EXECUTIVE SUMMARY

INTRODUCTION

In August 2005, the Shanks Waste Management (Shanks) retained Golder Associates UK Limited (Golder) to undertake a Phase II Site Investigation (SI) at the Site based upon the recommendations made in Golder's Phase I report. The SI works were undertaken in accordance with the Golder scope of works as detailed in the letter from Golder to the Shanks on 31 July 2005. The intrusive SI was carried out on-Site between the 16 August 2005 and 29 September 2005.

In addition to the soil sampling completed during the SI, two (2) rounds of river sediment sampling and three (3) rounds of ground and surface water sampling were undertaken. The first of the ground and surface water sampling exercises took place during the SI, with the remaining two (2) rounds completed on 1-3 November 2005, and 29-31 March 2006.

Ground gas was monitored on Site on four (4) occasions. These monitoring rounds took place during the SI and on three (3) subsequent occasions, on 29-30 September 2005, 1-2 November 2005, 13 December 2005 and 29 March 2006.

OBJECTIVES

The purpose of this report is to identify any areas of contamination in the soil, sediment, groundwater, surface water and ground gas within the area of the Site and immediately adjacent to it, and to determine their likely sources. In addition, this report is intended to undertake an evaluation of the geology and hydrogeology specific to the Site, based upon the characteristics of the samples retrieved in the drilling works undertaken.

The objectives of this work are to identify:

- environmental issues which may give rise to or relate to liability (structural, planning issues, cultural history or heritage issues will not be considered as part of this phase of work);
- any areas of soil, sediment, groundwater, surface water and ground gas contamination related to historical workings undertaken on-Site and operation of the HTI on-Site;
- characterisation of the subsurface of the Site (geology and hydrogeology) and any effect this may have on contaminants identified; and,
- the potential need for further investigation of any areas of contamination identified.

SITE INVESTIGATION METHODOLOGY

The SI methodology for the Pontypool HTI facility SI was designed in 3 main stages. These stages relate to the Potential Areas of Concern (PAoC) identified in the Phase I investigation, perimeter groundwater wells (to characterise groundwater, both up and down the postulated hydraulic gradient/flow of the Site) and "coverage" locations to provide the necessary sampling density to satisfy the requirements of BS10175 "Investigation of Potentially Contaminated Sites – Code of Practice".

The proposed SI layout was designed before any equipment and staff were mobilised to the Site and before any Site specific information was known with regard to the underlying geology. Following commencement of the investigation, several alterations were made to the original proposed SI layout. These alterations were made due to access constraints, unexpected on-Site circumstances (e.g. prior cleaning of the "Goop tank" and council clearing of parts of the perimeter drainage ditch), and to ensure suitable spatial coverage following the removal of these other sampling locations.

In addition, a number of locations were found to be dry, and as such, unsuitable for the installation of groundwater monitoring wells. Therefore, installation decisions were made on a hole by hole basis, with monitoring wells constructed at most locations where groundwater was identified.

A final total of ninety two (92) investigation locations were selected on and around the Site, comprising:

- seventy nine (79) drilled locations on-Site for soil sampling, forty eight (48) of which were installed with standpipes for groundwater and/or ground gas monitoring. Locations where standpipes were not installed were backfilled with bentonite and reinstated;
- seven (7) grab samples from the Lagoon and the Site perimeter ditch for assessment of the accumulated sludge and sediment;
- three (3) sample points along the course of the Afon Lwyd for sampling of river water and river bed sediment; and
- three (3) additional samples of sediment and water were taken: one from the surface water drainage course in PAoC 23 (sediment); one from the mains water supply; and, one sample of the driller's polymer which was used in one borehole to aid the recovery of drilling arisings during excavation.

CHEMICAL ANALYSIS

Samples of soil, groundwater and sediment were retrieved from the SI locations on-Site. A Site specific chemical analysis suite was designed for the samples obtained, based upon the findings of the Phase I Assessment and advice from the client regarding exemplar material types handled on-Site during its operational life.

FACTUAL DATA

Summary of General Stratigraphy

Stratum	Recorded Thickness (m)	Top of Stratum (mbgl)
TARMAC/CONCRETE HARDCOVER and/or GRASS/SOIL typically light brown sandy soil with common rootlets and grass cover	0.1 – 1.0 (Thickest concrete in area of static hearth)	0.0
MADE GROUND FILL or HARDCORE typically grey or brick red in colour with sand, gravel and hardcore chippings	0.0 – 2.7	0.1 – 0.6
SILTY GRAVELLY CLAY typically brown/grey to orange in colour with some reworking and inclusion of made ground material in upper surface	0.1 – 2.7 (several layers of the type shown may occur in this part of the stratigraphy, and in various configurations)	0.1 – 2.7
SANDY COBBLY GRAVEL typically brown/light brown in colour. Large light brown/yellow sandstone cobbles and sub angular gravel with coarse sands. Moist or water bearing in places		
SANDY GRAVELLY CLAY typically darker brown/grey to orange in colour with some black staining. Moist or water bearing in places.		
MUDSTONE typically red/brown in colour with grey/green mottling, commonly weathered in the top 0.5 m (approximately) to either a stiff clay or very weak thinly horizontally bedded mudstone. The unit is highly fractured in some areas. This unit has internal variations determined by weathering. Varies between: hard massively bedded mudstone/weak friable mudstone/very weak thinly bedded fissile mudstone. Sandstone beds were recorded within the mudstone.	0.0 – 22.3	1.4 – 4.0

Groundwater Characteristics

This monitoring identified two main groundwater horizons on-Site. These are: shallow groundwater (typically less than 4.0 mbgl) above the mudstone aquiclude and within the alluvial drift and glacial till deposits; and, the deeper, confined water bearing sandstone strata within the mudstone unit.

The volume and recharge within both the shallow and deep groundwater on-Site is highly variable, with typically low flow and slow recharge. Groundwater flow within the shallow superficial deposits appears likely to be in connectivity with the adjacent Afon Lwyd, whereas groundwater flow in the mudstone appears to be isolated from the river, with flow occurring through fracture flow and confined aquifer flow within discrete sandstone bands.

Ground Gas

A number of exceedances of the ground gas screening values were noted in the results from the second, third and fourth monitoring rounds.

BH38 was subject to additional analysis by a specialist contractor (CPL Industries) who also collected two additional "control" soil gas samples from locations on-Site. Gas sampling was undertaken on two occasions. The analysis indicated that the concentrations of organochlorine gases, predominantly vinyl chloride, were present in the sample obtained from BH38. Furthermore, CPL Industries recorded the presence of organochlorine and hydrocarbon gases in the two control wells, with a marked change in concentration noted between the monitoring rounds.

Radiation Survey

A specialist radiation assessment contractor (MATOM) attended Site prior to the excavation of holes in the area around the lime and radioactive store (PAoC 18) and used a hand held scintillation meter to scan the selected drilling locations. No readings were recorded on-Site during this survey that would suggest the presence of any remaining radioactive material. The majority of those locations surveyed displayed levels of radioactivity that were lower than the local background.

