APPLICATION SITE REPORT

FOR PPC APPLICATION

Kronospan Limited, Chirk

June 2004

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Summary

This Document represents the Site Report submitted as part of an application to the Environment Agency and Wrexham County Borough Council (Reference Number WCBC/IPPC/03/Kr) by Kronospan Ltd for a permit to operate an installation under Regulation 10 of the Pollution Prevention and Control (England and Wales) Regulations 2000.

Records of the site and surrounding areas have been reviewed along with the operational site records in order to describe the condition of the site and, in particular, to identify any substance in, on or under the land that may constitute a pollution risk to the land. Pollution prevention measures have been identified and an assessment of pollution potential to land has been undertaken.

1.0 Introduction

This assessment has been commissioned by Kronospan Ltd, Chirk, Wrexham, in support of their PPC application.

Kronospan is one of the UK's leading manufacturers of wood-based panels, laminated flooring and other related products for the furniture and building industries along with the DIY sector. Annual production of chipboard and MDF is in excess of 1 million m^3 and uses 1.2 million tonnes of timber every year from renewable sources. Of this, 30% is recycled timber.

1.1 Site Location

The installation is located on Holyhead Road at Chirk, near Wrexham in Denbighshire. The centre of the installation is at approximate National Grid Reference 328750, 338250. The installation covers an area of approximately 40 Ha as shown in Figures A1.1 and A1.2 of Appendix A1.

The installation is bounded by Holyhead Road to the east, and the Shrewsbury to Wrexham railway line to the west. To the north of the installation is a municipal sewage treatment works with an area of farmland beyond. To the south, the installation is bordered by a sports recreation ground, farmland and a small factory which processes cocoa beans for chocolate production.

Features of note in the vicinity of the installation include the Shropshire Union Canal, which passes through a small area of woodland beyond the railway line to the west, and the Afon Bradley small surface water course located to the north-west. To the east beyond Holyhead Road is a residential area, which also incorporates shops, schools and other public buildings. A small industrial estate is located to the south west of the installation on the other side of the railway line. A golf course is located on the western side of the canal.

The installation is approximately 100m above sea level and is generally flat with a slight rise towards the south of the installation. The area to the east is also fairly flat, with the adjacent village at a similar elevation, though beyond this the land rises gently. To the west the land slopes upwards beyond the canal to a range of hills over 300m in elevation.

1.2 Details of Installation

Kronospan Ltd's site in Chirk is part of a privately-owned international group which has production facilities throughout Europe and Asia and is a large producer of wood panels and associated products.

The principal products manufactured on the Chirk site include chipboard, medium density fibreboard (MDF), melamine-faced board and sawn timber for the furniture, construction and DIY industries.

For the purposes of the description of the various process areas within the installation and for enhanced simplicity, the installation has been sub-divided up into a number of smaller areas, based on differing uses of each area and the processes carried out within them.

The areas referred to are as follows, with their locations and indicative boundaries outlined on Figure A1.2 of Appendix A1.

1.2.1 (Area A) Main entrance, main car park, reception building and central offices

This area of the installation is not directly involved in any of the manufacturing processes and is the 'front of house'. Located principally in the south eastern corner of the installation at the main entrance, this area of the installation also includes a large area of car parking which is used by staff and visitors, and also for the temporary storage of haulage vehicles used for the delivery of raw material and the collection of finished product.

This area is shown in detail in Figure A3.1 in Appendix A3.

1.2.2 (Area B) Warehousing areas, loading areas, weighbridge, and external timber product storage areas

Much of the southern section of the installation is dominated by warehousing, where the packaged finished products are stored prior to distribution. There is also a supplementary external storage area where sawn timber products are stored prior to distribution.

Also included in this area is the weighbridge at the south east entrance to the installation and a number of loading platforms within the warehousing area.

This area is shown in detail in Figure A3.2 in Appendix A3.

1.2.3 (Area C) External surplus plant storage areas

There were several areas of the installation which are used for the uncontrolled external storage of items of new and used plant (including, for example, machine parts and fittings). These areas are not specifically designated for this purpose and are not subject to any sorting or regular clearing.

This area is shown in detail in Figure A3.3 in Appendix A3.

1.2.4 (Area D) Contractor's compounds

There were two areas of contractor's compounds noted during the site reconnaissance visit. These compounds are used as temporary accommodation for plant and personnel carrying out construction and maintenance activities across the plant. The layout of these areas will change depending on the occupants and their activities. At the time of the site visit these areas contained temporary accommodation, storage containers, construction materials and waste skips.

This area is shown in detail in Figure A3.4 in Appendix A3.

1.2.5 (Area E) MDF and chipboard production and finishing lines

This area incorporates a large portion of the main building and houses several production lines used to produce chipboard and Medium Density Fibreboard (MDF). The process involves the pressing of the wood fibres or chips combined with resin under high temperature and pressure. Following pressing, the boards are also cut and sanded to specified sizes and packed for distribution.

This area is shown in detail in Figure A3.5 in Appendix A3.

1.2.6 (Area F) Resin manufacturing plant and urea storage

Resin is manufactured in Kronospan's on-site manufacturing facility from formaldehyde, urea, melamine and other additives. This product is used for coreboard manufacture and paper impregnation. Urea is stored in powdered form in this area, with liquid materials supplied via overhead pipelines from storage tanks in the nearby central roadway area.

This area is shown in detail in Figure A3.6 in Appendix A3.

1.2.7 (Area G) Paper impregnation plant

There are four paper impregnation lines in which raw paper is impregnated with the internally produced resin, dried and cut to size.

This area also includes a water treatment plant to recycle water used in the MDF production process.

This area is shown in detail in Figure A3.7 in Appendix A3.

1.2.8 (Area H) Central roadway area

The central roadway divides the main warehouse/production building along an east-west axis. This area incorporates the adjacent welfare facilities, boiler houses, plant rooms and a number of large storage tanks.

This area is shown in detail in Figure A3.8 in Appendix A3.

1.2.9 (Area I) Pre-production area (wood chip sorting/washing/filtering)

Woodchips, sawdust and recycled fibres are cleaned, screened for non-wood debris, sorted by size, dried, and then stored in silos.

This area is shown in detail in Figure A3.9 in Appendix A3.

1.2.10 (Area J) Saw mill, hacker plant, chipper, Gannon Grindmaster, log sorting

In the saw mill the roundwood is debarked and then cut to size for use as low grade rough wood raw timber.

The hacker plant is where virgin timber is chopped into smaller pieces prior to washing, sorting and feeding into the chipboard and MDF manufacturing process.

The chipper is similar to the hacker, but also includes a debarking step, producing clean chips for MDF only.

The Gannon Grindmaster processes reject MDF and chipboard for reprocessing either as raw material or as boiler fuel.

The log sorter is a processing line for sorting logs into piles of similar size to aid the plant in distributing the logs to appropriate stockpile.

This area is shown in detail in Figure A3.10 in Appendix A3.

1.2.11 (Area K) Formalin plant and raw material processing

The formalin plant is used to produce one of the component parts in the resin-making process. The process converts methanol to formaldehyde which is then used internally in the resin-making facility. The formalin production areas are regulated Part A processes. The facility incorporates a reactor/process area, and a loading area with large storage tanks which hold methanol and the finished formalin product.

The formalin plant is located centrally within the installation adjacent to the log yard.

This area is shown in detail in Figure A3.11 in Appendix A3.

1.2.12 (Area L) Gas plant, water abstraction and storage areas

This small area of the installation is located immediately west of the formalin plant and is the location of two Liquified Petroleum Gas (LPG) storage tanks used to fuel the smaller vehicles used in the warehousing section of the operation. These storage tanks are located above ground. Adjacent to the tanks is a compound housing apparatus connected with the natural gas supply to the installation.

This area is also the location of several tanks where water is temporarily stored for use in the various industrial processes. One of the installation's groundwater abstraction wells is located on the east side of the formalin plant.

