the extraction of groundwater. Extraction wells assist in the control of a migrating plume.

**Extraction Pump**

Pump associated with extraction well system.

**FCAP**

Former **ChlorAlkali Plant** – operated 1944-2001 using mercury cells to produce chlorine, caustic soda and hydrogen; located in the south-eastern portion of Botany Industrial Park.

**Field Duplicates**

These are a set of two discrete samples collected from the one sampling point. The sample is prepared in the field by splitting a field sample, then submitting both to either the same laboratory (inter-laboratory duplicates) or a different laboratory (inter laboratory duplicate) as two independent samples, which are labelled as two discrete locations, the duplicate sample having no reference to the primary sample.

**Flow Net**

A set of intersecting equipotential lines and flowlines representing two-dimensional steady state flow through a porous media.

**Flow Path**

The direction in which groundwater is moving.

**Free Phase DNAPL**

DNAPL saturation exceeding the capillary pressure of the soil.

**FSRIB**

Full Scale Reactive Iron Barrier

**GC/MS**

Gas Chromatograph/Mass Spectrometer - Instruments for the measurement of concentrations of organic compounds in soil and water.

**GCP**

Groundwater **Clean-up Plan** – Plan prepared in response to Notice of Clean Up Action (NCUA).

**Geology**

The study of the earth as a whole, its origin, structure, composition and history, and the nature of the processes which have given rise to its present state.

**GTP**

Groundwater Treatment Plant- A chemical treatment plant required to be constructed for the ex situ treatment of groundwater from hydraulic containment as required by the Notice of Clean Up Action (NCUA).

**Geological Log**

A record of the lithology or stratigraphy of the rock or soil encountered in a borehole.

**Gradient**

The rate of inclination of a slope. The degree of deviation from the horizontal.

**Groundwater**

Water beneath ground surface.

**Groundwater Extraction Exclusion Area (formerly Groundwater Protection Zone 1)**

Area of groundwater as defined by DIPNR, during August 2003, for which there is an exclusion on the extraction of groundwater except for remediation purposes.

**HCB**

Hexachlorobenzene

**HCBD**

Hexachlorobuta-1,3-diene

**HCE**

Hexachloroethane

**Heavy Ends**

Waste stream from solvent manufacturing, which includes HCB, HCBD and HCE.

**Hydraulic Conductivity**

A coefficient of proportionality describing the rate at which water can move through a permeable medium.

**Hydraulic Containment**

Measures taken to lower the potentiometric surface and/or water table and effect hydraulic capture of the contaminant plume (as defined in the NCUA).

**Hydrogeology**

The study of the interrelationships of geological materials and processes with water, especially groundwater.

**Hydrology**

The study of the occurrence, distribution and chemistry of all waters of the earth.

**Hydrolysis**

A chemical reaction where water molecules react with organic compounds. With chlorinated organic compounds a by-product is hydrochloric acid, which will lower the pH of water.

**Flow Lines**

Direction of groundwater flow.

**Hydraulic Gradient**

The change in total head in an aquifer with the change in distance in a given direction.

**Hydrocarbon**

Organic chemicals such as benzene or tetrachloroethene that contain atoms of carbon and hydrogen.

**Hydrostratigraphic Unit**

A formation, part of a formation, or a group of formations in which there are similar hydrologic characteristics.

**Inorganic**

A chemical substance that does not contain carbon.

**In Situ Pore Fluids**

Water occupying the volume between mineral grains in a porous medium.

**Isomers**

Compounds whose molecules have the same overall composition but different structures.

 **$K_{oc}$** 

Organic carbon partition coefficient. A parameter that can be used to estimate the mass of an organic compound that will adsorb to organic carbon in the ground.

**Laboratory Control Sample**

Samples prepared by the laboratory by spiking an aliquot of appropriate clean matrix reagent with known concentrations of specific analytes. The control sample is then analysed and the results are used to assess the laboratory performance on sample preparation and analysis procedure.

**Laboratory Duplicate**

These are prepared within the laboratory by dividing a field sample into two samples and analysing separately.

**LAT**

Lowest Astronomical Tide.

**Lithology**

The geological (physical) character of a rock or soil.

**LOR**

Limit of Reporting. The lowest concentration that an analytical laboratory can report for an analyte with a sufficient degree of confidence. Also commonly referred to as the detection limit.

**Matrix Spike/Matrix Spike Duplicate**

Samples prepared by the laboratory in duplicate by individually spiking two aliquots of a field sample with known concentrations of specific target analytes. The matrix spike and matrix spike duplicate samples were then analysed and subsequently, the results used to assess the effects of the sample matrix on the accuracy and precision of analyses.

**Microgram ( $\mu\text{g}$ )**

One thousandth part of a milligram (mg) one millionth part of a gram (g); one billionth part of a kilogram (kg).

**Migration**

The movement of materials (e.g.. water, gas or contaminants in soil) from one location to another.

**Monitoring Well**

A well installed to routinely observe groundwater levels or to systematically collect water samples and analyse these for chemical pollution.

**Multilevel Piezometer**

See - Bundle Piezometer

**NAPL**

Non-Aqueous Phase Liquid - An organic chemical or mixture of organic chemicals that does not readily mix with water.