ENVIRONMENTAL ASSESSMENT

The initial assessment of the data obtained from the chemical analyses of soil and water samples from the Site was carried out using published screening values. These values were used to produce a table of Tier 1 screening values which were applied to the chemical analysis data from the analysis of soil and water samples from the Site.

Screening values for soils were therefore taken from four (4) main sources, and where an option was given values were selected for an industrial end use:

- CLEA Soil Guideline Values (SGV);
- United States Environmental Protection Agency (USEPA) Regions 3, 6 and 9;
- Canada Wide Petroleum Hydro-Carbon (PHC) Standard; and
- British Research Establishment (BRE) Special Digest.

A hierarchy of sources was applied to the screening values with CLEA SGV values used first, USEPA Region 3, 6 and 9 values used second and Canada Wide PHC Standard values used last. The BRE Special Digest values apply only to sulphate and are considered to be the most applicable for the screening of this determinand.

In the case of groundwater on-Site, the most applicable and vulnerable receptor is considered to be the Afon Lwyd, adjacent to the Site on its eastern edge. With this in mind, and where possible, Freshwater Environmental Quality Standards (FW EQS) were used to screen the data from the samples.

Screening values for waters were therefore taken from five (5) main sources:

- UK Environment Agency, FW EQS;
- UK Drinking Water Standards (UK DWS);
- EU Drinking Water Standards (EU DWS);
- United States Environmental Protection Agency (USEPA) Regions 3, 6 and 9; and
- World Health Organisation Drinking Water Standards (WHO DWS).

As with the values used for the screening of the soil analysis data, a hierarchy of sources was applied to the screening values with FW EQS values used first, UK DWS used second, then EU DWS followed by USEPA Region 3, 6 and 9 values with WHO DWS values used last.

SOIL RESULTS

The contamination recorded in soil samples indicates that a relatively low level of shallow soil contamination is present on-Site.

The results show that two (2) main areas of the Site display shallow soil contamination (Figure 12 shows the approximate footprint of these areas on the Site). These areas are:

- Shallow Soil 1 - the area around the covered vestibule and roasting chamber, central storage compound and tank farm (PAoC 12, 15 and 19); and

- Shallow Soil 2 - the area in and around the THP building (PAoC 16).

Shallow Soil 1 contains limited PCB and SVOC/VOC contamination in Boreholes BH23, BH29, BH41 and BH48. Shallow Soil 2 contains PCB, PAH and SVOC/VOC contamination in BH59, BH60, BH70, BH71, BH72, BH76 and BH77. The remainder of contamination identified in the laboratory analysis represents apparently unrelated, isolated occurrences that are not obviously attributable to a particular PAoC and will be considered as “hot spots”. Figures 8a-8g show the locations of all exceedances recorded in shallow soils.

Metals contamination was noted in samples from the eastern edge of the Site within the lagoon sludge and from soil and sediment in BH81 and GS6 respectively. The contamination recorded in the lagoon sludge and GS6 is likely to be due to accumulation and concentration

of contaminants in surface water and surface drainage (from both on and off Site sources). The contamination noted in BH81 appears to be an isolated "hot spot" of contamination.

Whilst it can be seen from the result that metals are ubiquitous in the soils across the Site, the concentrations identified on-Site are inconsistent with those identified off-Site, and as such, it is considered that the former HTI facility does not represent the principal source of the off-Site metal concentrations. The fact that metals appear throughout the Site may also reflect the fact that the Site resides on an area with previously elevated levels of metals .

Shanks Waste Management and Torfaen Borough Council have agreed to collaborate to further assess the off-Site metal concentrations in the soils adjacent to the Site boundary.

TPH contamination was recorded in one location (BH67). This location is known to have been used historically as a service area for Site machinery and as such, contamination of this type was anticipated at this location. This isolated result appears to be another "hot spot" of contamination.

PCB was found in several locations across the Site and can be grouped into two types of sample. The first were samples from accumulated sludge in the lagoon, and the sediment in the perimeter drainage ditch and surface water drain channel. The presence of PCB in these locations is likely to be from accumulation and concentration of contaminants in surface water and surface drainage. The second group of samples were from soil beneath areas of known PCB handling. These areas were the covered vestibule and roasting chamber, central storage area and tank farm, and the THP building. These exceedances are likely to represent spillage of PCB waste materials during handling.

SVOC (PAH) exceedances were found across the Site with a marked grouping of exceedances noted along the southeastern Site edge. The reason for this grouping is not clear, however, it was noted during sampling of the perimeter drainage ditch that a bonfire had recently been lit in the channel between GS6 and GS7. This may account for the elevated PAH levels in this region of the Site. Benzo(a)pyrene is the most commonly occurring PAH contaminant on-Site and its occurrence accounts for 70% of the PAH exceedances. This weighting may reflect the highly conservative screening value applied to benzo(a)pyrene.

VOC contamination was confined to two (2) areas. The area adjacent to the covered vestibule and roasting chamber (PAoC 12) and, the area around the THP building (PAoC 16). The majority of the contamination noted was trichloroethylene (TCE) and was confined to the area of the THP building. Tetrachloroethylene (PCE) was also identified in the THP building and in the area adjacent to the covered vestibule and roasting chamber.

No soil contamination was recorded at a depth greater than 1.8 mbgl (BH78), and the average depth of contamination is approximately 0.6 mbgl. The most commonly found contaminants were PCBs, SVOC and VOC.

A range of dioxin and furan concentrations were identified across the Site with concentrations (in TEQ) varying from levels typical of rural background to levels more typical of industrial sites. Given the public's interest in the presence of dioxins, furans and PCBs (WHO 12), the concentrations were assessed in a Human Health Risk Assessment which is included as Volume 4 of the Planning Application supporting documentation.

WATER RESULTS

Shallow Groundwater

The data from the initial 2 rounds of shallow groundwater monitoring indicate that consistent zones of contamination are present in shallow groundwater, as similar contaminant concentrations were noted in the data from both monitoring rounds. This data is confirmed by the data from the third round of groundwater monitoring data[1]. These zones vary in size dependant on the contaminant types, but they appear to be originating from three (3) discrete areas(Figure 13 shows the approximate footprint of these areas on the Site). These areas are:

- Shallow Groundwater 1 - the area around the HTI front face, deslagger pit, covered vestibule and roasting chamber, central storage compound and the tank farm (PAoC 7, 11, 12, 15 and 19);
- Shallow Groundwater 2 - the area in and around the THP building (PAoC 16); and,
- Shallow Groundwater 3 – the area in and around the diesel fuel pump and covered storage area (PAoC 20 and 25).

The first two of these areas correspond with the areas of, and contaminant types noted in, Shallow Soil 1 and Shallow Soil 2 (see Section 8.1.11). The third area corresponds with the TPH contamination noted in shallow soils within the covered storage area. Figures 9a-9f, 10a-10f and 11a-11f illustrate the locations of all Tier 1 screening criteria exceedances recorded in shallow groundwater (from Rounds 1, 2 and 3 respectively).