This area is shown in detail in Figure A3.12 in Appendix A3.

1.2.13 (M) Railway siding

A railway siding is located in the centre of the installation, bisecting the log yard. It has been zoned separately from the log yard as the potential types of contamination associated with this land use are distinct from the remainder of the surrounding log storage area. The siding links to the main Chester railway line which runs along the western boundary and is used for the import and export of goods.

This area is shown in detail in Figure A3.13 in Appendix A3.

1.2.14 (N) Kronoplus processing building

This building houses production lines and storage associated with the manufacture of laminated flooring and kitchen worktops. Adjacent to this facility is a loading area and a dust extraction plant.

This area is shown in detail in Figure A3.14 in Appendix A3.

1.2.15 (O) Garages and Mechanical workshop areas

This area houses workshops for maintenance of mobile plant. Included in this area is a tank farm providing storage for lubricants, hydraulic oils and fuel oils to serve an adjacent fuelling point. A bunded compound houses lubricant oils stored in drums and Integrated Bulk Containers (IBCs) on racking, with further material storage provided by tall racking.

This area is shown in detail in Figure A3.15 in Appendix A3.

1.2.16 (P) Surface water lagoons

Surface water drainage from roads, hardstanding and building roofs across the installation is discharged into the 'active' lagoon of capacity 2500 m3. Generally this water is recycled to be used to top up sprinkler tanks or for use as process water.

The 'inactive' lagoon, also of capacity 2500 m3, is used to store water, either for recycling, or if there is an excess, for discharge to the Afon Bradley, subject to its meeting consent conditions. If the water in the 'inactive' lagoon does not meet discharge consent and cannot be reused on-site, then it is treated to bring it back into consent before discharge.

This area is shown in detail in Figure A3.16 in Appendix A3.

1.2.17 (Q) Log yard

Approximately 1,250,000 tonnes of wood (roundwood, slabwood, wagon chips and recycled fibres) are received into the log yard per year. For the purposes of this assessment, the log yard area applies to the wood storage areas only, but does not include any pre-processing plant such as the log hacker or saw mill.

This area is shown in detail in Figure A3.17 in Appendix A3.

1.2.18 (R) Roadways and transportation routes

This area incorporates roadways that transverse the installation and associated pavements, verges and landscaped areas.

This area is shown in detail in Figure A3.18 in Appendix A3.

2.0 Objectives

The objectives of this report are:

To satisfy the requirements of the PPC Regulations at time of permitting by:

- Identifying the environmental setting and land pollution history of the site;
- Identifying activities that will be conducted at the installation that may lead to land pollution;
- Identifying and assess the preventative measures that are in place to protect the land; and
- Assessing whether there is:

  1. little likelihood that land pollution or leaks to land will occur during the future life of the installation;

  or there is:

  2. a reasonable possibility that there is potential for current or future land pollution of the land from the installation.

3.0 Site Setting and Sources of Desk Study Information

3.1 Introduction

The following sections detail the sources of desk study information reviewed in order to identify the condition of the installation and, in particular, to determine the potential for substances to be present in, on or under the land associated with present and past uses of the site and its surrounding areas.

3.2 Environmental Consents, Licences, Authorisations, Permits and Designations for the Site and Surrounding Area

3.2.1 Envirocheck Report and Regulatory Bodies

A Landmark Envirocheck report was obtained for the installation area and is included in Appendix C1. This report contains information provided by the Environment Agency (EA) in relation to any discharge consents, waste management licences, abstraction licenses, IPC Authorisations, PPC Permits, land drainage consents and any other relevant permits for the installation and within 500m of the installation boundary.

Discharge consents

There is one current surface water discharge consent for the installation, allowing discharge to enter the Afon Bradley at the north-west boundary. This lies in the catchment of the River Dee.

Within 500m of the installation boundary there are a further seven discharge consents in place. One of these is held by Cadbury Trebor Bassett, who operates the cocoa factory south of the installation, for discharge into the Afon Bradley at a location close to the Kronospan discharge. The remaining six consents are held by the water company, Dwr Cymru Cyfyngedig, four for discharge from the treatment works into the Afon Bradley at the north of the installation, and two in the residential area to the east which feed into the same watercourse.

Full details of all discharge consents are contained within the Envirocheck report included in Appendix C1.

Waste Management Licences

There are no waste management licences held for the installation or within 500m of the perimeter.

Abstraction Licenses

Kronospan currently has two groundwater abstraction licenses for use as process water and for evaporative cooling. Additionally, a licence is held for one of the locations in the centre of the installation for abstracted groundwater to be used for evaporative cooling. The locations of the abstraction boreholes are shown on Figure A4.2 in Appendix A4.

There are another seven surface water abstraction licenses held at three separate locations within 500m of the installation boundary. Four are held by British Waterways Board allowing abstraction of surface water from the Shropshire Union Canal for use as process water and evaporative cooling. Two licences are held by Chirk Golf Centre for spray irrigation on the nearby golf course, utilising surface water from Chirk Castle pool and outlet stream. A further license is held by the owner of Chirk Castle for abstraction from the same point, also for spray irrigation.

Full details of all abstraction licences are contained within the Envirocheck report included in Appendix C1.

IPC Authorisations

Kronospan holds an IPC authorisation for the formalin plant, for manufacture and use of organic chemicals within the chemical industry.

Within 500m of the installation boundary there is one other current authorisations. This is held by Cadbury's for treating or processing of vegetable matter.

Full details of all IPC authorisations are contained within the Envirocheck report included in Appendix C1.

IPPC Permits

The Envirocheck Report notes that there are two IPPC authorisations held by Kronospan for the installation. There are no dates supplied for these authorisations, but both are stated to be valid. Both relate to the use of organic chemicals, specifically oxygen-containing compounds such as alcohols.

There are no further IPPC permits noted within the 500m buffer zone surrounding the installation.

Full details are contained within Appendix C1.

3.2.1 Wrexham County Borough Council

Details of non-statutory nature conservation sites within a 10km radius of the installation were provided by the Planning and Environment section of Wrexham County Borough Council (WCBC) in the form of a plan showing the location of the various identified environmentally-sensitive areas.

WCBC confirmed the following environmentally-sensitive areas to be within a 10km radius of the installation:

- Sites of Special Scientific Interest (SSSIs);
- Wildlife Sites;
- Conservation Areas;
- Protected Trees/Woodland Areas;

The location of these is shown on the diagram supplied by WCBC which is supplied as Figure A5.1 in Appendix A5.

3.2.2 Countryside Council for Wales

The Countryside Council for Wales (CCW) were requested to provide details of any significant statutory nature conservation or environmentally-sensitive areas within 10km of the installation. The search revealed there were no such statutory designations.

3.2.3 UK RIGS Association

The UK Regionally Important Geological Sites (RIGS) Association was requested by post on 27 April 2004 to provide details of any geologically sensitive sites within 10km of the installation. At the time of writing, no response to this request has been received.

3.3 Geological, Hydrogeological and Hydrological Data

Geological and hydrogeological information for the installation was obtained from the following sources and is reproduced in Appendices A2 and C2, with the geological map for the installation reproduced as Figure A2.1.

- British Geological Survey, 1973. Geological Map (Solid) for Wrexham (Sheet 121), scale 1:50,000;
- British Geological Survey, 1973. Geological Map (Drift) for Wrexham (Sheet 121), scale 1:50,000;
- British Geological Survey, 1994. Solid and Drift Map for Wrexham (Sheet 121), Provisional Series, 1:50,000 scale;
- British Geological Survey, 1927/8. Geology of the Country Around Wrexham (Explanation of Sheet 121); Parts I and II;
- British Geological Survey Borehole Records, ref SJ23NE 190 (1994) and SJ23NE 191 (1994).
- Ground investigation reports supplied by Kronospan;
- National Rivers Authority, 1995. Groundwater Vulnerability Sheet 21 (West Shropshire) scale 1:100000.