**NCUA**

Notice of Clean Up Action – Notice issued by the NSW Environment Protection Authority under Section 91 of the Protection of the Environment Operations Act 1997. The notice (No. 1030236) was issued on 26 September 2003.

**Northern Plumes**

Plumes inferred to originate from sources located at the northern end of the Orica plant site.

**Oil/water Interface Probe**

Monitoring instrument used to obtain accurate measurements of product thickness in monitoring wells. Commonly used for LNAPLs and DNAPLs.

**Organic Compound**

A carbon containing compound.

**PCA**

Primary Containment Area – Block 2 Southlands

**PCE**

Tetrachloroethene (Perchloroethene)

**Peristaltic Pump**

A pump that can be used for purging and sampling of monitoring wells and bundle piezometers.

**Piezometer**

A well with a short slotted screen for measuring a potentiometric surface or elevation of the water table.

**Plume**

A mass of contaminated water extending outward from the source of the contamination.

**Plume Axis**

Inferred centre line of a dissolved phase groundwater contamination.

**Porosity**

The ratio of the volume of void spaces in a rock or sediment to the total volume of the rock or sediment.

**Potentiometric Surface**

An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a well.

**Precision**

The degree to which a measurement is reproducible.

**Primary Containment Area**

The primary containment area is defined in the NCUA as Block 2 of Orica Southlands.

**Pure Phase Solubility**

Aqueous solubility of a single organic compound.

**Recharge**

Replenishment of an aquifer by a natural process such as addition of water at the ground surface, or by an artificial system such as addition through a well.

**Recovery Test/ Recovery Trial**

Hydraulic test performed on a monitoring well which measures the rate at which the water level rises in the well after pumping has ceased.

**Residual Saturation**

The term given to DNAPL that is trapped in a pore space by capillary forces. Once the residual saturation has been exceeded it is then termed free phase DNAPL.

**Retardation**

A term used for the adsorption of contaminants in the aquifer that results in the plume front travelling more slowly than the rate of the groundwater flow.

**Rinsate Blank**

Type of field blank used to check specifically for cross-contamination from reuse of the sampling equipment.

**Saturated Zone**

An underground geologic formation in which the pore spaces or interstitial spaces in the formation are filled with water under pressure equal to or greater than atmospheric pressure.

**Screen**

Perforation in a well casing and usually located near the bottom of the well or at selected depths to tap perched aquifers.

**SCA**

**Secondary Containment Area** - The area defined in the NCUA as "the location where the EPA approved contaminant containment works upgradient of Botany Bay and Penrhyn Estuary, for the interception and containment of contaminant plumes that have migrated or may migrate beyond the primary containment area, are carried out".

**Semi-volatile Compound**

An organic compound which has a low potential to form a vapour at room temperature.

**SIM**

Selective Ion Mode



**Solubility Limits**

Maximum concentration at which an organic contaminant will dissolve in the aqueous phase.

**Sorption**

See Absorption and Adsorption.

**Southern Plumes**

Plumes inferred to be emanating from the southern part of the plant site, in particular Southlands.

**Southlands**

A parcel of land that is bisected by Springvale Drain and lies to the west of the Orica Plant site. Orica purchased the land from Australian Paper Manufacturers (APM) in 1980.

**Stratigraphy**

The study of rock and soil strata, especially their distribution, deposition and age.

**Surrogate Compound**

A compound that is introduced into a sample at a known concentration and is used as a system monitoring compound to assess the performance of individual organic analyses.

**Surrogate Spike**

System monitoring compounds used to assess the performance of the individual analyses. Compounds are spiked into all sample aliquots then undergo normal extraction and analysis procedures. Percent recoveries are calculated for each surrogate, providing an indication of the analytical accuracy.

**1,1,2,2-TeCA**

1,1,2,2-Tetrachloroethane

**1,1,2-TCA**

1,1,2-Trichloroethane

**1,2,4-TCB**

1,2,4-Trichlorobenzene

**1,2,4,5-TeCB**

1,2,4,5-Tetrachlorobenzene

**TCE**

Trichloroethene

**TDS**

Total Dissolved Solids - A basic measure of water quality (salinity), which refers to the amount of solids that remain when a water sample is evaporated to dryness.

**Trip Blank**

Type of field blank used to check if samples have been cross-contaminated with volatile contaminants during handling and transit between the field and laboratory. A trip spike typically comprises a sample of deionised water supplied by the laboratory in a laboratory sample bottle.

**TOC**

Total Organic Carbon.

**Topography**

The relief and contour of the land surface.

**TPH**

See Petroleum Hydrocarbons.

**Transmissivity**

The transmission rate of water (based on a unit width of an aquifer) relative to a hydraulic gradient.

***Unconfined Aquifer***

An aquifer whose upper level can extend to ground surface.

***Unsaturated Zone***

The area between ground surface and the underground water table. Interstitial spaces in this zone contain moisture (water) and air.

***VC***

Vinyl Chloride (Chloroethene)

***VFAs***

Volatile Fatty Acids

***VOC Scan***

Volatile Organic Compound analytical scan.

***Volatile Compound***

Chemical with sufficiently low vapour pressure to become a gas at room temperature.