The concentrations of metal and traditional chemical analytes are found in exceedance of the Tier 1 screening criteria across the Site, in the data from all three (3) monitoring rounds, with no notable pattern of distribution. It is considered that metal contamination is ubiquitous on the Site and, based on the on- and off-Site data, that the concentrations are likely to be a result of the geographical location of the Site (surrounding land uses and high natural background concentrations) rather than of the operations of the HTI facility.

MTBE, benzene, toluene, and xylene contamination appears to form a small zone in the area of Shallow Groundwater 1 centred in the area under, and slightly to the south of, the covered vestibule and roasting chamber, central storage compound and the tank farm (PAoC 12, 15 and 19).

[1] Due to the selective nature of the samples analysed during the third groundwater monitoring round this data set cannot be used as a "stand alone" data set. It is instead supplementary to the data from the initial two monitoring rounds.

TPH contaminants form two (2) zones which appear to stretch across all three (3) of the areas of shallow groundwater contamination. The larger zone covers Shallow Groundwater 1 and 3. This contamination appears to stretch from the eastern edge of the cooling towers (PAoC 1) to the southern edge of the diesel fuel pump (PAoC 20) and from the deslagger pit (PAoC 11) to the central storage compound (PAoC 15), and appears to be centred over the covered vestibule and roasting chamber, and the tank farm (PAoC 12 and 19). Although the results suggest that there may be two (2) zones here, with one overlapping the other. The second, and smaller, zone lies within the area of Shallow Groundwater 2, at the eastern edge of the THP building (PAoC 16). Data from the third groundwater monitoring round also identified TPH contamination in BH51, an area where apparent hydrocarbon contamination was noted during the SI.

The majority of the PCB contaminants identified form a single consistent zone in the area of the HTI front face, deslagger pit, covered vestibule and roasting chamber and the tank farm (PAoC 7, 11, 12 and 19). This is consistent with the extent of the area identified as Shallow Groundwater 1. The remainder of the PCB exceedances noted are scattered around the VOC bays (PAoC 6), drummed storage bay 5 (not a specific PAoC) and in the area south of the diesel fuel pump and east of the non-bulk storage area (PAoC 20 and 23). The analysis of the sum of 7 (NATO) and sum of 12 (WHO) PCB results recorded that the sum of 7 (NATO) results were more commonly in exceedance of the Tier 1 screening value than the sum of 12 (WHO). This would suggest that the contamination present on-Site is composed predominantly of the congeners that make up the sum of 7 (NATO) congeners, rather than the sum of 12 (WHO) congeners.

SVOC compounds form the least consistent of the zones noted, with considerable variation noted between the results of the first and second monitoring rounds (partially due to variations in groundwater levels meaning that some points could not be sampled). The main area of this contamination is in the area of Shallow Groundwater 1, with some contaminants noted in the area of the THP building (PAoC 16) and in the drummed storage bays (not a specific PAoC). This zone is characterised by pentachlorophenol and bis(2-ethylhexyl)phthalate, with some naphthalene, hexachloroethane, 1,2-dichlorobenzene and carbazole (carbazole was only recorded in the second groundwater monitoring round).

VOC compounds represent the highest number of exceedances of the Tier 1 screening values. As with TPH, VOC contamination covers all three (3) of the areas of shallow groundwater contamination. The VOC contaminants form three (3) distinct zones on-Site. The first, and largest, is in Shallow Groundwater 1 and is centred in the area around the covered vestibule and roasting chamber, and the tank farm (PAoC 12 and 19). The second zone is in Shallow Groundwater 2 and is centred in the eastern part of the THP building (PAoC 16). The third and smallest zone is in Shallow Groundwater 3 and is centred on BH74, adjacent to the southern corner of the diesel fuel pump (PAoC 20). The VOC contaminants are dominated by chlorinated solvents and associated daughter products. This is in keeping with the

historical incineration of such wastes and the nature of the chemicals used to "degrease" the transformers in the THP building (PAoC 16).

It would appear that the historical use and operation of the Site has had an impact upon shallow groundwater. Contaminants in shallow groundwater are more numerous, both in number and type, and more widespread than those identified in the soils analysis. This would suggest that contaminants have not filtered through the ground to groundwater, but that instead they have reached groundwater via preferential pathways. However, contaminants appear to be localised within three (3) discrete areas and appear to be closely related to those areas identified as their likely sources (the PAoC).

Following the retests undertaken on the Round 1 and 2 data, and the results of the Round 3 analysis, it is apparent that dioxin and furan contamination in the shallow groundwater beneath the Site is very limited. A single exception was noted in groundwater monitoring well BH51 where, in both the Round 1 and Round 3 data, an exceedance of the combined dioxin and furan Tier 1 criteria was noted. Concentrations of dioxin and furan in exceedance of the Tier 1 Screening criteria were also found in the soil samples retrieved from BH51. This may suggest an isolated area of contamination.

The remaining dioxin and furan results were all below the laboratory detection limit.

Deep Groundwater

Due to the small number of deep groundwater wells on-Site and the distances between their locations, it is not considered prudent to draw conclusions or trend patterns regarding deep groundwater contamination beneath the Site as part of this report. Therefore, until further data is available, it can only be concluded that contaminants are present in deep groundwater and their provenance is unclear.

The contaminants identified in deep groundwater were similar to those recorded in the shallow groundwater on-Site, comprising: metals and traditional compounds (Al, As, Cr, Cu, Ni, Se, Zn, sodium, sulphate, chloride and fluoride); hydrocarbons (specifically toluene and TPH); PCB (specifically sum of 7 (NATO) congeners); SVOC (pentachlorophenol in BH11), and; VOC (cis-1,2-dichloroethene, chloroform, 1,1,1-trichloroethane, TCE [BH11]and PCE [BH34]).

The concentrations of the contaminants and their relative ratios would suggest that these chemicals have not filtered down through the rock and soils from the surface (as very little partitioning appears to have occurred in the ionic balance analyses). In light of this, it should be considered that the potential exists for these chemicals to have reached the deep groundwater via a preferential pathway.

The potential exists that the decommissioned on-Site abstraction well may be acting as a preferential pathway between the shallow and deep groundwater resulting in the identified impacts at depth. The current construction and decommissioning details of the abstraction well could not be confirmed during the Phase II Investigation.

Furthermore, although every practical effort was made to ensure that preferential pathways were not created within the boreholes and monitoring wells during the Site investigation, the possibility exists that pathways may have been created.

It should however be noted that: very limited soil contamination was recorded at the locations of the deep groundwater wells; and, that those samples containing metals at concentrations in exceedance of the Tier 1 screening value were taken from widely spaced locations around the Site perimeter, both up and down inferred hydraulic gradient. It is considered that metal contamination is ubiquitous on the Site and, based on the on- and off-Site data, that the concentrations are likely to be a result of the geographical location of the Site (surrounding land uses and high natural background concentrations) rather than of the operations of the HTI facility.