3.3.1 Geology

The published geological mapping for the area indicates that the installation is underlain predominantly by glacial sand and gravel in the south of the site and by glacial till in the north. These superficial deposits are then underlain by Westphallan Coal measures of the Bettisfield Formation.

3.3.2 Hydrology

The Afon Bradley, which is a small tributary of the River Dee, flows approximately parallel to the western boundary of the installation, to the west of the railway line. This watercourse flows in a northerly direction.

There are two surface water lagoons located in the north western corner of the installation, which are used to store water prior to reuse or discharge.

According to the Environment Agency's records, the installation does not lie within a flood warning area or within an indicative floodplain. Copies of these records are reproduced as Figures C3.1 and C3.2 in Appendix C3.

3.3.3 Hydrogeology

The National Rivers Authority (now the Environment Agency) Groundwater Vulnerability Map for the area (Sheet 21, West Shropshire) indicates that the installation is underlain by a Minor Aquifer in the form of Coal Measures. Typically, minor aquifers are of variable permeability and, although, these aquifers do not generally produce large quantities of water for abstraction, they can be important in providing local supplies (such as that abstracted by Kronospan) and in supplying base flow to rivers.

The leaching potential of the soil at the site varies from low to high, with the pattern appearing to broadly mirror the distribution of the permeable granular deposits and the more impermeable clay-dominated till deposits. Those of high leaching potential have the ability to readily transmit a wide range of contaminants because of their rapid drainage and low attenuation potential and tend to be granular. Soils of low leaching potential are generally not

considered to be capable of permitting the vertical migration of contaminants due to their low permeability, although lateral flow remains a potential pathway.

A plan showing the hydrogeological setting of the site is provided within the Envirocheck report included as Appendix C1.

3.4 Site Operational Records, Emergency Response Records and records of any land pollution incidents in the vicinity of the site

Details of installation operation records and emergency response records were requested from Kronospan but the information was not available. An emergency response team, including fire response vehicle and fire attender, was observed during the site reconnaissance visit. This was located mid-way along the central roadway as shown on Figure A3.8 in Appendix A3.

A plan illustrating the installation's operation layouts, including the location and nature of known underground services and pipelines was unavailable for inclusion in this report.

The location of bulk storage tanks and raw materials/bulk product storage are shown on Figure A6.1 in Appendix A6.

A plan showing the installation's foul water and surface water drainage system is included as Figure A4.1 in Appendix A4.

3.4.1 Land pollution incidents

The Envirocheck report obtained contains records provided by the Environment Agency detailing any land pollution incidents associated with the installation and within 500m of the installation boundary. A copy of this report is contained within Appendix C1.

The following table details pollution incidents to controlled waters recorded by the Environment Agency. Full details are contained within the Envirocheck report.

ON-SITE						
Enviro check Report Map ID	**Property Location**	**Data source**	**Date of incident**	**Severity of Water Impact**	**Pollutant**	**Cause**
24	Kronospan, Chirk	Environment Agency	16th February 1992	Category 2 - Significant	Light Oil	Runoff
24	Culvert Sewage Treatment works	Environment Agency	3rd August 1994	Category 3 - Minor	Chemicals (Sheep Dip)	Runoff
25	Bradley Farm	Environment Agency	2nd March 1992	Category 2 - Significant	Unknown	Spillage
26	Kronospan, Chirk	Environment Agency	9th December 1991	Category 2 - Significant	Mud/Clay/Soil	Effluent Discharge
26	Kronospan, Chirk	Environment Agency	25th November 1997	Category 3 - Minor	Fire water/Foam	Accidental spillage/ leakage
27	Kronospan, Chirk	Environment Agency	10th April 1991	Category 3 - Minor	Light Oil	Accidental spillage/ leakage
28	Not available	Environment Agency	17th May 1995	Category 3 - Minor	Soft Drinks Manufacture	Unknown
29	Kronospan, Chirk	Environment Agency	19th January 1998	Category 3 - Minor	Fire water/Foam	Unknown
30	Kronospan, Chirk	Environment Agency	19th January 1998	Category 3 - Minor	Fire water/Foam	Unknown
OFF-SITE						
31	Afon Bradley Farm	Environment Agency	2nd December 1991	Category 2 - Significant	Light Oil	Bypass of treatment facilities
32	Cadbury's	Environment	14th February	Category 3 -	Light Oil	Unknown

		Agency	1996	Minor		
32	Cadbury's	Environment Agency	14th February 1996	Category 3 - Minor	Light Oil	Unknown
32	Kronospan Outfall	Environment Agency	21st February 1996	Category 3 - Minor	Light Oil	Runoff
33	Manley Hall, Bangor on Dee	Environment Agency	24th November 1998	Category 1 – Major	Oils – Diesel (including agricultural)	Unknown
33	Kronospan	Environment Agency	27th October 1998	Category 3 - Minor	Light Oil	Effluent Discharge
34	Chirk Sewage Treatment	Environment Agency	21st December 1994	Category 3 - Minor	Mud/Clay/Soil	Bypass of Treatment Facilities
35	Chirk SDW	Environment Agency	30th September 1991	Category 2 – Significant	Cement/Mortar	Effluent Discharge
36	Not available	Environment Agency	10th April 1992	Category 2 – Significant	Crude Sewage	Overflow
37	Cadbury's	Environment Agency	20th November 1991	Category 2 – Significant	Silage liquor (agricultural)	Unknown
38	Colliery Road, Chirk	Environment Agency	24th October 1997	Category 3 – Minor	Road Runoff	Unknown
39	Not available	Environment Agency	22nd February 1992	Category 3 – Minor	Unknown	Overflow
40	Chirk Primary School	Environment Agency	18th April 1996	Category 3 – Minor	Sewage-Septic Tank Effluent	Unknown
41	Chirk	Environment Agency	14th September 1991	Category 2 - Significant	Farm Effluent/Slurry	Effluent Discharge

The Envirocheck report does not show any recorded pollution incidents to land. Due to the nature of the activities and processes which are carried out on the site, there is the potential for leaks and spillages to occur. However, Kronospan do not hold records of any such incidences of pollution which may have affected the ground or water.

3.5 Existing Site Investigation and Assessment Reports

The following records of previous ground investigation at the installation were available for review:

- Geo-Civil (Gustcrest Limited) on behalf of Building Design Partnership, February 1977. Report on Site Investigation at Kronospan Limited, Chirk. Ref: THL/SEW/GC.7728.
- Sub Soil Surveys Ltd, March 1984. Report on Ground Investigation at site of Proposed Formaldehyde Plant at Kronospan, Chirk. Ref: 38399.
- Sub Soil Surveys Ltd, January 1992. Report on Ground Investigation at site of Industrial Redevelopment at Kronospan, Chirk. Ref: 91/204.
- Sub Soil Surveys Ltd (on behalf of Alfred McAlpine Building North, July 1993. Results of Ground Investigation Kronospan Ltd, Chirk. Ref: 91/204.

The known spatial extent of these investigations is shown on Figure C4.1 included within Appendix C4. These investigations were undertaken primarily for ground engineering purposes, and were associated with construction projects. None of the reports or records supplied contained any details of laboratory chemical analysis.

There were also a number of plans and borehole records for which no location reference or accompanying report was made available. These have therefore not been included on the figure illustrating the extent of ground investigation undertaken.

In addition, two boreholes records from within the installation boundary were obtained from the British Geological Survey. The boreholes were drilled to provide the groundwater abstraction wells.

3.6 Other Information

The following sources of information have also been reviewed and are included in Appendix C5.

- Published Ordnance Survey (OS) Maps dated 1879-2000.

Historical OS maps have been examined for alterations in land use which may give rise to land contamination. A summary of the historical maps and their key information is shown in the table below.