Surface Water

The contamination identified within the samples retrieved from the Afon Lwyd was typified by the presence of metals. In general, the concentrations of the metals noted in the samples from the Afon Lwyd showed little variation in their concentration between the upstream, midstream and downstream samples. A slight upstream to downstream increase in the concentrations of zinc, copper, chromium and aluminium was noted in the surface water during the first round of monitoring; however, it is considered possible that these increased concentrations were a result of suspended solids being included in the analyte at the laboratory. Further monitoring did not record a similar trend.

This would suggest that these contaminants are present in the River water prior to passing the Site, and indeed before passing within the likely influence of groundwater flow from beneath the Site and the historical stack plume footprint.

Benchmark Samples

The two benchmark samples were analysed during monitoring Round 1.

The sample of distilled Site tap water contained levels of zinc in exceedance of the Tier 1 screening criteria. No other contaminants were noted in this sample.

The drillers polymer sample contained aluminium, zinc, copper, TPH (specifically C10-C16) and chloroform at concentrations in exceedance of the Tier 1 screening criteria. Upon receipt of these results we contacted the drillers to discuss the potentially contaminative nature of

this material. Our discussions with the drillers revealed that the TPH in the polymer is the active ingredient that allows the polymer to thicken and aid drilling. Data sheets from the supplier of this polymer note that this material rapidly biodegrades after use. However, it was noted in the results of the analysis of groundwater from BH34 (where the polymer was used) that the TPH concentration was slightly elevated in Rounds 1 and 2 (although the concentration did drop significantly between the rounds, from 954 µg/l to 121 µg/l).

A series of overview summary sheets providing a non technical summary of the results detailed in this report have been produced by Shanks and are provided as Addendum 1. The summary sheets demonstrate graphically the range and scale of the laboratory results recorded in samples collected from the Site, the adjacent drainage ditch and the Afon Lwyd.

EXECUTIVE SUMMARY

Shanks Waste Management (Shanks) commissioned Golder Associates (UK) Ltd (Golder) to undertake a Phase III Quantitative Risk Assessment (QRA) to support redevelopment proposals for the former HTI Plant, Pontyfelin Industrial Estate, New Road, Pontypool, Gwent, NP4 0SH (hereafter referred to as "the Site"). The Human Health Risk Assessment (HHRA) forms part of the overall QRA and follows previous desk based study and intrusive assessments performed by Golder. This human health risk assessment report has been peer reviewed by Dr Brian Reid of the University of East Anglia and a copy of Dr Reid's report is provided in the Appendices.

The HHRA has not assessed 'short term' risks associated with occupational exposure during any future development, investigation or remediation activities or for the ongoing use of the Site as a waste management facility. Risks to human health from contaminants of concern during these activities would need to be assessed and managed under appropriate health and safety legislation. Shanks have stated that, where appropriate, additional investigations (e.g. workplace monitoring) and risk assessments (e.g. Control Of Substances Hazardous to Health risk assessments) will be undertaken to manage potential 'short term' risks from exposure to contaminants of concern.

The purpose of the HHRA is to assess the risk to human health from exposure to chemicals in soil, groundwater, surface water and sediment samples identified during the previous Phase II investigation, with a view to assisting Shanks in the management of environmental issues relating to site redevelopment.

A conceptual site model was developed and established potential contaminant source, pathway and receptor linkages appropriate to the Site within the local environmental setting. Golder assessed health risks from contaminants of concern within the following scenarios:

- on-Site exposure to contaminants during the current and proposed industrial use of the Site (risks from soil, shallow groundwater and deep groundwater);
- off-Site exposure to contaminants recorded in soil/sediment within the shallow drainage ditch located outside the Site boundary (risks from soils); and
- exposure to contaminants recorded in water and sediments within the Afon Lwyd (risks from river sediment and water).

Contaminants of concern included dioxins, furans, polycyclic aromatic hydrocarbons, polyaromatic hydrocarbons, volatile and semi volatile organic compounds, total petroleum hydrocarbons and metals.

The HHRA was undertaken in accordance with recognized modeling software and using conservative approaches which represent 'worst case' estimations for the given source – pathway – receptor scenarios. The peer review has described these 'worst case' scenarios as extremely conservative. The results demonstrate that historic activities at the Site have

resulted in impacts to soil that may represent unacceptable human health risks to current and future users of the Site, with predicted exposure being approximately twice that of the published health criteria values for vinyl chloride, dioxins and furans. The estimation of risks from groundwater did not identify the need for future intervention from a human health perspective.

Priority contaminants of concern requiring either further assessment by means of site investigation or further assessment by review of remediation options appraisal are nickel, lead, vinyl chloride, dioxins, furans and dioxin-like PCBs. Whilst it can be seen from the result that metals are ubiquitous in the soils across the Site, the concentrations identified on-site are inconsistent with those identified off-site, and as such, it is considered that the former HTI facility does not represent the principal source of the off-site metal concentrations. The fact that metals appear throughout the site may also reflect the fact that the site resides on an area with previously elevated levels of metals. Shanks Waste Management and Torfaen Borough Council have agreed to collaborate to further assess the off-site metal concentrations in the soils adjacent to the Site boundary.

Evidence that human health risks from the TPH Aliphatic C_{16}-C_{35} fraction may arise from its presence in shallow groundwater in BH68 was re-evaluated based on conservative assumptions made regarding the inhalation HCV used for this fraction and uncertainties on the actual concentration present in the borehole. Risks identified from nickel and lead in the drainage ditch sediment are unlikely to be realized since it is understood that sediment in the drainage ditch has been excavated since completion of the initial investigation.

EXECUTIVE SUMMARY

Shanks Waste Management (Shanks) commissioned Golder Associates (UK) Ltd (Golder) to undertake a Phase III Quantitative Risk Assessment (QRA) to support re-development proposals for the former HTI Plant, Pontyfelin Industrial Estate, Pontypool, Gwent. The Hydrogeological Risk Assessment (HRA) forms part of the overall QRA, and follows previous desk based study and intrusive assessments performed by Golder.

The purpose of the HRA is to assess the risk to controlled waters from chemicals in soil and groundwater identified during the Phase I and II site investigation (Volume 3). This will assist Shanks in the management of environmental issues relating to site re-development. The HRA was undertaken in accordance with current good practice, using Environment Agency sponsored software and adopting a conservative approach.

The site investigation data showed that the main contaminants of concern at the Site included dioxins and furans (PCDDs and PCDFs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons, volatile and semi volatile organic compounds, petroleum hydrocarbons, pesticides, metals and other inorganic ions.

A conceptual site model was developed in order to establish the potential contaminant source - pathway - receptor linkages. The hydrogeological risks from contaminants of concern were then assessed using the following scenarios:

- impact on shallow groundwater and the Afon Lwyd from contamination within the soil source;
- impact from contaminated groundwater at the point of entry into the Afon Lwyd; and
- impact to (and from) the deep groundwater in the Raglan Mudstone.

The methodology adopted for undertaking the scenarios above was determined by the level of certainty, and assumptions relating to the conceptual site model. The shallow groundwater conditions are well characterised, and a quantitative risk assessment using the probabilistic software ConSim was considered to be the most appropriate method of assessment. Due to operational difficulties experienced on site during drilling, there is less data available, and hence less certainty, over the deep groundwater regime. As a consequence, a qualitative risk assessment was used to describe the potential risks associated with impacts to, and from, deep groundwater.

The quantitative risk assessment for shallow groundwater adopted a staged approach to ensure that appropriate contaminants of concern were targeted. The first stage was to ‘screen’ potential contaminants found within the soils using a simple spreadsheet calculation. The results of this work were then used to determine what contaminants would be appropriate to consider in ConSim, particularly in terms of contaminant transport and fate. The contaminants considered within ConSim included bromide, metals, SVOC, VOC, TPH, PCB, PCDDs and PCDFs (dioxins and furans).

The results of the risk assessment modelling were presented in full, to illustrate the range of possible outcomes for the 95th, 90th, 75th and 50th percentiles. The need for remediation would be greatest at the 95th percentile, reducing in scale as the 50th percentile is approached. In view of the site context, model conservatism, and the re-development proposals, it was considered appropriate to use the 90th percentile results for assessing the risks to shallow groundwater and the Afon Lwyd. The results of a sensitivity analysis are also presented to illustrate the most sensitive input parameters.

At the 90th percentile the results of the ConSim modelling predict that nickel, zinc and bromide are the contaminants of concern from the existing soil source at the Site. Bromide is predicted to be the primary contaminant of concern from shallow groundwater beneath the Site. The modelling did not predict any impact from PCDDs or PCDFs (dioxins and furans), PCBs, VOC, SVOC, or hydrocarbons.

Bromide was used as an indicator of an un-retarded inorganic anion, and was selected for assessment on the basis that this may have historically been present in the trade effluent at the Site. The results for bromide in both soils and groundwater have been compared to the water quality screening standard for bromate in drinking water. However, during the modelling it became more questionable as to how applicable to bromide such a stringent water quality standard is. To understand this uncertainty further, it is essential to consider the presence of bromide more widely. Bromide occurs naturally as sodium bromide salt in seawater with an average concentration of 67 mg/l. On the other hand, bromate can be formed during disinfection of drinking water, and the standard was newly incorporated into the Water Supply (Water Quality) Regulations 2000 on the basis of its health effects. The lack of a water quality standard for bromide would suggest that the potential health effects are less apparent. In addition, the observed water quality in surface water samples collected adjacent to the Site does not indicate that bromide is present at the predicted levels. On these grounds, the results for bromide are considered to be overly precautionary, and it is recommended that further dialogue is held with the Environment Agency on the applicability of this standard in the context of the risk assessment.

The quantitative risk assessment has assumed that shallow groundwater flows beneath the Site and enters the Afon Lwyd. However, ConSim is unable consider the effects of dilution in the river, and the predicted results are therefore considered to be conservative. It has been estimated that a relatively small dilution factor (as low as 16) will be required to achieve the relevant water quality standards for nickel and zinc. Therefore in the event that a dilution factor is applied, then the risks to surface water from the site are likely to be low. The observed water quality data from surface water monitoring adjacent to the site would support the argument that the effects of dilution are likely to limit any potential impact from heavy metals.

The qualitative risk assessment for deep groundwater in the Raglan Mudstone also followed a staged approach. This uses a number of decision-making frameworks to establish the

sensitivity of the receptor. The process seeks to determine what the significance of any impact might be, and predicts an 'initial' risk level. The 'initial' risk level can then be used to assist determine the degree of further investigation, and/or mitigation measures required to eliminate or reduce the risks to an acceptable 'residual' risk. The outcome of the qualitative risk assessment was to establish that the deep groundwater may be assigned an intermediate risk level.

The derivation of risk based remedial targets for controlled waters should consider the requirement to balance the needs of the Site (in terms of re-development), with the need for continued protection and enhancement of the water environment. The hydrogeological risk assessment has demonstrated that, at this stage, it is inappropriate to develop remedial targets for soils or groundwater in relation to controlled waters. This may be subject to revision as more information on deep groundwater and river flows becomes available. There is however a need to relate any decisions made with regard to controlled waters, to the remedial targets derived for other receptors, such as human health. As a consequence, remedial works that may be required for say, human health, are likely to have increased benefit in the protection of controlled waters.

Shanks recognise the limitations of the existing conceptual model, particularly with respect to the deep aquifer, and the degree of hydraulic connection between the site and the Afon Lwyd. Shanks further understand that in order to satisfy the regulatory requirements associated with any application under the Pollution Prevention and Control (England and Wales) Regulations 2000, then the potential pollution linkages and hence risks to (and from) deep groundwater need to be more fully determined.

As a consequence, Shanks are committed to refining the conceptual model through the installation of further monitoring boreholes and the collection of additional site specific data. Shanks propose that these works are undertaken in the interim period between planning submission and the PPC application being made. It is further recommended that the Environment Agency is involved in the planning of any future site investigation and monitoring.

4.5 Conclusions and Recommendations of Tier One

The following conclusions and recommendations are based on the hazard quotients predicted in this Tier One ERA, information on background levels and off-Site monitoring data obtained during the course of this assessment and existing biological survey information.

4.5.1 Evaluation of risks to the Part IIA receptors related to Site releases

4.5.1.1 Potential Risks to Aquatic Life Related to the Afon Lwyd water and Sediment Quality

The Afon Lwyd is proposed to be designated as a SINC given the records of otter, bat species, brown trout, salmon and bullhead within its reaches. The Environment Agency Wales (2006) classified stretches of the Afon Lwyd both upstream[11] and downstream[12] the Site as Class C (fairly good, i.e. biology worse than expected for unpolluted river) based on samples of macro-invertebrates community. The CSM presented within the Tier Zero ERA identified the aquatic community of the Afon Lwyd as receptors of potential concern.

The estimation of HIs suggested a **potential risk** to aquatic plants and invertebrates due to copper in water. The sample presenting the highest HIs for copper in water was GS13 (Sept-05) which is located downstream of the Site. However, the sample collected six months later (Mar 06), at the same location presented HIs similar to the ones located upstream of the Site. The presence of suspended solids in the water samples could have influenced the analysis in September 05. It should be noted that copper was not considered a chemical of major concern in either sediment or on-Site soil samples.

With the exception of copper, HIs predicted **low to negligible risks** for aquatic plants, invertebrates, fish and benthic organisms for all other chemicals.