Year	Scale	On-site Key Features	Surrounding Area	Potential Sources of Contaminants
1879	1:10560	Entire area is agricultural fields. Small central field is marked as an area of woodland. A small farm house (presumed to be that which is still in existence today) is located at the southern boundary.	Railway line to Chester is shown on the western boundary of the site, with the Chester and Ellesmere Canal beyond to the west. A roadway is shown running along the eastern boundary of the site, with the land to the north and south also occupied by farmland. Immediately to the north of the site, the boundary is marked by a small stream, beyond which the 'Bottom Wharf' is marked, which it is assumed is a surface water feature which links to the canal to the west.	Nothing significant within installation boundary.
1895	1:10560	No significant changes.	No significant changes.	No significant changes.
1900	1:10560	The site is now bisected in an west-east direction by the Brynkinalt Siding which joins with the main Shrewsbury & Chester Railway Line. This siding runs through to Chirk Green Village to the east of the site.	The Glyn Valley Tramway is now also marked running adjacent to the main railway line to the immediate west of the site.	Nothing significant within installation boundary.
1902	1:10560	No significant changes.	No significant changes.	No significant changes.
1914	1:10560	No significant changes.	No significant changes.	No significant changes.
1954	1:10560	A number of additional small buildings are noted at the central eastern boundary of the site, which are thought to be domestic properties.	The land to the south remains largely as agricultural land. The land to the north at 'Bottom Wharf' also now shows a small 'Sewage Works'. To the north-east of the eastern boundary a series of buildings is now marked which appear to link to a building further to the east called 'Chirk and District Cottage Hospital'.	There is the potential for increased surface water pollution beyond the northern site boundary associated with the Sewage Works.
1979	1:10000	The southernmost half of the site is now occupied by two long buildings and several small tanks marked as a 'Factory'. The buildings correspond to the current location of the warehousing. A 'Drain' is marked in the centre of the site. Another 'Factory' is identified in the north-east part of the site, which corresponds to the location of the existing Kronoplus building.	The entire surrounding area appears much more developed, with the town of Chirk considerably increased in size. Another factory (Cadbury's) is now located beyond the southern site boundary, and a significant number of properties, including a school, dominating the land immediately to the east of the site.	Unknown sources of contamination may be associated with the processes within each of the factory units shown both on-site and off-site.
1993	1:10000	Within the site boundary, the two rectangular	No significant changes.	The expansion of the buildings in the south of

		buildings have considerably expanded and now occupy the majority of the southern half of the site. There are also a number of additional paths, roads and fence lines marked on the map.		the site may indicate the expansion of the number and type of processes. The potential sources of contamination are therefore likely to be increased accordingly.
2000	1:10000	The overall site layout remains largely unchanged, although the building at the location of the Kronoplus building has been increased in size. Several weighbridges are also noted close to the site entrance.	No significant changes.	The expansion of the buildings at the existing location of the Kronoplus building may indicate the expansion of the number and type of processes. The potential sources of contamination are therefore likely to be increased accordingly.

Anecdotal evidence indicates that the location of the existing Kronoplus building at one time was the location of a Ministry of Defence (MoD) facility, possibly a munitions works. It is not unusual for such facilities to be excluded from OS mapping from 1930s to 1960s. Use of land for military-related activities can result in a very wide range of contaminants being present within soil and groundwater.

Due to the confidential nature of the MoD activities, no details are available outlining the nature of processes carried out or the materials used within these processes. However, use of land for military-related activities can result in a very wide range of contaminants being present within soil and groundwater.

4.0 Site Reconnaissance

4.1 Introduction

A site reconnaissance visit was conducted on 19 and 20 April 2004 by Katie Dunn and John Ford of Atkins. The area surveyed corresponds to the full area of the installation as shown on Figure B1.1 in Appendix B1. The Atkins personnel were accompanied and assisted during the visit by Iain Ferguson, Quality and Environmental Co-ordinator for Kronospan.

The purpose of the site visit was to inspect the installation and immediate perimeter for any indications of land pollution and to record relevant observations using notes, sketches and photographs. The infrastructure of the installation and general condition of buildings and surfaces was also visually examined to assess its competence and therefore potential to have caused pollution releases to land or to have provided a pathway for its migration. There were a number of areas within the installation in which it was not possible to take photographs due to safety restrictions.

No testing of soils or waters was carried out during this visit.

The following site features were inspected and as a result any photographs of features are included in Appendix B2.

4.2 Storage Tanks and Associated Pipework

Information relating to the size, location and contents of tanks on site was provided by Kronospan and supplemented, where possible, by observations made during the site reconnaissance visit.

There are numerous storage tanks located across the installation, containing a variety of products including raw materials to be used in the production process, fuel oils, hydraulic oil, heating oil, lubricants and waste products. There are also several tanks on-site which hold water for both process use and for fire suppression systems.

All tanks on site were observed to be in good condition and there was no evidence of direct leakage from any of the permanent storage facilities.

A table containing details of all tanks identified on site is provided in Appendix A6. Locations of these tanks are shown on the location plans for each area, Figures A3.1 to A3.18, contained in Appendix A3. Figure A6.1 in Appendix A6 provides a summary of the locations of these tanks.

There are three main groupings of tanks which represent the largest volume of storage on site:

Formalin Plant (Area K): This area, located in the centre of the installation, is where chemicals are stored and utilised as part of the formalin (formaldehyde solution) production process. The tanks are contained within a bunded area, and in addition the roadway where loading takes place is also bunded. Due to the flammability of the stored materials there are strict rules to control potential sources of ignition.

There are six main tanks in the delivery area, with a number of smaller tanks and reactor vessels also located across this area. Three of the larger tanks are for storing methanol which is used to produce formaldehyde; the remaining three are used for holding the finished product, which is transported by road tanker to large storage tanks adjacent to the central roadway.

Details of the tanks in this grouping are included in the table in Appendix A6.

The layout of this area showing the positions of individual tanks can be seen on Figure A3.11 in Appendix A3.

Central Roadway Area (H): An area on the north side of the central roadway contains a row of large tanks which hold material to supply the adjacent production areas. There are 17 tanks within this grouping, split across several bunded areas.

These tanks contain wax emulsion, urea formaldehyde resin and formalin, all of which are used in the chipboard and MDF production processes. There are also two tanks which contain diesel oil for the back-up heating system.

An overhead pipeline connects the formalin tanks to the resin-making facility located to the east of this grouping. There has recently been a minor leak to one of these pipelines which was repaired, the small loss of product having been contained by the bunded area adjacent to the tank. Other pipelines connect tanks to the adjacent MDF and chipboard production lines . Many of these pipelines cross the roadway at height. It was reported by Kronospan that all pipelines in this facility are above ground. Principle pipeline routes are shown on the individual area plans, Figures A3.1 to A3.18, contained in Appendix A3.

Details of the tanks in this grouping are included in the Appendix A6.

The layout of this area showing the positions of individual tanks can be seen on Figure A3.8 in Appendix A3. This also gives details of the numerous minor tanks in this area including those located in the glue kitchen and boiler rooms.

Garages and Mechanical Workshop Area (O): At the western end of this area there are a number of tanks which contain oils for fuel or lubrication. These are contained within a series of brick or concrete bunds. Two fuel pumps are located in a separate bunded area to the north of this grouping which are used for fuelling vehicles. Staining on the ground indicates that there have been spills outside of the bund surrounding the fuelling area, probably as a result of the fuelling hose not being replaced within the bund after use. Fuel is supplied to these pumps from the adjacent diesel tanks via a pipeline which runs just above ground level and is encased in concrete.

Details of the tanks in this grouping are included in the table in Appendix A6.

The layout of this area showing the positions of individual tanks can be seen on Figure A3.15 in Appendix A3.

Hydraulic oil systems

There are several locations on site where hydraulic oil is stored in tanks or reservoirs. This oil is used in the installation's mechanical machinery such as the fibre, chipboard and melamine high-temperature presses. Hydraulic oil storage facilities are provided to the MDF and chipboard lines locally to the machinery and is heated by boiler K7.