The modelled concentrations of zinc, selenium, benzene, toluene, xylenes and MTBE in groundwater at the point of entry into the Afon Lwyd within 1000 years exceed their relevant screening guidance values for protection of aquatic life. These concentrations have been modelled using measured soil and groundwater concentrations derived from samples on-Site. However, based on the high degree of conservatism within the modelling, i.e. the exclusion of dilution effects in the River as well as biodegradation processes which are known to be relevant for a number of these compounds**,** the risks to the aquatic communities of Afon Lwyd due to migration of chemicals currently found in soil and groundwater at the Site is considered **low to negligible**.

In conclusion, the results indicate that the above chemicals would be unlikely to detrimentally affect the long-term maintenance of the aquatic communities of the Afon Lwyd.

[11] Conf.Nant Dare - Conf.Nant Ffrwdoer in 2000 and 2002
[12] Conf.Railway Str.-Conf.Nant Dare in 2000 and 2003

4.5.1.2 Potential Risks to Terrestrial Receptors using the Afon Lwyd Banks

The preliminary CSM identified the following terrestrial receptors of potential concern:

- terrestrial plants;
- soil invertebrates;
- microbes;
- birds; and
- mammals.

These groups of organisms could be exposed to impacted soils in the limited areas of the Site not covered by hardstanding and, most importantly, where soils have been impacted off-Site.

Previous studies (Panteg reports and Shanks' monitoring data) illustrate that impacts (in terms of soil contamination) from the Site are almost entirely restricted to a strip of land approximately 200 m wide around the eastern Site boundary. This strip includes the Afon Lwyd banks and for this reason, organisms living or using the river banks are considered to be of particular concern.

Results of analysis of soils data from the Afon Lwyd banks are not available. There are, however, data on soils quality on-Site (approximately 20 m from the western margin of the river; Phase II Report) and off-Site (approximately 50 to 100 metres from the eastern margin: sampling points 20A, 20B, 33, 21 and 22).

HIs calculated for soils sampled on western margin of the river (on-Site) suggested **potential risks** for terrestrial receptors due to the presence of chromium, lead, mercury, nickel, vanadium, zinc, di-n-butyl phthalate and dibenzofuran. HIs calculated for soil samples on the eastern margin of the river suggest **potential risks** to birds from lead (n.b. data for chromium, mercury, nickel, vanadium, di-n-butyl phthalate and dibenzofuran was not available). However, concentrations of lead upwind of the Site (sampling point 18) present **low to negligible** risks for terrestrial receptor groups.

The results presented above indicate that it is possible that terrestrial organisms living on or visiting the banks of the Afon Lwyd near to the Site could be affected by the above chemicals in soil. The presence of these chemicals could be attributable to former Site activities, but could also be attributable to other sources of contamination unrelated to Site activities. Such sources may include former (including historical) industrial activity (mining, steel working etc), road base materials (depending upon source), emissions and deposition of atmospheric pollutants from the highway network etc.

Two important sources of further information should be considered. Firstly, the results of a detailed ecological survey of the range of wildlife habitats and vegetation types performed by Gemmell (1991), within a radius up to 1000 m from the plant stack when operational, showed no evidence of pollution impacting on plant communities or soil-dwelling invertebrates.

Secondly, even if organisms using the banks of the River near to the Site could be affected by the contaminants present, an impact at community level would be improbable. This is because large mammals (e.g. otter) or birds would have a larger home range than any impacted areas of soils near to the Site. Smaller species (e.g. water voles) could be affected at the individual level, but probably not at the population level. Migrating species would only be exposed during the months of the year that they occupy this habitat. A study which takes such factors into account is normally only undertaken at Tier Three ERA stage (if warranted) and would require food-chain modelling. Thus, consideration of such factors is outside of the scope of this Tier One ERA.

The risks at the plant community level due to root uptake of groundwater by plants located between the Site and the river was considered **negligible**.

4.5.2 Risks to other Part IIA receptors than Afon Lwyd

In addition to the Afon Lwyd, the following protected habitats have been identified:

- River Usk (SAC);
- River Usk (Lower Usk)/Afon Wysg (Wysg Isaf) (SSSI); and
- Craig-y-felin Wood (proposed SINC).

Since the Tier One ERA results suggest that the long-term maintenance of the aquatic communities of the Afon Lwyd would be unlikely to be affected by the chemicals which have formed the basis for this assessment, it can be assumed that the same conclusion should apply to the other Part IIA receptor sites listed above which are located at some distance downstream (9.5 km in the case of the River Usk).

Terrestrial organisms occupying these other protected (or proposed protected) sites are also not considered to be at risk since soil impacts from the Site are almost entirely restricted to a strip of land approximately 200 m wide around the Site (Gemmell).

4.5.3 Revised conceptual Site model

A revised CSM is presented in Figure 3, based upon the results of this Tier One ERA. This illustrates that the only Part IIA receptor potentially at risk is the Afon Lwyd. Former HTI activities remain considered as a potential source of off-Site soil contamination together with other anthropogenic activities in the region. The main route of transport identified is historical air deposition. Local geological conditions can also influence the concentrations of chemicals in soil, water and sediments, particularly of metals.

Migration of chemicals currently found in soil and groundwater at the Site to the river is not considered of major concern. Therefore this route is not illustrated in the revised CSM.

The Tier One ERA predicts low to negligible risks for aquatic organisms (plants, invertebrates, fish and benthic community). Consequently, those organisms are not illustrated in the revised CSM. Amphibians, if present, could be exposed via dermal contact with water and sediment, but risks to these organisms has not been evaluated given the near absence of toxicological data for this receptor group in literature.

Soil invertebrates and microbes living within the river banks may be directly exposed to contaminated soil. Riparian vegetation could also be exposed via root uptake from soil.

Mammals and bird species could be exposed by ingestion of food (plants, invertebrates and fish), depending on their diets. Although not illustrated in Figure 3, all wildlife could also be exposed via ingestion of soil, water and, occasionally, sediment, depending on their feeding habits and habitats.

The Tier One ERA has predicted potential risks for vegetarian and insectivorous species, but probably not at population level. Risks for piscivorous species could not be evaluated. The ingestion pathway could be better evaluated using food-chain modelling and measured or predicted concentrations of chemicals in food items, however, such an analysis is normally only undertaken at Tier Three stage where this is warranted and was therefore outside of the scope of this study.

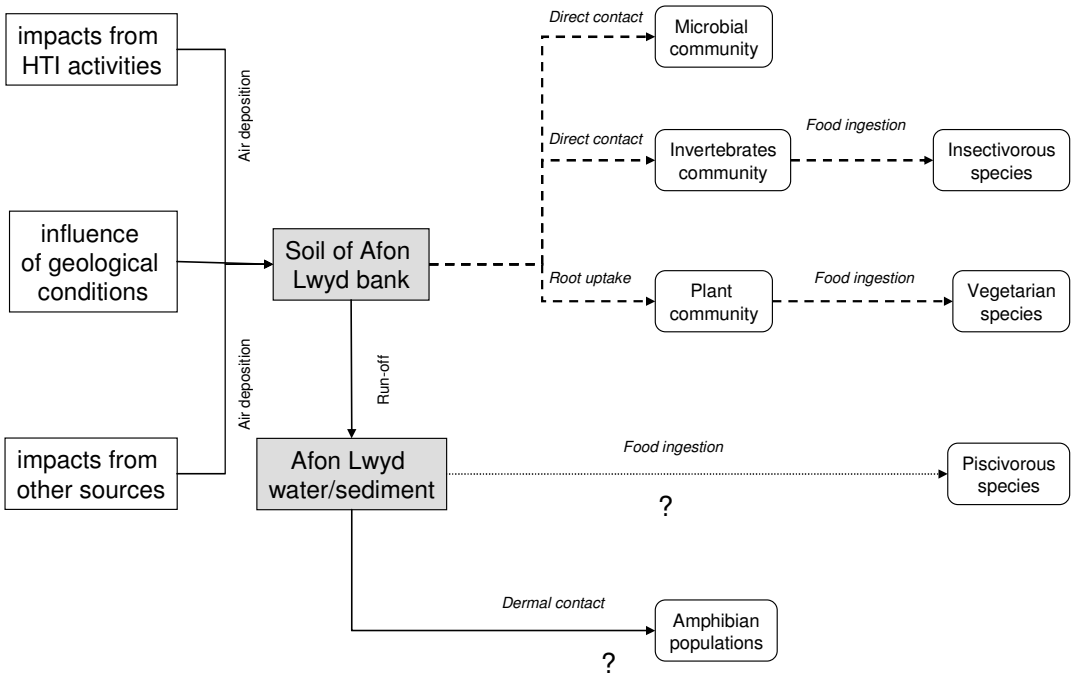
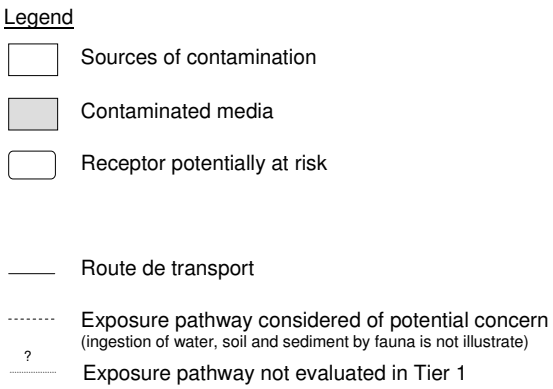


Figure 3: Revised Conceptual Site Model (CSM)

(Ingestion of water, soil and sediment not represented.)
(Other sources: road, local industries past and present etc.)



4.5.4 Recommendations

Additional soil sampling from the Afon Lwyd banks, both upstream and downstream of the Site is recommended in order to decrease uncertainties related to the risks to identified terrestrial receptors occupying this habitat. Sampling will be discussed with TCBC and undertaken by Shanks early in 2007, subject to agreement with land owners.

Re-sampling of the drainage ditch is recommended as soil removal has already been conducted and the residual levels are not known. Additional sampling of off-Site surface soil should also be undertaken in order to evaluate background levels and the influence of other anthropogenic sources which may have contributed to the presence of the soil contaminants detected as it is considered that the former HTI facility does not represent the principal source of the off-Site metal concentrations. Sampling should include locations upwind of the Site as well as the river banks upstream of the Site. Analysis should comprise all chemicals identified as potential concern in soil during this Tier One ERA. This will include chromium, lead, mercury, nickel, vanadium, zinc, di-n-butyl phthalate, dibenzofuran (chemicals in soil presenting HI > 10) as well as PCBs, dioxins and furans (chemicals associated with former Site activities). Shanks and TCBC have agreed to collaborate to assess further the off-Site metal concentrations in the soils adjacent to the Site boundary. Sampling will be discussed with TCBC and may be undertaken early in 2007, subject to agreement with land owners.

Further sampling of surface water within the Afon Lwyd should be undertaken including at a number of locations upstream and downstream of the Site in order to confirm copper concentrations and to provide data relating to suspended solids. Sampling will be discussed with TCBC and will be undertaken early in 2007.

In the light of the additional sampling proposed, a revised Tier One ERA will be produced using the additional analytical data yielded from the investigations above. If concentrations in the River banks suggest potential high risk (i.e. HIs greater than 10) and if the assessment of background levels suggests impact from the Site, rather than from other sources, a Tier Two risk assessment would be warranted.

EXECUTIVE SUMMARY

In February 2006 Shanks Waste Management Ltd (Shanks) retained Golder Associates (UK) Ltd (Golder) to undertake a Remedial Options Appraisal (ROA) and develop a preliminary remediation strategy for the Pontypool HTI Plant, Pontyfelin Industrial Estate, New Road, Pontypool, Gwent, NP4 0SH site (the Site).

This ROA is intended to communicate the advantages and disadvantages associated with the implementation of a variety of remedial technologies that could be used to remediate those contaminants identified in the Phase II Environmental Site Assessment and Intrusive Site Investigation Report (December 2006) to concentrations in line with the conclusions of the individual Human Health (HHRA), Hydrogeological (HRA) and Ecological (ERA) Quantitative Risk Assessments (QRA) undertaken by Golder.

Prior to completion of the ROA it was necessary to assess the output data from each of the risk assessment models, in order to establish those specific contaminants for which remediation is required.

Remediation is based upon the **source – pathway – receptor** framework as detailed in the Phase I Environmental Site Assessment (October 2006) report. Should either a source, pathway or receptor be missing from the conceptual model for each contaminant then there is considered to be an acceptable risk to the associated receptors. Therefore, the approach adopted in the ROA will address the source and/or the potential for removing the pathway or receptor.

The ROA assesses a wide range of alternative remediation technologies using a Remediation Decision Matrix (RDM) which is based on United States Environmental Protection Agency (USEPA) protocols.

The use of the RDM involves evaluating the range of technologies against the following criteria:

- **Technology Applicability** – This includes an assessment of whether the technology is effective for treating a specific contaminant based on the existing Site conditions (soil types, aquifer characteristics etc.), the implementability of the technology and whether the technology is available (i.e. emerging, developing or proven);

- **Permissibility** – An assessment of the degree of difficulty anticipated to obtain permits/licenses from the EA and/or LA;

- **Cost** – An assessment of the potential cost of remediation;

- **Treatment Time** – An indication whether the remediation technique may be used to achieve goals within the time period required by Shanks; and

- **Acceptability** – An assessment of whether the remediation technique is likely to be accepted by those involved (client, regulator, Site management and other stakeholders).

The completed RDM includes an individual score for each criteria and use of a numerical algorithm to produce a total score for each of the alternative technologies. Completed RDMs for both soil and groundwater for each contaminant, or group of similar contaminants, will be completed and included in the report structure.

Each of the risk assessments undertaken produced a list of contaminants for soil (including sediment and sludge), ground gas and/or water that are considered to represent an unacceptable risk to identified receptors using the site specific risk assessment models. These contaminants are the Contaminants of Concern (COC) for the Site.