All the pipework is located above ground.

Heating oil systems

The installation has two separate oil-filled heating systems which serve the main production/warehouse buildings and Kronoplus buildings respectively. An overhead pipeline extends from the main building and transports heated oil to the formalin production area. There are several tanks across the installation that house this thermal oil, including a number of thermal expansion tanks at high level and storage facilities in the main boiler complex to the south of the central roadway. All the pipework associated with the heating oil system is located above ground, with any loss from this pipework contained by the hardstanding beneath. Further details of the nature of containment were not provided by Kronospan at the time of writing.

Storage facilities associated with the heating oil system are shown on the individual plans for each area, Figures A3.1 to A3.18 in Appendix A3.

4.3 Hardstanding and Bunds

4.3.1 Hardstanding

Figure B1.2 in Appendix B1 illustrates the approximate proportions of hardstanding which were observed during the site reconnaissance visit. All but a small fraction (<20%) of the southern half of the installation, i.e. south of the railway siding, is covered by hardstanding or built structures, the unsealed areas here being predominantly landscaped areas by the entrance and vehicle park, which lie outside of the main operational area. At the north end of the installation, the log yard where the roundwood, recycled wood and chipped natural wood are stored, remains largely underlain by exposed soil.

The following table outlines the nature, condition and extent of the underlying surface at each of the pre-defined areas of the installation. Condition has been determined by a general visual assessment and rating based on this, paying particular attention to the number and size of any cracks, chips, potholes, stains and other general indications of damage.

Site Section		Estimated Proportion Hardstanding (%)	Estimated Proportion Exposed Soils (%)	Condition of hardstanding, where applicable (1 = Very Good, 5 = Poor)	*Significant* potential for direct vertical downwards migration of contamination to land? Yes/No
A	Car Park/Reception/Offices	70	30	1	No.
B	Warehousing/ Loading areas/ Weighbridge/ outdoor timber storage areas	100	0	1	No.
C	External redundant plant storage areas	10	90	N/A	Yes
D	Contractors compounds and substations	50	50	2	Yes
E	MDF/ Chipboard production lines	100	0	1	No.
F	Urea/ resin manufacture and storage	100	0	2	No.
G	Paper impregnation	100	0	1	No.
H	Central Roadway Storage area	100	0	2	No
I	Pre-production	100	0	3	No.
J	Saw mill/ hacker plant/ log sorting	100	0	2	No.
K	Formalin plant and chemicals storage	100	0	1	No.
L	Gas plant/ water storage/ well water extraction point	80	20	1	No.
M	Railway siding	100	0	1	No.
N	Kronoplus building	100	0	1	No.
O	Garages and Mechanical Workshops	100	0	4	Yes. Large cracks (particularly in the garage workshop area) may provide a pathway for obvious surface hydrocarbon contamination to migrate downwards to the underlying soil.
P	Surface Water Lagoons	100	0	Unknown	No
Q	Log Yard	10	90	N/A	Yes. Large area of softstanding would allow downwards migration of contamination.
R	Roadways/ installation transportation routes	100	0	1	No.

4.3.2 Bunded Areas

Bunded areas are created by raised concrete ramps across roadways in two locations on the site, at the formalin plant loading area and at the western end of the central roadway where several large tanks are located. The concrete kerbs at the sides of these roads complete the enclosure of these areas. These bunded areas are shown on the detail plans for each of these areas, Figures A3.11 and A3.8 respectively in Appendix A3. These bunds are intended to contain material should there be a spill in either of these loading areas, and also provide tertiary containment should there be failure of any of the bunds surrounding the separately bunded tank groups in these areas.

In addition to these larger bunded areas, there are smaller bunds around individual tanks or groups of tanks, or at the boundary of certain production areas. These are shown on the detail drawings for each of the installation areas, Figures A3.1 to A3.18 in Appendix A3. Details on the condition and contents of these bunded areas are provided in Appendix A6.

4.4 Vegetation

The areas of managed vegetation within the installation area shown in Figure B1.2 of Appendix B1 are almost entirely restricted to the entrance, car parking, and reception area of the installation. Within this area, the vegetation consists of landscaped areas of grass, small trees and shrubs. All vegetation within this area appeared to be healthy and did not appear to exhibit any signs of stress due to ground contamination.

Within the operational zone of the installation, there are no areas of managed vegetation other than a small grassed area by the entrance to the Kronoplus building. Parts of the log yard and perimeter areas such as the contractor's compounds were intermittently covered by weeds. There was no visible distress to any of the vegetation.

4.5 Surface Water Features

There are two lagoons, located side by side, each 2,500m^3 in volume and designated the 'Active Lagoon' and the 'Inactive Lagoon'. The active lagoon is the lagoon which receives water from the surface water drains to be discharged into the outlet chamber to allow the recycling of water into the sprinkler tanks and for process water using a submersible pump. The inactive lagoon is isolated from the inlet and outlet chambers and allows the water that is outwith limits of consent for discharge to be contained until deemed fit to discharge.

The flow rate into the installation surface water drains is typically 20m^3/hr. The active lagoon can be expected to fill at the rate of 5% (125m^3) of its volume per 1mm of rainfall.

The site surface water first enters a four-chamber interceptor. This allows small quantities of low density oils to float to the surface and be removed by a continuous 'oil mop'. The flow into the lagoon is continuously sampled and analysed (on a 30 minute cycle) for formaldehyde and ammonia.

The water enters into the 'Active Lagoon' through a motorised Penstock valve. As far as practical, water from this lagoon is recycled to the installation sprinkler tanks. Although the objective is to recycle all surface water, excess water can be discharged (once at an acceptable quality) from the 'Inactive Lagoon' into the Afon Bradley, which feeds the River Dee. Discharge is facilitated by manually opening "Penstock A" and its operation is controlled via procedure KC/ENV/PRO/0001. The release of water from the active lagoon (which) to the Afon Bradley is by a "fit to discharge" procedure which prevents the discharge of water that is outside the consent limits set by the Environment Agency.

Water that is above of 'consent quality' is stored the 'Inactive Lagoon' prior to appropriate treatment.

If both lagoons were to completely fill (the design basis is on a 1 in 5 year storm) then they will overflow (at the inlet to the lagoons) to the adjacent Afon Bradley.

4.6 Nature of the Storage and Handling of Materials

Activities and procedures noted during the site reconnaissance that may lead to the loss of substances to land are outlined below. Items identified in specific locations on site are described below categorised under the area in which the activity takes place. At the end of this section general practices which were observed across several areas are described.

4.6.1 External redundant plant storage areas (Area C) and contractors compounds (Area D)

At the perimeter of the installation are the various contractor compounds and open storage areas where redundant plant has been placed to await disposal or relocation. Most of these areas were noted to be underlain by exposed soils, and were observed to be in a generally untidy state. Some of the redundant plant, in particular tanks and pipework which had been removed from the plant, was observed to be visually contaminated with oily products such as lubricating oils. Oil staining and a small quantity of a white opaque liquid were observed on the unsealed ground surface, indicating that migration of these products was taking place.

The contractor's compound on the east side of the installation was observed to be untidy. Small quantities of substances such as paint, lubricating oil and hydraulic fluid were stored in this area. Most of this material was located in small metal or plastic drums housed in a metal box which acted as a bund. A few drums were noted outside of the bund and there was evidence of some minor spills. Empty containers were also noted to be stockpiled on the ground outside of the main storage area. Again, the ground in this area comprises exposed soil.

The nature of areas such as the external storage areas and contractor's compound is likely to vary as different contractors operate in these areas and different maintenance tasks are undertaken. Contractors are generally responsible for handling their own materials and waste, which might lead to a variable standard in how these products are managed. Kronospan does not have any policies or procedures in place for management of contractors and their operational areas other than statutory safety measures.

4.6.2 Garages and Mechanical Workshop (Area O)

In this area, oil spills are evidenced by heavy staining on the ground throughout this area, and oily sheens on the surface of rainwater puddles. This appears to be the result of many minor spills during fuelling and maintenance of vehicles. There is an oil interceptor next to the maintenance shed, and the area around this was noted to be particularly heavily soiled. The hardstanding in this area is in poor condition with open joints which could allow this material to migrate downwards into the ground below.

Close to this area is a bunded compound for storage of lubrication oils. It was noted that several IBCs and drums were located outside of the bunded area. Some of these were empty and marked as scrap, with others marked as containing waste oil. Other materials in the workshop area were also stored outside of bunded areas, including a large number of drums of butanol on racking and used batteries on a pallet adjacent to the maintenance shed. Minor leaks from any of these containers would contribute to the soiling of this area. On racking against to the wall of the adjacent production/warehouse building, ammonium sulphate is stored in large plastic sacks. It was observed during the site visit that one of the sacks was split at the bottom and there was a small pile of powder on the ground. This material is soluble and was visibly wet from rainfall.

The road adjacent to this area is heavily trafficked with vehicles en-route to the log yard, but traffic movements are well controlled and protection is provided by bollards and concrete barriers. Vehicle movements inside the maintenance area are more hazardous as there are numerous obstacles in this area, including storage containers and vehicle parts. These restrict circulation and there is a danger of collision between vehicles operating in this area and the many storage containers, some of which are not held inside the bunded compound or racking.

To the west of the vehicle maintenance and fuelling point there is an area where waste is collected for disposal. Liquid wastes are stored in this area as well as empty containers. This is an area of hardstanding, but there is no bund around the liquid wastes which were stored in IBCs. The IBCs observed during the site visit contained pigmented liquids, likely to be wash-water from cleaning pipelines or production plant which contained dyes. At least one container appeared to be leaking slightly, and staining on the ground indicated previous leaks having occurred. Adjacent to these containers empty steel drums were stacked on pallets, but some were lying on their side on the ground. Some of these drums still contained hydrocarbon residues which could leak if the drums are not stored upright. There are no barriers to segregate or protect these containers from vehicle impact.

4.6.3 Formalin plant (Area K)

Materials used in the formalin production process are stored locally in bulk storage tanks or in portable containers and drums. There are two large cylindrical storage tanks for methanol and a further four for storage of the finished product (formalin). There was no evidence of any spillage in this area.

Opposite the formalin loading area is a bunded storage area which held a number of IBCs containing acids and other substances used in the formalin making process. Adjacent to this bunded area is an area of unsealed ground which extends beyond the bunded section of roadway. Several IBCs were stored on this unsealed ground, some stacked on top of each other. Any leakage from these containers is likely to enter the ground directly. Some of the IBCs appeared to be empty and awaiting removal, but it was not possible to confirm if this was the case for each one observed during the visit. The empty containers are still likely to contain some residual product.

Formalin is transported from the formalin plant to storage tanks in the central roadway area by road tanker. This method of transport carries inherent risks, and significant spillage could occur if a tanker were involved in a collision. Vehicle movement on site was noted to be very heavily controlled for safety reasons. Additionally, loading and unloading areas are bunded and the route taken by these tankers is confined to sealed areas, though in some areas material could be lost to ground where the hardstanding is in poor condition.

4.6.4 Surface water lagoons (Area P)

IBCs are used to store oily residues which are removed from the surface water drainage interceptor by a skimming system adjacent to the lagoons. These IBCs were stored on an area of hardstanding, but this was not bunded. Any leakage or overflow from these containers is likely to enter the ground or flow into the adjacent lagoon.

4.6.5 MDF and chipboard production and finishing lines (Area E) and pre-production area (Area I)

The hardstanding in the pre-production area was observed to be in a poor condition in places with some open joints and cracking. This surface is hosed down frequently to keep it clean, directing any accumulating material on the surface towards a sump by the central roadway. This seemed to be done to reduce the build up of sawdust, but it was noticeable that there was an oily sheen on the stream of water running along the gully towards the sump.

4.6.6 Paper impregnation (Area G)

In the warehouse near the paper store, there was a small area of racking where IBCs and drums were stored. This had a small concrete bund at the base which appeared too small to contain the total volume of liquid held above it, and several of the containers stored here were overhanging the bund. Staining on the bund indicated minor spillages having taken place, most likely to have occurred during filling or emptying operations. The area outside of the bund is sealed ground.

It was observed during the site visit that there were many areas inside the production buildings where bulk containers were stored. Some of the storage areas afforded little protection from vehicles which may operate in those areas.

4.6.7 Log Yard (Area Q)

The log yard contains large stacks of logs awaiting processing. Due to the seasonal nature of the logging industry there can at times be a large volume of material located in the log yard, some of which may remain in situ and exposed to the elements for several months. A liquor with a high organic content could be potentially generated as a result of leaching from 'natural' wood and bark. No evidence of the brown-stained run-off which would indicate this contamination was observed during the site visit.

4.6.8 Saw mill, hacker plant, chipper, Gannon Grindmaster, log sorting (Area J)

Reclaimed timber is delivered to site to be used in the production of chipboard and similar products. Reclaimed timber chips are stored in large stock piles in the outdoor log yard area, before this material is processed by sorting and cleaning in the pre-production apparatus. This material is stored in the open, which allows any contaminants that may be contained in the unprocessed wood chips to be leached by rainwater. Kronospan has strict standards on material they will accept and samples are inspected from each delivery to check for contaminations. The unloading and stockpiling of this material was noted to be taking place on an area of hardstanding during the site visit.

4.6.9 General issues identified across the installation

Across the installation, in addition to the permanent storage tanks noted in section 4.2 above, there were several areas where IBCs and drums were stored. Most of these were located in designated bunded areas, but there were also some that were placed temporarily in locations without localised bunding, including instances where liquid waste needed to be stored whilst maintenance was taking place. An example observed during the site visit was a quantity of IBCs containing liquid waste located adjacent to the resin production plant as the sump in this area was undergoing maintenance. In this particular instance the containers are still within a wider bunded area (the central roadway) which removes the risk of product loss, but small groupings and individual IBCs were observed outside of bunds in many areas, including areas with exposed soils.

4.7 Surface Water and Foul Drainage

Foul and surface water are collected in separate systems. The foul drainage enters the local mains drainage system for treatment off-site. This requires some pumping on the site due to the inadequate falls which preclude gravity drainage.

Surface water is collected from roadways, roofs and hardstanding and runs northwards towards the surface water lagoons. Water flows into the 'active' lagoon from where it is recycled back into the process or into sprinkler tanks. Water is stored in the 'inactive' lagoon pending use or discharge to the Afon Bradley, subject to meeting discharge consent.

A survey of installation drainage was carried out in May 2004. This survey was limited to confirming the location and layout of drainage infrastructure and taking samples for contamination testing. No comments were made on the condition of the drainage runs in the report. In the absence of this information it is not possible to comment on the likelihood of material escaping from the drainage system. However, at the time of writing, the applicant is in the process of completing a full drainage Closed Circuit Television (CCTV) survey, although results were unavailable for incorporation into this report.

Figure A4.1 in Appendix A4 is a plan of the drainage obtained from this survey.

The drainage report did identify several manholes where the drainage appeared to be blocked. This could be due to the accumulation of solid material in the pipelines, which is likely

because of the amount of sawdust and other debris entering the system. Blockages could also have been caused by collapse of the pipework, which would provide an opportunity for material to enter the ground where the drainage system is breached. Blocked or reduced capacity drainage could also allow manholes and gullies to overflow during periods of high rainfall, which could result in this effluent discharging on to the adjacent ground, and enter into the ground if this area happens to be unsealed.

The contamination testing conducted during the drainage survey showed that the surface water effluent exceeded the discharge limits for formaldehyde in the majority of areas where samples were taken. It is possible that high concentrations were detected partly due to recent dry weather resulting in low levels of water in the system.