Full justification of the identification of each of the COCs is given in the respective QRA reports. However, a brief summary of those contaminants identified is included in the following sections.

The conclusions of the HHRA identified that the historic industrial activities at the Site have resulted in impacts to soil that potentially represent an unacceptable risk to current and future users of the Site. The estimation of risks from groundwater did not identify the need for future intervention from a human health perspective.

The HRA concluded that no significant risk was posed to ground or surface water by the presence of contamination in soil or groundwater at the 90th percentile peak concentrations.

In light of the results of the Tier One ERA, it is considered that a Tier Two assessment may be required for the Site; however, it is proposed that this is confirmed by further soil and groundwater sampling which is described further in Section 7.0 of this document.

The table below gives a summary of those contaminants, which, following completion of the HHRA and the partial completion of the HRA and ERA, represent the full COC list for the Site. The full details for the individual COCs can be seen in the respective QRA reports.

The samples containing Nickel & Lead concentrations considered to be of potential risk to human health were identified in the ditch at the perimeter of the Site. Subsequent to the collection of the samples, the ditch was excavated by Torfean Borough Council contractors and as such, the analytical data is no longer applicable to the current conditions.

Summary of COCs Identified in the Risk Assessments

Parameters for which remedial action may be required QRA identifying risk	Soil	Soil Gas	Water
Copper (ERA)	NRR	NRR	FAN
Chromium (ERA)	FAN	NRR	NRR
Lead (HHRA & ERA)	FAN	NRR	NRR
Mercury (ERA)	FAN	NRR	NRR
Nickel (HHRA & ERA)	FAN	NRR	NRR
Vanadium (ERA)	FAN	NRR	NRR
Zinc (ERA)	FAN	NRR	NRR
Di-n-butyl phthalate (ERA)	FAN	NRR	NRR
Dibenzofuran (ERA)	FAN	NRR	NRR
Dioxins, Furans & PCBs (HHRA & ERA)	FAN	NRR	NRR
Vinyl Chloride (HHRA)	FAN	FAN	NRR

Notes:
(ERA) – Identified as being of potential risk to Ecological receptors
(HHRA) – Identified as being of potential risk to Human Health receptors
"FAN" Further Assessment Necessary
"NRR" No Remediation Required

Whilst it can be seen from the results of the Phase II investigation that metals are ubiquitous in the soils across the Site, the concentrations identified on-site are inconsistent with those identified off-site, and as such, it is considered that the former HTI facility does not represent the principal source of the off-site metal concentrations. The fact that metals appear throughout the Site may also reflect the fact that the Site resides on an area with previously elevated levels of metals .

Shanks Waste Management and Torfaen Borough Council have agreed to collaborate to further assess the off-site metal concentrations in the soils adjacent to the Site boundary.

Although a number of remedial techniques have been briefly discussed in the text of this document, it is apparent that, to produce a detailed site specific Remediation Method Statement (RMS) for the Site, the following parameters will require consideration:

- further targeted site investigations and soil/groundwater/soil gas monitoring exercises will need to be undertaken (see Figure 3 for proposed on-site areas of investigation);
- further off-site soil/sediment and surface water monitoring;
- the requirements of any remedial design will need to be incorporated within the flood defence system; and

- the requirements of any remedial design will need to be incorporated within the visual impact assessment.

Due to the restrictions of access and the placement of the existing buildings, it was not possible to complete a full detailed investigation in the areas of the Tank Farm and HTI Plant. A further, more detailed, investigation into these areas of known contamination will be undertaken following the demolition of the site structures.

This will enable accurate delineation of contaminant source terms in these areas, assessment of risks posed by soil, groundwater and soil gas contaminant concentrations and enable the remedial options to be refined where necessary.

It is recommended that a program of monitoring of ground gas is commissioned in all of the wells fitted with a gas tap across the Site. It is considered that the identification of high and elevated concentrations of methane, vinyl chloride and organochlorine gases in the area of the Tank Farm *and* the two control wells may be indicative of a wider ground gas issues on the Site. This work should be undertaken prior to the start of any sub-surface demolition works on-site in order to identify any potential risks to demolition contractors and site staff.

The additional information provided by the ground gas assessment programme will assist in the refinement of the remedial strategy.

The identification of dioxins and furans (and dioxin-like PCBs) as a potential risk to human health in the areas of soft landscaping has been discussed in depth in Section 6.1.3 and it was confirmed that, at present, no remedial work is considered necessary on the basis that the impacts identified in the area of the proposed flood defence scheme will be remediated, if necessary, at the time of the construction of the flood protection bund.

However, in the event that Torfaen Borough Council requests further validation of the levels of potential risk associated with the dioxin, furan and dioxin like PCB concentrations in the soft landscaping at the Site, further soil samples will be collected and submitted for laboratory assessment and the human health risk assessment revised on receipt of the additional data. The exact number and location of the sampling points will be confirmed if this work is deemed necessary and it is intended that the proposed investigation strategy will be discussed in detail with Torfean Borough Council prior to its completion.

The HRA has identified the need for more information regarding the apparent deep sandstone water bearing strata identified in BH88. The further SI will need to include the excavation of deep boreholes, and installation of monitoring wells, across the Site in order to determine the extent and characteristics of this water body. During the drilling, hydraulic testing and geophysical analysis will be undertaken and, once these works are completed, sampling and monitoring of groundwater will occur. This will allow the HRA to incorporate the deep aquifer and fully assess any potential risks posed to it, or by it, to sensitive receptors in the vicinity of the Site.

In addition to the assessment of the deep groundwater, it is proposed to obtain information relating to the hydraulic relationship between the shallow groundwater at the Site and the Afon Lwyd. It is anticipated that this data will confirm the discussions in the HRA relating to the relative dilution of the groundwater at the point that it discharges to the Afon Lwyd.

The current Tier 1 ERA has identified the need for further soil and surface water monitoring followed by refinement of the Tier 1 model. The information required from the further sampling is as follows:

- assessment of the concentrations of the identified COCs in the soils from the banks of the Afon Lwyd adjacent to the Site;
- assessment of the dissolved copper concentrations in the Afon Lwyd;
- assessment of the concentrations of the identified COCs within the soft landscaping areas in the ditch adjacent to the Site; and
- assessment of the concentrations of the identified COCs within the background soils in the vicinity of the Site.

On the basis of the conclusions of the refined Tier 1 assessment, it may be necessary to progress to a Tier 2 assessment. A Tier 2 ERA is likely to consist of further detailed assessment for several aspects of the contamination on-site and may include toxicity analysis and further ecological assessment (see Section 5.3).

Following completion of the necessary ecological risk assessments, this remedial options appraisal will be refined and an appropriate remedial strategy prepared.

It is anticipated that the additional work outlined above will be undertaken in a phased manner in consultation with Torfaen Borough Council. The deep groundwater assessment will be completed as part of the PPC Applications and determination process.

Preparations for the decommissioning of the Tank Farm and HTI Plant have commenced.