On occasions where discharge consent levels are exceeded in the lagoons, the water is treated in the 'inactive' lagoon to bring levels below consent levels to allow discharge.

5.0 Assessment of Land Pollution Potential

5.1 Polluting Substances and Relevant Activities

A list of all substances used, stored and manufactured (plus waste by-products from the manufacturing process) is contained in Appendix D1. An assessment of their pollution potential has been made based upon their chemical properties, toxicity and volume stored, used or manufactured. Those substances thus identified have been taken forward to Section 5.2 below.

Potentially polluting substances identified on site have been grouped according to the process/activity on site where these materials are present.

5.1.1 Formalin manufacture

The formalin manufacturing process produces formaldehyde solution. This is achieved through reacting methanol with caustic soda (sodium hydroxide) and water. This process also uses a number of other chemical substances in small quantities such as catalysts, corrosion inhibitors and water treatment additives. These included sodium bisulphite and a variety of acids.

- **Methanol** is volatile and has a high mobility in soil. If released to soil, methanol is expected to degrade via biodegradation and be susceptible to significant leaching.
- **Caustic soda** (sodium hydroxide) used in this process comes in a liquid form. This is a strong alkali and is soluble in water. The resulting solution is corrosive but not toxic.
- **Formaldehyde solution** (formalin) is highly mobile in soil and has a low volatility in soil.
- **Sodium bisulphite** is soluble in water, giving an acidic solution. Exposure of solid phase to air results in oxidation to sulphate, with some release of sulphur dioxide (SO_2) gas.
- **Sulphuric acid and hydrochloric acid** are all highly corrosive and have a high mobility in soils and water.

5.1.2 Resin manufacture

Resins are produced on site from a blend of liquid formaldehyde solution, urea in a dry flake/powdered form and various additives. This is used to coat the wood chips and fibres so that they will bond together during the manufacturing process.

- **Formalin**'s potential polluting properties are noted above.
- **Urea** is soluble in water and is has a high mobility in soil. The substance biodegrades readily, releasing carbon dioxide and ammonia.
- **Sulphamic acid and formic acid** are all highly corrosive and have a high mobility in soils and water.
- **Urea-formaldehyde resin** is soluble in water and of low viscosity. This substance can potentially release ammonium vapour.

5.1.3 MDF/Chipboard dyeing

In addition to the raw wood chips or fibres and the appropriate binding resin, a top coating of green dye can be applied to the finished product to signify different final product grades. The dye is applied as a low viscosity liquid which water based. No details on the precise chemical

content of this substance were available, however, the storage containers are labelled as 'hazardous to marine life'.

5.1.4 Production wastes

Liquid wastes from a variety of sources are collected on-site in IBCs for removal and disposal off site. Such wastes include contaminated water from cleaning production area glue and pigment lines, and interceptor effluent.

The exact composition of these materials cannot be determined as they are unlikely to have a consistent composition. Most observed wastes were reported to be predominantly water.

The glues used for attaching laminate finishes to worktop products were reported to be water-based and non-hazardous.

- **Dyes and pigments** – dyes and pigments used on the site are all water based and will therefore have a high mobility in soil.

- **Hydrocarbon Oils** are likely to be contained in some wastes such as interceptor effluent. These have high mobility in both saturated and unsaturated soils and are significant potential groundwater and surface water pollutants.

5.1.5 Maintenance activities

Fuel, hydraulic, lubricating and waste oils and mixed wastes from interceptors are stored in the maintenance area and at selected locations across the site. The maintenance area also contains stored vehicle batteries containing acids.

- **Battery acids** are corrosive, highly mobile and highly soluble in water. Spillages of battery acids on concrete hardstanding can corrode the surface and reduce the ability of the hardstanding to contain other spills.

- **Hydrocarbon/hydraulic oils** have high mobility in both saturated and unsaturated soils and are significant potential groundwater and surface water pollutants.

5.1.6 Previous land use

The desk study report has indicated a number of previous land uses which may have produced ground contamination prior to the establishment of the Kronospan installation.

Anecdotal evidence indicates that the area at the north of the installation currently occupied by the Kronoplus building formerly housed a military production facility. There may be significant residual pollution in the ground from this activity, but due to the sensitive nature of this type of facility there is no further information available on the nature of any associated contaminants.

5.2 Preventative measures

The pollution preventative measures (physical infrastructure and those relating to testing, inspection and maintenance) for each relevant activity associated with the potentially polluting substances have been identified and their extent and condition assessed. The results of this work are presented in Appendix D2.

Plans showing the locations of these activities are shown in Appendix A5 and A6.

Primary containment:

All liquid chemical materials used on site are contained in drums, IBCs or bulk storage tanks. Containers are checked when arriving on site and placed into appropriate storage areas across the installation.

Dry materials such as the urea used in resin manufacture and the ammonium sulphate are contained in large plastic sacks.

Secondary Containment:

The vast majority of materials are stored on areas of hardstanding with bunding provided for products where appropriate.

Tertiary Containment:

Tertiary containment is provided by the site surface and foul water drainage systems which are both routed through interceptors. Foul water is treated off-site and surface water is contained on-site in the lagoons at the north end of the installation if it is found to be within the discharge limits set by the Environment Agency. Constant monitoring of effluent arriving at the lagoons ensures contaminated water is not discharged directly to the Afon Bradley watercourse.

5.3 Assessment of the Likelihood of Land Pollution

Appendix D2 contains an assessment of the likelihood of land pollution from the installation.

The assessment has identified relevant activities where there is a reasonable possibility that there is or will be current or future pollution of the land from the installation. Reference data will be collected and reported within six months of the issue of a permit for the installation.

6.0 Conceptual Site Model

6.1 Geology and Hydrogeology

The published BGS geological maps indicate that the geology underlying the installation comprises glacial sands and gravels overlying Glacial Till overlying Carboniferous Middle Coal Measures. Bedrock does not outcrop on the site.

A number of borehole logs were available from Kronospan records; these have been used to characterise the ground conditions below the installation. Details of these reports are outlined in section 3.5.

6.1.1 Made ground and topsoil

Made ground was identified in most of the boreholes reviewed. The made ground predominantly comprised clay, sand and gravel or stone (hardcore), possibly introduced for engineering purposes. However, in a number of boreholes, materials such as saw dust, wood waste, ash, clay, glass, pottery, paper, brick, concrete, slag and wood were noted.

The made ground, where present, was generally around 2.0m to 2.5m thick, with a maximum recorded thickness of 2.7m.

6.1.2 Interbedded clay, silt, sand and gravel

The made ground noted above was underlain throughout the site by a complex and highly variable sequence of interbedded clay, silt, sand and gravel. This material varied in nature quite considerably over small lateral and vertical distances, sometimes being dominated by finer fractions and sometimes by the coarser material. Considerable thicknesses of silt were locally present.

The upper layers of clay were locally described as "shaley", while deeper clay deposits were sometimes noted as being laminated.

The depth to the base of this interbedded material varied markedly across the site. The shallowest depth at which the base of the material was encountered was 7.3m, while a number of the boreholes were drilled to depths of up to 20m without the base being encountered. One borehole was drilled to 24m depth without encountering the base of this material.

The clay and silt generally ranged in consistency from soft to firm, while the sand and gravel layers were generally medium dense.

It is considered that this material was deposited in a fluvial or glacial outwash environment.

6.1.3 Glacial Till

In the boreholes where the base of the interbedded deposits described above was proven; the underlying material was identified as Glacial Till ("Boulder Clay"). This material was generally described as a very stiff clay with occasional gravel inclusions and sand lenses.

The depth to the top of this material, where encountered, ranged from 7.3m to 21m, although as noted above a number of boreholes were drilled to depths greater than 20m without this material being encountered.

6.1.4 Groundwater

Two distinct groundwater bodies were noted on the borehole logs reviewed during the current report. The shallower of the groundwater bodies was generally encountered at between 2.0m and 4.0m depth, within the interbedded deposits (predominantly within the sand and gravel).

When encountered, the water level generally rose to a rest level up to 1.4m above the strike level.

A deeper groundwater body was encountered in a number of boreholes within a sand and gravel layer immediately above the Glacial Till. This groundwater body was encountered at between 8.5m and 21.1m depth, and showed a significant rise when struck, with rest groundwater levels being as shallow as 3.7m depth in one borehole.

Groundwater was also occasionally encountered in the made ground, although based on the information currently available the extent of this perched groundwater appears to be limited.

6.2 Surface Water Features

The surface water features in the vicinity of the installation are shown on Figure A5.2 of Appendix A5 and are as follows:

Surface Water Feature	Proximity to Installation	Approx Flow Direction	EA Water Quality Grade
Afon Bradley	Immediately beyond north-western installation boundary	North	Unknown
Shropshire Union Canal	Immediately beyond western installation boundary	N/A	Grade 2 (Good)
River Ceiriog	<1km south	N/A	Grade 1 (Very Good)
River Dee	<5km north	N/A	Grade 1 (Very Good)

As outlined in section 3.3, there are no natural surface water features within the installation boundaries.

Surface water drainage for the installation is shown on Figure A4.1 of Appendix A4.

Quantitative data available from previous ground investigations and monitoring pertaining to the hydrogeological conditions underlying the installation was limited. However, it is anticipated that the regional groundwater regime is likely to be in hydraulic continuity with the River Dee, with a general flow direction to the north. It should also be noted that there is a groundwater abstraction well located centrally within the installation and there may be some localised flow towards this point during periods of abstraction pumping.

6.3 Results of Previous Investigations/Assessments

The previous ground investigation reports and borehole logs which were made available did not contain the results of any laboratory contamination testing. The geology encountered has been discussed above. Copies of the borehole records are contained within Appendix C4.

6.4 Other Receptors

The above discussion has identified ground, surface water and shallow groundwater as relevant environmental receptors which may be affected by any polluting substances which might be released by current and future activities on the site. Section 5 of this report and the content of Table D2 outline which specific process areas present a reasonable likelihood of ground or groundwater contamination occurring.

Other significant receptors which may potentially be affected by any ground contamination have been identified as:

- Human Health (residents of local residential properties).

6.5 Land Pollution History

Prior to the development of the site by Kronospan in 1970, the area covered by the installation was dominated by 'greenfield' agricultural use and therefore the likelihood of the land being significantly contaminated prior to development is very low. There remains uncertainty over the precise historical use (and hence potential for residual contamination) use of the area of the installation where the Kronoplus building is now located as it was the former location of an MoD facility.

Records of previous ground investigations have shown that the Made Ground is present underlying several areas of the installation. Whilst this material appears to be dominated by reworked natural deposits a number of records noted the localised presence of materials such as saw dust, wood waste, ash, clay, glass, pottery, paper, brick, concrete, slag and wood. The source of this material is not known but may possibly be due to imported fill material use to level the site.

There are no records available from Kronospan relating to significant incidences of pollution or records of significant losses of stock. The Landmark Envirocheck report details a number of recorded pollution incidents which are associated with the Kronospan installation, which are summarised in Section 3.4.1. However, none of these incidents recorded any significant impact to land.

The site reconnaissance visit conducted as part of this report recorded a number of areas of visible surface spillages, principally in non-process areas, such as mechanical workshops and plant storage areas. In these areas of the installation, there was no available information on the procedures adopted in the event of spillages of potentially polluting substances.

6.6 Site Zoning

Whilst in previous sections of the report the installation has been zoned for the purposes of defining the various processes which take place, for the purposes of the conceptual model, the installation will be considered a single area. This conceptual model is illustrated graphically in Appendix E1.

6.7 Summary Conceptual Site Model (CSM)

6.7.1 Introduction

The findings of the desk study and site reconnaissance (detailed above) have been used to develop the conceptual site model (CSM) for the installation. Uncertainties in the CSM are identified and their significance discussed.

The CSM is based on the assumption of 'normal' operational and environmental conditions. In the event of any 'catastrophic' event such as a major spillage or fire, there is the potential for the pollution prevention measures described to become inadequate and for the conceptual model to therefore alter.

6.7.2 Conceptual Site Model

A graphical representation of the CSM has been produced and is shown in Appendix E2.

Of the substances used in the various manufacturing and production process in operation within the installation, those which are used in the form of a liquid or aqueous solution are considered to pose the most significant risk of contamination if spilled or leaked. Those which are used in solid, crystalline or powder form are considered to present a lower risk as they are unlikely to migrate rapidly over a significant distance if spilled or leaked.

Of the liquid/aqueous substances, the majority are organic compounds which exhibit a range of environmental fate and transport characteristics. However, in general, the environmental behaviours of these substances will include slight to high solubility in the aqueous

environment, high mobility in soils, and moderate volatility on exposure to soil and water. Full details of physiochemical and environmental characteristics of each substance known to be used on site are outlined in Table D1.

Within the process areas, primary, secondary and tertiary pollution prevention measures are in place and were generally noted to be functioning effectively, and can be expected to prevent the significant loss of pollutants to ground in the event of spillage or leakage.

The log yard area presents a greater possibility of pollution occurring to the ground or groundwater in comparison to the other process-related areas of the installation. Whilst the nature of the contamination contained within the raw wood chips may pose a relatively low risk to the environment, the absence of any primary, secondary or tertiary pollution prevention measures will result in any contaminated leachate entering the underlying soils and possibly groundwater. Furthermore, there remains the potential for a wide range of leachable contaminants to be present within the recycled wood (which comes from a wide range of sources).

The other areas of the installation where a reasonable likelihood of pollution to underlying ground and groundwater has been identified are in the external surplus plant storage areas (Area C) and in the mechanical workshop areas (Area O). These are not areas of the installation which are process-related or production-related.

The external surplus plant storage areas have no primary, secondary or tertiary pollution prevention measures, and therefore any residual liquid substances, leachable contaminants or corrosion products can enter into the exposed soil and, possibility, underlying groundwater.

During the site reconnaissance visit, significant evidence of surface spillage of fuel oils, battery acids and other hydrocarbons in the vicinity of the mechanical workshop areas was noted. Whilst this area is underlain by hardstanding, this was noted to be in poor condition, with many cracks and gaps which lead directly to the underlying soils. Therefore, there is currently a reasonable likelihood that contamination could be entering the underlying soils and groundwater either as mobile free phase product, or in aqueous solution.

6.7.3 Uncertainties in the CSM

In developing the conceptual site model, there are a number of assumptions which have been made. Associated with these assumptions are a number of uncertainties, as summarised below:

Uncertainties related to sources:

- The extent of any contamination which may already be present within the near surface soils due to the absence of contamination data contained previous ground investigation reporting;

- A significant proportion of the raw wood material enters the installation as recycled wood which comes from a large number of sources. Whilst this material is periodically screened on delivery to the installation to monitor its contents and ensure the material is 'clean', there remains the potential for a wide range of leachable contaminants to be contained within the wood resulting from where it has been sourced.

Uncertainties relating to pathways:

- The condition of the installation's drainage system remains uncertain, despite the completion of a recent drainage survey. Whilst there is no particular reason to believe that the drains are transmitting contaminants to ground or groundwater and it is assumed that the system is intact and functioning, there is no evidence to support this assumption;

- There remain uncertainties over the hydrological regime underlying the installation. A number of assumptions have been made, particularly with respect to groundwater flow direction and the level of hydraulic continuity of the groundwater and surface water;

- There is also a degree of uncertainty over the effectiveness of the Coal Measures underlying the installation at depth to act a Minor Aquifer and therefore the susceptibility of any groundwater within this aquifer to contamination.